

Fig. 1. Jackson State Forest.

REPORTS OF THE
DEPARTMENT OF CONSERVATION AND DEVELOPMENT
STATE OF NEW JERSEY

ANNUAL REPORT

For the Year Ending June 30,
1918

Department of
Conservation and Development

SUCCEEDING
THE GEOLOGICAL SURVEY
THE FOREST PARK RESERVATION COMMISSION
THE STATE MUSEUM COMMISSION
THE STATE WATER-SUPPLY COMMISSION
THE WASHINGTON CROSSING PARK COMMISSION
THE FORT NONSENSE PARK COMMISSION



TRENTON, N. J.
M.:cCRELLISH & QUIGLEY Co., State Printers

1919

Letter of Transmittal.

To His Excellency, Walter E. Edge, Governor.

Sir:—I have the honor to submit for your information, and for transmittal to the Legislature as required by law, the annual report of the Department of Conservation and Development for the fiscal year ending June 30th, 1918. It includes reports by the Board, the State Geologist, the State Forester, and the State Firewarden.

By direction of the Board of Conservation and Development.

Very respectfully yours,

ALFRED GASKILL,

Director.

State House, September 17th, 1918.

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The Department of Conservation and Development.

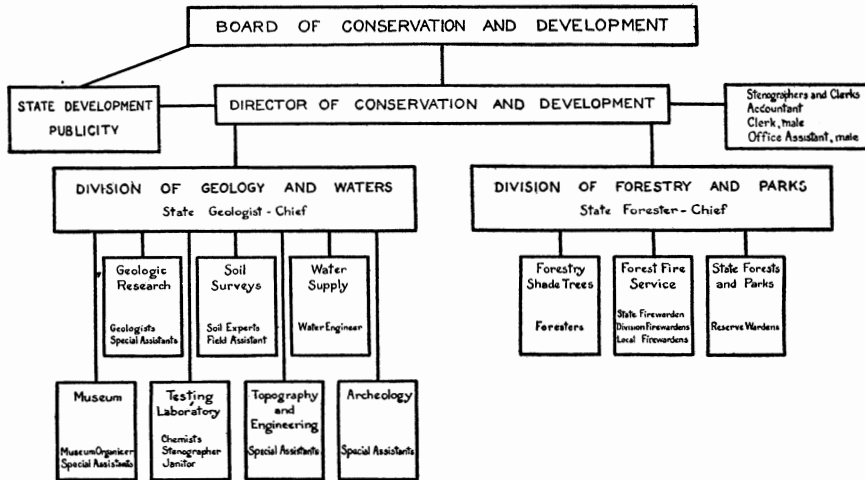
OFFICE, STATE HOUSE ANNEX, TRENTON.

The Board of Conservation and Development.

HENRY CROFUT WHITE, *President*,North Plainfield
 PERCIVAL CHRYSTIE,High Bridge
 JOHN L. KUSER,Bordentown
 SIMON P. NORTHRUP,Newark
 STEPHEN PFELL,Camden
 ISAAC F. RICHEY,Trenton
 GEORGE A. STEELE,Eatontown
 WILLIAM E. TUTTLE, JR.,Westfield

ALFRED GASKILL, Princeton,*State Forester and Director*
 HENRY B. KÜMMEL, Trenton,*State Geologist*
 CHARLES P. WILBER, Trenton,*State Firewarden*
 M. W. TWITCHELL, Trenton,*Assistant State Geologist*
 H. T. CRITCHLOW, Trenton,*Water Engineer*
 J. VOLNEY LEWIS, New Brunswick,*Consulting Geologist*
 W. M. BAKER, Trenton,*Assistant Forester*
 HELEN C. PERRY, Trenton,*Museum Curator*
 R. B. GAGE, Trenton,*Chemical Engineer*
 C. C. ENGLE, New Brunswick,*Soil Classifier*
 WM. LINDSAY, Trenton,*Assistant State Firewarden*
 JOS. E. ABBOTT, Vineland,*Division Firewarden*
 F. C. TORREY, Lakehurst,*Division Firewarden*
 R. E. THOMPSON, Morris Plains,*Division Firewarden*

DEPARTMENT OF CONSERVATION AND DEVELOPMENT



Report of the Board of Conservation and Development.

The thirtieth day of June having been adopted by the Legislature as the termination of the official year, the following report covers the period between November 1st, 1917, the date of the last report, and June 30th, 1918.

CHANGES IN BOARD MEMBERSHIP.

Changes in the Board's membership have been as follows: Mr. Nelson B. Gaskill, having resigned on May 9th to accept a commission in the United States army, Mr. Isaac F. Richey, of Trenton, was appointed his successor. Messrs. Edward S. Savage and Charles L. Pack, whose terms expired July 1, were respectively succeeded by Mr. William E. Tuttle, Jr., of Westfield, and Mr. John L. Kuser, of Bordentown.

Mr. Henry Crofut White was elected President for the year beginning July 1.

WAR ACTIVITIES.

The past year, despite wholly inadequate appropriations, increased expense in every line of activity, and the almost insuperable difficulties occasioned by the great war, has demonstrated, as never before, the value to the State of a department charged broadly with the power and duty of investigating and conducting any project of State development not specifically committed elsewhere. In the national emergency, the Board has not hesitated to construe and exercise such power and duty liberally, with the knowledge that no mere adherence to routine, however efficient, would, or should, be accepted as sufficient, but that its part in the State's response to the Government's call could only be performed by constructive thought and effort.

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As must always be the case, because of the Board's peculiar position, much of its work has been suggestive and co-operative. Not by neglect of any essential detail of the Department's activities; rather by redoubled thought, determination, and effort on the part of the whole organization, these have been exercised with due regard for the needs of the State and nation alike and in co-operation with the Federal administration.

Food production now having been well organized under established agencies, the following subjects were some of those receiving particular attention.

In forestry, serious effort has been made to locate practically available lumber supplies for the Government.

An active wood fuel campaign has been organized and conducted, and measures taken to provide such fuel, in co-operation with the State Fuel Administration, with important results apparent.

In response to the Government's call for black walnut and white ash considerable supplies of each have been located.

A State-wide census of lumber resources is about to be commenced.

The exhibition space and cabin on the Trenton Fair grounds which have been used for several years to exhibit Departmental activities, especially in forestry, will be occupied in 1918 by the Red Cross.

In geology, the State's already noted maps have, by constant labor, been kept up to date for the use, and with the expressed approbation of the military and industrial authorities.

Assistance in the search for war minerals and mineral fertilizers has been repeatedly sought and given.

In the location of the several encampments and cantonments, the Government has asked and received frequent advice and information as to potable water supplies. Moreover, at the Department's suggestion, Chapter 137, Laws of 1918, was enacted, granting to the Federal Government during the period of the war for any military encampment free use of any source of potable water which does not interfere with the needs of an established community.

REPORT OF THE BOARD.

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An arrangement has been made with the Federal Government by which the Water Engineer will undertake a study of the interconnection of water and steam power plants in this and neighboring States for the purpose of conserving coal.

MOSQUITO CONTROL.

Whether for military advantage, the health of our civil population or the future industrial and financial development of the State, the Board believes and takes this occasion to reassert that no subject within its own, or perhaps any other jurisdiction, more greatly merits consideration, effort, or *sufficient* appropriations than the extermination of the mosquito.

Public interest and public demand are increasing in practically every section, as is the belief, both scientific and popular, based upon accomplishment, that the adopted plans are thoroughly practical.

Late in the winter, the Atlantic City Chamber of Commerce took up actively the recommendation of the Director of this Department and inaugurated a campaign for immediate State control. That is now under way. Early in the spring the executives of several shipyards and munitions plants became greatly concerned for the health and comfort of the workers, and, with State officials, considered plans for extensive control. The problem appears to involve only a question of money, and money in a very moderate amount, considering the benefits to be secured. The practical freeing from the mosquito pest of large portions of Bergen, Essex, Hudson, Union, Middlesex, Monmouth, Ocean, Atlantic and Cape May counties justifies the assertion that our whole area can be swept clear.

The Department continues to urge an appropriation by the State of \$750,000, to be available in annual installments of \$150,000 each, with which sum, in addition to what the counties are prepared to spend, it is confidently believed that the salt-marsh mosquito can be practically driven from New Jersey within five years. The labor problem should and can be met by detailing prisoners and reformatory inmates to the work. Continued study of the benefits to be derived from salt-marsh mosquito control

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indicates that the estimate that the ratables will be increased by at least \$500,000,000 within 20 years is too low, rather than too high, since many enterprises—industrial, agricultural, social and recreational, wait upon the elimination of the insects.

In the face of such facts, a legislative policy which, despite every effort of the Department and of many county and important individual interests, results in an appropriation of but \$10,000, cannot but be viewed with regret and concern.

UNDEVELOPED LANDS.

The special report on the undeveloped lands of the State, submitted to the Governor and published with the report of the Department for 1917, has aroused much interest and caused many inquiries.

New Jersey's great advantages, outside the metropolitan and coast section, have been so studiously ignored that few, even of our own people, know anything about them.

Though the State is one-fourth smaller than Belgium, and its population only two thirds as dense, the two are comparable in their diversity of resources. In their development, the contrast is significant. Belgian soil is highly cultivated, there is little waste land. With that, and a moderate store of minerals, as a basis, her industries have multiplied, her resorts and social life have been established, and a greater population, per area unit, is supported than in any other European state except one.

All this and more is possible here. We have the best location in the United States. Our soil, climate, and natural advantages are unsurpassed. The facts that our industries have met the demand for war supplies, that our waterfronts are carrying more shipbuilding and shipping than those of any other State, that our territory has been found fit for great munitions plants, military and naval encampments, and a vast number of new industrial enterprises, are proof of our attractions. They are further proof to any thoughtful mind of the need of balancing them with proper agricultural development in the regions suitable therefor. In the face of these things, the people of New Jersey are under obligation to realize their heritage and to redeem it.

REPORT OF THE BOARD.

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LAND REGISTRY.

As a means of making effective the effort to locate new citizens the State needs an organization which shall collect and distribute definite information concerning lands of every kind available for occupancy. Other States with far less resources than our own do this and accomplish much. The Department has repeatedly tried to secure an appropriation for the purpose, but without success. For no more than \$5,000 a year very important results can be secured. From this point of view the State is a business, and demands business facilities and advertisement.

FORESTRY.

The development of the State along the lines above indicated calls attention to the fact that we have too much forest. Our effort, therefore, continues toward removing, for agriculture or other purposes, some of the forests that occupy land fit for a higher use, and at the same time toward developing the remaining forests so that they shall be more productive. In other words, we need fewer but better forests. This effort appears to be upon the point of receiving considerable support through the desire of the Federal Government to be assured of the necessary lumber supplies near the points of consumption. New Jersey has been almost criminally neglectful of her opportunities in the way of producing from her own land the lumber that her industries need, instead of importing it so largely from other regions. The means to this end have been frequently stated: *First*, to control forest fires; and, *second*, to assist the owners of the forests to make them productive and profitable.

State forests.—The 16,178 acres of forest land owned by the State is being added to as opportunity arises. These seven tracts (see pp. 67, 68) serve the double purpose of providing demonstrations in practical forestry, and confirming the State's determination to make the most of our forest resources. For neither of these objects are great areas required. It is far wiser to leave most of our forests in private control and to make it worth while for the owner to care for and develop them.

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Shade trees.—In arboriculture, or shade tree work, the State at large is more keenly interested than ever. Shade tree commissions are increasing. The care of trees under private control is more widespread. Late in the spring the Forester submitted to the State Highway Department a plan by which the highways outside of municipalities could be provided with shade, and the Freeholders of Bergen County have already taken preliminary steps toward the same end.

Forest fires.—The forest fire service continues to cope with the traditional fire evil under very serious shortage of money, yet with fair success. The time has arrived when this organization should be materially strengthened so that property values represented by growing forests shall have the security to which they are entitled. The recommendations of the State Firewarden in this connection (see p. 85) are endorsed by the Board. The number of fires and the losses suffered cover but eight months, and therefore are not comparable with those published annually heretofore, but they show about the usual losses. These figures hereafter will be reported for each *calendar* year, since that period better represents conditions than the fiscal year.

KITTATINNY FOREST PARK.

After having carefully considered for a year the recommendation made by the State Forester, the Board is convinced that the creation of a great forest park on the Kittatinny Mountain, in Sussex and Warren counties, is a project of inestimable worth, and urges that provision be made for the gradual acquisition of the property. (See map.)

The necessity for extensive and varied playgrounds for all classes of people is generally admitted. One of New Jersey's greatest resources is her coast resorts, and to other hosts the woods and mountains are a necessity. Numbers of our own citizens seek their recreation in the hill country of New York, Massachusetts, Pennsylvania and the far West, entirely unconscious of the fact that within our own borders lies a forested mountain region of wonderful attraction.

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Kittatinny Mountain extends from the Delaware Water Gap to the New York line—about 36 miles—and attains an elevation of 1,800 feet. It is wild and rough, completely forested and practically uninhabited, yet is within three hours by train or automobile of Jersey City or Newark. The region is in every way adaptable for a public playground. Close to the foot of the mountain, on the southeast, is a chain of lakes to which considerable numbers of people are now attracted, but which is capable of providing recreation for many times the number. On the northwest is the Delaware valley. Within the region are innumerable trout streams, springs of clear water, and opportunities for camping. (See figs. 2-6) The whole country is easily reached by common roads. By the construction of improved highways on each side of the main ridge every part would become readily accessible.

Another strong reason for the establishment of this State playground rests in the fact that it would attract to the adjacent farm lands and villages a summer population which would tend to overcome the present movement away from the territory, and would build up property values to the great advantage of the communities.

The Federal Government is creating and advertising widely a system of National parks in the far West which now includes seventeen units and over six million acres. But all those are so far away that few can afford the time or the money to visit them. And the State is supporting the Palisades Inter-State Park, though that, after all, is of less direct value to the people of New Jersey than to the people of New York.

This proposition is advanced, not as against the Hudson valley effort, but rather as a complement to it. In our view, the State needs a large area of wild land such as this to which people can resort for a few days or weeks.

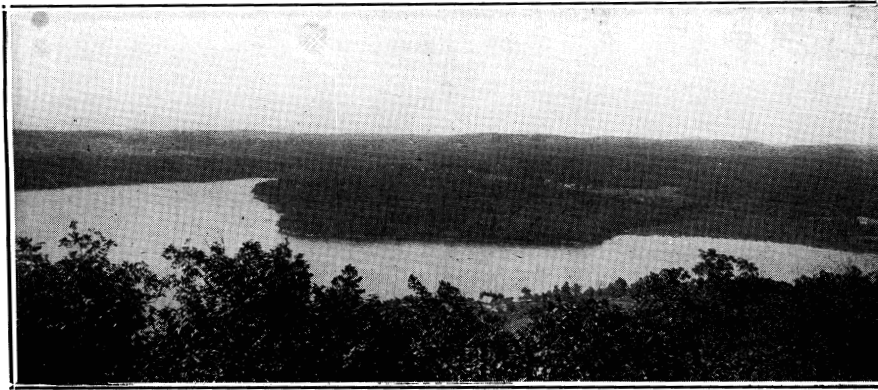
The property needs no embellishment, for in the woods, the streams, the waterfalls and mountain outlooks nature has provided the best. Practical roads, not expensive highways; trails to and along the mountain crest; rough shelter and camp sites are all that need be provided.

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Seventy-five hundred acres, out of the forty thousand that it may be ultimately advisable to own, are now in State possession and have been partly developed. (See p. 67.) It is estimated that 30,000 acres of land can be acquired for \$250,000. If \$25,000 a year are devoted to purchase, the object can be accomplished rapidly enough. The maintenance charge for the whole area need not exceed \$10,000 a year. Ultimately the charge can be completely covered from the income derived from the forests.

WASHINGTON CROSSING PARK.

Proposals in this connection made to the Legislature last winter aroused interest and discussion, at least, and it is now likely that upon return to normal conditions, if not before, provision will be made for a suitable memorial at this historic point. Several years ago the Washington Crossing Park Commission adopted an ambitious plan which has been urged by local interests more or less vigorously from time to time without promise of success. Other sections of the State manifest slight interest. The Department deems the acquisition and improvement of the old ferry house and land immediately about it indispensable to the project. With that accomplished, the next requirement is money for a memorial. It is for the Legislature to decide whether we proceed handsomely, acquiring for park purposes the area indicated on the Commission plan, or, following a modest suggestion, sell the land we now own in the neighborhood and with the proceeds establish a memorial. There will be a memorial eventually and it should stand where the crossing was effected, not merely in the vicinity. Providing and maintaining a large park adjacent thereto as part of the enterprise is a task which the Department will assume most cheerfully if funds are voted by the people's representatives. Maintenance alone would involve not less than \$10,000 a year. An initial outlay of about \$250,000 is required for land and memorial suggested by the Commission plan mentioned. Attention is being given all suggestions of co-operation by the Government of the United States and by the Commonwealth of Pennsylvania, as a favorable step by either is certain to bring prompt response in New



Figs. 2-6. Good playgrounds—Stokes State Forest.

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Jersey. In that direction we see most attractive possibilities of accomplishment on a large scale, yet, in our judgment, it is unwise to leave the project indefinitely awaiting outside action. The Department proposes to make every effort in behalf of early and suitable marking of that location on the east bank of the Delaware River where General Washington landed his soldiers on that memorable night.

WATER RESOURCES.

Excess diversion tax.—Under the operation of Chapter 252, Laws of 1907, the Board certified to the State Comptroller the sum of \$20,470.89 as due the State for water diverted during 1917 in excess of the statutory free allowance. Of this amount \$11,182.82 remains unpaid.

In an action brought by the East Jersey Water Company the Department's certification of the tax was upheld by the Supreme Court and the sum due has been paid. Upon the basis of that decision, and the Department's recommendation, the Comptroller has requested the Attorney-General to bring suit against all the cities and water companies which have heretofore refused to pay any excess diversion charges. In some instances this refusal goes back several years and the successful outcome of the suits will result in the collection of upwards of \$51,000. In this matter the Board has taken the position that the law should be impartially enforced and that all amounts legally certified, either by it or by its predecessor, should be paid.

New diversions, dams, etc.—During the period covered by this report the Board passed upon five applications to divert water and two plans for dams.

Its engineer has investigated the development of water-powers along Musconetcong River, the beginning of a State-wide study of water-powers and their utilization.

Apparatus has been purchased and arrangements are being made for the accurate determination of the amount of water diverted and the pump slippage of water plants not equipped with accurate meters.

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Its studies of the distribution and occurrence of underground water-supplies have been continued and advice given regarding their utilization.

A study of the economy of water metering is under way.

WHARTON TRACT.

The Department conceives one of its most important duties to be the comprehensive examination, and, so far as its jurisdiction extends, regulation and development of the State's potable water supplies.

Increasing population means increased demand with decreased available sources and supply. Industrial plants not only require, but are dependent upon a sufficiency that is running into amounts hitherto unimagined, or at least unanticipated by any proportional scientific provision. Already the cities of the northern portion of the State, as well as some of the smaller communities, have had practical demonstration of present limitations, and feel grave concern for the future. Industrial development has been stayed in some instances and its progress, especially about New York and Raritan Bays, feared for by those interested therein.

In South Jersey, on the other hand, both surface and underground supplies far exceed any local needs, either present or likely to develop. One of the largest tracts available as a source is that owned by the Wharton Estate. The Board, as the result of a very limited examination, made three years ago, at the request of Governor Fielder, reported adversely to the State's purchase of this tract, at the price then named. This tract, however, appears to have undeniable advantages as the source of a great public supply of pure water, and the Board cannot too strongly emphasize the wisdom of an adequate investigation to determine definitely its precise value; the feasibility and cost of water transportation therefrom; its advantages or disadvantages as compared with other possible sources; and other data sufficient to permit an authoritative and definite determination of so important a question.

The cost of such investigation will not probably exceed ten thousand dollars and in the opinion of the Board an appropriation should be made therefor at the earliest opportunity.

REPORT OF THE BOARD.

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STATE MUSEUM.

That the Board has not overestimated the popularity of the State Museum and its educational value is shown by the fact that 20,515 persons visited it during the eight months covered by this report. Of these 3,615 were school children, in 149 classes.

The preparation of loan exhibits, particularly those representing steps in the manufacture of articles in common use, has continued, and the demand from schools indicates that this phase of the Museum's work is highly appreciated by teachers of all grades.

The space available in the State House, both for display and for work rooms, is wholly inadequate if the Museum is to develop along the lines contemplated; and small as the space is, the growing demand for office room threatens curtailment. If this shall eventuate it probably will be necessary to close the Museum to the public and restrict its work to circulating exhibits, a probability which has already aroused strenuous protest by the leading educational institutions and authorities. A separate Museum building, or larger quarters in a new wing of the State House, with a separate entrance from the street or park, is imperatively needed.

In March the Board granted a six months' leave of absence, without pay, to Miss Perry, the Curator, to permit her to engage in war work in France.

TESTING LABORATORY.

The new laboratory was taken over from the contractor near the close of the year, although occupied earlier. A portion of the equipment has been installed, so that the work demanded by the Highway Department could be done. In the interest of economy much of the installation work has been performed by members of the Department.

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SHARK RIVER INLET IMPROVEMENT.

The channel at Shark River continues to maintain itself between the concrete jetties, although it varies in position and depth with the shifting of sand-bars under varying winds. Removal of the wooden piles of the falsework and pouring concrete for a small portion of the cap of the north jetty are all that remain to be accomplished.

SOIL SURVEY.

The study and mapping of our soils, carried on for several years by the Department in co-operation with the United States Bureau of Soils, was continued, most of the field work being in Atlantic and Burlington counties. About the middle of June, the field party was transferred to Morris county, where, during the hot months, work can be carried on with greater expedition and comfort than in the mosquito-infested areas in the south. The importance of this work and the results obtained are set forth in the report of the State Geologist (p. 32).

EMPLOYMENT OF INSTITUTIONAL INMATES.

The policy of working prison and institutional inmates, according to their ability, upon the roads, and other public enterprises promises to be successful. We recommend again that some of these wards of the State be made available for the improvement of the State forests; for opening and maintaining fire lines; and especially for the urgent work of ditching the mosquito marshes.

PUBLICATIONS.

In addition to the annual administrative report for 1917, the following special publications have been issued:

Wood Fuel. A 16-page bulletin, illustrated, showing the State's firewood resources and how to utilize them. A second edition is now on the press.

A Shade Tree Guide. A 22-page bulletin, illustrated, giving specific advice on the care of shade trees.

Archæology of Warren and Hunterdon Counties. (Bulletin 18, Geologic Series.) An 88-page bulletin giving location and description of Indian habitations.

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The Quaternary Formations of Southern New Jersey. (Volume III of the Final Reports of the State Geologist.) A report of 218 pages, illustrated, giving the results of an exhaustive study of the southern portion of the State.

Topographic Atlas Sheet No. 35, on a scale of 1 inch = 1 mile. Revised edition.

Morristown Topographic Atlas Sheet, on a scale of 1 inch = 2,000 feet. Revised edition.

Geologic Map of New Jersey. Scale, 1 inch = 4 miles. New edition.

Road Map of New Jersey. Scale, 1 inch = 4 miles. Revised edition.

County and Municipality Map. Scale, 1 inch = 4 miles. A revised edition of this map was in the hands of the engraver at the close of the year.

ADVICE AND INFORMATION FREE.

The policy of the Department has long been, and still is, to make the knowledge which it has accumulated freely available to the public. Only upon the ground that our studies and investigations are for the education and advantage of all can the use of public funds for these purposes be justified.

Correspondence is invited; information is given by letter or in printed reports; only in cases where an inquiry involves special field or laboratory work, which it is advisable to undertake, will any charge be made.

AUXILIARY COMMITTEE.

Because of the war's demand upon the time of most men, the Board has deemed it inadvisable to call upon the Auxiliary Committee. Such a body of experienced, public-spirited citizens will be of great value in the near future provided, of course, appropriations shall render it possible to carry out the recommendations that the committee undoubtedly will be prepared to make.

DETAILED REPORTS.

The activities of the organized branches of the Department are covered by the reports of the State Geologist, the State Forester and the State Firewarden, submitted herewith.

THE OUTLOOK.

The Department has been considerably handicapped by the withdrawal of several of its members to engage in war work, and the necessity of training their successors, or the inability to find such successors, but far beyond this, its activities have been hampered at every turn for want of funds. It was necessary to make a general advance in salaries to meet present living conditions; unfortunately the Legislature did not see fit to increase the appropriation to cover those advances; the result is that the Department is even more restricted than it has been.

The record of the Department's first three years of effort is closed with an expression of regret that means have not been provided to develop the many latent resources of New Jersey. Few States are so wonderfully endowed; few have so persistently neglected great opportunities.

