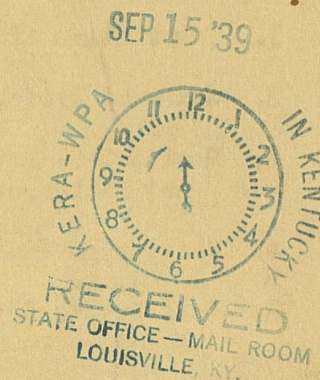




INVENTORY OF PHYSICAL PROPERTIES OF ELECTRIC UTILITIES

A CIRCULAR PRESENTING THE TECHNIQUE
FOR COMPILING AN INVENTORY OF THE
PHYSICAL PROPERTIES OF ELECTRIC
UTILITIES OPERATING WITHIN A STATE.

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FOREWORD

This circular provides a suggested operating technique for compiling an inventory of the physical properties of electric utilities operating within a State. It is hoped that the suggestions, as far as they are pertinent, will serve as a guide to successful project operation and will aid those responsible for technical supervision.

The procedures outlined herein are not mandatory. Local conditions and legal requirements may necessitate some changes. It has been demonstrated, however, that these procedures and forms are adequate to accomplish the stated objectives of such a survey.

These procedures relate only to the technique of project operation. Nothing in this circular is to be construed as affecting or modifying in any way administrative procedures of the Work Projects Administration.

F. C. Harrington
Commissioner of Work Projects

PREFACE

This circular presents information that is necessary for the operation of a project to inventory all property of electric utilities operating within a State. It explains the organization of the project and the various phases of its operation and will, therefore, assist sponsors and the Work Projects Administration officials to formulate projects of this type.

The present procedure is based to a large extent upon the experience of the New Hampshire Public Service Commission, which completed an inventory of electric utility properties throughout New Hampshire by means of a CWA project in 1934. The procedure was prepared by Claude M. Smith, Inventory Engineer of the New Hampshire Commission, who was in charge of the CWA project. The WPA Division of Research gratefully acknowledges the kindness of the New Hampshire Commission in granting Mr. Smith a leave of absence to prepare this procedure for WPA use.

Acknowledgment is due Nelson Lee Smith, Chairman of the New Hampshire Public Service Commission; Charles W. Smith, Chief of the Bureau of Accounts, Finance and Rates of the Federal Power Commission; John C. Damon, Supervising Engineer; and Leslie T. Fournier, Supervising Utilities Analyst of the Securities and Exchange Commission for their advice and counsel in the preparation of this procedure. In order to provide the necessary technical assistance in the planning of projects or in their setting up and operation, an advisory committee has been formed consisting of Nelson Lee Smith, Charles W. Smith and John C. Damon.

The circular has been prepared under the direct supervision of the Division of Research, and the procedure outlined is recommended by the Division of Professional and Service Projects as a guide in the operation of this type of research, statistical, and survey project.

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INVENTORY OF PHYSICAL PROPERTIES
OF
ELECTRIC UTILITIES

NATURE OF THE PROJECT

A. General Objectives

For many years lack of current data concerning the location, extent, and character of physical properties of electric utilities operating within the State has greatly hindered the efficient functioning of State public service commissions and similar regulatory bodies. This circular provides instructions for the operation of a property inventory project to collect and compile this much needed information in a form that will be very readily adapted to the various needs of State regulatory commissions and easily perpetuated.

The need for such data has been recognized by regulatory bodies but the cost of financing work of this magnitude is so great that, lacking outside financial assistance, it has been found impossible to finance the necessary surveys without penalizing the consumer. The initiation of projects of this type offers a solution to the financial question and affords the State commissions an opportunity to collect data highly important for regulatory purposes.

The fact that a project of this type can be carried on by relief labor, under the proper supervision, has been established by the experience of the New Hampshire Public Service Commission. When the Civil Works Administration program was initiated in 1933, the New Hampshire Public Service Commission immediately applied for funds to make a complete inventory of all privately-owned electric utilities. The proposal was accepted and the project was well under way early in 1934. As this project neared completion, the New Hampshire Commission

took steps to insure its continuing usefulness. A revision of the accounting classification was instituted and a continuing inventory record was prescribed. In meeting this requirement the utilities found it necessary to reconcile their records with the commission's CWA inventory and in this way a check upon the results was obtained. The reconciliation indicated that the commission's CWA inventory was remarkably accurate.

For the sponsoring agency to receive the maximum amount of service from an inventory of this type, the original inventory must be kept up to date. A part of the data compiled will ordinarily not be used immediately. By the time it is needed it will be out of date unless the inventory is kept current. Consequently, provisions should be made by the commission at the initiation of the project for the maintenance of a current inventory. Maintenance of a current inventory requires that the utilities adopt a system of accounts for keeping an accurate record of all changes in fixed capital, including detailed information regarding all units of property. Additions and retirements should be summarized by tax districts annually and reported to the commission for inclusion in the property ledgers set up by the original inventory projects. The New Hampshire experience indicates that the inventory can be kept up to date at a relatively small cost.

In brief, the general objectives of this inventorying project include the collection, compilation and recording of information regarding the location, extent, and character of all physical properties of electric utilities. The resulting inventory is to be

in a simplified form suitable for the recording of yearly changes.

B. Types of Data Obtained

The final data obtained will consist of a field inventory of all physical property of the electric utilities operating within the State. Unless the State has already adopted some other system of accounts, the inventory should be set up in property ledgers by accounts that will conform with the Federal Power Commission's Uniform System of Accounts. For example, under "Steam Production" the following accounts will be shown: Land and land rights, structures and improvements, boiler plant equipment, engines and engine driven generators, turbo-generator units, accessory electric equipment, and miscellaneous power plant equipment.

Each of the foregoing accounts may be briefly defined as follows:

The land and land rights account will include a description and location of land used in steam generation.

The structures and improvements account will include a description of buildings to house, support and safeguard property or persons, and where possible the date of construction.

The boiler plant equipment account will include all available data regarding furnaces, boilers, steam and feed water-piping apparatus, and accessories used in production of steam to be used primarily for generating electricity.

The engines and engine driven generators account will include a complete description of engine driven units and accessory equipment used in generating electricity by steam, such as

circulating pumps, vacuum pumps, condensate pumps, throttle and inlet valves, bleeder valves, governors, speed limit devices, and all such equipment.

The turbo-generating units account will include data regarding turbine driven generating units and accessory equipment.

The accessory electric equipment account will include data concerning miscellaneous equipment, such as auxiliary generators and exciters together with their driving units, storage batteries for control operation including charging equipment, switchboards, switches, switch compartments, lightning arresters, and all such material.

The miscellaneous power plant equipment account will include a description of miscellaneous equipment devoted to general station use and also steam generating stations which cannot properly be included in the foregoing accounts; items chargeable to this account will include compressed air and vacuum cleaning systems, cranes and hoisting equipment, and station maintenance equipment, such as lathes, drill presses, grinders, etc.

The following is a list of the major types of equipment to be inventoried. This listing is in accordance with the Federal Power Commission's Uniform Classification of Accounts

PRODUCTION PLANT

Steam Production

- Land and land rights
- Structures and improvements
- Boiler plant equipment
- Engines and engine driven generators
- Turbo-generator units
- Accessory electric equipment
- Miscellaneous power plant equipment

Hydraulic Production

- Land and land rights
- Structures and improvements
- Reservoirs, dams, and waterways
- Water wheels, turbines, and generators
- Accessory electric equipment

Miscellaneous power plant equipment
Roads, railroads, and bridges

Internal Combustion Engine Production

Land and land rights
Structures and improvements
Fuel holders, producers, and accessories
Internal combustion engines
Generators
Accessory electric equipment
Miscellaneous power plant equipment

TRANSMISSION PLANT

Land and land rights
Structures and improvements
Station equipment
Towers and fixtures
Poles and fixtures
Overhead conductors and devices
Underground conduit
Underground conductors and devices
Roads and trails

DISTRIBUTION PLANT

Land and land rights
Structures and improvements
Station equipment
Storage battery equipment
Poles, towers, and fixtures
Overhead conductors and devices
Underground conduit
Underground conductors and devices
Line transformers
Services
Meters
Installations on customers' premises
Leased property on customers' premises
Street lighting and signal systems

GENERAL PLANT

Land and land rights
Structures and improvements
Office furniture and equipment
Transportation equipment
Stores equipment

Shop Equipment
Laboratory equipment
Tools and work equipment
Communication equipment
Miscellaneous equipment
Other tangible property

In addition to the property ledger records secured by the inventory, town or city maps are to be prepared showing transmission and distribution lines, substations, switching stations, and generating plants. A map will be made showing the operating divisions by companies and a single State map will be made showing all transmission lines, substations, switching equipment, and generating plants. To supplement the land and rights-of-way records, maps will be made to show the extent and location of all land owned by the utilities.

C. Uses of Data Obtained

There are many uses for accurate, up-to-date information concerning the physical property of operating electric utilities. As commissions become acquainted with the usefulness of continuous inventory records they will find that such information is indispensable to effective regulatory activities. Continuous inventory records will be found serviceable in connection with any one or more of the following:

1. Informal Negotiations

The continuing inventory will prove to be a distinct value to the commissions and the utilities in eliminating formal proceedings. It will be found that approximate valuation, using the con-

tinuing inventory to arrive at the number of units in use, may be compiled with ease and reasonable accuracy to serve the purpose in preliminary negotiations with the operating companies. This type of valuation will tend to eliminate long formal cases which always involve a considerable amount of time and money on the part of both the commission and the utility. Without doubt the most common use for a valuation of this type is in negotiating rate adjustments.

2. Formal Proceedings

(a) Rates.--When informal rate negotiations fail to give the proper results, the public service commissions may initiate formal proceedings. In such a proceeding, both the commission and the utility may be requested to make an appraisal of all used and useful property to determine the present day value which will be used as the basis of calculations as to the reasonableness of the rates in question. If an up-to-date inventory of the property in question is not available, a special field inventory must be made. This course prolongs the proceedings and also is extremely expensive to both the commission and the utility.

The method suggested in this circular provides for a continuing inventory by tax districts with equipment functionally classified. Therefore, when individual contracts are submitted to the commission for approval, they may be studied with all information at hand concerning the physical property used in serving the consumer involved.

(b) Securities.--In formal proceedings appraisals may be necessary to enable the commission to pass upon petitions seeking

authority to issue securities. For such appraisals, as in the case of rates, an up-to-date inventory must be available. The type of inventory outlined in this circular provides a current inventory in which the additions to and retirements from the fixed capital, after the original inventory was compiled, have been checked in the field by the commission's engineers. If it is the desire of the utility to finance only the additions made during a certain period or since the last securities issue was made, this information is also available.

(c) Purchases, consolidations, mergers, etc.--As in the case of securities, appraisals may be required by the commission to pass upon petitions concerning purchases, consolidations, mergers, etc. In some cases, these petitions may deal with only a small part of the operating property. In such cases if a sale or transfer of property is under consideration, the appraisal might well be made without field inspection since the continuing inventory is very detailed.

A continuous inventory has the further advantage that the appraisals prepared by the commission and by the utility are based upon identical units. This feature has a tendency to eliminate lengthy discussions between the appraisal engineers as to the accuracy of each inventory.

