3547 Skaha Lake Road, Penticton, British Columbia V2A 7K2 Telephone: 493-8261

Linda Hannah
Planning and Assessment Branch
Victoria

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File: N5016010
Summerland
Shaughnessy Spring

Subject: Nitrogen and Phosphorus in Shaughnessy Spring

At our meeting on June 23rd I was asked to provide two pieces of information for the planning document for the Trout Hatchery water supply at Shaughnessy Spring. One was revised estimates of nitrogen and phosphorus loading from creeks in the area; the other was explanation on the difference in the water quality between Lower Prairie Creek and Lower Eneas Creek.

In order to provide a better estimate of the total load of nitrogen and phosphorous provided by Gary Kennedy's update of 1980, I wanted to incorporate the nitrogen and phosphorus which would be contributed from natural stream load components. The natural component that Kennedy envisoned was nitrogen and phosphorus expected water in the water regardless of whether people lived in the area. These estimates were made with the values given in the Okanagan Basin Study (OBS Technical Supplement No.4, pages 204, 205). The values for Nitrogen and Phosphorous respectively, are 16% and 38%. Using these numbers the revised total load for the drainage area 5D1, which includes Shaughnessy Springs study area, would be: 18927 kilogram per year total nitrogen and 1460 kilogram per year total phosphorus.

To obtain a total load for surface water in the drainage area from Eneas Creek, Prairie Creek and Shaughnessy Spring, it is necessary to calculate the load for Shaughnessy Spring. A flow figure of .08 cubic meters per second was used for this calculation together with average quality data for the whole period of record stored on the Ministry of Environment Computer System. Thus Shaughnessy Spring has an annual load (kilogram per year) of: 11,600 nitrate, 13,600 total nitrogen and 40 total phosphorus. Adding the Shaughnessy Spring loading to the annual load for Eneas and Prairie Creek gives a total surface water load for the drainage area (kilograms per year) of 40,300 total nitrogen and 670 total phosphorus.

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The loading estimate on the basis of the measurement agrees well for phosphorus with those estimates that were made by Kennedy (1982). For nitrogen, however, the estimates made upon observations of surface water are much greater than those estimates made by Kennedy (1982) on the basis of accounting for sources of nutrient. No reason for this discrepancy is obvious to me. I would hope that the information assembled by Phil Epp might shed some light on possible reasons for the difference between measurements of nitrogen load in streams and estimates based on inputs.

Eneas Creek and Prairie Creek both increased in nitrate and total nitrogen from the upstream sampling point to the mouth. However, Eneas Creek increased to a much greater extent in this reach than did Prairie Creek. You asked me to speculate on possible reasons for the difference between these two creeks. One difference is that Prairie Creek flows through a more urban environment than does Eneas Creek. There is a much greater area of orchard surrounding this reach of Eneas Creek than the comparable reach of Prairie Creek. For this reason it is tempting to attribute the difference to a greater agricultural component in the case of Eneas Creek and a greater urban septic tank component in the case of Prairie Creek. From this it would follow that nitrate might be affected more by agricultural sources than septic tank sources.

I am reluctant to advance such an argument for two reasons: one is that Prairie Creek exists in what is presumably a much larger creek channel than Prairie Creek created by itself. The channel for Prairie Creek was the old channel for Trout Creek before the latest series of glaciations. Therefore, the gravels which underlie Prairie Creek must be quite extensive, presumably more extensive than those underlying Eneas Creek which I presume is still in its original channel. Thus Prairie Creek might have a much greater load of nitrate associated with groundwater flow in it's streambed than Eneas Creek. The other reason why it seems to me unreasonable to attribute the difference in nitrates increase along the comparable reach of the two Creeks to urbanization versus orchard fertilizer is that Prairie Creek is culverted for a good portion of its flow through Summerland. Eneas Creek, on the other hand exists in a channel with a gravel bed even though the course of the channel itself has been redirected in a number of locations along the creek. Because of the culverting of Prairie Creek it is possible that the creek is perched above the groundwater table and as a result might not receive all of the nitrate rich water which could exist in the groundwater table. Thus there are at least three differences between Prairie Creek and Eneas Creek which might account for the greater increase of nitrate in Eneas Creek ~~and~~ than Prairie Creek.

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I might also point out that the major increase in nitrate concentration for Eneas Creek occurs about the same distance from Okanagan Lake as for Shaughnessy Springs. In 1980 we collected a series of samples along the Lower Eneas Creek from Highway 97 to Okanagan Lake. In six sampling sites along Eneas Creek only the lowest two sampling sites showed the really dramatic increase in nitrate which was reflected in the data set for site 0500324 at the mouth of Eneas Creek in the report on Shaughnessy Springs. The more upstream of these two sampling sites is roughly the same distance back from Okanagan Lake as Shaughnessy Springs itself. This suggests that for Eneas Creek as for Shaughnessy Springs the contact with permeable soil and clay layer pushes nitrate-rich groundwater to the surface in both Eneas Creek and Shaughnessy Springs.

Please let me know if you have any questions about information in this memo or other material I have submitted on Prairie and Eneas Creek.

Dr. J. E. Bryan
Head, Environmental Section
Waste Management Program Okanagan
Sub-Region

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