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Memorandum

To: Sandi Stephens
From: Joe Joy
Subject: Review of work relating to Black Diamond WTP

Presented are the main points of two pieces of work performed by consultants, R.W. Beck (1985) and ERM Southeast (1986) on the Black Diamond WTP failure issue. Also included are comments and a figure made during my review of these works in preparation of designing a monitoring study of the site as requested by the Ecology Northwest Regional Office and METRO.

R.W. Beck and Associates performed a month long monitoring of the plant in May, 1985, and reviewed other water quality data. Their findings were presented by the City of Black Diamond as proof of the failure of the WTP. In response, the USEPA hired the firm ERM Southeast, to review and comment on the Beck report and other available data. USEPA is using ERM's findings as proof of the plant's success.

R.W. Beck's Evaluation:

- The City's NPDES permit report shows adequate removal based on reduced concentrations of nutrients. This is inappropriate; the calculations should be based on load.
- Effluent loads to the marsh are below estimated design loads; despite this, the marsh and lagoons were failing to meet NPDES permit limits for: BOD, SS, nitrogen and phosphorus removal.
- Long-term seasonal loads to Rock Cr. from the WTP are unknown because of inaccurate flow monitoring devices at the Morganville Bridge monitoring station (final effluent after marsh treatment).
- Total phosphorus concentrations in Rock Cr. below the marsh have increased 10-fold since the WTP began operation- from an average of 0.05 mg/L to 0.74 mg/L.
- Poor phosphorus removal may be a function of poor soil adsorption capacities.
- During their monitoring, they found 26 to 64% of the flow at the Morganville Br. to be unaccounted.

ERM Southeast's Evaluations:

Critique of Beck report:

- Beck's water budget for the May, 1985 monitoring is in error:
  - -flow instruments used (Gurley meters) have a high degree of inaccuracy in low velocity waters
  - -interaction between the creek and the marsh was not considered
  - -precipitation effects on flow was not considered
- Beck's nitrogen removal calculations were in error:
  - -nitrogen removal in the lagoons was not estimated

-removal of Rock Cr. nitrogen inputs above the WTP were not estimated
-removal of other nitrogen inputs into the marsh were not considered, and a load was not ascribed to these other inputs

o BOD and TSS calculations in error:
-lagoon should be removing adequated BOD which was not considered in the report
-TSS "occasionally" exceeds NPDES limits in effluent from the lagoon, but the marsh should be able to handle it and Beck did not evaluate this

Evaluation of the WTP

o The DMRs show adequate treatment of BOD and TSS:
-lagoons have been acheiving an average 84.8% BOD removal;probably more if aerators were run more often
-some "occasional" violations of TSS, but lagoons usually cannot meet 30mg/l, so permits are usually modifed to fit the technology
-wetlands have adequate capacity to treat TSS
-aerators should not effect TSS concentration

o Nitrogen removal is probably adequate:
-assuming: 30% removal in lagoons; unaccounted flows are attributed 0.7mg/l; there is interaction between Rock Cr., other flows and the marsh
-removal efficiencies range from 66% to 71% depending upon the combination of mechanisms used
-"it is not possible to conclusively prove that the wetland is either meeting or not meeting the permit nutrient removal effiencies on a mass basis."

o Phosphorus is not meeting removal efficiencies:
-this is true for marsh treatment systems everywhere
-alum treatments of effluent prior to marsh dispersal have been successful
-a wasteload assessment is necessary to determine the amount of removal required to protect Lake Sawyer, and set reasonable effluent limits

o Channelization of Rock Cr. by the City may have compromised the efficiency of the marsh system

Ecology WQIS Evaluation:

Beck helped to clarify some of the issues at the plant by showing how:

o The current monitoring system is inaccurate and unreliable.
o The phosphorus concentrations in the creek have jumped an order of magnitude since the plant came on line.
o There are wide variations within a single month in terms of concentration, removal efficiency, flow and effluent loading.

ERM has presented many good points in its critique of Beck's work:

o Beck should have monitored lagoon effluent to better judge the efficiency of the marsh system
o The unaccounted flows make evaluation of the efficiency of

many aspects of the marsh difficult, if not, impossible.

- o Some load should have been ascribed to the unaccounted flows
- o Some removal should be attributed to the lagoon for nitrogen and BOD
- o The steady-state water balance model does not accurately describe the marsh

Neither paper can accurately describe the nitrogen,BOD or TSS removal efficiency of the treatment system from the current database. Each admits this as they discuss their calculations. For example, each declares the steady-state model is improper, but both use it to prove their case.

