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PRESENT STATUS OF TOPOGRAPHIC MAPPING IN WASHINGTON

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The mapping program of Washington must be considered with that of the whole United States. The work carried on here is not a special variety applicable to this state alone but is similar to that being done throughout the entire country. So any discussion of our mapping progress must, for proper understanding, be founded on the national program, and due consideration must be given to the aims and problems of those responsible for the country-wide map.

Topographic or three-dimensional maps are the standard base maps of the United States. They show with the highest degree of practical accuracy the horizontal relationship between physiographic features of the earth's surface and, by means of contours, their vertical extent. They show, in addition, all of the more prominent cultural features, such as roads and trails, railways, mines, and buildings. The physiographic portion is unchanging and is accurately located for all time; the culture is constantly changing, so that part of the map is occasionally revised for later editions. The size of the map, the symbols used in designating the various data, the coloring, and the lithography all conform to a set design that is uniform for the whole country. The separate maps are called quadrangles, and each represents an area of 15 or 30 minutes of latitude and longitude; they are units in the mosaic which will represent the entire United States.

It was realized long ago that the results of exploration were of little use unless plotted on an accurate map, yet it was not until 1889 that a standard map was planned and started. The United States Geological Survey was established in 1879 in order to more systematically explore the country and investigate its mineral resources. To carry on this work and to put the results before the public, topographic maps were vitally necessary, so ten years after the founding of the Survey Congress authorized the initiation of the mapping work which has been carried on steadily ever since.

There has been scant demand of a general public nature for mapping, and in consequence appropriations have always been small. It is probable that about 50 per cent of the country is still unmapped, and at the present rate of progress it may be another hundred years before topographic maps of present-day accuracy are available for every locality. This length of time is due partly to the fact that only about one-half of the completed maps are up to present standards, - the earlier ones were made by reconnaissance methods and, although extremely useful, are not on a par with the later mapping.

To expedite this work and save some of the enormous waste incident to working in unmapped regions, there has come a more and more concerted effort to force the completion of our mapping program within a reasonable time. In 1919 a conference of Federal map-making agencies resulted in a plan being proposed whereby a general utility topographic map of the country would be completed in 13 years. The map was not made, but one result of great importance from this meeting was the appointing at that time of a Board of Surveys and Maps to coordinate all of the mapping activities of the Government. This Board, aided by an advisory council composed of representatives from non-Federal map-using agencies, has studied the use of and need for topographic maps by Government and industry and has drawn up constructive programs for national mapping.

In 1922 the results of the Board's investigations were made public and, later sponsored by that organization, the Temple Act was passed by Congress. That legislation of 1925 called for the completion of mapping in 20 years at an estimated cost of \$37,200,000 to the Federal Government and \$12,000,000 to the States, or a total of \$49,200,000. It was pointed out that this was hardly more than the cost of one battleship, which would soon become obsolete. But funds were not provided and the Act was inoperative.

The Board has continued to function and now includes representatives from 23 map-making and map-using agencies of the Government. These are:

- Corps of Engineers (War Department)
- Coast and Geodetic Survey (Commerce Department)
- Geological Survey (Interior Department)
- General Land Office (Interior Department)
- Division of Topography (Post Office Department)
- Bureau of Soils (Agriculture Department)
- Bureau of Reclamation (Interior Department)
- Bureau of Public Roads (Agriculture Department)
- Office of Indian Affairs (Interior Department)
- Mississippi River Commission (War Department)
- Lake Survey (War Department)
- Forest Service (Agriculture Department)
- International (Canada) Boundary Commission (State Department)
- Hydrographic Office (Navy Department)
- Military Intelligence Department, General Staff (War Dept.)
- Federal Power Commission
- Air Corps (War Department)
- Bureau of Aeronautics (Navy Department)
- Aeronautics Branch (Commerce Department)
- Bureau of Foreign and Domestic Commerce (Commerce Dept.)
- Geographic Section (State Department)
- Division of Maps (Library of Commerce)
- Bureau of Lighthouses (Commerce Department)

In the study that has been made to determine the real use of topographic maps and the benefits to commerce, industry, and Government of a completed mapping program, some very interesting and pertinent facts have been brought out. The United States Geological Survey is mapping as fast as available funds will permit, but this is not fast enough for the special needs of many government agencies and private concerns. So these, of necessity, must engage in mapping in addition to their regular work. This means a duplication of effort and expense that would be obviated if one agency were in charge of all mapping. The War Department must have accurate maps in order to plan for the protection of the country; if not available, the Corps of Engineers must prepare them. The Geological Survey is dependent on maps in classifying the public lands, determining geologic structures, and cataloguing our mineral resources. The Forest Service cannot function without maps and must make their own if standard topographic sheets are not on hand. The Bureau of Chemistry and Soils must start with maps in soil classification. Highway construction has taken approximately a billion dollars a year since the World War. This work often requires a comparison of several routes with consequent surveying that would be largely unnecessary if topographic maps were available. It has been said that if our highway construction cost 1 per cent more without topographic maps than with them, the difference in ten years would be almost the equivalent of the cost of completing the topographic mapping of the country. Similar things may be said with regard to reclamation, aeronautics, water power development, and many other services and activities of present day civilization.

