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THE PANAMA CANAL

THE THIRD LOCKS PROJECT

JUNE 1941

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FOREWORD

This pamphlet is for the purpose of presenting general information for visitors to the Panama Canal and others who may be interested in the principal features of the Third Locks Project which is now under construction to increase the capacity of the Canal. At this time construction has just begun and the detailed designs are not yet fully complete. The information contained in this pamphlet is based on the estimates and designs as they exist today and so should be accepted as in some measure tentative and subject to revision as further studies, tests, analyses and detailed designs are completed.

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GLEN E. EDGERTON,
Governor.

June 1, 1941

AUTORIDAD DEL CANAL DE PANAMA-CENTRO DE RECURSOS TECNICOS

THE PANAMA CANAL

THIRD LOCKS PROJECT

Current international events and the beginning of construction on the Third Locks Project to increase the capacity and aid in the defense of the Panama Canal again focus world attention on the Isthmus of Panama.

Panama has long been important in New World history because of commerce crossing the Isthmus. Construction of the Panama Canal attracted wide-spread public attention and completion of the project marked the beginning of a new phase in interoceanic shipping. The commercial success and military importance of the Canal are today common knowledge.

The uninterrupted use of the Canal and its military value are of such importance that Army and Navy strategists have extensively studied the defense of the Canal and considered the desirability of enlarging the Panama Canal or constructing a second canal in some other location across Central America. The original builders were aware that the Canal's capacity would eventually require enlargement, for the project was planned with an optimum size which would be ample for a reasonable period but which would not include excess capacity that would be long unused.

While history assured the eventual success of the Canal project, there was nothing to indicate the rapid growth in ship size which was to follow the opening of the Canal. Probably few, if any, of the most optimistic builders of the original Canal would have dared predict that enlargement of the Canal would be under way as early as the year 1941.

Officially anticipating the need for enlargement of the Panama Canal, or construction of a new canal at some other location, Congress in 1929* authorized the President to cause to be made, under the direction of the Secretary of War and the supervision of the Chief of Engineers, and with the aid of such civilian engineers as the President deemed advisable, a full and complete investigation and survey for the purpose of ascertaining the practicability and approximate cost of constructing and maintaining (1) such additional locks and other facilities in the Panama Canal as may be necessary to provide for the future needs of interoceanic shipping, and (2) any other route for a ship canal between the Atlantic and Pacific Oceans. The Act specifically provided, in part, for a survey of a canal route across the Republic of Nicaragua.

*Public Resolution No. 99, 70th Congress, approved March 2, 1929.

In accordance with the legislation cited, two reports were prepared, one by the Governor of The Panama Canal which considered the construction of an additional set of locks and ultimate conversion of the Canal to sea level; and the other, a report by Lt. Colonel Dan I. Sultan, C.E., concerning the Nicaraguan route. Both reports proposed construction of locks 1,200 feet long, 125 feet wide, and 42.5 feet deep. At that time, it was estimated that a third set of locks at Panama would cost $140,000,000 and that to lower the Canal to sea level would cost $1,000,000,000. The cost of the proposed Nicaraguan Canal was estimated at $697,000,000 plus $25,000,000 for rights, franchises, lands, etc. The maintenance cost of the Nicaraguan Canal was estimated at $10,800,000 a year, which was an amount greatly in excess of the added cost of operating a third set of locks at Panama. The interoceanic Canal Board reviewed the reports, visited the Canal sites and concluded that no immediate steps were then needed to provide increased facilities for passing water-borne traffic from ocean to ocean, that the construction of a third set of locks and conversion of the Panama Canal into a sea-level canal was the most practical solution to the problem, but that at some later date consideration should be given to the Nicaraguan Canal.

Nicaraguan Canal

The route considered most practical for an interoceanic ship canal across the Republic of Nicaragua was from Greytown, on the Atlantic Coast, to Brito, on the Pacific Coast, by way of Deseado and San Juan Rivers and Lake Nicaragua. The Nicaraguan Canal would be 173 miles long, as compared with 51 miles for the Panama Canal. Like the Panama Canal, locks near each coast would be necessary to lift ships to the elevation of the lake surface, 105 to 110 feet, and for 70 miles the Canal would be through Lake Nicaragua. The lock size and canal cross section were the same as that considered for the Third Locks at Panama and it was estimated that the Nicaraguan Canal would have a capacity of about 180,000,000 tons a year. To construct a canal across Nicaragua, a complete organization similar to that at Panama, including Civil government and community developments, would be necessary, and to defend the location, a second Central American Defense Unit would be necessary.

Enlargement of the Panama Canal

The Report of the Governor of The Panama Canal, dated August 4, 1931, submitted in connection with the studies authorized by the Act of 1929, considered a project for a third set of locks with a project for converting the Panama Canal into a sea-level canal. With the completion of Madden Dam in 1934 and the resultant increase in water supply, the Governor was of the opinion that a third set of locks would not be needed until about 1970, and that such locks, if constructed over a period of ten or twelve years prior to that time, would be ample to care for increased shipping needs for a long future period. The third locks considered at that time were to be parallel and contiguous to the existing locks. The increase in capacity would be between 40,000,000 and 45,000,000 tons per year. It was

considered that to lower the Panama Canal to sea level would require from 35 to 40 years for most economical construction, and that as a step in lowering the Canal to sea level, it would be necessary to construct a third set of locks. In view of the time required for conversion, it was estimated that the project for lowering the Canal to sea level should start shortly after the third locks were completed. Construction schedules were prepared to provide for the lowering of the Canal channel by dredging and the alternate lowering of various locks so that traffic through the Canal would be uninterrupted. The Governor recommended that no project for a sea-level canal at Panama be then adopted and that tentative plans for the future contemplate increasing the capacity of the lock canal by a third set of locks. It should be noted that the estimated cost of $140,000,000 for the third set of locks did not provide for locating the locks at some distance from the old structures, as is now being done, nor did it provide for the larger dimensions now planned or for the incorporation of safety features, now considered essential for the third locks.

