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FRESHWATER FISHERIES ADVISORY SERVICE

MARINE DEPARTMENT

INVESTIGATION REPORT

North Island Job No. 2

Acclimatisation Society District: Auckland

Title of Job: A biological survey of the Waihou and Waimakariri Rivers.

Objectives: An investigation of the reportedly high population of small rainbow trout.

Introduction: The general locality of the Waihou and Waimakariri Rivers can be ascertained by reference to the accompanying map.

The survey of the two rivers was carried out from 18 October to 30 November 1967, by the North Island Technical Field Service. Bottom fauna samples were taken in both rivers and the results are shown in tabular form. Excessive depth encountered in many sectionsof the river, prevented further samples being taken.

Findings: Part "A" - Waihou River

Physical Features:

The survey of the Waihou River was carried out from the headwaters downstream to Te Aroha. The river rises approximately 10 miles east of Putaruru, in State Forest property, and for the first six miles exists as a small stream between 2 and 4 feet wide flowing through a steep bush and scrub covered valley. In this form the Waihou enters an area of numerous springs (see Plate 1) and in this region, the river becomes wide and deep. These springs also result in excellent water clarity and several large fish approximately 2 to 5 lbs were seen. This section of the river has many different species of water weeds which can, in places, make up as much as 80% of the river volume. Bottom stability is good, although spawning would probably take place above the springs where suitable gravel is available; the bottom composition in the springs area being mainly pumice and sand. Along the river banks, willows and raupo are plentiful but extensive land clearing is taking place. This could have a

detrimental effect on the entire lower stream if proper care is not taken.

Downstream from the springs the river flows through a steep gorge, and down a long series of rapids, before entering open farmland. From here the Waihou winds its way for approximately 46 miles, until it reaches Te Aroha, where it becomes wider, discoloured, and sluggish in movement.

Apart from the Waimakariri, the Waihou is fed by several smaller tributaries, the most important of which are the Oraka and Waiomou. Both these streams were surveyed for two miles upstream, but no fish were seen. The Waiomou appears to be recovering from a serious pollution problem of unknown origin, which apparently resulted in a widespread kill of fish and bottom fauna. Another smaller stream, the Purere was also surveyed and found to contain a high population of small trout and stretches of gravel suitable for spawning.

The lower reaches of the Waihou are prone to flooding. Readings taken at the gauge site, at Opal Springs, record recent flood heights of over 15 feet above normal water level. During times of flood the river at this point is extremely discoloured, due to the large amount of mud, sand and other debris in suspension. Consequently, below Okauia, the river bed in many places is covered with thick mud. At present, in the upper reaches, flooding is not serious and although the river becomes discoloured it clears rapidly.

The waterfall and rapids at Okoroire (Plates 3 & 4) present an impossible barrier to upstream trout movement. Here the river is forced to plunge through a narrow cleft in the rock formation.

Fish:

There is a marked predominance of small fish in the Waihou although there is also a distinct population of fish of larger size.

In the headwaters above the gorge rapids large fish were observed, with few fish under about 9 inches in length. Below the gorge, the predominant size decreased to between 3 and 12 inches, although several larger fish were seen. Below Okoroire, fish observation became difficult due to the increased depth of water. However, discussions with local anglers revealed that fish caught in this area, were generally

of a good size by New Zealand standards, but the catch rate was low.

A record of fish caught during the survey is set out in Table 1.

Bottom Fauna:

Bottom fauna counts were low throughout the areas sampled (Water depth confined all sampling to above Okoroire). Freshwater crayfish (koura) were plentiful in the upper reaches, and although they were not recorded in the samples (due to the technique used), stomach contents showed that they formed a substantial part of a normal Trout diet.

Sampling stations are indicated on the locality map, and the results of the samples are set out in Table 2. Plate 2 shows one of the sample areas in this section.

Weed:

As previously stated weed growth in the area of the springs is very heavy. The growth in the remainder of the river is moderately heavy, with oxygen weed being predominant and water-cress growing prolifically along the river edge.

Predators:

Several small rookeries of black shags were located along the banks of the Waihou. Their probable effect is incorporated in the discussion.

From observation and local opinion, it appears there are no eels in the Waihou above Okoroire, although large eels can be caught below this Point. The reason suggested for the failure of the eels to migrate further upstream, is their dislike of the sulphur-bearing mineral water that enters the river at Okoroire. However, their actual presence could soon be verified by means of a few set pots.

