Memorandum

To: Regional Water Quality Control Board
1739 Fourth Street
Santa Rosa, California

Date: [July 1968]

From : Department of Fish and Game

Subject: Big Sulphur Creek, Sonoma County

Fish and Fish-food Organism Survey

On July 15 & 16th, 1968, Keith Dunbar and John Hannum of the Regional Water Quality Control Board #1 staff in Santa Rosa and Dick Moore, Steve Weyand and Tom Whitfield of the California Department of Fish and Game conducted this survey on Big Sulphur Creek beginning a short distance upstream from the P. G. & E. Geothermal units and Geysers Resort to a point a short distance downstream from the confluence with Squaw Creek. Samples were also obtained in Squaw Creek within 200 feet of the mouth;

The Sampling Station locations are as follows:

Station la - Big Sulphur Creek 300 feet upstream from the bridge leading to P.G. & E. geothermal plants.

Station lb - Big Sulphur Creek 900 feet upstream from the bridge leading to P.G. & E. geothermal plant. Station begins at upstream side of pool and extends upstream 100 feet.

Station 2a - Big Sulphur Creek at footbridge at mineral bath house extends 50 feet upstream and 50 feet downstream from center of bridge.

Station 2b - Big Sulphur Creek riffle at discharge from P.G. & E. Units 1 and 2.

Station 3a - Big Sulphur Creek downstream from the P. G. & E. Unit A3 discharge and 300 feet upstream from fire trail crossing

Station 3b - Big Sulphur Creek immediately downstream from Buckman Mine tailings and immediately upstream from waste discharge of Geothermal Resources Rorabaugh #2 well.

Station 4a - Big Sulphur Creek upstream from confluence with Squaw Creek extending 30 feet downstream and 70 feet upstream from center of bridge.

Station 4b - Big Sulphur Creek downstream about 200 feet from confluence with Squaw Creek at 1st riffle-pool area.

Station 4c - Big Sulphur Creek downstream from confluence with Squaw Creek [under] ~~below~~ County Road Bridge.

Station 5a - Squaw Creek extending upstream from the confluence with Big Sulphur Creek from 100 feet to 200 feet.

This sampling was conducted to document the number, volume, and type of fishes and fish food organisms present in- the streams of this watershed which is undergoing rapid change from man's activities. Potential and existing waste discharge and pollution problems include: natural and developed geothermal discharges; wastes from well drilling, which includes bentonite and detergents; mine waste from a mercury mine; "side-casting of rock and dirt that enters the stream from both private and county roads [and sheet erosion of watershed.

A Homelite portable generator, producing 250 volts at about 3 amps, was used to supply shocker current. Block nets were used to bracket the sample area to prevent fish movement into or out of the sample area. Sample stations

were 100 feet long. Two passes with the electrofisher were made at each station. Electrofishing sampling was conducted at all stations. A summary of the findings are as follows:

Table 1

Big Sulphur Creek is a steelhead-trout stream. Other fish occuring in the stream usually compete for food and space and are generally thought of as "rough" or "trash" fish. These other fish are less susceptible to pollution and are the first fish to occur downstream from a damaged area.

The most important natural fish food organisms are those which have a part or all of their life histories in the water itself. These include the mayflies, stoneflies, Caddisflies and various forms of two winged flies such as blackflies, midges, and craneflies. All of these organisms normally occur in or near the bottom of the stream.

Stoneflies, mayflies and Caddisflies of various kinds and in large numbers indicate a healthy stream habitat. Stoneflies require high quality water to exist. Mayflies are especially important and have been referred to as the "cows" or "rabbits" of the environment, changing plant life into animal life and thus furnishing food for the predatory animals. On the other hand, gnats, midges and other small flies can tolerate polluted areas and their population can become extremely large in waters that predatory insects and fish cannot tolerate.

The stream bottom organisms were sampled with a square-food Surber Sampler.

The Surber Sampler consists of a one foot square metal frame with a cone shaped net attached along one edge. The frame was placed on the stream bottom with the net on the downstream side. Stream bottom material within the area of the frame was washed in front of the net to collect the stream bottom organisms. The organisms were preserved and counted in the Region 3 Water Quality Laboratory with the aid of a microscope. Two samples were taken at each station. The findings are as follows:

Table 2

Table #2 indicates several things. Stoneflies, which require a high quality environment, occur only in Station lb and 5a of the upstream Big Sulphur Creek and Squaw Creek undamaged areas. Mayflies occurred in good numbers at all stations, except the two stations downstream from P. G. & E. #3 discharge The mayflies mostly in the early stages of their development indicating they are being cropped by predators. The Caddisflies can withstand the discharge downstream from P. G. & E. #3; however, they evidently cannot withstand the siltation in Big Sulphur Creek upstream from Squaw Creek at Station 4a. This same species was observed on January 5, 1967, in 73° F. water in the tributary near Station 3a that has a large amount of iron oxide on the stream bottom.

The large number of fly larvae in the one sample at Station 4a were immature black flies which normally occur only on rocks in the swiftest water. They can become abundant in riffles and even in pools when predators are non-existent. These black flies are also among the first insects to repopulate a stream following chemical treatment which has killed all fish and immature

insects. Evidently no predatory fish, including trout, and possibly no predatory insects, mainly dragonflies, stoneflies, and water bugs, are present at Station 4a on Big Sulphur Creek.

In summary, all three fishes, steelhead-trout, suckers and roach, appeared sufficient numbers in the unpolluted stream areas. Young fingerling steelhead-trout far outnumbered all other fishes combined. No trout were caught at any stations receiving either natural or developed geothermal discharge

Fish food organisms in unpolluted areas remain relatively higher than polluted areas despite extreme cropping by predatory fish. Fish and fish food organisms require water of better quality than exists downstream from the natural and developed geothermal discharges.

Table #1

BIG SULPHUR CREEK

Summary of

Electrofishing 7/25/68

[illegible]	Number of Fish at Stations							Grams of Fish in ml. at Sta.	
	1a	2a	3a	4a	1	2	3a	4a	5a
[illegible]	[illegible]	0	0	0	[illegible]	[illegible]	[illegible]	0	-
[illegible]	[illegible]	0	0	[illegible]	[illegible]	[illegible]	[illegible]	0	-
[illegible]	[illegible]	[illegible]	1	0	12	[illegible]	[illegible]	0	-
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	1,117

Table 2

BIG SULPHUR CREEK

Total number of stream bottom organisms sampled on ~~July [illegible]~~ 26, 1968 the indicated days.

Organisms	1/6/68 Sta # 1a	5/9/68 Sta # 1a	7/16/68 Sta # 1b	11/13/68 Sta # 1a
Mayflies	244	149	36	88
Caddisflies	67	70	175	64
Dragonflies	0	0	0	0
Stoneflies	16	29	3	20
Flies (Gnats, Midg	65	12	35	19
Beetles	0	9	25	26
Water Bugs	1	0	25	7

Average number of organisms per ~~sample~~ Square foot sample

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
92	90	148		74

Average volume of organisms per Square foot sample

ml	10 ml	—	2[illegible]	2.1

Table 2

BIG SULPHUR CREEK

Total number of stream bottom organisms sampled on July 15 & 16, 1968*

Organisms	Stations ** 1b	2a	3a	4a	5a
Mayflies	36	26	1	7	65
Caddisflies	175	268	215	10	74
Dragonflies	0	1	0	0	0
Stoneflies	3	0	0	0	11
Flies (Gnats, Midges etc.)	35	20	7	69	33
Beetles	25	1	2	2	6
Water Bugs	25	7	0	0	5

* 2 square foot stream bottom samples per station

** For station locations see attached map.