SALMON FOR THE FUTURE

A BIO-PHYSICAL INVENTORY REPORT OF FORTUNE CREEK

STEVE F. ZACHARY

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a

BIO-PHYSICAL INVENTORY REPORT

of

FORTUNE CREEK

by Steve F. Zachary

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SUMMARY

A study of Fortune Creek was conducted to evaluate it's use by salmonids as a spawning and rearing channel. Key fish species were identified by using an electro-shocking device and by setting minnow traps at 5 stations along the stream. Samples of chinook, coho, sockeye and rainbow trout were located within the waters of Fortune Creek. Fish samples taken were of fry to smolt size during the length of study.

Other data collected at these stations included water temperature, dissolved oxygen and turbidity. A major problem on the stream was the warming of the waters as it flowed through the valley. Large variations in temperature can be lethal to healthy salmonids. A difference between the upper and lower stations of 12 degrees celsus was recorded during one 24 hr. period. The cause of this problem is the result of inadequate shading along the banks. The generous planting of trees and shrubs could provide shade and prevent solar heating of the water.

Turbidity of 100 Johnson turbidity units (J.T.U.s) were 20 times the acceptable level for salmonids. At one location, the W. Tobler farm, a dugout was constructed at a point where the feeder stream enters Fortune creek. Turbidity levels were measured both upstream and downstream of the dugout. Data indicates a 46 % reduction in silt loading to the stream.

Much of the upper reaches of the stream have been dredged over the past four years. Fine clays and silt have been removed to expose washed spawning gravels under the surface. Increased spawning productivity occurs in areas that have been previously dredged. The material removed also provides support to the stream bank in the form of a dyke.

In areas that have not been dredged, the stream is higher than the surrounding farm land. Water flooding farm lands was pumped back into the stream, greatly increasing it's silt loading. Bank erosion and fouling of the water was common in areas where fencing of livestock was inadequate. Cattle in these areas tend to wallow in the cooler waters. This activity disturbs spawning gravels and the increased level of siltation smothers the eggs and fry of the Salmonids.

Dugouts could be constructed in these areas and livestock fenced away from the stream.

A railway line cuts diagonally across Fortune creek 2.5 km. upstream of it's mouth forming a dyke across the stream. At the time of this study, the channel which allows water to flow through the rail system was backed up flooding the plain up-stream of the rail line. Improper maintainance of the channel by the railway left large amounts of debris to accumulate at the mouth of the channel.

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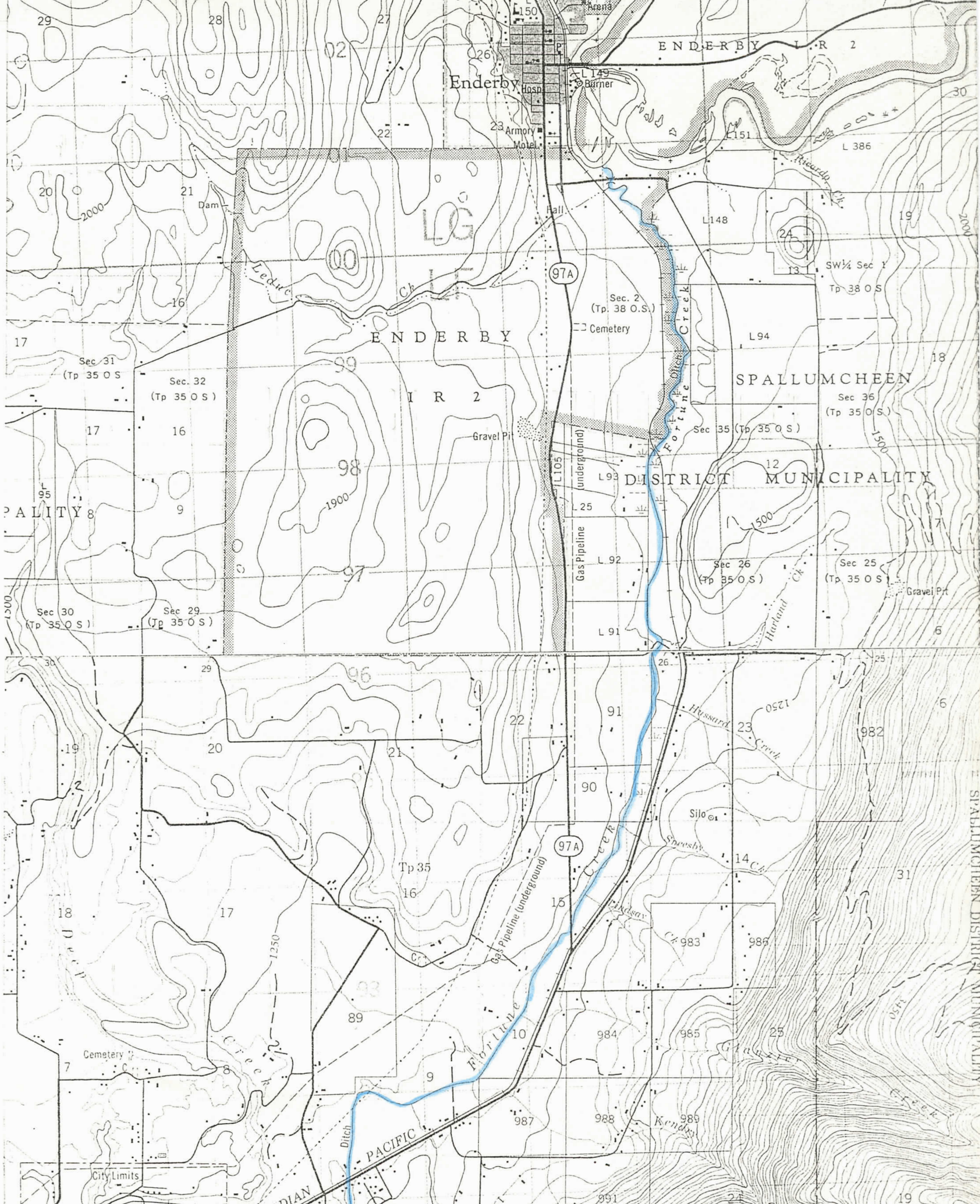

Enderby
Arena
Hosp
Burner
Armory
Motel
ENDERBY I.R. 2
L 149
L 150
L151
L 386
Ricardo Ck.
Dam
Fall
Leduc Ck
97A
Sec. 2 (Tp. 38 O.S.)
Cemetery
SW¼ Sec 1 Tp 38 O S
L148
L94
Fortune Creek
Ditch
SPALLUMCHEEN
Sec 36 (Tp 35 O S)
Sec. 32 (Tp 35 O S)
Sec 31 (Tp 35 O S)
Sec 35 (Tp 35 O S)
Gravel Pit
Gas Pipeline (underground)
L105
L93
L 25
L 92
L 91
DISTRICT MUNICIPALITY
PALITY
Sec 26 (Tp 35 O S)
Sec 25 (Tp 35 O S)
Sec 30 (Tp 35 O S)
Sec 29 (Tp 35 O S)
Harland Ck
Hassard Creek
Silo
Sneesby Ck
Lindsay Ck
Tp 35
Deep Creek
Cemetery
Fortune
Ditch
CANADIAN PACIFIC
Kendry
Glanzier Creek
City Limits
Armstrong Junction
Fairgrounds
Arena
Shopping Centre
Trans Sta
Armstrong
Sewage
Hospital
Senior Citizens Home
Dump
Tp 17 R9 W6M
Anderson Creek
SPALLUMCHEEN DISTRICT MUNICIPALITY

1.0 INTRODUCTION

The following report is an evaluation of Fortune Creek for use as salmon spawning and rearing channel. Use by land owners and their effects on the stream are included with recommendations for salmonid enhancement.