In compiling inventory data, the date of installation of major items of equipment is determined whenever possible. The availability of such information to the appraisal engineers greatly decreases the chance of differences of opinion regarding the remaining life and thus saves a great deal of time in formal hearings.

3. Accounting Supervision

Some electric utility companies have made their analysis of fixed capital independently of any inventory. Often such an analysis starts from an inventory made at the time of acquisition and is brought up-to-date by an audit of all subsequent vouchers and work orders. This system is usually accepted as sound; and if the utility has had a good work order and retirement system, the results may be satisfactory. To test this system, however, an up-to-date inventory of all physical property is necessary. If it is not available the accountant cannot accurately check the units found on the books with those actually in service. It is possible to require a tie-in between the physical units shown in the continuing inventory and the valuation appearing on the books of the companies. Because of inadequate retirement systems, utilities are occasionally found to be carrying units of property on their books that actually have been retired from the operating plant. Hence, an appreciable reduction of the rate base may be made in some cases as a result of facts developed from a complete inventory of utility properties.

The continuous inventory record enables regulatory commissions to check more carefully the additions to and retirements from the fixed capital accounts inasmuch as it requires utilities to maintain complete data concerning all physical property changes reported to the commission. The work orders used for this purpose give the full details of all changes, whether additions or retirements, and are checked in the field as necessary to determine the accuracy of the reported changes.

4. Engineering Service

Data provided by inventory records will serve to solve many operating problems. For instance, they will furnish information that will assist in solving voltage regulation problems which are very important for some State commissions because of the extensive sales campaigns on appliances, especially in the rural areas. The town maps show the phase, voltage and wire size of all rural lines, and the distance from the source of power. With this information available, the service engineer's problem may often be solved without leaving the office. There are many other cases where these records may be useful to the service department as, for example, on questions of interconnection of distribution or transmission systems, determining the availability of service in rural areas, and furnishing necessary information regarding availability of generating plants and transformer stations at any designated point.

5. Depreciation

A few State regulatory bodies have required that studies be made to establish depreciation rates for each class of property. For balance sheet purposes, the annual depreciation charges are consolidated and treated as a single composite reserve. For analytical purposes, however, some jurisdictions require that each electric utility maintain records segregating its reserve according to the functional classification of the electric plant. As the historical background in many cases has been very deficient, it is often desirable to test these prescribed or accepted rates from time to time. Since continuous inventory records show the useful life cycle of any unit

of property, they are invaluable for this testing.

D. Sponsors

The Work Projects Administration is vitally interested in the proper sponsorship and the successful operation of projects financed by Emergency Relief Appropriation funds. Sponsors will be held fully responsible for the proper and efficient conduct of the project.

Projects of this type should be sponsored by State or local regulatory bodies. Such groups have the necessary interest and regulatory powers to insure successful results. These agencies can make effective use of data provided through the inventory and will be interested in plans for perpetuating the inventory. To insure the success of projects of this type, the sponsoring agent should have ready cooperation from the companies whose property is to be inventoried.

PLANNING THE PROJECT

A. Relationship Between Sponsor and Utilities

1. General The purpose of this project is to collect, compile, and record information pertaining to the extent and characteristics of the physical property of electric utilities. The larger part of the property will be inventoried independently of all company records. Only two classes of property will be inventoried from the company's records: meters, and land and rights-of-way. Even for these classes, the sponsor must not use the company's records without first determining their accuracy in the field.

In setting up the project the sponsor should determine how much detail should be recorded in view of the probable uses of the data. For instance, in evaluation work, the more detail there is available for the engineer, the less complicated is his task. However, in compiling this inventory some consideration should be given the cost of perpetuation. It is possible to record so much detail that the cost of perpetuating these records is unduly increased for both the commission and the utility.

Before drawing up the project proposal, a conference between the sponsor and the utilities concerned should be arranged, so that an explanation of the undertaking can be made. The element of cooperation should be stressed. It would be well to explain that utilities not having continuing inventory records may acquire at this time a satisfactory compilation at an extremely low cost.

This could be made possible by assigning company men to assist the inventorying party in establishing such facts as wire sizes and property ownership. Similarly, one of the plant engineers might accompany the crew inventorying power equipment. In rendering this service the company could satisfy itself as to the accuracy of the inventory and at the same time obtain an inventory of its own.

The company should be assured that the project will not interfere in any way with the regular operations of the plant. Assurance should also be given that necessary safety precautions will be observed on the project and that only qualified men representing the company or sponsor will be allowed to determine the type and rating of high voltage equipment. There will be no climbers on the project as the wire size will come either from the company records or the utility representative with the party. Each member of the project should be given an identification letter or card to eliminate any misunderstandings.

2. Accounting During Project

One very essential requirement must be made of the utility: Namely, when the project starts, the utility must start maintaining a record of all additions to and retirements from the physical plant. Furthermore, these records must be supported by details that will allow the inventory engineer to determine the extent, character, and location of this equipment. These records are to be summarized by tax divisions and reported to the commissions annually and supplemented with data that will allow the sponsor's maps to be kept up to date.

3. Pole Marking

It is desirable, before starting the project, to work out with the utility company a systematic method for numbering the pole lines. This will

prove very beneficial to both the sponsor and the utilities. Since the numbering system will have to be adapted to the characteristics of the properties involved, a specific plan will not be recommended here.

B. Personnel

Following the conference between the sponsor and the utilities, detailed plans should be made for project personnel. Too much emphasis cannot be placed upon the necessity for first rate supervision. The number of noncertified workers ^{1/} on the project is limited to a small proportion of the total number of employees on the WPA project pay roll. Consequently, it is highly desirable that the noncertified group be supervisory engineers.

In the present section considerable attention will be given to the qualifications and duties of the principal supervisors and technicians. Qualifications of the remaining personnel will also be discussed. It should be emphasized at the outset, that the personnel layouts which follow are not mandatory. Rather they are intended to indicate the nature of the personnel requirements for a project of this type. In setting up a workable project, variations from the outline suggested in the circular may be necessary. Ordinarily about 400 workers will be required for one year for every \$200,000,000 of fixed assets to be inventoried.

1. Supervisors: Qualifications and Duties

The general supervision of the project should rest with a

^{1/} Certified workers are those who have been certified as in need of relief.

competent employee of the commission who will devote his full time to the project as chief engineer. He will be aided by an assistant engineer. In event this arrangement is not feasible, it will be necessary to retain a full-time consultant to supervise the project. The project then divides itself into a field unit and an office unit (see personnel organization chart).

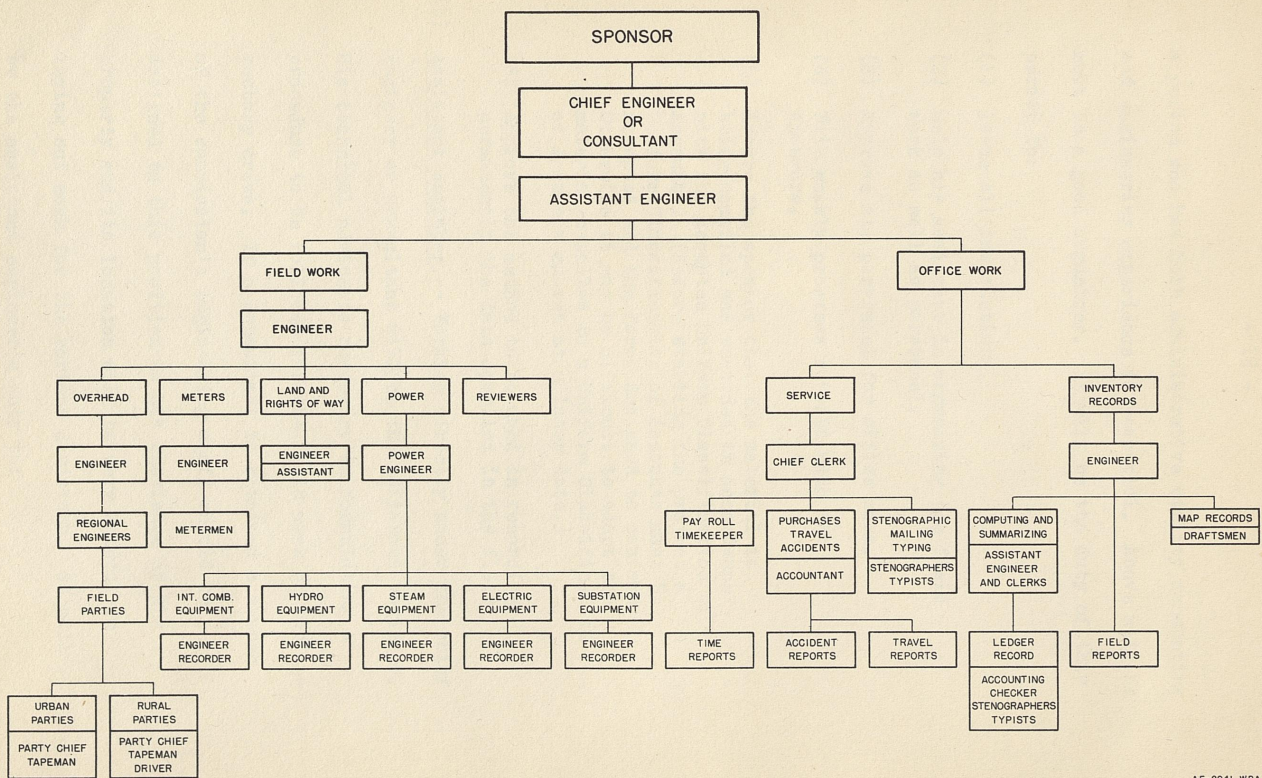
The field unit takes the complete inventory. This unit is in charge of the field supervisor who in turn has four assistants covering overhead, meters, land and rights-of-way, and power, respectively. The power engineer will have several specialists helping him.

The office unit is set up in two independent sections, each responsible to the chief engineer or consultant. The inventory records engineer is responsible for summarizing and recording the information collected in the field. The second office section--under the chief clerk--is responsible for preparation of project pay rolls, purchases, travel, etc.

A statement of the general qualifications and duties of the foregoing supervisory staff follows:

- (a) Chief engineer or consultant.--Ultimate responsibility for the entire undertaking rests upon the sponsoring agency. Therefore, it is for the best interest of this agency that the employee who is designated as chief engineer be assigned full time to the project. If this is not feasible, a full-time consultant should be retained in an advisory and supervisory capacity. Upon this full-time supervisor rests directly the responsibility for the quality of the work and the completion of the task. Hence,

ORGANIZATION CHART



a person who has both administrative utility accounting and engineering experience is essential. Above all, he must be a good organizer. It will be the duty of this person to:

- (1) Issue all instructions.
- (2) Help his assistant in organizing the field work as well as personnel.
- (3) Approve all personnel for office work.
- (4) File weekly progress reports with the sponsors.
- (5) Assure the sponsor that the material is being compiled and recorded in accordance with the accepted Uniform Classification of Accounts. (Before starting the project a Uniform Classification of Accounts must be accepted and the forms designed to conform. Otherwise it may be difficult to adapt the material compiled to a Uniform Classification of Accounts chosen at a later date.)
- (6) Approve the method to be used in recording permanently the data compiled in the field.

