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REPORT

OF THE

SECRETARY OF WAR;

BEING PART OF

THE MESSAGE AND DOCUMENTS

COMMUNICATED TO THE

TWO HOUSES OF CONGRESS

AT THE

BEGINNING OF THE SECOND SESSION OF THE FORTY-EIGHTH CONGRESS.

IN FOUR VOLUMES.

VOLUME II.

PART 1.

WASHINGTON:
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1884.

ANNUAL REPORT

OF THE

CHIEF OF ENGINEERS,

UNITED STATES ARMY.

1884.

DEFENSES OF SAN FRANCISCO, THE NAVY-YARD AT MARE ISLAND, AND THE ARSENAL AT BENICIA—continued.

Fort on Alcatraz Island, San Francisco Harbor, California, in charge of Lieut. Col. G. H. Mendell, Corps of Engineers.—Alcatraz Island is an important element in the defense of the channels of San Francisco Harbor. Its position gives it command of the channels by which a hostile fleet may approach the city. The defenses are in an incomplete condition. No construction has been carried on during the past eight years. The works are under the charge of a keeper, who, with a detail of prisoners confined on the island, maintains the defenses in good condition.

During the past year storage was prepared for a considerable number of torpedoes.

The work done during the year was devoted with success to keeping the parapets, slopes, magazines, roads, drains, buildings, and public property in good order.

The plan of the work requires revision.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
No appropriation asked for next fiscal year.

Fort Mason, San Francisco Harbor, California, in charge of Col. C. S. Stewart, Corps of Engineers.—During the late civil war two temporary earthen batteries were built on this point.

In the east battery the timber platforms are decayed as well as the wood-work of the magazines, part of which has caved in. This battery is unserviceable.

Projects for new earthen batteries of heavy guns and mortars for the occupation of this important point in the second line of defense for the bay and harbor of San Francisco have been prepared by the Board of Engineers for the Pacific Coast.

No appropriation was made for the fiscal year ending June 30, 1885.
No appropriation asked for next fiscal year.

Batteries on Angel Island, San Francisco Harbor, California, in charge of Col. C. S. Stewart, Corps of Engineers.—The three earthen batteries on this island were built during the late civil war for temporary use. The timber platforms and the timber magazines are decayed, and nearly all the gun-carriages have been condemned.

The batteries are practically unserviceable.

Barbette eathern batteries for the heaviest guns have been planned by the Board of Engineers for the Pacific Coast, to occupy the most valuable positions on the island which bear on the channels leading to the upper part of the bay, to the navy-yard at Mare Island, and to the arsenal at Benicia.

No appropriation was made for the fiscal year ending June 30, 1885.
No appropriation asked for next fiscal year.

DEFENSES OF THE COLUMBIA.

Defenses at the mouth of the Columbia River, Oregon, and Washington Territory, in charge of Capt. C. F. Powell, Corps of Engineers.—The defenses consist of Fort Stevens, an inclosed earthwork at Point Adams, Oregon, on the south side, and the earthen batteries at Fort Canby, Cape Disappointment, Washington Territory, on the north side.

DEFENSES OF THE COLUMBIA—continued.

The works command the channels at the entrance, the ship-channels leading to Astoria, and the anchorage in Baker's Bay under the lee of the cape on the north.

The channels to the river have natural depths of 19 to 24 feet at low water, and a mean rise of tide above this plane of 7½ feet.

These defenses are field works in character; they were built hastily during the late civil war in anticipation of complications with foreign powers. On account of increased penetration of present ordnance, and and the decay of the greater part of the wooden platforms and magazine timbers, the works are of little value in their present condition except for drill purposes.

Fort Stevens, Oregon.—During August and September the marsh sod revetment of the interior slope was repaired; four shot-platforms and five gun-platforms were constructed in place of decayed ones; in June the magazine was wholly rebuilt, except replacing part of the earth covering.

Fort Canby, Washington.—The service magazine and three gun platforms at the center battery were rebuilt, placing this battery in good condition throughout; minor repairs were made to the right battery magazine, and timber received for rebuilding magazine at left battery.

