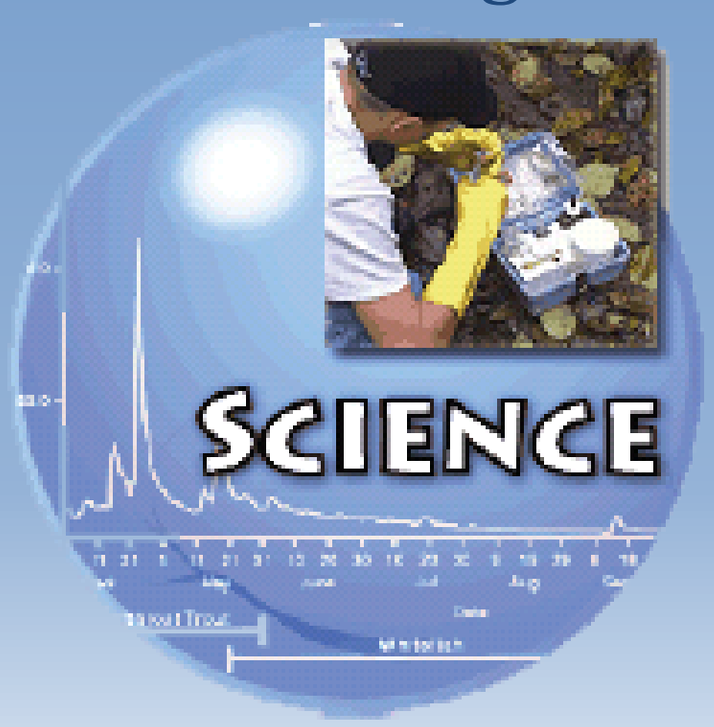
Selecting A Dam Site

Where Geometry, Physics, and Ecology Converge



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Dam Engineering

- Higher dams generate more electricity because the water is travelling faster through the turbines.

- Higher and wider dams require more concrete to build, so they are more expensive.

- Higher and wider dams result in larger reservoir surface areas, which drowns out more forest and ecosystem area.

- Higher dams make for larger and more expensive fish ladders.

- Shorter, but wider dams are easier to construct and build fish ladders for.

How Tall Can Dams Be Built?

World's Highest Dams

Order	Name	River	Country	Type	Height(m)	Year Completed
1	Kogun	Vakhah	Russia	E-R	335	UC
2	Nurek	Vakhah	Tajikistan	E	300	1980
3	Grand Dixence	Dixence	Switzerland	G	285	1961
4	Inguri	Inguri	Georgia	A	272	1980
5	Chicoasen	Grijalva	Mexico	R	261	1980
6	Tehri	Bhagirathi	India	E-R	261	UC
7	Kishau	Toas	India	E-R	253	UC
8	Ertan	Yalong Jiang	China	A	245	UC
9	Sayano-Shushensk	Yenisei	Russia	A	245	UC
10	Guavio	Guavio	Colombia	R	243	UC

Type: E = Earthfill, R = Rockfill, E-R = Earth and Rockfill, G = Gravity, A = Arch
UC, under construction
Source: National Performance of Dams Program/Stanford University at http://npdp.stanford.edu/ and the U.S. Committee on Large Dams Register of Dams

World's Largest Hydropower Projects

Order	Name	River	Country	Capacity (MW)	Year Completed
1	Itaipu	Parana	Brazil/Paraguay	12,600	1983
2	Guri	Caroni	Venezuela	10,300	1986
3	Sayano-Shushensk	Yenisei	Russia	6,400	1989
4	Grand Coulee	Columbia	USA	6,180	1942
5	Krasnoyacsk	Yenisei	Russia	6,000	1968
6	Church Falls	Churchill	Canada	5,428	1971
7	La Grande 2	La Grande	Canada	5,328	1979
8	Bratsk	Angara	Russia	4,500	1961
9	Ust-Ilim	Angara	Russia	4,320	1977
10	Tucurui	Tocantins	Brazil	3,960	1984

Source: National Performance of Dams Program/Stanford University at http://npdp.stanford.edu/ and the U.S. Committee on Large Dams Register of Dams

Dams generally can not exceed 1000 feet in height, due to the enormous pressure of the water on the concrete walls

Skykomish River Watershed

- The Skykomish River in Western Washington is one of the last major undammed rivers in the Pacific Northwest.