THE BOARD OF CONSERVATION AND DEVELOPMENT,

By ALFRED GASKILL,
Director.

Financial Statement.

FOR THE FISCAL YEAR ENDING JUNE 30TH, 1918.

RECEIPTS.

Appropriation for Maintenance (8 mos.), ²	\$42,000 00	
Transferred to Township Fire Bills,	1,200 00	
		\$40,800 00
Appropriation for Township Fire Bills,	\$5,000 00	
Transferred from Maintenance,	1,200 00	
		6,200 00

DISBURSEMENTS.

Administration—		\$47,000 00
Salaries—Clerical and Emergency,	\$3,725 92	
Traveling expenses—Board members,	103 46	
Stationery and blanks,	1,006 26	
Postage,	1,159 71	
Telegraph and telephone,	143 29	
Express and freight,	85 05	
Books, instruments and furniture,	674 12	
Incidental supplies,	159 22	
Insurance,	342 09	
Printing (not stationery and blanks),	518 75	
Division of Geology and Waters—		
Salaries—Technical Force,	13,490 50	
Traveling expenses—Technical Force,	1,032 45	
New maps,	749 00	
Laboratory apparatus, supplies, etc.,	373 84	
Museum supplies,	681 20	
Heat, light and power at Laboratory,	362 39	
Incidental supplies,	160 24	
Division of Forestry and Parks—		
Salaries,	11,303 18	
Traveling expenses—Foresters,	457 30	
Traveling expenses—Fire Service,	2,794 40	
Maintenance of State forests,	191 90	
Fire Service Equipment,	31 32	
Fire lookout tower,	350 00	
Incidental supplies,	133 10	
Forest tax lieu,	293 78	
Township fire bills,	5,395 56	
Held for fire bills outstanding,	804 44	
On requisition for outstanding bills,	307 69	
Lapsed to State Treasury,	169 75	
		\$47,000 00

¹ Above statement includes bills paid to December 1, 1918, but incurred prior to June 30, 1918.

² Total appropriation for year was \$63,000, but change in the fiscal year reduced appropriation to proportionate amount for 8 months.

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NEW TESTING LABORATORY.

Appropriated for building,	\$34,639 00	
Appropriated for equipment,	3,000 00	
Transferred from Road Department,	2,050 00	
		\$39,689 00
Expended to June 30, for equipment,	\$5,033 28	
Lapsed to State Treasury,	16 72	
Expended to June 30, for building,	27,008 43	
Contracts,	7,630 40	
Lapsed to State Treasury,	17	
		\$39,689 00

SHARK RIVER INLET IMPROVEMENT.

Appropriations, State and local,	\$114,000 00
Expended to June 30,	\$107,300 33
Reserved for rentals, etc.,	5,655 25
Lapsed to State Treasury,	1,044 42
	\$114,000 00

CASH ACCOUNT.

RECEIPTS.

Balance on hand November 1, 1917,	\$180 09	
Sale of geological maps and reports,	825 80	
Fire penalties,	2,518 60	
Forests and parks,	209 00	
Miscellaneous,	58 21	
		\$3,791 70

DISBURSEMENTS.

Paid State Treasurer,	\$1,267 05	
Paid to Township Treasurers,	1,841 05	
Miscellaneous,	13 00	
On hand June 30, 1918—		
Due State Treasurer,	\$317 20	
Due Township Treasurers,	353 40	
		670 60
		\$3,791 70

Report of the State Geologist.

HENRY B. KÜMMEL.

ADMINISTRATION.

Scope of Report.—This report summarizes the activities of the Division of Geology and Waters for the eight months' period ending June 30th, 1918. The field season July to November is not included in this shortened fiscal year, and therefore the record of outdoor activities is briefer than in previous years.

Some scientific results of the work of the Division have been published as special reports and maps (see p. 24). The continued popularity and demand for the maps of the Department is evidenced by the following figures of sheets distributed: 1916, 5642; 1917, 5618; 1918 (8 mos.), 3509. There has been a great demand for these maps by military officers and others in connection with the numerous cantonments, camps and other military stations in New Jersey.

TOPOGRAPHY AND ENGINEERING.

Shark River Inlet Improvement.—In November the work of driving piles at the seaward end of the north jetty was completed, and casting the reinforced cement top was commenced. Before this could be completed, inclemency of weather and shortage of funds compelled cessation of the work. The plant was put in order for the winter and the crew, with the exception of the superintendent, discharged. An arrangement was made with the firm from whom the machinery was hired by which rent should not be paid during the months it was not in use.

It was expected that the adjudication of the claim for rental for the use of the contractor's plant would be settled shortly, and that a part of the money thus tied up would become available for completing the work. Contrary to expectations and promises, the decision had not been made at the close of the fiscal year (nor at the time of writing, September 1st). It has therefore been impossible to complete the capping as intended. The superintendent and one or two men have been engaged in removing the wooden piles of the falsework which obstructs the channel, and in cleaning up.

The delay in completing this work, due in considerable part to the slowness of litigation, is certainly exasperating, but beyond the power of the Department to remedy, restricted as it is by the limitations of its appropriation.

Resignation of C. C. Vermeule.—In May C. C. Vermeule, for many years consulting engineer and topographer to the Geological Survey, and later to the Department, was forced by pressure of his other interests to sever all connection with the Department. This step was a matter of deep regret, particularly to the State Geologist, because of his long association with Mr. Vermeule, whose integrity and ability as an engineer he held in high esteem.

Mr. Vermeule's connection with the Geological Survey began in 1879, when as assistant to Dr. Geo. H. Cook, then State Geologist, he was engaged in making the topographic map of the State. Placed in full charge of this work the following year, he pushed it energetically to completion in 1887, and supervised the engraving of the lithographic stones and the publication of the finished maps. Other results of the topographic survey were set forth by him in a volume of 435 pages entitled "Topography, Magnetism and Climate of New Jersey," he being the author of the first two topics. All subsequent revision and alteration of the topographic maps, made necessary by the marvelous development of the metropolitan sections of the State, have been under Mr. Vermeule's supervision.

On the completion of the topographic survey Mr. Vermeule opened an office in New York as consulting engineer, with the Geological Survey as one of his clients, a relationship which con-

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tinued uninterrupted until his resignation. After the topographic survey, he commenced his studies of stream flow and the water resources of New Jersey—investigations which continued over many years and which, in importance, equal his topographic work.

These studies were made public in the report of the Survey entitled "Water Supply, Water Power, the Flow of Streams and Attendant Phenomena," published in 1894. Supplemental papers in several later Annual Reports of the State Geologist dealt with floods, particularly those of Passaic River.

Later Mr. Vermeule gave considerable attention to the study of forest conditions in New Jersey and the effect of forests on rain fall and stream flow, a considerable portion of the Report on Forests, 1899, having been written by him.

During the thirty-nine years of his connection with the Geological Survey and its successor, he was called upon for advice on diverse engineering subjects in addition to those enumerated above. Some of his papers on these matters were published in the Annual Reports of the State Geologist; others are in the files of the Department.

Revision of maps.—Atlas sheets 39 and 42, commonly known as the Municipality Map and the State Road Map, were revised during the year so as to bring them up to date. A new edition of the Roap Map was printed and placed on sale. The engravers were at work on the Municipality Map when the year closed.

MINERAL STATISTICS.

As in previous years, the Department has co-operated with the United States Geological Survey in the collection of the statistics of mineral production during 1917. This work has been under the direction of Dr. M. W. Twitchell, who has prepared the summary tables given on pages 107 to 109. The total for the State amounted to \$45,516,478, an increase of \$5,080,816 over that for 1916.

SOIL SURVEY.

The differentiation of the soils and their mapping in accordance with the standards of the United States Bureau of Soils at Washington has proceeded without interruption except as imposed by climatic conditions. However, the cessation of field work during the winter gave opportunity for the compilation of field data, and the preparation of the maps necessary to the publication of the final report.

During November and part of December, field work was continued in South Jersey, in the Millville area, 204 square miles being mapped. The field party consisted of Messrs. A. L. Patrick and H. C. Smith, of the United States Bureau of Soils, and C. C. Engle and L. L. Lee, of the Department of Conservation and Development. About the first of December Messrs. Patrick and Smith were sent to other States, but field work was continued by the New Jersey men until the middle of the month, when inclement weather prevented. During the winter months Mr. Engle at the experiment station at New Brunswick, and Mr. Lee in the Trenton office, worked on their maps and reports.

The State's men commenced field work the third week in April in South Jersey, and after a few days spent in revision of several small tracts in the Millville area, the party began mapping the soils in the region covered by atlas sheets 32 and 33. This area lies chiefly in Burlington and Ocean counties east of a line from Mount Holly to Hammonton. It will be known as the Toms River area. It embraces approximately 1100 square miles, and two or more field seasons (spring and fall) will be necessary to complete the survey. Since the greater part of this tract lies within the so-called "pine" belt, and is undeveloped agriculturally, the careful classification and mapping of the soil will go far toward determining the proper values of this portion of the State. It is known, of course, that all the soils of this area are light and sandy and not so well suited for general farming as heavier soils. It is believed, however, that not all parts of this area are of the same value; that the soil of some parts is much better than of others, and that the soil survey will give definite and authoritative

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information. If the survey does nothing more than furnish reliable information by which a check may be placed upon the fraudulent representations of speculative real estate dealers, it will be worth all its costs; for these undeveloped and comparatively unknown areas are the most subject to vicious misrepresentation, by which many persons are induced to purchase farms at what appear to be low prices, but in reality are exorbitant rates.

About the middle of June the State men were joined by Messrs. A. L. Patrick and E. B. Deeter, of the United States Bureau of Soils, and the party moved to northern New Jersey, a change made advisable by the difficulty of working in the mosquito-infested areas of the southern part of the State during the hotter months. One hundred and thirteen square miles had been mapped before the transfer was made.

The area to be mapped in North Jersey is that covered by atlas sheet 25, and probably the western part of sheet 26. It lies immediately east of the Belvidere area completed last year, and will be known as the Bernardsville area.

STATE MUSEUM.

The popularity of the State Museum as an agency of interest and instruction shows no signs of lessening. The attendance both of classes from schools and of adults has been well maintained. Special exhibits from time to time have added to the general interest. The influence of the Museum beyond the limits of Trenton is increasing. More use is being made of the loan collections as a greater variety of material has been prepared.

With more room for preparation, and more funds for material and workers, the usefulness of the Museum and its value as an adjunct to the educational system of the State can be much increased. War conditions have, however, compelled a curtailment rather than an expansion for the coming year in that less funds will be available. But this is not the worst feature of the present situation. The crowded condition of the State House and the necessity of providing office room for new departments has compelled the State House Commission to decide to trans-

form a part of the present Museum room into offices.¹ While this is in a measure a necessity, it is nevertheless fatal to the continuation of the activities of the Museum as a place of exhibition. The space remaining will be too small and crowded for the proper display and artistic arrangement of materials, particularly since it is necessary to use a part of the present space for a workroom. Unless a suitable building near the State House can be rented, or proper quarters provided in a new wing of the Capitol, the exhibition work of the Museum must inevitably cease, or at best be greatly curtailed. What this means can be better appreciated after a perusal of the following paragraphs in which Museum activities are stated at some length.

In March, Miss Perry, to whose energy and vision the success of the Museum was so largely due, requested and was granted leave of absence to engage in war work in France. The administrative officers were extremely loath to recommend, and the Board to grant, such a request because of their realization of the great value of Miss Perry's work in reorganizing and directing the Museum activities. It was recognized, however, that those same qualities which had made her work here so great a success fitted her admirably for the new work abroad, and the leave was granted. It is hoped that she will resume her duties with the Department during the coming year. In the meantime, Mrs. Kathryn B. Greywacz, Acting Curator, has carried on the work in an acceptable manner.

Permanent exhibits.—Some time has been spent in completing a number of the permanent exhibits which had been labeled and only temporarily arranged. A few new ones were given a permanent place in the Museum. A complete list of permanent exhibits follows.

Natural history.—Queer Fish, Food Fish, Bird Homes, How Birds Get Their Food, Common Birds of Trenton Classified According to Color, Ducks of New Jersey, Turtles and Snakes, Animals of New Jersey, Animals and Their Young, Poisonous and Edible Mushrooms of New Jersey.

Industries.—Wool, Silk, Dyeing of Silk, Flax, Cotton, How Pottery is Made, Belleek, Underglaze and Overglaze Decorations, Mosaic and Tile Pictures, Hollow Tile, Electrical Porcelain, Bricks, Sanitary Ware, Rubber, Zinc, Iron and Steel, Copper.

¹ This plan was later changed and the Museum left undisturbed.—H. B. K.

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Geology.—Useful Minerals and Rocks, Minerals and Rocks of Trenton and Vicinity, Structural Features of Rocks, Fossils, Common Rocks, Common Rock-forming Minerals, Properties of Minerals, Road Materials, Building Stones, Clays of New Jersey, Minerals of New Jersey, Rocks of New Jersey.

Pictures.—Thirty of the one hundred original water-color sketches of New Jersey wild flowers, by Miss Caroline Fox, have been framed and hung in the Museum. These make a most pleasing frieze.

Special exhibits.—The schools of Trenton and the public have taken much interest in the special exhibits held at the Museum this year. Several of these were arranged to meet the desire for information along all lines relating to the war, such as the Red Cross and military exhibits, war posters, food conservation, and Camp Dix model. A complete list follows:

	<i>Attendance.</i>
November 1-15.	
Patriotic War Posters—	
Red Cross and Military Exhibit,	1586
December 10-January 15.	
School Lending Sets—	
Mushrooms,	1291
February 4-23.	
Pottery,	2156
March 15-30.	
Food Conservation,	1885
April 2-May 1.	
Tapestry—	
Wild Flower Sketches,	2043
May 6-June 7.	
Birds and Bird-houses,	3322
June 7-29.	
Camp Dix Model,	1729

Because of the interest shown by the schools and the public in the military and Red Cross exhibit, it was continued in connection with the patriotic war posters. The poster exhibit included forty of the best selected American patriotic posters and twenty or thirty war posters of England, France, Russia and Italy. These were lent by the Newark Museum Association, Newark, New Jersey.

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The exhibition of school lending sets included the industrial process charts, Riker mounts, pictures, and lantern slides, prepared by the Museum for lending to schools throughout the State.

The mushroom exhibit consisted of fungi, including paintings, specimens, and descriptions of edible and poisonous mushrooms. The material was furnished largely by Edward B. Sterling and Edwin Fowler. Splendid water-color sketches were made for this exhibit by the Misses Anna and Alice Fowler and Caroline Fox.

The pottery exhibit included specimens of the clays found in New Jersey, showing their appearance when fired, various methods of testing them, and different processes of decoration; also a display of the clay products of the State, viz., pottery, belleek, china, mosaic and tile, sanitary ware, brick, crucibles, electrical supplies, and hollow tile. For the last three days of each week a pottery expert gave demonstrations of primitive pottery making, coiling, turning on the wheel, and casting in molds.

The exhibition of the work of the New Jersey State Commission for the Blind included basketry, hand-woven fabrics, knitted and crocheted articles, sewing and embroidery. Three days each week the blind themselves gave demonstrations of their handiwork. On the two Saturdays children from the Blind Babies' Home at Summit, New Jersey, built and furnished a playhouse. These demonstrations were very popular.

The Food Conservation exhibit, prepared with the assistance of the United States and New Jersey Food Administrations, the Russell Sage Foundation, the State Department of Agriculture, and the Home Economics Committee of the Contemporary Club of Trenton, included substitutes for wheat, meats, fats, and sugar; canned and dried fruits and vegetables; one hundred calories exhibit; posters and charts; and suggestions of practical ways of conserving food. Women from all sections of the city were invited to attend food lectures held at the Museum, and helpful literature was distributed by school children to the homes in which such practical suggestions would be of greatest value.

The tapestry exhibit included a tapestry loom, cartoons, and wall and furniture pieces, lent by the Edgewater Tapestry Looms, Edgewater, New Jersey. In connection with it, the one hun-

dred original water-color sketches of wild flowers, by Miss Caroline Fox, were shown.

The bird and bird-house exhibit included warblers of New Jersey, bird homes, how birds get their food, common birds of the State, game birds, rare birds, and twenty-five bird-houses made by the school boys of Trenton.

The Camp Dix model, which was lent by the Newark Museum Association of Newark, New Jersey, attracted much attention. This block model was exactly reproduced from the original plan of the camp and gave an accurate idea of the layout of the cantonment.

Local school work.—The schools of Trenton and vicinity have co-operated with the Museum in all of its work. Bulletins announcing current exhibits are sent to principals and museum representatives of public, parochial, and private schools, and many classes visit the Museum during school hours to study both the permanent and special displays. Girls in the domestic science classes of the Junior High School baked samples of war breads and cakes for the Food Conservation exhibit. The bird-houses exhibited were made by the boys in the manual-training classes of Trenton schools. The Museum planned to have children's hour every day from 4 to 5 o'clock, but, during the session of Legislature, no classes or groups of children were permitted to visit the Museum. Because of this restriction, children's hour was held only before and after the session of Legislature. Students from the State Normal School volunteered to tell stories about objects in the Museum, and to take the children on short hikes for nature study talks.

Loan collections.—The Museum's loan collections are continually multiplying. They include the industrial process charts, which illustrate the processes of manufacture of the leading industries of this country; Riker mounts of common moths and butterflies, and insects; cases each containing three fish; and colored mounted pictures of birds, animals, fish, insects, trees, flowers, fruits, and minerals. Ten mounted pictures and four exhibits, such as charts and Riker mounts, or one natural history case, may be ordered by any school in the State at one time, kept for one

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month, returned and exchanged for other material. Cases containing birds or small mammals are now being prepared and will be ready for circulation in September. Other industrial, forestry, and geologic sets are in the course of preparation. Following is an inventory of the loan collections ready for circulation:

Industrial process charts, 14 inches by 22 inches, with accompanying literature:

- 23 Silk. From the silk-worm egg to the finished cloth.
 - 18 Wool. From the fleece to the finished cloth.
 - 22 Cotton. From the cotton boll to thread and cloth.
 - 20 Flax. From the flax plant to thread and cloth.
 - 10 Textile fibres. Showing microscopic characteristics.
 - 18 Textile weaves. Showing in diagram four common weaves.
 - 14 Cereals. Wheat, barley and corn, and cereals made from them.
 - 16 Wheat. Showing the manufacture of flour.
 - 7 Corn products. Showing the uses of corn.
 - 24 Chocolate and Cocoa. Its manufacture and uses.
 - 1 Salt. Showing origin and uses.
 - 12 Spices. Pictures and samples before and after grinding.
 - 23 Cork. Its manufacture and uses.
 - 11 Glass. Showing the manufacture of glass bottles.
 - 22 Rubber. From the tree to the automobile tire.
 - 13 Asbestos. Its manufacture and uses.
 - 13 Paper. Showing the process of manufacture.
 - 12 Linseed Oil, Paint and Varnish. Showing how they are made.
 - 6 Shears. Showing how they are made.
 - 6 Spoons. Showing how they are made.
 - 6 Pins. The making of common and safety pins.
 - 15 Pens. From the steel to the finished pen.
 - 16 Pencils. Showing manufacture of pencil and rubber.
- Total number of industrial charts—328.

Specimens in Riker mounts, 11 inches by 14 inches, or 7 inches by 11 inches:

- 12 Common Moths and Butterflies.
- 28 Common Insects.

Fish cases containing 3 fish, 6
 Colored pictures, mounted, 11 inches by 14 inches, 1,000

Number of loan collections circulated January 1—June 30, 1918:

Industrial charts,	189
Booklets,	114
Riker mounts,	31
Fish cases,	2
Mounted pictures,	448

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Lantern slides.—The Museum has nearly 4,000 lantern slides for circulation in the schools of the State. This summer, broken slides will be replaced by new ones, and where duplicate slides are needed they will be supplied. A set of about 250 slides relating to the present war will be added to the collection.

Number of orders for slides in the past 8 months, 93
 Number of slides circulated for the past 8 months, 3,053

Traveling exhibits.—A number of traveling exhibits have been prepared to lend to libraries, schools, and community centers throughout the State. These exhibits may be kept for two or three weeks and then sent on to another place.

The traveling Red Cross exhibit, which shows all the articles made by the Red Cross, with directions for making, was sent out March 1.

The one hundred water-color sketches of spring and fall wild flowers, autumn leaves, berries, etc., are ready for circulation. Twelve frames have been prepared, with a box for shipping, in which twelve selected pictures from the hundred sketches may be shown.

The traveling mushroom exhibit includes thirty small water-color studies of poisonous and edible mushrooms.

A small exhibit of military insignia and chevrons is in course of preparation and will be sent out as soon as it is completed.

Attendance.—The attendance at the Museum is shown in the following tabulation.

<i>Month.</i>	<i>Number of Classes.</i>	<i>Number of Pupils.</i>	<i>Children's Hour.</i>	<i>Total Attendance.</i>
November,	31	535	...	2317
December,	2	57	423	1570
January,	3	42	...	1722
February,	37	1107	...	3703
March,	30	789	...	3899
April,	10	145	427	2031
May,	27	731	418	3128
June,	9	2145
	149	3615	1268	20515

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The average attendance has been as follows :

Per day,	100
Per week,	595
Per month,	2,564
Total attendance for the 8 months' period,	20,515

The attendance would have been still greater if classes and groups of children had been permitted to visit the Museum during the whole year.

IRON MINING.

Great activity has characterized the iron mines of New Jersey. The Wharton properties, purchased by the J. Leonard Replogle interests, are being rehabilitated after a long period of idleness, and bid fair to be large producers during the coming year. This includes the unwatering of the Hibernia mines, operation of the furnaces at Wharton, and the extensive development of the Scrub Oak mine, west of Wharton and overlooking Succasunna Plains.

Scrub Oak Mine.—A broad area of strong magnetic attraction on the west slope of the hill above the plains at Kenvil was opened before 1864 by a series of shafts in a line about 1,000 feet long. The ore was so lean, however, that operations lasted only a short time. It was worked again in 1880 and 1881, about 2,500 tons of ore being then mined. There was some prospecting in 1905 and a new shaft was started, but nothing of importance resulted. In the spring of 1917 the new owners of the Wharton Steel Company put down three holes about 600–700 feet northeast of the old open cut, and two others about 950 feet further northeast. These disclosed a large body of lean ore at depths of about 230 feet and 400 feet with a probable minimum length of about 1,600 feet. Analyses of the ore showed metallic iron 40 to 43 per cent, and phosphorus 0.026 to 0.078—a Bessemer ore.

On the strength of this showing a large investment has been made in developing this ore body and in erecting buildings for crushing, sorting and concentrating the ore. A four-compartment shaft has been sunk in the foot wall 100 feet from the ore

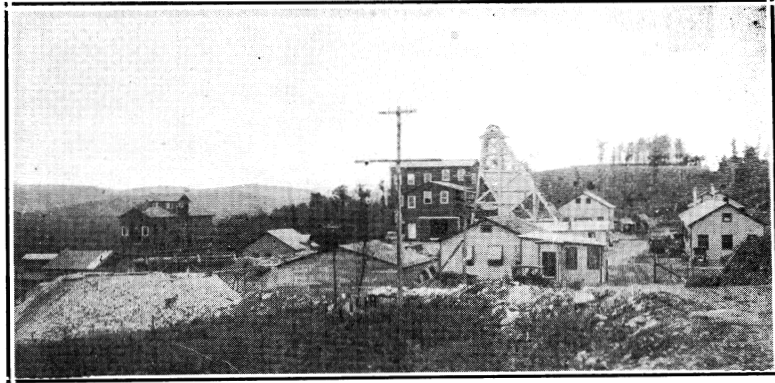


Fig. 7. General view of the Scrub Oak Mine.

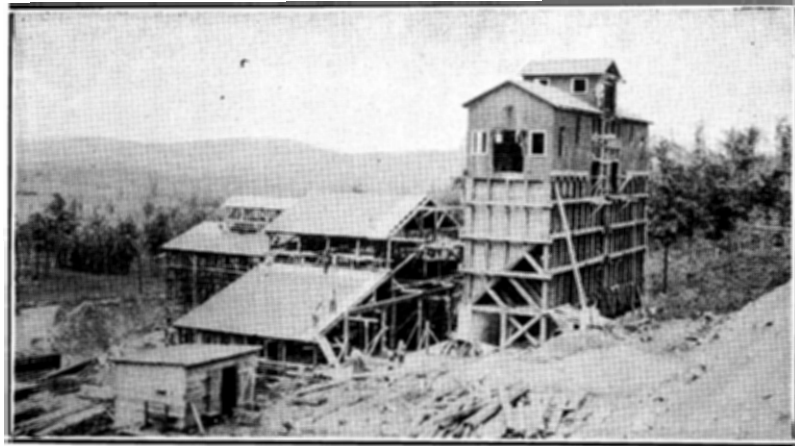


Fig. 8. Head frame and crushing mill—Scrub Oak Mine.