Many of the platforms of the batteries are in an unserviceable condition.

No appropriation was made for the fiscal year ending June 30, 1885.
No appropriation asked for next fiscal year.

BOARDS OF ENGINEERS.

THE BOARD OF ENGINEERS.

The Board of Engineers stationed in New York City consisted of Col. John Newton (until March 6, 1884), Col. J. C. Duane (since April 12, 1884), Lieut. Col. Henry L. Abbot, Lieut. Col. Cyrus B. Comstock, and, when so ordered, the officer in charge of the work under consideration.

The Board has been engaged in the duties which have from time to time been referred to it, and has submitted the following report of its operations:

Coast defenses.—The defenseless condition of our sea-coast and the urgent necessity that immediate steps be taken to remedy this evil have been so frequently and thoroughly discussed that further remarks on this subject are unnecessary.

Any one who has taken the trouble to investigate the matter must be aware that our harbor defenses, which were all constructed many years since, and were designed to contend with wooden ships armed with smooth-bore guns of moderate dimensions, are utterly unable to cope with an iron-clad fleet armed with the modern rifled gun, and that in fact such a fleet could destroy our torpedo defenses, run past our batteries, and enter any harbor in this country with perfect impunity.

Any system of defense which will effectually avert such a disaster will necessarily involve the employment of both batteries and obstructions. Neither guns nor mines alone can stop a fleet. Without the latter, ships can run by any battery, either by taking advantage of the night or a fog, or, if well protected by armor, can even do so in broad daylight. On the other hand, if the mines are unprotected, their destruction by the enemy is a mere question of time.

EXAMINATIONS AND SURVEYS FOR IMPROVEMENTS, TO COMPLY WITH REQUIREMENTS OF THE RIVER AND HARBOR ACT OF AUGUST 2, 1882.

The following locality was, after preliminary examination, reported by the local engineer as worthy of improvement so as to admit the passage of small vessels, but the work not a public necessity:

1. *Redwood Slough, San Mateo County, California.* (See Appendix O O 8.)

And the following were reported as not worthy of improvement:

1. *Alameda Creek, Alameda County, California.* (See Appendix O O 9.)
2. *Santa Monica Bay, California.* (See Appendix O O 10.)
3. *Clear Lake, Lake County, California.* (See Appendix O O 11.)

IMPROVEMENT OF THE HARBOR OF SAN DIEGO, CALIFORNIA.

Officer in charge, Col. C. S. Stewart, Corps of Engineers.

The object of this improvement is to prevent the deposit in this harbor of the sand and soil brought down during floods by the San Diego River.

A project was formed in 1875 to turn the river back into False Bay, its former outlet. The work was done in 1876. An artificial channel was cut from a point in the river bed near Presidio Hill to a slough from False Bay; the old channel was dammed; and a levee, faced with stone and crossing the valley from bluff to bluff, was built between the artificial water-way and San Diego Bay to retain the overflow during floods.

Thus far the improvement has been a success.

The rainfall the past season has been unprecedented, amounting to 25.97 inches, of which 9.05 inches fell in February. The annual average rainfall heretofore has been but 9.32 inches. The floods have been numerous and high, carrying into the ocean a vast body of materials. The damage by the floods to the work has been slight. The usual injury has been done to the embankment by the burrowing of badgers and the gullying of reverse slopes by surface water. Owing to high water in the river, no repairs have been made.

The cost of extra services during the storms has been $132. The total expenditure from the beginning of the improvement to June 30, 1884, has been $80,372.50.

The amount still available from the appropriation for repairs made in 1879 will probably last for several years.

July 1, 1883, amount available	$759 50
July 1, 1884, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1883	132 00
July 1, 1884, amount available	627 50

(See Appendix P P.)

IMPROVEMENT OF RIVERS AND HARBORS IN OREGON AND WASHINGTON TERRITORY—CONSTRUCTION OF CASCADES CANAL, COLUMBIA RIVER—IMPROVEMENT OF LOWER CLEARWATER RIVER, IDAHO.

