DIVISION OF
Water and Land Development

DEPARTMENT OF LAND AND NATURAL RESOURCES

State of Hawaii

Successor to Hawaii Water Authority

SEVENTH ANNUAL REPORT • 1960
DIVISION OF
Water and Land Development
DEPARTMENT OF LAND AND NATURAL RESOURCES
Successor to HAWAII WATER AUTHORITY

State of Hawaii

SEVENTH ANNUAL REPORT
to the Governor
FOR THE YEAR ENDED DECEMBER 31, 1960

HONOLULU, HAWAII
February 1961
Organization

DEPARTMENT OF LAND AND NATURAL RESOURCES
State of Hawaii

Members of the Board

RICHARD L. SUMMERS, Chairman, Honolulu
WILLIAM K. H. MAU, Vice Chairman, Honolulu
E. H. COOK, Director, Honolulu

ANTHONY BRUN, Lihue
G. ALAN FREELAND, Lahaina

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FRANK G. SERRAO, Honolulu

Ex Officio

GEORGE I. BROWN, Honolulu
GORDON P. CHUNG-HOON, Honolulu

Division of Water and Land Development

ROBERT T. CHUCK, Manager-Engineer
Honorable William F. Quinn
Governor of Hawaii
Iolani Palace
Honolulu, Hawaii

Dear Sir:

The year 1960 has been a period of transition as the programs of several predecessor agencies became consolidated under the jurisdiction of the new Department of Land and Natural Resources. Although there has been significant progress in defining the various staff and line functions of the department, the evolution of a thoroughly cohesive program will not be achieved until well into 1961.

Inasmuch as the Division of Water and Land Development was known as the Hawaii Water Authority for most of the year, it seems appropriate to cover the 1960 activities of the Division in a manner to provide continuity with the six annual reports issued by the Authority. Hence, we are issuing this separate report on the water resources program of the Department as carried out by the Hawaii Water Authority through November 4, 1960, and by the Division of Water and Land Development thereafter.

Respectfully submitted,

Director, Department of
Land and Natural Resources
February 5, 1961

Director
Department of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

Gentlemen:

We are pleased to submit herewith the annual report of the Division of Water and Land Development. It includes also the activities of the Hawaii Water Authority, under which name the Division was known through November 4, 1960. In general, the report follows the pattern of the six annual reports of the Hawaii Irrigation Authority and its successor, the Hawaii Water Authority. However, in order to better orient the reader, coverage of organization and administration appears at the beginning of this report.

The state-wide water resources program gained momentum during 1960, both in its general aspects and in the completion of specific localized projects. Reports were completed on pan evaporation records for the state and on basic water resources data for Molokai. A preliminary draft was also completed on suggested rules and regulations to provide for the optimum utilization of the state’s ground-water resources. An exploratory well-drilling program was launched under a contract to lease fully-manned equipment.

Development activities of the Division included follow-through on construction of domestic water systems for Waimanalo, Oahu, four locations on Kauai, and Kona, Hawaii; also, the initiation of studies for a system at Kawaihae, Hawaii. Several miscellaneous projects such as mineral studies were undertaken by the Division in its capacity as the engineering and technical services arm of the Department.

Significant construction progress was made in 1960 on irrigation systems for Molokai and for Lalamilo, Hawaii. And the Division continued to operate the Waimanalo Irrigation System.

Respectfully submitted,

Robert H. Chuck
Manager-Engineer, Division of Water and Land Development
ORGANIZATIONAL CHANGES

The Division of Water and Land Development of the Department of Land and Natural Resources was formerly the Hawaii Water Authority. The Department succeeded to the duties and functions of the Authority in 1959 under the provisions of the Reorganization Act of the First State Legislature of Hawaii. The Board of Land and Natural Resources appointed E. H. Cook as director of the Department in June 1960.

The name of the Hawaii Water Authority was changed to the Division of Water and Land Development on November 5, 1960, at which time the Division’s program was delineated to include the responsibilities of land and mineral development as well as the Authority’s existing program of water resource studies and development.