Fig. 9. Concentrating mill—Scrub Oak Mine.

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with an eastward dip of 55 degrees. At 233 feet there is a cross cut to the ore, and a level run in the ore to the southwest. Simultaneously, drifting was commenced from the old workings to connect with this level. This development work has opened up a body of ore through a distance of 1,100 feet 30 feet or more in width. On August 1st, 1918, the headings were only 190 feet apart, and connection was made before September 1st.

The hoisting, crushing, separating and concentrating plant (figs. 7, 8, 9) will have a capacity of 100 tons per hour, so that this mine if operated at full capacity will be a large producer.

The ore body is a banded magnetite gneiss, the magnetite appearing in grains, pencil-like lines and thin sheets. Where richest there are thicker sheets or masses, some of which show a buck-shot structure. It contains 40-43 per cent of metallic iron, which by concentration will be raised to 60-63 per cent, and 0.05 or less of phosphorus.

In connection with the expenditure of large sums of money by progressive iron-mining men in this great development, it is interesting to remember that operations in this same ore body had several times been abandoned as unprofitable. Changing conditions in the iron industry, the development of better mining methods, the perfection of magnetic concentration and large tonnage capacity have made it possible to transform an abandoned mining property into a large producer. This is only an example of what will unquestionably happen to others of the abandoned iron properties of this State.

GREENSAND MARL.

In his report for 1917 the State Geologist called attention to the importance of the glauconite or greensand marl deposits of New Jersey as a source of potash. At that time marl was being dug near Marlton by the Atlantic Potash Company and shipped to a plant near Easton, Pa., for treatment and recovery of the potash. Shipments have continued during the period covered by this report, but have been more or less retarded by abnormal conditions. During the spring of 1918 a plant for the recovery

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of potash from the greensand marl was under construction near Medford, but at the close of the fiscal year had not been put into operation. It is being constructed under the direction of the E. G. Spilsbury Engineering Company, of New York, and when completed will have a capacity of 100 tons per day.

PROSPECTING FOR OIL.

Nothing of importance has been done in prospecting for oil in New Jersey during the past eight months. At Millville, where there was so much excitement over the reputed discovery in October, 1916, all efforts have been abandoned. At Beaver Creek, near Newport, Cumberland County, the drilling derrick and machinery are still on the ground, but in April the operator, after spending several months in the early part of the year in endeavoring to remove tools and a broken pipe, at a depth of about 800 feet, stopped work and no information can now be obtained as to future plans. The attempt to find oil in the red shale near Belle Mead, Somerset County, was given up in December, 1917, at a depth of 2,100 feet, no trace of oil having been discovered, and the equipment being sold at sheriff's sale for the benefit of creditors.

These failures only emphasize the warning repeatedly given by this Department that there are no facts known pointing unequivocally to the occurrence of oil in New Jersey, and there are good reasons for doubting its existence in commercial quantities.

CLAY INVESTIGATIONS.

The intensive study of the clay deposits of the Woodbridge district commenced by this Department and the Department of Ceramics at Rutgers College has been continued. Since the investigation consists chiefly of laboratory tests of various sorts, the bulk of the work is done by the Department of Ceramics, and questions regarding the quality of clay and its adaptability are referred to that Department for reply, the State Geologist

dealing chiefly with questions of geographic occurrence and field relations.

The war has completely stopped the importation of certain German clays extensively used in this country, particularly in graphite crucibles and lead pencils, and has also greatly reduced the amount of clay obtainable from other countries, such as English ball clay. Manufacturers have therefore been compelled to seek substitutes, and New Jersey as one of the chief clay-producing States has seen great activity in this industry. As a result of the investigations undertaken by these departments, it has been possible to find a successful New Jersey substitute for the German pencil clay. This was recommended to manufacturers and is now being largely used. A mixture of clays from the Woodbridge district was found which is giving good satisfaction in the manufacture of graphite crucibles, in place of the German Klingenberg clay formerly believed to be indispensable. Crucibles molded from New Jersey clays are being successfully used in the United States assay foundries, and although the amount of clay used is not proportionately large at present, it would appear that there is a promising future for this clay in the crucible industry.

The curtailment of building operations has materially reduced the quantity production of New Jersey terra-cotta and of the higher grades of structural clay products. Some factories have been compelled either to close their doors or turn to other lines of manufacture. The great demand from the metallurgical industries for fire brick and other refractory products has given the terra-cotta manufacturers an opportunity to adopt a new line of product with very little change in equipment. Our clay investigations have been of great value to these manufacturers in selecting high-grade clays for fire brick, since the terra-cotta clays cannot be used for this purpose.

High-grade kaolin is not found in New Jersey, but it is quite possible that some of our fire clays may be substituted to advantage for the English ball clay, and one such clay, recommended as a result of this series of tests, is being successfully used in the production of porcelain ware.

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Not a few inquiries have been received from manufacturers in other States, and in some cases it has been possible to recommend clays for their specific needs. By this means the exportation of New Jersey clay to other States has been promoted.

GANISTER ROCK.

The term ganister rock or ganister is applied to a siliceous sandstone, or quartzite, containing a small amount of aluminous matter, with perhaps some iron oxide, which when ground can be molded and burned to make a highly refractory silica fire brick.

Attention is directed to a large deposit of rock suitable for this purpose located on the north side of Gravel Hill, Hunterdon County, 1½ miles north of Holland Station on the Belvidere Branch of the Pennsylvania Railroad. The deposit was quarried for several years, the rock being crushed and conveyed by aerial tramway to the railroad and shipped mainly to iron foundries in the Lehigh Valley district, but has not been worked recently. So far as known it has not been used for silica brick, although laboratory tests indicate that it is admirably adapted for this purpose.

The rock is a very coarse conglomerate of light-colored to white quartzite pebbles and small boulders embedded in a matrix of similar but finer material. The pebbles and boulders are traversed in all directions by fracture planes so that they readily break into small pieces the size of hickory nuts or walnuts. The matrix is but slightly indurated, so that the rock can be readily dug and broken without blasting.

Chemical analysis¹ of an average sample of the finer portion gave the following result:

Si O ₂ ,	98.27
Fe ₂ O ₃ ,	0.19
Al ₂ O ₃ ,	1.30
Ca O,	trace
Mg O,	trace
Loss on ignition,24
	100.00

¹ Analysis furnished by Jas. G. Vail, Philadelphia Quartz Company.

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Brickettes molded from this material with 2 per cent CaO in the form of lime hydrate were tested under the direction of G. H. Brown, Director of the Department of Ceramics. He reports that their softening or fusion point corresponds to that of pyrometric cone 32 (approximately 3,218 degrees Fahrenheit), and that in this respect this material is fully equal to the silica brick made from Pennsylvania ganister.

The "Gravel Hill" ganister contains a small amount of iron oxide, which does not appear to affect the quality of the brick in any way, although it causes a somewhat speckled appearance when burned. The molding properties of the mixture of Gravel Hill ganister and the lime bond is excellent, the resulting brick being heavy and dense.

WORK FOR OTHER STATE DEPARTMENTS.

Close co-operation has been maintained with the State Highway Commission. In addition to the work done in the testing laboratory (see below), the State Geologist on several occasions, at the request of the Highway Engineer, made field examinations along the proposed alignment of new roads to determine the nature of the material which would be encountered in excavation for grading, particularly whether the cuts would be in rock or dirt.

The information possessed by this Department regarding the occurrence and quality of limestone has been put at the disposal of the Department of Agriculture and the Department of Charities and Corrections in their endeavor to find a quarry of rock suitable for agricultural use, where the quarrying and grinding can be done by prisoners from the penal institutions.

TESTING LABORATORY.

The new laboratory was occupied in January, although in an uncompleted condition, and not accepted by the Board until June. The construction contracts did not include the installation of machinery, work tables, and benches, nor the building of ventilating

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hoods, with their complicated plumbing and lighting, and not all of this work was completed even at the end of June. It was therefore necessary to use the old laboratory for many lines of work even after the new building had been occupied.

In order that the funds appropriated for equipment might be used as far as possible in the purchase of needed apparatus, much of the installation of equipment was done by Mr. Gage and his assistants.

This naturally interfered somewhat with the scientific work which might have been carried on, had the new facilities been available. It was possible, however, to do the necessary routine testing work demanded by the State Highway Commission. The materials used in twenty-five pavement contracts were tested and approved before using. During the construction of bituminous pavements, samples of the completed pavement are taken daily by the Highway Department inspectors and sent to the laboratory for analysis. Usually each carload of bituminous and Portland cement is tested before use, and each car of sand and stone during the initial stages of the work is sampled and tested.

At the request of the Highway Engineer, Mr. Gage, in charge of the laboratory, has prepared those parts of the standard road specifications which relate to materials used, and has collaborated in those parts relating to methods of construction. Each road contract is also referred to him for approval as to materials specified. This takes no little time as each contract usually has six sets of specifications to be examined.

In connection with moving from the old to the new laboratory, it was advisable to sort over all samples and to discard a large part, and to revise the record system, work which was not completed.

It is proper at this time to express the thanks of the Department to Col. Washington A. Roebling, through whose interest and public spirit the old laboratory was made possible. For fourteen years Colonel Roebling gave for this purpose, rent free, the second story of a brick building owned by him. Now that these rooms are returned to him, this public record of his action should be made.

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DIVERSION OF WATER.¹

The jurisdiction of this Department, as successor to the State Water-Supply Commission, over the diversion of water for potable purposes is set forth in Chapter 252, Laws of 1907, and Chapter 304, Laws of 1910. During the period from November 1st, 1917, to June 30th, 1918, the Board has acted upon five applications and one extension, as follows:

Commonwealth Water Company.—On October 2d, 1917, the Commonwealth Water Company, Summit, filed an application for permission to divert water from wells located in the Canoe Brook and Passaic valleys, to supply the Town of West Orange. After a public hearing in the State House, Trenton, on November 7th, 1917, at which there was no opposition, the application was approved on the same date, subject to the standard conditions and to the following special conditions:

"It is hereby agreed and understood that the diversion of water for the purpose of supplying the Town of West Orange shall be limited to a monthly average of two million gallons per diem, which is the approximate maximum capacity of the proposed 16-inch pipe line connecting the existing one-million-gallon reservoir on Wyoming Mountain and the proposed distribution reservoir in West Orange."

Formal acceptance was filed on February 4th, 1918. Later, the time for commencement of construction was extended to January 1st, 1919, and the time of completion to July 1st, 1920.

City of South Amboy.—On October 17th, 1917, the City of South Amboy filed an application for permission to divert water from wells to be located about one-half mile south of the city limits along the Bordentown and Amboy turnpike for the purpose of supplying the City of South Amboy and vicinity. A public hearing was held in the State House, Trenton, on November 7th, 1918, and the application approved on the same date, subject to the usual terms and limiting the amount of water to be diverted under the permit to an average of 1,500,000 gallons per diem during any month. Formal acceptance was filed February 4th, 1918. The proposed source of supply did not develop favorably and at the close of the period covered by this report the city was in search of a more promising source of water.

Hanover Water Company.—On March 21st, 1918, the Hanover Water Company filed its application for permission to divert water from wells for supplying the Borough of Wrightstown and inhabitants thereof. After the public hearing held in the office of the Board at Trenton on April 3d, 1918, the application was approved subject to the usual conditions and a limitation of 75,000 gallons daily. This plant has been in operation since March, 1918, and supplies the territory formerly served by the Wrightstown Water Company.

¹The paragraphs relating to surface water supplies were prepared by H. T. Critchlow, Water Engineer of the Department.

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Atlantic Loading Company.—On May 2d, 1918, an application was filed on behalf of the Ordnance Department of the United States Government by the Atlantic Loading Company, Agent, for the approval of its plans to divert water from wells to supply their shell-loading plant, and the Village of Amatol adjacent thereto, which is the housing section for the workers. The point of diversion is about 2½ miles northeasterly from Elwood, Mullica Township, Atlantic County. The application was approved June 5th, 1918, following a public hearing on that date held in the office of the Board, Trenton. Acceptance of the terms and conditions was filed July 5th, 1918. The water-supply system is in operation.

Bethlehem Loading Company.—On May 20th, 1918, the Bethlehem Loading Company, Bethlehem, Pa., filed its application for permission to divert water from wells for the purpose of supplying the housing section of its shell-loading plant near Mays Landing, N. J. A public hearing was held in the office of the Board, Trenton, on June 5th, 1918, and approval given on the same date subject to the usual terms and conditions. The water-supply plant is now in service.

Peoples Water Company.—On December 5th, 1917, an extension of six months from January 1st, 1918, was granted the Peoples Water Company for commencement of work on its water-supply system at Keansburg, Monmouth County. An additional extension of one year from July 1st, 1918, was also granted on June 5th, 1918. These extensions were made at request of the company owing to delays in obtaining the approval of the Public Utilities Commission.

EXCESS DIVERSION CHARGES.

Charges for 1917.—Under the provisions of Chapter 252, Laws of 1907, and Chapter 304, Laws of 1910, all municipal corporations, corporations, or persons, diverting water either from surface, sub-surface, well or percolating sources, or from any combination of such sources for water-supply purposes, are required to keep accurate records by meter or other approved methods of the amount of water used, and to report the same quarterly to the Board, as successor to the State Water-Supply Commission. For surface supplies, Chapter 252, Laws of 1907, makes certain provision for excess diversion charges.

For the year 1917 the Board fixed a rate of \$1.00 per million gallons, the minimum rate provided by law. Certification of the amount due the State was made on February 14th, 1918, to the Comptroller according to statute. Of the sum certified, \$9,288.07 was paid before July 1st, or within a few days thereafter. The Attorney-General has been requested to bring suits promptly to collect the unpaid accounts.

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EXCESS DIVERSION OF SURFACE WATERS, YEAR 1917.

NAME.	Average daily allowance based on census of 1905, or consumption, 1907, in gallons	Average daily consumption for year 1917, in gallons	Average daily excess, in gallons	Total excess for year 1917, in millions of gallons
Acquackanonk Water Co.,	4,356,000	7,242,000	2,886,000	1,053.39
Bridgeton, City of,	1,362,400	2,001,104	638,704	233.13
Burlington, City of,	803,800	1,146,323	342,523	125.01
Butler Water Co.,	280,000	316,100	36,100	13.08
East Jersey Water Co.,	9,081,700	20,041,700	10,960,000	4,000.40
Frenchtown Water Co.,	97,500	157,400	59,900	21.86
Hackensack Water Co.,	21,712,166	27,568,169	5,856,003	2,137.44
Haledon, Boro of,	297,400	400,000	102,600	37.45
Jersey City, City of, ...	38,400,000	52,828,000	14,428,000	5,266.22
Lopatcong Water Co., ..	400,000	1,106,700	706,700	257.95
Middlesex Water Co., ..	1,750,700	4,400,778	2,650,078	967.25
Millville Water Co.,	1,188,400	1,204,270	15,870	5.79
Montclair Water Co., ..	2,752,100	2,829,200	77,100	28.14
Newark, City of,	36,241,666	46,300,000	10,058,334	3,671.28
New Brunswick, City of,	2,566,371	5,239,923	2,673,552	975.86
New Jersey Zinc Co., ..	160,000	170,000	10,000	3.65
Newton, Town of,	442,200	680,895	238,695	87.13
Rahway, City of,	1,521,635	1,835,683	314,048	114.61
John A. Roebling's Sons Co.,	116,000	302,452	186,452	68.05
Somerville Water Co.,...	1,293,335	1,647,876	354,541	129.39
Tintern Manor Water Co.,	3,144,609	3,811,100	666,491	243.27
Trenton, City of,	13,490,000	16,423,000	2,933,000	1,070.54
Totals,	141,457,982	197,652,673	56,194,691	20,510.89

East Jersey Water Company vs. the Board of Conservation and Development.—In June the Supreme Court decided the writ of certiorari obtained by the East Jersey Water Company and the Acquackanonk Water Company vs. the Board of Conservation and Development in favor of the State, thus sustaining the charges for excess diversion in 1915 and 1916 made by this Board. These amounted to \$219.69 for the Acquackanonk Water Company, and \$3,916.73 for the East Jersey Water Company.

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The decision was not appealed and the charges were promptly paid.

Inasmuch as several disputed points of law were settled by this decision, it is quoted in full below.

NEW JERSEY SUPREME COURT.

EAST JERSEY WATER COMPANY,
Prosecutor,
v.
BOARD OF CONSERVATION AND DE-
VELOPMENT,
Defendant. } On Certiorari.

ACQUACKANONK WATER COMPANY,
Prosecutor,
v.
BOARD OF CONSERVATION AND DE-
VELOPMENT,
Defendant. } On Certiorari.

1. The defendant, as successor of the State Water Supply Commission, certified to the State Comptroller the names of each of the prosecutors above named as corporations owing money to the State for the diversion of water for the last half of the year 1915 and for the year 1916, and the sums due from each for each period, under the Water Supply Act, C. S., Vol. 4, page 5797. The statute requires such certificate to be filed between January 1st and February 15th in each year. The certificates in question were not filed until February 17th, 1917: Held, that the statute as to filing was not mandatory, and that the omission of the State Water Supply Commission or its successor to file the certificates before February 15th in each year did not forfeit the right of the State to collect the sums subsequently certified, the right of appeal being allowed and availed of.

2. The words of the statute "now being legally diverted" means the amount being diverted according to law in 1907 when the act went into effect, and do not extend to a quantity which, by contract, the corporation may subsequently require to supply increased needs of those with whom it has contracted to supply water. An abstractor may take what it was in 1907 diverting, and, if that did not reach the statutory maximum exemption, as much more as is required to make the total maximum diversion allowed without payment of the license fee. If in 1917 the daily diversion exceeded 100 gallons per capita, the amount then diverted may be taken without payment, and, if it was less, no license fee can be imposed until it exceeds the statutory quantity.

Argued February Term, 1918, before Justices BERGEN AND BLACK.

HUMPHREYS & SUMNER, for Prosecutor.

JOHN W. WESCOTT, Attorney General, and HERBERT BOGGS, Assistant Attorney General, for Defendants.

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The opinion of the court was delivered by

BERGEN, J. :

The questions involved in the above cases are similar, were argued together, and can be disposed of in one opinion.

The Board of Conservation and Development certified to the State Comptroller the amounts of money claimed to be due to the State from the foregoing prosecutors respectively, for water diverted from streams for the purpose of a public water supply, between July 1st, 1915, and December 31st of the same year, and also from the East Jersey Water Company between January 1st and December 31st in the year 1916 as well. The Comptroller of the State demanded payment thereof and a writ of certiorari was allowed to review the proceedings upon which the demand was based. The power of the Commission to fix the amount and certify it to the Comptroller and his right to demand payment is based upon a statute entitled "An act to establish a State Water Supply Commission and to define its powers and duties, and the conditions under which waters of this State may be diverted." P. L. 1907, 633, C. S., Vol. 4, 5797, section 8 of which provides that "every municipality, corporation or private person in diverting the water of streams or lakes with outlets, for the purpose of a public water supply, shall make annual payments on the first day of May to the State Treasurer for all such water hereafter diverted in excess of the amount now being legally diverted," provided no payment shall be required until such diversion exceeds 100 gallons per capita daily of the persons supplied, the payments required being based on the amount diverted in excess of the amount so fixed, and to be deemed a license, the amount of the payment to be fixed by the Commission at a rate prescribed by the act. The statute further provides that the Commission shall certify to the State Comptroller, as soon as practicable after the first day of January, and not later than the 15th day of February of each year, the names of all corporations or persons owing money to the State for the diversion of water during the preceding year with the amount due; that the State Comptroller shall promptly notify such debtors of the amount of their indebtedness to the State, and if not paid on or before the first day of July of the same year, the default shall be certified by the State Comptroller to the Attorney-General, who shall take immediate steps to collect the same.

It is conceded by the prosecutors that the Commission certified to the Comptroller the names of the two prosecutors and the amount due from each on the 17th day of February, 1917, and that this certificate was subsequently amended by reducing the sums claimed to be due, and the amended certificate filed with the Comptroller of the State, about the 9th day of March, 1917. It is also conceded that the amounts fixed are correct and should be paid if the prosecutors are liable.

The first point which both prosecutors urge relates to the charge for the half year ending December 31st, 1915, which is that, as to this license fee, they are not liable because it was not fixed prior to the 15th of February, 1916, the argument being that this requirement of the statute is mandatory, and if the Commission neglect to fix the amount and certify it to the Comptroller before that date, the right of the State is forfeited.

The prosecutors in their brief insist that the requirements of the act as to ascertainment of the amount due, and the machinery established for the collection of these debts is mandatory, and if not strictly complied with no payment can be enforced by the State. They do not contest the rule that statutes directing the mode of proceedings of public officers are usually held to be directory and that a strict compliance with such a provision is not essential to the validity of the proceeding unless there is something in the statute which shows a different intent, but they argue that the provision that the certificate shall be made not later than the 15th day of February in each year is mandatory, and an express limitation on the right of the State to enforce the payment if default be made, and they further argue that unless this be so the State might enforce such a payment after holding in suspense for an indefinite time, even as long as one hundred years. It is not necessary in this case to speculate regarding conditions a century hence, or even for a shorter period, or whether an undue delay might warrant an inference of the abandonment of such right, for in this case the prosecutors lost nothing by the delay. They were accorded the right to appeal, and their appeal was heard and considered, and was just as effective as if made a year earlier. The statute provides that any party aggrieved by the action of the Commission may file a written complaint on or before March 20th, which shall be heard and the appellant permitted to give evidence of the facts, all of which was accorded the prosecutors in this case, and they availed themselves of it.

It also requires the Commission to certify to the Comptroller the amount due as soon as practicable after the first day of January, and not later than the 15th day of February in each year. This we think is directory and not mandatory, and if the certificate was not filed with the Comptroller before March 20th in any one year, the right of the delinquent to appeal would not be lost. The requirement to file the certificate not later than the 15th day of February in each year is not an express limitation, and the omission or neglect to do so does not work a forfeiture of the right of the State to collect the license fee, if the certificate be subsequently filed and an opportunity for appeal afforded.

It is next urged that the present defendant was the successor of the State Water Supply Commission by virtue of the statute, P. L. 1915, 426, which provides that it shall not take effect, or be construed to include the State Water Supply Commission until the 30th day of June, 1916, and that the State Water Supply Commission shall retain all its powers and continue to discharge them until that date, so that it was its duty to make the certificate for the year 1915, but we see no reason why the defendant could not perform after it came into office the duty which its predecessor had neglected. The liability to pay had been fixed by statute, and it was a mere matter of calculation to ascertain the amount due. We can perceive no legal reason why this license fee should be cancelled, or the State denied its right to collect it, for any of the reasons so far considered.

The writ of certiorari allowed the Acquackanonk Water Company is limited to a review of the order certifying the amount due for the last six months of the year 1915, and it is not concerned in the question raised by the East Jersey Water Company relating to the certificate for the year 1916, and therefore as to the Acquackanonk Company the proceedings will be affirmed.

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On behalf of the East Jersey Company it is argued that both license charges are illegal because prior to June 15th, 1907, when the original act went into force, that company was under contract to supply certain municipalities with whatever quantities of water they from time to time required, and to pump and filter all the water used by other water companies which were under contract to furnish a supply of water to certain municipalities, and that it was legally diverting in 1907, such quantity of water as was then, or might in the future be, required to supply its contracts, at least to its then capacity of 65,000,000 gallons daily, while its then actual diversion did not exceed 28,000,000 gallons daily. The defendant certified to the Comptroller as due a sum based on the actual diversion in 1907, and the correctness of the amount and computation is not questioned, the complaint being that the water company is not required to pay for excess diversion where it is required to supply municipalities with which it had then contracted for whatever quantities they from time to time required. In other words, there can be no excess subject to the license fee so long as the diverted water is required to fulfill the contracts.

This construction will make the statute inefficacious because the growing demands of the different contracting municipalities for water may take the entire flow of the Passaic River, and ought not to be adopted unless required by the statute in plain terms. The statute requires payment "for all such water hereafter diverted in excess of the amount now being legally diverted," with the proviso that no payment be required until the legal diversion shall exceed 100 gallons per day per capita. We are of opinion that "legally diverted" means not a future diversion, but one now being exercised under a legal right, and that under this statute a legal abstractor may take what he was diverting in 1907, and, if that did not reach the statutory maximum of exemption, as much more as is required to make the total diversion 100 gallons per day per capita, for each of the municipalities supplied, without payment of the license fee.