Officer in charge, Capt. C. F. Powell, Corps of Engineers, with Lieut. Willard Young, Corps of Engineers, under his immediate orders.

1. *Lower Willamette and Columbia rivers, Oregon and Washington.*—The present project for this improvement was adopted in 1877, and modified in 1879 and 1882, the object being to afford a ship-channel of

20 feet depth at low water. The project consists in a permanent contraction of water-way for improvement of the four bars from Portland to Saint Helen's, Oreg.; in dredging and stirring up the bottom at these bars during construction of permanent works, and also at shoal places below Saint Helen's and in snagging operations.

The natural depth of channel at the shoalest place was about 9 feet, and on six other bars 10½ to 15 feet, at low water.

The amount expended to June 30, 1884, is $505,363.02, and has resulted generally in maintaining a ship-channel of a least depth of 17 to 18 feet at low water from Astoria, near the mouth of the Columbia River, to Portland, 100 miles inland.

Operations during the year consisted mainly of temporary improvement at two places where permanent contraction of water-way had not been commenced; about 29,000 cubic yards were dredged at one place, and about 35,000 cubic yards sluiced at the other. Preservation of permanent works, repairs to the incomplete ones from damage, and minor snagging operations were also conducted. The city of Portland carried on dredging in conjunction with the Government dredging, and in about double the extent of the latter.

The appropriation estimated for, $354,000, is for completion of the permanent structures projected, temporary improvement and preservation during the year, extension of the plan of permanent contraction to the bars below Saint Helen's, and for removal of a rock obstruction; for an explanation of which see report of the Engineer in charge, in Appendix Q Q 1.

The completion of the improvement will dispense with an expensive lighterage and delay now necessary at low stage.

July 1, 1883, amount available		$12,167 85
Amount received by transfer of property to other improvements		600 00
		12,767 85
July 1, 1884, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1883		12,765 87
July 1, 1884, amount available		1 98
Amount appropriated by act approved July 5, 1884		100,000 00
Amount available for fiscal year ending June 30, 1885		100,001 98
Amount (estimated) required for completion of existing project (exclusive of annual expense of temporary improvement and maintenance)		83,635 00
Amount that can be profitably expended in fiscal year ending June 30, 1886, as explained above		354,000 00

(See Appendix Q Q 1.)

2. *Mouth of the Columbia River, Oregon and Washington Territory.*—The plan of this improvement, as required by the act of July 5, 1884, is the construction of a low-tide jetty, about 4½ miles long, from near Fort Stevens, on the South Cape, to a point about 3 miles south of Cape Disappointment. The natural channel is shifting, sometimes good and sometimes poor, but always unreliable. Of late years the channel has carried about 19 feet at low water and for an insufficient width; 26 feet are required on the bar in a wide and direct channel, and 30 feet are desirable on account of the heavy seas of the locality, for the deep vessels needed by the Columbia River trade.

Preceding appropriations have been made for surveys, expenses of a Board of Engineers, and minor temporary improvement. The amount expended therefor is $17,500.

It is expected that the present appropriation will permit the construc-

tion of elevated tramways from the Fort Stevens Landing, along high water, to the point from which the jetty is projected into the breakers; the purchase of plant, including a fleet of sea-going dump-scows; required wharf extension; construction of needed buildings; extensive brush work at the base of Clatsop Spit; and generally preparations for work on the jetty proper.

The appropriation asked for, $500,000, is for building about 1¾ miles of the structure, which it is believed will check a present shifting tendency of the channel southward, increase the channel depth, and give prompt relief to a large and increasing shipping.

July 1, 1883, amount available	$2,965 38
July 1, 1884, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1883	2,965 38
Amount appropriated by act approved July 5, 1884	100,000 00
Amount (estimated) required for completion of existing project	3,710,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1886	500,000 00

(See Appendix Q Q 2.)