Third Locks Authorization

In 1936 the Governor of The Panama Canal was authorized and directed by Congress* to investigate the means of increasing the capacity of the Panama Canal for the future needs of interoceanic shipping, and to prepare designs and approximate estimates of cost of such additional locks and other structures and facilities as are needed for the purpose. In accordance with this legislation, the Governor submitted a report, dated February 24, 1939**, wherein it was considered that construction of an additional system of locks should be started within 10 or 12 years on the basis of commercial requirements alone. Consideration of defense caused the Governor to recommend that the new locks be constructed at some distance from the old locks, requiring approach channels to connect with the existing waterway. Because of the incorporation of defense features and the necessity of excavating approach channels, the Governor estimated the cost of the project at $277,000,000.

On August 11, 1939***, Congress authorized the construction of a third set of locks in Panama, substantially in accordance with the plans contained in the Governor's report, for the purpose of more adequately providing for the defense of the Panama Canal and for increasing its capacity for the future needs of interoceanic shipping. As provided in the Governor's report, the new locks at the Pacific end of the Canal are to be from 1,500 to 3,000 feet westerly of the existing Pacific side locks, and the New Gatun Locks are to be about 3,000 feet easterly of the old Gatun Locks. The locations are shown on maps on the following pages. The War Department Civil

*Public Resolution No. 85, 74th Congress, approved May 1, 1936.
**House Document No. 210, 76th Congress, first session.
***Public No. 391, 76th Congress

Appropriation Act of 1941 provided funds in the amount of $15,000,000 to begin work on the project, and provided that the Governor of The Panama Canal could, when authorized by the Secretary of War, enter into contracts prior to July 1, 1941 for, or on account of, the Third Locks construction to an amount not in excess of $99,000,000.

Initial Work

Following authorization of the Third Locks Project and prior to the appropriation of funds for construction, existing Canal forces had begun plans for the design and construction so that the least possible delay would ensue when funds were made available. Thus, on July 1, 1940, the dipper dredge, CASCADAS, started the subaqueous excavation for the Third Locks Project. At the same time, offers of employment were extended to previously selected, specially qualified men throughout the United States to fill key positions in the Third Locks design and construction organizations. Personnel was rapidly assembled to prepare designs and to supervise the early construction stages. As with most major construction projects, personnel housing and care was the first major item to be considered.

The town at Diablo Heights, about 2 miles north of Balboa Heights, had been started to provide housing for employees working on protective features of the existing locks, and when Third Locks funds became available, the town was expanded and designated as headquarters for the construction of the new locks. To care for increased American personnel (usually referred to as Gold employees) on the Atlantic side, a new townsite, Margarita, was laid out about 2½ miles southeast of Cristobal. Construction of living quarters and public buildings in this town has been rapidly advanced and it was first occupied in January of 1941. Native tropical laborers (usually referred to as Silver employees) on the Atlantic side will be housed in a newly developed camp near the existing town of Gatun. To care for employees immediately connected with the construction of the Pacific side locks, a townsite was laid out at Cocoli on the western side of the Canal, approximately opposite Diablo Heights and construction of this town is now in progress. Provisions are made in this location to care for both Gold and Silver personnel. Diablo Heights, Cocoli, and Margarita are complete towns in themselves, each having a commissary, post office, school, clubhouse, fire station, dispensary, et cetera. Contractors will, in general, provide buildings for use of their employees who will reside in these new Third Locks towns. It is estimated that at the maximum, about 2,300 people will reside in Diablo Heights, 2,500 in Cocoli, and 1,500 in Margarita, including families of employees. The Third Locks townsites are shown on Plates I, II and III on the following pages.

The Special Engineering Division of the Department of Operation and Maintenance was organized to handle all matters relating directly to the Third Locks Project, including both the design and actual construction, but existing organizations and facilities of The Panama Canal are being utilized to the fullest possible degree in prosecution of the Third Locks work. Regular Canal organizations have developed the new townsites and constructed