If in 1907 the daily diversion exceeded 100 gallons per capita, the amount then diverted, if lawful, may be taken without payment, and if it was less, no license fee can be imposed until it exceeds the statutory quantity. We do not deem it of any importance what disposition the East Jersey Water Company makes of the water after diversion, it is the original person or corporation who diverts that the statute applies to. The license fee was imposed on the excess diverted beyond the amount actually being taken in 1907, and that being, in our view, a correct construction of the law, we find no error in this record.

This leads to an affirmance, with costs, of all the license fees imposed which are now under review in both cases.

COLLECTION OF BACK CHARGES.

Since the above decision has upheld the legality of the charges for excessive diversion heretofore levied by this Board and its predecessor the State Water Supply Commission, the Board has

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taken the position that a suit should be brought to require payment in those cases where it had not been made. In co-operation with the State Comptroller and the Attorney General data for suits against delinquents are being prepared. The water companies and municipalities in arrears with the amounts unpaid are as follows:

Acquackanonk Water Company,	\$1,165 43
Atlantic City,	2,521 62
Bridgeton,	357 60
East Jersey Water Company,	3,916 73
Jersey City,	22,285 34
Millville Water Company,	1,227 48
New Brunswick,	2,491 75
Newark,	5,742 65
Perth Amboy,	82 46
Peoples Water Company,	69 28
Rahway,	270 39
Trenton,	11,606 30
	\$51,737 03

CONSUMPTION FOR THE YEAR 1917.

The reports from 223 public water supplies throughout the State (which include all the more important systems) show that during the year 1917 a total population of about 2,687,000 persons was supplied with about 313,000,000 gallons of water daily, or at an average rate of 117 gallons daily per person. The following table gives additional information on consumption, etc.:

PUBLIC WATER SUPPLIES IN 1917.

Source of Supply.	Number of Systems.	Population.	Consumption—Gallons daily.	
			Total.	Per Person.
Surface,	48	1,798,526	208,020,000	116
Underground, ..	161	612,672	62,707,000	103
Combination, ..	14	276,053	42,297,000	153
Totals, ...	223	2,687,251	313,024,000	117

This tabulation shows that of the total consumption 66.5 per cent is from surface sources, 20 per cent is from underground sources, and 13.5 per cent is from combination sources. Segregating the surface and underground water included in the combination sources, the percentages of the total consumption become: 72.2 per cent surface, 27.8 per cent underground.

PLANS FOR DAMS.

Glenwild Lake Company.—Plans for the construction of a dam on Mud Brook, about one mile north of Bloomingdale, Passaic County, were filed by the Glenwild Lake Company, Butler, Morris County, October 9th, 1917. Details regarding the plans were set forth in the preceding annual report. Approval was given by the Board November 7th, 1917. Inspections were made December 21st, 1917, March 30th, 1918, and July 11th, 1918, the structure being completed June 27th, 1918.

Palisades Interstate Park Commission.—Plans for the construction of a concrete dam by the Palisades Interstate Park Commission, on Green Brook, Bergen County, were approved April 3d, 1918, after an inspection of the site and minor changes in the plans. This structure will be 290 feet long and raise the water 29 feet above the stream. The lake formed will have an area of 15 acres and a capacity of 45 million gallons; it will be used simply for pleasure purposes in connection with the Interstate Park development.

Inspections.—At the request of Assemblyman H. G. Hershfield, of Passaic County, an inspection was made of the Pompton Lakes dam on the Ramapo River, March 18th, 1918, and a report bearing on the condition and safety of the structure was submitted to the mayor of the borough.

Other inspections were made during the period from November 1st, 1917, to June 30th, 1918, as follows:

City of New Brunswick, dam on Lawrence Brook, April 10th, 1918, and May 21st, 1918.

Montclair Boy Scouts' Association, dam near Oakland, Bergen County, November 30th, 1917, and June 15th, 1918.

City of Newark, Oak Ridge Reservoir dam, November 15th, 1917, April 8th, 1918, and August 16th, 1918. (See fig. 10.)

WATER POWER ALONG MUSCONETCONG RIVER.

The shortage of coal throughout the country has naturally directed attention to water powers and their possible utilization. About 1890 an exhaustive study of the water powers of New Jersey was made by the State Geological Survey and the results

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published in Volume III (Report on Water Supply), copies of which can still be obtained by addressing the State Geologist. Since that date there have been many changes in the method of utilizing water powers, most notable of which are the turbine and the electric transmission line. The Department of Conservation and Development by its hydraulic engineer (May, 1918) made an investigation of the water powers along Musconetcong River between Riegelsville and Hackettstown to determine to what extent the available power along this stream is being utilized. This investigation is the beginning of a general study of the water powers of the State to be carried on by the Department as rapidly as circumstances permit.

It was found that at 14 plants a total of about 2,500 H. P. is being utilized, or can be used during normal conditions of stream flow. The largest development is at the Warren plant of the Warren Manufacturing Company, where 950 H. P. has been developed. The total fall in the Musconetcong between Hackettstown and the junction with the Delaware River at Riegelsville is 410 feet. (See fig. 11.) Of this total fall 176 feet, or less than half, are being utilized. However, a large part of the fall cannot be used because ample allowance has to be made to prevent damage and interference from backwater during floods. It would be possible to utilize some of this undeveloped fall by increasing the height of some of the dams. This plan has been followed in the rebuilding of some structures.

The following table compares the utilization of water powers along the Musconetcong between Hackettstown and Riegelsville for 1894 and 1918:

<i>Kind of Mill.</i>	<i>1894.</i>		<i>1918.</i>	
	<i>H.P.</i>	<i>No. of Mills.</i>	<i>H.P.</i>	<i>No. of Mills.</i>
Paper mills,	955	3	1610	3
Grist mills,	579	10	368	6
Graphite grinding mills,	80	1	290	2
Worsted yarn mills, .....	..	..	110	1
Machine knives mills,	75	1	100	1
Saw mills, .....	..	..	40	1
Snuff mills,	35	1	..	..
Total,	1724	16	2518	14
Total head in feet,	179		176	



Fig. 10. Raising dam at Oak Ridge Reservoir, on Pequannock River—Newark Water-Supply System.



Fig. 11. Power dam and raceway on Musconetcong River, above Riegelsville.

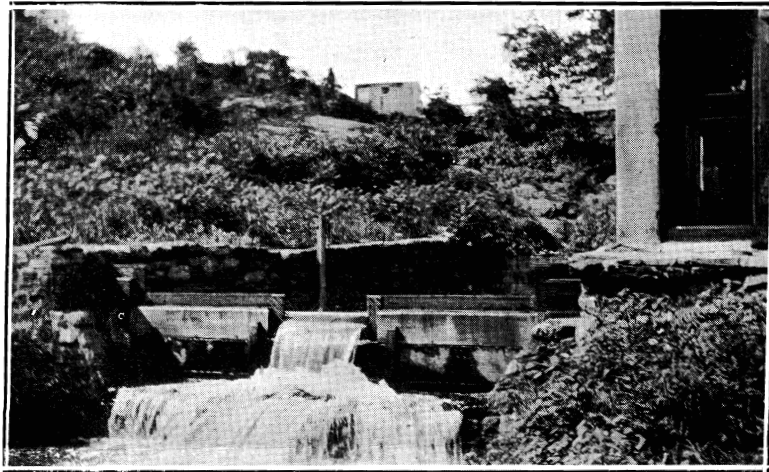


Fig. 12. Measuring weir on outlet to Splitrock Pond, Morris County.

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This tabulation shows an increase of 46 per cent in the utilized horse-power during 24 years, although the number of mills decreased by two, one being put out of use and another having been washed out by floods. However, this reduction in the number of mills has caused only a slight reduction in the total head developed on account of increase in the height of some of the dams that have been repaired or rebuilt.

The topography and development of this valley are such that large storage reservoirs are not practicable, hence there is considerable variation in the amount of power available at different seasons. In order to maintain their power six plants have installed auxiliary steam or oil engines. The Warren Manufacturing Company has just completed a project to utilize electricity from Easton, Pa., for auxiliary power. This plan will save coal on account of the high efficiency of the central power plant and will eliminate the transportation of coal to the isolated plants.

Practically all of the dams originally built to develop these water powers along the Musconetcong were of the timber-crib, rock-fill type. In some cases this type of construction extended from bank to bank, forming the entire dam, while in other cases only the spillway or overflow portions were of this type, being connected to the banks by earth wings or dykes. Within recent years six of these original structures have been repaired, or replaced by the more permanent concrete dams, which are not only safer, especially during floods, but require very little maintenance work.

EFFECT OF METERING ON WATER CONSUMPTION.

This Department in co-operation with the State Public Utilities Commission is studying the effect of metering on the consumption of water and the water rates throughout the State. To date the work has included the collection of data bearing on this important subject and certain tabulations from the annual reports for 1917 of the water utilities to the Public Utilities Commission. Sufficient time has not been available to complete the investigation, but it is proposed to complete the work as soon as possible since interesting and valuable conclusions can probably be obtained.

MEASUREMENT OF WATER CONSUMPTION.

The first duty of the waterworks official is to furnish to all of his customers a safe and satisfactory supply of water both as to quality and quantity. In rendering this service he must ever keep in mind the cost of production and maintenance involved, otherwise the water supply plant and the people served will suffer on account of the inefficiency which will certainly follow a lack of attention to this important factor. The total cost of the service is directly dependent upon the amount of water furnished, and this is especially true for water supply plants where pumps or a purification system have to be maintained.

Reports to this office submitted by the various water departments and companies throughout the State show that a number of water plants have no accurate means of determining the amount of water furnished to the distribution system by their pumps, and that some gravity plants have absolutely no way to measure the draft on their reservoirs. Permanently installed meters on the supply mains afford the best means of knowing the amount of water delivered; and when these instruments are properly adjusted and maintained they give a continuous and accurate record of the consumption which is of great value. Another common method of measuring the water consumption in a pumping system is to make use of the capacity of the pump and the number of strokes or revolutions as recorded by the automatic counter with which most up-to-date pumps are provided. The accuracy of this method depends upon the efficiency of the pumps as regards "slippage."

With the idea of rendering a practical service to the water supply systems in the State, this Department has recently contracted for the purchase of an up-to-date equipment for measuring the flow of water in the supply mains. The tests made with this equipment will indicate the total flow, and the variation in the rate of flow for the period of the test, which may range in length from 24 hours to a week, or even longer in some cases. Such a test made on a pumping system will enable the determination of the amount of slippage, and may be the means of saving considerable quantities of fuel, which is a patriotic duty. Ex-

cessive leakage can also be detected and thus afford another check on the expense of operation.

CAUSES OF WATER SUPPLY SHORTAGE.

The unnecessary use and careless wasting of water is a habit for which American towns and cities are noted. The average consumption for 40 American towns and cities has been given by a reliable authority as 101 gallons daily per person, while the average for 40 European cities is given as 51 gallons daily per person. A great many people consider water to be practically as free as the air they breathe. Yet it costs money to install and operate the water plant that delivers water to the consumer, and this cost is directly in proportion to the amount of water delivered. The water consumers, including those who buy their water unmetered or on the "flat rate," in the long run pay the total cost, and are penalized for the careless use of water in the lack of service due to low pressure and scarcity during times of excessive consumption.

The experience of last winter brought home to many communities in New Jersey as well as throughout the country in general, that their water supplies must be conserved and improved to meet the emergency demands upon them. An analysis of the situation throughout this State shows that the water shortage has been due to one or more of the following causes:

1. Increased draft due to wasting of water.
2. Limit of the water-plant capacity.
3. Damage to a vital part of the water plant.
4. Increased draft due to rapid increase in the territory supplied.
5. Shortage of water in streams, wells, or other source of supply.

A well-designed waterworks is capable of delivering sufficient water to meet a reasonable maximum demand, including water for fire fighting. Nevertheless, many communities experience a lack of pressure and supply of water during extremely cold weather. The all-too-common practice of wasting water to prevent freezing of pipes is invariably the cause of the shortage.

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If such a practice is ever justifiable, it is not necessary to waste more than a very small stream to prevent freezing in the pipe.

The installation of meters on all of the house-service pipes would at least make it possible to charge the careless customers for the water they waste and induce them to take measures to improve conditions to prevent freezing of the plumbing. The engineering literature cites many localities which have lowered their water consumption by the installation of service meters on all houses. Another cause of weakness in many systems is excessive leakage in reservoirs, in the transmission mains, and in the distribution pipe lines. All water should be metered at the intake or at the pumps so that there may be a check on the water lost due to these causes. Sometimes a special survey for leaks is very profitable.

The last cause of water shortage mentioned above, but by no means the least important, has to do with a lack of water at the source of supply. It is a fact, well known but unfortunately too often disregarded, that streams, and even wells and springs, are subject to a wide variation in the amount of water they will yield at various seasons of the year. It is not wise to depend upon a source of supply for more water than it will deliver in the driest period; the dry-season yield of the source can be augmented by storing water during the wet season, but there is a possibility of over-development and of being unable to fill the reservoir during unusually dry years. A continuous record of the flow of a stream over a long period of years is of the highest value in determining the amount of water available from the drainage area. Such records are seldom available due in part to lack of foresight in planning for future sources of supply and also because the value of such data, as compared with the cost and trouble of obtaining them, is too often not appreciated. Next in value to a continuous record comes one of the flow for the driest period. Finally, a record of the rainfall in the vicinity for a long period of years, combined with the area of the watershed, is of value in estimating the flow of the stream. Actual records of stream flow should be used when available and every effort should be made to obtain such records, at least for the dry periods. When it is proposed to take a new supply from a stream, a weir, or

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other measuring device, should be established at some point near the proposed intake at the earliest date possible and continuous records kept (fig. 12).

This Department through its engineering force is ready to cooperate with waterworks' officials in their studies for the improvement and development of their sources of supply. While the office records as to the yield of streams and wells and the distribution of rainfall throughout the State are far from complete, they are available for whatever application they may have in the study of the available water-supply.

UNDERGROUND WATERS.

Inquiries answered.—Frequent inquiries regarding underground water-supplies come to the Department from engineers, well drillers, water companies, municipal water departments, State institutions, manufacturers, and private individuals. Information is usually desired as to the probable success in obtaining supplies, quality and quantity of the water, depth of water-bearing strata and nature of the materials likely to be penetrated. The experts of the Department, aided by an extensive collection of well records from all parts of the State, answer such inquiries as fully as the facts in hand justify.

Localities recently reported upon.—Among the localities studied and reported upon during the past year, the following are of special importance; Mount Holly, for the Mount Holly Water Company; South Amboy, for the City Engineer; Wrightstown, for the Wrightstown Water, Sewer and Light Company; Sandy Hook, for the United States Proving Grounds; Colonia and Rahway, for the United States Convalescent Hospital; Elwood and Amatol, for the Atlantic Loading Company; Mays Landing, for the Bethlehem Loading Company; near Middlebush, Middlesex County, for the United States Radio Station; Maurer and Perth Amboy, for the Barber Asphalt Paving Company; South Trenton, for the Magnetic Pigment Company. It will be noted that six of the above are directly related to war enterprises.

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Collection of well records.—A number of new well records of value have been added to the extensive series now in the files of the Department. Information of this kind is of great practical value and all who can supply any data regarding recently drilled wells or deep borings or contemplated well-drilling operations will be assisting us greatly in our investigations by forwarding the facts to Dr. M. W. Twitchell, Assistant State Geologist, who has immediate charge of this work.

Report on underground waters.—During the year Dr. Twitchell has made substantial progress in the preparation of a comprehensive report upon the underground water supplies of the State.

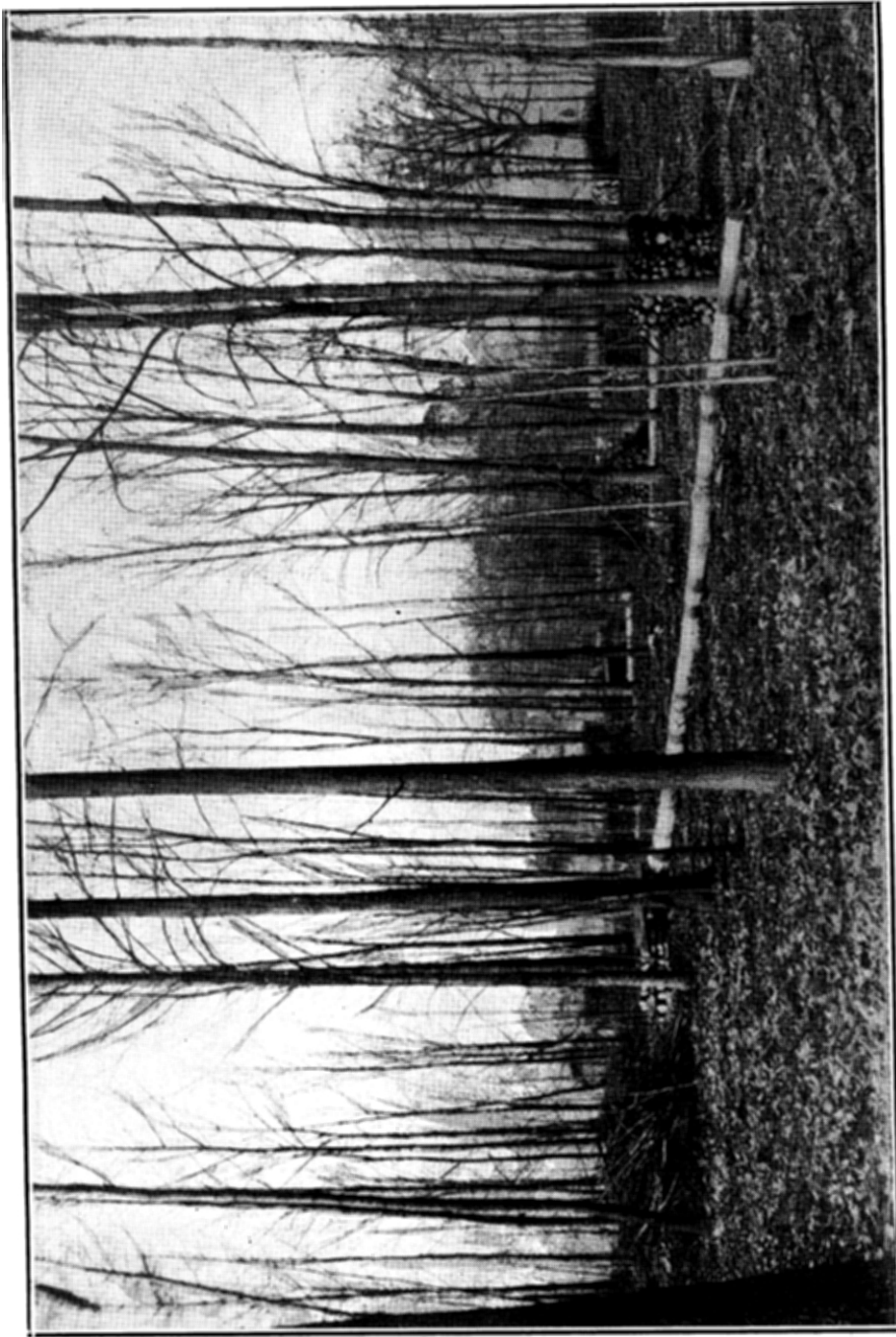


Fig. 13. Woodlot improved by partial cutting.

Report of the State Forester.

ALFRED GASKILL.

The Division of Forestry and Parks has devoted its effort to the protection of forest interests within the State and to meeting war needs. All else has been subordinate.

War work has included advice and assistance in the location and development of ground for encampments and munitions plants; the protection of the same against forest fires; aid in the search for woods required in war industries of which the State has some supply, as ash for airplanes, walnut for gunstocks, oak for shipbuilding; provision for wood fuel to help out the coal shortage; and assistance in recruiting the 10th and 20th Engineer Regiments, made up of foresters and woodsmen, and now doing effective work in France. *The protective service* has included the maintenance of the forest fire organization at a high point of efficiency; the care of the State forests; and as much attention as could be given to private forest lands and to shade tree interests. Several members of the Division have gone into the army; their places have been filled by men who are not eligible for such service.

THE FORESTS OF NEW JERSEY.

It is necessary to repeat, and to emphasize, the statement so frequently made, that New Jersey has too much forest, measured by area, though far too little if measured by value. The effort of the Division is to have converted to agricultural, or other higher use, the land now in forests that is suitable for such purpose, and to give the remainder a greater value. New Jersey can well afford to clear three quarters of a million acres

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of forest land; it would then have remaining the 25 per cent of its area in forests which is commonly held to be necessary for the welfare of a State.

This end can be secured chiefly through fire control. Our forests are naturally so vigorous, that, given a chance, they easily maintain themselves, not in ideal condition to be sure, but well enough until the people shall have recognized their true value, economic and social. Forest planting is unnecessary, except in a limited way where clearings have been unwisely made, or where the owner prefers to have forests rather than fields. It is important to contest the belief that worth-while forests can be secured only by planting. In this State nature usually will perform the task at far less cost. Chiefly for this reason the Department furnishes no young trees for forest planting, as is done in some States.

The forests of the State, however owned, have gained materially within the past ten years. Most of the improvement is due to fire control, and to the increased care that such security induces. Further gains will depend in large measure upon the maintenance, and the betterment, of the forest fire service.

ASSISTANCE TO WOODLOT OWNERS.

One of the chief efforts of the Division is to help forest owners make their properties productive. Assistance in forest management, in forest planting, in all that is involved in the care of a forest, is given without cost, except for traveling expenses, wherever it is requested. This service has been accepted by many persons this year and the result, especially in portions of North Jersey, is clearly seen in the many ordered forests, and in their increased productiveness. Present lumber prices offer no great encouragement toward the expenditure of money in forest improvement, but an owner who looks toward the future, especially one who considers the æsthetic value of a woodlot, finds that a satisfactory income from the outlay involved is easily calculable.

**WOOD
MUST BE BURNED
IN THE RURAL SECTIONS
TO SAVE COAL
FOR THE TOWNS AND CITIES**

WHOSE FUEL MUST COME BY RAILROAD
Every Ton of Coal carried into the Country Districts increases Freight Congestion

It is very possible that where Firewood is available without Railroad Delivery

**COAL WILL BE REFUSED
AS A
WAR MEASURE**

Coal Dealers, Business Men, Farmers and Residents
in communities where Fuel-Wood can be cut and hauled locally are warned to

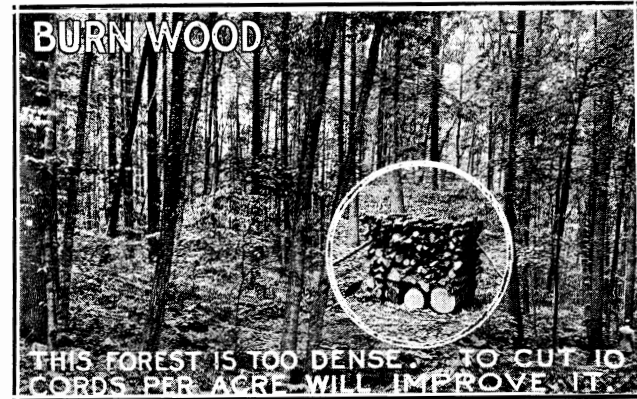
**PROVIDE WOOD FUEL
FOR NEXT WINTER**

RICHARD C. JENKINSON
Federal Fuel Administrator for N. J.

**WISE CUTTING WILL IMPROVE OUR
WOODLANDS, WHILE FURNISHING
FUEL-WOOD.**

ADVICE FREE UPON REQUEST.

ALFRED GASKILL
State Forester



MAKE NEW JERSEY'S FORESTS HELP WIN THE WAR

The excess and inferior wood now standing in New Jersey forests equals in Fuel Value 350,000 Tons of Hard Coal or 7000 Car Loads of 50 Tons each

The removal of this wood will not deplete nor injure, but will improve the woodlands. Failure to use it will aggravate the fuel and car shortage and be neglect of an opportunity for permanent forest betterment.

For railroad delivery coal costs less and requires less car space than wood. Towns and cities must therefore use coal.

In communities where wood can be cut and hauled locally

THE USE OF WOOD FUEL

(1) is cheaper than coal, (2) provides for idle help and teams while eliminating cash outlay for coal (3) produces a money profit by the sale of any excess supply, (4) furnishes \$1.00 worth of fertilizer in the ashes of each cord, (5) uses otherwise wasted wood and leaves the remaining timber improved.

Do not strip any area clean; thin it out regularly and systematically, thereby stimulating growth. Weed the woods like a garden, but use the waste and excess-products as the gardener cannot.

Advice and assistance in doing such cutting for improvement is given free. Write for particulars and publications.

ALFRED GASKILL, State Forester, State House, Trenton.