- (b) Assistant engineer.-- Working directly under the chief engineer or consultant will be the assistant engineer. His technical advice is necessary in formulating a procedure to be followed for the field work of the inventory crews. If a consultant is retained a member of the commission's engineering staff should be assigned to this position as his knowledge of the property and its location will be very helpful in laying out work for the various divisions. It will be the assistant engineer's duty to:

- (1) Lay out a general plan to be followed in the field.
 - (2) Determine the field maps that are to be used.
 - (3) Pass upon scales, choice of data, and technical details on maps of company properties.
 - (4) Prepare or pass upon all instructions. These instructions should be forwarded to the chief engineer or consultant for publication and distribution.
 - (5) Handle all questions of administration that the field parties may bring in, referring them if necessary to the chief engineer or consultant.
 - (6) Pass on the field forms to be used.
 - (7) Assist the field supervisor in organizing the personnel.
 - (8) Keep in close touch with the utilities to guarantee cooperation.
- (c) Field supervisor.--This engineer is in direct charge of all field work. The position should be filled by an electrical engineer of training and ability. He may be a retired consultant or appraisal engineer wishing only temporary work of this nature. Such a man is very valuable as he is familiar with both old and new equipment and is likely to have had experience in

organizing projects of this scope. Since the responsibility of compiling the inventory in the field rests with the field supervisor, he should be given authority to consult and hire the head of each division operating under his guidance. His success, which means the success of the project, is dependent on the care taken by his assistants in securing the field data. It is the duty of the field supervisor to:

- (1) Choose the head of each field department.
- (2) Aid the chief engineer and the assistant engineer in choosing the remainder of the organization.
- (3) Divide the general areas assigned by the assistant engineer into work units for each of his divisions.
- (4) Aid his four main assistants (one of each for overhead, meters, land and rights-of-way, and power) in efficiently routing parties throughout the territory so that the greatest amount of work may be accomplished with the least amount of travel.
- (5) Acquaint each assistant with the general routine to be followed, as well as explain the forms to be used. This is important since the responsibility of training all field workers falls on these assistants.
- (6) Check all travel expense accounts, material vouchers, and pay rolls for the field workers before they are submitted to the sponsor.

- (7) Assure himself by spot checks in the field that the inventory is being compiled accurately.
 - (8) Coordinate the work of the various divisions under his supervision.
 - (9) File weekly progress reports with the chief engineer or consultant regarding his phase of the work.
- (d) Assistant field supervisors.--Four assistants report directly to the field supervisor: namely, the overhead engineer, the meters engineer, the land and rights-of-way engineer, and the power engineer. The principal qualifications of these four assistants and the regional engineers (aids to the overhead engineer) are given below. The duties of each are given in some detail in Appendix A, Section I.

The overhead engineer must be an electrical engineer who is familiar with transmission and distribution systems. Upon this man falls the responsibility of training the inventory field crews and regional engineers who are to inventory overhead equipment. The regional engineers are directly responsible to the overhead engineer. Regional engineers should be

qualified to check the work turned in by the field parties. Moreover, they should be able to answer any question regarding problems these parties may have encountered in the field. Men with line construction experience would be well qualified for these positions. They must know all types of equipment associated with transmission and distribution overhead systems and also must be able to grasp procedural details readily, as all instructions to field parties will come from these men. The meters engineer need not be a specialist. A man with organizing ability and some electrical experience will qualify. The land and rights-of-way engineer should have experience that will enable him to classify land according to its use. He should be able to determine the amount of land needed for efficient operation of an electric utility company. The type of work in this branch of the organization is such that the other workers need not be men of special training; they may be recruited from a clerical group.

The power engineer holds a very important position. He must be able to coordinate valuable data that have been collected by specialists. Each of his assistants should be a specialist in one type of equipment, such as internal combustion, hydro, steam, and accessory electric and substation equipment.

- (e) Inventory records engineer. - An electrical engineer with accounting experience is ideal for this position. He must be able to supervise the work of a large group in computing and recording the data collected in the field. Since this position is of a permanent nature, it may be advisable for the sponsor to transfer an employee who is thoroughly familiar with the procedures of the sponsor. However, a young electrical engineer with some experience can be readily trained to fill the position. It is the duty of the inventory records engineer to:

- (1) Supervise all office work pertaining to the auditing, compiling, and recording of field data as well as supervising--with the assistant engineer--the mapping division.
- (2) See that all data are tied in with the map records.
- (3) Develop the system to perpetuate the records once they are set up. It should be his responsibility to see that the sponsor's

instructions to the company regarding changes in physical plant during the inventory are carried out.

(4) Plan all the work for his group.

(f) Chief clerk.---This supervisor is the administrative officer of the project. It will be his duty to:

- (1) Prepare and verify pay rolls.
- (2) Direct the people in charge of material, travel, and safety.
- (3) Maintain complete personnel records.
- (4) Furnish stenographic, filing, and mailing service to all departments.
- (5) Maintain an adequate supply of all necessary forms, maps, instruction sheets, etc., and get such supplies to the men in the field as needs are reported.
- (6) Maintain project records as to cost, progress, and any other information that may be needed by the sponsor or by the Work Projects Administration.

This completes the discussion concerning the supervisory staff. It might be well to point out that all the foregoing members of the supervisory staff except the regional engineers will not be usually certified workers.

2. Other Personnel: Qualifications

For the remainder of the organization requirements as to experience are less exacting. Nearly all of the workers in the "Other Personnel" group can be taken from the lists of certified workers. Following are general qualifications for each group except the general project office help which may be taken from the clerical group:

- (a) Field parties.---The bulk of the project employees will be put into the field as "field parties" under the supervision of regional engineers. Members of the field parties need no special qualifications other than willingness to learn; one man in each party should be a legible writer. The success of these men depends largely upon the instructions given by the overhead engineer and supervision of the regional engineers. Each field party will usually consist of a party chief, a recorder, and a tapeman. The duties of each member of the field party are given in Appendix A, Section I.
- (b) Metermen.---These men may be secured from workers in the clerical classification. Their work will be mainly with company records. Electrical experience is desirable but not essential.
- (c) Reviewers.---These men are responsible to the assistant field supervisors and will assist in editing the field tally sheets. Most of the reviewers may be recruited from some of the best workers in the nonsupervisory field force. The duties of the reviewers are given in Appendix A, Section I.
- (d) Computers.---A part of this group should be well

acquainted with electrical equipment; the remainder may be accountants or clerks.

- (e) Draftsmen.--This group must have some first-class draftsmen. However, a large proportion of the work will be tracing, for which junior draftsmen can be used.

C. Forms To Be Used and Sources of Data

I. Forms To Be Used

Examples of most of the necessary forms are given in Appendix B. Instructions for their use are given in Appendix A, Section II.

In general, four types of forms will be necessary to take the field inventory: overhead (Form 1), meters (Form 2), land and rights-of-way, and power. Plain ruled sheets with a vertical line for separating the number of units and the description of the units are usually satisfactory as field sheets for inventorying land and rights-of-way, power, and underground other than services.

Summaries are later prepared in the office from the field forms. Suggested forms are given for summarizing the overhead field inventory (Forms 3-10) and the meter inventory (Form 2). Ordinarily, special summary forms will not be necessary for land and rights-of-way or for power. The purpose of the summary forms is to group and classify the data so that they can readily be entered in the permanent property ledger forms (Form 11 for land and rights-of-way, Form 12 for all other property).

In addition to the forms used for compiling and recording the inventory, forms are necessary for the utility company to report changes made in physical inventory (Forms 13 and 14).

2. Sources of Data

The overhead equipment data (Form 1) and the power equipment data are collected in the field. The data pertaining to meters (Form 2) and those regarding land and rights-of-way are taken from the company records and spot checked in the field for accuracy.

D. Information Needed for Project Proposal

Sponsors desiring to initiate a project should consult the State coordinator of the Work Projects Administration who will cooperate in the preparation of estimates for personnel requirements and will aid in determining the costs of supervision, printing, and other expenses which are usually borne by the sponsor 2/.

The project proposal prepared by the sponsor must include detailed statements setting forth the purpose and scope of the project, the operating procedure to be used, personnel requirements, qualifications of project supervisors, transportation costs, and materials and equipment requirements. It is expected that the sponsor will maintain the inventory system after it is installed; a statement to this effect is required in the project proposal.

2/ It is suggested that the WPA State Director of Professional and Service Projects immediately inform the Division of Professional and Service Projects, Work Projects Administration, Washington, D. C. In this way the advice and counsel of the staff of that division, the Securities and Exchange Commission, the Federal Power Commission and the New Hampshire Public Service Commission may be obtained and utilized in the preliminary steps of project planning.

1. Nature and Scope of the Project

The project proposal must set forth the general purpose and scope of the project. The statement pertaining to scope should include the following information for each utility company that is to be included in the survey:

- (a) A map, when available, of the transmission and distribution system.
- (b) The number and size of the generating plants.
- (c) The number of services.
- (d) Approximate number of miles of transmission lines.
- (e) Approximate number of miles of distribution lines.
- (f) Approximate number of substations, both transmission and distribution.
- (g) Book value of property.
- (h) Amount of information available in company offices.

The foregoing information together with data on the proportion of urban and rural properties will be helpful in making a reasonable estimate of costs.

2. Operating Procedure To Be Used

Working out the Operating Procedure will necessarily require a considerable amount of careful planning. The project proposal must set forth a full statement of the procedure to be used in the study. This includes a set of the forms to be used, a description of the operations

to be performed, a statement of the method of collecting the data, a set of instructions for project workers, and a statement indicating whether a final report will be made from the material. A careful study of this circular will be of considerable aid to the sponsor in drawing up a suitable operating procedure.

3. Project Supervision

The project proposal should include statements giving the name, address, and work history of the consultant or chief engineer, the assistant engineer, and the field supervisor. The proposal should also indicate whether these supervisors will devote full or part time to the project.

4. Estimate of Project Personnel

The project proposal must include a statement of the estimated personnel requirements for the study. Since the characteristics of an electric utilities plant vary widely from State to State, it is impracticable to present man-hour estimates applicable to all States for these inventory projects. Estimates of personnel may be of some value, however, as a guide in connection with the preparation of a specific project application.

To obtain personnel estimates for a given State, it is satisfactory to assume that the field and office work will vary directly with the total valuation. A similar relationship does not hold for supervision. The supervision necessary to inventory \$200,000,000 in one year amounts to approximately six percent of total man-months. This percentage would be lowered if the fixed capital were increased and the time limit were the same; conversely, the percentage would be increased for smaller amounts of fixed capital.

There follows an estimate of the personnel necessary to inventory \$200,000,000 worth of electric utility property in one year's time. It is assumed that the property includes generating, transmitting, and distributing equipment and that there is a fair distribution of urban and rural customers. The estimate is based on a 30-hour week. There is no allowance in the estimate for the general full-time supervisors (consultant or chief engineer, assistant engineer, and field supervisor) since general supervision will be paid ordinarily by the sponsor. 3/

FIELD WORK

Overhead

1 - Overhead engineer (in charge)	1 year
10 - Regional engineers	"
60 - Party chiefs	"
60 - Tapemen	"
60 - Recorders	"

Meters

1 - Meters engineer (in charge)	1 year
40 - Metermen	"

Land and Rights-of-Way

1 - Land and rights-of-way engineer (in charge)	"
6 - Assistants	"

Power

1 - Power engineer (in charge)	1 year
8 - Engineer-specialists	"
8 - Recorders	"

General

15 - Reviewers	1 year
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OFFICE WORK

Inventory Records

1 - Inventory records engineer (in charge)	1 year
40 - Computers and summarizers	"
5 - Stenographers	"

3/ This is the minimum sponsor contribution in personnel. Where possible, the sponsor should be encouraged to pay for the services of other key supervisors, particularly the overhead engineer and the power engineer in order to insure a salary for these supervisors that will attract the highest possible type of supervisory personnel.