The latter program had its origins in the duties and functions of the Hawaii Irrigation Authority, which was established in 1953 to determine feasibility and to design and operate irrigation systems. In 1957, the agency’s program was broadened to include a territory-wide water resources survey and a master plan for water development. In keeping with this enlarged scope of responsibilities, the agency’s name was changed to Hawaii Water Authority.

L. H. Herschler, who was manager-chief engineer of the agency since 1953, formulated many of the basic policies and initiated the water resources program now being carried out by the Division of Water and Land Development. On his resignation in June, 1960, he was succeeded by Robert T. Chuck as acting manager-chief engineer of the Authority. In November, Mr. Chuck became manager-engineer of the Division.

PERSONNEL

Employees of the Division at the end of the year totaled 41, an increase of 3 over 1959. During the year, 11 employees were hired, 6 were transferred or left government service, and 2 took military leave. The number of employees at the Division’s headquarters in the State Office Building remained 25 and the number at Waimanalo, 9. Neighbor Island personnel included 4 on Hawaii, 2 on Molokai, and 1 on Kauai, with Hawaii and Kauai accounting for the increase in staff.

Employees joining the staff in 1960 were: Tatsuji Hirata, Harvey Young, Albert Ozaki, Harry Hayakawa, George Higa, Arleigh Akana, Daniel Lum, Amelia Cordova, Gordon Akita, Hiram Pang, and Jean Tanaka.

In addition to Manager-Engineer Robert T. Chuck, key personnel are: Walter O. Watson, Jr., assistant manager-engineer; Takeo Fujii, in charge of design and construction; James Yoshimoto, in charge of water resources studies and development planning; and Kwan You Chang, special research assistant.
STATE-WIDE PROGRAM

The territory-wide water resources program launched in 1957 by authority of Act 22 of the Territorial Legislature has been further implemented during the past year. The program consists of research, surveys, and investigations of all water resources in the state and includes a continuing inventory. Comprehensive data are compiled concerning the nature, location, quantity, and other characteristics of these resources.

The purpose of the studies is to formulate a long-range master plan for logical and orderly development of Hawaii’s water resources. Through proper planning and coordination, maximum benefits can be achieved from the multi-purpose development of water for domestic, agricultural, municipal, industrial, power, and recreational use.

MOLOKAI WATER PLAN

An immediate objective of the state-wide water resources program is the formulation of a master plan for the development of Molokai’s water resources. The first step in this direction was accomplished in 1960 with the completion for publication early in 1961 of An Inventory of Basic Water Resources Data: Molokai.

Plates above and on opposite page, reproduced at a reduced scale from the report on Molokai water resources, illustrate how Division staff translates statistical data into graphic form.
DISTRIBUTION OF MEDIAN, MAXIMUM, AND MINIMUM MONTHLY RAINFALL AT SELECTED RAIN GAGES, FOR PERIOD OF RECORD

MEDIAN MONTHLY RAINFALL
ISLAND OF MOLOKAI

NOTE: Figure next to rain gage denotes median rainfall for period 1933 to 1957 inclusive
based on values from 32 gages.
The report brings together all available records of Molokai rainfall, streamflow, pan evaporation, and water wells. The basic data on rainfall and streamflow comprises actual measured values, plus means and medians. Analyses of the data include isohyetal maps of median annual and median monthly rainfall and duration-discharge curves of mean daily streamflow.

With the aid of this material, a comprehensive water plan for Molokai will be formulated and published.

**PAN EVAPORATION REPORT**

An important phase of the state-wide water resources study is the compilation of pan evaporation records. Such data are used to estimate water losses caused by evaporation and transpiration, two related components of the hydrologic cycle. During the past year, the Division staff assembled all available records on pan evaporation in Hawaii into a single useful volume which will be published early in 1961.

This report contains a numerical index of pan evaporation station records, an alphabetical index which serves as a cross-reference, index maps showing the locations of the stations on each island, and tables of monthly and annual records of pan evaporation through 1959. Also included are the maximum, minimum, and median values of monthly and annual pan evaporation, determined for the period of record.

**RAINFALL RECORDS OPEN FILE**

The U. S. Weather Bureau for many years has published the observed rainfall records of its official rain gages in its publication, *Climatological Data, Hawaii*. However, the large number of records of unofficial gages maintained by other government agencies, private companies, and individuals have not been published. They have been maintained in the open files of the Bureau.