The project was formulated through Mr. Walter Elias, District Supervisor of the Department of Fisheries and Oceans, and their public relations man, Mr. Dennis DeMontier.
All work was conducted on a 1:50,000 reconnaissance level II.

1.1 Project need

The Department of Fisheries and Oceans had no formal data on the bio-physical properties of Fortune Creek, or reccomendations for managing it as a Salmonid spawning channel.
It was through the conscientous effort of Mr. Dennis DeMontier, Department of Federal Fisheries, that this project was iniated.

1.2 Purpose of study

The purpose of this study, was to evaluate current Salmonid production in Fortune creek and recommend changes to improve the stream as a salmonid spawning and rearing channel. The results of this report were presented to the Government of Canada, Department of Fisheries and Oceans and Selkirk College.

1.3 List of objectives

The Department of Fisheries and Oceans identified the following topics as priorities for research.

1) Document the species, numbers and distribution of fish in the stream.
2) Produce a bio-physical map of the stream
3) Obstructions to migrating fish
4) Information necessary to manage the stream

1.4 Location of Fortune Creek:

The stream is located East of Armstrong and flows through the North Okanagan Valley to the Salmon River, 1 km. South of Enderby. The valley is relatively flat with gently sloping grassy side hills. This rural farming area is productively used by dairy farmers, grain producers, and has some horse ranching.

The climate of the area has essentially mild winters and warm summers. Temperatures in the area may reach a maximum of 40.6 degrees celsius and have recorded lows of -42.2 degrees celsius. Daily maximum temperatures during the time of study reached 30 degrees C. on May 7/8 1987. Precipitation amounted to 23 mm. during three days of rainfall. This was recorded from April 30 1987 to May 2 1987.

2.0 CURRENT ENHANCEMENT EFFORTS

A Salmon Enhancement Project was headed by the Department of Fisheries public relations man, Mr. Dennis De Montier. The first salmon incubator was constructed in 1983. It was erected with the help of Tom and Ria Smith, Mr. Kim Fulton, and the local fish and game club. This project was located on the Smith property adjacent to Fortune creek. In 1985, after a few sucessful years, a new concrete tank was constructed.(plate 1) This design utilises a flow through system of creek water and has a much larger capacity.(plate 1)

Plate 1

This year has seen the sucessful rearing of many Coho fry. Although not as mature as the schools fish, these fry were growing at a rate relative to the streams normal temperature.

The local community has reared 4,000 Coho Fry in four of the local schools. Mature spawning Coho were brought into the class rooms where they were relieved of their eggs, fertilized, and placed in classroom incubators. Children watched daily as their tiny eggs matured into Coho fry. On May 11, 1987 I was fortunate enough to be present during the release of one groups fish.(plate 2)

Plate 2

With some assistance, and direction, Fortune creek can play a major role in promoting awareness of our Salmon resources.

3.0 DESCRIPTION OF RESOURCE

Coho Salmon occur naturally only in river systems flowing into the Pacific Ocean. Adult Coho migrate from the sea late in the season over a prolonged period. The female lays between 2100 to 2789 eggs. The eggs are very susceptible to temperature ranges and determines the amount of time to hatch.

The alevins remain 2-3 weeks in the gravel until the yolk is absorbed and emerge as free swimming, actively feeding fry. Some fry migrate almost immediately to lakes but most remain at least one year in tributarystreams. Those remaining in the spawning stream take up residence in nearby shallow gravel areas near the stream bank, feed voraciously, and grow quickly.

By late April they are about 100 mm. long and are referred to as smolts, who then go through physiological changes in preparation for life in salt water. Most Coho spend about 18 months in the sea and return to spawn in the fall.(plate 3)

Plate 3

4.0 METHODS

The project was limited to a three week time period from April 27, 1987 to May 15, 1987 inclusive. All work was conducted personally on a daily basis.

A series of five research stations were established at key locations along the stream. At these stations GEE type minnow traps were used to capture fish. Fish were weighed using a triple beam balance and lengths were measured on a Fork Board. A min/max thermometer was placed inside the traps to record water temperature variations. A Y.S.I. meter was used to record dissolved oxygen levels and a DRELL kit provided turbidity information. Electro-shocking equipment was used in other key locations.

Station #1 was located near the municipal water resevoir for the city of Armstrong. This marks the farthest upstream travel of a spawning salmon. The municipality has built a concrete dam 1 km. upstream of this location and diverts the stream flow through a pipe which empties into their reservoir system. It is the overflow of the reservoir that replenishes the water to the stream. Indications of stream biology show that from the dam to the reservoir, approximatly 1 km. of prime Salmonid spawning habitat has been lost to the diversion.

Station #2 was located just South of Hwy.#97 at a point that marks the end of the shaded portion of the stream. It is from Stn. #1 to this point that the stream is covered by a canopy of decidous trees and shrubs.

Station #3 was placed at a point downstream where flows are reduced by the gentle gradient of the stream as it opens into the valley floor. There were no brush species along this part of the stream and this station was primarily used to compare changes in water temperature.

The location of Station #4 was at a point where a feeder stream flowed into Fortune creek just West of the Stepny bridge. It was at this location that a dugout had been built to reduce sedimentation into the stream and provide water for cattle away from the main stream. Turbidity measurements upstream and downstream of the dugout were taken.

The point farthest down stream that could be accessed was the location of station #5. This station was set under the wooden bridge as it crosses into the Spallumcheen Indian Reserve. Accumulations of debris and the shade provided by the bridge gave easy access to large schools of fry.

To positively ensure capture of all fish species present, a variety of capture methods were used. Minnow traps captured most fish while I used a dip net at station 5 to capture Sockeye fry too small for the traps. Mr. Dennis DeMontier assisted in electro-shocking other areas of the stream which allowed capture of fish too large for the minnow traps.

A subjective assessment of the stream side vegetation and problem areas was conducted. The entire length of the stream was walked and problem areas were located and plotted on a 1:20,000 map which was later transfered to a 1:50,000 map enclosed in this report.

Much of the information was obtained by informal interviews of local residents who pointed out many of the problems they have dealing with the stream. I also visited one of the schools which was raising coho fry and discussed problems with their incubation system.

5.0 RESULTS

5.1 FISH SPECIES

Chinook smolts and fry were located at station #5 under the bridge in large numbers. The average size being 3.6 gms. and 64.5 mm.in length. The chinook smolts were located at station #4 in the dugout by means of electro-shocking. Fish at this location were feeding heavily on squawfish fry. The largest fish weighed 15.4 gms. and was 104 mm. in length.

