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Dear Wade,

As per your request regarding our proposal EWS Q357 for the treatment for Lake Water 21 Unit inn 1-4 piece bath + kitchen tagged for Vacation Investment Properties. The supplied water analysis is as follows:

Hardness: 2 gpg **Iron: 0.01 ppm** **pH: 6.8**
Sulphur: 0.0 ppm **TDS: 46 mg/L** **Tannins: 1.0-2.0 ppm**

Proposed System Designed Flow Rate
The system proposed with the utilization of 1.5" control valves on 24"x72" mineral tanks has the capability to meet a peak demand treated water flow rate of 65 GPM. This was engineered and designed based on the existing pumps capability of pumping 50 GPM while each of our filtration stages is in a duplex alternating configuration with 100% redundancy and back up with a suggested flow rate of 25 GPM to the 21 Unit Inn this will allow proper water required by existing pumping system to backwash, and or regenerate each stage of water filtration properly with minimum pressure drop.

Filtration Stages of Operation Data Design

Stage 1
This will consists of a chemical feed metering injection pump operated by a digital F-2000 flow meter which will operate the feed pump for the injection of pH correction (increase) chemical to raise the pH up from the current recorded levels of 6.8. This is necessary as for the removal of Tannins in our later filtration stage operating water through an organic trap anion exchange resin will lower the pH making the water more acidic. Calculations for injection of pH correction increase chemical will be controlled by a digital floe meter increasing pump injection speed based on demand flow rate to ensure proper pH correction for all water to the Inn.

Stage 2
Standard on any lake water treatment process as the increased pH water will travel through Filter AG Plus turbidity filtration media filtering lake water for turbidity and or suspended solids down to 5 micron which will perform a backwash and a fast rinse to remove any and all turbidity absorbed by the granular media bed depth of filtration to drain automatically programmed to alternate and cycle based on a pre set determined amount of gallons as well as a day's override. Turbidity is a general term for suspended (undissolved) matter in water which makes it appear cloudy. Turbidity in surface water (lakes, streams) can be caused by fine sand, clay, dirt, or vegetable matter. Water from wells can be cloudy from clay, sand, oxidized iron, etc. Water systems (pipes and tanks) can add turbidity due to corrosion products. Tanks and mains may be filled with turbid water which may settle out but later be put back in suspension by high flow rates through them. Calculations for turbidity filtration utilizing a 14x30 mesh granular media will operate under any pH water conditions, maximum water temperature of 140F, (60C) which must have a freeboard bed depth of 50% for proper backwashing and fast rinsing operating parameters with a backwash flow rate of 15-20 gpm/sq.ft. of bed area. A formula is required with the tank diameter and cubic inch of height required with the use of backwash requirements of media to understand and require the proper amount of water to clean and rinse the filtration media utilized in a specific size of mineral tank. The formula calculation is as follows:

Filter Tank Diameter: 21"
Backwash Flow Rate per Square Foot of Bed Area: 15-20
Tank Diameter / Sqft. Bed Area
Tank Diameter: 21 / 2 = 10.5
12 / 12 = 0.875
0.875 X 3.14 = 2.748
2.748 X 1 = 0.875
Tank Diameter per Square Foot Of bed Area: 2.41

Therefore using filter ag plus with a backwash flow rate of 15-20 gpm/sqft. Bed area
2.41 X 15 = 36 GPM

Stage 3
Will consist of our organic trap tannin removal ion exchange filter which will remove the tannins (organics) from the lake water utilizing control valves and anion exchange resin which uses sodium chloride as a regenerate for the exchange of tannins off of the water resin. Tannin is a type of organic matter which is familiar to many of us. The yellow to brownish-black color in tea or coffee is partially caused by tannins. When leaves and other vegetation decay, tannins are freed with a resulting color. There seems to be varying opinions whether tannins themselves cause staining. Although extremely high amounts such as found in a cup of coffee definitely cause staining on the coffee cup. If the tannins combine with other substances in the water, staining may occur. For example if soluble iron is present, the tannins tie up the iron and prevent it from being removed by a water softener. Although the cold water containing this iron tannate complex may not cause staining, the hot water or bleach in a washer

may break the complex and the iron will cause staining. Waters containing undissolved tannins are often mistaken for having an oil film on the surface. Calculations for tannin removal utilizing anion exchange resin media will operate under pH water conditions of 5-9 ppm with a maximum water temperature of 140F, (60C) which must have a freeboard bed depth of 50% for proper backwashing, regenerate draw/slow rinse, and fast rinsing operating parameters with a backwash flow rate of 3-6 gpm/sq.ft. of bed area. A formula is required with the tank diameter and cubic inch of height required with the use of backwash requirements of resin to understand and require the proper amount of water to perform the ion exchange of tannins utilized in a specific size of mineral tank. The formula calculation is as follows:

Filter Tank Diameter: 21"
Backwash Flow Rate per Square Foot of Bed Area: 15-20
Tank Diameter / Sqft. Bed Area
Tank Diameter: 24 / 2 = 12
12 / 12 = 1
1 X 3.14 = 3.14
3.14 X 1 = 3.14
Tank Diameter per Square Foot Of bed Area: 3.14

Therefore using tannin anion resin with a backwash flow rate of 3-6 gpm/sqft. Bed area
3.14 X 5 = 15.7 GPM

Stage 4

Polishing chemical removal taste & odour polishing is the final stage prior to ultra violet disinfection for bacteria free water. Backwashable automatic filters also with 100% back up will be utilized to clean and polish the water provided to the Inn. Centaur Carbon utilized over graded quartz under bed is a liquid 12x40 mesh virgin activated carbon NSF certified manufactured to develop catalytic functionality. This carbon is suited for the use in residential and or commercial water filters, for treatment of process water in the bottling and soft drink industries. Centaur carbon combines a fine pore structure for enhanced absorption of trace contaminants with high catalytic activity for their elimination. Calculations for carbon polishing filtration utilizing a 14x30 mesh granular media will operate under any pH water conditions, maximum water temperature of 140F, (60C) which must have a freeboard bed depth of 50% for proper backwashing and fast rinsing operating parameters with a backwash flow rate of 10-12 gpm/sq.ft. of bed area. A formula is required with the tank diameter and cubic inch of height required with the use of backwash requirements of media to understand and require the proper amount of water to clean and rinse the filtration media utilized in a specific size of mineral tank. The formula calculation is as follows:

Filter Tank Diameter: 21"
Backwash Flow Rate per Square Foot of Bed Area: 15-20
Tank Diameter / Sqft. Bed Area
Tank Diameter: 21 / 2 = 10.5
12 / 12 = 0.875
0.875 X 3.14 = 2.748
2.748 X 1 = 0.875
Tank Diameter per Square Foot Of bed Area: 2.41

Therefore using filter Centaur Carbon with a backwash flow rate of 10-12 gpm/sqft. Bed area
2.41 X 10 = 24 GPM

Water Treatment Proposal Conclusion:

Based on supplied water test recorded analysis for the treatment process to treat lake water to potable bacteria free water the above process engineered and designed by Excalibur Water Systems will meet all filtration requirements utilization all major components and resins and medias to hold the NSF certification. All calculations for removal of contaminants based on water trest results and designed flow rate for maximum bed depth contact time for proper filtration are met and exceeded based on our current design. Our designed system with an existing pumping system capable of delivering a peak flow rate of 50 GPM and a estimated flow rate of 25 GPM to the Inn by utilizing duplex alternating filtration and exchange systems we will be able to meet and deliver treated water to the inn and be able to perform any regeneration required at anytime with proper backwash flow rates required at a minimum of 40 psi.

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