The latest result of the fine work of the Board of Surveys and Maps was the plan submitted in 1934 to the National Resources Board of the Federal Government which called for the completion of the standard topographic map within a period of 10 years. Under this plan aerial photography would be called to the aid of usual topographic methods. The unmapped or inadequately mapped agricultural lands of the United States would be mapped on the scale of 1 inch to the mile, and planimetric and advance contour maps would be made available on varying scales for certain areas. The unmapped and inadequately mapped areas of minor economic importance, such as rugged mountains and sparsely settled deserts, would be mapped in final form on the scale of one-half inch to the mile. The total estimated cost, including resurvey of inadequately mapped areas, and purchase of instruments and trucks, was:

Control surveys	\$20,200,000
Aerial photography	5,540,000
Planimetric mapping	21,486,000
Contour mapping	60,722,000
Reproduction	<u>9,583,000</u>

Total	\$117,531,000
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This involved the mapping of 2,200,000 square miles at an average cost of \$54 per square mile, or about 8 cents per acre, to be borne entirely by the Federal Government. The horizontal control would be completed in 6 years, the planimetric mapping in 7 years, the vertical control in 8 years, and the final contouring in 10 years. This would be so arranged that certain areas, where maps were requested by governmental agencies, would have first priority and would be completed in 2 years; other areas would have second priority and would be finished in 5 years; and the remainder would be mapped in 10 years.

The plan has the endorsement of all the principal agencies of the Government who make or use maps as well as the enthusiastic backing of map users in the professions and industry. It is not in operation; although the United States Geological Survey applied for funds this biennium to provide for the first year, the application was disapproved because unfeasible under the present relief program. In the meantime Federal mapping in Washington and throughout the United States is progressing slowly under the only system possible with low appropriations.

Washington State has kept pace with the rest of the country in topographic mapping, and the situation here is normal among States. The Snohomish quadrangle was surveyed in 1893-4-5, being started only four years after the United States Geological Survey first began mapping. The Tacoma quadrangle was surveyed in 1894-5, and these were followed by the Portland, Mt. Stuart, Methow, Glacier Peak, Chelan, St. Ilaguamish, Spokane, and later quadrangles. Some of these earlier maps were surveyed by less exact methods than prevail now and are scheduled for remapping. The work has progressed more or less steadily ever since its beginning, and, at the present time the State has about 52.5 per cent of its area mapped.

Beginning with 1909 the State began cooperating with the Government in the mapping program. Under that plan the State provides a certain amount of money which is matched by Federal funds, and topographic work is carried on in addition to that which is being done by the Government alone. Thirty and one-half 30-minute quadrangles and twelve and one-half 15-minute quadrangles have been surveyed by the Federal Government. Ten 30-minute and sixteen 15-minute quadrangles have been surveyed in cooperation with the State. This completed work totals, on the basis of 30-minute areas, 37 per cent Federal and 15.4 per cent cooperative work.

At present, five 30-minute quadrangles and minute quadrangles are in the process of being mapped; this is

7.4 per cent of the total in the State and leaves about 40.0 per cent yet to be mapped. Those soon to be finished include LaPush, Hoh Head, Spruce Mountain, Mount Tom, and Mount Olympus quadrangles, all lying west of the Olympics and being surveyed by the Army using aerial photography to supplement ground work; Mount Constance quadrangle, in the heart of the Olympics; Fort Simcoe quadrangle, in the Yakima region; Marcus Metaline, and Newport, to the north of Spokane; and the Olympia and Troutdale quadrangles, on the west side of the Cascades. The last two are joint projects but differ from the usual cooperative mapping in that their field work, with the exception of Federal supervision, was paid for by the State as a relief measure. The other quadrangles are entirely Government projects and State funds are not being used, although the first work on the Newport quadrangle, in 1930, was cooperative. The Olympia, Troutdale, Metaline, Fort Simcoe, and Mount Constance quadrangles have had their field work finished and the maps are nearly ready for distribution. Field work is about one-tenth through in the Marcus quadrangle, but has been temporarily discontinued due to disbursement limitations under relief scales governing most Federal mapping. The Newport quadrangle is about one-third through and is being continued since a special allocation is being made for that mapping. The other quadrangles west of the Olympics have had all aerial work finished and ground work is in progress.