In January 1960, these open files were transferred to the Hawaii Water Authority, and now the Division of Water and Land Development has the responsibility for collecting, collating, and maintaining rainfall records from all rain gages in Hawaii except official Weather Bureau gages. The Division’s open files, which now include unpublished records from 1948 as well as the Bureau’s published *Climatological Data*, are available to all agencies and individuals for reference. They are perhaps the most complete source of rainfall records in the state.

**EXPLORATORY WELL DRILLING**

The First State Legislature in 1960 appropriated $90,000 to carry out the first-year increment of a projected two-year exploratory well-drilling program. The purpose of the program is to obtain needed information on ground-water resources in Hawaii. In the selection of test well sites, primary consideration is given to wells that will support the state’s economic develop-
ment program, subject of course to favorable geological factors.

Plans and specifications for the program were completed in August 1960, providing for the lease of fully-manned well-drilling equipment. The cost of exploratory wells constructed on this basis is less than the cost of such wells if each were to be contracted individually. The contract was awarded in September, and drilling of Exploratory Well No. 1 was begun on November 1 at Waikapu, Maui.

It is planned to drill a second well at Hanapepe, Kauai, and a third well during the first fiscal year of the program.

GROUND-WATER USE

Under Act 274 of the 1959 Territorial Legislature, the Governor was authorized to appoint a five-man Commission on Ground-Water Resources whose responsibility it would be to regulate the use of ground-water resources as necessary to minimize the threat of exhaustion, depletion, waste, pollution, or deterioration from salt encroachment. The Hawaii Water Authority was designated to serve a staff function for the Commission, acting as a coordinator to promote cooperation among the various water agencies and to prevent the duplication of services and facilities.

Duties of the proposed Commission were assigned to the Board of Land and Natural Resources under the Reorganization Act, and the Authority's staff functions are now the responsibility of the Division of Water and Land Development.

In 1960 the Division staff formulated suggested rules and regulations to implement Act 274 after making a preliminary study of similar regulations in other jurisdictions. It is anticipated that further study and revisions will be necessary before the Board will be ready to hold public hearings and promulgate the rules and regulations.

DIVISION OF HYDROGRAPHY

For many years the Division of Hydrography has been under the jurisdiction of the Land Commissioner of the Territory. Under a cooperative program with the Federal Government, the district engineer of the U. S. Geological Survey was also chief hydrographer of the Division.

The cooperative agreement, renewed annually, provides for the measurement, compilation, and publication of water resource data. The data includes streamflow measurements at designated streams and the location and characteristics of existing ground-water developments such as wells, shafts, and tunnels. This information is useful to the Division in establishing its comprehensive water development plan for the state. The U.S.G.S. also makes specialized water studies when requested, particularly where highly technical facilities and personnel are required.

With the consolidation of all water functions of predecessor agencies under the Division of Water and Land Development, it is logical that the cooperative program with the U.S.G.S. also fall under the jurisdiction of the Division. Beginning January 1, 1961, the manager-engineer of the Division will assume the role of the former chief hydrographer. Henceforth, the cooperative program will be jointly planned to assure its coordination with the State's water resources program.
A 50,000-gallon tank and 8-inch main will improve Kauai water system at Hanalei.

Development Program

KAUAI DOMESTIC WATER SYSTEMS

Koloa-Poipu. In April 1960 construction was started on improvements to the Koloa-Poipu water system which will allow limited hotel and apartment construction in the beach area. The facilities, scheduled for completion in February 1961 under a $156,000 contract, include a 250,000-gallon storage tank and approximately 8,500 feet of 12-inch and 8-inch pipelines.

The Division has been responsible for the design and construction of these facilities at the request of the Superintendent of Public Works, whose department had been allotted $200,000 for the project by Act 150, SLH 1957.

Lihue. An appropriation of $130,000 by Act 224, SLH 1959, has been made available to the Division to improve the Lihue water system in order to provide adequate service to the hotel-resort area now under development at Kalapaki Beach, site of the new Kauai Surf Hotel.