Part "B" - Waimakariri River

Physical Features:

The Waimakariri River is a tributary of the Waihou, and rises in the south-east extremities of the Kaimai Ranges. From its source, the river flows for approximately two miles through a moderately sloped pine and bush clad valley, before entering open farmland.

Due to the difficult access to this area, a complete survey

commenced above the entry of the Kutahihi Stream into the Waimakariri. From that point the stream follows a winding course through open farmland for approximately ten miles it joins the Waihou at a point two miles upstream from the Okoroire Hot Springs. The areas of native bush and scrub, found in the upper reaches, give way to open grassland, with occasional stands of pine and willow, along the banks in the lower reaches.

The river flow in the upper reaches is rather swift with many small rapids. The height of the banks varies from 5 to 20 feet. In this upper area, noticeable bank erosion is taking place (Plate 5), and in one section the river flows through a tangle of fallen trees and collapsed bank (Plate 6). Long stretches of shallow flats ending in deep pools occur throughout the remainder of the river (Plate 7). Bottom composition is generally suitable for spawning, but stability is poor with the gravel continually shifting.

Fish:

On the first visit to the Waimakariri no fish were observed, but on subsequent visits several fish were seen, ranging in size from about 5 to 9 inches. Small numbers of fingerling trout were also seen in the river shallows.

Results of fishing during the survey are also set out in Table No. 1.

Bottom Fauna:

From the samples taken, and general observations, bottom fauna concentration in the Waimakariri is low. Again, the sampling stations are indicated on the locality map, and the results of the samples are set out in Table No. 3.

Weed:

Weed growth in the Waimakariri is not heavy. In the upper reaches where the river bottom is reasonably stable, a small variety of water weed and algae were found. Large amounts of water cress, sheltering many small crayfish (Koura), grows along the river edge.

Predators:

The only obvious form of predation that could occur in the Waimakariri, would be by shags. Several black shags were seen, but all were in flight and probably came from rookeries situated on the Waihou River.

No eels were found, and this endorses the assumption that there are no eels upstream of Okoroire.

Discussion

An examination of the results of the bottom fauna samples, shows that the composition of the fauna is satisfactory, but the density of the animals is low.

As a general rule, young trout in the first few months of life, are only able to eat small, soft-bodied animals e.g. larvae of Diptera (midges), Coleoptera (beetles), and Ephemeraptera (may flies). As trout grow they prefer larger animals including those with a hard external case, e.g. Trichoptera (caddis), Mollusca (snails). However, as Ephemeraptera (may flies) and Plecoptera (stoneflies) also reach a significantly large size they are also included in the diet of larger fish.

The bottom fauna samples examined indicate that both the Waihou and Waimakariri Rivers contain a well-balanced fauna, suitable for trout food, and for trout of all sizes. However, as stated before, the density of the bottom fauna is low. This is a critical factor in determining the number and size of fish a body of water can support, as the weight of fish produced is dependant on the food available. In the Waihou River, the average density of animals per square foot was 95 (flats were 97, pools were 28 and rapids were 226). The range of animals was from 16 to 226 per square foot. Values for the Waimakariri gave an average density of 96 animals per square foot, (flats - 111, pools - 23, rapids - 117) or an overall range of 3 to 215.

Comparative figures calculated by Allen (1951) for the Horokiwi Stream show an average density of animals per square foot of 422, and an overall range of 236 to 672.

Unfortunately, time and materials did not permit a detailed chemical analysis of the water to determine the pH and chemical composition. However, the presence of a varied but limited bottom fauna seems to indicate that chemical conditions must be suitable for normal growth. The most obvious limiting factor to the density of bottom fauna, is the instability of the stream bed. The light pumice and gravel of the beds of both rivers, is very unstable and continually shifts downstream. This movement would be greatly accentuated in time of flood, when the velocity of the water is increased. Such movement of the river bed is obviously detrimental to the fauna which spend all or part of their lives amongst the rocks of the stream bed.

The unstable river bed cannot only affect the trout indirectly by the unavailability of food, but also directly by causing a high mortality rate among the fish. In his study of the Horokiwi Stream, Allen (1951) showed that floods which cause disturbances to the stream bed resulted in high losses of eggs, fry and older trout. This fact has also been borne out by work done, by Mr Burnet of the Marine Department, near Christchurch. Thus, although a flood selectively affects eggs and young fish rather than larger fish, it does have an overall inhibitory effect on the entire population. Large fluctuations in the adult trout population can be expected under such circumstances, depending on the frequency of floods, as entire year classes may be irreparably harmed.