The cost of this surveying, of course, varies greatly with the relief of the various localities. Of 30-minute areas, the most expensive to map are those in the rugged mountains such as the Olympics and northern Cascades. Approximately \$18,000 was required for the Mount Constance quadrangle. The Chehalis quadrangle was about \$14,500 and represents an intermediate and average area, so far as cost is concerned. The Connell quadrangle of southeastern Washington was \$12,800 and is representative of the least expensive areas in the State to map. These figures are for 30-minute areas, on a scale of 1:125,000 (one-half inch to the mile) and with a 50 or 100-foot contour interval. Fifteen minute quadrangles are on the scale of 1:62,500 (1 inch to the mile) and have a contour interval of 20 or 25 feet; they cost approximately double that of 30-minute quadrangles for the given area.

The satisfactory future of topographic surveying in Washington is sure enough, but the length of time necessary to complete the whole region is dependent on many changing circumstances. The appropriation for the United States Geological Survey for the new fiscal year, starting June 30, 1935, was \$400,000 for topographic surveys and \$110,000 for topographic and geologic maps. Appropriations have been made also for continuing the work of the Coast and Geodetic Survey, which is engaged in completing a 25-mile level and triangulation net, upon which the topographic surveying is based. It is reasonable to presume that steady progress will be made on the extremely important mapping program, and there is the very probable chance

that the ten-year plan of the Board of Surveys and Maps will be put in operation. Washington may not be in the enviable position of some States in having its standard map completed; but the most necessary quadrangles are completed, or soon will be, and the rest of the areas will be mapped just as soon as funds are available.

Washington Topographic Quadrangles

Quadrangle	Year	Size (Min.)	Mapped	Unmapped	Mapping	Remarks
Allyn		15		X		
Anderson		15		X		
Anacortes		15		X		
Arlington	1912-13	30	X			$\frac{1}{2}$ in Wash. (a)
Asotin		30		X		
Astoria		30		X		
Bacon		15		X		
Beverly	1909-10	15	X			(a)
Bissell		30		X		
Blaine	1905	15	X			Practically 20'
Blacklock Island	1906	30	X			$\frac{1}{4}$ in Wash. (b)
Cape Elizabeth		30	1/8	7/8		
Cape Flattery		15		X		
Cathlamet		30		X		
Cedar Lake	1910-11	30	X			(a)
Chehalis	1913-14	30	X			(a)
Chelan	1897-98	30	X			
Chewelah	1924-27	30	X			
Chiwaukum	1900-01	30	X			
Chopaka	1902-03	30	X			
Clallam		15		X		
Colockum Pass	1919-20	$\frac{1}{2}$ of 30	X			(a)
Colville	1927-29	30	X			
Connell	1916	30	X			(a)
Corfu	1921	15	X			
Coulee City		30	$\frac{1}{4}$	$\frac{3}{4}$		
Coupeville		15		X		
Coyote Rapids	1913-14	15	X			(a)
Dalles (The)		30		X		$\frac{1}{2}$ in Wash.
Davenport		30		X		
Destruction Isl.		15		X		
Dungeness		15		X		
East Harbor		15		X		
Eatonville		30	X			
Ellensburg	1899	30	X			
Elk Park		15		X		
Ephrata		15		X		
Fidalgo		15		X		
Ft. Simcoe		30			X	
Friday Harbor		15		X		
Gate		30		X		
Gig Harbor		15		X		
Glacier Peak	1897-99	30	X			
Goldendale		30		X		$\frac{1}{2}$ in Wash.
Hanford	1922	15	X			

Washington Topographic Quadrangles - continued.