Coho fry were also found in these locations with one weighing 4.5 gms. and 75 mm. in length. All fish appeared to be healthy and well fed. There was no evidance of parasites although none were disected to locate internal problems. Sockeye fry were located at stn. #5 in large numbers. These averaged 39 mm. in length and wind conditions didn't allow accurate measurement of weights. It appeared that these fry were preyed upon by larger fish as they were usually found in very secretive locations.

Rainbow trout fry and juveniles were found throughout faster flowing waters at stn. #2 and stn. #3. The largest of these that could fit into the trap was 24.4 gms. and 122 mm. in length. All fishs appeared well fed and in good health.

Rainbow trout were found in highly oxygenated water and located under cut banks or under some form of shade cover.
The presence of Salmonids at varying levels of maturity indicates that Fortune creek is presently being used by Salmonids as a spawning and rearing stream.

5.1.1 Enhancement

Projects currently underway are gaining a good hold of the problems and solutions to enhancement of a Salmonid stream. The active groups are taking precautionary measures to ensure productive fish stocks are being introduced into Fortune ck. creek.
The classroom incubators need a cooling system to reduce the water temperature to that of the normal stream. The fish in the tanks tend to over mature early and a cooling system would rectify this problem.

5.2 TEMPERATURE

Due to farming practices and the removal of stream side vegetation, increased water temperature is of major concern. Least effected are the upper stretches. There is abundant brush cover from the municipal water reservoir (stn.1) down stream to highway 97 (stn.2). Water temperatures at stn.1 and stn.2 were simular and varied only marginally. In the open farm lands from stn.2 to stn.5 the water temperature rose as much as 12 degrees celsus.

Areas of brush cover often found salmonid species lurking in these cooler waters. Most fish were caught near undercut banks, deeper pools, and bridge crossings. Lack of shade reduced the amount of productive habitat in stream and resulted in solar heating of the water.(plate 4)

Plate 4

5.2.1 ENHANCEMENT

The planting of brush species along the stream would greatly reduce direct solar heating of the water. Species that would brush rapidly such as willow, red osier dogwood and cottonwood should be placed in strategic locations.This would both reduce water temperatures and enhance the beauty of the stream. Stream banks would also be stabilized by rooted vegetation.

5.3 DREDGING

That portion of the stream from stn. 2 to a point downstreamn of stn.3 is an example of good results achieved by dredging. It's washed gravels sport the majority of the salmonid species found in the stream. There is a proposal for more of the stream to be dredged this fall. Plans are to continue dredging from highway 97 downstream to the Stepney bridge.

Whenever the stream overflows it's banks the resultant pumping of flood water back into the stream causes increased siltation of the stream bottom.

Plate 5

A worse situation is depicted above (plate 5) as the stream flows from the Stepney bridge downstream to the Shuswap river. Nearly overflowing it's banks, the stream hadn't reached full flood levels at that time.

It was found that throughout the length of the lower sections that the water levels of the stream were higher than the surrounding farm land. At high water this caused water to flow onto the farm lands and flooding the cultivated fields. The resultant pumping of this excess water into the stream caused increased siltation of the stream bed. It was found that at certain locations along the length of the stream that a pipe was laid through the dyke and a valve fixed to one end. This idea was to drain fields of excess water after the flood levels subsided. In reality, many of the valves were left open which resulted in high flows flooding the fields.(plate 6)

Plate 6

A dredging plan that would lower the levels of the stream to below the level of the surrounding farm land would allow for natural drainage of the farm fields.

5.3.1 Enhancement

A continous and rigorous plan must be implemented to lower the levels of the stream bed in Fortune creek. The benefits would increase productivity of the stream as a Salmonid spawning channel and improve the farm lands in the area.

As this requires heavy equipment, funds must be made available for this type of enhancement to be put forth. Shuttle type valves could replace those valves which are often overlooked during times of high flood. This would reduce the possibility of accidental flows on to farm land.

5.4 FENCING

Problems of inadequate fencing along those portions of the stream occur only where livestock require water.(plate 7)

Plate 7

These wallowing holes disrupt stream banks and destroy Salmonid spawning beds. The secreted effluent from livestock reduces the oxygen levels in the stream by decomposing the waste materials. This activity greatly reduces the amount of oxygen available to rearing fry.

5.4.1 Enhancement

The use of a fenced dugout as a watering hole would reduce the amount of disruption to the stream. Bank stability would be increased and result in reduced siltation of spawning beds. The direct discharge of effluent into the stream would be minimal and would benefit the oxygen levels critical to Salmonid fry. Fencing of those portions of the stream are required only where there is a conflict with livestock use.

5.5 PROBLEM AREAS

At a point approximatly 2.5 km. upstream of station #5 is the location of where the Canadian Pacific Railway crosses Fortune Creek. The track bed acts as a dyke to hold the streams waters.

Plate 8

Land on the opposite side of the dyke (plate 8) is usable farm land.

The narrow channel built to allow water to pass through the dyke is inadequate at times of high flood. Accumulations of debris are left to back up water flow.(plate 9)

Plate 9

Plate 10

This results in flooding of the entire valley floor.(plate 10)

5.5.1 Enhancement

A concerned effort must be made by the Canadian Pacific Railroad to rectify this problem. An increase in the size of the stream channel must be made to overcome problems of flooding the valley bottom. Regular maintainance of the channel to clear it of debris accumulation must be scheduled.

6.0 Recommendations

I would recommend that projects which are currently undertaken be continued. Funding be made available to continue current projects and to provide resources to carry out future enhancement projects. Areas in need of enhancement most are;

1) increasing the numbers of salmonids in Fortune creek by rearing and releasing of fry into the stream.

1) providing adequate shade to reduce water temperatures and provide rearing habitat.

2) dredging of the stream bottom to improve stream habitat for salmonids.

3) fencing of livestock to reduce their effects on salmonid habitat.

4) clearing and widening of the C.P.R. channel to reduce flooding of the valley floor.

There are many areas of enhancement not coverd in this report on Fortune Creek. An in depth study must be made to evaluate Fortune creek as a salmonid spawning and rearing stream.