Under normal conditions a body of water will reach a stable carrying capacity of fish, and fluctuate around this point of equilibrium. Under such conditions stocking with young fish is seldom the solution to increasing the weight of fish produced or harvested. "Although we can increase the number of trout in the stream by liberations, destruction of predators, and so on, we cannot increase the total weight unless we can also increase the amount of food available to the trout" (Allen 1951). In general terms, this means that a body of water can support and maintain a certain weight of fish, whether this weight is composed of many small fish or fewer large fish. In the Waihou and Waimakariri Rivers, this weight of fish is composed largely of small individuals. The lack of eels in the upper reaches only augments this condition as the young eels normally compete with and reduce the number of small trout able to survive.

The problem of why the two rivers support a large population of small fish, and not a less dense population of fish of a larger size range is thus largely due to several interacting factors. The following is a recapitulation:

(a) The frequency and severity of floods is random, and large fluctuations in numbers and size of fish are to be expected. The present large population of small fish is probably due to a period of relatively little disturbances during the first few months of life thus allowing a high proportion to survive

(b) There is apparently little predation or competition in the rivers. Contrary to popular opinion, a certain amount of predation is frequently beneficial to an animal population, as it removes surplus individuals, resulting in less competition for food and space among the survivors. In the Waimakariri, and in the Waihou above Okoroire, shags appear to be the only predators of any significance. Eels are normally important competitors with small trout and their failure to appear in the areas surveyed could well result in an excessive survival of small trout.

(c) The shortage of food can cause a decrease in the growth rate of the fish. Thus, a fish would mature at a smaller size than is normal, resulting in a large population of small fish.

All these major factors seem to affect the population but to establish which, if any, is the major point would require a long term investigation.

Recommendations

The basic problem to be overcome is the stabilisation of the river bed. Reports indicate that in the past the average size of fish was greater than at present, this is borne out by the present state of the river and the natural and unnatural degradition as follows:-

(a) The unstable nature of the rivers is a normal geological process which is occurring during the maturation of the rivers.

(b) The extensive land clearing which has taken place over the last few years, especially in the headwater areas, has resulted in faster run-off from the land, causing more frequent and sudden fluctuations and floods.

Any river-improvement schemes, e.g. building of groynes, will require considerable finance and labour and is probably beyond consideration for fishery purposes alone. It is imperative to ensure that future land clearing does as little damage as possible to these rivers. The establishment of reserves or buffer areas would be of most help, but care in construction of roads etc. and foresight in ensuring proper drainage will help. Only by such stabilization of the river can a really adequate fishery redevelop.

The present size restriction is adequate, but anglers, or at least children, should be allowed to utilize any lure or bait to harvest small fish and reduce the population. Any management technique that reduces the competition among small fish should result in gradual increase in the size of the remaining fish and result in better all-round angling.

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TABLE 1 ANGLING RESULTS

LOCATION	TIME	METHOD	CATCH	AV.SIZE (legal)	CATCH/hr
Oraka Stm. (Landlands Rd)	2 hrs evening	Dry fly	None	-	0.0
Pukere Stm. (Whites Rd. Bridge)	4½ hrs evening	Dry fly	9 undersize 3 legal	9½"	0.7
Waimakariri (State Highway 5)	1¾ hrs evening	Dry fly	4 undersize	-	0.0
Waihou (various places)	14 hrs evening	Dry fly	17 undersize 6 legal	9½"	0.4
Waihou (springs area)	3 hrs midday	Dry fly Worm	2 legal (2 large fish lost)	17"	0.7
			Grand average of Catch/Hr, for legal fish =		0.4

Note:- Legal size is 9 inches, even with this low size the rate of legal to sublegal was 30 : 11, or about normal for a size limit of 12" in most streams.