Construction was started in July 1960 on a 250,000-gallon storage tank in the vicinity of Kauai Inn and approximately 5,000 feet of 8-inch pipeline running southeasterly along Rice Street to the resort area near Nawiliwili Stream. Completion is expected in March 1961.

Wailua-Kapaa. In March 1960 the construction of an exploratory well for the Wailua-Kapaa water system was completed at a cost of $7,681. Since the well water proved satisfactory, the Division has proceeded to integrate the well into the Wailua-Kapaa system.

A contract for $14,808 was awarded in October 1960 for well site improvements and
connecting pipeline, scheduled for completion in February 1961. In November 1960 a contract for $11,820 to provide and install control equipment, and a contract for $33,867 to construct about 5,000 feet of 12-inch and 6-inch pipeline along Nonou and Haleiilio Roads, were awarded. Both of these projects were scheduled to begin in January 1961.

Approximately $65,000 in County of Kauai funds has been made available for improvements to the Wailua-Kapaa system.

Hanalei. The Division completed its study and recommendations for improvements to the Hanalei water system and in December 1960 awarded a contract for $107,921 for construction of the first phase. The contract is subject to the availability of funds from the County of Kauai to augment the balance of the Legislative appropriation provided by Act 150, SLH 1957.

Improvements connecting with the existing County 4-inch line will consist of 9,000 feet of 8-inch pipeline along Kuhio Highway to Weke Road and continuing along the latter across the Hanalei River to the Hanalei well and thence to a 50,000-gallon storage tank at about elevation 175. Construction is expected to be started early in 1961 and be completed before the end of the year.

DOMESTIC WATER PROJECTS
Island of Kauai

Pipeline route of Wailua-Kapaa water system will be along Nonou and Haleiilio Roads.

WAIMANALO WATER DEVELOPMENT

The general plan for development of State lands at Waimanalo Valley, Oahu, approved by the 1959 Territorial Legislature, moved ahead during 1960 with the start of construction of water transmission and storage facilities in July. A 20-inch pipeline 5 1/2 miles long will extend the Honolulu Board of Water Supply's main trunk line from the Waimanalo-Kailua junction to the Valley, where a 2-million gallon reservoir will be used for storage. The project, which is expected to be completed in April 1961, is being financed with a Legislative appropriation of $950,000. With its own funds, the Board will develop new water sources and construct transmission lines to the Waimanalo-Kailua junction.

Initially, until new sources are developed, the pipeline extension will alleviate shortages of domestic water during dry periods and will improve water pressure. Eventually, it is expected that irrigation water will be available from the system, thus eliminating the need for the uneconomical Waimanalo Irriga-
tion System now operated by the Division of Water and Land Development. (See section on Irrigation Systems.)

KONA WATER DEVELOPMENT

The studies and exploratory well drilling carried out at Kona, Hawaii, by the Hawaii Water Authority with funds appropriated by Act 150, SLH 1957, resulted in the construction of three successful wells by the end of 1959. With a pumping capacity of a little over a half-million gallons a day each, these wells—two at Kahaluu and one at Keel—now provide the Kona area with a dependable ground water source to supplement its gravity flow system supplied from surface water sources.

In January 1960, construction was completed of a 50,000-gallon storage tank and a 1.2 mile transmission line of 6-inch and 8-inch pipes connecting the Kahaluu wells with the Kailua-Kealakekua pipeline of the County water system. Cost of these improvements was $81,149.

Work was started in June 1960 under a $410,862 contract to construct 4.4 miles of 12-inch and 8-inch transmission pipelines from the Kahaluu wells along Mamalahoa Highway to the County’s storage tank at Wai'ana and appurtenant tanks. By the time this project is completed in August 1961, it is expected that installation of pumps and controls under a separate contract will also have been completed.

Another phase of the Kona water development program will consist of 12 miles of 8-inch transmission lines and appurtenant storage tanks and pumps serving the area along Mamalahoa Highway from the Keel wells to the Kahaluu wells. The Division completed a master plan for this phase in 1960 and will construct as much of this system as is possible with available funds. The system will not reach Konawaena School, Kona Hospital, or the population centers of Kealakekua and Captain Cook until an additional appropriation is made. Bids for construction of pipelines and tanks will be advertised in February 1961, and bids for pumps and controls shortly thereafter.