The Government needs BLACK WALNUT and WHITE ASH Timber for Gunstocks and Airplanes.

Those owning or knowing of Trees or Groves of these species will help by notifying the STATE FORESTER of their location, size and condition.

(OVER)

Fig. 14. The wood fall campaign.

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MARKETS.

The public is well acquainted with the difficulty of marketing agricultural products with satisfaction to the producer; an even greater difficulty is found with forest products, where the quantity available is small and often remote. To meet this difficulty the Division maintains a corrected, up-to-date list of buyers of all kinds of forest products, and is prepared to help bring buyers and sellers together without cost to either.

On the buyer's side the Division is also helpful, as when last winter, it found within the State logs for the makers of truck baskets who, because of freight congestion, were unable to satisfy their needs from the South, their source of late years.

WOOD FUEL.

Anticipating a shortage of coal last winter, the Division prepared early in the fall a bulletin on wood fuel. Owing to printing delays it was not available until December; but at the height of the coal famine, it, and several press bulletins issued, had a positive effect in increasing the production of cordwood. Since that time, the Division has co-operated actively with the State Fuel Administrator, and now is directing a campaign for a much greater production of cordwood for use next winter. (Fig. 14.) In this effort the agricultural interests also are co-operating.

New Jersey has ample supplies of wood-fuel—certainly not less than half a million cords. Most of it can be taken from the forests in a way not to injure, but positively to improve, them. Unfortunately the congestion in transportation, and scarcity of labor, make it impracticable to provide more than a small quantity of this fuel for city use. It must be utilized by those who live within hauling distance of the forests. Every cord of wood that is used in the country saves the transportation and the use of three-fourths of a ton of coal, for the people and the industries that cannot use wood. One result of the effort last winter was, that in at least two State institutions suffering was averted by the ability of the managers to provide wood when the coal supply failed.

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The successful practice of forestry anywhere depends upon a constant market for cordwood. It would be a blessing to the State if the rough wood that now cumberes our forests could be systematically removed without expense to the owners.

FOREST FIRES.

The report of the State Firewarden covers this subject in full. New Jersey now stands well in the van in the efficiency of its forest fire service, though no one knows better than those closely connected with it, its defects and limitations. To maintain an organization of 5 State wardens, and about 350 local wardens, covering approximately 1,900,000 acres of forest, on a total expenditure, State and townships, of about \$25,000 a year, is something of an achievement. That fires are not completely suppressed is quite a matter of course, in view of the exposure, the character of our woodlands, and of the people who frequent and live adjacent to them. The experience of 12 years justifies the belief that the fire problem in New Jersey is well in hand. We shall have fires, and serious ones, so long as our woodlands are held in low esteem, and so long as the control exercised by the State lacks the strength which the State Firewarden represents that it needs. The greatest promise of betterment lies in a provision for an adequate patrol of the forested areas during the dangerous seasons, spring and fall. As the State's effort in forestry is predicated upon an effective fire service, there can be no sufficient, or satisfactory, forestry, or forests, except in the degree that forest fires are prohibited.

STATE FORESTS.

During the year, 501 acres have been added to the area of State forests and 1,400 acres more are under purchase contract. Only two forest fires occurred on the whole 16,178 acres, and they burned but 12 acres. The condition of the forests on all of the properties is steadily improving. The plantations made on the Lebanon and the Bass River forests promise to give valuable information concerning the value of various species for planting. In June a contract was entered into for the removal of merchant-

able timber, chiefly dead and dying chestnut and dead oak, on a portion of the Stokes forest. The contract will run for a year, is expected to yield about \$600 and will considerably improve the property.

In the spring the artillery command at Camp Dix made an examination of the Lebanon forest for the purpose of determining its fitness for an artillery range. Fortunately, it was found to be not suitable, chiefly because the tree growth has become so dense. This fact supports in an emphatic way the contention that in South Jersey any forest will establish itself wherever protection against forest fires is assured.

On the Stokes forest a fire outlook tower is under construction on one of the highest points of the mountain. This will have telephone connection and will be valuable as an observation point and a shelter for tourists, as well as a means of locating forest fires. Its construction was made possible by a contribution of \$250 by the Federal Forest Service from the fund provided under the Weeks' law. The State furnished more than an equal amount.

The construction of trails, and the improvement of roads on the Stokes forest has gone forward, though much more slowly than is desirable. A number of camp sites along the brooks and adjacent to the waterfalls have been prepared for occupation. The systematic development of this forest along recreational lines is highly desirable. Its extension to include the greater part of the crest of the Kittatinny Mountain, and the formation of a great State forest park, would be of immense advantage to all outdoor lovers, as well as to the section in which it is located. Provision for the establishment of this forest park is strongly urged.

The State forests and their locations are described as follows; inquiries can be addressed to the warden or ranger in charge, or to the State Forester.

STATE FORESTS.

Bass River Forest.—Warden, Samuel Budd Allen, New Gretna, . . . 1,634 acres. Is in Burlington County, six miles northwest of Tuckerton, and is typical of the so-called "pine barrens." A considerable number of experimental plantations and several well-developed experimental thinnings are on it.

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- Jackson Forest*.—Warden, 43 acres.
 Is in Ocean County, 10 miles west of Lakewood on the New Egypt road, and carries a forest of nearly pure pine about 35 years old. It is used to demonstrate the methods of practical forestry and as a resting place for travelers.
- Lebanon Forest*.—Warden, Victor Bush, Pemberton, 3,620 acres.
 Is in Burlington County, nine miles southeast of Pemberton, and contains pine, oak and cedar. Several experimental plantations and more recent thinnings are on it, but it is used largely as a demonstration in fire control under particularly difficult conditions. Considerable fire damage has been suffered since the acquisition of the property, but it is in better condition in every way than when it was acquired. A portion of the area is under agricultural development by the State Colony for Feeble-Minded Males at Four-Mile.
- Mount Laurel Forest*.—Warden, Harvey Darnell, Moorestown, . . . 20 acres.
 Is an isolated tract of hardwood and pine in Burlington County, three miles southeast of Moorestown. It is peculiarly accessible and susceptible to forest management, and because of very complete and successful thinning and plantings six years ago, has unusual value as an example of applied forestry. (Fig. 13.)
- Penn Forest*.—Warden, George L. Inman, Chatsworth, 2,764 acres
 Is in Burlington County, six miles southeast of Chatsworth. It is a tract of almost pure pine in the heart of the wilderness. The forest on much of it is in better than average condition and affords a pointed example of the value of fire protection in developing timber growth under typical conditions in "The Pines."
- E. C. Stokes Forest*.—Forest Ranger, Paul B. Haines, P. O. Branchville, 7,537 acres.
 Is in Sussex County, two and a half miles west of Branchville. It is typical of absolute forest land in North Jersey. Under fire protection it is rapidly developing in value, and it has great possibilities as a park. Roads, trails and camping sites are being provided as fast as facilities permit. Through recent additions the forest is now easily accessible from the highway in Culver's Gap and is available for use by a limited number of camping parties.
- Swartswood Lake*.—Forest Ranger, Paul B. Haines, P. O. Branchville, 560 acres.
 Is in Sussex County, seven miles northwest of Newton. It consists of Swartswood Lake, with an area of 544 acres, and eight adjacent pieces of upland embracing 16 acres. It is maintained for the use of the public as a park and recreation spot.
- Total, 16,178 acres.



Fig. 15. Trees must be planted to break glare and wind.



Fig. 16. Trees planted too closely—road over-shaded.



Fig. 17. No planting needed.
SHADE INCREASES THE VALUE OF OUR HIGHWAYS.

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STATE COLONIES.

It is unfortunate that the offer of a portion of Stokes forest as a site for a second feeble-minded colony has not been accepted. The colony at Four-Mile on Lebanon forest, which was established in 1914 and now has 48 inmates, seems to prove the wisdom and value of locating such institutions remote from centers of population. By the establishment of a similar colony in Sussex County, the people of New Jersey would be greatly advantaged, while the State forest itself would gain directly by the labor that the inmates might perform in the forests and on the roads.

SHADE TREES.

The Division constantly finds opportunity to be helpful to municipal shade tree commissions and to numerous shade tree owners. Its policy and practice is to afford a shade tree commission definite advice and assistance by visits as often as may be required. Individuals are commonly assisted by mail, as it is practically impossible to take up on the ground questions affecting single trees. Much more work in this line would be accomplished if the Department were able to employ an arborist, as has been recommended for several years.

Shade tree commissions.—The list of shade tree commissions published in the report for 1917 has had a few additions, but need not be republished, though the fact that the State has upwards of 90 such organizations, with resources of nearly \$300,000 a year, deserves emphasis. An amendment to the Shade Tree act, passed at the last session of the Legislature, simplifies the law in several respects.

Shade tree guide.—A twenty-two-page bulletin entitled "A Shade Tree Guide" was issued in May and is available for the benefit of all who want to know how to care for their trees properly. It deals with the subjects of planting, injuries, nourishment, etc., in a brief, practical way.

Roadside trees.—The effort to have the country roads throughout the State bordered by trees is progressing. There is a very

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general desire for this advance, and, as this is written, the State Highway Commission has under consideration a proposition that it adopt a rule that all roads under its jurisdiction shall be provided with shade wherever that is practicable; that such shade shall be secured by rows, or groups, of trees retained from the adjacent forest; or, in open country, by planting such species in such manner as conditions make most advisable. The foresters of the Division will furnish the necessary technical assistance. (Figs. 15-17.)

Ornamenting public school grounds.—Little progress has been made in the effort to have public school authorities give more attention to planting the school grounds—for instruction in dendrology as well as for pure ornament. The Department of Public Instruction, however, has in preparation a handbook relating to the construction and beautifying of school buildings and grounds. To that the State Forester will contribute a chapter on school-ground improvement. The offer heretofore made to prepare for any school board, without cost, a landscape plan for their school grounds is still in force, and the Division is ready to be of assistance in that way.

TREE PESTS.

No new tree pest, of either insect or disease form, has come to the State. Through the activity of the State Entomologist the Gypsy moth and the Brown-tail moth, which cause such havoc in New England, do not trouble us, and the Elm-leaf beetle is kept in control. The white pine blister rust continues to give concern to all owners of white pine trees and it is doubtful if we shall escape serious losses through this disease. Fortunately the State has no important forests of white pine. The chestnut blight is still present, and in the northwestern part of the State continues to destroy a large number of trees, though indications that it is less virile than it was are not lacking.

In December a press bulletin warning all shade tree commissions and tree owners of the danger of a tussock moth outbreak was prepared in co-operation with the State Entomologist and widely published. The infestation occurred according to prom-

FORESTER'S REPORT.

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ise, only a few communities threatened having taken the necessary precautions.

With the exception of the pine blister rust and the chestnut blight, all serious tree enemies within our borders are controllable by practical means. It is unreasonable to expect that any shade tree should live and thrive indefinitely under adverse conditions and with an utter lack of attention. A moderate amount of intelligent care will serve to ward off most ills to which shade trees are subject. The Division can and does help by advice and instruction. It has no power to do more.

DO NOT EMPLOY UNKNOWN TREE DOCTORS.

Tree owners are again urged to care for their trees, or to have them cared for by reputable experts. A man who is unknown, or without credentials, should never be allowed in a valued tree. He is likely to do more harm than good. The State Forester is ready to advise all inquirers.

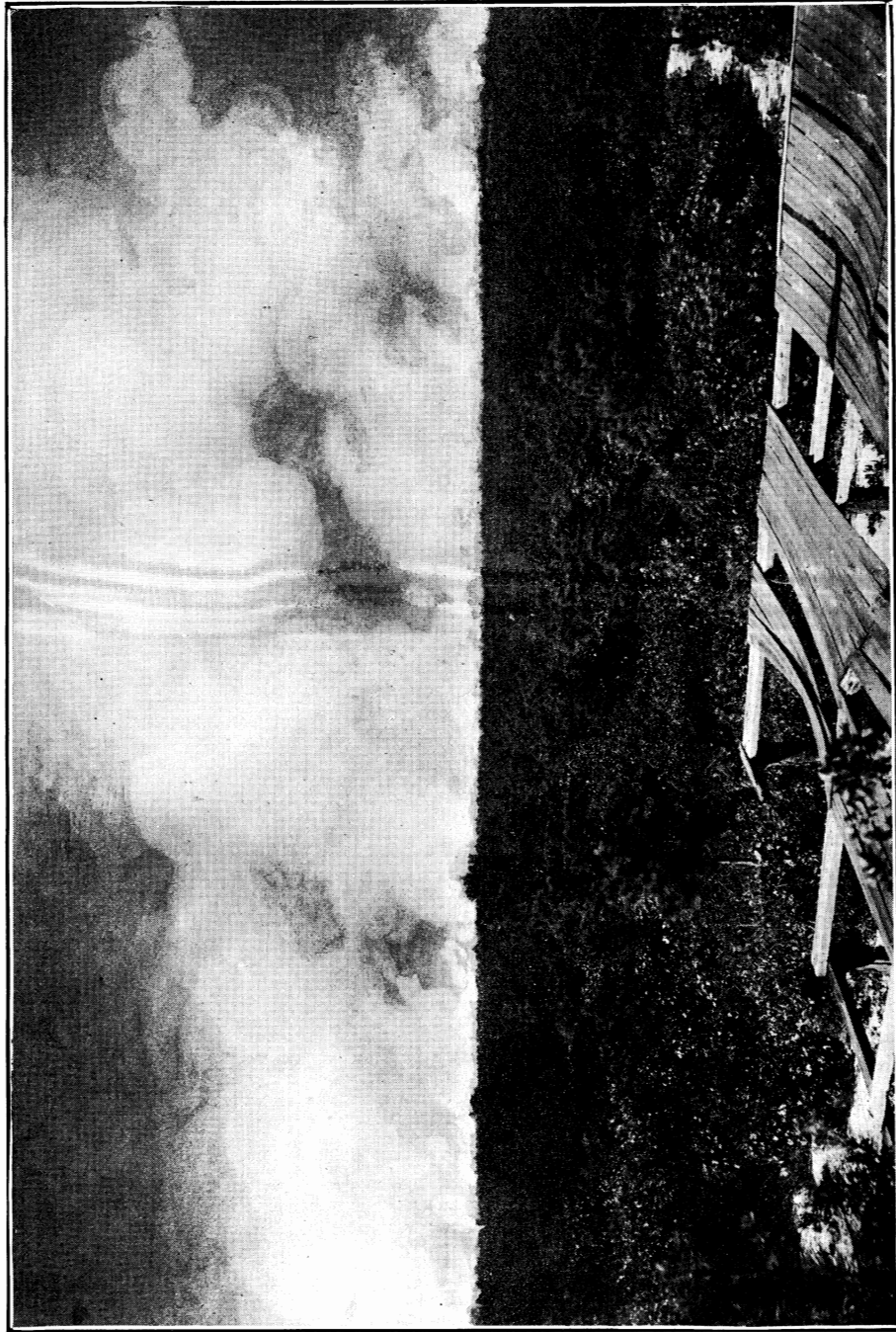


Fig. 18. Forest Fire.

Report of the State Firewarden.

C. P. WILBER

INTRODUCTION.

The report which follows is for the eight months, November, 1917, to June, 1918, inclusive, in conformity with the new official year designated by the last Legislature. Because of this it has not been attempted to compare the shortened year with the full twelve months of previous reports in any detailed way.

Also, the midsummer break in the new year strikingly interrupts the active forest fire season. Because of this, and since the calendar period is both the normal division and is in universal use throughout the country in dealing with forest fire figures, the records will hereafter be compiled from January to December.

On account of this the figures for the period from January to June of the past fiscal year will appear again in summarizing the complete calendar year 1918 in the next report. Therefore the data and discussion below are in a measure unrelated to those of preceding years and to the future. Since they thus stand alone, the statistical matter is treated in a far less specific way than heretofore.

SPECIAL WAR CONDITIONS.

War activities and conditions have presented special features in the forest fire work in three respects.

1. Withdrawal of the man power from rural sections for military service and by industrial employment has made the task of finding adequate crews of competent fire fighters difficult and often well-nigh impossible. The situation is still further aggra-

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vated by the prevailing high wage rate, which renders the maximum legal compensation offered for forest fire service so unattractive that the wardens encounter a reluctance in response to their summons which has heretofore never been known. Because of this it is becoming difficult for wardens to respond to calls for fires with their usual promptness and to control fires as effectively and shortly as heretofore. It is not possible, of course, to replace the workers, nor wise to alter a previously satisfactory wage scale, to meet a temporary condition. It is but just to the local force, however, that the situation be noted to avoid unfair criticism and to stimulate still greater public care with fire.

2. In the heretofore strictly forest sections the sudden and tremendous development of munitions plants and depots, of camps and war-time industries and activities, has brought into these sections a fire menace of unprecedented magnitude. The clearing of vast areas of woodlands in the heart of the remote forest sections has necessitated the burning of huge quantities of brush and waste materials. The haste of the operations has tended to minimize proper caution in this work and force its supervision into the hands of inexperienced and indifferent managers. Because of this, few, if any, of such projects have failed to start one or more forest fires and in a number of instances these have become so large as to rank with the most serious fires in recent years.

3. The sudden influx of great numbers of workers to the outlying sections because of the industrial and military concentrations mentioned above has brought its serious menace also. These workers, largely of the nomadic or commuting type, have filled the highways in the forest areas with traffic heretofore undreamed of. A large proportion of this element has no conception of the readiness with which fires start, or of their destructive capacity when burning. Some are simply careless, some indifferent, but discarded smoking materials and matches from this population already have greatly increased the fires which start, and threaten to give still further difficulty as they increase in numbers.

To meet this situation with the ordinary means is not a possibility. Short-handed and less efficient fire fighting is but one of the normal outgrowths of the national war activity. It must,

FIRE WARDEN'S REPORT.

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and will be, met in each locality with as little weakening of the previously attained efficiency as possible. But the increased menace is outside the sphere and beyond the control of the existing organization. Through the efforts of the State office, efficient and interested foremen have replaced the original men in charge of brush burning in a few instances and the local situation has been relieved. But no general remedy will be found in this way. There must be made available an adequate force to patrol such locations, if serious conditions are to be avoided in the coming fall and spring. Without this, even its partial control will be extremely problematical. (See p. 85.)

THE FIRE SEASON.

During November, 1917, the State experienced unusually severe forest fire conditions. Early and continued low temperature produced an exceptionally heavy leaf litter. Dry weather made the surface growth and litter dangerously inflammable. Prevailing high winds rendered fires extremely hard to control. Because of these conditions and concurrent with the opening of the hunting season, there were from two to four times as many November fires as in any recent year save in the holocaust of 1914, which but little exceeded the record of the past fall. Many of the fires occurred at times and in places which made it impossible to control them before they had burned large areas.

The early winter weather late in November put an end to a serious situation and brought relief until the opening of spring. In March an unusually early season of fine weather ushered in an early fire season, which accompanied by high winds brought on a difficult fire situation. Because of this, more than one-third of the fires, in the eight months considered, started during this month and in a number of instances they reached large size.

April and May were unusually favorable and, save for short periods of dry, windy weather, brought an unexpected relief from the conditions of the preceding month. Although during brief drouths fires occurred in considerable numbers, few of them

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became serious in size. With the opening of June, full summer foliage and continued wet weather so reduced the fire menace that a negligible number occurred, none of which were serious.

FOREST FIRES BY MONTHS.

	<i>No.</i>	<i>Per Cent of Total.</i>		<i>No.</i>	<i>Per Cent of Total.</i>
November,	201	27	March,	230	30
December,	11	1	April,	193	26
January,	4	1	May,	100	13
February,	9	1	June,	7	1

NUMBER AND AREA OF FIRES.

(See Tables 1 and 2.)

In previous reports it has been customary to set out very small or incipient fires as "embryo fires," these being all fires under 5 acres in area. To conform more nearly to prevailing practice elsewhere and to secure local data in more detail, only fires burning less than 2 acres are this year and will be hereafter included in the "embryo" class. Of necessity, it appears at first from this new classification that the proportion of fires which are true forest fires has increased. For the year, 29 per cent of all fires have burned less than 2 acres, 63 per cent less than 10 acres, and 90 per cent less than 100 acres—a decided improvement over the previous records in this respect. Moreover, for the period covered, the average area per fire, 73 acres, and the average loss per fire, \$68, are the lowest figures since 1912.

The total area burned was 55,282 acres and the loss recorded \$51,529. (See Table 1.)

Seriously large fires, burning 1,000 acres or more each, have been fewer, and that they have reached such size in every instance has been due to abnormal winds in a dry time, or to remote location which delayed their discovery, retarded the arrival and hampered the movements of the fire fighters, combined with the conditions outlined on pages 73 and 74.

FIRE WARDEN'S REPORT.

Table 1—Forest Fires in 1918, and in Previous Years.

Years.	No. of Fires.	Total Acres Burned.	Acres per Fire.	Total Loss.	Loss per Fire.
No organized service, incomplete reports.					
1872,		100,000		\$1,000,000	
1880,	54	71,074	1,316	252,240	\$4,671
1885,		128,000		1,128,000	
1895,	49	66,120	1,349	600,000	12,245
1902,	65	98,850	1,520	169,323	2,605
1903,	79	85,046	1,076	305,744	3,870
1904,	81	41,530	512	193,413	2,388
Organized fire service.					
1907,	167	11,525	69	11,647	70
1908,	533	52,978	100	64,536	121
1909,	563	93,525	166	133,944	238
1910,	611	81,452	133	127,850	209
1911, Forest Fires,	289	64,404	122	86,940	165
Embryo Fires, ¹ ...	239				
1912, Forest Fires,	214	26,291	48	21,501	39
Embryo Fires, ¹ ...	331				
1913, Forest Fires,	311	53,823	77	67,205	99
Embryo Fires, ¹ ...	367				
1914, Forest Fires,	396	78,655	92	83,880	99
Embryo Fires, ¹ ...	451				
1915, Forest Fires,	549	150,258	147	209,090	207
Embryo Fires, ¹ ...	467				
1916, Forest Fires,	269	51,654	88	69,001	118
Embryo Fires, ¹ ...	314				
1917, Forest Fires,	486	92,479	106	79,335	90
Embryo Fires, ¹ ...	385				
1918, ³ Forest Fires,	539	55,282	73	51,529	68
Embryo Fires, ² ...	216				

¹ Burned less than 5 acres.

² Burned less than 2 acres.

³ Short year: 8 months only.

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Table 2—Forest Fires by Relative Area Burned, and by Counties, November 1, 1917, to June 30, 1918.

COUNTY.	Number of forest fires.					Total Embryo Fires (less than 2 acres).
	2-10 Acres.	11-100 Acres.	101-1000 Acres.	Over 1000 Acres.	Total.	
North Jersey—						
Bergen,	16	11	1	1	29	15
Hunterdon,	2	.....	1	.....	3	4
Morris,	48	32	10	.....	90	26
Passaic,	11	20	6	.....	37	20
Somerset,	18	2	2	.....	22	8
Sussex,	11	13	.....	.....	24	9
Union,	5	3	3	.....	11	1
Warren,	12	4	2	.....	18	16
Fires that burned in more than 1 county, .....	.....	.....	1	1	2	.....
Totals,	123	85	26	2	236	99
South Jersey—						
Atlantic,	22	25	14	1	62	29
Burlington,	10	4	4	.....	18	2
Camden,	11	10	2	.....	23	14
Cape May,	9	11	2	.....	22	8
Cumberland,	18	29	8	2	57	9
Gloucester,	5	9	1	.....	15	3
Mercer, .....	.....	.....	.....	.....	.....	4
Middlesex,	18	15	4	.....	37	5
Monmouth,	23	5	3	.....	31	13
Ocean,	15	14	3	2	34	26
Salem, .....	.....	1	.....	1	2	4
Fires that burned in more than 1 county, .....	.....	.....	1	1	2	.....
Totals,	131	123	42	7	303	117
State Totals,	254	208	68	9	539	216
Per cent. of State Totals,	34	27	9	1	71	29

FIRE WARDEN'S REPORT.

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CAUSES OF FIRES.

(See Table 3.)

Railroads.—This year fires set by the railroads have been 31 per cent of the total, the lowest percentage ever recorded from this cause. This record, despite the difficulties known to be prevalent, especially in proper care of the rights-of-way, is emphatic testimony to the prevailing interest in fire prevention and control, particularly among those who have charge of the rights-of-way. It is known that a considerable additional number of fires have started along the railroads, which were so promptly and effectively controlled by railroad employees that no notice of them reached a firewarden. While far from being a settled problem, it seems fair to hope that the period of greatest anxiety on this account is passing. When a co-operation as ready and as thorough can be reached with the operating departments as that now almost universally existing with the right-of-way departments, the annual responsibility of railroad locomotives for forest fires will be a minor factor.