16 -- Typists	1 year
8 -- Checkers	"
2 -- Accountants	"
25 -- Draftsmen	"

General Office

1 -- Chief clerk (in charge)	1 year
2 -- Timekeepers	"
1 -- Personnel man	"
1 -- Accountant	"
2 -- Stenographers	"
2 -- Typists	"

Various factors will affect the cost of the inventory project. Climatic conditions are especially important. It is very difficult to operate a survey of this type in the winter, especially in snowy areas. If the project must function through the winter, it would be desirable to concentrate during the summer on rural territory where traveling will be difficult during the winter season, thus leaving the large urban centers for work during the winter and spring. Through such planning the climatic factor will be greatly minimized.

The length of period over which the project will operate will also affect the cost. If the duration of the project is doubled, for example, approximately the same number of supervisors will be necessary for half as many men. The result would be an increase in the total cost of the project to both the sponsor and the WPA.

The distribution of the available certified relief workers will affect project costs as men working away from home must be compensated for their extra living expenses. Ordinarily, these extra costs must be borne by the sponsor.

5. Transportation

A considerable amount of mileage must be allowed on a project of this type as the field parties, especially in the rural areas, must have a car most of the time. In addition, the power crews and the metermen must be transported from place to place. It is estimated that five percent of the total project costs will be for transportation. Ordinarily, the sponsor will be expected to furnish transportation. All transportation facilities, whether furnished by the sponsor or provided from Federal funds, should be in accordance with the safety regulations of the Work Projects Administration.

6. Materials

The necessary materials, other than those used for the permanent records, make up a relatively small percent of the total cost of the project. They consist mostly of forms and miscellaneous small items, such as tapes, footometers (a mechanical device which may be wheeled or attached to a car for measuring distances), teleheights (a device for determining the pole heights), paper, pencils, etc., the cost of which will be determined locally. To these costs must be added the rental fee of office equipment, such as typewriters, adding machines, and a mimeograph machine. The total of all these plus the permanent record equipment will amount to from five to seven percent of the total project costs. The sponsor will be expected to furnish the necessary materials.

E. Operating Problems

1. General

The operating problems encountered by individual divisions

of the project will be fully covered in Appendix A under "Instructions to Project Supervisors." The following paragraphs deal with some of the sponsor's general problems.

2. Order of Inventorying

The first problem that will be encountered will be the order of operations. The sponsor should, in as many cases as feasible, completely inventory one property at a time. This will avoid the need for picking up a lot of loose ends at the end of the project. Another advantage of the suggested order is that if for some unforeseen reason the project could not be completed, the material already compiled would be of value without further expenditure. Small companies should be left until the last and then inventoried in a group.

3. Adjustment of Inventory

As was suggested under "Accounting During Project," the utility must keep a very accurate record of additions and retirements during the inventorying period. If the inventories can be completed for all companies by the end of the year in which they are started, they should all be adjusted at the same time. Otherwise, those completed may be adjusted at the end of the first year, and the remainder held for adjustment until the end of the following year.

4. Inventorying Transmission Lines

The methods used in inventorying transmission lines must be determined by the uses to be made of the inventory. It may be advisable to inventory these lines as a unit. By using this system the methods of reporting changes are simplified to the extent that it is not necessary to report changes by tax districts or towns. However, this may complicate

studies that are made at a later date as these lines often run through more than one tax district or town, and sometimes through more than one operating district.

Another method often used is to inventory transmission lines in a tax district or town by lines. This may mean inventorying a section of line from one town boundary to another, from town boundary to substation, from substation to junction of another line, or between two substations. This system requires keeping all work orders by tax districts or towns and by lines in order to continue the records as set up. However, for studying transmission systems serving a specific locality this information is valuable.

Still another method is to inventory transmission lines as a group by tax districts; a 13,000 volt line, for example, would be grouped with a 33,000 or 66,000 volt line within the same tax district. This method is the least desirable of all in that the individual lines lose their identification. As a result, the lines can be studied only by consulting the company records. The system of reporting is simplified but little or none at all since the company must keep detailed records as to location in order to perpetuate its own inventory.

To summarize, the first system requires that property be inventoried by lines, disregarding tax or operating districts. The second requires that property be inventoried by lines within a tax district, and the third allows a group compilation of all lines within a tax district.

5. Inventorying Meters and Transformers

Line transformers and customers' meters may be shown

separately by cities and towns or by operating divisions. If the latter method is used, the companies should keep a separate statistical record to show the extent of each class of property in service by cities or towns and the number held in reserve. The sponsor should decide which of the two methods he is to use before starting the field work.

6. Small Franchises

In compiling the inventory there will be instances in which more than one company holds a right to serve in a township. Often a company will serve only a very few customers in the township and in such a case the electric properties in the township should be inventoried and grouped with those of some contiguous city or town. This grouping should not be done when there are more than 25 customers served by the company. Through such grouping of franchises, the utility's detail work is somewhat lessened.

F. Summary of Procedural Steps

Following is a brief summary of steps to be followed in compiling an inventory of physical property of electric utilities:

1. In the field, enumerate all data pertaining to transmission and distribution systems including both overhead and underground.
2. In the field (or possibly from the company records and checked in the field), enumerate all data pertaining to the generation and transformation of electricity.
3. Using the company records, compile all data

pertaining to meters and land owned or leased by the company. This information should also be spot checked in the field.

4. Prepare a complete inventory of all general equipment used primarily in connection with the operation of electric utility properties.
5. While the material covered by sections 1, 2, and 3 is being collected, the same field parties should prepare a map record showing the location of all this property except the meters.
6. The material collected in sections 1, 2, 3, and 4 should be checked and summarized in the office.
7. This summarized material should be transferred to the permanent property ledger in a form that will allow changes to be made as they occur and that will conform with the Uniform Classification of Accounts used in a given State.
8. The map material collected in the field should be checked and transferred to the permanent records.

APPENDIX A

DETAILED INSTRUCTIONS

I. INSTRUCTIONS TO PROJECT SUPERVISORS

A. Field Supervisor

1. Under no condition are the field men to talk to customers regarding any change of equipment; adjustment of bills, or any general service complaint. If the field men have any suggestions to make they should be made to the engineer in charge and if he thinks them to be important he may bring them to the attention of the management. It would be well to instruct the field men to report any dangerous conditions that may exist on the pole lines or any condition existing that if remedied would aid the management in rendering better service.

2. The field supervisor must prepare instructions as to just what type of equipment each division is to inventory, as well as a list of units under each type of equipment. There are cases where assemblies are considered as a unit to avoid a tremendous amount of detail being kept in the permanent continuous inventory record. These cases should be singled out in the instructions. This list of units and assemblies will be covered in the instructions to each division head with their general instructions.

3. Underground equipment may be found throughout the territory to be inventoried. It would be costly to assign an organization to inventory only this equipment. Therefore, the parties assigned to inventorying overhead should be trained to inventory underground equipment as they encounter it. Otherwise, it would be necessary to duplicate a great deal of travel. Definite instructions regarding the problem must be issued to the overhead engineer, including suitable

methods of venting manholes before entry for inspection or listing of equipment.

4. Instructions should be prepared requiring each of the four assistant field supervisors (overhead engineer, meters engineer, land and rights-of-way engineer, and power engineer) to report weekly regarding the progress made. This report should show the proportional part of the complete towns inventoried in the case of distribution parties, the towns or lines inventoried in the case of transmission, the generating plants in the case of power crews, and the substations in the case of substation crews. It would be well to record the progress on a pin map in the sponsor's office to confirm the written reports. This information should be as accurate as possible as the sponsor will use these compilations to check the adequacy of the remaining funds to complete the project.

B. Overhead Engineer--Duties

1. Training Personnel

After the personnel is chosen and available for assignment, small groups of these men should be taken into the field and thoroughly trained in the methods to be used in inventorying, particularly with reference to the identification of equipment. It would be best not to have over 15 men in each training group. It also might be well to wait until a few groups have been trained before selecting the regional engineers and the party chiefs. The regional engineers and party chiefs should be given special training later.

A good method of training is to select a nearby section of distribution line that will cover nearly all types of equipment.

Start with the wood poles and explain what they may expect to encounter in the field, such as various methods of marking, which will show ownership, variation in height, and how to determine the kind of treatment. On the recently set poles it will be possible to determine the date set as most of them carry some marking, such as date nail or a stencil. Next show the various types of cross arms, with their special braces, such as alley arms, vertical braces, etc., explaining that it is not always possible to determine the cross-arm size by counting the pins because many times there will be blank spaces or extra pins. Next explain that guys should be considered as one unit regardless of the length or makeup. There will be three types of guys--anchor, head, and stub. The inventory sheet explanation goes into detail regarding each type. Care must be taken that all guys are recorded. Often they are quite difficult to discern, especially tree guys. The other item under pole supports will be push braces. There is only one type of push brace, and it should be considered in its entirety as a unit. There will be some difficulty encountered in dealing with secondary brackets. Most of them are standard to all manufacturers, but their appearance may vary somewhat. It would be well to prepare an instruction sheet showing the various types of brackets with their trade names. Racks will fall under this general explanation but should cause little difficulty as they are standard in appearance.

The problem of wire will be somewhat difficult for beginners to understand as it is necessary to classify by use. Each party chief must be given special instructions on this phase of the inventorying. It is very likely that in some locations the field party will find

transmission and distribution wires both primary and secondary as well as street lighting attached to the same pole; here it might prove difficult to distinguish between transmission and primary distribution. Be sure that the distinction is well covered in the instructions. In many towns and cities the fire alarm wires may be on the company poles; this may be confusing. It is desirable that the company furnish a man to distinguish wire sizes and material when this is not feasible, it will become the duty of the party chief to estimate as best he can, from the ground, the sizes and material of the wire.

Since there are so many different types of insulators, cutouts, and arresters, it would be well to issue written instructions illustrated with sketches regarding this equipment. Insulators are not to be broken down by material (such as glass and porcelain) but classified by voltage and type. The Uniform Classification of Accounts will require that insulators be segregated as to their use. This will not be difficult as the use must be determined for the wire account. The men should be warned against inventorying one point brackets as pin insulators; they will often be found on top of the cross arms. Cutouts will vary a great deal; plug, porcelain box, and wood box will be found in the field. The plug will not vary in style or rating but the porcelain and wood box will vary a good deal. It is essential that the rating be determined. This information can be obtained from the ground if the observer is well trained, as the sizes will vary with the capacity of the cutout. Arresters will vary approximately the same as the cutouts and the same instructions will apply. There will be little trouble in identifying grounds. These are to be classified by use. The men should be instructed to be

certain that all lightning arresters are grounded.

