

M E M O R A N D U M

May 31, 1977

State of  
Washington  
Department  
of Ecology

To: Gerry Calkins

From: Dan Kruger

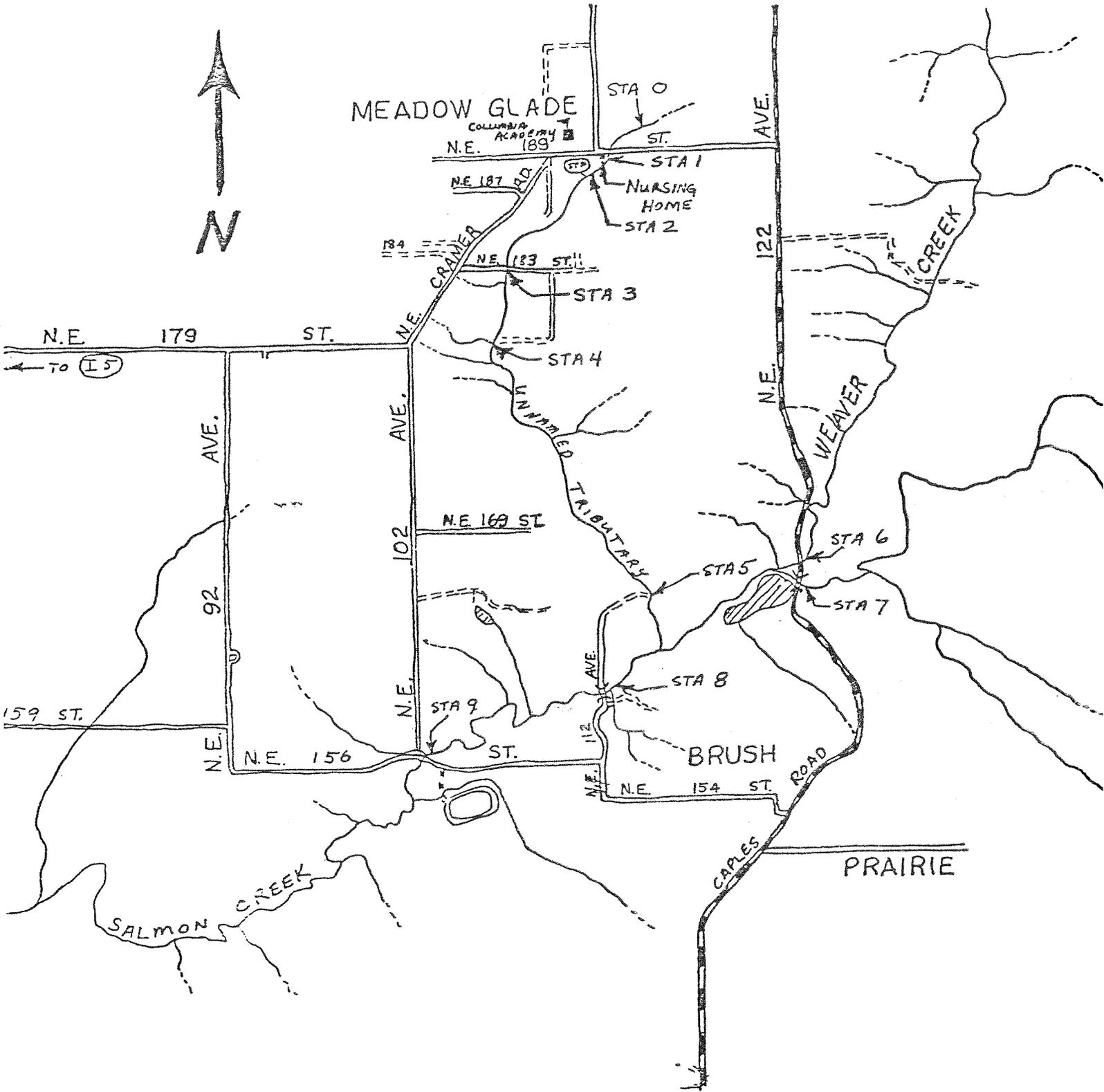
Subject: Columbia Academy - Salmon Creek Survey

INTRODUCTION

Columbia Academy (Clark County) is a small private high school with a current student enrollment of 244 and a faculty of 30. The academy operates a small trickling filter sewage treatment plant with a permit discharge limitation of 0.06 MGD. The average discharge for May was 0.003 MGD. The treatment plant, although not hydraulically overloaded, seldom meets NPDES requirements for wastewater effluents due to the lack of a certified plant operator. The problem proposed to me was to conduct a survey to determine the impact of the Columbia Academy sewage treatment plant (STP) effluent on the primary receiving stream, an unnamed tributary, as well as an important secondary receiving stream, Salmon Creek.