Quadrangle	Year	Size (Min.)	Mapped	Unmapped	Mapping	Remarks
Hoh Head		15			X	
Hood River	1925-26	30	X			$\frac{1}{8}$ in Wash.
Hoquiam	1911-12	15	X			(a)
Humptulips		30	1/8	7/8		
Jamezon		30		X		
Kalama		30		X		
Kanaka Bay		15		X		
Keller		30		X		
Lake Crescent	1918	15	X			(a) (c)
LaPush		15			X	
Malaga	1911-12	15	X			(a)
Marblemount		30		X		
Marcus		30			X	
Mazama		30		X		
Metaline		30			X	
Methow	1897+99	30	X			
Montesano		30	1/8	7/8		
Moses Lake	1910	15	X			(a)
Mt. Adams	1903-04	30	X			
Mt. Aix	1900-02	30	X			
Mt. Baker	1907+09	30	X			
Mt. Constance		30			X	
Mt. Hood and vicinity	1909-11	35				(d)
Mt. Olympus		15			X	
Mt. Rainier	1924	30	X			
Mt. Rainier Nat. Park						(e)
Mt. St. Helens	1913-14 and 16	30	X			
Mt. Stuart	1896-97	30	X			
Mt. Tom		15			X	
Mt. Vernon	1909	30	X			(a)
Newport		30			X	
Oakesdale	1903	30	X			
Ocean Park		15		X		
Ocosta	1913	15	X			(a)
Okanogan	1903	30	X			
Olympia		15			X	
Omak Lake		30		X		
Osoyoos	1902	30	X			
Othello	1922	15	X			
Ozette Lake		15		X		
Pacific Lake NW $\frac{1}{4}$		15		X		
Pacific Lake NE $\frac{1}{4}$		15		X		
Pacific Lake SE $\frac{1}{4}$		15		X		
Palisades		15		X		
Pasco	1904+14	30	X			(a)
Pierce		15		X		

Washington Topographic Quadrangles - continued.

Quadrangle	Year	Size Min.	Mapped	Unmapped	Mapping	Remarks
Pleasant Lake		15		X		
Point Hanson		15+		X		3/2 of 15'
Point Misery		15		X		
Point Roberts		15		X		
Pomeroy		30		X		
Port Angeles	1917	15	X			(c)
Port Crescent	1917-18	15	X			(a)
Port Gamble		15		X		
Portland	1896	15	X			1/2 in Wash.
Port Orchard		15		X		
Port Townsend		15		X		
Priest Rapids	1913-14	15	X			(a)
Prosser	1915	30	X			(a)
Pullman	1903-05	30	X			
Pysht	1918	15	X			(a) (c)
Queets		15		X		
Quilcene		15		X		
Quincy	1909	15	X			(a)
Reardon		30		X		
Red Rock	1909	15	X			(a)
Republic	1901	30	X			
Richardson		15		X		
Riparia NE 1/4		15		X		
Riparia SE 1/4		15		X		
Riparia SW 1/4		15		X		
Ritzville		30		X		
Rock Lake		30		X		
Samish Lake	1917	15	X			(c)
Schrag	1923	15	X			
Scooteny Lake	1922	15	X			
Seattle	1893	15				(f)
Shelton		30		X		
Skykomish	1897 & 1902	30	X			
Slate Pass		30		X		
Snohomish	1893-95	30	X			Includes 15' Seattle quad.
Snoqualmie	1900-01	30	X			
Spokane	1898	30	X			
Spruce Mt.		15			X	
St. Helens N. 1/2		30	X			5/8 in Wash.
Steamboat Mt.	1924-26	30	X			

Washington Topographic Quadrangles - continued.

Quadrangle	Year	Size (Min.)	Mapped	Unmapped	Mapping	Remarks
Stehekin	1901-02	30	x			
Stilaguamish	1897-99	30	x			
Sultan	1919-21	30	x			(a)
Sumas	1906	15	x			
Troutdale SE $\frac{1}{4}$	1909-11	15	x			Included in Mt. Hood & vicinity
Troutdale, SW $\frac{1}{4}$		15			x	
Troutdale, N $\frac{1}{2}$		30		x		
Tacoma	1894-95	30	x			
Umatilla	1907	30	x			1/8 in Wash. (b)
Van Zandt	1917-18	15	x			(a) (c)
Walla Walla	1916-19	30	x			(a)
Wallula	1915	30	x			(a)
Washtucna	1923	15	x			
Wenatchee	1911-13	15	x			(a)
Wheeler	1923	15	x			
Wickersham	1917-18	15	x			(a) (c)
Wilbur		30		x		
Wilson Creek		15		x		
Winchester	1909	15	x			(a)
Winona		30		x		
Yakima		30		x		
Zillah	1906	30	x			

- (a) Cooperation with State of Washington.
 (b) Cooperation with State of Oregon.
 (c) Cooperation with War Department.
 (d) See Troutdale, SE $\frac{1}{4}$.
 (e) See Mt. Rainier.
 (f) See Snohomish.

Progress Summary

	Quads.	Quads.	On basis of 30' quads.	
	30'	15'	No. of quads.	Per cent.
Mapped (Federal Cooperative with State Total)	30 $\frac{1}{2}$	12 $\frac{1}{2}$	33.6	37.0
Unmapped	10	16	14	15.4
Mapping	40 $\frac{1}{2}$	28 $\frac{1}{2}$	47.6	52.5
Total	27	37 $\frac{1}{2}$	36.4	40.1
	5 $\frac{1}{2}$	7	6.7	7.4
	72 $\frac{1}{2}$	73	90.7	100.0