There is no problem in identifying transformers, but there may be difficulty in establishing their rating. It will be found that many companies have this information stenciled on the outside of the case; if not, it will be the duty of the company man to obtain this information. Only company men should be allowed inside any enclosure surrounding transformers. Care is to be taken that voltage regulators are not mistaken for transformers; the former may be readily identified as there will be no secondary wires or service wires running from them. Street lighting transformers will be a little more difficult to identify. However, if the circuit is followed out, this difficulty will be eliminated.

While inventorying transformers, the field party will find special transformer installations where platforms, cement mats, vaults, and buildings have been constructed to support or house transformers. These installations may also include extra cross arms, extra insulators, brackets, cutouts, arresters, and wire. While the Federal Power Commission's Uniform Classification of Accounts does not require that these installations be kept separate, it has proved beneficial in many cases to have this material segregated by installations. This can be done by assigning identifying names or numbers to each installation. If a transformer platform is supported by poles that also support the primary or secondary circuits, the poles are to be inventoried as distribution poles. But when a structure (including the poles) is used solely to support the transformer station, it is to be inventoried as a part of the transformer installation. Care must be taken to explain

to the field parties the difference between these installations and the distribution substation installations. Possibly it will be well to point out that these installations transform current from primary distribution voltage to the voltage at which it is used by the customers.

Services are to be considered as a unit regardless of their makeup. Open wire services are to be broken down into two, three, or whatever number of wires there may be. With cable service it will be only necessary to list the number. In the case of underground services, it is the policy of many companies to have the customer own all underground services that take off from overhead conductors. Therefore, before inventorying any utility property the policy of the company should be determined.

An instruction sheet should be issued that covers every type of street lighting fixture that may be encountered. Code letters should be assigned to each type of fixture. It will be found that one type of bracket may be assembled with more than one type of head. In these instances code letters should be issued to each assembly. Street lights will also be considered a unit, and the drop wires and their supports will not be inventoried. The unit will consist of all material from where the drop wires take off from the conductor. Many meter boxes will be very similar in appearance to time switches. Therefore, it is necessary that the data covering time switches and meter boxes be read from the name plate. Street lighting standards or ornamental poles must not be included in the distribution pole account; they must be inventoried as a separate unit. The data should include the height, make, type, and catalog number of the standard and a complete description

of the head.

The points to be covered in the training of the field parties that will inventory the transmission system will be very similar to the foregoing instructions for distribution lines. In the case of poles it will be necessary to inventory by location, as in many cases there will be two and three pole structures; these are to be noted and their height recorded, as in distribution. Also many steel structures will be found. The type of structure and its height will be recorded, and it will be advisable to sketch the type of tower on the back of the inventory sheet. The field parties should be well instructed as to how the insulator supports are to be inventoried as there are many types other than wood. Details of the construction may be acquired from the utility; if this is possible the trouble of sketching equipment will not be necessary. The tower footings are to be carefully measured, and in cases where crib work in swamps is used this also is to be noted. The insulators will be inventoried the same as distribution insulators, noting the type, voltage, and if they are disc insulators, the number of discs.

One type of equipment peculiar to transmission lines is the switches used for sectionalizing the lines. Since this is all high voltage equipment, it will be necessary for the company man to determine the type and rating of this equipment. In inventorying transmission conductors, be sure not to inventory parallel grounds as primary conductors.

Underground equipment will be quite difficult to inventory. Where the companies have built their underground systems as major projects, however, it will be quite simple to take the original work order into the field and spot check. But, in some cases, it will be found that these underground systems have been built up in short sections and a great number of work orders are involved. In such instances, a complete new inventory should be made. When inventorying underground, a division of material by use should be made, such as transmission, distribution, and street lighting. Cables and conduits will not be difficult to recognize. However, data concerning the specifications of cables would be hard to obtain without the help of company records. Manholes are to be classified by size and type of material; the same applies to all drainage equipment. Miscellaneous equipment, and fixtures, such as grating, ladders, cable racks, and hangers, etc., is to be listed by type. Equipment associated with underground installations will be far more standard than that associated with overhead.

When inventorying conduits, indicate the material (concrete, fibre, iron, tile, etc.), the number of ducts a section, and the length of each section. Service ducts should be kept separately. All junction boxes, service boxes, potheads, and such equipment will vary in dimension, but the design will be similar. Care should be taken to inventory and set up equipment associated with communications, signal system, and remote control in their proper accounts.

Following this training on identification of equipment the field parties should be instructed as to the methods to be used in

recording the inventory. An explanation of the overhead inventory form is given in Appendix A, Section II.

2. Organization of Overhead Personnel

During the training period, the instructor (overhead engineer) will have a chance to be in close contact with the complete overhead field personnel which should aid him materially in choosing the men to act as regional engineers and party chiefs. The number of men required to fill these positions will vary directly with the size of the project. There should be one regional supervisor to six or seven field parties. Each field party is made up of a party chief, a recorder, and a tapeman.

With this organization complete, the overhead engineer should confer with his regional engineers regarding the efficient routing of the field parties. A certain section should be laid out for each regional engineer. The size of this territory will depend upon the density of the population. Not more than one month's work should be laid out at a time. It should be made clear to the regional engineers that each town or city must be completely inventoried before leaving. Failure to do this will result in a large number of loose ends to gather up at the end of the project. Moreover, it is necessary to have a tax district complete before the summarizers' and typists' work can start.

Instructions should be prepared listing the symbols to be used by all field parties in recording various types of equipment.

Next the overhead engineer should prepare instructions outlining the duties of each member of his staff, which are as follows:

(a) Regional engineer--duties. - It is the duty of each regional engineer to:

- (1) Have full charge of the field parties operating under his direction and to confer with the overhead engineer regarding routing of these parties.
- (2) Be responsible for the accuracy and neatness of work turned in by field parties under his supervision.
- (3) Determine the proper procedure for taking inventory when a situation arises which is not covered by the general instructions referring to the general supervisor if necessary.
- (4) Make sure after the training period that the party chiefs are familiar with the material to be inventoried. If there is any doubt as to the knowledge of these men, it would be well to arrange for them to visit the company stockroom before going into the field.
- (5) Inventory personally all transformers in the company stockroom. This list should be marked "Transformers in stock."
- (6) Certify the accuracy of all field sheets making sure they are properly filled in, tied in, and mapped. When street names do not appear on the map, they must be supplied. Where names or numbers of roads or streets are adopted for heading field sheets the corresponding road on the map must be similarly labeled.
- (7) Make sure there are no short spurs missed in the inventory and also that all equipment on poles carrying both transmission and distribution is inventoried by the proper party.
- (8) Fill in on inventory sheets all data that could not be obtained in the field by the field party. This will have to be collected in the company office. Where company men are not available to accompany the field parties it will be necessary for the regional engineer to verify the information recorded regarding wire sizes and equipment ownership.
- (9) Be responsible for an orderly compilation of the field parties' time and mileage, which will be submitted weekly to the overhead engineer.

- (10) Report any member of field parties under his supervision whom he feels is not performing his work properly.
 - (11) Prepare daily progress reports of all parties under his supervision and mail them weekly to the overhead engineer.
 - (12) Forward a report when a city or township has been fully inventoried. The report should be forwarded to the overhead engineer with the final field sheets and the completed map. The report should contain a statement that the tax district is completed; it should also bring to the attention of the summarizers any unusual construction they may have encountered.
- (b) Party Chief--Duties.---It is the duty of each party chief to:
- (1) Follow the route laid out for him and to take all short side runs and dead ends when encountered.
 - (2) Locate the transmission and distribution lines as found in the field on maps designated by the regional engineers. These lines should be tied in with the inventory sheets by proper symbols so that the computers may definitely check the field sheets with these maps at a later date.
 - (3) Be responsible for the accuracy of his records.
 - (4) Personally sign the sheets where indicated to show that he has reviewed them and certifies their correctness.
 - (5) Turn in at the close of each day to the regional engineer all completed field sheets together with the time and mileage for his party. If the junction of his district with another party seems complicated, the party chief should inform the regional engineer with a written memorandum.
 - (6) Report to the recorder the numbers and names of units found in the field in their proper order.
 - (7) Determine--with the assistance of a company man-- the size of wire and cable as well as the ownership of poles.
 - (8) Check each pole when inventoried with chalk or crayon.

(c) Recorder--Duties.--It is the duty of each recorder to:

- (1) Keep the notes of the party and to personally sign each sheet where indicated.
- (2) Start new sheets for new streets or branches.
- (3) Start new sheets for each tax district and record the data as instructed by the regional engineer.

(d) Tapeman-Duties.--It is the duty of each tapeman to:

- (1) Report to the recorder the measured distances to the nearest foot from pole center to pole center.
- (2) Be responsible for the tape at all times.
- (3) Transport the party in accordance with instructions of party chief.

3. Rechecking of Field Sheets

The following points should be covered when rechecking the field sheets.

- (a) Primary and secondary shown on one sheet must be tied in to next sheets by notes in the first column of the inventory sheet; e.g., "From pole 100 on Summit Avenue to pole 93 on Main Street." This refers to the first and last span on each sheet, respectively. This system will eliminate any missing spans in the primary and tend to help eliminate missing spans in the secondary.
- (b) Examine the sheets by columns to see that all secondary circuits are fed from a transformer and that all services are fed from a transformer or a secondary circuit. Also check to see that each transformer either feeds a secondary circuit or a service. In making these checks the possibility of a break in the secondary circuit is completely eliminated.

- (c) Look out for missing span lengths and missing mileage readings. On rural lines where speedometer readings are used for length of primary conductors, length of secondary spans must be taped and this distance recorded on the line "span lengths."
- (d) Investigate all questionable notations, such as one wire primaries, or secondaries, five and six wire services, three wire services from two wire secondaries, street lights without conductors, etc.
- (e) Study sheets to make sure that other users will understand and be able to correctly interpret all notations. Empty spaces must be left unfilled. Do not draw any lines across them.
- (f) Where underground equipment is encountered, be sure the complete system is covered by following the company maps when available. When maps are not available, the first step in inventorying underground should be to map completely the territory to be inventoried. This may be accomplished with the assistance of the utility plant engineer who will be very familiar with the layout.

C. Meters Engineer--Duties

1. The meters engineer must assist the overhead engineer in choosing the motemen who are to work in this division. The metermen will not be experienced men. Therefore, it will be the duty of the meters engineer to train the personnel as well as organize the work.

It will not be necessary to familiarize the metermen with physical characteristics of the various types of meters as they will deal mostly with the company records.

2. The metermen should be organized into parties of two; one should read off the book data, while the other records.

3. It will be the duty of the meters engineer to make all final arrangements with the utility managements for the metermen to have access to the company records. However, he should assure the management that his men will not interfere with the office routine.

4. He should next prepare an instruction sheet containing the general procedure to be followed and a brief statement as to type of equipment that will be found in the records. Following is a list of the equipment with a statement as to the general data to be collected on each type.

- (a) Watt-hour meters.--In auditing the meter records it will be disclosed that type numbers are not standard but vary from one manufacturer to another. Consequently, type number information on meters should be disregarded. The primary interest should rest on the rating of the meter. The inventorying party should be concerned with the voltage, amperage, phase, and the number of wires of each meter. In going through the meter record, every unusual installation should be noted, such as those with steel cabinets, test blocks, etc. There will be cases where special recording watt-hour meters will be installed. Full name plate data are to be taken in these cases.