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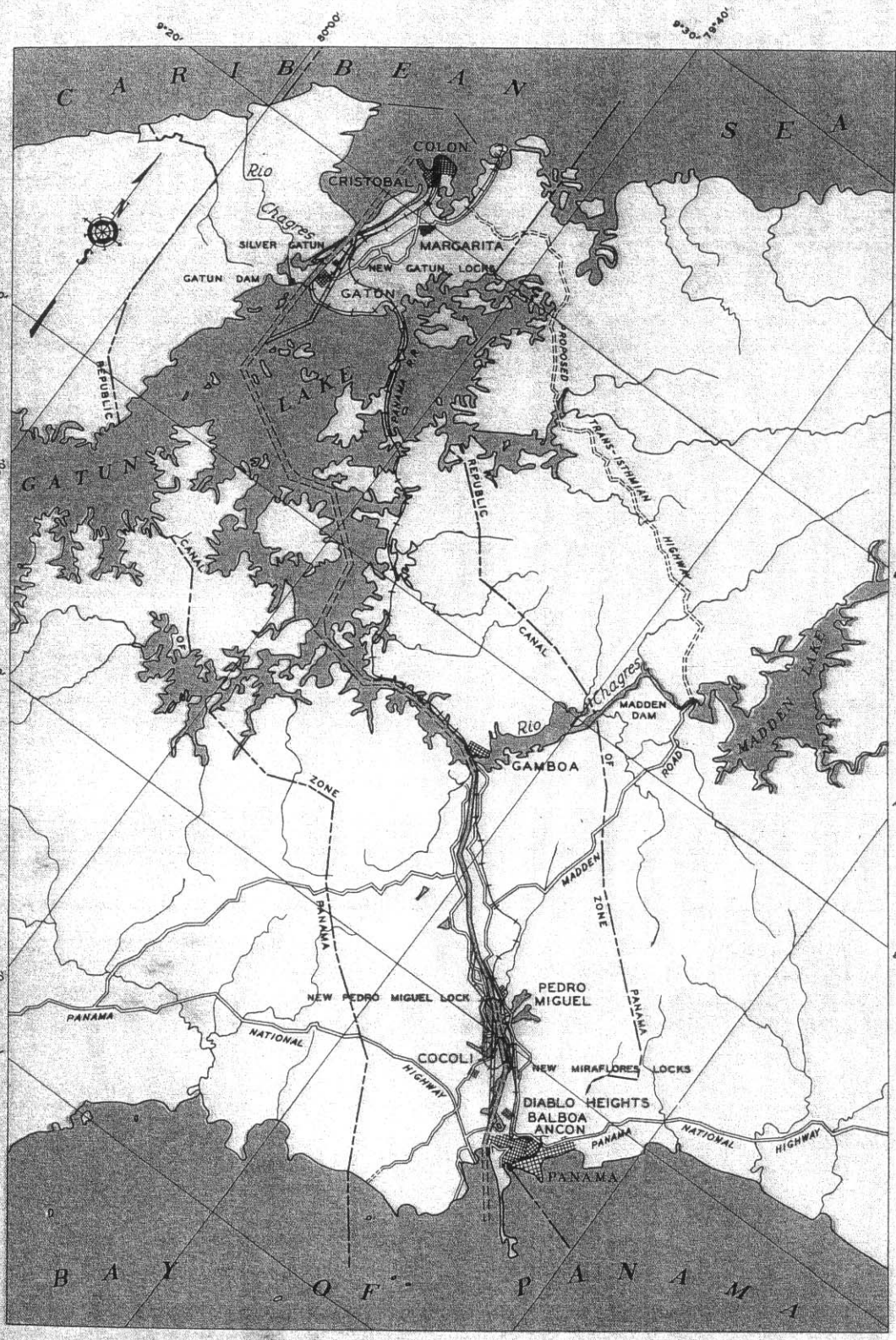