Brush burning.—This year the number of fires caused by careless or ignorant burning for "cleaning up" is greater in proportion to the total than before. Further, the 13 per cent so recorded unquestionably does not represent the total number so started, because of the impossibility of locating the origin of many "brush" fires, in the busy season for such fires, without a more complete patrol. Where patrol has been possible forest fires from this cause have been few. Rigid enforcement of the requirement for permits for building any fire in or near the woodlands is gradually reducing the unnecessary burning and inducing greater care where fire must be employed. It also is increasing the precision with which the origin of fires from brush burnings are known. A widespread and active patrol of the principally affected areas during the special danger periods appears to offer the only means of rapid progress in curtailing fires from this cause. (See p. 85.)

Smokers.—A determined effort to ascertain more closely what fires may be charged to careless smokers has brought out the fact

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that 21 per cent of the total fires which burned were so started. It is beyond question that this figure would be far larger could all such fires which are now classed as of "Unknown Cause" be segregated. An effort has been made to reach the smoker with a warning through wide distribution of a special poster dealing with this problem. Here again, however, persistent patrol alone appears to offer the final remedy; not alone through the apprehension and punishment of those who thus start fires, but by its insistent appeal and warning to smokers frequenting the rural sections.

Miscellaneous.—As the work of caring for fires and ascertaining their causes grows better organized and more precise, the ignorant and unnecessary use of back-fire is found to be a major cause for the large size and long duration of many, if not most, of the larger fires. This tendency to ill-advised use of fire by any but an authorized warden in the presumed intent to check a fire already running, or the selfish protective burning for personal protection which is allowed to run at will after its primary purpose has been achieved and its originator's property safeguarded, has been recognized as a serious, as well as an illegal, menace since the work first started. Its relation to the fire control work is more evident from this year's record than ever before, but final control must wait until patrol is made available to provide men who have the time and means of watching this situation while fires are burning. This the active fire fighting forces cannot find opportunity to do while busy with the fire itself. This year again a small proportion of the fires have been due to children at play, another situation which is susceptible of only gradual remedy through education, unless an enlarged State force is made available.

Campers, picnickers and sportsmen.—It annually is pointed out that the illegal and careless or ignorant building of camp fires, bonfires, and the like, is responsible for many fires. Persistent endeavor to advertise this situation is slowly replacing the wood fire by more convenient and effective alcohol or petroleum burners. But the natural tendency to gather round and cook over the camp fire still remains, and in a region of dense population and easy access, such as New Jersey, intensive and continuous pa-

FIRE WARDEN'S REPORT.

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trol alone is the final remedy. Last fall such a patrol in the deer-hunting sections on the open dates, following a similar effort in the two previous years, proved that open fires were quite unnecessary and that the sportsman was more comfortable and more conveniently accommodated without the wood fires that previously had been deemed indispensable. Men and funds for similar work during the fishing season and when the automobile picnicker is in the wooded sections appears to offer the only effective way of bringing warning and suggestion to the out-of-doors pleasure seeker in general. It is recognized that this menace is due to ignorance in the main and that the remedy is prompt when those offending realize the facts, but ordinary avenues of publicity will not suffice.

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Table 3—Forest Fires by Causes and Counties, November 1, 1917, to June 30, 1918.

COUNTY.	Number.												Totals.
	Locomotive.		Brush Burning.		Smokers.		Miscellaneous.		Unknown.		Totals.		
	FF	eF	FF	eF	FF	eF	FF	eF	FF	eF	FF	eF	
North Jersey—													
Bergen,	8	6	6	3	6	3	2	2	7	1	29	15	
Hunterdon,	2	1	1	1	1	1	1	1	1	1	3	4	
Morris,	18	5	12	7	26	6	6	1	28	7	90	26	
Passaic,	16	8	1	1	16	7	1	1	3	4	37	20	
Somerset,	4	2	3	3	6	1	1	3	8	3	22	8	
Sussex,	13	3	2	1	5	3	2	4	4	24	9		
Union,	2	1	2	2	2	2	2	5	11	11	1		
Warren,	6	13	2	2	2	2	2	5	3	18	16		
Fires that burned in more than 1 county,			1				1				2		
Totals,	69	39	30	12	64	20	13	10	60	18	236	99	
South Jersey—													
Atlantic,	23	13	7	4	8	4	2	2	22	6	62	29	
Burlington,	3	3	3	5	1	1	1	7	2	18	2		
Camden,	6	9	3	3	6	1	1	7	1	23	14		
Cape May,	8	6	5	4	1	1	1	5	1	22	8		
Cumberland,	8	2	8	1	13	2	3	25	4	57	9		
Gloucester,	3	2	2	1	8	1	1	1	1	15	3		
Mercer,				3						1	4		
Middlesex,	3	1	3	1	5	1	2	24	2	37	5		
Monmouth,	11	9	2	2	7	1	2	9	1	31	13		
Ocean,	11	13	3	3	4	3	2	14	5	34	26		
Salem,			1	1	1	2	1	1	2	4			
Fires that burned in more than 1 county,					1			1		2			
Totals,	76	53	37	19	62	15	13	6	115	24	303	117	
State Totals,	145	92	67	31	126	35	26	16	175	42	539	216	
Per cent. of State Totals,	31		13		21		16		29				

FF—Forest Fires.
eF—Embryo Fires (less than 2 acres).

FIRE WARDEN'S REPORT.

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THE FOREST FIRE SERVICE.

The State force.—The improving efficiency in local fire control, due mostly to the work of the State wardens, has continued again this year. (See p. 77.) Despite a marked increase of the activity of the State wardens in actual fire fighting, the record of violations handled and disposed of evidences the growing hold on that problem. (See p. 93.) In addition, particular effort has been made by means of two special posters to reach the smokers and those burning brush, with information and warning. Aside from personal activities, the State firewarden's office and force has also answered frequent calls for special war work in connection with Liberty Loan, wood fuel, war timber supply, and other similar activities.

Local organization.—To meet developing local needs the fire service has been installed in seven additional townships as follows: Alexandria, Clinton, East Amwell, Franklin, Holland, and West Amwell in Hunterdon County, and Montgomery in Somerset County. Also, because of its political division the area of old Pompton township, Passaic County, has been reallocated to embrace the three new boroughs. The service, therefore, is active in 156 townships with 352 local wardens on the list. Because of the three-year term, first instituted a year ago, changes in personnel have been rare and local efficiency, therefore, has been advanced by the stability. The effectiveness of this local organization is apparent from the fact that year by year the average area burned per fire is going down. In view of the facts outlined on page 74 this is the more creditable this year. Moreover, in the face of an always increasing number of fires reported started, the proportion cut off before they become serious remains as great or greater as time goes on. To stop fires from starting, a different type of organization must be made available—not to supplant that now in operation, but to supplement it. (See p. 85.)

Lookouts.—The McKeetown Lookout Station, Atlantic County, installed a year ago by the co-operation of the City of Atlantic City, has amply justified the expectation that it would prove invaluable in fire control in the area within its scope.

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In co-operation with the Federal Forest Service, by which \$250 of the necessary funds were furnished under the so-called "Weeks' Law," a lookout tower and telephone connection are under construction on the Kittatinny Ridge near Culvers Lake in Sussex County.

The lookout station at Batsto, Burlington County, and that at Ceder Pond, Passaic County (see p. 85) again have been in operation during the fire season.

Rural mail patrol.—The co-operative arrangement under which the Postmaster-General designated all rural mailmen as forest fire patrolmen has been continued and has given valuable assistance to the local force by prompt notice of fires.

Federal patrol.—The fund of \$2,000 allotted for forest fire patrol and lookout work in North Jersey from the so-called "Weeks' Law Fund" has been continued. Under this allotment during November, 1917, and since April 15th, 1918, the watcher at the Cedar Pond Lookout Station has been on duty.

During November a patrol of eleven men, partly by motor and partly on foot, was maintained in the areas most frequented by gunners. With the opening of April the single motor patrolman heretofore employed took up work again.

As has so often been pointed out before, this patrol has made available in North Jersey an adjunct of the firewarden system whose value is only slightly measured by the numerous fires reported promptly to the proper warden. Its worth as a fire preventive agency is the far more important element. Unquestionably, in areas patrolled, fewer fires have started from causes which can be controlled by individual carefulness. (See p. 85.)

Special railroad co-operation.—During the year a plan of co-operation has been worked out with the Erie Railroad to care for the situation along its Greenwood Lake Division where forest fire conditions have always been extremely bad. Under the plan the entire danger area will be made safe by clearing and burning along the right-of-way for a distance of 200 feet from the track. In times of extreme fire danger this work will be supplemented by motor patrol to follow each locomotive movement over that portion of the line where the forest fire menace is great.

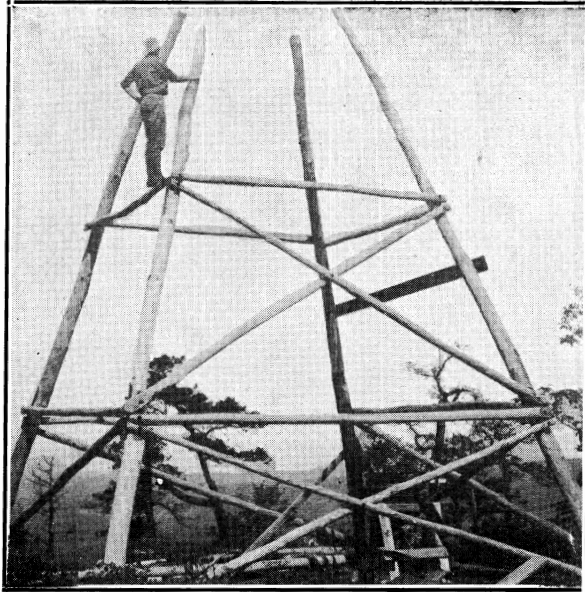


Fig. 19. Fire Lookout Tower.

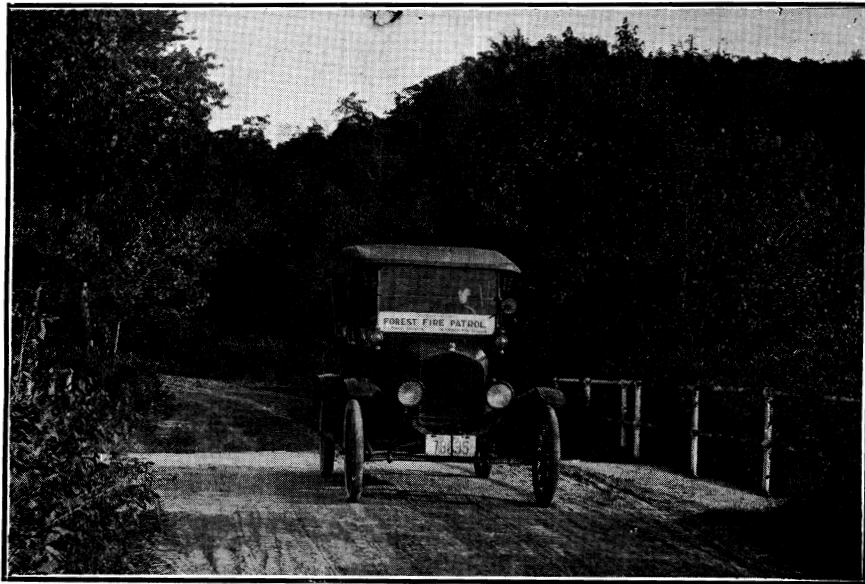


Fig. 20. Fire Patrolman.

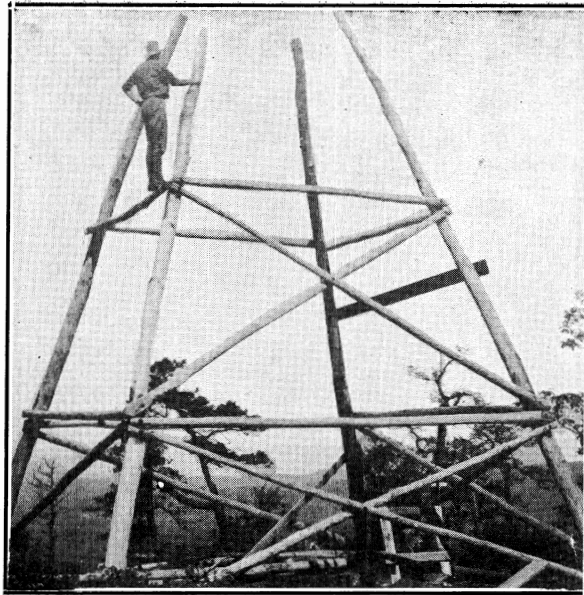


Fig. 19. Fire Lookout Tower.

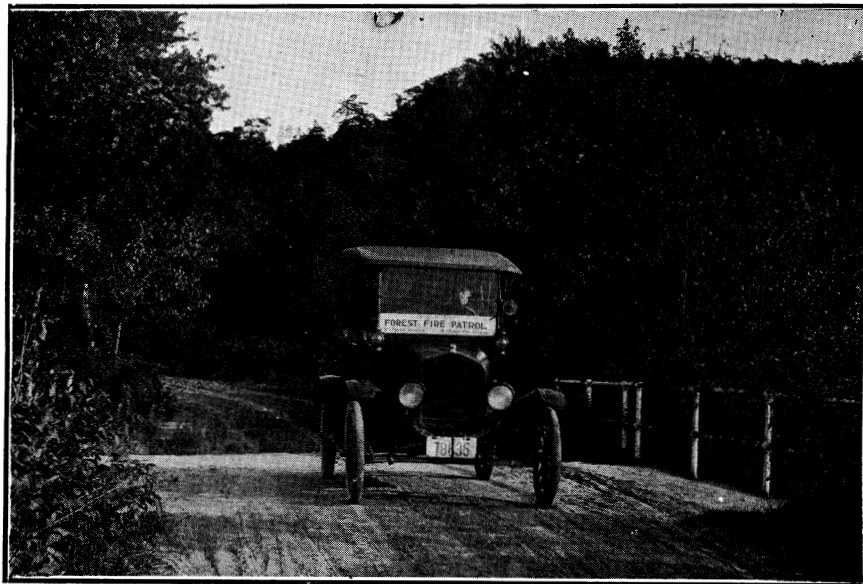


Fig. 20. Fire Patrolman.

Value of the Service.—The service annually rendered in forest protection is impossible to calculate in concrete figures. No estimate of the potential power for damage by the small fire is possible nor attempted. It is certain, however, that fire protection, and that alone, will guarantee to the State a forest cover and forest productivity to the million or more acres which will grow trees profitably but are unsuited to any other use.

There is, however, a concrete measure of additional worth in the work done in forest protection. In the eight months just passed, improved property to the value of more than \$200,000 has been saved from sure injury, if not destruction, by forest fire. The list of property saved which is known to be far from complete, includes dwellings, farm buildings, industries, cranberry bogs and buildings, and farm and forest products.

Needs of the Service.—A year ago the need for an enlarged State force to provide for forest fire lookout and patrol service was emphasized. The effectiveness of the existing system of local wardens and fire fighters is attested by the record of their work. (See p. 83.) But the sphere of their activity and influence is largely limited to the control of fires already burning.

The number of fires which start is annually increasing. Despite the most prompt and efficient attention, serious and costly fires will occur when woods and weather conditions are dangerous so long as fires are started in large numbers.

The conditions noted on page 74 with regard to the increasing fire menace are but an abnormal hastening of a situation which has been developing heretofore. New Jersey's rural population is increasing rapidly. Her good roads and splendid accessibility by steam and electric lines open even the remoter sections to the vast population of her own and neighboring cities, the densest organized population in the world. Her resorts attract this element into and across the wilderness areas in numbers unique for such localities. From such conditions arise a permanently increasing source of forest fires.

Further than this, effectual fire protection in its earlier stages of itself creates an increased menace. Many small fires may be started and put out in areas where previously one large fire, though it destroyed its value, made the larger area temporarily

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immune. Recuperation of the formerly abused and continually burned woodlands involves the dense and more inflammable conditions always found where young forest growth and underbrush predominate. For the next quarter century, until the growing forest has recovered beyond the period of excessive younger stock, the State must carry this added burden as the price of past indifference and neglect.

To cope with these conditions two means must be provided: There must be permanent watch to assure prompt notice of all fires which start, so that they may be cut off before they can escape control; there must be agents in the danger zones to caution all against the danger and to apprehend those whose carelessness, indifference, or ignorance contribute to the needless annual wastage of the forest resources and possibilities of the State. Fire lookouts and patrol have done and are doing this where they have been made available by the interest of the Federal Government and of private or municipal agencies. The State should not be made dependent on such sources for the means to serve her interests. It cannot rely upon them for any general remedy.

FIRE WARDEN'S REPORT.

Table 4—Forest Fires by Counties and Townships, November 1, 1917, to June 30, 1918.

County and Township.	Number.		Acres Burned.	Loss to Forests and Other Property.	Cost to Extinguish.	Paid by. ²		
	Forest Fires.	Embryo Fires.				Township.	State.	Offenders.
Atlantic County—								
Absecon (City),...	1		40	\$10				
Buena Vista,	11	3	1208	490	\$108.65	\$36.76	\$36.76	\$45.80
Egg Harbor,	9	2	484	210	168.40	77.20	77.20	14.00
Egg Harbor (City)	2		10	5	21.00	7.00	7.00	7.00
Folsom,								
Galloway,	20	9	1420	1090	292.15	100.45	100.45	101.25
Hamilton,	2	2	1150	950	54.67	4.50	4.50	46.87
Hammonton,	4	4	727	360	182.89	64.44	64.45	54.50
Linwood,								
Mullica,	8	2	3696	3703	351.35	4.75	4.75	346.85
Northfield (City),								
Pleasantville,	1		5					
Port Republic,								
Weymouth,	6	6	846	365	119.78	54.39	54.39	21.00
Total,	62	28	9586	\$7241	\$1298.89	\$349.49	\$349.50	\$637.27
Bergen County—								
Franklin,	8	6	57	\$208	\$143.00	\$33.50	\$33.50	\$76.00
Hohokus,	6		2394	1769	275.00	137.51	137.49	
Montvale (Boro.),	3		70	85	11.00			15.00
Oakland (Boro.), .	2	1	1405	1205	18.00			18.00
Park Ridge (Boro)	2		30	15	18.00	3.00	3.00	12.00
Ridgefield (Boro),	7	7	58	34	30.10	13.55	13.55	3.00
Woodcliffe Lake, .	4	1	58	45	29.00	10.00	10.00	9.00
Total,	32	15	4072	\$3361	\$524.10	\$197.56	\$197.54	\$133.00
Burlington County—								
Bass River,	3		13	30	\$30.10	\$15.05	\$15.05	
Evesham,	2		13	5	10.25			\$10.25
Medford,								
New Hanover, ...	2		165	155	27.00	13.50	13.50	
Pemberton,	8	1	1630	475	177.55	78.78	78.77	30.00
Shamong,	1		5	10	6.00			6.00
Southampton,								
Tabernacle,	1		20	20	7.80	3.90	3.90	
Washington,								
Woodland,	2	1	270	45	13.10	6.55	6.55	
Total,	19	2	2116	\$740	\$271.80	\$117.78	\$117.77	\$46.25

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Table 4—Forest Fires by Counties and Townships, November 1, 1917, to June 30, 1918—Continued.

County and Township.	Number.		Acres Burned.	Loss to Forests and Other Property.	Cost to Extinguish.	Paid by. ²		
	Forest Fires.	Embryo Fires.				Township.	State.	Offenders.
Camden County—								
Berlin,	1		10	\$5	\$4.00	\$2.00	\$2.00	\$3.00
Chesilhurst Boro.,								
Clementon,	4	1	65	35	40.00	16.00	16.00	8.00
Delaware,	1	1	50	25	13.00	6.50	6.50	5.00
Gloucester,	2	3	10	105	18.45	5.60	5.60	16.70
Voorhees,								
Waterford,	6		616	2556	112.40	23.65	23.65	71.10
Winslow,	9	9	479	310	152.25	22.74	22.76	107.75
Total,	23	14	1230	\$3036	\$340.10	\$76.49	\$76.51	\$211.55
Cape May County—								
Dennis,	3		165	\$85	\$55.75	\$6.87	\$6.88	\$45.00
Lower,	1	3	3		16.00	2.00	2.00	12.00
Middle,	10	5	384	372	116.60	48.43	48.42	69.25
Upper,	6		184	235	89.54	18.77	18.77	54.00
Woodbine (Boro.),	2		105	35	18.90	7.55	7.55	10.00
Total,	22	8	841	\$727	\$346.79	\$83.62	\$83.62	\$190.25
Cumberland Co.—								
Commercial,	3		730	\$530	\$87.85	\$15.43	\$15.42	\$57.00
Deerfield,	6		291	145	31.00	5.75	5.75	65.00
Downe,	10		3557	3315	296.10	87.70	87.70	120.70
Fairfield,	1	2	10	10	17.00	4.00	4.00	9.00
Landis,	10	5	312	475	163.70	76.22	76.23	11.25
Lawrence,	2		285	150	23.25	4.63	4.62	14.00
Maurice River, ..	10		4263	928	243.48	103.94	103.94	61.00
Millville (City),..	17	2	535	347	234.90	110.44	110.47	9.00
Total,	59	9	9983	\$5900	\$1097.28	\$408.11	\$408.13	\$346.95
Gloucester County—								
Clayton (Boro.),..	1		7	\$3	\$8.00	\$4.00	\$4.00	.....
Elk,								
Franklin,	8	2	1134	590	91.95	40.46	40.48	\$23.00
Monroe,	4	1	145	95	39.95	1.97	1.98	55.00
Washington,	2		14	10	17.00	8.50	8.50	.....
Total,	15	3	1300	\$698	\$156.90	\$54.93	\$54.96	\$78.00

FIRE WARDEN'S REPORT.

Table 4—Forest Fires by Counties and Townships, November 1, 1917, to June 30, 1918—Continued.

County and Township.	Number.		Acres Burned.	Loss to Forests and Other Property.	Cost to Extinguish.	Paid by. ²		
	Forest Fires.	Embryo Fires.				Township.	State.	Offenders.
Hunterdon County—								
Alexandria,								
Bethlehem,	3	1	305	\$204	\$25.35	\$12.67	\$12.68	
Clinton,								
East Amwell,								
Franklin,								
Holland,								
Lebanon,		1		3000				
Tewksbury,		1			5.00	2.50	2.50	
West Amwell,		1			1.00	.50	.50	
Total,	3	4	305	\$3204	\$81.35	\$15.67	\$15.68	
Mercer County—								
Hopewell,								
Princeton,	4				\$19.00	\$6.50	\$6.50	\$20.00
Total,	4				\$19.00	\$6.50	\$6.50	\$20.00
Middlesex County—								
East Brunswick,	10		311	\$290	\$68.85	\$34.42	\$34.43	\$30.00
Madison,	11	3	622	523	216.90	98.45	98.45	25.00
Monroe,	1		263	2150				
Sayreville,	13	2	181	115	86.20	43.09	43.11	
South Brunswick,	2		190	160	16.00	8.00	8.00	
Total,	37	5	1567	\$3238	\$387.95	\$183.96	\$183.99	\$55.00
Monmouth County—								
Atlantic,								
Freehold,	3		1550	\$1600	\$115.65	\$57.82	\$57.83	
Howell,	23	7	475	1673	395.12	101.98	101.97	\$194.42
Middletown,	1		10	10	8.00	4.00	4.00	
Ocean,	4		38	40	20.75	7.88	7.87	5.00
Shrewsbury,	1	5	3		30.50	4.00	4.00	22.50
Wall,		1						10.00
Total,	32	13	2076	\$3323	\$570.02	\$175.68	\$175.67	\$231.92

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Table 4—Forest Fires by Counties and Townships, November 1, 1917, to June 30, 1918—Continued.