KAWAIHAE WATER STUDY

The First State Legislature, through Act 23, SLH 1960, appropriated $75,000 to conduct a study for a water system to serve potential developments in the Kawaihae-Puako area of the Island of Hawaii. In order to determine the availability of a basal ground water source for the area, a contract for $37,766 was let in October to drill an exploratory well. Progress has been slow due to the unusual rock formation at the test site; at the year’s end the test hole had been drilled to 220 feet.

Possible surface water sources to serve the area are being investigated, and a study of necessary water system facilities and water requirements is under way.

MISCELLANEOUS PROJECTS

The Division is responsible for the installation of the supply pipeline and construction of the storage tank for the Molokai Demonstration Farm authorized by Act 5, SLH 1960. Operation of the farm is under the jurisdiction of the University of Hawaii. Construction of pipelines was completed in October and the storage tank in December 1960.

The Division participates in the planning of subdivisions on State lands, providing engineering and drafting services. Three such subdivisions came within the purview of the Division in 1960: Waiakea House Lots, 4th Series, in Hawaii; Waianae Kai Farmlot Subdivision on Oahu; and Maalaea House lots Subdivision on Maui. At the end of the year, plans and specifications for the Waiakea distribution pipeline had been completed by the County and were subject to review by the Division. Plans were being formulated for a cost study of incremental development at Waianae Kai and the construction of a manure disposal system and treatment plant. An engineering feasibility study was being outlined for Maalaea.

The Division also assisted in the appraisal of State lands and Hawaiian Homes Commission lands for exchange purposes by providing preliminary development plans and cost estimates.
Above, Kona water development project advances with construction of steel tank along Waiaha-Kahalu'u pipeline.

Right, test well is started at Kawaihâe as part of study and planning project undertaken in 1960 by the Division.
Irrigation Systems

WAIMANALO IRRIGATION SYSTEM

In view of the comprehensive, multiple-use development now planned for Waimanalo Valley, the Waimanalo Irrigation System cannot be feasibly expanded to operate on an economic basis. Until the domestic water system has the capacity to accommodate the irrigation needs of the Valley, the Division of Water and Land Development will be obliged to operate the obsolete open-ditch irrigation system at a loss. Despite an all-time high of 166 million gallons of water used and a near record $37,115 in revenues, the system sustained a loss of $23,457 in 1960. Cumulative losses since the start of operations in November 1953 now amount to $160,591.

At the end of the year, 877 acres farmed by 82 tenants were served by the system, an increase of 63 acres over 1959. Of the total, 500 acres were privately owned by 58 farmers, 258 acres of State lands were farmed by 23 farmers on 30-day revocable permits, and another 119 acres of State lands were occupied by the Waimanalo Experimental Farm.

Both production and marketing conditions were generally favorable for Waimanalo farmers during 1960. They produced for the Honolulu market 29 different vegetables, 10 types of fruits and nuts, 11 varieties of flowers, plus beef, dairy products, chickens, eggs, and hogs. The wholesale value of this output, including flowers, is estimated at more than $1.5 million.

On the basis of acreage planted throughout the year, the ten leading crops were:

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<th>Crop</th>
<th>Average Acreage</th>
<th>Percent of Total Planted</th>
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</thead>
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<tr>
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<td>34</td>
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<tr>
<td>2. Guava</td>
<td>37</td>
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<td>3. Corn</td>
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<td>4. Banana</td>
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<td>5. Watermelon</td>
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<td>6. Passion Fruit</td>
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<td>4</td>
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<td>7. Acerola Cherry</td>
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<td>8. Macadamia Nut</td>
<td>9</td>
<td>3</td>
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<tr>
<td>9. Snap Beans</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>10. Broccoli</td>
<td>5</td>
<td>2</td>
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MOLOKAI IRRIGATION PROJECT

The longest irrigation tunnel in the state was holed through on schedule in November 1960, when contractors reached Waikolu Valley after having bored 26,825 feet to link the wet windward area of Molokai with the fertile but dry leeward area. Construction of Waikolu Tunnel, the major facility of the Molokai Irrigation and Water Utilization Project,
was hampered by water infiltration up to a maximum of 7 million gallons per day and averaging about 3 million. Presently about 2 million gallons per day is infiltrating into the tunnel.