- (b) Demand meters and demand attachments.--It will be desirable to separate these two items. The demand meter is a one-unit combination assembly of meter and indicator; when either part fails, it is necessary to take the unit from service. The demand attachment, however, may be put into operation with any meter; if the meter fails, the demand attachment may be transferred to another meter. In the case of demand meters it will be necessary to take the complete name plate data as they vary a great deal in type. In this class of meters there will also be found many special installations, such as graphic and maximum demand meters. This equipment should all be carefully listed. For demand attachments it will only be necessary to show the rating or scale and capacity.
- (c) Metering transformers.--The "current" transformer is an instrument connected in series with the incoming lines, while the "potential" transformer is connected across the incoming lines. These two types of equipment offer somewhat of a problem, since definite location will be difficult to establish from the meter records unless these records are closely analyzed. These transformers may be used where primary metering is necessary, where special recording meters are used, and where watt-hour meters of small capacities are used to record consumption of a customer having a large load. It will be desirable to record all installations using this type of equipment as a separate unit by assigning to it a

name for identification. It will then be possible to take these records into the field and spot check by locations. An installation will usually consist of a meter cabinet, a slate or marble panel, a meter switch, a test block, meter transformers, and a meter. For potential transformers, the voltage rating and the voltage ratio should be recorded; for current transformers the amperage or current rating and the current ratio should be recorded.

5. In addition to the metermen who will work with company records, the meters engineer should assign two or three men to do nothing but spot check company records. These men should be given data pertaining to the meter rating and location; with this information they should visit the location and determine the accuracy of the company records. It may be necessary to readjust the working hours of these men especially in mill towns in order to avoid more than one call to check the meter.

6. In the instructions to the field checkers the fact should be brought out that in certain cases these men may find so-called "jumpers" across the meters which consumers may install to steal current. These "jumpers" in their simplest form consist of two wires connected between the incoming line-side of the meter and the load-side of the meter, thus by-passing current over these external wires, without going through or registering on the meter.

7. For inventory purposes it will be desirable to use each company's meter field books, as these have a complete listing of all active meters. These books contain also data indicating the rating of each meter.

It will probably be necessary to return some of these books to the company meter readers before all the data in the book can be obtained. In such cases care should be taken to make an accurate record of the stopping point in order to avoid duplications or omissions in the final count.

8. An accurate record of changes in number of meters in use during the inventorying period must be kept. After the active meters are tabulated all inactive meters in the company stockroom must be inventoried. These records must be adjusted to conform with the changes that have taken place during inventorying period.

9. The meters engineer will have full charge of all personnel in this division. It will be his duty to fully instruct the metermen, to check the field reports for consistency and neatness, to submit progress reports weekly to the general supervisor, and to answer any questions that may arise in the field.

D. Land and Rights-of-Way Engineer

1. It will be the duty of the land and rights-of-way engineer and his assistant or assistants to compile data as to the extent, location, and use of all land and rights-of-way. This information must be compiled from the company records and then checked in the field. The description of the land--when company owned--should be taken from the deeds. The description should include a statement of the extent of the property, its use, and the deed reference from which the information was taken. In cases where property is not owned but various rights are held by the company, a record should be made as to the type of agreement as well as a description of the property involved. Rented buildings are not to be included.

2. While inspecting these land records, the land and rights-of-way engineer should watch for property that is held in excess of that required for electric operations. There will be many cases where large plots of land were bought to acquire certain rights or possibly bought for future development. This land should be segregated and held in the nonoperating account. There will be cases where property was bought to protect the rights of the company. In such instances the transactions should be carefully analyzed. If the judgment of the company is questioned by the land and rights-of-way engineer, he should confer with field supervisor before classifying the property. In other cases where it was necessary for the companies to acquire land in excess of that needed, the land and rights-of-way engineer should tentatively classify this land as he finds it; but he should bring these cases to the attention of the field supervisor, who in turn will ask the chief engineer for a final classification.

3. In as many cases as possible the land and rights-of-way engineer should establish the amount of cutting that was necessary to clear the land for its present use. This information is very helpful in appraising the property at a later date.

4. The land records should be supplemented by maps showing the exact location of all company owned property. It will be the duty of the land and rights-of-way engineer to check these records in the field to determine the accuracy of the company records.

5. The administrative duties of the land and rights-of-way engineer are the same as those prescribed for the other division heads.

E. Power Engineer

1. It will be the duty of the power engineer to supervise the inventorying of all types of generating and substation equipment.

2. He will assist the field supervisor in selecting the personnel and also assist in drafting instructions for the head of each of his departments. The power engineer will divide his work into five departments, each headed by a specialist. Each specialist will be responsible for his department and report directly to the power engineer. The departments will be hydro, internal combustion, steam, accessory electric, and substation equipment. In order to avoid overlapping, each specialist will inventory only that equipment associated with his department.

3. The equipment to be inventoried is as follows:

- (a) Hydro equipment.--Inventory all structures and improvements used in connection with hydraulic generation.

This includes buildings to house, support, or safeguard property or persons and all fixtures permanently attached.

There should be data concerning foundations, retaining walls, brick, steel or concrete stacks, and chimneys when set on foundations that form part of the general foundation of the building. The superstructure of the building should be recorded in details that would allow reconstruction of the building on paper. Fixtures permanently attached to the building may be elevators, cranes, hoists, boilers, furnaces or any equipment for heating, ventilation, plumbing, lighting, etc.

Inventory all reservoirs, dams and waterways; all permanent constructions used for impounding, collecting, storing, regulating, and delivering of water to water wheels and from the draft tubes to the tailrace should be enumerated. This will include: Bridges and culverts (when not a part of roads or railroads; dams including wasteways, spillways, flash boards, spillway gates with operating and control mechanisms, tunnels, gate houses, and fish ladders; dikes and embankments; foundations and settings specially constructed for and not expected to outlast the apparatus for which provided; intakes including trash racks, rack cleaners, control gates and valves with operating mechanisms, and intake house when not a part of station structure; power lines wholly identified with items included herein; retaining walls; water conductors and accessories including canals, tunnels, flumes, penstocks, pipe conductors, forebays, tailraces, navigation locks and operating mechanisms, water-hammer and surge tanks, and supporting trestles and structures; and all other miscellaneous equipment that may be associated with the above mentioned.

Water wheels, turbines, and generators should be described, and where possible the name-plate data should be recorded regarding each unit. The following items should be enumerated: Exciter water wheels and turbines including runners, gates, governors, pressure regulators, oil pumps,

operating mechanisms, scroll cases, draft tubes, and draft-tube supports; foundations and settings specially constructed for and not expected to outlast the apparatus for which provided; generator cooling system; generators--main, A.C., or D.C., including field rheostats and connections for self-excited units; lubricating systems; main turbines and water wheels including runners, gates, governors, pressure regulators, oil pumps, operating mechanisms, scroll cases, draft tubes, and draft-tube supports; mechanical meters and recording instruments; miscellaneous water-wheel equipment including gages, thermometers, meters, and other instruments; and all other miscellaneous equipment that may be associated with the above mentioned.

- (b) Steam equipment.--The structure and improvement records should include the same data as those under hydro equipment.

Boiler plant equipment to be inventoried includes all furnaces, boilers, coal and ash handling, and coal preparing equipment, steam and feed water piping, boiler apparatus and accessories used in the production of steam, mercury, or other vapor to be used for generating electricity. Items to be inventoried under the boiler plant equipment account will be: Ash handling equipment including hoppers, gates, cars, conveyers, hoists, sluicing equipment including pumps and motors, sluicing water pipe

and fittings, sluicing trenches and accessories, etc., except sluices which are a part of a building; boiler feed system including feed water heaters, evaporator condensers, heater drain pumps, heater drainers, de-aerators, and vent condensers, boiler feed pumps, surge tanks, feed water regulators, feed water measuring equipment, and all associated drives; boiler plant cranes and hoists and associated drives; boilers and equipment including boilers and baffles, economizers, superheaters, soot blowers, foundations and settings, water walls, arches, grates, insulation, blow-down system, drying out of new boilers, also associated motors or other power equipment; coal handling and storage equipment including coal towers, coal lorries, coal cars, locomotives and tracks when devoted principally to the transportation of coal, hoppers, downtakes, unloading and hoisting equipment, skip hoists and conveyers, weighing equipment, magnetic separators, cable ways, housings and supports for coal handling equipment; draft equipment including air preheaters and accessories, induced and forced draft fans, air ducts, combustion control mechanisms, and associated motors or other power equipment; gas-burning equipment, including holders, burner equipment and piping, control equipment, etc.; instruments and devices including all measuring, indicating, and recording equipment for boiler plant service together with mountings and supports; oil-

burning equipment including tanks, heaters, pumps with drive, burner equipment and piping, control equipment, etc.; pulverized fuel equipment including pulverizers, accessory motors, primary air fans, cyclones and ducts, dryers, pulverized fuel bins, pulverized fuel conveyors and equipment, burners, burner piping, priming equipment, air compressors, motors, etc.; stacks including foundations and supports, stack steel and ladders, stack brick work, stack concrete, stack lining (when set on separate foundations, independent of substructure or superstructure of building); station piping including pipe, valves, fittings, separators, traps, superheaters, hangers, etc., for station piping system (including all steam, condensate, boiler feed and water supply piping, etc., but excluding piping for condensing water, plumbing, building heating, oil, gas, air, or piping specifically provided for in the structure account); stoker or equivalent feeding equipment including stokers and accessory motors, clinker grinders, fans and motors, etc.; water purification equipment including softeners and accessories, evaporators and accessories, heat exchangers, filters, tanks for filtered or softened water, pumps, motors, etc.; water-supply systems including pumps, motors, strainers, raw-water storage tanks, boiler wash pumps, intake and discharge pipes, and tunnels not a part of a building.

Record all equipment associated with steam engines (reciprocating or rotary, and their associated auxiliaries) and engine driven generators. Exclude turbo-generator units from this account as they have an account of their own. The following should be included: Air cleaning and cooling apparatus including blowers, drive equipment, air ducts not a part of building, louvres, pumps, hoods, etc.; bolting, shafting, pulleys, reduction gearing, etc.; circulating pumps including connections between condensers and intake and discharge tunnel; cooling system including towers, pumps, tank, and piping; condensers including condensate pumps, air and vacuum pumps, ejectors, unloading valves and vacuum breakers, expansion devices, screens, etc.; cranes, hoists, etc., including items wholly identified with items listed herein; engines, reciprocating or rotary; foundations and settings especially constructed for and not expected to outlast the apparatus for which provided; generators--main, A.C., or D.C., including field rheostats and connections for self-excited units, and excitation systems when identified with the generating unit; governors; lubricating systems including gages, filters, tanks, pumps, piping, motors, etc.; mechanical meters including gages, recording instruments, sampling and testing equipment; piping-main steam including connections from main throttle valve to turbine inlet; pressure oil system

including accumulators pumps, piping, motors, etc.; tunnels, intake and discharge, for condenser system, when not a part of a structure; water screens, motors, etc.

Inventory all turbo-generator units including turbine and generator, field rheostats, and electric connections for self-excited units.

- (c) Internal combustion equipment.--Inventory of structures will be the same as that under "Hydro" and "Steam."