County and Township.	Number.		Acres Burned.	Loss to Forests and Other Property.	Cost to Extinguish.	Paid by. ²		
	Forest Fires.	Embryo Fires.				Township.	State.	Offenders.
Morris County—								
Boonton,	7	3	67	\$37	\$84.30	\$26.75	\$26.75	\$47.80
Chester,	2	1	25	16	19.75	4.00	4.00	19.75
Denville,	8	.....	201	162	125.70	51.60	51.60	22.50
Hanover,	14	3	1579	2290	324.70	97.71	97.69	139.30
Jefferson,	4	6	86	55	118.20	53.60	53.60	60.00
Mendham,	2	0	20	75	16.50	8.25	8.25	.....
Montville,	9	2	117	85	147.00	49.75	49.75	56.00
Morris,	7	4	46	42	174.75	53.62	53.63	72.00
Mt. Arlington, ...	3	1	73	295	68.00	34.00	34.00	.....
Mt. Olive,	2	2	17	96	58.80	19.90	19.90	20.00
Passaic, .....	.....	.....	.....	.....	.....	.....	.....	.....
Pequannock,	5	.....	258	280	137.50	21.00	21.00	95.50
Randolph,	10	1	199	515	210.90	94.20	94.20	40.50
Rockaway,	10	2	830	1135	336.80	159.36	159.34	45.00
Roxbury,	1	1	5	.....	6.00	1.00	1.00	5.00
Washington,	7	.....	155	155	129.20	64.60	64.60	.....
Total,	91	26	3678	\$5238	\$1958.10	\$739.34	\$739.31	\$623.35
Ocean County—								
Berkeley,	3	1	5106	\$2010	\$106.75	.....	.....	\$108.40
Brick,	9	3	244	635	140.00	\$58.00	\$58.00	25.00
Dover,	4	1	25	60	41.50	17.25	17.25	7.00
Eagleswood, .....	.....	1	.....	5	6.00	.....	.....	6.00
Jackson,	5	1	888	830	190.50	73.00	73.00	69.50
Lacey,	1	5	2000	1000	53.80	5.86	5.89	42.05
Lakewood,	6	1	82	70	58.60	15.20	15.20	28.20
Little Egg Harbor, .....	.....	.....	.....	.....	.....	.....	.....	.....
Manchester,	6	10	1500	885	155.40	9.00	9.00	137.40
Ocean, .....	.....	1	.....	.....	5.00	2.50	2.50	.....
Plumstead,	3	.....	773	250	14.00	7.00	7.00	.....
Stafford,	1	.....	125	100	11.50	5.75	5.75	.....
Union,	2	2	1030	875	66.20	27.30	27.30	21.60
Total,	40	26	11769	\$6720	\$849.25	\$220.86	\$220.89	\$445.15
Passaic County—								
Pompton,	30	13	2442	\$2238	\$483.25	\$188.42	\$188.43	\$133.15
West Milford,	11	7	191	143	170.37	31.14	31.13	113.10
Total,	41	20	2633	\$2381	\$653.62	\$219.56	\$219.56	\$246.25

FIRE WARDEN'S REPORT.

Table 4—Forest Fires by Counties and Townships, November 1, 1917, to June 30, 1918—Continued.

County and Township.	Number.			Loss to Forests and Other Property.	Cost to Extinguish.	Paid by. ²		
	Forest Fires.	Embryo Fires.	Acres Burned.			Township.	State.	Offenders.
Salem County—								
Alloway,	1	1	15	.....	\$11.00	\$5.50	\$5.50	.....
L. Alloways Creek,	1	.....	10	\$10	16.60	.....	.....	\$16.60
Pittsgrove, .....	.....	1	.....	.....	4.00	.....	.....	9.60
Quinton,	1	1	1200	2500	150.40	3.25	3.25	143.90
Upper Pittsgrove, .....	.....	1	.....	.....	8.00	.....	.....	10.00
Total,	3	4	1225	\$2510	\$190.00	\$8.75	\$8.75	\$180.10
Somerset County—								
Bernard,	9	5	85	\$144	\$206.50	\$65.50	\$65.50	\$75.50
Bridgewater,	3	1	18	20	33.00	16.50	16.50	.....
Hillsborough, .....	.....	.....	.....	.....	.....	.....	.....	.....
Montgomery, .....	.....	.....	.....	.....	.....	.....	.....	.....
North Plainfield,	8	.....	580	572	152.30	68.65	68.65	15.00
Warren,	2	2	16	5	43.80	20.90	20.90	2.00
Total,	22	7	699	\$741	\$435.60	\$171.55	\$171.55	\$92.50
Sussex County—								
Andover, .....	.....	.....	.....	.....	.....	.....	.....	.....
Byram, .....	.....	2	.....	.....	\$12.00	.....	.....	\$12.00
Frankford, .....	.....	.....	.....	.....	.....	.....	.....	.....
Franklin (Boro.),	1	.....	100	\$25	19.00	\$9.50	\$9.50	.....
Green, .....	.....	.....	.....	.....	.....	.....	.....	.....
Hampton, .....	.....	.....	.....	.....	.....	.....	.....	.....
Hardyston,	8	1	59	69	64.10	3.00	3.00	108.10
Hopatcong, .....	.....	1	.....	.....	4.00	.....	.....	4.00
Montague,	1	2	25	25	16.65	8.33	8.32	.....
Ogdensburg Boro.	4	2	87	162	26.00	.....	.....	26.00
Sandyston,	2	.....	11	8	14.60	5.30	9.30	.....
Sparta,	7	.....	260	425	97.40	44.55	44.55	8.30
Stillwater, .....	.....	.....	.....	.....	.....	.....	.....	.....
Vernon, .....	.....	.....	.....	.....	.....	.....	.....	.....
Walpack,	1	8.00	4.00	4.00
Wantage,	1	75	35	20.00	10.00	10.00
Total,	24	9	617	\$749	\$281.75	\$84.68	\$88.67	\$146.40

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Table 4—Forest Fires by Counties and Townships, November 1, 1917, to June 30, 1918—Concluded.

County and Township.	Number.		Acres Burned.	Loss to Forests and Other Property.	Cost to Extinguish.	Paid by. ²		
	Forest Fires.	Embryo Fires.				Township.	State.	Offenders.
Union County—								
Mountainside,	3	.....	90	\$113	\$84.70	\$42.35	\$42.35	.....
New Providence, ..	6	1	694	550	45.70	7.75	7.75	\$33.20
Scotch Plains,								
Springfield,								
Total,	9	1	784	\$663	\$130.40	\$50.10	\$50.10	\$33.20
Warren County—								
Allamuchy,	2	2	6	\$3	\$33.00	\$16.50	\$16.50	.....
Blairstown,	2	.....	44	75	16.25	6.50	6.50	\$3.25
Franklin,								
Hardwick,								
Harmony,								
Hope,	2	.....	408	405	99.20	7.00	7.00	85.20
Independence, ...								
Knowlton,	7	11	301	487	193.48	42.15	42.15	109.18
Mansfield,								
Pahaquarry,	1	2	25	25	26.60	13.30	13.30	.....
Washington,	3	1	31	49	43.95	21.99	21.96	.....
White,	2	.....	16	15	9.00	.....	.....	9.00
Total,	19	16	831	1059	\$421.48	\$107.44	\$107.41	\$206.63
State Total,	1553	214	55282	\$51529	\$9963.38	\$3265.07	\$3276.14	\$3923.77

¹ This total is greater than the actual number (539), because in 14 cases one fire burned in two or more townships.

² The sum of these columns often differs from the "Cost to Extinguish" item, because a fine was larger than the bill, or a bill was withdrawn, etc.

FIRE WARDEN'S REPORT.

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VIOLATIONS OF THE LAW.

(See Tables 4 and 5.)

Penalties imposed on those who are responsible for forest fires, or who use fire carelessly or illegally, are apparently the most potent deterrent of repetition by the individual or in the community. Continued and emphatic emphasis, therefore, has been put upon the effort to establish the origin of New Jersey's fires. It has, however, been recognized from the first that arbitrary dealing with the situation would often impose unnecessary hardships if not actual injustice. The effort, therefore, has been to deal with each case individually in the way which promised best to prevent recurrence of the same difficulty, locally. This treatment of the matter slowly but surely is curtailing careless and reckless use of fire in the communities where close supervision has been possible. This year, with the limited force, the responsibility has been definitely fixed and the offender penalized for 45 per cent of the fires. The total number of violations of the law fixed (388) is little less for the eight months' period than for the full year in any previous record.

It is felt that the preliminary stage of educational work in this respect has now been passed. Justifiable ignorance of the requirements of the law requiring permits and excusable ignorance of the danger in using fire and smoking materials no longer can be recognized. On this assumption the policy of leniency which has previously prevailed has been definitely set aside and far more rigorous penalizing for forest fires has superseded, to emphasize the penalty involved as well as to continue the warning heretofore sought through this feature of the work.

There still remain 222 cases from the past year to be disposed of, a larger proportion than usual because of the mid-season time of closing the record. Of the 143 cases pending from the two previous years but 31 are still unsettled.

The penalties collected during the year amounted to \$2,518.68, of which the railroads paid \$1,656.92, and other agencies \$861.68.

Table 5—Violations of the Forest Fire Law, November 1, 1917, to June 30, 1918.

DATE	COUNTY AND TOWNSHIP.	OFFENDER.	OFFENSE.	SETTLEMENT.
<i>Atlantic County—</i>				
April 1,	Buena Vista,	A. S. Walker,	Saw mill engine set fire,	Paid firewarden's bill, \$7.80.
April 26,	Buena Vista,	Jacob Tarboy,	Allowed a brush fire to escape, ...	Paid \$25 fine.
	Buena Vista,	Atlantic City R. R.,	3 fires set by locomotives,	Paid firewarden's bills, \$11.00.
	Buena Vista,	Pennsylvania R. R.,	1 fire set by locomotive,	Pending.
March 11,	Egg Harbor,	Wm. Hollis,	Set fire without a permit and allowed it to escape,	Released with warning.
March 30,	Egg Harbor,	O. E. Kencher,	Allowed a brush fire to escape, ...	Paid fine, \$10.00.
	Egg Harbor,	Atlantic City R. R.,	1 fire set by locomotive,	Pending.
	Egg Harbor City,	Pennsylvania R. R.,	1 fire set by locomotive,	Pending.
April 5,	Galloway,	Chas. Guerrieri,	Set fire without a permit and allowed it to escape,	Dropped—insufficient evidence.
April 26,	Galloway,	Jno. Turner,	Set fire without a permit,	Paid fine, \$10.00.
	Galloway,	Atlantic City R. R.,	2 fires set by locomotives,	Paid firewarden's bills, \$17.00.
	Galloway,	Atlantic City R. R.,	1 fire set by locomotive,	Pending.
	Galloway,	Pennsylvania R. R.,	5 fires set by locomotives,	Paid firewarden's bills, \$33.00.
	Galloway,	Pennsylvania R. R.,	1 fire set by locomotive,	Dropped—insufficient evidence.
	Galloway,	Pennsylvania R. R.,	7 fires set by locomotives,	Pending.
December 6,	Hamilton,	Jos. Vetri,	Allowed a brush fire to escape, ...	Paid fine, \$5.00.
	Hamilton,	Atlantic City R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$41.87.
January 12,	Hammonton,	Angelo Del Vecchio,	Set fire without a permit,	Paid fine, \$2.00.
April 6,	Hammonton,	Jno. Hartley,	Allowed a brush fire to escape, ...	Paid fine, \$27.50.
April 6,	Hammonton,	John Sintner,	Son set fire,	Dropped—offender mentally irresponsible.
May 2,	Hammonton,	Pennsylvania R. R.,	2 fires set by locomotives,	Pending.
	Weymouth,	John Dougherty,	Set fire without a permit,	Paid fine, \$10.00.
	Weymouth,	Atlantic City R. R.,	2 fires set by locomotives,	Cases dropped—township bills too tardy.
	Weymouth,	Atlantic City R. R.,	2 fires set by locomotives,	Pending.
<i>Bergen County—</i>				
November 8, ...	Franklin,	J. H. Blauvelt,	Set fire without a permit and allowed it to escape,	Offender burned to death—no action taken.
November 13, ..	Franklin,	New York, Susquehanna and Western R. R.,	9 fires set by locomotives,	Pending.
	Hohokus,	Mary M. Post,	Set illegal backfire,	Released with a warning.
	Oakland,	Stephen H. Welling,		
	Oakland,	New York, Susquehanna and Western R. R.,	2 fires set by locomotives,	Pending.

March 20,	Ridgefield,	Mrs. W. H. Lockington, ..	Set fire without a permit and allowed it to escape,	Paid fine, \$3.00.
April 5,	Ridgefield,	F. Kapersyc,	Set fire without a permit,	Dropped—offender in military service.
April 5,	Ridgefield,	Thomas Smith,	Set fire without a permit,	Pending.
March 17,	Parkridge,	C. W. Kay,	Set fire without a permit and allowed it to escape,	Paid fine, \$12.00.
March 30,	Montvale,	Mrs. A. M. Morris,	Set fire without a permit,	Pending.
March 23,	Woodcliff Lake,	E. Groclande,	Set fire without a permit and allowed it to escape,	Paid fine, \$5.00.
April 5,	Woodcliff Lake,	J. B. Menville,	Allowed a brush fire to escape, ..	Pending.
March 19,	Woodcliff Lake,	Romaine Hener,	Set fire without a permit and allowed it to escape,	Pending.
<i>Burlington County—</i>				
March 27,	Evesham,	Frank Traino,	Set fire without a permit and allowed it to escape,	Released with a warning.
April 6,	Evesham,	Peter Schafer,	Allowed a brush fire to escape, ..	Paid fine, \$10.25.
April 1,	Pemberton,	E. O. Lippincott,	Set fire without a permit and allowed it to escape,	Pending.
March 30,	Pemberton,	Pennsylvania R. R.,	1 fire set by locomotive,	Paid firewarden's bills, \$20.00.
	Shamong,	Samuel Gager,	Burned charcoal pit without a permit,	Released with a warning.
	Shamong,	New Jersey Central R. R., ..	1 fire set by locomotive,	Pending.
<i>Camden County—</i>				
April 3,	Berlin,	F. Chavanne,	Set fire without a permit,	Paid fine, \$3.00.
March 17,	Clementon,	Atlantic City R. R.,	1 fire set by locomotive,	Pending.
	Delaware,	R. C. Hamblen,	Set fire without a permit and allowed it to escape,	Paid fine, \$5.00.
April 6,	Gloucester,	Samuel Wilson,	Set fire without a permit and allowed it to escape,	Pending.
April 17,	Gloucester,	Subrick Grabulski,	Set fire without a permit,	Pending.
April 3,	Waterford,	Wm. Galliger,	Set fire without a permit,	Paid fine, \$3.00.
April 3,	Waterford,	F. F. Dittess,	Set fire without a permit,	Paid fine, \$3.00.
April 26,	Winslow,	Wm. Green,	Set fire without a permit and allowed it to escape,	Pending.
May 8,	Winslow,	Hydraulic Press Brick Co., ..	Locomotive set fire,	Pending.
	Winslow,	Atlantic City R. R.,	13 fires set by locomotives,	Paid firewarden's bills, \$92.75.
<i>Cape May County—</i>				
March 18,	Dennis,	Emma Collins,	Set fire without a permit and allowed it to escape,	Paid fine, \$10.00.
	Dennis,	Pennsylvania R. R.,	1 fire set by locomotive,	Pending.
March 4,	Lower,	Atlantic City R. R.,	3 fires set by locomotives,	Paid firewarden's bills, \$12.00.
	Middle,	D. L. Spooner,	Set fire without a permit,	Paid fine, \$1.00.
March 19,	Middle,	Roscoe Spaulding,	Allowed a brush fire to escape, ..	Paid fine, \$10.00.
March 18,	Middle,	Mrs. E. S. Starr,	Set fire without a permit and allowed it to escape,	Pending.

Table 5—Violations of the Forest Fire Law, November 1, 1917, to June 30, 1918—Continued.

DATE.	TOWNSHIP. COUNTY AND	OFFENDER.	OFFENSE.	SETTLEMENT.
<i>Cape May County—Con.</i>				
March 18,	Middle,	Atlantic City R. R.,	3 fires set by locomotives,	Paid firewarden's bills, \$22.25.
	Middle,	Atlantic City R. R.,	1 fire set by locomotive,	Pending.
	Middle,	Atlantic City R. R.,	1 fire set by locomotive,	Dropped—insufficient evidence.
	Middle,	Pennsylvania R. R.,	2 fires set by locomotives,	Paid firewarden's bills, \$21.00.
April 7,	Upper,	Samuel Borden,	Set fire without a permit and allowed it to escape,	Pending.
	Upper,	Atlantic City R. R.,	2 fires set by locomotives,	Paid firewarden's bills, \$9.00.
	Upper,	Pennsylvania R. R.,	1 fire set by locomotive,	Pending.
<i>Cumberland County—</i>				
April 5,	Commercial,	Stephen Demus,	Set fire without a permit and allowed it to escape,	Pending.
December 7,	Deerfield,	Fred Herder,	Set fire without a permit,	Paid fine, \$5.00.
April 4,	Deerfield,	Jacob Yankelabitz,	Set fire without a permit,	Paid fine, \$5.00.
April 26,	Deerfield,	H. H. Gotlieb,	Son set fire without a permit,	Pending.
April 15,	Deerfield,	Jos. Lischler,	Set fire without a permit and allowed it to escape,	Pending.
May 2,	Deerfield,	Frank Dembezynski,	Set fire without a permit and allowed it to escape,	Paid fine, \$10.00.
May 2,	Deerfield,	Wm. J. Lanning,	Set fire without a permit and allowed it to escape,	Pending.
April 24,	Deerfield,	O. Somers,	Set fire without a permit and allowed it to escape,	Paid fine, \$10.00.
	Downe,	New Jersey Central R. R.,	2 fires set by locomotives,	Pending.
April 6,	Fairfield,	Geo. Cuff,	Set fire without a permit,	Pending.
	Fairfield,	New Jersey Central R. R.,	1 fire set by locomotive,	Pending.
May 8,	Landis,	Vineland Training School,	Fire set by inmate without a permit and allowed to escape,	Pending.
	Landis,	Pennsylvania R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$3.53.
	Landis,	Pennsylvania R. R.,	2 fires set by locomotives,	Pending.
April 26,	Maurice River,	M. Carli,	Set an illegal backfire and allowed it to escape,	Paid fine, \$10.00.
April 27,	Maurice River,	Charles Morse,	Set an illegal backfire and allowed it to escape,	Paid fine, \$10.00.
April 27,	Maurice River,	John Lupperger,	Set an illegal backfire and allowed it to escape,	Pending.
April 26,	Maurice River,	Mrs. Cassie Lupperger,	Set fire without a permit,	Pending.
April 29,	Maurice River,	C. C. Compton,	Set forest fire by careless smoking,	Released with a warning.
May 9,	Maurice River,	Mike and Steve Pernock,	Set fire without a permit,	Pending.
	Maurice River,	Pennsylvania R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$6.00.
	Millville,	Pennsylvania R. R.,	2 fires set by locomotives,	Pending.

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	Millville,	Pennsylvania R. R.,	1 fire set by locomotive,	Dropped—insufficient evidence.
	<i>Gloucester County—</i>			
February 26, ...	Clayton,	Pennsylvania R. R.,	1 fire set by locomotive,	Dropped—insufficient evidence.
March 3,	Franklin,	David Sink,	Set forest fire by careless smoking,	Pending.
	Franklin,	Stephen Domokos,	Set fire without a permit and allowed it to escape,	Paid fine, \$10.00.
March 5,	Franklin,	Michael Trevilli,	Set fire without a permit and allowed it to escape,	Paid fine, \$10.00.
December 5, ...	Monroe,	John Polan,	Set fire without a permit,	Paid fine, \$5.00.
March 23,	Monroe,	Jos. Slobodzin,	Set fire without a permit and allowed it to escape,	Pending.
	Monroe,	Atlantic City R. R.,	1 fire set by locomotive,	Dropped—township bill too tardy.
	Monroe,	Atlantic City R. R.,	1 fire set by locomotive,	Pending.
	<i>Hunterdon County—</i>			
	Bethlehem,	Lehigh Valley R. R.,	2 fires set by locomotives,	Dropped—township bill too tardy.
	<i>Mercer County—</i>			
March 19,	Princeton,	Frederick Highman,	Set fire without a permit and allowed it to escape,	Pending.
March 24,	Princeton,	Louis Corti,	Set fire without a permit and allowed it to escape,	Paid fine, \$10.00.
April 11,	Princeton,	Henry Dorham,	Set fire without a permit and allowed it to escape,	Pending.
	<i>Middlesex County—</i>			
April 6,	East Brunswick,	Jacob Dalenback,		
March 28,	East Brunswick,	A. Kuhn,	Set forest fire by careless smoking,	Pending.
April 17,	East Brunswick,	Wm. Liebnitzky,	Set fire without a permit,	Paid fine, \$10.00.
May 3,	East Brunswick,	Andrew Straczek,	Set fire without a permit,	Paid fine, \$10.00.
November 1, ...	Madison,	Abram Rosenthal,	Set fire without a permit,	Released with a warning.
April 18,	Madison,	Mitchell Valley,	Set fire without a permit,	Paid fine, \$5.00.
April 18,	Madison,	Edward Boyce,	Set fire without a permit,	Pending.
May 8,	Madison,	N. Y. Telephone Co.,	Allowed a brush fire to escape,	Released with a warning.
May 18,	Madison,	Alex Casper,	Set forest fire by careless smoking,	Pending.
	Sayreville,	Pennsylvania R. R.,	4 fires set by locomotives,	Dropped—township bill too tardy.
	<i>Monmouth County—</i>			
March 29,	Howell,	Bennett Gravel Co.,	2 fires set by locomotives,	Pending.
	Howell,	Brinton Cook,	Set fire without a permit and allowed it to escape,	Paid fine, \$10.00.
	Howell,	New Jersey Central R. R.,	9 fires set by locomotives,	Paid firewarden's bills, \$92.55.
	Howell,	New Jersey Central R. R.,	4 fires set by locomotives,	Pending.
	Howell,	Pennsylvania R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$5.35.
	Howell,	Pennsylvania R. R.,	2 fires set by locomotives,	Pending.
April 27,	Middletown,	Frank Brasch,	Set fire without a permit,	Pending.
	Ocean,	New Jersey Central R. R.,	1 fire set by locomotive,	Pending.

FIRE WARDEN'S REPORT.

Table 5—Violations of the Forest Fire Law, November 1, 1917, to June 30, 1918—Continued.

DATE.	COUNTY AND TOWNSHIP.	OFFENDER.	OFFENSE.	SETTLEMENT.
March 19,	<i>Monmouth County—Con.</i> Shrewsbury,	Mrs. O. A. Porter,	Set fire without a permit and allowed it to escape,	Pending.
November 27, ...	Shrewsbury,	New Jersey Central R. R.,	3 fires set by locomotives,	Paid firewarden's bills, \$20.00.
April 6,	Wall,	John Kessler,	Set fire without a permit,	Released with a warning.
April 6,	Wall,	J. W. Newman,	Set fire without a permit,	Paid fine, \$5.00.
April 6,	Wall,	J. H. Wooley,	Set fire without a permit,	Released with a warning.
April 6,	Wall,	Jacob Thompson,	Set fire without a permit,	Paid fine, \$5.00.
November 10, ...	<i>Morris County—</i> Boonton,	Geo. Fichtner,	Set forest fire by careless smoking,	Paid fine, \$27.80.
April 26,	Boonton,	J. H. De Poe,	Set fire without a permit and allowed it to escape,	Paid fine, \$10.00.
May 1,	Boonton,	Pietro Simiboldi,	Set fire without a permit and allowed it to escape,	Pending.
June 17,	Boonton,	Pietro Simiboldi,	Set fire without a permit,	Pending.
June 17,	Boonton,	Clarence de Camp,	Set fire without a permit,	Pending.
April 22,	Boonton,	Clarence de Camp,	Set fire without a permit,	Pending.
April 27,	Chester,	Isaac S. Hoffman,	Set forest fire by careless smoking,	Pending.
March 29,	Denville,	D. L. & W. R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$9.75.
March 30,	Denville,	J. H. Fordyce,	Set fire without a permit,	Pending.
May 16,	Denville,	Peter Reuss,	Set fire without a permit and allowed it to escape,	Pending.
June 26,	Denville,	Oscar Kratz,	Responsible for a forest fire,	Pending.
June 26,	Denville,	Dover Advertising Co., ..	Set fire without a permit,	Pending.
November 9, ...	Denville,	D. L. & W. R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$18.00.
April 2,	Denville,	D. L. & W. R. R.,	1 fire set by locomotive,	Pending.
April 2,	Hanover,	Osborn & Marselis,	Steam roller sparks set forest fire,	Released because of the patriotic efforts of the operators of the roller.
March 30,	Hanover,	Charles Boulton,	Set fire without a permit,	Paid fine, \$5.00.
March 24,	Hanover,	J. G. Bell,	Set fire without a permit,	Released with a warning.
June 24,	Hanover,	Josef Nemes,	Set fire without a permit and allowed it to escape,	Pending.
November 10, ..	Hanover,	Geo. Chambers,	Set fire without a permit and allowed it to escape,	Pending.
November 10, ..	Hanover,	Mt. Lakes Co., Inc.,	Set fire without a permit,	Pending.
November 10, ..	Hanover,	D. L. & W. R. R.,	3 fires set by locomotives,	Paid firewarden's bills, \$33.30.
November 10, ..	Hanover,	D. L. & W. R. R.,	1 fire set by locomotive,	Pending.
November 10, ..	Hanover,	Morristown & Erie R. R., ..	2 fires set by locomotives,	Pending.
November 10, ..	Jefferson,	T. L. Winterbottom,	Left brush fire without proper watch,	Pending.