The contractor is now proceeding with diversion works in Waikolu Valley, including dams, pipelines, and a foot-bridge; construction will soon begin on the lining of the tunnel invert. Exploratory wells will be drilled in the Valley and in the tunnel to determine the capacity of the ground water aquifer and the feasibility of ground water development to supplement the surface flow. It is expected that this phase of the project will be completed by the end of 1961.

The Division is now preparing construction plans and specifications for the remainder of the project, which will include 7 miles of transmission lines from the tunnel to the service area, a storage reservoir, and 20 miles of distribution lines in the service area. Construction of these facilities can be undertaken as soon as funds are available.

Total cost of the Molokai project is estimated at $9.5 million. Of this amount, about $5 million has been allotted, requiring an additional $4.5 million to complete the project. If the necessary funds had been available earlier, construction of the transmission and distribution facilities might have proceeded concurrently with construction of development facilities. However, there will now be a time lag between the completion of the work in Waikolu Valley and the completion of facilities to serve water to 13,650 acres of crop land.

The Division is attempting to obtain Federal loan funds under the Small Reclamation Projects Act to finish the project. Mr. Rex R. Reed, loan engineer of the Bureau of Reclamation, will make an inspection trip of Molokai early in 1961 in connection with this Federal loan application.
Rugged working conditions experienced in construction of Waikolu tunnel of the Molokai Irrigation Project are dramatically illustrated in these photos by Hawaiian Dredging & Construction Co., Ltd. Left, the "Waikolu Rapid Transit" emerges, dripping, from the tunnel with workmen commuters. Above, aike water pours into tunnel. Below, photo emphasizes endless ventilating tube. Above right, project superintendent George Underwood of Morrison-Knudsen, Inc., checks the water level. Bottom right, Underwood celebrates tunnel breakthrough with A. A. Carswell, vice-president of HD&C, and Robert T. Chuck, manager-engineer of the Division.
LALAMIRO IRRIGATION SYSTEM

Water from the Upper Hamakua Ditch-Waimea Reservoir system, on Hawaii, developed over the years by the Hawaii Water Authority and other predecessor agencies, has not yet been used for irrigation purposes. After many changes in the concept and plans for the original Waimea Irrigation and Water Utilization Project, it has proven most practical to utilize the water developed to serve farm lots on State lands at Lalamilo.

Construction of improvements necessary for a Lalamilo Irrigation System was begun in May 1960 under a contract for $339,276, which also included roadways for the first increment of 26 lots containing about 600 arable acres. These improvements are scheduled for completion in March 1961, after which it is expected that the Department of Land and Natural Resources will make the farm lots available to qualified applicants.

Existing statutes indicate that all construction and operating costs of a State irrigation system must be charged to the water users. Repayment of the total cost of the Lalamilo system, including the water development and transmission facilities originally designed to serve other areas, would result in excessively high water charges. In view of this, it is recommended that the 1961 Legislature consider subsidizing the Lalamilo system, perhaps rescinding the requirement that all capital costs of this project be paid by the water users.
This arid, cactus-covered land at Lalamilo will become productive irrigated farmland.

Distribution reservoir of 4.5 million gallon capacity, above, is lined with prefabricated asphalt panels. Water will be carried from reservoir through pipeline, below, to bring life to the new Lalamilo homestead farmlots.
### SUMMARY STATEMENT OF FINANCES, 1960 - PROJECT FUNDS

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<th>Allotments</th>
<th>Unallotted Balance</th>
<th>Appropriations</th>
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**Summary Statement of Finances, 1960 - Other Than Project Funds**

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<td>90,000</td>
<td>--</td>
<td>88,133</td>
<td>37,115</td>
<td>74,116</td>
<td>79,911</td>
</tr>
<tr>
<td>Act 18, SLH 1960</td>
<td>25,000</td>
<td>25,000</td>
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<td>88,133</td>
<td>37,115</td>
<td>74,116</td>
<td>79,911</td>
</tr>
<tr>
<td>Ground-Water Use:</td>
<td></td>
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<tr>
<td>Act 274, SLH 1959</td>
<td>75,000</td>
<td>75,000</td>
<td>--</td>
<td>88,133</td>
<td>37,115</td>
<td>74,116</td>
<td>79,911</td>
</tr>
</tbody>
</table>