- It is home to some large salmon runs, although they have to be trucked past the three waterfalls on the South Fork because those were natural obstructions to migrating salmon.

- The headwaters of the river originate in high alpine wilderness areas of the Cascade range including the Wild Sky, Alpine Lakes, and Henry M. Jackson wildernesses.

Your Mission

- Examine the topographic maps of the Skykomish River Watershed and make a selection for the dam site. Your goal is to supply electricity to at least 100,000 homes.

Selection Criteria

- Try to maximize electricity production by maximizing the height of the dam.
- You can generate the same electricity of 1 foot of dam height for every 5 feet of width.

In your electricity calculations use: Each section that is 5 feet high and 1 foot across = 1 KW of electricity

1000 kilowatts = 1 megawatt and 1 megawatt powers approximately 800 homes

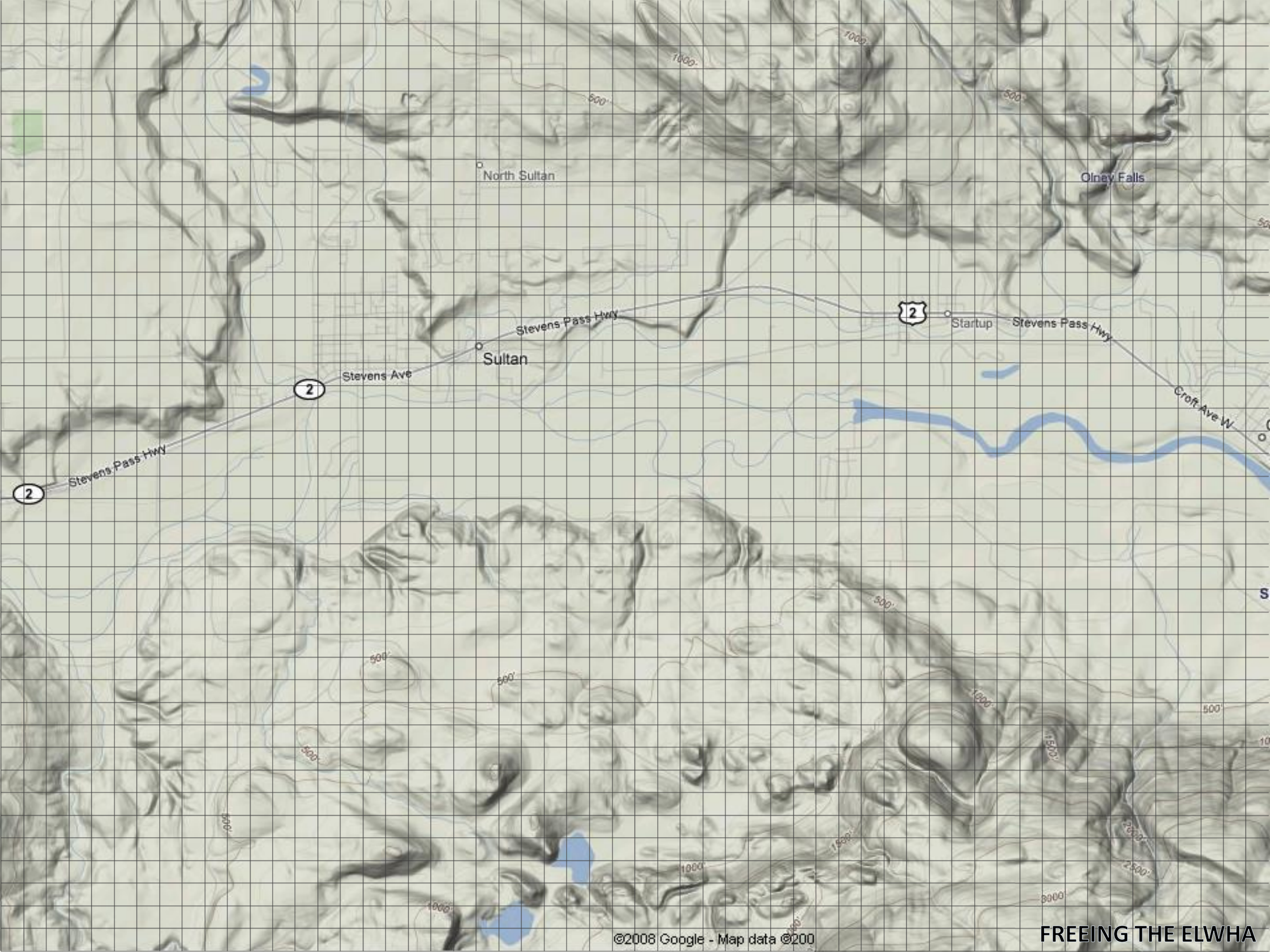
- However, the dam needs to minimize the area drowned by the reservoir.
- Your dam can not exceed 1,000 feet in height.