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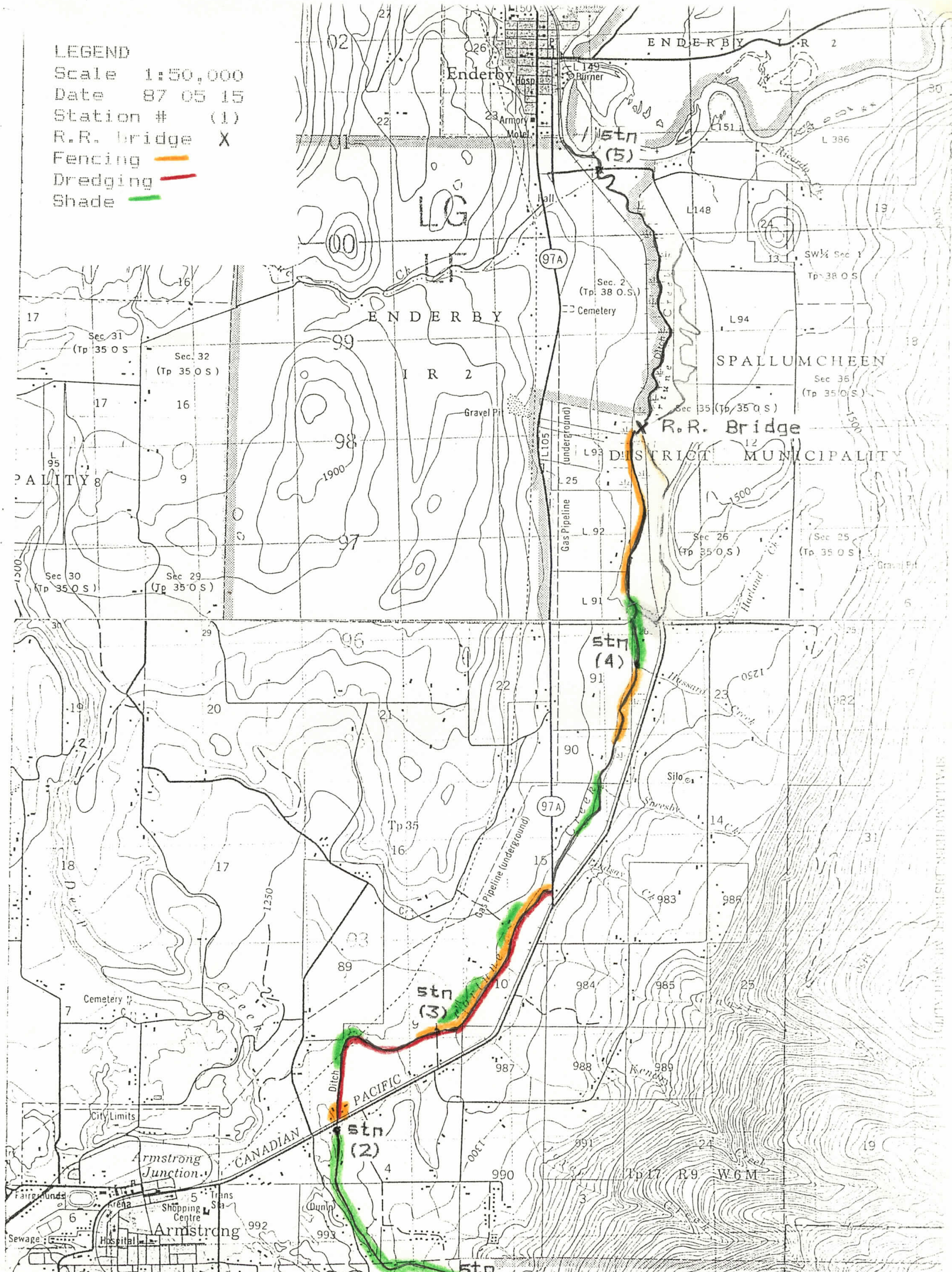

LEGEND
Scale 1:50,000
Date 87 05 15
Station # (1)
R.R. Bridge X
Fencing
Dredging
Shade
stn (1)
stn (2)
stn (3)
stn (4)
stn (5)
R.R. Bridge
Enderby
ENDERBY I.R. 2
SPALLUMCHEEN
DISTRICT MUNICIPALITY
Armstrong
Armstrong Junction
CANADIAN PACIFIC
97A
Gas Pipeline (underground)
Cemetery
Gravel Pit
Hospital
Shopping Centre
Fairgrounds
Sewage
City Limits
Senior Citizens Home
Arena
Ditch
Tp 17 R 9 W 6 M
Tp 35

SALMONID SPECIES RECORDED FORTUNE CREEK .

FISH BY STATION

STATION # - (Y Axis)

- - - - BY - - - -

species - (X Axis)

Number					
Row %					
Column %					
Total %	Chinook	Coho	Sockeye	Trout	Row Totals
	0	0	0	18	
	0.0	0.0	0.0	100.0	18
2	0.0	0.0	0.0	42.9	24.7
	0.0	0.0	0.0	24.7	
	0	0	0	24	
	0.0	0.0	0.0	100.0	24
3	0.0	0.0	0.0	57.1	32.9
	0.0	0.0	0.0	32.9	
	1	3	0	0	
	25.0	75.0	0.0	0.0	4
4	5.9	33.3	0.0	0.0	5.5
	1.4	4.1	0.0	0.0	
	16	6	5	0	
	59.3	22.2	18.5	0.0	27
5	94.1	66.7	100.0	0.0	37.0
	21.9	8.2	6.8	0.0	
Column	17	9	5	42	73
Totals	23.3	12.3	6.8	57.5	100.0

Chi square = 84.371
Degrees of freedom = 9
Probability of chance = 0.000

Valid cases = 73
Missing cases = 0
Response rate = 100.0 %

SALMONID SPECIES RECORDED FORTUNE CREEK

AVG LENGTH BY SPECIES

Criterion Variable : LENGTH (mm)

	Mean	S.D.	N	Pct.
For entire sample (Missing = 0)	63.658	16.917	73	100.0
species				
Trout =	68.595	14.493	42	57.5
Chinook=	64.471	14.888	17	23.3
Coho =	57.889	13.100	9	12.3
Sockeye=	29.800	1.483	5	6.8

SALMONID SPECIES RECORDED FORTUNE CREEK

AVG WEIGHT AND LENGTH BY SPECIES

Criterion Variable : WEIGHT (gm)

	Mean	S.D.	N	Pct.
For entire sample (Missing = 5)	4.244	3.548	68	93.2
species				
Trout =	4.702	3.885	42	61.8
Chinook=	3.665	3.342	17	25.0
Coho =	3.200	1.635	9	13.2

StatPac - Statistical Analysis Package

Task number 1

STATION #	DATE	species	WEIGHT (gm)	LENGTH (mm)
N2	May 4	Trout	01.5	043
N2	May 5	Trout	01.7	052
N2	Apr.29	Trout	02.0	064
N2	May 8	Trout	02.3	059
N2	May 4	Trout	02.4	061
N2	May 9	Trout	02.5	065
N2	May 4	Trout	03.6	068
N2	May 9	Trout	04.4	075
N2	May 8	Trout	04.5	065
N2	May 5	Trout	05.1	078
N2	May 8	Trout	05.2	070
N2	May 8	Trout	05.5	067
N2	May 8	Trout	05.6	073
N2	Apr.30	Trout	07.5	068
N2	Apr.30	Trout	08.3	080
N2	Apr.30	Trout	08.4	068
N2	May 5	Trout	13.6	110
N2	Apr.30	Trout	24.4	122
S4	May 5	Trout	01.5	061
S4	May 4	Trout	01.8	052
S4	May 9	Trout	01.9	050
S4	May4	Trout	02.1	052
S4	May 4	Trout	02.1	055
S4	May 4	Trout	02.3	052
S4	May 4	Trout	02.7	065
S4	May 4	Trout	02.8	064
S4	May 4	Trout	03.1	055
S4	May 8	Trout	03.1	065
S4	May 4	Trout	03.8	067
S4	May 4	Trout	03.8	068
S4	May 4	Trout	03.8	069
S4	May4	Trout	04.1	077
S4	May 4	Trout	04.2	068
S4	May4	Trout	04.2	068
S4	May 9	Trout	04.3	065
S4	May 5	Trout	04.3	076
S4	May 4	Trout	04.5	068
S4	May 5	Trout	04.6	078
S4	May 4	Trout	05.0	068
S4	May 4	Trout	05.5	075
S4	May 4	Trout	06.5	088
S4	May 5	Trout	07.0	087

