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# CRITIQUE OF THE WASHINGTON DEPARTMENT OF ECOLOGY SURVEY OF THE WILLAPA RIVER ON AUGUST 20, 21, 1974

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# CRITIQUE OF THE WASHINGTON DEPARTMENT OF ECOLOGY SURVEY OF THE WILLAPA RIVER ON AUGUST 20, 21, 1974

The survey report of the Willapa River on August 20, 21, 1974 by the Washington Department of Ecology has been reviewed. In reading the report, it appears that many of their data and observations are in conflict with our data and conclusions. The following critique attempts to explain why the differences have occurred.

First, it is advisable to include some background information, so that one understands some of the technical terms. The object of the DOE study was to demonstrate a dissolved oxygen sag in the Willapa River, and further to show that such a sag was caused by East Point Seafood effluents.

With respect to organic waste discharges, such as those discharged by East Point, the primary concern is not the fate of the wastes per se, but the effects of their degradation on water quality, in particular the dissolved oxygen (DO) concentration in the receiving waters.

A measure of organic waste load is biochemical oxygen demand (BOD), which indicates the amount of oxygen drawn upon in the process of decomposition of the waste. The rate at which the BOD is exerted combined with the rate at which oxygen is restored determines the level of dissolved oxygen (DO) in the river.

In a river flowing one way (without tidal influences) the combined effect of an organic waste discharged at a specific location and reaeration in the stream results first in a decrease, and then an in-

crease in DO as the waste is carried downstream for many miles. This phenomenon is described by a characteristic curve known as the "oxygen sag".

Other things being equal, factors that reduce the rate of BOD lengthen and decrease the oxygen sag, while those that accelerate BOD have the reverse effect. The shape of the oxygen sag curve is also affected by the rate of reaeration, which depends largely on channel characteristics as they affect turbulence, the area of the air-water interface, the net oxygen produced by photosynthesis from aquatic plants and the velocity of stream flow.

The potential for finding a conventional oxygen sag in the Willapa River is low. The tide turns the river flow around four times in 24 hours, and the wastes are moved and recombined in a complex pattern. The heavier salt water flows mostly in the lower depths of the Willapa River, and the degree of mixing of fresh and salt water further complicates the development of a "typical" oxygen sag curve.

The role of photosynthesis as a producer of oxygen, in the dissolved oxygen balance of receiving waters is a complex one. Photosynthesis depends on light, nutrients available, stream velocity, types of waste load, water depth and water temperature.

It is possible that if one measured the DO levels under and near the East Point dock, low levels of DO would be recorded, especially at slack tides. However, as the tide begins to move the organic loading wastes, the DO at stations other than the immediate vicinity of East Point (Stations C, D, E, F, G) are higher or not significantly reduced. That is to say, if one considers Stations C, D, E, F, and G as the immediate vicinity of East Point, organic waste discharge as a single point (they

are all within approximately 900 feet of the East Point plant) the so called oxygen sag at Stations C, D, E, F, G becomes a very localized condition whose effect is not detectable, using the DO data on page 17 of the report, at Stations A, B or H, I several miles on either side of the East Point plant. Thus, the usual connotation of a DO sag curve which is detectable for a distance of several miles is not demonstrated by the DO data on page 17 of the report. What is demonstrated by the graph on page 10 of the report is an expanded set of stations near the East Point plant which tend to magnify the higher BOD zone near the plant, and then contrasts the higher DO levels at the other stations.

Furthermore, low DO readings were measured by the DOE at stations far upriver, e.g., on 8/20/74, surface and 10 foot level, the third sets. The third set on 8/20/74 at the 10 foot level has the lowest DO's (5.4 mg/l) at Stations J and K, far upriver from the East Point plant. It is highly unlikely that the low DO's at J and K mentioned above are caused by East Point organic wastes when higher DO readings are interposed between East Point plant and Stations J and K. The same is true for station J and K on 8/20/74 surface, third set data.

Perhaps the greatest influence on the conclusions reached by the DOE is based on the design of their study, i.e., the location of sampling stations. By locating five sampling stations (C, D, E, F, G) along one bank and under the East Point plant and nearby floats very little resolution of the DO conditions in other parts of the river could be determined. Then by locating a station several miles downriver from South Bend (Station A) and locating several stations above Raymond (Stations J and K), and by selecting certain data as seen on page 10 of the report, a temporary oxygen sag curve close to the East Point plant

can be sketched. The other 90 percent of the river flowing by the East Point plant and its potential for flushing away oxygen demanding wastes is ignored.

Furthermore, detailed mapping of the DO levels up and down river are difficult to plot from the report without the time of day since the tide reverses the river flow four times a day.

Another potential source of error in the DOE data is the use of the Hydrolab instrument for dissolved oxygen determinations. The integrity of the DO data depends on the DO probe and the membrane on the end of the probe. The DOE field staff were experiencing some problems with their DO probe membranes as mentioned on page one of their report. Due to the importance of dissolved oxygen in the determination of a DO sag curve, our group decided to titrate all our dissolved oxygen samples by the more conventional Winkler Method.

Finally, the report ignores the biological indicators (juvenile salmon, anchovies, and oysters) that survive in a healthy condition and actively feed in the vicinity of the East Point dock.

I trust the DOE will soon grant East Point's permit for continued operations. I do not find their report reliable evidence for a dissolved oxygen sag in the Willapa River that is attributable to East Point Seafood.