- Once the dam site is selected, draw the dam on the topographic map, draw the reservoir that will fill the valley, and calculate the reservoir surface area.

- The winner will be the team with the lowest Reservoir:Electricity ratio (ft^2/MW)

- Each grid square represents 1000 feet by 1000 feet or 1,000,000 ft^2

Skykomish River Watershed



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Galena

Ragged Ridge

Snowslide Gulch

Iron Mountain

North Fork Skykomish River

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Jumpoff Ridge

Heybrook Ridge

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Wallace Falls State Park

Wallace Falls

Lake Isabel

May Creek

North Fork Skykomish River

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Heybrook Mountain

Sunset Falls

Canyon Falls

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North Fork
Skykomish
River

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Heybrook
Ridge

Jumpoff
Ridge

Heybrook
Mountain

Sunset Falls

Canyon
Falls

Bridal
Veil Falls

Lake
Serene

Philadelphia
Mountain

Mt Index

South Fork
Skykomish
River

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NE Stevens Pass Hwy

2

Grotto

Miller River

NE Stevens Pass Hwy

2

Skykomish

NE Stevens Pass Hwy

2

Temple Mountain

Cleveland Mountain

Sobieski Mountain

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Beckler Peak

Miller River

NE Stevens Pass Hwy

Skykomish

NE Stevens Pass Hwy

NE Stevens Pass Hwy

Temple Mountain

Sobieski Mountain


Delberts Ridge
Stevens Pass
Big C Mount
Stevens Hwy
The Barrier
Cowboy Mountain
Windy Mountain
Deception Falls
NE Stevens Pass Hwy
2
FREEING THE ELWHA


Mt Fernow
Alpine Baldy
Roberts Ridge
Windy Mountain
Stevens Hwy
The Barrier
NE Stevens Pass Hwy
Alpine Falls
Deception Falls
NE Stevens Pass Hwy
2
2
2