3. *Upper Willamette River, Oregon.*—The project for this improvement was adopted in 1870, modified in 1878, and application extended in later years. The object is to afford and maintain an easy light-draught navigation from Portland to Eugene City and on 12 miles of tributaries, making a distance of 184 miles. The work consists in snagging operations, bar scraping, and for the reach between the Willamette Falls and Corvallis, in the contraction of water-way by low cut-off or wing dams and in rock removal. The natural channel from Portland to Willamette Falls, 12 miles, was generally deep and wide; above the falls it was narrow, tortuous, and much obstructed. The mouth of the Yamhill, 28 miles from the falls, was the head of an inconvenient low-water navigation on a draught of 2½ feet; 1 foot only could be carried above. The amount expended to June 30, 1884, is $145,499.46, and has resulted in making and generally keeping an easy channel, with a least depth during the year of 2½ feet to Corvallis, 102½ miles from the falls, and also, except during extreme low stage, to Harrisburg, 34½ miles further. The reach from Harrisburg to Eugene, on account of railroad facilities and difficult access from the farming region to the landings, has been abandoned during late years for navigation.

Limited operations were conducted during the year for one and a half weeks by the snag-boat, and subsequently by a small boat party. Two buoys which had been carried away from Rock Island Rapids were replaced by new ones; gauge readings were taken at four stations during a season of unusually low water.

The amount asked for, $20,000, is to be applied to the construction of a snag-boat and 2,000 feet of low dams, operation of the boat for a year and rock removal, for part completion of the present project and maintenance of the channel for a year.

July 1, 1883, amount available	$196 07	
Amount received by transfer of property to other improvements	126 42	
		$322 49
July 1, 1884, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1883		321 95
July 1, 1884, amount available		54
Amount appropriated by act approved July 5, 1884		10,000 00
Amount available for fiscal year ending June 30, 1885		10,000 54

Amount (estimated) required for completion of existing project (exclusive of annual expense of temporary improvement and maintenance)	33,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1886	20,000 00

(See Appendix Q Q 3.)

4. *Upper Columbia and Snake rivers, Oregon and Washington Territory.*—The plan of this improvement, adopted in 1877, consists in rock removal at numerous rapids, to give channel depths, at low water, of 5½ feet in the Columbia and 4½ in the Snake on a reach of river of 266 miles from Celilo, at the head of the Dalles obstructions on the Columbia, to Lewiston, Idaho, at the junction of the Snake and Clearwater rivers, and was made when the Upper Columbia navigation was confined to that route.

The natural channel was narrow, tortuous, and dangerous, with a swift current and depth at low stage of 2 to 4 feet. On reaches between the rapids the depth is ample, and throughout the banks are stable.

The amount expended to June 30, 1884, is $213,944.97, and has resulted in improvement at fifteen localities. Seven places remain for work under the present project. Contract work was executed during the year at Five-Mile Rapids and at reef next below Five-Mile, on the Snake River. Work at Little Goose Island and Log Cabin Island Rapids, also on the Snake, is included in the present contract, whose expiration is October 31, 1884.

The amount asked for is to complete the present project, requiring $36,000, and to extend the improvements on the Snake River above Lewiston, and on the Columbia River above the mouth of the Snake; for an explanation of which, see report of the engineer in charge.

July 1, 1883, amount available		$5,140 29
July 1, 1884, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1883	$3,085 26	
July 1, 1884, outstanding liabilities	130 57	
		3,215 29
July 1, 1884, amount available		1,924 46
Amount appropriated by act approved July 5, 1884		20,000 00
Amount available for fiscal year ending June 30, 1885		21,924 46
Amount (estimated) required for completion of existing project		36,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1886		36,000 00

(See Appendix Q Q 4.)

5. *Columbia River at the Cascades, Oregon.*—The plan for this improvement, adopted in 1877 and modified in 1880, is to give lockage around the main rapid, and open river navigation through the minor rapids below, for stages, at the foot of the canal, of 20 feet above low water. The plan is arranged for easy extension for higher stages. The canal will be about 3,000 feet long; the low-water lock will have a lift of about 24 feet; the lock capacity will be 90 by 462 feet, with a least draught of 8 feet.

