Given:

q_1 = 5 m^3/s

h_1 = 75 ft = 22.860 m

h_2 = 70 ft = 21.336 m

ρ = 1000 kg/m^3 is density of water

g = 9.81 m/s^2 is acceleration due to gravity

Solution:

(1) In absence of water in the tank A the power output of the turbine is equal to decrease in gravitational potential energy of the water which is given by

$W_1 = \rho*g*h_1*q_1$ = 1000*9.81*22.86*5 = $1.121*10^6$ W = 1.121 MW

The speed of water flow is given by

$v_1 = \sqrt{2*g*h_1}$ = sqr(2*9.81*22.860) = 21.18 m/s

Let A be cross sectional are of the tube. Then the volume water flow is given by

$q_1 = A*v_1$

From which we get

$A = q_1/v_1$ = 5/21.18 = 0.2361 m^2

Now consider when the draft tube is at 70 feet below the water surface

Now the speed of water flow is given by

$v_2 = \sqrt{2*g*(h_1-h_2)}$ = sqr[2*9.81*(22.860-21.336)] = 5.468 m/s

So the new volume water flow is given by

$q_2 = A*v_2 = 0.2361*5.468 = 1.291\ m^3/s$

Comparing it with q_1 we conclude that the volume water flow through the turbine reduces

(2) The water is incompressible, so the water flow rate is the same in the draft tube. Therefore the output at the end of the draft tube is the same as at its input

$q_{out} = q_2 = 1.291\ m^3/s$

(3) The new output power of the turbine at the end of the draft tube is given by

$W_2 = \rho *g*(h_1 - h_2)*q_2 = 1000*9.81*(22.860-21.336)*1.291 = 1.930*10^4\ W = 19.30\ kW$

Comparing it with W_1 we conclude that the power of the turbine reduces