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Valhalla
Lichtenberg Mountain
Mountain
Dalberts Ridge
Stevens Pass
Big Chief Mountain
Windy Mountain
Stevens Hwy
The Barrier
Cowboy Mountain
Josephine Lake
NE Stevens Pass Hwy
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Heybrook
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Canyon
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Merchant
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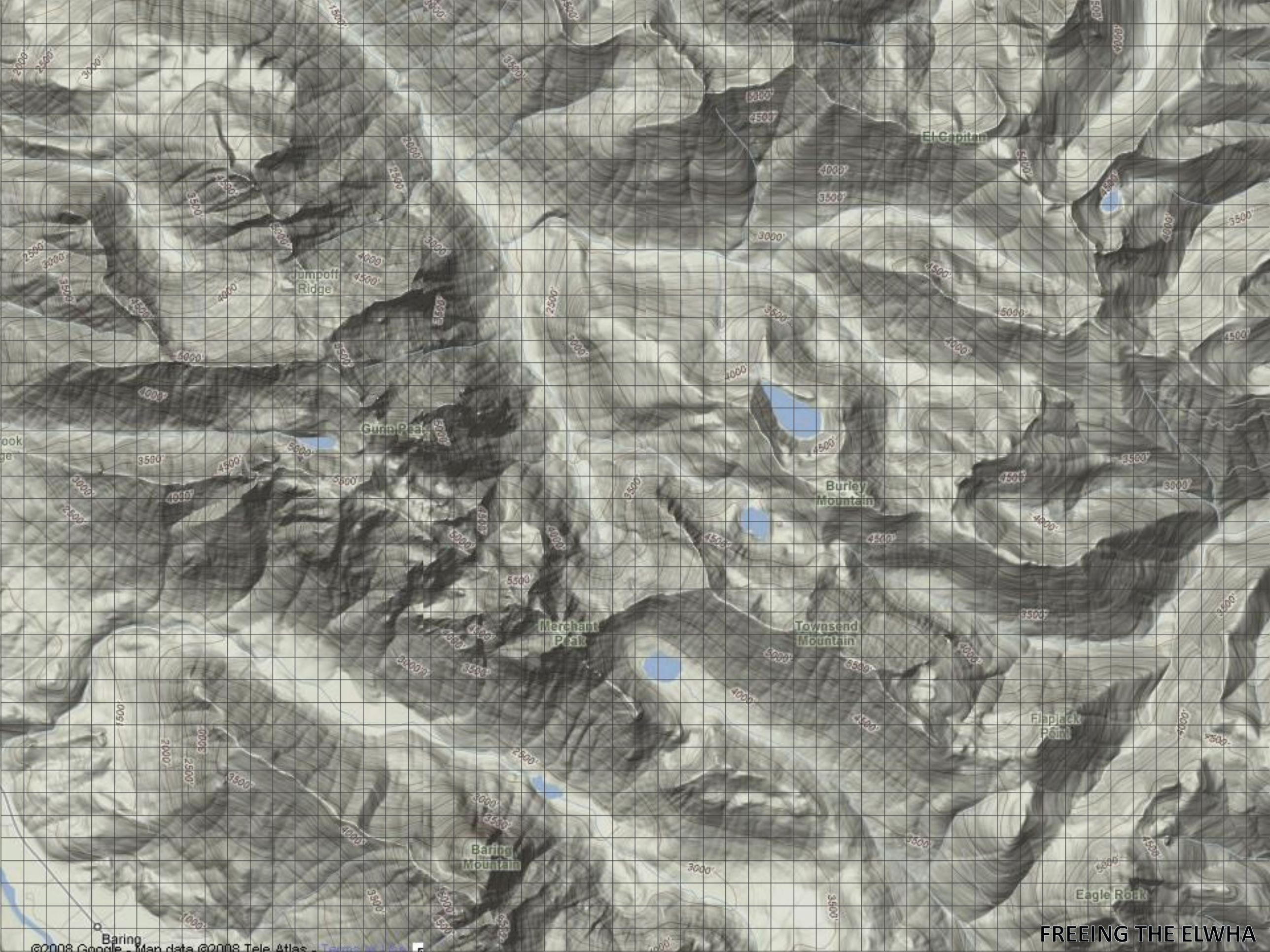
Veil Falls
South Fork
Skykomish
River
Lake
Serene
Philadelphia
Mountain
Baring
Mountain
Baring
2
2
FREEING THE ELWHA


Jumpoff Ridge
Gunn Peak
El Capitan
Burley Mountain
Merchant Peak
Townsend Mountain
Flapjack Point
Eagle Rock
Baring Mountain
Baring
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Galena