November 8, ...	Jefferson,	Elizabeth Chamberlain, ...	Set fire without a permit and allowed it to escape,	Paid fine, \$5.00.
March 30,	Jefferson,	Jas. Hough,	Set fire without a permit,	Pending.
		New York, Susquehanna and Western R. R.,	2 fires set by locomotives,	Dropped—township bills too tardy.
April 15,	Montville,	J. H. Millidge,	Set fire without a permit,	Paid fine, \$15.00.
	Montville,	D. L. & W. R. R.,	3 fires set by locomotives,	Paid firewarden's bills, \$41.00.
April 2,	Morris,	A. H. Pierson,	Set fire without a permit and allowed it to escape,	Pending.
April 6,	Morris,	Mrs. Michael Underhill, ...	Fire set by small children,	Released with a warning.
April 28,	Morris,	John A. Blair,	Set fire without a permit and allowed it to escape,	Pending.
	Morris,	D. L. & W. R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$15.00.
March 20,	Mt. Olive,	Mrs. Daniel M. Lawler, ...	Set fire without a permit and allowed it to escape,	Pending.
April 2,	Mt. Olive,	Dr. T. E. Gurtner,	Set fire without a permit and allowed it to escape,	Pending.
	Pequannock,	Wharton & Northern R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$87.00.
	Pequannock,	New York, Susquehanna and Western R. R.,	1 fire set by locomotive,	Dropped—insufficient evidence.
	Pequannock,	New York, Susquehanna and Western R. R.,	1 fire set by locomotive,	Pending.
March 24,	Randolph,	Edw. Lowry,	Set fire without a permit and allowed it to escape,	Pending.
March 30,	Randolph,	Walter Pitkin,	Set fire without a permit and allowed it to escape,	Pending.
April 28,	Randolph,	Alexander Roussell,	Set fire without a permit and allowed it to escape,	Pending.
April 2,	Randolph,	Geo. Baird,	Set fire without a permit and allowed it to escape,	Pending.
November 16, ...	Rockaway,	Jno. Shanger,	Set fire without a permit,	Released with a warning.
November 27, ...	Rockaway,	Raymond Peterson,	Set fire without a permit,	Paid fine, \$2.00.
March 30,	Rockaway,	Wm. Thompson and Preston Davenport,	Responsible for a forest fire, ...	Pending.
April 28,	Rockaway,	J. K. Hollingshead,	Set forest fire by careless smoking,	Pending.
April 3,	Rockaway,	Thos. Clackworthy,	Set fire without a permit,	Dropped—insufficient evidence.
June 8,	Rockaway,	M. L. Armstrong,	Set fire without a permit,	Released with a warning.
March 29,	Rockaway,	Edw. Weaver and Jno. and David Fredericks,	Set fire without a permit,	Pending.
	Rockaway,	Wharton & Northern R. R.,	2 fires set by locomotives,	Paid firewarden's bills, \$18.00.
	Rockaway,	Wharton & Northern R. R.,	1 fire set by locomotive,	Dropped—insufficient evidence.
March 29,	Roxbury,	Robert Roane,	Allowed a brush fire to escape, ...	Pending.
April 6,	Roxbury,	Dover Advertising Co., ...	Employee set fire without a permit and allowed it to escape,	Pending.
	Washington,	New Jersey Central R. R.,	1 fire set by locomotive,	Dropped—insufficient evidence.
	<i>Ocean County—</i>			
April 15,	Berkeley,	W. Garrison,	Allowed a brush fire to escape, ...	Pending.
	Berkeley,	Pennsylvania R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$6.00.

Table 5—Violations of the Forest Fire Law, November 1, 1917, to June 30, 1918—Continued.

DATE.	COUNTY AND TOWNSHIP.	OFFENDER.	OFFENSE.	SETTLEMENT.
<i>Ocean County—Con.</i>				
April 14,	Berkeley,	Pennsylvania R. R.,	1 fire set by locomotive,	Pending.
April 20,	Brick,	Winfield Gant,	Fire set by children,	Pending.
	Dover,	New Jersey Central R. R.,	1 fire set by locomotive,	Pending.
November 14, ..	Eagleswood,	Mark Zoole,	Set fire without a permit and allowed it to escape,	Paid fine, \$6.00.
April 8,	Jackson,	Frank Applegate,	Set fire without a permit and allowed it to escape,	Paid fine, \$25.00.
May 15,	Jackson,	Chester Lemming,	Set forest fire by careless smoking,	Pending.
June 19,	Jackson,	Wm. Greening,	Set fire without a permit,	Pending.
	Jackson,	New Jersey Central R. R.,	1 fire set by locomotive,	Pending.
	Lacey,	New Jersey Central R. R.,	2 fires set by locomotives,	Pending.
	Lacey,	Tuckerton R. R.,	1 fire set by locomotive,	Pending.
	Lakewood,	New Jersey Central R. R.,	2 fires set by locomotives,	Pending.
	Manchester,	New Jersey Central R. R.,	2 fires set by locomotives,	Paid firewarden's bills, \$5.60.
	Manchester,	New Jersey Central R. R.,	4 fires set by locomotives,	Dropped—township bills too tardy.
	Manchester,	New Jersey Central R. R.,	5 fires set by locomotives,	Pending.
	Manchester,	Pennsylvania R. R.,	1 fire set by locomotive,	Paid firewarden's bills, \$5.00.
	Manchester,	Tuckerton R. R.,	2 fires set by locomotives,	Pending.
May 9,	Union,	Gasper Mollnar,	Set fire without a permit,	Pending.
	Union,	Tuckerton R. R.,	1 fire set by locomotive,	Pending.
<i>Passaic County—</i>				
November 3, ...	Pompton,	Frank Duffard,	Set fire without a permit,	Paid fine, \$5.00.
November 9, ...	Pompton,	Hattie Conklin,	Set fire without a permit,	Released with a warning.
November 15, ..	Pompton,	Chas. W. Price,	Set an illegal backfire and allowed it to escape,	Paid fine, \$10.00.
March 30,	Pompton,	New York Transit Co., ...	Employees set fire without a permit,	Released with a warning.
	Pompton,	Erie R. R.,	11 fires set by locomotives,	Paid firewarden's bills, \$115.15.
	Pompton,	Erie R. R.,	3 fires set by locomotives,	Pending.
November 12, ..	West Milford,	Newark Water Dept.,	Narrow-gauge locomotive set fire, ..	Released with a warning.
December 2, ...	West Milford,	Willis Furbee,	Set fire without a permit and allowed it to escape,	Pending.
June 16,	West Milford,	Wm. Lohe,	Set fire without a permit,	Pending.
	West Milford,	New York, Susquehanna and Western R. R.,	2 fires set by locomotives,	Pending.
	West Milford,	Erie R. R.,	2 fires set by locomotives,	Paid firewarden's bills, \$16.50.
	West Milford,	Erie R. R.,	3 fires set by locomotives,	Pending.
<i>Salem County—</i>				
May 6,	Lower Alloway Creek, ..	Winfield Scudder,	Set fire without a permit and allowed it to escape,	Pending.

December 4, ...	Pittsgrove,	Robert Meade,	Set fire without a permit,	Paid fine, \$5.00.
May 3,	Pittsgrove,	Robert Cooper and Frederick Garton,	Fire set by small sons,	Pending.
April 19,	Upper Pittsgrove,	Emil Eifert,	Set fire without a permit,	Pending.
	<i>Somerset County—</i>			
	Bernard,	D. L. & W. R. R.,	4 fires set by locomotives,	Paid firewarden's bills, \$50.50.
	Bernard,	D. L. & W. R. R.,	2 fires set by locomotives,	Pending.
March 28,	Bridgewater,	J. Vanugo,	Allowed camp-fire to escape,	Pending.
April 6,	North Plainfield,	Casero,	Allowed a brush fire to escape,	Pending.
April 26,	North Plainfield,	Mrs. M. Grozman,	Set fire without a permit and allowed it to escape,	Pending.
March 30,	Warren,	Allen Grosch,	Set fire without a permit and allowed it to escape,	Paid fine, \$2.00.
	<i>Sussex County—</i>			
	Byram,	D. L. & W. R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$7.00.
	Byram,	D. L. & W. R. R.,	1 fire set by locomotive,	Pending.
May 26,	Hardyston,	Chas. Tanchik,	Set fire without a permit,	Pending.
	Hardyston,	New York, Susquehanna and Western R. R.,	1 fire set by locomotive,	Dropped—township bills too tardy.
	Hardyston,	New York, Susquehanna and Western R. R.,	7 fires set by locomotives,	Pending.
May 5,	Hopatcong,	Benjamin Davis,	Set forest fire by careless smoking,	Pending.
May 7,	Hopatcong,	Wm. Robinson,	Set fire without a permit,	Pending.
	Ogdensburg,	New York, Susquehanna and Western R. R.,	5 fires set by locomotives,	Pending.
November 8, ...	Sparta,	Richards & Gaston Co.,	Set fire without a permit,	Released with a warning.
November 14, ...	Sparta,	New Jersey Zinc Co.,	Employees refusal to fight fire,	Pending.
	Sparta,	New York, Susquehanna and Western R. R.,	1 fire set by locomotive,	Pending.
	<i>Union County—</i>			
April 6,	New Providence,	Wm. H. Rogers,	Set fire without a permit and allowed it to escape,	Pending.
	New Providence,	D. L. & W. R. R.,	3 fires set by locomotives,	Paid firewarden's bills, \$8.20.
	<i>Warren County—</i>			
March 17,	Blairstown,	Bertzel Lance,	Set forest fire by careless smoking,	Pending.
April 1,	Hope,	Raymond Banghart,	Set fire without a permit and allowed it to escape,	Pending.
March 30,	Knowlton,	Emma Shannon,	Set fire without a permit and allowed it to escape,	Paid firewarden's bills, \$40.18.
	Knowlton,	D. L. & W. R. R.,	4 fires set by locomotives,	Paid firewarden's bills, \$43.00.
	Knowlton,	Lehigh & New England R. R.,	4 fires set by locomotives,	Pending.
	Knowlton,	New York, Susquehanna and Western R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$4.00.

Table 5—Violations of the Forest Fire Law, November 1, 1917, to June 30, 1918—Concluded.

DATE.	COUNTY AND TOWNSHIP.	OFFENDER.	OFFENSE.	SETTLEMENT.
March 30,	<i>Warren County—Con.</i> Knowlton,	New York, Susquehanna and Western R. R.,	5 fires set by locomotives,	Pending.
	Pabaquarry,	New York, Susquehanna and Western R. R.,	3 fires set by locomotives,	Dropped—township bills too tardy.
	Washington,	D. L. & W. R. R.,	1 fire set by locomotive,	Dropped—township bills too tardy.
March 22,	White,	Wm. Percival,	Set fire without a permit and al- lowed it to escape,	Paid fine, \$9.00.

APPENDIX.

Mineral Production in New Jersey in 1917.¹

The collection of statistics regarding mineral production in New Jersey is carried on co-operatively by the New Jersey Department of Conservation and Development and the United States Geological Survey, and the figures obtained are published by each of the two organizations in its own publications. This co-operative method tends to greater accuracy, more accord in the figures published by each organization, saves expense, and prevents troubling the producers by requests for the same information from two sources.

The following brief statement of the mineral production in New Jersey during 1917 indicates that New Jersey not only continues to hold its own but steadily advances along almost all lines of mineral production in which it has been engaged for some years past.

Total production.—The total value of the mineral production of New Jersey during 1917 was \$45,516,478. This was an increase of \$5,080,816 over the output for 1916. The chief increases were in clay and clay products (nearly \$2,000,000), iron ore (nearly \$500,000), sand and gravel (nearly \$400,000), stone (over \$200,000), and miscellaneous products (over \$4,000,000).

Zinc ore.—New Jersey continues to be one of the leading States in the mining of zinc ore. The quantity of ore taken from the mines in 1917 was 720,561 short tons. This was the output of the Franklin Furnace mine and the Sterling Hill mine, both owned by the New Jersey Zinc Company, the sole zinc producer in the State. The total amount of zinc ore which has been taken

¹ Compiled by M. W. Twitchell, Assistant State Geologist.

from the mines in New Jersey since 1880 is 8,904,584 short tons. The zinc ore is all crushed and separated by electro-magnetic methods at the mills at Franklin Furnace. Most of the resulting crude products then go to plants owned by the New Jersey Zinc Company which are located in Pennsylvania, where they are converted into high-grade metallic zinc (or spelter) and zinc oxide, which find various uses in the industrial arts.

Iron ore.—The notable features of the iron mining industry in New Jersey during 1917 were the increase from six to eight in the number of mines reporting sales, considerable development work on several other mines, including the Scrub Oak and Hibernia of the old Wharton group of properties which have been idle for several years, the maintenance of the production at the high figure of about 490,000 tons, and the pronounced increase in the total value of the sales and in average value per ton. Four companies operated seven mines in 1917, reporting 489,943 long tons of magnetite iron ore mined, which was practically the same as the preceding year—3,061 long tons less, to be exact. The amount marketed was 474,708 long tons, having a value of \$2,341,160, a decrease in quantity of 53,376 long tons, but an increase in value of \$464,104. The average value per ton was \$4.93, while in 1916 it was \$3.55, which was the greatest it had been for over ten years. The total amount of iron ore which has been mined in New Jersey since 1870 is 21,873,353 long tons.

Clay and clay products.—The significant features of this great industry during the year 1917 were the increase in the production of raw clay beyond the million dollar mark, the increase in the pottery output of a million and a half dollars over the record-breaking production of the previous year, largely due to increases in high-grade wares such as were formerly imported from abroad, and the increase of the grand total from \$21,605,198 to \$23,564,935, the highest output in the history of the industry. The manufacture of chemical stoneware and porcelain reached the point where it can be separately listed, there being five producers and an output valued at about half a million dollars. The output of fireproofing and hollow blocks forges ahead of that of architectural terra cotta, and the various forms of tile, with a record production valued at \$2,167,296. The output of common

brick naturally decreased, owing to abnormal building, transportation and fuel conditions; while that of fire brick nearly doubled, suggestive of the large increase in the number of plants requiring refractory linings to furnaces, chimneys, etc.

Stone.—The most noticeable feature of the stone industry of New Jersey in 1917 was the large increase in the output of limestone, the increase in value being from \$245,019 to \$413,477 or \$168,458, an advance of 69 per cent. This was chiefly in limestone for blast furnace flux, evidently due to increased activity in the steel industry on account of the war. As for a number of years past, the production of trap rock, chiefly in the crushed form for road metal, railroad ballast and concrete, continued to advance, the value of the increase over 1916 being \$79,739. On the other hand the output of other forms of rock (except limestone) fell still further, the decrease as compared with 1916 being from \$128,063 to \$86,322 or \$41,751, a fall of 32 per cent. The total output of stone in New Jersey in 1917 was valued at \$1,872,755, a net increase of \$206,456 over that for 1916. This includes trap rock, limestone, granite, sandstone, argillite, slate and talc-rock or serpentine.

Portland cement.—The plant of the Alpha Portland Cement Company, one of the large producers of Portland cement in New Jersey, was idle for the larger part of 1917 and there was therefore a decrease in the total State production as compared with the previous year. The other two producers, the Edison Portland Cement Company and the Vulcanite Portland Cement Company, were in active operation. It is not practicable to give the separate figures for the production and the value of the output is therefore included this year under the heading "Miscellaneous."

Sand and gravel.—This is one of the important mineral industries of the State. It is also one of the most widely distributed, there being 71 active producers in 1917, with pits in 16 out of the 21 counties in the State. The total output of sand in 1917 was 2,995,004 short tons, valued at \$1,693,038, an increase of \$386,085. The striking feature of the year was the large increase in molding sand, which forged to first place with an output of 611,916 tons valued at \$651,279, an increase of \$171,853. There was also a substantial increase in the output of fire or furnace

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sand, amounting to \$71,508. Both of these increases were apparently due to war activities.

Peat.—For the first time in the history of the peat industry the production can be separately given. The total output in 1917 was 42,361 short tons with a value of \$320,550. The value of the output in 1916 was \$197,754. Most of the peat mined was used for agricultural purposes. Four of the producing plants were located in Sussex County and one in Warren County.

Other minerals.—In addition to the minerals separately discussed above, New Jersey produced in 1917, 1,283,157 gallons of mineral waters, valued at \$115,188; 5,002 short tons of lime, valued at \$18,978; small amounts of greensand marl, ground quartz and precious stones, and considerable quantities of coke, and lead and zinc pigments. In many of these cases the number of operators is less than three and for this or other reasons the individual figures cannot be published. In a number of cases, in order to bring the figures of the State Survey as nearly as possible in accord with those published by the Federal Survey, and to avoid giving values of both raw materials and of products derived from them, the values have been included under the heading "Miscellaneous," but not included under the heading "Total for all products." This change in policy has naturally reduced in some measure the State total, as compared with previous reports.

Statistical table.—Details of the mineral production are given in the following table, which also presents figures for previous years for purposes of comparison.

APPENDIX.

Mineral Production in New Jersey in 1917.

Product.	No. of Producers.	1917.		1916 Value.	1915 Value.
		Quantity.	Value.		
Zinc ore (a),	1	720,561 s. t.	(a)		
Iron ore (b),	5	474,708 l. t.	\$2,341,160	\$1,877,056	\$1,140,400
Clay—					
Fire and sagger clay, ...	30	281,098 s. t.	\$815,507	\$585,230	\$412,353
Brick clay,	8	38,563 "	46,204	17,880	35,808
Stoneware clay,	8	12,041 "	39,326	22,388	28,706
Ball clay,	6	5,118 "	28,264	26,397	27,879
Other grades (c),	14	43,542 "	106,402	138,901	113,158
Total raw clay,	39	380,362	\$1,035,703	\$790,796	\$617,904
Sanitary ware,					
Porcelain electrical sup-	21		\$7,202,671	\$6,458,356	\$4,793,406
Pottery—					
plies,	14		1,893,382	1,674,093	1,028,992
China, bone china, delft, belleek,	6		1,632,622	1,407,930	983,855
White ware, etc. (d), ..	8		1,040,697	811,391	665,633
Stoneware, etc. (e),	5		43,595	148,410	126,415
Chemical stoneware and porcelain,	5		472,681 }		
Miscellaneous (f),	12		250,195 }	564,698	451,037
Total pottery,	54		\$12,535,843	\$11,064,878	\$8,049,338
Brick and tile—					
Fire brick,	15	42,065 M	\$2,290,899	\$1,162,794	\$899,613
Common brick,	42	205,794 M	1,843,246	2,366,614	2,099,654
Front brick,	9				
Fancy brick,	2		682,014	816,346	784,919
Enameled brick,	3				
Total brick,	57		\$4,816,159	\$4,345,754	\$3,784,186
Fireproofing and hollow blocks,					
Architectural terra-cotta, ..	6	302,648 s. t.	\$2,167,296	\$1,830,949	\$1,389,120
Tile (other than drain tile),	12		1,322,202	1,818,052	1,430,968
Drain tile,	4		1,301,960	1,298,392	995,097
Miscellaneous (g),	8		31,300	30,542	41,331
			354,472	425,835	275,378
Total tile, etc.,	33		\$5,177,230	\$5,403,770	\$4,131,894
Total brick and tile, ..	89		\$9,993,389	\$9,749,524	\$7,916,080
Total clay and clay products,	182		\$23,564,935	\$21,605,198	\$16,583,322
Stone—					
Trap (h)	45	1,395,566 s. t.	\$1,372,956	\$1,293,217	\$1,281,545
Limestone (i),	15		413,477	245,019	159,549
Other stone (j),	11		86,322	128,063	170,967
Total stone,	71		\$1,872,755	\$1,666,299	\$1,612,061

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Mineral Production in New Jersey in 1917—Continued.

Product.	Pro- ducers.	1917. Quantity.	1917. Value.	1916 Value.	1915 Value.
Total crushed stone (<i>k</i>),	54	1,474,815 s. t.	\$1,444,858	\$1,369,926	\$1,380,266
Sand—					
Molding sand,	34	611,916 s. t.	\$651,279	\$479,426	\$331,792
Building sand,	30	1,818,275 "	545,437	417,954	421,927
Blast sand,	9	95,741 "	127,244	86,599	48,236
Grinding and polishing sand,					
Fire or furnace sand, ...	13	118,682 "	121,295	49,787	37,184
Glass sand,	5	100,448 "	93,194	115,204	64,862
Paving sand,	5	121,601 "	57,725	83,146	53,559
Engine sand,	5	58,552 "	30,319	23,318	20,133
Other sands (<i>l</i>),	12	69,789 "	66,545	51,519	22,476
Total sand,	65	2,995,004 "	\$1,693,038	\$1,306,953	\$1,000,169
Gravel,	25	787,453 "	332,286	210,520	447,388
Total sand and gravel,	71	3,782,457 "	\$2,025,324	\$1,517,473	\$1,447,557
Peat (<i>m</i>),	5	42,361 s. t.	\$320,550	\$197,754	(<i>m</i>)
Mineral waters (<i>n</i>),	14	1,283,157 gal.	115,188	130,993	\$116,226
Lime,	7	5,002 s. t.	18,978	26,084	35,393
Miscellaneous—					
Coke (<i>o</i>),	16		24,196,511	11,041,814	10,821,452
Greensand marl (<i>p</i>), ..					
Ground quartz,					
Precious stones,					
Lead and zinc pigments (<i>q</i>),					
Zinc ore (<i>a</i>),					
Portland cement (<i>r</i>), ..	372		\$45,516,478	\$40,399,540	\$33,364,117
Pig iron (<i>s</i>),					
Total of all products (<i>t</i>),					

a. As there is but one zinc operator, the value of the ore cannot be given separately, but is included in the total for miscellaneous minerals. From this zinc ore there was obtained, at plants located in other States, 155,332 long tons of manganiferous zinc residuum.

b. The quantity of iron ore given is the ore marketed.

c. Includes slip clay, foundry clay, crucible clay, clay for abrasive wheels, etc.

d. Whiteware, C. C. ware, white granite, semi-porcelain ware, and semi-vitreous porcelain ware.

e. Stoneware, yellow or Rockingham ware, and red earthenware.

f. Includes tobacco pipes, hardware trimmings, art pottery, souvenirs, saggars, etc. In 1916 and 1915 included also chemical stoneware and porcelain.

g. Includes sewer-pipe, stove lining, gas logs, flue lining, wall coping, conduits, glass house supplies, etc.

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- h.* The quantity figure given is that of crushed stone only. Its value was \$1,358,735.
- i.* Chiefly limestone used for blast furnace flux, with smaller amounts used for agricultural purposes, road making, etc. The crushed stone is included in the total for crushed stone, below.
- j.* Includes granite, sandstone, argillite, slate and talc and serpentine, which have to be combined in order to conceal individual production. The crushed stone items are included in the total for crushed stone, below.
- k.* These values have been included in the figures for the different varieties of stone and in the total stone production.
- l.* Includes filter sand, sand for soap manufacturers, etc.
- m.* Peat production figures were not available prior to 1916.
- n.* Of the total value, \$107,437 is the table water and \$7,751 is for medicinal water. In addition, 73,605 gallons were used for soft drinks.
- o.* This is coke made as a by-product of gas manufacture in by-product ovens. In former years we have included both the value of the coke and the gas, tar, etc., but this year the value of the coke alone is included. This value is also included in the total for all products, as no duplication of values is thereby involved so far as the present table is concerned, none of the coal used having been mined in nor credited to New Jersey.
- p.* The production here reported was largely for experimental purposes in connection with potash investigations.
- q.* The total for both lead and zinc pigments is here included; but that for the lead pigments only is included in the total for all products, as the zinc ore which is largely used in the manufacture of the zinc pigments is credited elsewhere in the table.
- r.* As the plant of one of the three producers was idle during the most of the year 1917, it is impracticable to give separately the output of Portland cement as in previous years.
- s.* This is included here in the miscellaneous total; but not in the total for all products, as much of the iron ore used was mined in this State and is already credited elsewhere in the table. The quantity produced in 1917 was 187,753 long tons.
- t.* Certain items which were included under "Miscellaneous" are not included in this total for the reason that to do so would involve more or less duplication of values, as the raw materials from which they are produced are already credited under the appropriate heads. Among these are zinc pigments, and pig iron. Owing chiefly to the fact that the United States Geological Survey, with whom we co-operate in the collection of these statistics, has to avoid duplications arising from crediting products to two or more States, whereas we have New Jersey alone to consider, their total for the State can never be brought to agree exactly with ours.