**WAIMANALO IRRIGATION SYSTEM**

<table>
<thead>
<tr>
<th>Month</th>
<th>Water Sold (Gallons)</th>
<th>Acreage Served</th>
<th>Service Charges</th>
<th>Additional Billings</th>
<th>Water Charges</th>
<th>Total Charges</th>
<th>Rainfall (Inches)</th>
<th>Mean Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>2,806,156</td>
<td>853,960</td>
<td>$2,150.03</td>
<td>$3.62</td>
<td>$224.66</td>
<td>$2,362.31</td>
<td>2.57</td>
<td>72°F</td>
</tr>
<tr>
<td>February</td>
<td>4,744,757</td>
<td>853,980</td>
<td>$2,150.03</td>
<td>$3.62</td>
<td>$379.59</td>
<td>$2,518.24</td>
<td>3.95</td>
<td>72°F</td>
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<tr>
<td>March</td>
<td>1,343,849</td>
<td>856,684</td>
<td>$2,141.71</td>
<td>$3.62</td>
<td>$107.49</td>
<td>$2,252.85</td>
<td>3.62</td>
<td>74°F</td>
</tr>
<tr>
<td>April</td>
<td>11,597,977</td>
<td>902,262</td>
<td>$2,255.74</td>
<td>$3.62</td>
<td>$2,262.81</td>
<td>$4,622.17</td>
<td>1.25</td>
<td>74°F</td>
</tr>
<tr>
<td>May</td>
<td>17,037,499</td>
<td>902,262</td>
<td>$2,255.74</td>
<td>$3.62</td>
<td>$1,363.01</td>
<td>$3,622.37</td>
<td>2.00</td>
<td>76°F</td>
</tr>
<tr>
<td>June</td>
<td>27,170,079</td>
<td>902,262</td>
<td>$2,255.74</td>
<td>$3.62</td>
<td>$2,174.29</td>
<td>$4,433.65</td>
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<tr>
<td>July</td>
<td>28,016,354</td>
<td>902,262</td>
<td>$2,255.74</td>
<td>$3.62</td>
<td>$2,241.31</td>
<td>$4,500.67</td>
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</tr>
<tr>
<td>August</td>
<td>29,534,831</td>
<td>902,262</td>
<td>$2,255.74</td>
<td>$3.62</td>
<td>$2,362.81</td>
<td>$4,622.17</td>
<td>1.05</td>
<td>80°F</td>
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<tr>
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<td>22,693,229</td>
<td>902,262</td>
<td>$2,255.74</td>
<td>$3.62</td>
<td>$1,815.47</td>
<td>$4,074.83</td>
<td>1.45</td>
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</tr>
<tr>
<td>October</td>
<td>12,441,289</td>
<td>880,224</td>
<td>$2,200.56</td>
<td>$3.62</td>
<td>$955.31</td>
<td>$3,199.49</td>
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</tr>
<tr>
<td>November</td>
<td>6,991,041</td>
<td>885,652</td>
<td>$2,213.24</td>
<td>$3.62</td>
<td>$595.32</td>
<td>$2,776.18</td>
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</tr>
<tr>
<td>December</td>
<td>1,762,228</td>
<td>882,116</td>
<td>$2,206.79</td>
<td>$3.62</td>
<td>$140.90</td>
<td>$2,353.01</td>
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<tr>
<td>Total</td>
<td>166,170,139</td>
<td>885,535</td>
<td>26,566.80</td>
<td>43.44</td>
<td>13,293.69</td>
<td>39,903.93</td>
<td>29.21</td>
<td>76°F</td>
</tr>
</tbody>
</table>

*a For lots less than 3 acres.  
*b Waimanalo Experimental Farm. Lat. 21° 21' 16" N, Long. 157° 42' 50" W, elev. 58 ft.*
Well drillers position bit as work progresses on test bore at Kawaihae, Hawaii, one of the projects undertaken during the year 1960 by the Division.