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SALMONID SPECIES RECORDED FORTUNE CREEK

4	May 8	Chinook	15.4	104
4	May 9	Coho	1.3	045
4	May 9	Coho	03.1	052
4	May 9	Coho	04.5	075
5	Apr.30	Chinook	00.9	056
5	Apr.30	Chinook	01.0	050
5	Apr.29	Chinook	01.1	048
5	May 9	Chinook	01.4	045
5	May 9	Chinook	01.5	046
5	May 4	Chinook	01.6	049
5	May 1	Chinook	03.2	065
5	Apr.30	Chinook	03.4	064
5	May 1	Chinook	03.5	066
5	May 4	Chinook	03.5	068
5	May 4	Chinook	03.5	073
5	May 1	Chinook	03.6	067
5	May 1	Chinook	04.1	070
5	May 1	Chinook	04.3	072
5	May 1	Chinook	04.8	076
5	May 1	Chinook	05.5	077
5	May 9	Coho	01.3	042
5	May 9	Coho	01.5	043
5	May 5	Coho	03.6	061
5	May 5	Coho	03.6	065
5	May 5	Coho	03.7	062
5	May 5	Coho	06.2	076
5	May 9	Sockeye	Missing	028
5	May 9	Sockeye	Missing	029
5	May 9	Sockeye	Missing	030
5	May 9	Sockeye	Missing	030
5	May 9	Sockeye	Missing	032

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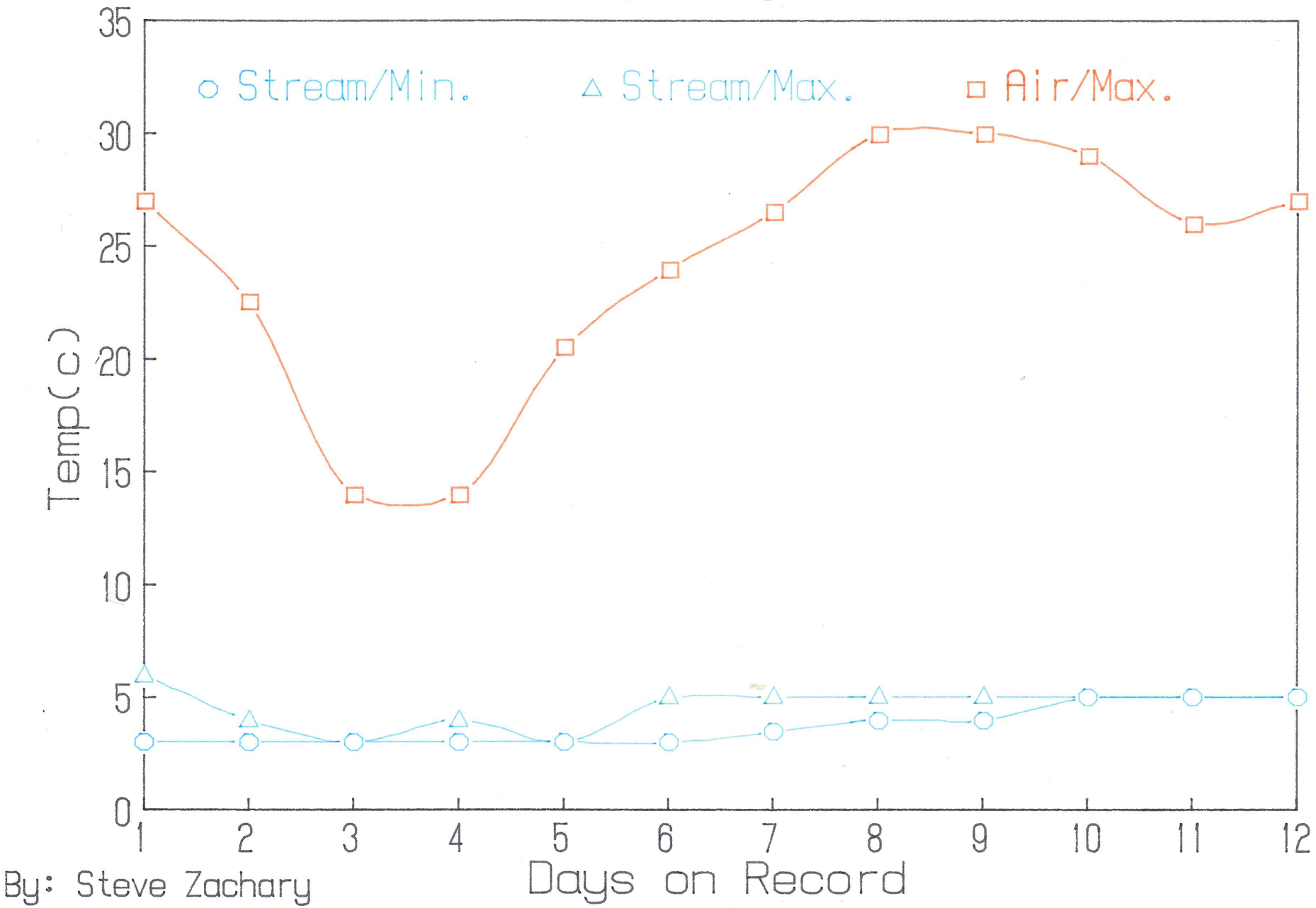
FORTUNE CREEK STN. 1

Daily Temp. (c)