Inventory all fuel holders, producers, and accessories; all equipment installed for fuel handling and storage between the point of fuel delivery to the station and intake pipe to the engine should be inventoried in detail. Items chargeable to the internal combustion equipment account will be: Blower and fans; boilers and pumps; economizers; exhauster outfits; flues and piping; pipe system; producers; regenerators; scrubbers; steam injectors, tanks for storage of oil, gasoline etc.; vaporizers.

Inventory in detail all internal combustion engines devoted to the generation of electricity. This account will include: Air-filtering system; belting, shafting; pulleys, reduction gearing, etc.; cooling system, including towers, pumps, tanks, and piping; cranes, hoists, etc., including items wholly identified with apparatus

listed herein; engines, including Diesel, gasoline, gas, or other internal combustion types; foundations and settings especially constructed for and not expected to outlast the apparatus for which provided; governors, ignition system; inlet valve; lighting systems; lubricating systems including filters, tanks, pumps, and piping; mechanical meters including gages, recording instruments, sampling, and testing equipment; mufflers; piping; starting systems, compressed air, or other including compressors and drives, tanks, piping, motors, boards and connections, storage tanks, etc.; steelwork specially constructed for apparatus listed herein; waste heat boilers, antifructuators, etc.

The internal combustion engine generators account should include: Cranes, hoists, etc., including items wholly identified with such apparatus; fire-extinguishing equipment; foundations and settings, specially constructed for and not expected to outlast the apparatus for which provided; generator cooling system including air cooling and washing apparatus, air fans and accessories, air ducts, etc.; generators--main, A.C., or D.C., including field rheostats and connections for self-excited units and excitation system when identified with the generating unit; lighting systems; lubricating system, including tanks, filters, strainers, pumps, piping, coolers, etc.; mechanical meters and recording instruments; platforms, railings, steps, gratings, etc., appurtenant to apparatus listed herein.

- (d) Accessory electric equipment.--This department is to inventory all accessory driven electric equipment used primarily in connection with generating electricity by water, steam, or internal combustion power and its delivery from the generating station to adjoining overhead or underground construction. Also included is auxiliary generating equipment to supply all electricity for auxiliary and general station use. Items to be inventoried under this heading will include: Auxiliary generators and exciters together with their driving units; storage batteries; control operation including charging equipment; switch boards together with their wiring, switches, switch compartments, lightning arrestors, etc.; motor generator sets, frequency changers and rotary converters with their transformers; synchronous condensers, transformation equipment for supplying transmission or distribution feeders or for station use; cables, wires, and control equipment and other apparatus wholly identified with any of the apparatus included in this account, such as cranes, hoists, ventilating systems, etc.
- (e) Substation equipment.--This department is to inventory all equipment located in substations (either indoor or outdoor) used for the purpose of changing the characteristics of the electric current in connection with its transmission or distribution or of controlling its flow. This includes all

wiring and apparatus between the incoming terminals and the outgoing terminals of any substation, switching station, or transformer station. Items to be inventoried under the heading of substation equipment will include: Bus compartments, concrete, brick, and sectional steel, including items permanently attached thereto; conduit including concrete and iron duct runs not part of a building; control equipment, including batteries, battery charging equipment, transformers, remote relay boards, and connections; conversion equipment including transformers, indoor and outdoor, frequency changers, motor generator sets, rectifiers, synchronous converters, motors, cooling equipment, and associated connections; fences; fixed and synchronous condensers, including transformers, switching equipment, blowers, motors, and connections; foundations and settings especially constructed for and not expected to outlast the apparatus for which provided; general station equipment, including air compressors, motors, hoists, cranes, test equipment, ventilating equipment, etc.; platforms, railings, steps, gratings, etc.; appurtenant to apparatus listed herein; primary and secondary voltage connections, including bus runs and supports, insulators, potheads, lightning arresters, cable and wire runs from and to outdoor connections or to manholes and the associated regulators, reactors, resisters, surge arresters,

and accessory equipment; switchboards, including meters, relays, control wiring, etc.; switching equipment, indoor and outdoor including oil circuit breakers and operating mechanisms, truck switches, and disconnect switches; tools and appliances.

- (f) General equipment.--Under each of the five foregoing departments the power engineer will find equipment devoted to general station use. This is to be inventoried along with the other equipment according to use. All equipment that can not be associated with any one class of property should be included. Examples are: Compressed air and vacuum cleaning systems, miscellaneous hoisting equipment, fire extinguishing equipment, intrasite communication systems, fire alarms; station maintenance equipment, such as lathes, shapers, drill presses, etc., with their shafting, belting, and driving units; ventilating equipment, laboratory equipment, and all such miscellaneous equipment.

Each of the foregoing power equipment items should carry as much detail as it is possible to acquire. However, for the smaller pieces of standard equipment, the name plate data and year of installation are sufficient. Particular attention should be devoted to major items of power equipment. For each turbo-generator unit, for example, a record should be made of: The name plate number, the name plate ratings in kilovolt-amperes, kilowatts, and the power factor; also the water rate at

one-half load, at three-fourths load, and at full load; the steam pressure and temperature; the maximum continuous load the unit can carry in kilowatts at the rated power factor; the generator voltage, phase and frequency; and the year of installation. As was suggested in the earlier part of the manual unless an orderly method is followed in inventorying this equipment, some equipment is apt to be overlooked.

After all equipment at one location has been inventoried by the proper departments, it will be the duty of the power engineer to consolidate these data and check the complete installation for omissions.

It will be advisable to have all specialists concerned with any one installation inventory that installation at the same time. In following this plan all the inventorying parties will be finished at approximately the same time and the finished data may then be turned over to the inventory records department for checking and typing.

F. Reviewers

The engineers in charge of the four field divisions will have at their disposal a number of reviewers who will assist them in checking the field sheets turned in by the field parties. It will be the duty of these men to check for omissions, to be sure the field sheets are tied in with one another and the map, and also check to be sure the material compiled may be readily interpreted by the summarizers.

G. Inventory Records Engineer

The duties of the inventory records engineer have already been given in the text section entitled "Personnel," where this

engineer was assigned the duty of supervising all office work pertaining to auditing, compiling, and recording of data collected in the field. To fulfill these obligations to the project, he should prepare instructions regarding the routine of the work and the duties of each person under his supervision.

All field sheets and maps should come directly to the inventory records engineer. He, with whatever assistance he may need, should segregate these data by towns and hold until a town is completed in the field. An exception to this routine will occur in the larger towns or cities that are sectionalized. As soon as the field sheets and maps for a complete town or section are received in the office, a clerk assigned to this work is to stamp each sheet. This stamp will allow for the signature of the computer, the summarizer, and the checker. In no case should these sheets be accepted for final filing until someone has signed for each of these operations.

The inventory records engineer will now assign this material to a group of three: The Checker will make sure the field sheet is tied in with the map record, check the continuity of the route to make sure the sheets are tied in to one another, and lastly check the heading to make sure all the information is there. He will then number the sheets in red pencil, sign, and pass on to the computer. This man must analyze the body of the sheet very carefully for any omission and must interpret the sketches and classify the material. After the sheet is analyzed he should summarize the material on the sheet and record the data in the proper column. He is then to sign the sheet and pass it on to the summa-

rizer. This man will be responsible for transferring the compiled data on the field sheets to the final summary forms. These forms will be explained in appendix A, section II. After signing, the summarizer should collect the field sheets by towns, place in a folder, and transfer to the file department.

The material is now ready for the typists who will in turn transfer the data on the summary sheets to the property ledgers. The work of the typists will be checked by the readers for any clerical errors. The permanent records will be discussed under appendix A, section II.

The inventory records engineer shall supervise the mapping department. After he is assured by the checkers that all the inventoried property in one town or city is properly mapped, the field maps should be turned over to the draftsmen. It is desirable to prepare the tracings of uniform size. Therefore, it will be necessary to vary the scale somewhat because of the variation in the size of the towns to be mapped. It is advisable to study the territory to be mapped as it may be possible to agree on a scale and a map size that will cover all the townships. Urban areas will require a much larger scale than rural areas. It will probably be necessary to use 200 feet to the inch scale for urban areas; otherwise, the map will be so congested it will not be usable.

For base maps covering rural areas it is suggested that the maps of the United States Geological Survey be used. When these are not available, town or city maps will have to be used. If the latter maps are used they should be carefully checked for changes that have occurred since they were compiled.

For base maps covering urban areas, town or city maps will have to be used. A careful check should be made for such things as distorted road widths, omission of alleys, new streets, etc. The field crews may find that more than one map is available; in such cases, each map should be studied before choosing one.

The completed maps should show the extent of the distribution or transmission system within the town or city, the location of each generating plant or substation, the voltage and wire sizes at the terminus of each primary distribution line, the voltage of each transmission line, and the location of all underground. When a town is served by more than one company it will be necessary to compile a map for each company.

A State map should be compiled showing the areas served by each company. This will be a sizable map; a 2- or 4-mile scale should be used. This is necessary as in many towns more than one company has a franchise to serve and the divisions must be accurate; it is impossible to make accurate divisions on a map with a 10- or 12-mile scale.

Another State map should be made showing all transmission lines, generating plants, switching stations, substations, and tie-in lines for customer groups. This map should also be compiled on a 2- or 4- mile scale. The lines should be labeled as to ownership and voltage; when a line carries both transmission and distribution this also should be noted.

The only other maps necessary to the project should show the land owned by each company. It would be advisable to compile separate maps, on a half-mile scale, to show all property at one location owned by each utility. These maps should be tied in to the master reference

map, made up on a 5- or 6-mile scale, showing all the property owned by one company.

All maps should be compiled on linen tracing cloth to allow for annual changes.

Suggested symbols to be used on these maps are as follows:

-  Hydro-generating plant
-  Steam generating plant
-  Hydro-steam generating plant
-  Internal combustion generating plant
-  Substation
-  Switching stations

S-#6-2300V Distribution line on town map

33KV Transmission line on State transmission map

33KV Transmission line on town map

— — — Line carrying both transmission and distribution

○ — — — Customer group tie-ins

— — — Underground

In organizing the draftsmen it may be advisable to assign one man the task of compiling the transmission map; one the area served map; and the remainder of the work will be assigned as the data are received from the field.

Other duties assigned to the inventory records engineer are of a routine administrative nature and will not be discussed as they are the same as those assigned to other supervisory engineers.

H. Chief Clerk

It will not be necessary to issue instructions to cover the duties of this employee as they will vary, dependent on the requirements of the sponsor and the Work Projects Administration.

II. INSTRUCTIONS ON FORMS USED

Four sets of forms are necessary to meet the requirements of the inventory. One set will be required for enumerating the inventory in the field, another for summarizing the field sheets in the project office, a third set for permanently recording the results of the summaries in ledger form, and a fourth set for annually reporting changes in the inventory once it is established. A discussion of each of these sets follows. The general instructions given in this section will require amplification to meet local conditions and problems.

A. Field Forms

Field inventory forms will be required for overhead, meters, land and rights-of-way, and power. Examples of field inventory forms are given in Appendix B for overhead (Form 1) and meters (Form 2). General instructions for filling out these two forms are given below. Plain ruled sheets with a vertical column for separating the number of units and the description of the unit are usually satisfactory as field sheets for inventorying land and rights-of-way, power, and underground other than services. The sponsor will be expected to submit copies of all field forms to be used and instructions for filling out the forms.