The amount expended to June 30, 1884, is $799,252.10. Work during the year consisted in preparing stone for and laying 4,075 cubic yards of dry squared masonry face and rubble backing in the side wall on the left at upper entrance to the canal, and 2,997 cubic yards of dry stone pavement on the slopes and berm on the left side of the canal; excavating 13,302 cubic yards of material on the canal line, and quarrying about 1,500 cubic yards of bowlders for building stone. Work of river improvement was also conducted, and to the extent of removing 3,160 cubic yards of rock by submerged blasts and breaking and loosening 45,814 cubic yards by drill-hole charges.

The appropriation asked, $500,000, is for guard-gate and part lock

construction, building structures accessory to the canal excavation at the upper entrance to the canal, and for additional river improvement, if required, otherwise on lock construction.

July 1, 1883, amount available		$79,284 07
July 1, 1884, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1883	$73,536 17	
July 1, 1884, outstanding liabilities	50 75	
		73,586 92
July 1, 1884, amount available		5,697 15
Amount appropriated by act approved July 5, 1884		150,000 00
Amount available for fiscal year ending June 30, 1885		155,697 15
Amount (estimated) required for completion of existing project		1,505,397 31
Amount that can be profitably expended in fiscal year ending June 30, 1866		500,000 00

(See Appendix Q Q 5.)

6. *Entrance to Coos Bay, Oregon.*—The present project for this improvement, adopted in 1879, is to build a half-tide jetty or training-dike from near Fossil Point inside of the entrance, for making a deeper and more direct channel across the sea-bar. The natural channel was shifting, usually tortuous, and sometimes with not more than 7 to 8 feet depth at mean lower low water; the mean rise of tide above this plane is 5.6 feet.

The amount expended to June 30, 1884, is $99,977.96, and has resulted in the construction of an incomplete jetty, in deep water, of a length of 1,689 feet, affording during the last three years a straighter and more stable channel. The general effect of the jetty on the sand-spits and on the direction of the ebb has been to partly erode the north spit and to deflect the ebb about one-half from its original direction to that desired.

The appropriation asked for is to be applied in extension of the jetty. It is expected with this amount to make the depth permanent which will have been gained and to further improve the channel direction, giving much benefit to a large and increasing coasting trade.

July 1, 1883, amount available	$2,812 37	
Amount received by transfer of property to other improvements	2,400 00	
		$5,212 37
July 1, 1884, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1883		5,190 33
July 1, 1884, amount available		22 04
Amount appropriated by act approved July 5, 1884		30,000 00
Amount available for fiscal year ending June 30, 1885		30,022 04
Amount (estimated) required for completion of existing project		470,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1886		150,000 00

(See Appendix Q Q 6.)

7. *Entrance to Yaquina Bay, Oregon.*—The project for this improvement, adopted in 1879, is to build a jetty 3,700 feet long on the south side of the entrance for closing the south channel and making a permanent central channel of a depth of not less than 12 feet at mean lower low water. The mean rise of tide is 7.1 feet. Of three natural shifting channels the best one gave a depth from 7 to 9 feet reduced, the two others are obstructed by rock.

The amount expended to June 30, 1884, is $109,990.01. A brush

much obstructed by drift and at places closed by jams. The amount expended to June 30, 1884, is $2,982.44, and has resulted in partly opening a channel, on a length of about 42 miles down-stream, from the Chehalis Indian Reservation Landing to Montesano, the head of coasting navigation. This was done last year by an experienced party working from small boats and from shore. Two jams and two drift-heaps were broken and many snags removed, making a total of 1,611 pieces of drift removed.

The appropriation asked is to continue the snagging begun and to extend operations to the mouth of the Chehalis and up-stream to Claquato, and on a few miles of tributaries.

July 1, 1883, amount available	$2,904 45
July 1, 1884, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1883	2,886 89
July 1, 1884, amount available	17 56
Amount appropriated by act approved July 5, 1884	2,500 00
Amount available for fiscal year ending June 30, 1885	2,517 56
Amount (estimated) required for completion of existing project	5,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1886	5,000 00

(See Appendix Q Q 11.)