Ragged Ridge

Snowslide Gulch

Iron Mountain

North Fork Skykomish River

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Jumpoff Ridge

Heybrook Ridge

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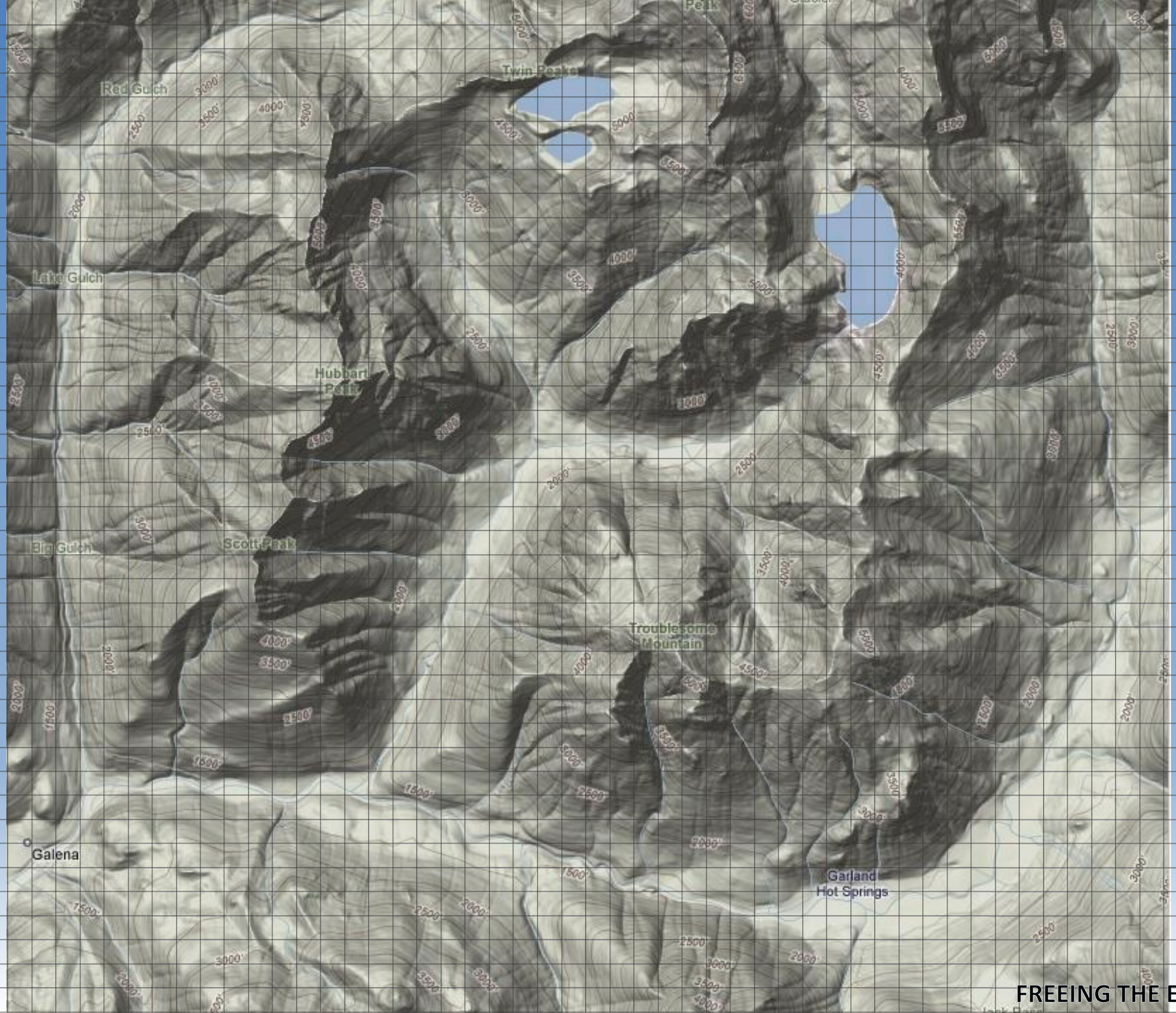
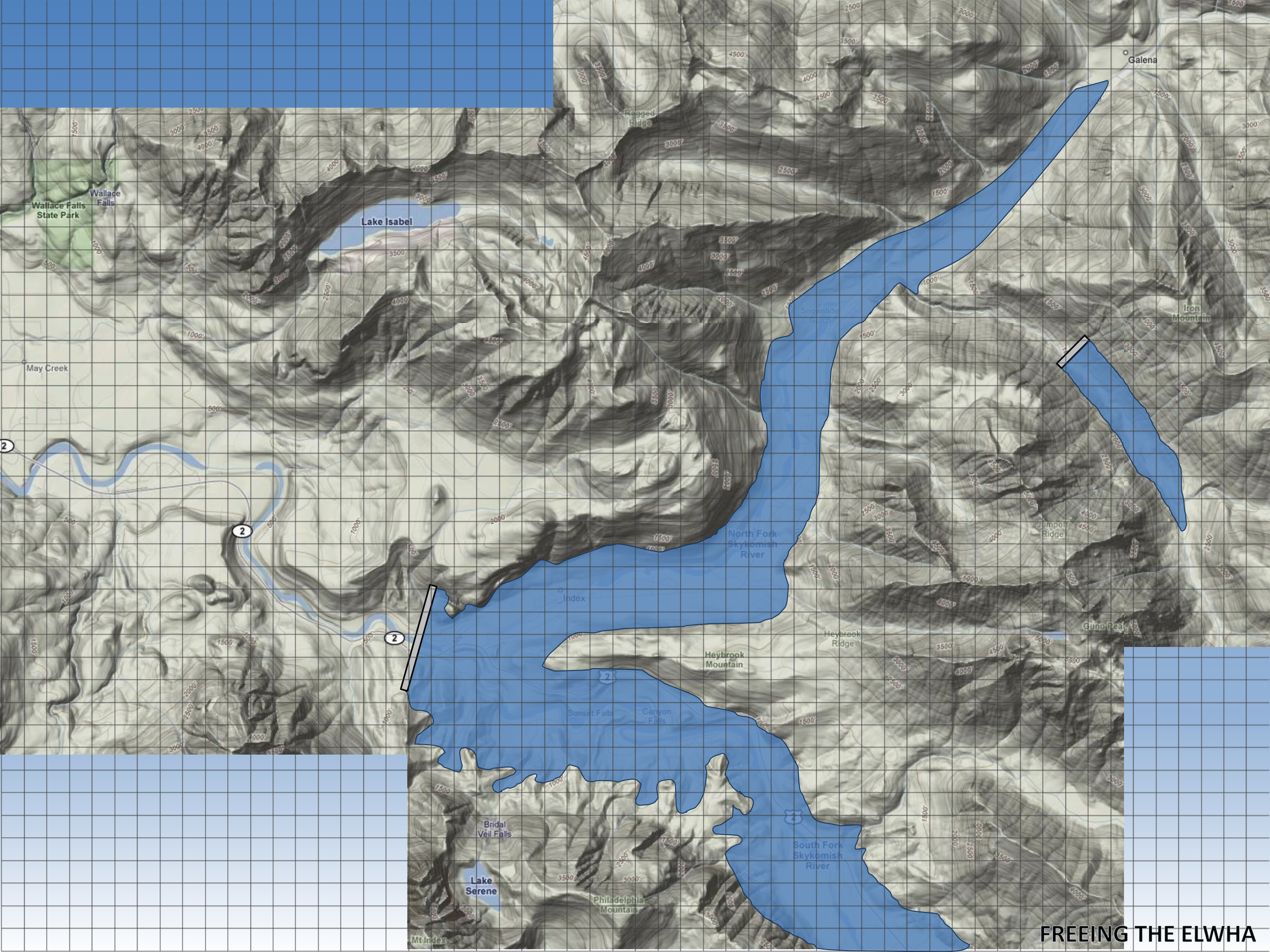

