

MEMORANDUM

Date: January 24, 2012
To: Water Right File 47-7458
From: cpalmer
Re: Licensing memo

PD: There is one point of diversion at Deep Creek. From the field exam photos, it appears that there is a rectangular weir at a point on the channel that goes into the fish ponds. In addition, the field examiner made the comment that there is a rectangular weir at the outlet. It appears that the condition of the permit that requires measuring devices at the inlet and outlet has been met.

POU: The place of use consists of a series of ponds.

VOLUME CALCULATION: The volume that the field examiner recommended is based on the full volume of the fish operation. To further pin down a volume, I will evaluate the amount of water that is actually required to achieve beneficial use for the size of the operation. There are a few known factors in this case; the diversion rate is 29.8 cfs, the volume of the ponds is 14,400 cubic ft., and the other factors that I will use in my calculation will come from industry standards per staff engineer Mat Weaver's analysis in connection with permit 47-7659.

Density Index ($W = D \times L \times V$)		Flow Index [$F = W / (L \times Q)$]
W=weight in lbs		F=1.5 unitless
D=range 0.4-1 unitless		W=weight in lbs
V=140,400 cubic ft-size of ponds		L=13.5 inches-length of fish
L=13.5 inches-length of fish		Q=13,374.24 gpm or 29.8 cfs
W= 758,160-1,895,400 lbs of fish		W=270,828.4 lbs

Can rate accommodate the size of the ponds?-----> NO, can only accommodate 270,828.4 lbs of fish.

The limiting factor is the diversion rate

Since I know how many lbs of fish 29.8 cfs can accommodate, I can back-calculate the density index to figure out how much space (volume) is required to raise 270,828.4 lbs of fish.

$270,828.4 \text{ lbs} = 0.4-1 \text{ (range)} \times 13.5 \times V$
V range = 20,061.4 cubic ft to 50,153.4 cubic ft

Despite the size of the raceways being 140,400 cubic ft, the volume range that is necessary for the amount of fish that they can raise is 20,061.4 - 50,153.4 cubic ft. To further calculate how much water is beneficially used in the fish raceways, I calculated how much water is required to keep up the water quality. A water change of 2.5 times per hour is required to maintain adequate oxygen for trout. Using that rule of thumb, I reach the following conclusion:

2.5 times per hour is 60 changes in a day.
 $60 \times 20,061.4 = (1,203,684 \text{ cubic ft/day} \times 365) / 43,560 = 10,086 \text{ afa}$
 $60 \times 50,153.4 = (3,009,204 \text{ cubic ft/day} \times 365) / 43,560 = 25,214 \text{ afa}$

The amount of water beneficial used for the subject fish propagation operation does not exceed 25,214 afa.

Secondary Check

Annual Volume for Fish Propagation

1. Calculate changes per hour:

Total flow into facility x 3600/facility volume (cf) = changes

2. Calculate annual volume:

Facility volume (AF) x changes x 8760 = AFA

3. Calculate volume given by permitted flow:

Flow rate (cfs) x 1.9835 x 365 days = AFA

1. $29.8 \text{ cfs} \times 3600 / 50,153.4 \text{ cf} = 2.1 \text{ changes}$

2. $1.15 \text{ AF} \times 2.1 \times 8760 = 21,155.4 \text{ AFA}$

3. $29.8 \text{ cfs} \times 1.9835 \times 365 \text{ days} = 21,574.5 \text{ AFA}$

4. Choose the lowest figure (in this case they two figures are so close, we can go with the full volume as recommended above)

Recommendation: 21,155 AFA (this is within the range in the beneficial use calculation and is justifiable.