12. *Lower Clearwater River, Idaho.*—The present project, adopted in 1878, is to make a channel through the rock reefs and cobble-stone bars from Lewiston, at the mouth of the river, to the North Fork, a distance of 40 miles, of 4 feet depth at low stage, and of a navigable width for small steamers. The natural channel was impracticable for boats and difficult for rafts. The amount expended to June 30, 1884, is $15,000, and has resulted in improvement more or less complete at Reuben's Rapids, Kent's Chute, and Big Eddy Rapids, on the lower 30 miles.

Work during the year was at Reuben's Rapids; 154.48 cubic yards of solid rock were removed.

The appropriation asked is for continuation of the work.

July 1, 1883, amount available	$4,395 23
July 1, 1884, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1883	4,395 23
Amount (estimated) required for completion of existing project	19,434 00
Amount that can be profitably expended in fiscal year ending June 30, 1886	20,000 00

(See Appendix Q Q 12.)

13. *Gauging waters of the Columbia River and principal tributaries.*—A self-registering gauge was operated at Astoria during July, August, and September, and record of reports of pilots made, to test the value of the gauge record in measuring the bar condition. From a study of the observations, in connection with others on the adjoining coast, it is reported that a definite relation exists between the tide-gauge curve and the movements of the sea volume other than tidal movements, and that this relation furnishes an indication of the state of the bar with regard to its roughness.

The appropriation asked for ($5,000) is for the ordinary Astoria gauge service; for giving information about the bar to pilots, masters, and fishermen calling for it; to establish water-gauges at points above Astoria, on the Columbia and principal tributaries, and to gauge the river's outflow.

July 1, 1883, amount available	$48 52
July 1, 1884, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1883	48 33
July 1, 1884, amount available	19
Amount appropriated by act approved July 5, 1884	1,000 00
Amount available for fiscal year ending June 30, 1885	1,000 19
Amount that can be profitably expended in fiscal year ending June 30, 1886	5,000 00

(See Appendix Q Q 13.)

EXAMINATIONS AND SURVEYS FOR IMPROVEMENTS, TO COMPLY WITH REQUIREMENTS OF THE RIVER AND HARBOR ACT OF AUGUST 2, 1882.

The following locality was, after preliminary examination, reported by the local engineer as not worthy of improvement, and the work not a public necessity:

1. *Humptuleps River, Washington Territory.* (See Appendix Q Q 14.)

And the following as worthy of minor improvement, but work not a public necessity:

2. *Lewis River, Washington Territory.* (See Appendix Q Q 14.)
3. *Dwamish River, Washington Territory.* (See Appendix Q Q 14.)

EXAMINATIONS, SURVEYS, AND CONTINGENCIES OF RIVERS AND HARBORS.

For examinations and surveys for improvements, and for contingencies, and for incidental repairs of harbors for which there is no special appropriation, an appropriation of $150,000 should be made, of which sum $50,000 for surveys and $100,000 for contingencies, including incidental repairs of harbors.

MAINTENANCE AND REPAIRS OF WASHINGTON AQUEDUCT—INCREASING WATER SUPPLY OF THE CITY OF WASHINGTON—ERECTION OF FISH-WAYS AT THE GREAT FALLS OF THE POTOMAC.

Officer in charge, Maj. G. J. Lydecker, Corps of Engineers, with Capt. R. L. Hoxie and Capt. T. W. Symons, Corps of Engineers, under his immediate orders.

1. *Washington Aqueduct.*—The appropriation for the year was $20,000, of which one-half was contributed from the revenues of the District of Columbia. It has been applied to the usual routine work necessary for the care and preservation of the aqueduct and its accessory structures.

The consumption of water in twenty-four hours, as measured on the 27th of June, was 24,827,013 gallons, being about the same as that shown by the measurements made in June, 1883, and 5,000,000 gallons less than for 1882.

The following is a money statement for the fiscal year ending June 30, 1884:

Amount available July 1, 1883		$20,000 00
Amount expended during the year	19,724 61	
Outstanding liabilities June 30, 1884	275 39	
		20,000 00

The amount required for the fiscal year ending June 30, 1886, is $22,000, being $2,000 in excess of the last appropriation. Experience has