PARAISO SPRINGS RESORT
FLUORIDE WATER TREATMENT
REGENERATION EFFLUENT
ANALYSIS

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PREPARED BY:
TIM BUSHMAN CWS VI, CI
FOR:
THOMPSON HOLDINGS, LLC

CULLIGAN QUALITY WATER ENTERPRISES, 625 WEST MARKET STREET, SALINAS, CA 93901
STATE OF CALIFORNIA CERTIFIED SMALL BUSINESS OSDS Ref# 61403
831-755-0500 1-800-252-1001 FAX 831-755-0510

Introduction

Paraiso Springs Resort has proposed to install a water treatment system in order to reduce Fluoride concentrations to acceptable levels.

The treatment system utilizes Activated Alumina (AA) Filtration to accomplish treatment. Because the AA media possesses a finite capacity for Fluoride, the media must be regenerated in order to provide continued service.

Due to the volume of treated water required for the facility and the corresponding scale of the treatment system required, it will be necessary for the system to regenerate onsite.

There are two (2) main constituents that may be of concern contained in the regeneration effluent, being Fluoride and Aluminum. The Fluoride content occurs from the removal during treatment. The Aluminum content is the result of a slight media attrition that occurs during the regeneration process.

A scaled pilot has been completed in order to determine operating parameters as well as expected waste water volumes and waste constituents of the proposed full scale system.

There are two options for the handling of the regeneration effluent:

Option One is for Off-site hauling to an approved disposal site.

Option Two is to send the regeneration effluent to the resort's proposed waste water reclamation facility where it would be stored in a 4.38 million gallon reservoir and diluted with the previously treated water as well as the additional supplemental irrigation water required for irrigation of the property.
In reviewing the CH2M Hill Technical Memorandum titled Estimated Wastewater Production and Proposed Treatment, Irrigation, and Storage dated January 27, 2009 and Revised August 03, 2010, the waste water would be treated to tertiary standards and then used for irrigation of the onsite plant material. That water would have uptake into the irrigated plant material through evapo-transpiration with little or no percolation of the irrigated water.

Objective

In order to evaluate the most optimal operating parameters for each effluent option, this analysis has been prepared using the data compiled during the recent Pilot Test and by making some full scale operating procedure assumptions.

The objective was to run scenarios to see what the chemical fluoride makeup would be after combining the effluent and treated waste water along with additional water needed for irrigation. Although as stated above very little, if any irrigation water would actually achieve percolation or groundwater recharge.

The property currently has two (2) wells available to provide feed water sources to the treatment system. Well #1 contains lower levels of Fluoride (2.8 ppm) than does Well #2 (10 ppm).
The attached spreadsheet analysis uses various well blend ratios (Well #1 : #2) to feed the Fluoride treatment system in a effort to determine the treatment system's capacities, as well as the Fluoride and Aluminum concentrations contained in the regeneration effluent resulting from each blended ratio scenario.

Certain assumptions were made in producing the analysis.

Namely these are as follows:

- Well #1 Fluoride concentration = 2.8 ppm
- Well #2 Fluoride concentration= 10 ppm
- Monthly calculations based on 28 day month
- Fluoride ions returned in the effluent water to the reclaimed waste water system cannot be more than what was removed by the Activated Alumina treatment system.

1.) Capacities were calculated utilizing the most conservative pilot service run (2507 gallons) using 100% Well #2 (10ppm) as a base throughput. The full scale system is 13 ½ times larger than the pilot system, therefore the base capacity would be 33,844 gallons- (2507*13.5) when the full scale system is operated with 100% Well #2 feed water source.

2.) Regeneration effluent volume was determined by using the empirical pilot data and then extrapolated to calculate the effluent volume for the full size system.
The concentration of Fluoride Ions in the regeneration effluent was calculated based on the amount of Fluoride removed during the service cycle due to the fact that the Fluoride concentrations of the regeneration effluent cannot physically be more than was removed by the system during treatment.

3.) Because the regeneration procedure is not expected to change, and in actuality has an opportunity to be more efficient in the full scale system, regardless of the feed well blend ratio used, the effluent volume figure of 3800 gallons remains constant throughout the analysis.

4.) The primary dilution factors assume the full build out daily water requirement of 43,800 gallons per day with 90% of the treated water being recovered within the waste water system. Since this recovered water for dilution water had been originally treated by the Fluoride Treatment System, a conservative 0.5 ppm F residual was assigned to this value for evaluation purposes.

5.) The Secondary Dilution contains figures for the volume of Well #1 water required to be added to the reclaimed water in order to accomplish the planned irrigation requirements for the resort. This number is averaged for the year for each month and based on the CH2M Hill technical memo estimating the amount of irrigation water needed in the dry months of the year.

6.) Post Dilution Aluminum concentrations were calculated using a base 99 ppm Al concentration resulting from the regeneration process in the pilot study. Even though the AL concentrations are a fraction of the MCL for Al after dilution they were included for reference purposes.

Conclusions

Given this data, either Blending Scenario One or Two would provide optimal treatment operations and produce effluent F concentrations that are relatively equal or less after dilution than the influent F concentrations feeding the system.