Another aspect of the survey was to determine the possibility of non-point source pollution in the study area. The rural community of Meadow Glade (Figure 1) is at present served by septic tanks. Of major interest to Gerry Calkins is the impact from the Meadow Glade Nursing Home septic tank and drainfield which are adjacent to the headwaters of the unnamed tributary. Therefore the question raised is, do the leachates from the septic tank enter into the receiving stream deteriorating water quality?

Figure 1. Columbia Academy and vicinity with station locations.



## RESULTS AND DISCUSSION

On 3 May, 1977 I conducted a preliminary survey. Samples for total and fecal coliform bacteria were collected from the end of the chlorine contact chamber at the STP and in the unnamed tributary, above and below the discharge pipe. The results obtained (Appendix II) were extremely high. At station 1, above the STP and Meadow Glade Nursing Home counts for total and fecal coliforms were 28,000 and 9,100, respectively. Coliform counts coming from the chlorine contact chamber were 80,000 totals and 8,000 fecals. At station 3, downstream from the STP, counts for both total and fecal coliforms were below those levels determined at station 1. Either the STP had no impact on the unnamed tributary or this sample was not representative of the stream at that station. The latter seems more likely, because downstream concentrations at station 4 increased to 31,000 totals and 4,500 fecals. The flow meter reading for the STP on 3 May gave a plant discharge of 0.002 MGD.

On 9 May, 1977 a complete survey of the area was conducted. Five additional stations were established in order to completely separate and identify all possible sources of pollution. Station descriptions are given in Appendix I. Grab samples were collected within a two hour period from all stations.

The Meadow Glade Nursing Home does not appear to be a source of pollution to the unnamed tributary through septic tank leaching. Comparison of data between stations 1 and 2 (above and below) shows little or no change in all parameters.

The Columbia Academy STP, with a discharge of 0.003 MGD, has a substantial impact on a short reach of the unnamed tributary. A gradual increase in turbidity, pH, and conductivity was determined from station 0 to station 5, the most downstream station. Substantial increases in total and fecal coliform densities, nitrate, nitrite, ammonia, orthophosphate, and total phosphate concentrations were determined below the STP outfall. Data collected above and below the STP (station 2 vs. station 3) showed a 12-fold increase in total coliform bacteria with fecal coliforms increasing only 3-fold. At station 5 total coliforms were half those found at station 0, whereas fecal coliforms remained somewhat higher, about 2.5 times greater than at station 0. Fecal coliform densities are very high with a median value of 1150 colonies per 100 milliliters. A definite fecal pollution problem exists in this area.

Levels in nitrate nitrogen increased 2.3 times below the STP, but were not unusually high. Standards for domestic drinking supplies recommend the use of water with nitrate nitrogen concentrations below 10 mg/l (Quality Criteria for Water, 1976). The maximum concentration in the receiving waters was 1.8 mg/l at station 4. Similarly, nitrite nitrogen increased 5-fold to a maximum concentration of 0.11 mg/l at station 3. However, this value is also far below standards set for human consumption at 1.0 mg/l (Ibid.). Ammonia nitrogen showed the largest increase (10 times) to 0.54 mg/l below the STP outfall, but decreased rapidly at station 5 to 0.02 mg/l, a lower concentration to that at station 0 (0.08 mg/l). The rapid loss of ammonia can be explained by the following processes; nitrification ( $\text{NH}_3 \rightarrow \text{NO}_3$ ), denitrification ( $\text{NH}_3 \rightarrow \text{N}_2(\text{gas})$ ), or nitrogen assimilation ( $\text{NH}_3 \rightarrow \text{organic -N (biomass)}$ ).

The data suggest that the unnamed tributary has nearly recovered from the effects of the STP 2.4 kilometers downstream from the point of discharge. It appears that the Columbia Academy STP has only a localized effect on the unnamed tributary.

The unnamed tributary converges with Salmon Creek approximately 300 meters downstream from station 5. A visual determination of stream discharge indicated that Salmon Creek would dilute any chemical or physical effect from the unnamed tributary. Chemical analysis of Salmon Creek showed very little change below its confluence with the unnamed tributary. The small variations in water quality between stations 7 and 8 the author believes to be a combination of tributary flow from both Weaver Creek and the unnamed tributary.