Red Gulch
Twin Peaks
Lake Gulch
Hubbart Peak
Big Gulch
Scott Peak
Troublesome Mountain
Galena
Garland Hot Springs

Examples

- The following slide shows two potential dam sites.
- Site 1 is located near the confluence of the North and South Forks of the Skykomish River. It is 500 feet high and 5000 feet across.
- Site 2 is located on Trout Creek, a tributary of the North Fork Skykomish River. It is 500 feet high and 1500 feet across.
- Each grid square is 1000x1000 feet (1,000,000 ft^2).
- The area of the reservoir can be calculated by counting all of the grid squares within the reservoir. For a grid square that is not wholly in the reservoir, count it if more than 50% of it is water. If less than 50% is in water, do not count it.



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Example Answers

- Site 1 is 500 feet tall and 5,000 feet across. Thus, it contains a surface area of 2,500,000 ft^2, which is = 500,000 5x1 segments.
- Each 5x1 section generates 1KW for a total of 500MW. That's 400,000 homes.

- Site 1 impounds 211 sections for a surface area of 211,000,000 ft^2

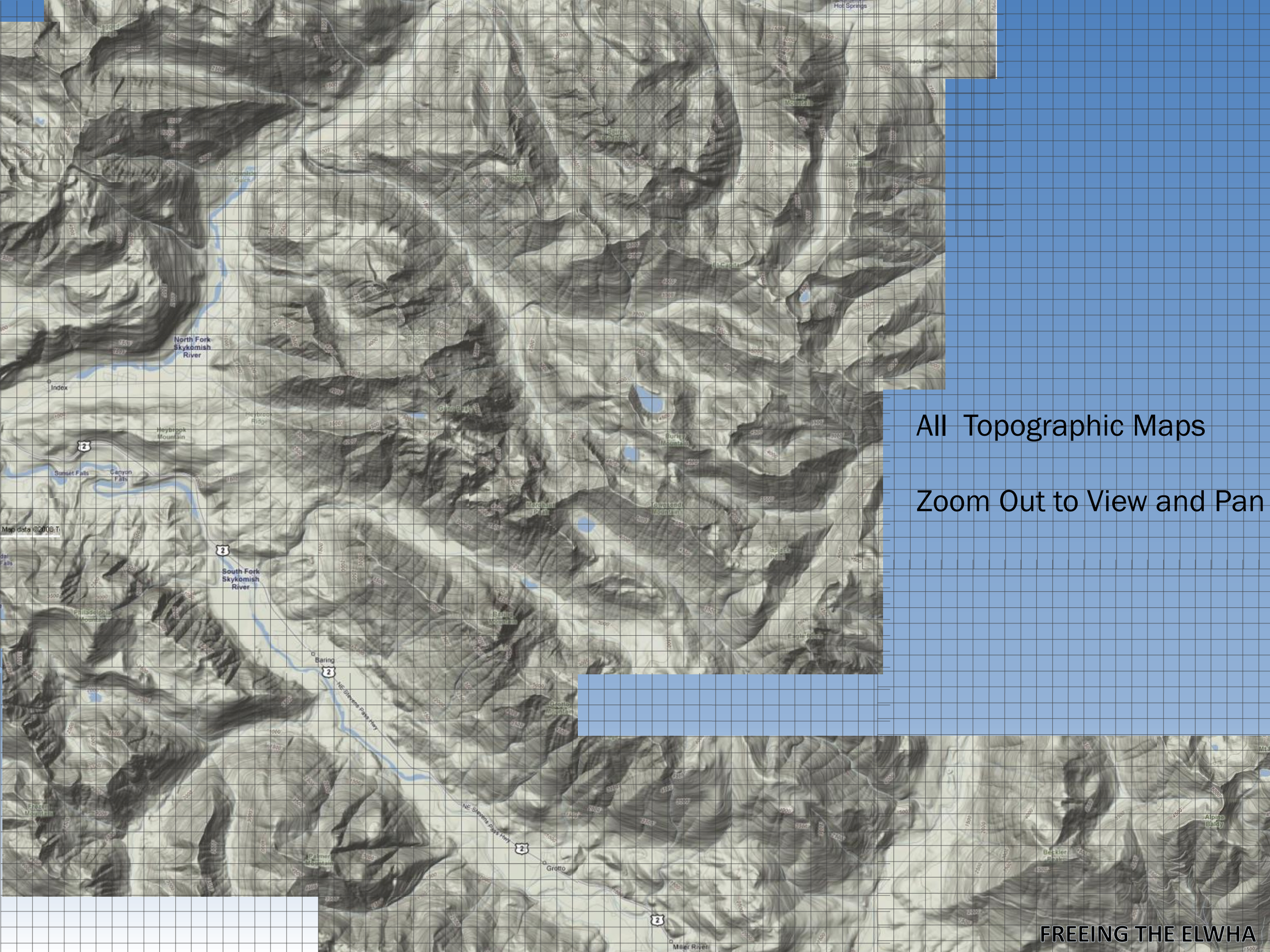
- The Reservoir:Electricity Ratio is 211,000,000 ft^2 /5,000MW = 42,200 ft^2/MW

- Site 2 is 500 feet tall and 1500 feet across.
- Thus, it contains a surface area of 750,000 ft^2 which is 150,000 5x1 segments. That generates 150 MW of electricity. That's 120,000 homes.

- Site 2 impounds a lake of 12 sections for a surface area of 12,000,000 ft^2

- The Reservoir:Electricity Ratio is 12,000,000 ft^2/1500 MW = 8,000 ft^2/MW

- Site 2 is definitely the better choice!!!



All Topographic Maps

Zoom Out to View and Pan

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