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FORTUNE CREEK STN. 2

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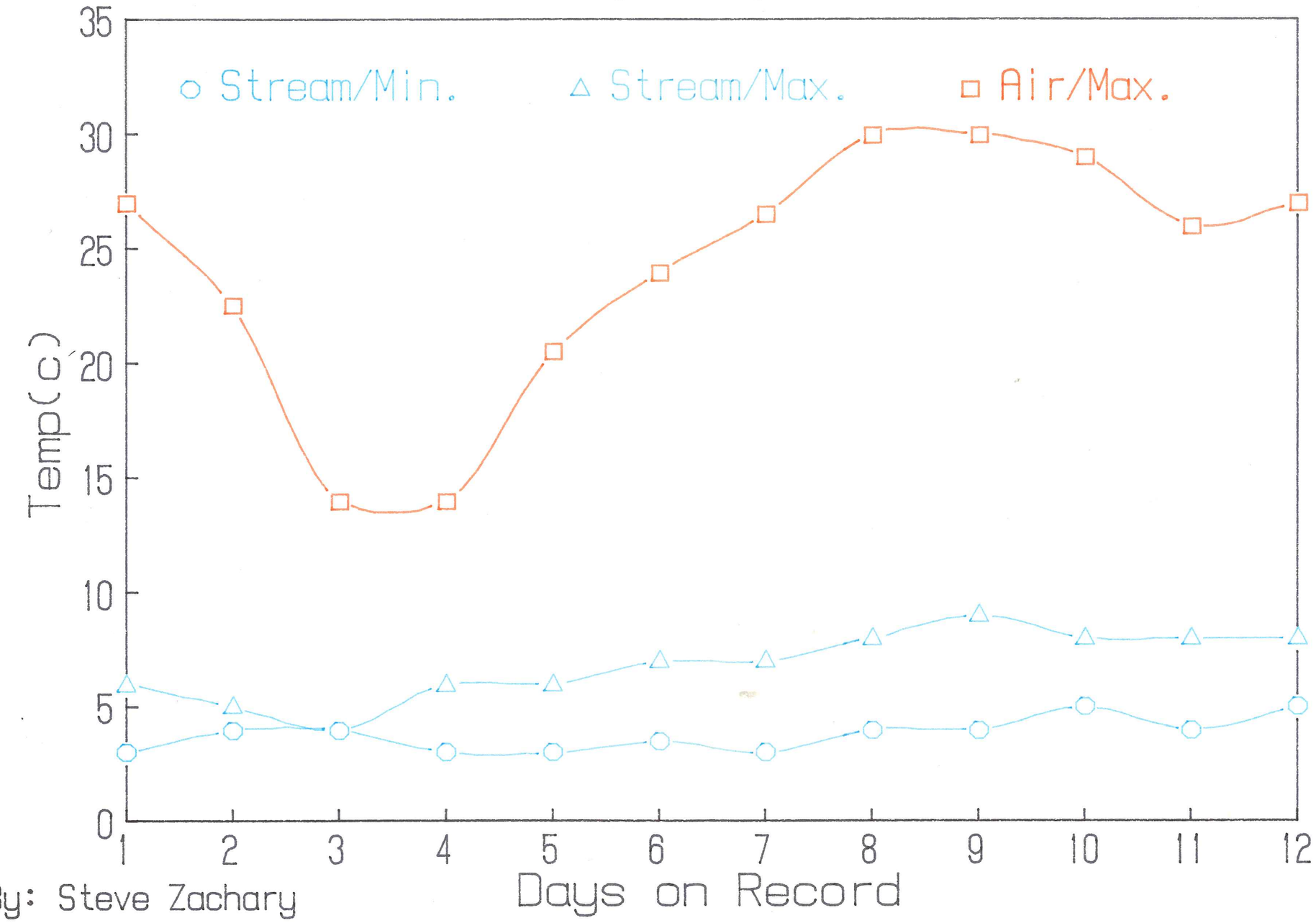

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FORTUNE CREEK STN. 3

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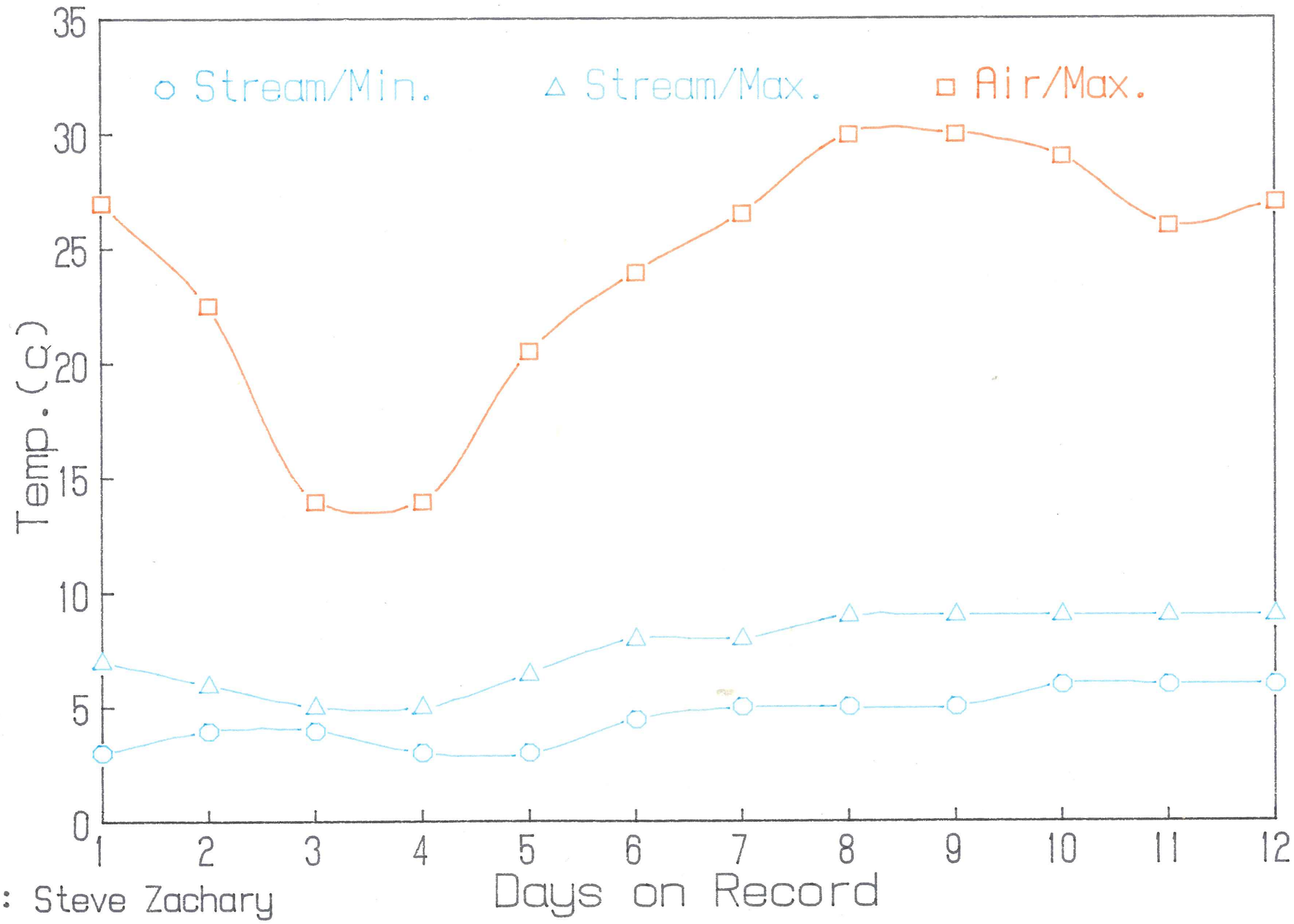