CANAL ZONE AND VICINITY

THIRD LOCKS CONSTRUCTION IN RED

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MILES

PLATE I

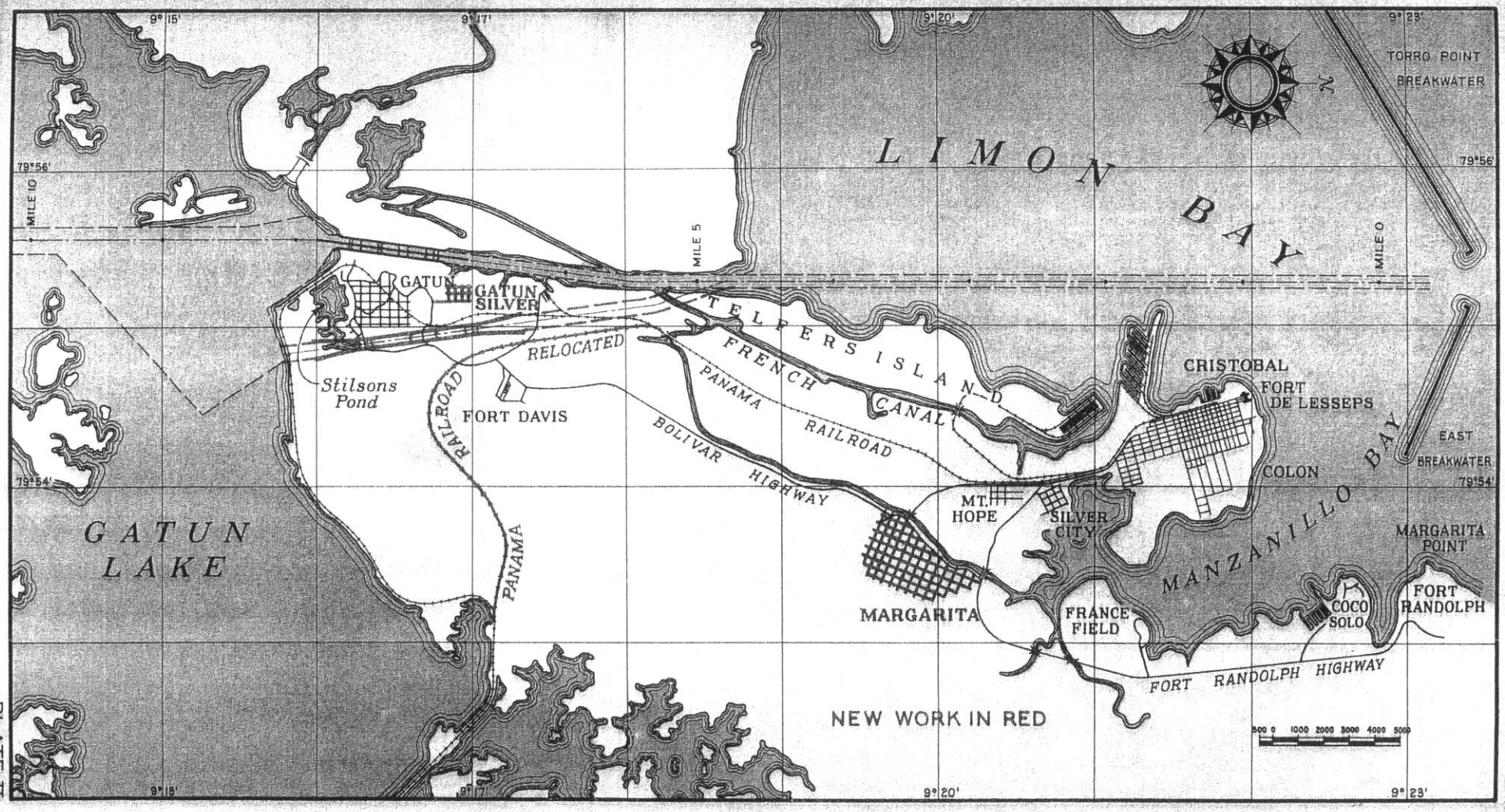

PLATE II

THIRD LOCKS — ATLANTIC SIDE

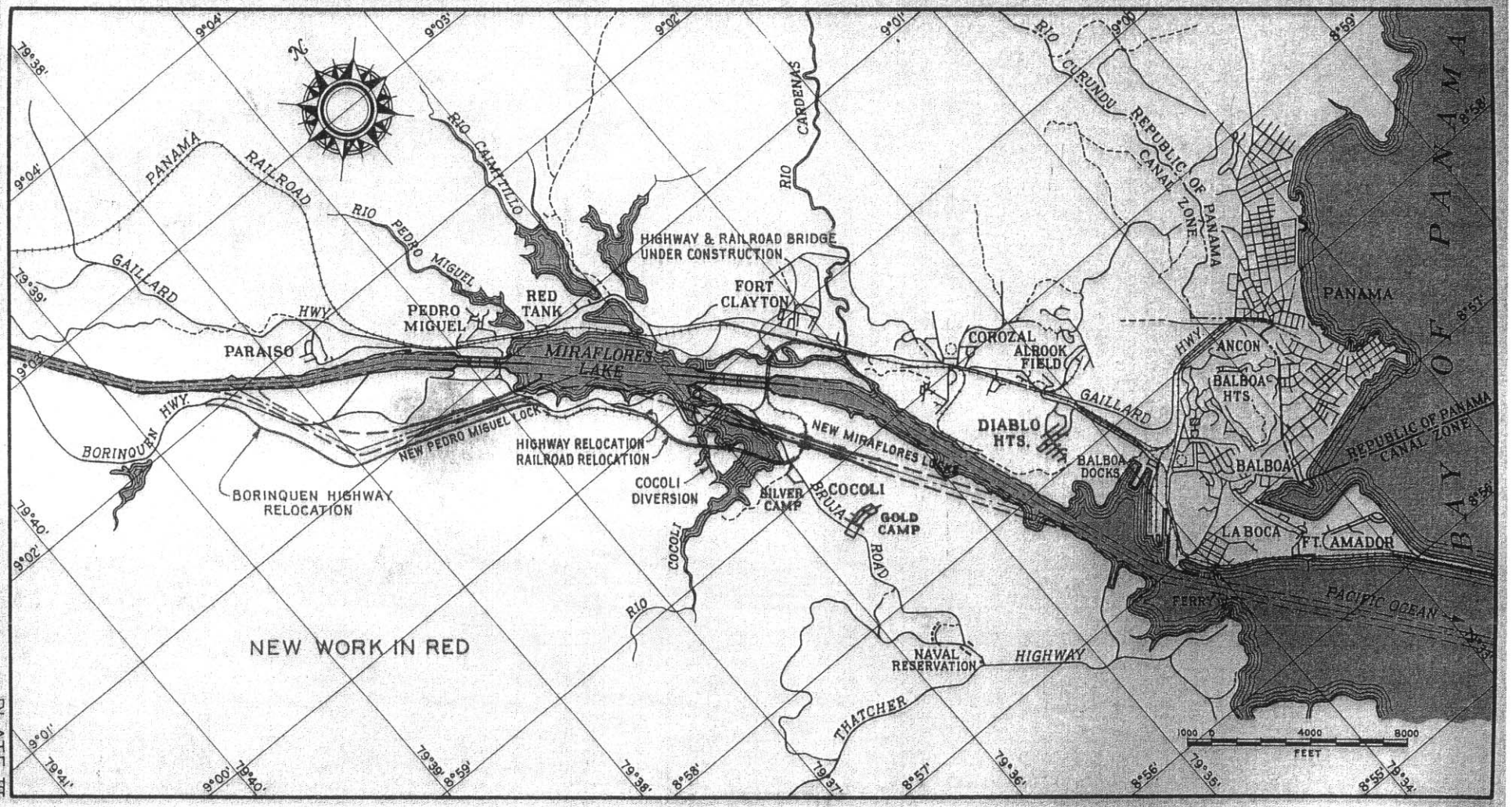

PLATE III

THIRD LOCKS – PACIFIC SIDE

the quarters for new employees. Existing personnel, payroll, supply, legal, and other sections of the regular Panama Canal organization handle Third Locks matters with regular and added personnel, thereby avoiding duplication of these functions in the Special Engineering Division.