DK:ee

cc: Dick Cunningham  
Central Files

APPENDIX I

Station Descriptions

STATION DESCRIPTION

- Sta. 0 - Located on north side of N.E. 189 St. and directly east of N.E. 112 Ave. in marsh.
- Sta. 1 - Located behind Meadow Glade Nursing Home on the northeast end of carport area.
- Sta. 2 - Located on unnamed tributary below the Meadow Glade Nursing Home but immediately above its confluence with the Columbia Academy STP.
- Col. Acad. STP - Located behind the grocery store on N.E. 189 St. directly across from Columbia Academy.
- Sta. 3 - Located on the south side of N.E. 183 St. as it crosses the unnamed tributary down embankment at end of culvert.
- Sta. 4 - Located on the south side of N.E. 179 St. (dirt road) as it crosses the unnamed tributary down embankment at end of culvert.
- Sta. 5 - Located on N.E. 112th Ave. (dead end road), northwest of Brush Prairie, immediately downstream from a small green house, on the unnamed tributary.
- Sta. 6 - Located on Weaver Creek as it crosses Caples Road, on west bank north of Brush Prairie.
- Sta. 7 - Located on Salmon Creek as it crosses Caples Road, on west bank north of Brush Prairie.
- Sta. 8 - Located on Salmon Creek where it crosses N.E. 112 Ave., on south bank below its confluence with Weaver Creek and the unnamed tributary.
- Sta. 9 - Located on Salmon Creek immediately east of the intersection of N.E. 156 St. and N.E. 102 Ave. on west bank.

APPENDIX II

Coliform Data

Columbia Academy - Salmon Creek Survey  
Data Collected 5/3/77

## Coliform Bacteria (#/100 ml)

<u>Station</u>	<u>Total</u>	<u>Fecal</u>
1	28,000	9,100
C.A. STP	80,000	8,000
3	24,000	5,200
4	31,000	4,500

APPENDIX III

Data Tables

Columbia Academy - Salmon Creek Survey

Data Collected 5/9/77

Parameter	Mainstem of Unnamed Tributary		Mainstem of Salmon Creek		Weaver Creek	
	Sta.		Sta.		Sta.	
pH	0	6.8	7	7.3	6	7.3
	1	6.9	8	7.3		
	2	6.9	9	7.3		
		C.A. STP	7.1			
	3	7.1				
	4	7.4				
	5	7.5				
Turbidity (NTU)	0	3	7	6	6	6
	1	4	8	7		
	2	4	9	7		
		C.A. STP	28			
	3	5				
	4	6				
	5	6				
Conductivity (umhos/cm)	0	140	7	52	6	85
	1	140	8	55		
	2	150	9	55		
		C.A. STP	370			
	3	180				
	4	160				
	5	140				
Total Coliform Bacteria (#/100 mls)	0	800	7	2000	6	5800
	1	1500	8	800		
	2	500	9	2000		
		C.A. STP	800,000			
	3	6000				
	4	2000				
	5	400				
Fecal Coliform Bacteria (#/100 mls)	0	150	7	150	6	240
	1	560	8	350		
	2	440	9	280		
		C.A. STP	46,000			
	3	1300				
	4	1200				
	5	480				

Parameter	Mainstem of Unnamed Tributary	Mainstem of Salmon Creek	Weaver Creek
	Sta.	Sta.	Sta.
Nitrite Nitrogen NO <sub>2</sub> -N (mg/l)	0	.02	7 .02
	1	.02	8 .02
	2	.02	9 .02
	C.A. STP	.02	
	3	.11	
	4	.08	
	5	.02	6 .02
Nitrate Nitrogen NO <sub>3</sub> -N (mg/l)	0	0.87	7 .52
	1	0.82	8 .65
	2	0.76	9 .02
	C.A. STP	.40	
	3	1.70	
	4	1.80	
	5	1.14	
Ammonia Nitrogen NH <sub>3</sub> -N (mg/l)	0	.08	7 .02
	1	.04	8 .02
	2	.05	9 .03
	C.A. STP	8.40	
	3	.54	
	4	.40	
	5	.02	6 .06
Ortho- phosphate O-PO <sub>4</sub> (mg/l)	0	.12	7 .04
	1	.09	8 .02
	2	.10	9 .05
	C.A. STP	1.9	
	3	.44	
	4	.36	
	5	.12	6 .25
Total Phosphate (mg/l)	0	.17	7 .04
	1	.11	8 .06
	2	.12	9 .06
	C.A. STP	3.3	
	3	.58	
	4	.40	
	5	.15	6 .28