TABLE 2

WAIHOU RIVER - BOTTOM FAUNA

Expressed as Animals per Square Foot and by Percentage of each group in each Location

Location & No. of samples	Sample Type & No. Range	Ephemeroptera (May flies)	Plecoptera (Stone flies)	Trichoptera (Caddis flys)	Coleoptera (Beetles)	Diptera (flies)	Mollusca	Others
Head-Waters	Stone Flies predominant in samples taken. Main trout food is Koura							
Road Bridge at State Highway 5 (5 samples)	Flats -62-124 Pools 16-39	49	4	20	8	11	5	3
Waihou Durrants Farm (3 samples)	Flats 22-173 Rapids 226	31	13	32	16	3	3	2
Average No. of Each Animal per Sample		38	8	26	12	6	4	3

TABLE 3

WAIMAKARIRI RIVER - BOTTOM FAUNA

Expressed as Animals per Square Foot and by Percentage of each Group in each Location

Location and No. of Samples	Sample Type & No. Range	Ephemer-optera (May flies)	Plecop-tera (Stone flies)	Trichop-tera (Caddis Flys)	Coleop-tera (Beetles)	Diptera (flies)	Nema-toda	Others
Headwaters (6 samples)	Rapids-44 to 158 Flats - 3 to 76 Pools -21 to 73	28	7	8	2	50	2	3
Road Bridge at State Highway 5 (5 samples)	Flats - 3 to 147 One Pool - 3	22	19	6	29	17	6	1
Waimakariri Confluence with Waihou (6 samples)	All Flats -95 to 215	19	17	6	41	13	2	2
Average Number of Each Group per Sample		21	14	6	29	22	2	2

REFERENCES

1. Allen, R.K. (1951) The Horokiwi Stream
New Zealand Marine Department, Bull No. 10.

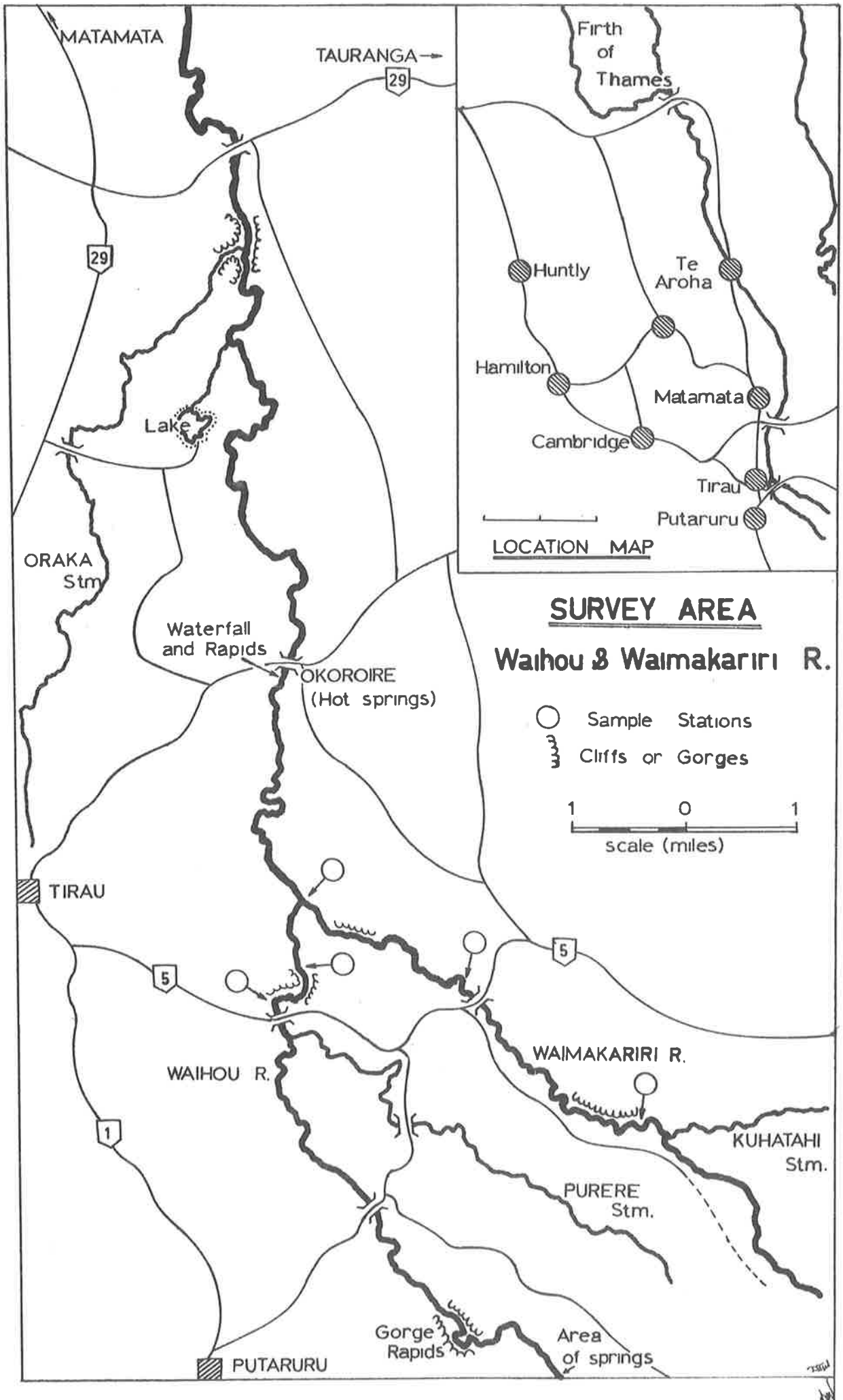
MATAMATA
TAURANGA
29
29
Lake
ORAKA
Stm
Waterfall
and Rapids
OKOROIRE
(Hot springs)
TIRAU
5
5
1
WAIHOU R.
WAIMAKARIRI R.
KUHATAHI
Stm.
PURERE
Stm.
Gorge
Rapids
Area
of springs
PUTARURU
Firth
of
Thames
Huntly
Te
Aroha
Hamilton
Matamata
Cambridge
Tirau
Putaruru
LOCATION MAP
SURVEY AREA
Waihou & Waimakariri R.
Sample Stations
Cliffs or Gorges
1 0 1
scale (miles)