Design of the new locks was facilitated, as necessary basic data for use in connection with the Third Locks Project have been collected for a number of years as a regular part of the maintenance work of various units of The Panama Canal, and surveys and studies made in connection with various reports called for by Congress were planned, and records preserved, with a view to their use when construction of a new set of locks was authorized. Accordingly, when work began on detailed designs early in the fiscal year 1941, most of the basic data were at hand and many of the general features to be incorporated in the Third Locks were already established. To determine the exact Locks locations, subsurface exploration previously begun was continued by means of core boring and test pits, and materials were tested for bearing power, compaction, permeability, et cetera. At the time of this writing, about 100,000 lineal feet of core drilling has been completed in connection with the Third Locks Project. Hydraulic model studies were undertaken to determine the best design for the hydraulic features of the new locks and a testing laboratory was established to determine the best materials for use in the locks and to test, and insure conformance with required standards, materials used in the new construction.

Features of the New Locks

Although only a few existing ships are too large to be accommodated by the old locks, studies of shipping and naval requirements indicated that the new locks should be 1,200 feet long, 140 feet wide, and 45 feet deep to provide for the largest existing vessels and others still larger, likely to be constructed in the future. Ships of 100,000 tons displacement, or probably larger, could use the new locks. Plate IV on the following page shows the growth in ship sizes in recent years. Studies of present locks' operating methods will permit modifications in the design for the new locks which will add to the safety and ease of their operation. In general aspects, the new locks will be similar to the old locks, except that long symmetrical, slightly flaring guide walls will be used instead of a single long straight wall along one side of the lock approach, and a short sharp flaring wall on the other.

The magnitude of the Third Locks Project is indicated by the estimated quantities of major items in connection with Third Locks construction, as tabulated on the last pages herein.

Excavation Plan

Material to be excavated from the new locks' sites and approach channels varies from the hardest basalt rock to soft mud. The Atlantic approach to the New Gatun Locks, about 7,800 feet long, and the Pacific approach to the New Miraflores Locks, about 8,000 feet long, are through

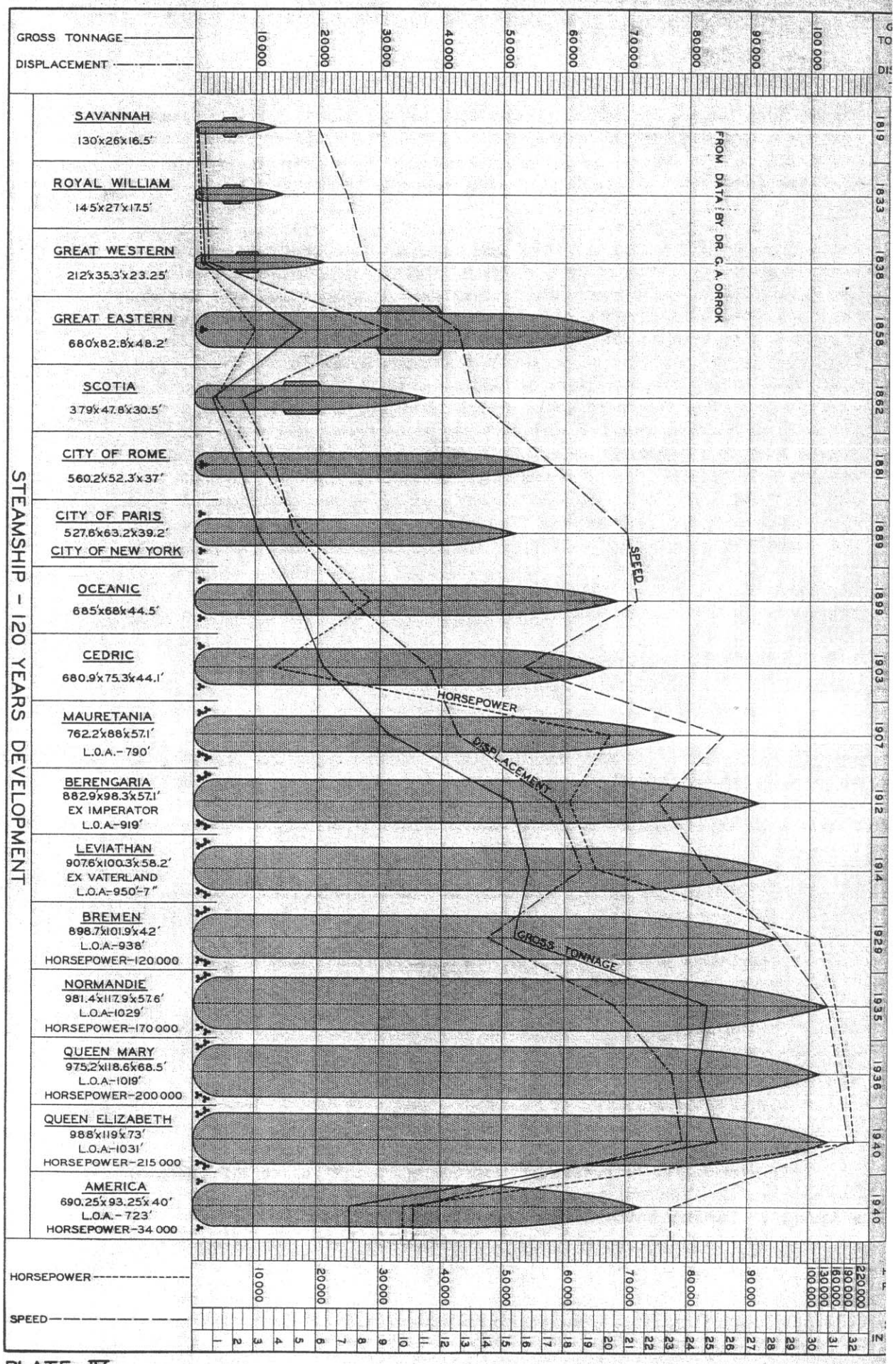
STEAMSHIP – 120 YEARS DEVELOPMENT
GROSS TONNAGE
DISPLACEMENT
HORSEPOWER
SPEED
SAVANNAH
130'x26'x16.5'
ROYAL WILLIAM
145'x27'x17.5'
GREAT WESTERN
212'x35.3'x23.25'
GREAT EASTERN
680'x82.8'x48.2'
SCOTIA
379'x47.8'x30.5'
CITY OF ROME
560.2'x52.3'x37'
CITY OF PARIS
527.6'x63.2'x39.2'
CITY OF NEW YORK
OCEANIC
685'x68'x44.5'
CEDRIC
680.9'x75.3'x44.1'
MAURETANIA
762.2'x88'x57.1'
L.O.A.–790'
BERENGARIA
882.9'x98.3'x57.1'
EX IMPERATOR
L.O.A.–919'
LEVIATHAN
907.6'x100.3'x58.2'
EX VATERLAND
L.O.A.–950'-7"
BREMEN
898.7'x101.9'x42'
L.O.A.–938'
HORSEPOWER–120 000
NORMANDIE
981.4'x117.9'x57.6'
L.O.A.–1029'
HORSEPOWER–170 000
QUEEN MARY
975.2'x118.6'x68.5'
L.O.A.–1019'
HORSEPOWER–200 000
QUEEN ELIZABETH
988'x119'x73'
L.O.A.–1031'
HORSEPOWER–215 000
AMERICA
690.25'x93.25'x40'
L.O.A.–723'
HORSEPOWER–34 000
FROM DATA BY DR. G.A. ORROK
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PLATE IV

