



October 1, 2007

Mr. David Khan, P.E.
ADEC Drinking Water Program
410 Willoughby Avenue
Juneau, AK 99801

Re : Eaglecrest Drinking Water System PSWID 110643

Dear Mr. Khan,

In order to comply with the new Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR), Eaglecrest Ski Area proposes to install an additional filtration component into its existing treatment system. This letter report describes the existing treatment system, the demand on the system, and the storage system; the proposed system upgrade; and provides CT calculations for inactivation of *Giardia* and viruses.

Existing Eaglecrest Drinking Water System

The existing water source for Eaglecrest is an un-named tributary of Fish Creek. Raw water is extracted from the creek via a Jacuzzi Deep Well pump, operating at 18 gallons per minute (gpm), and pumped into the Water Treatment Building. The existing treatment system includes a Marlo AGA-30 sediment filter followed by a cartridge filter manifold fitted with 1.2 micron Eden Excel filters. Filtered water is chlorinated via a chemical injection pump, and moved into a water storage system comprised of two reservoirs operating in series. Treated water free-falls into the top of an 8,000-gallon reservoir, flows out through the bottom into one end of a 20,000-gallon reservoir. Stored water flows from the opposite end of the 20,000-gallon reservoir into the distribution system. Both reservoirs share the same base elevation and are the same height, allowing the water level to equilibrate between the two reservoirs. Since the input rate of 18 gpm often exceeds the usage, excess water is wasted from the 8,000-gallon reservoir via an overflow line.

Average demand from the distribution system has is less than 18 gpm, evidenced by the typical overflow of water from the 8,000-gallon reservoir. Instantaneous peak flow for the system has been calculated to be 24 gpm based on peak visitors/day and 32 gpm based on fixture counts (see Tables 1 and 2). Access to water usage by visitors is limited to approximately 8 hours per day during the ski season, which usually runs from

December through April. Maintenance and caretaker staff are on site from 8 to 24 hours per day, year round.

Table 1. Eaglecrest Drinking Water System Flow Estimates Based on Visitors/Day

	Visitors/day	gal/visitor	Meals/day	gal/meal	Flow, gal/day	Avg Flow, gal/min
Average	375	10	200	2	4,150	7
Peak	1,500	8	750	2	13,500	24

Table 2. Eaglecrest Drinking Water System Peak Flow Estimate Based on Fixture Count

Building	Fixture Count						TOTAL
	Toilets	Urinals	Lavatories	Showers	Kitchen Sinks	Restaurant Sinks	
Lodge	10	4	10	0	1	1	
Maintenance Shop	1	0	1	0	0	0	
Caretaker's House	1	0	1	1	1	0	
Total Fixture Count	12	4	12	1	2	1	
Fixture Units	2.5	2	1	2	1.5	4	
Total Fixture Units	30	8	12	2	3	4	59
Maximum Flow, gal/min							32

Fixture units and flow from Table 4, Water System Design, PSDMagazine.org, March/April 2007

Reservoir Baffling Characteristics

Neither reservoir is baffled. Mixing is more complete in the 8,000-gallon reservoir due to the free-fall into the top and the extra movement due to the overflow of water. Flow through the 20,000-gallon reservoir is subject to short-circuiting as the inlet and outlet are both located low on the tank. An extremely conservative baffling factor of 0.05 was selected as appropriate for both reservoirs.

Proposed System Upgrade

The proposed upgrade to the Eaglecrest system includes the installation of two Strainrite bag filters outfitted with HPM99-CC-2-SR and HPM99-CCX-2-SR filter bags in series. Five of the existing eight cartridge filters will remain in the system to provide prefiltration for the more costly bag filters. Each stage of the system will be outfitted with a pressure gauge (incoming raw water, Marlo sand filter, cartridge filters, and each bag filter). Once system pressure reaches a maximum differential pressure of 25 psi, the operator will provide the necessary maintenance on the component with the largest pressure differential.

Removal of *Cryptosporidium* and *Giardia* Contamination

Under the LT1ESWTR, 2-log removal is required for *Cryptosporidium* and 3-log removal plus inactivation is required for *Giardia*. The system upgrade accomplishes 2-log removal of *Cryptosporidium* and 2.5-log removal of *Giardia* through the use of the Strainrite bag filters, using HPM99-CC-2-SR and HPM99-CCX-2-SR filter bags in series.

Inactivation of *Giardia* and Viruses Using Chlorine Disinfection

18 AAC 80.645 (b) Drinking Water Regulations requires a minimum of 0.5 log inactivation of *Giardia* by disinfection. This level of disinfection will also provide the required 4-log removal of viruses. The required 0.5-log removal, along with a filter providing a 2.5 log *Giardia* cyst removal rating, will supply the 3.0-log removal and inactivation required by 18 AAC 645 (a) (1).

Chlorine Contact Calculations:

$$CT = \text{Chlorine Concentration (mg/l)} \times \text{Contact Time (min)}$$

where Contact Time represents the contact time in the two reservoirs, adjusted for short-circuiting using the baffling factor.

Eaglecrest system records show an average chlorine concentration of 0.71 mg/L. Table 3 shows the CT calculation for average flow, average peak flow, and instantaneous peak flow. Also shown in Table 3 is the required CT value from Table K of 18 AAC 80 for pH 7 at 5°C with a chlorine concentration between 0.6 mg/L and 0.8 mg/L for 0.5-log disinfection. The current storage system exceeds the CT requirement of 24 for all flow conditions listed in Table 3.

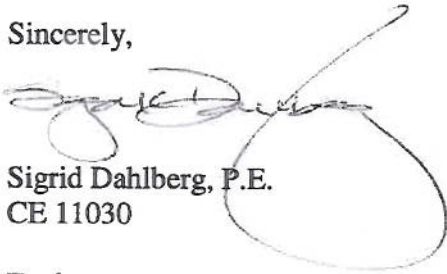
Table 3. CT Values for Eaglecrest Drinking Water System

	Cl (mg/L)	Flow Rate (gal/min)	Theoretical Contact Time (min)	Baffling Factor	Adjusted Contact Time (min)	CT (mg- min/L)
Average Flow	0.71	18	1556	0.05	78	55
Average Peak Flow	0.71	24	1167	0.05	58	41
Peak Instantaneous Flow	0.71	32	875	0.05	44	31
Required Value						24

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Drawings for the upgrade of the Eaglecrest Drinking Water System are enclosed (Figures 1 and 2). If you have any questions concerning the drawings or this letter report, please do not hesitate to call me.

Sincerely,

A handwritten signature in dark ink, appearing to read "Sigrid Dahlberg", with a large, looping flourish extending from the end of the name.

Sigrid Dahlberg, P.E.
CE 11030

Enclosure