Both agree phosphorus removal in the system has failed. Instream phosphorus concentrations below the marsh have dramatically increase since the WTP began operation (Figure 1). Both show improper monitoring of the plant. Both agree more monitoring is necessary to determine if other removal efficiencies are as poor as for phosphorus.

cc: Lynn Singleton, WQIS
Gary Brugger, NWRO

REFERENCES CITED

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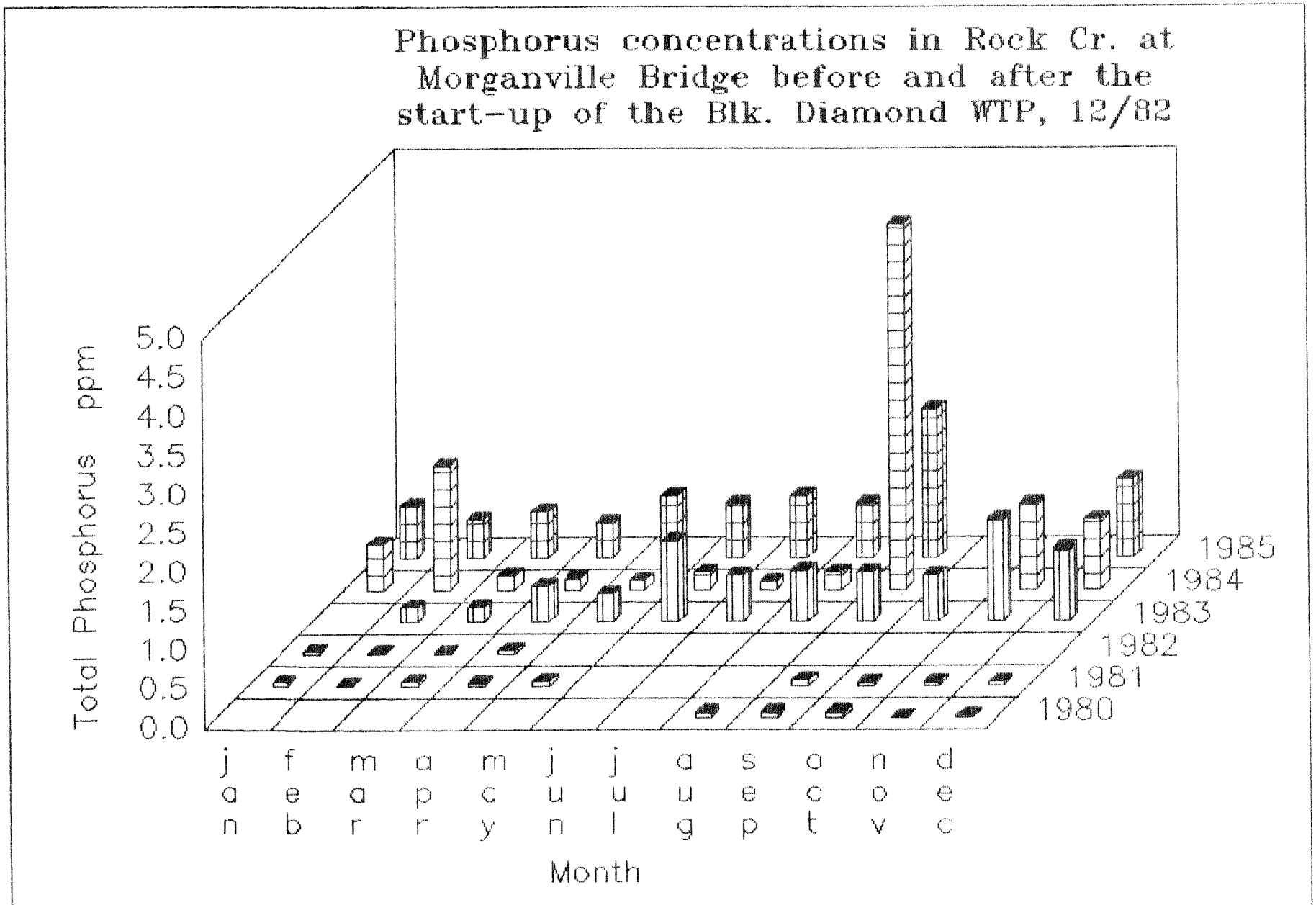

Figure 1. Phosphorus data for Rock Cr. from KCM, 1982 and Ecology, 1986.