swamps. Excavation in these low areas has been started and will be done by floating dredges of The Panama Canal Dredging Division. Soft material will be removed by suction dredges and deposited to build up near-by low areas and the harder material, much of which will require blasting, will be loaded on barges by dipper dredges, and dumped in deep water at sea. A small amount of dredging will also be required in Miraflores Lake, adjacent to the new lock approach channels. To fully utilize the increased depth of the new locks, the Atlantic entrance to the Canal will be deepened 4 feet by dredging. The last phase of the new locks project will be removal, by dredging, of the land plugs, or dams, which will be left at the ends of the dry excavation jobs to prevent the in-flow of water during construction.

Excavation of the actual lock sites, the north approach channel to the New Pedro Miguel Lock, and the south approach channel to the New Gatun Locks, is possible by ordinary dry land methods and excavation in these areas will be by contract. The magnitude of the project and the long time involved in both planning and executing the work make it desirable to excavate and place the concrete in the lock structures under separate contracts. Concrete construction will not begin until the latter part of the year 1942. While it was possible to begin the "wet" excavation by dredge as soon as funds were available for Third Locks work, excavation by contract was necessarily delayed until the locks' design was sufficiently advanced to permit the excavation limits to be fixed and contract plans to be prepared.

Contract Work

NEW GATUN LOCKS. By October, 1940, geological studies and the design of the new locks had advanced sufficiently to permit advertising for the New Gatun Locks Structure, South Approach Channel and Appurtenant Works. Prior to the opening of bids on December 4, 1940, the locks' site had been cleared of jungle growth by Government forces and the many utility changes and highway relocations required by construction of the new locks had been started by the various Canal organizations which normally prosecute such work. At the opening of bids in Washington, D. C., Martin Wunderlich Company and Okes Construction Company were the low bidders on the Gatun excavation contract, with a bid of $8,517,100. Upon award of the contract, construction equipment was moved to the Canal Zone and on February 19, 1941, the first power shovel began excavation of the new locks' site.

The contractor has elected to excavate the northerly section of the locks' site by hydraulic dredge, as the material will be largely soft muck. The dredge will be constructed on the site. The central and southerly parts of the locks' site and the south approach channel, where clay, sandstone and agglomerate will be encountered, will be excavated by tractor-drawn carrying scrapers and by power shovels, draglines, and various types of large hauling equipment. Excavated material will be used to fill in Stilson's Pond, southeast of the town of Gatun, and to fill and level other low areas in the vicinity of Gatun and Fort Davis. In addition to excavating for the locks proper, the contractor at Gatun will grade for the relocation of the Panama Rsilroad and excavate a new drainage canal east of the locks' sitesto control

drainage from areas to be filled with waste material. Since construction of the new locks will make an island of the section of land between the old and the new locks and on which the town of Gatun is situated, the main line of the Panama Railroad which formerly ran through Gatun will be moved so as to remain on the east side of the new locks. The relocated section of the railroad will be 3.9 miles long, and will shorten the main line distance from Colon to Panama City by 2-2/3 miles. About 12,000,000 cubic yards of excavation will be required under the New Gatun Locks excavation contract.

At the time of writing, June 1, 1941, excavations for the New Gatun Locks totals 1,700,000 cubic yards, excavation for the railroad relocation 60,000 cubic yards, and excavation for the drainage canal 86,000 cubic yards, and the excavation is 15% complete.

Excavation of the first section of the locks' site is to be completed in 510 calendar days so that placing of concrete by another contractor may begin. A second section must be completed in 840 calendar days and a third section, which completes the contract, must be finished in 960 days. The locks excavation is about 9,040 feet long and the south approach channel about 460 feet long. The maximum depth of cut will be about 210 feet, and the maximum width about 1,060 feet. These maximums do not occur in the same location due to the nature of the material to be excavated.