1. Overhead Field Sheet (see Appendix B - Form 1)

This form will be used by field parties for inventorying overhead. As was stated previously the party chief will report to the recorder the extent and character of all units found in the field and the tapeman will furnish the data as to the span lengths. Following is an explanation of the form.

Heading

Sheet number - Omit.

Party sheet - Start with number 1 daily and follow through in numerical sequence. The sheet number should be preceded by the party number.

Type - Indicate whether transmission or distribution.

Mileage - Used only in rural areas where pole lines follow the road for long distances.

Balance of data show information as indicated.

Poles

Marks - Indicate company pole number.

Ownership - When owned by more than 2 parties, use symbol "J/3"; for two parties, "J"; solely owned, "S." Ownership should be determined by company representative.

Kind - Wood, steel, or whatever may be used; in the case of steel show type; if round, give diameter at ground line. When towers are used, determine type; if not standard, make sketch on back of sheet.

Treatment - Show full treated or painted. Full treated, "F"; painted, "P"; when stopped, note "S" in this space.

Date set - In many cases there will be date nails; in others, the date will be stamped on the pole.

25' - 30' - 35' - Equipment provided will determine these lengths. Use other blanks for poles of sizes other than the ones mentioned.

Crossarms

2 pin) - Show number of units opposite proper description. When crossarms other than the ones mentioned are encountered, use extra spaces.

Special braces

Include alley arms, angle iron, or any other type that may be found. Alley arms, "AL"; angle iron, "AI."

Guys

Anchor - Anchor is pole to dead man, anchor, or rock; "A."

Head - Head is pole to pole, building, or tree; "H."

Stub poles - Stub guys are made up of two separate guys and a pole. Each stub guy is to be considered as two head guys or a head and anchor guy, depending upon the way the stub pole is guyed. Record only the stub pole length in this space.

Push braces

There is only one type. Therefore, only the number of units will be entered in this space.

Racks

2 spool) - Write in description of others when en-
3 spool) countered. Assembly should include spools.

Secondary brackets

Show type by symbol.

Wire

Span lengths - Spans should be measured from pole center to pole center. Omit this line when automobile mileage is used.

Primary) - Use these spaces for number of spans,
Secondary) such as 2 or 3, filling in opposite
Street lights) each the wire size; e.g., "#6WP."

Insulators

For transmission or distribution insulators, show type as designated and voltage.

For street light insulators, show type as designated.

Cutouts

Must be inventoried as to their use, either line or transformer. Show type and capacity.

Arresters

Same.

Grounds

Same.

Transformers

Inventory as indicated.

Services

Mark opposite 2 wire or 3 wire whether underground, "UG," or overhead, "OH."

Street Lights

Type - Show this by symbols, such as "A" for Goose-neck, "B" for Right Angle Bend, etc.

Time switch - Show capacity and voltage.

Street light transformer - Show type and rating.

Remaining lines to be used for miscellaneous equipment.

General

Additional information may be shown on the back of any sheet but sheet should be marked "Over." This should be used in the case of doubtful equipment, unusual construction, or possibly a small map of an underground system.

If there is any question regarding any separate item, this item should be marked with a question mark and brought to the attention of the regional engineer.

2. Meter Field and Summary Sheet (See Appendix B - Form 2)

This form is to be used for recording data from the company records regarding all equipment used for measuring the electricity delivered to the users. The heading, which is self-explanatory, must be filled in as indicated. In the first column of the form record the specification of the equipment to be inventoried; in the remaining columns record the number of units found. These columns are designed to record five meters in one space; this is desirable as it will be found, in going through the meter books, that a large majority of the meters will have the same rating. Furthermore, the grouping of meters will help to reduce the number of meter sheets to a minimum.

Record information concerning: meters of all kinds; demand attachments; metering transformers (both current and potential); miscellaneous meter equipment, such as meter boxes, test blocks, etc., and special meter installations. Data to be recorded are listed in section I of this appendix under "Meters engineer --duties."

B. Summary Forms

The general purpose of the summary inventory form is to classify the field data so that they can readily be transferred to the permanent ledger forms by typists. Examples of overhead summary forms (Forms 3 -- 10) are given in appendix B. The meter field and summary sheet (Form 2) is used both as a field form and as a summary

form. Summary forms will not be required for land and rights-of-way since these data will be transferred directly from the field sheets to the ledger forms. Nor will a summary form ordinarily be necessary for power since power plants have very few units associated with a major unit of equipment at a given location that are alike. Power units are not summarized when recorded in the property ledger as they are perpetuated by locations and use. For example, in a distribution substation each panel of the switchboard is inventoried separately and associated with the unit it controls. General instructions for the overhead summary forms follow.

1. Overhead Summary Forms (see Appendix B--Forms 3-10)

Overhead data compiled in the field on Form 1 will be summarized and totals transferred to the summary forms. As one page of a summary form is filled out the total of that page is transferred to the second page of the same form, thus providing a convenient running total of the territory being inventoried. Do not try to summarize any special equipment on these sheets. When a special structure or a special piece of equipment is encountered on the field inventory Form 1, transfer it to a blank sheet making sure the transferred material is marked so it will not get lost.

C. Property Ledger Forms

After a summary is compiled for a given town, the data are to be typed on the property ledger forms. The property ledger constitutes the permanent and basic record of the inventory. A description of the necessary ledger forms (Forms 11 and 12) follows:

1. Land Record Ledger Sheet (see Appendix B--Form 11)

Record the land and rights-of-way data on Form 11. The heading of the record indicates the ownership, the operating district, the town, and the land use. In the body of the record incorporate a complete

description of the property including details as to the location in the town, title, area (for rights-of-way, also indicate the length and width). All this material is to be compiled by the land and rights-of-way division and typed on the ledger form directly from the field sheets. There will be a ledger sheet for each class of property in each town. The strip labeled "This space for annual certification" will be used to note reference numbers and dates of changes.

2. Equipment Record Ledger Sheet (see Appendix B--Form 12)

All data except land and rights-of-way are to be entered on Form 12. The heading is the same as that of the land ledger form; the body, however, differs in that all descriptions of units are made in the column to the right side of the sheet. The number of units are entered on the line opposite the unit description under the date on which the inventory was completed. The remaining columns are for annual changes. This compiled data should be divided by towns or cities and then subdivided by accounts that conform with whatever Uniform Classification of Accounts that may be adopted. In the upper right corner of each sheet, indicate the account number that covers the property listed on the sheet.

D. Report of Inventory Changes

The report forms have no part in the compilation of the original inventory. They are suggested forms to be used by the utilities for annually reporting changes in their physical property. It is important that the commission determine the various units of

reporting so that the original inventory may be kept up to date. The Commission may do this by defining the units of reporting. Another method is to furnish each utility company with a copy of the final inventory and require that changes in the number of the various units listed be reported periodically. The following two forms are suggested for reporting inventory changes.

1. Report of Changes in Physical Inventory (see Appendix B -- Form 13)

This form should be used for reporting all changes in units of property except those for which the exact location is specified in the inventory (e.g. poles, wire, meters, transformers, street lights, etc.). The heading of the form is self-explanatory. In the first and second columns list the account number and unit description, respectively. The remainder of the columns are for the purpose of recording additions and retirements of the specified unit classified by towns within the operating district.

2. Report of Changes in Physical Inventory (see Appendix B -- Form 14)

This form is used for all property changes other than those covered by Form 13. In general, Form 14 is used for reporting changes made in items of equipment that carry a great deal of detail or are recorded in the ledger by location (e.g. power plants, substations, buildings, land, etc.). Locations and descriptions of property should be indicated in sufficient detail to readily identify the unit or units involved.

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APPENDIX B
FACSIMILES FORMS

OVERHEAD FIELD SHEET

Company _____ Sponsors Name _____ Sheet No. _____

Town _____ Party Sheet _____ Party Chief _____ Recorder _____

Street _____ From _____ To _____ Date _____

Type _____ Mileage Start _____ Mi. Finish _____ Mi. Net _____ Mi.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Totals
	Marks																					
	Ownership																					
	Kind																					
	Treatment																					
	Date Set																					
Poles																						
	25'																					
	30'																					
	35'																					
Cross Arms	2 Pin																					
	4 Pin																					
	6 Pin																					
	Pin																					
	Special Braces																					
Guys	Anchor																					
	Head																					
	Stub Pole																					
	Push Braces																					
Racks	2 Spool																					
	3 Spool																					
	Spool																					
	Second Brackets																					
Wire	Span Lengths																					
	Pri. No.																					
	Pri. No.																					
	2nd No.																					
	2nd No.																					
Trans. or Dist. Insulators	St. Lt. No.																					
	St. Lt. No.																					
	Pin																					
St. Lt. Insulators	Disc																					
	Strain																					
Cutouts	Pin																					
	D.E.																					
Arresters																						
Transf. Services	Grounds																					
	Voltage																					
	KVA																					
Street Lights	Phase																					
	2 Wire																					
	3 "																					
	Cable																					
Type																						
	Time SW.																					

Note: When printed this sheet should be 9 $\frac{7}{8}$ " X 16". For purposes of easy reading all vertical lines and the top double lines should be in red ink; the horizontal lines should be in blue.

Company _____

Sheet No. _____

District _____

Date Recorded _____

Town _____

Recorder _____

[illegible]

Note: When printed this sheet should be $9\frac{7}{8}" \times 16"$

AF-2928, WPA

LAND LEDGER SHEET

P-100 Form II

COMPANY _____ DISTRICT _____ TOWN _____ ACCOUNT NO. _____
ACCOUNT NAME _____ SHEET NO. _____

Note: When printed this sheet
should be 11 X 15 inches.

This Space for Annual Certification

AF-2937, WPA

EQUIPMENT RECORD LEDGER SHEET

P-100 Form 12		COMPANY		DISTRICT		TOWN		ACCOUNT NO.		SHEET NO.													
ACCOUNT NAME												UNIT DESCRIPTION											
	Total 12/31/39	Add 1940	Retire 1940	Total 12/31/40	Add 1941	Retire 1941	Total 12/31/41	Add 1942	Retire 1942	Total 12/31/42	Add 1943	Retire 1943	Total 12/31/43	Add 1944	Retire 1944	Total 12/31/44							
1																	1						
2																	2						
3																	3						
4																	4						
5																	5						
6																	6						
7																	7						
8																	8						
9																	9						
10																	10						
11																	11						
12																	12						
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14																	14						
15																	15						
16																	16						
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26																	26						
27																	27						
28																	28						
29																	29						
30																	30						
31																	31						
32																	32						
33																	33						
34																	34						
35																	35						

Note: When printed this sheet should be 11 X 17 inches. All vertical lines, the top parallel horizontal lines, the second and every fifth line thereafter should be printed in red. All remaining horizontal lines in the body of the table should be blue.

AF-2939, WPA

REPORT OF CHANGES IN PHYSICAL INVENTORY

[illegible]

Note: When printed 1 : sheet should be 11 X 15 inches.

P-100
Form 14

SHEET _____

REPORT OF CHANGES IN PHYSICAL INVENTORY
COMPANY _____

DISTRICT _____ TOWN _____ PERIOD _____ ENDING _____

*Note: When printed this sheet
should be 8½ X 11 inches.*

AF-2940, WPA

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