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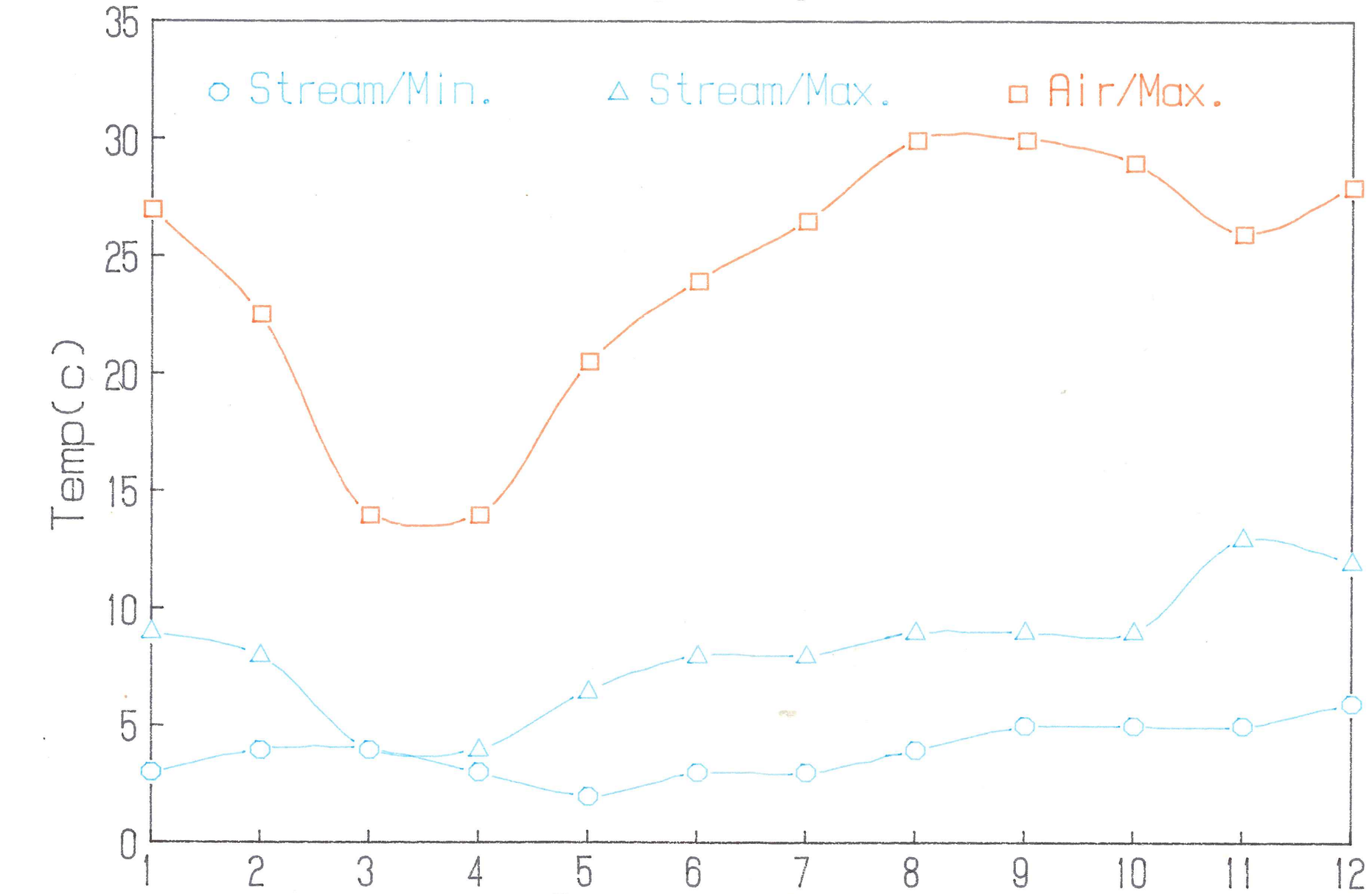
FORTUNE CREEK STN. 4

Daily Temp. (c)



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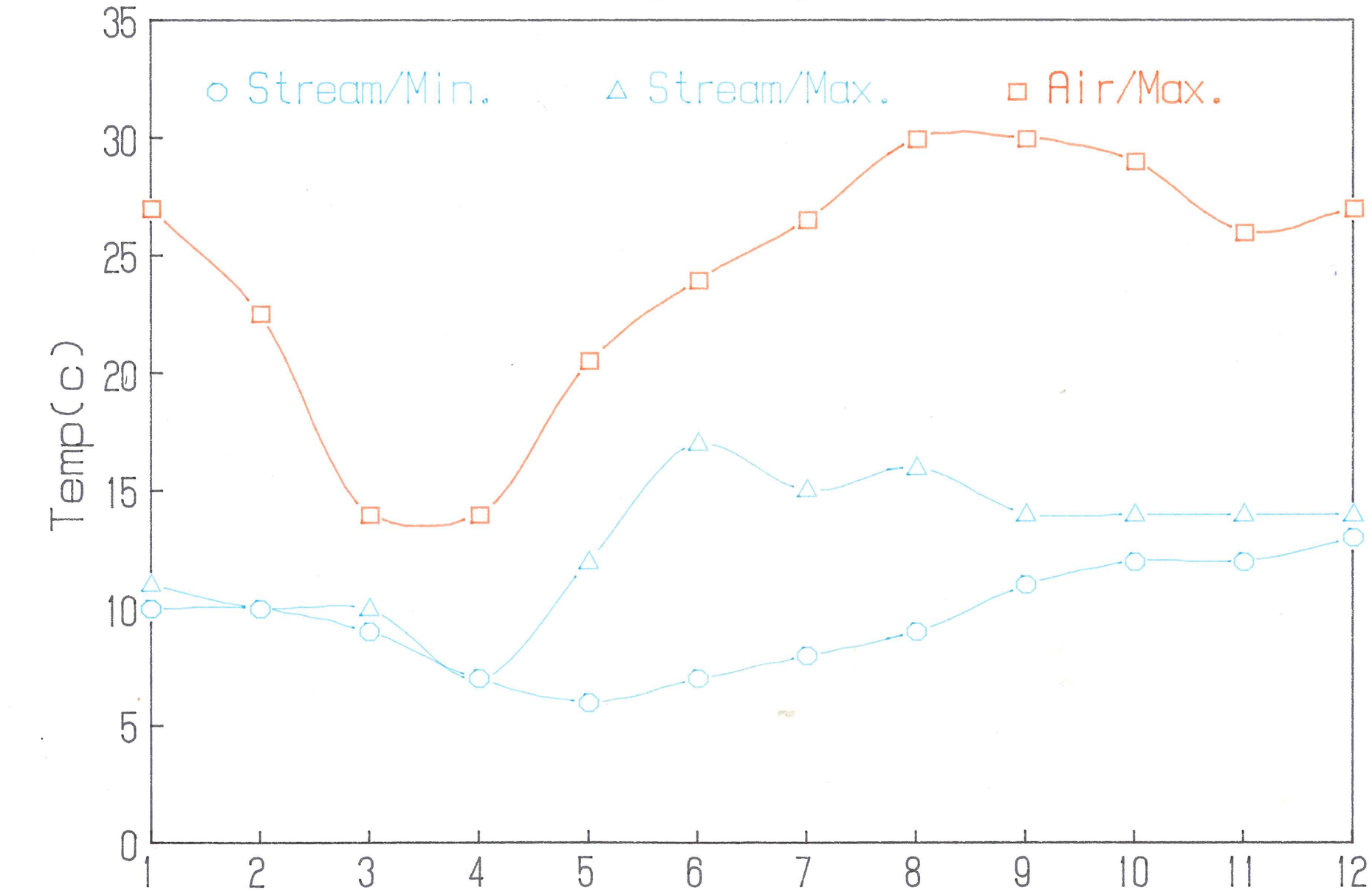
FORTUNE CREEK STN. 5

Daily Temp. (c)