NEW MIRAFLORES AND PEDRO MIGUEL LOCKS. Bids for the excavation of the New Miraflores and Pedro Miguel Locks sites, the Pedro Miguel North Approach Channel and Appurtenant Works, were opened in Washington, D. C., on April 17, 1941. The low bid of $22,436,086 was submitted by the Panama Constructors and award of the contract was made April 24. Work required by this contract will begin by June 10. This contract will require the excavation of about 28,700,000 cubic yards of material, the crushing and stockpiling of 2,150,000 cubic yards of rock from the excavation, to be later used for concrete aggregate, the grading of about 3 miles of railroad location and 4.6 miles of highway location, and construction of a 250-foot reinforced-concrete highway and railway bridge. Excavation waste is to be used to fill low areas including a small arm of Miraflores Lake, in the vicinity of the locks, and provide leveled areas for use in future operations. The work is divided into three sections: Section I, Miraflores Locks sites, 7,100 feet long, to be completed by the contractor in 400 calendar days; Section II, the Pedro Miguel Lock's site, 5,746 feet long, to be completed in 660 calendar days; and Section III, the Pedro Miguel North Approach Channel, 7,850 feet long, to be completed in 1,200 calendar days. The material to be excavated consists of clay, mud, agglomerate, culebra, cucaracha, and hard basalt. Maximum depth and width of excavation for the locks is 213 feet and 1,050 feet respectively. Preparation of the railroad grade will require a maximum cut of 104 feet and a maximum fill of 65 feet.

WET EXCAVATION. Excavation by dredge has continued since the beginning of the fiscal year 1941. To date 1,840,000 cubic yards of material have been removed by suction dredge from the Atlantic entrance by-pass channel and 1,560,000 cubic yards of earth and rock have been removed by dipper dredge

from the Pacific entrance by-pass channel. Drilling and blasting of rock and hard material are now in progress by both floating and land equipment in the by-pass channels. To expedite the dredging, several new tugs and barges have been or will be purchased and a contract has been let for a new 28-inch suction dredge.

APPURTENANT WORK. In constructing the Third set of Locks, there are numerous appurtenant works to be constructed and many existing utilities and facilities to be relocated or replaced. One of the major items now being constructed is the Miraflores Swing Bridge, which will provide both rail and highway access to the west side of the Canal and to the new Pacific Locks' sites. The movable bridge will have two main spans, each 184 feet long, which will cross the old Miraflores Locks approach channels and rest on a common center pier on the locks' center wall. The balancing spans which swing opposite the main span will each be 92 feet long. The east approach to the bridge across the Rio Grande will be a steel and concrete viaduct resting on 26 bents. The bridge and approach structure have a total length of about 2,250 feet. Construction of the substructure for the bridge is under way by Panama Canal forces, and a contract for fabrication and erection of the superstructure was signed with the Pittsburgh-Des Moines Steel Company early in April, 1941. The contract price is $1,078,840 and the work involves the fabrication and erection of about 5,500,000 pounds of structural steel in the East Approach Viaduct, 2,450,000 pounds in the movable bridge and 390,000 pounds of machinery. The contract requires completion of the East Approach Viaduct by January 8, 1942, and completion of the entire contract by March 29, 1942.

Another major appurtenant work now well-advanced is the construction of 30 Quartermaster, Motor Pool, stable area and truck shed buildings to replace structures which must be demolished to clear the New Gatun Locks site. Other work includes the relocation of streets and highways, power and communication lines, water lines and reservoirs, and sewer and drainage lines and structures. Ultimately a movable bridge will be constructed across the new Miraflores Locks to provide continued rail and highway access to the west side of the Canal, and another movable bridge will be constructed across the New Gatun Locks to provide continued access to the town of Gatun which will be on an island when the new locks are completed.

Design and Future Work

Having been successfully operated for over 25 years, the existing locks structures and operating procedures are the basis for the new locks design now in progress. The increased size of the new locks adds only slightly to the design problem. The use of more modern machinery and control systems will add to the ease and safety of new lock operation and extensive protective devices will insure uninterrupted service. Completion of the design is being expedited but standard laboratory tests and experiments are in progress to insure adoption of the most suitable design.

Although the project is the largest single current engineering work in the world, its planning and execution are not unduly involved, and principal attendant problems not met in usual construction work are those usually ac-

companying tropical work, transportation, since supplies, equipment and American personnel must all travel to the Canal by ship, and the supply of tropical laborers. Increased Army, Navy and Canal construction has absorbed all available Panamanian labor and made the recruiting of additional laborers necessary in other Central and South American countries and in the Caribbean Islands.

Contracts for furnishing cement and aggregate for the concrete in the new locks will probably be advertised for bids late in the summer of 1941, and bids for the concrete work itself are scheduled to be taken during 1942. Construction of the locks structures will begin after completion of Part I of each of the locks' excavation contracts and the construction contractors will probably be allowed about 1,200 calendar days to complete the locks. The New Gatun Locks dry excavation by contract is well begun, dredging is under way by the Dredging Division in both the Atlantic and Pacific by-pass, or approach channels, and major contract excavation operations on the Pacific side locks will begin in June, 1941, but maximum activity on the project will probably not occur until during the year 1944, when both concrete placing and excavation will be in progress.