PLATE 1- Commencement of Springs area.

PLATE 2- Sample area below Highway 1.

WAIHOU RIVER

PLATE 3- Falls and rapids near Okorire.

PLATE 4- Falls and rapids near Okorire.

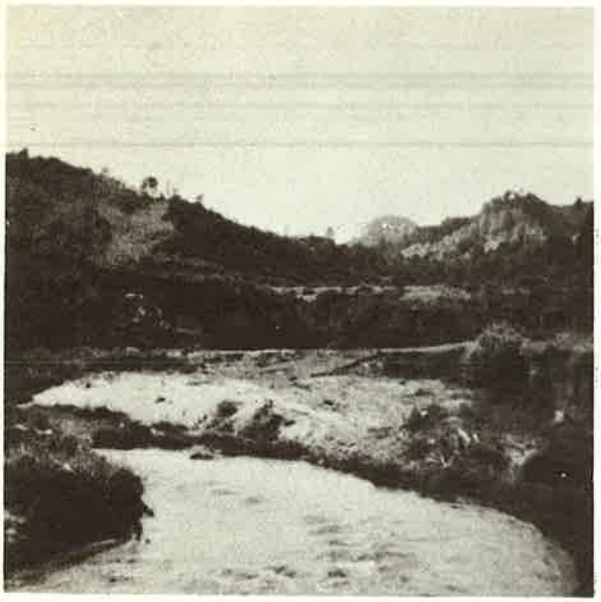

PLATE 5–Headwaters showing flood level.

PLATE 6–Severe bank erosion.

WAIMAKARIRI RIVER.

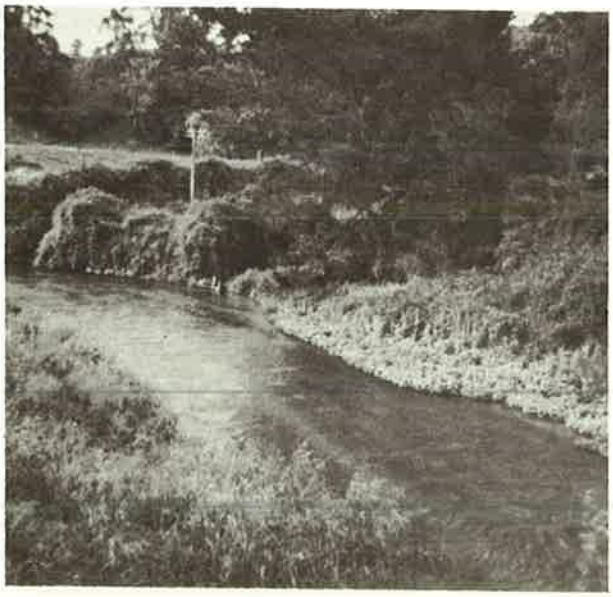

PLATE 7– Sample Area.