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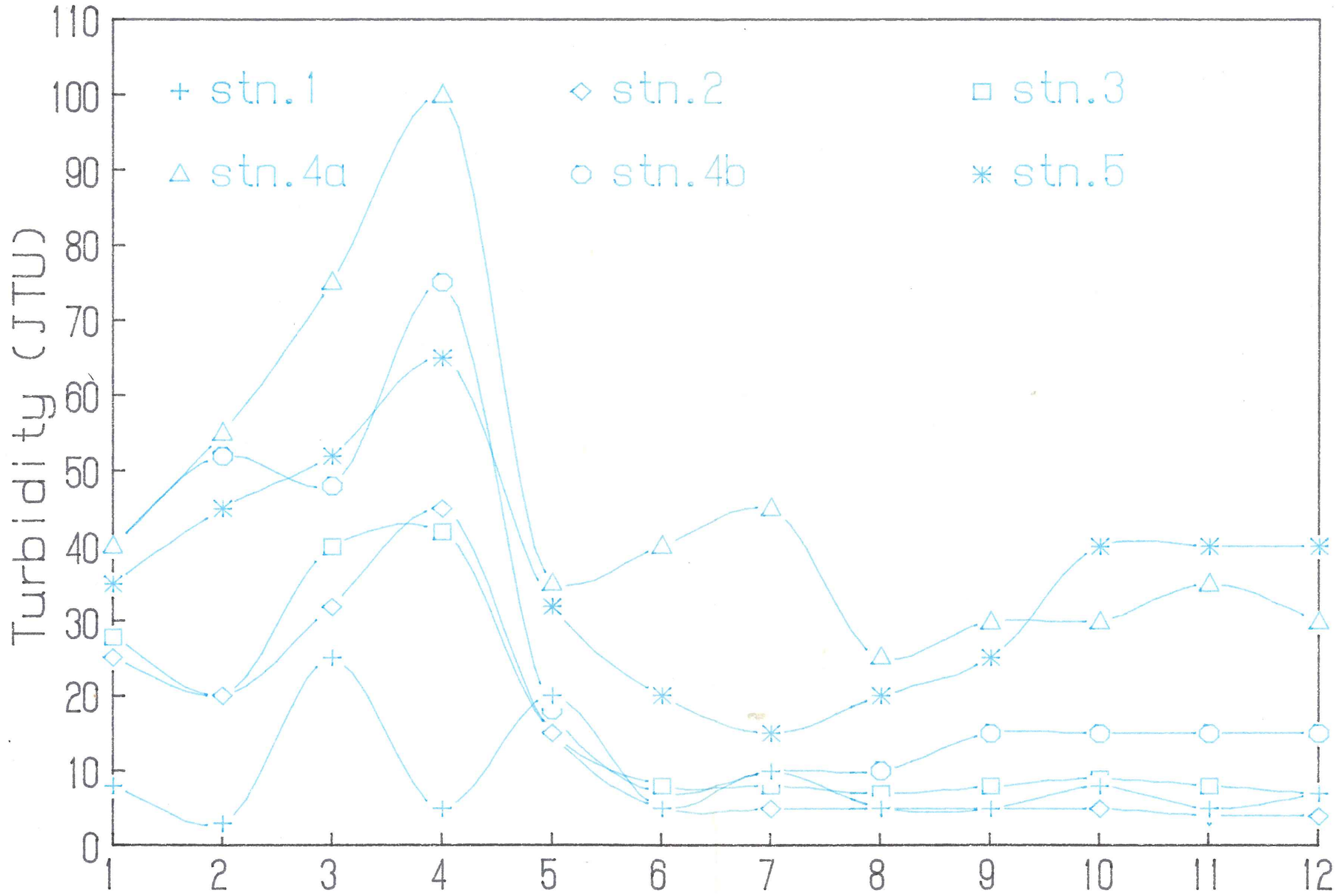
FORTUNE CREEK

Turbidity (JTU)



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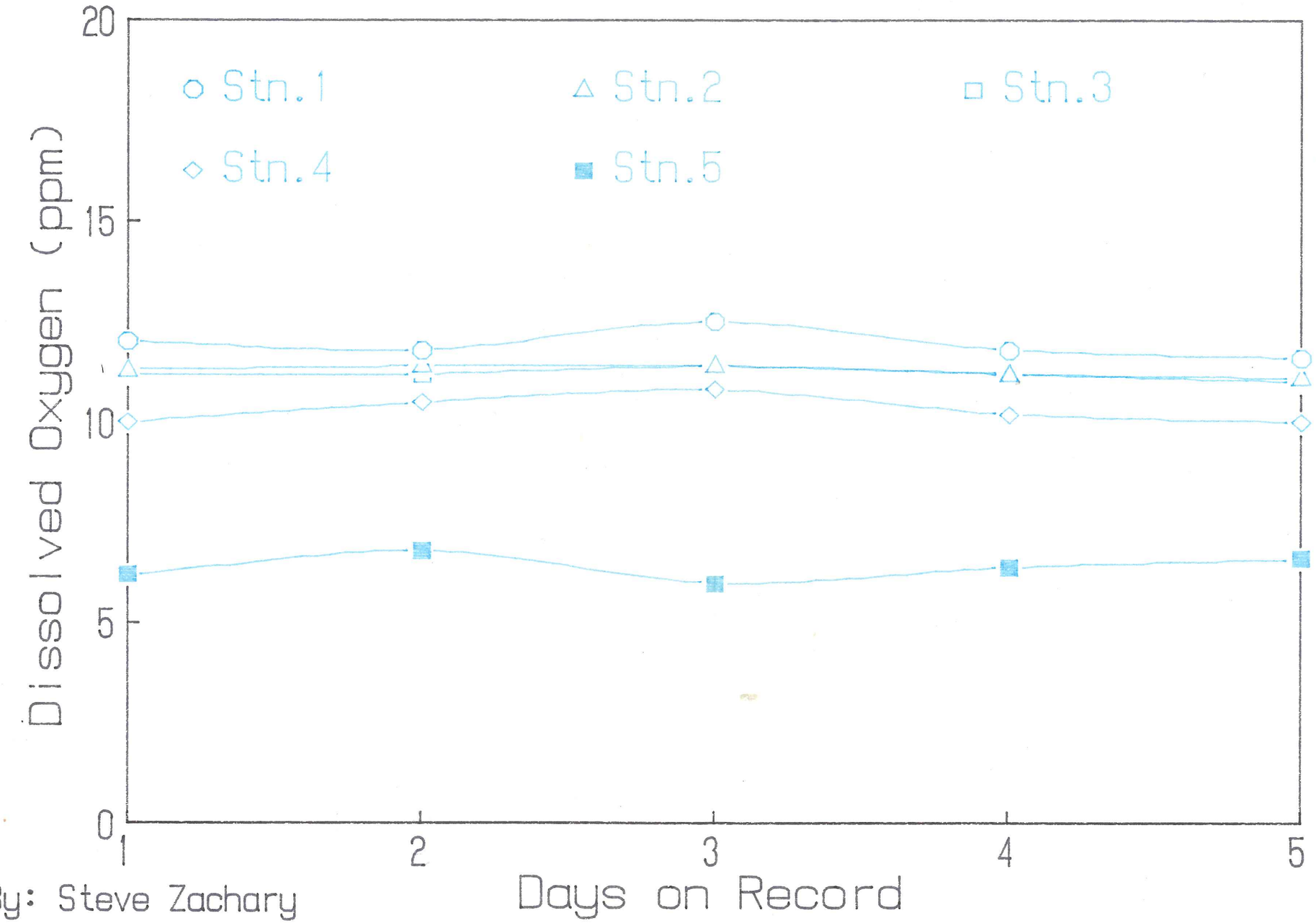
FORTUNE CREEK

Dissolved Oxygen (ppm)



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