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STATISTICS

Third Locks Project

LOCKS	
Number of chambers to be constructed	6
Length of each lock chamber	1,200 feet
Width of each lock chamber	140 feet
Usable depth of each lock chamber	45 feet
Total length, all new locks, including guide walls	19,679 feet
Total excavation required (exclusive of approach channels)	17,750,000 cubic yards
Concrete required for construction	4,900,000 cubic yards
Reinforcing steel to be used	40,800,000 pounds
Machinery and miscellaneous metal work	172,000,000 pounds
APPROACH CHANNELS TO CONNECT NEW LOCKS WITH EXISTING CANAL	
Total length	34,985 feet
Maximum width	600 feet
Minimum width	300 feet
Minimum depth	45 feet
Wet excavation required (by dredge)	29,700,000 cubic yards
Dry excavation required (by land methods)	21,950,000 cubic yards
Total excavation in approach channels	51,650,000 cubic yards
EXISTING ATLANTIC CANAL ENTRANCE, DEEPEN FROM 42 TO 46 FEET	
Excavation required (by dredging)	2,437,000 cubic yards
EMPLOYMENT (AS OF MAY 1, 1941)	
Special Engineering Division	623
Other Canal Divisions (employees temporarily on Third Locks work, exclusive of new towns work)	1,671
Contractors (on Third Locks work)	349
Total	2,643
Estimated maximum employment	7,000 to 8,000
Total length, Third Locks and Approach Channels	10.35 miles
Total excavation, Third Locks Project	71,837,000 cubic yards
Estimated total cost, Third Locks Project, including appurtenant works	$277,000,000

Canal Zone and Existing Canal

LOCATION OF PANAMA CANAL

Due south of Pittsburgh, Pennsylvania	
North, 8° 55', to 9° 25' from equator	
Distance to New York	1,974 miles (nautical)
Distance to San Francisco	3,245 miles (nautical)

AREA OF CANAL ZONE

Land	361.86 square miles
Water	190.94 square miles
Total	552.8 square miles

CLIMATE

Temperature, average daily maximum, Pacific Side	87.3°
Temperature, average daily minimum, Pacific Side	73.1°
Average relative humidity	83%
Annual rainfall, Pedro Miguel	80.9 inches
Average rainfall, Atlantic Side	124.1 inches

PRESENT CANAL

Length	51 miles
Minimum channel width	300 feet
Maximum channel width	1,000 feet
Minimum channel depth	40 feet
Number of lock chambers	12
Locks, length	1,000 feet
Locks, width	110 feet
Locks, depth	40 feet

GATUN LAKE

Surface elevation	85 feet
Surface area	163.5 square miles
Capacity	183,172 million cubic feet

EXCAVATION, ORIGINAL CANAL

Excavated by the French, total	78,146,960 cubic yards
Excavated by the French, useful in present Canal	29,908,000 cubic yards
Excavation in the original Canal prism, to date of opening	208,027,540 cubic yards
Auxiliary excavation	76,644,655 cubic yards
Grand total excavation, 1904 to 1939, inclusive	419,467,555 cubic yards

Original cost of the Panama Canal (Net) $380,000,000

Canal Traffic by Fiscal Years 1915 to 1940

Fiscal Year Ended June 30--	Number of Transits	Panama Canal Net Tonnage (3)	Tolls	Tons of Cargo
1915 (1)	1,058	3,507,000	$ 4,366,747.13	4,888,400
1916 (2)	724	2,212,000	2,403,089.40	3,093,335
1917	1,738	5,357,000	5,620,799.83	7,054,720
1918	1,989	6,072,000	6,428,780.26	7,525,768
1919	1,948	5,658,000	6,164,290.79	6,910,097
1920	2,393	7,898,000	8,507,938.68	9,372,374
1921	2,791	10,550,000	11,268,681.46	11,595,971
1922	2,665	10,556,000	11,191,828.56	10,882,607
1923	3,908	17,206,000	17,504,027.19	19,566,429
1924	5,158	24,181,000	24,284,659.92	26,993,167
1925	4,592	21,134,000	21,393,718.01	23,956,549
1926	5,087	22,906,000	22,919,931.89	26,030,016
1927	5,293	24,245,000	24,212,250.61	27,733,555
1928	6,253	27,229,000	26,922,200.75	29,615,651
1929	6,289	27,585,000	27,111,125.47	30,647,768
1930	6,027	27,716,000	27,059,998.94	30,018,429
1931	5,370	25,690,000	24,624,599.76	25,065,283
1932	4,362	21,842,000	20,694,704.61	19,798,986
1933	4,162	21,094,000	19,601,077.17	18,161,165
1934	5,234	26,410,000	24,047,183.44	24,704,009
1935	5,180	25,720,000	23,307,062.93	25,309,527
1936	5,382	25,923,000	23,479,114.21	26,505,943
1937	5,387	25,430,000	23,102,137.12	28,108,375
1938	5,524	25,950,383	23,169,888.70	27,385,924
1939	5,903	27,170,007	23,661,021.08	27,866,627
1940	5,370	24,144,366	21,144,675.36	27,299,016
Total	109,787	493,385,756	474,191,533.27	526,089,691

(1) Canal opened to traffic August 15, 1914

(2) Canal closed to traffic approximately 7 months of fiscal year by slides

(3) Panama Canal net tonnage prior to 1939 are estimated figures based on revised measurement rules which became effective March 1, 1938

PROHIBIDA LA REPRODUCCION SIN AUTORIZACION DEL AUTOR
UNAUTHORIZED USE OR DUPLICATION IS PROHIBITED

AUTORIDAD DEL CANAL DE PANAMA - CENTRO DE RECURSOS TECNICOS

SEAL OF THE CANAL ZONE ISTHMUS OF PANAMA
THE LAND DIVIDED - THE WORLD UNITED