HARRIS WATER ENGINEERING, INC.
954 E. 2ND AVE., SUITE #202
DURANGO, COLORADO 81303
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February 25, 2009

Colorado Department of Health and Environment
WATER QUALITY CONTROL DIVISION
Drinking Water Engineer
Christine Lukasik
222 S. 6th Street, RM #232
Grand Junction, CO 81501-2768

RE: Happy Scenes Water System PWSID # CO0234390

Dear Ms. Lukasik;

This letter is in response to your conversation with Amy Kraft on February 23, 2009, to confirm that the Baker Monitor #6WPSM well cap has been installed on the Happy Scenes Well #1, as proposed in the Engineering Design Report.

Also, in regards to your conversation with Ms. Kraft, please be informed that the underground tank's overflow releases of treated water from the tank goes directly onto the ground. The tank is located in an area where this discharge is neither problematic nor illegal.

Please find attached the revised Tank Profile and Treatment Train drawings as requested. We sincerely appreciate your help with this project and look forward to continued work with you in the future

Sincerely,

Steven C Harris, P.E.

Attachments: Treatment Train, Revised 2/24/09
Tank Profile, Revised 2/24/09

HAPPY SCENES WATER SYSTEM
ENGINEERING REPORT

PLAN REVIEW ADDENDUM

SUBMITTED:
February 2009

PREPARED FOR:
Happy Scenes Water System
1577 CR 500
Bayfield, CO 81122

PREPARED BY:
Harris Water Engineering, Inc.
954 E. 2nd Ave., Suite #202
Durango, CO 81301
970-259-5322

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January 2009

Colorado Department of Health and Environment
WATER QUALITY CONTROL DIVISION
Drinking Water Engineer
Christine Lukasik
222 S. 6th Street, RM #232
Grand Junction, CO 81501-2768

RE: Happy Scenes Water System PWSID # CO0234390
Engineering Design Report
Plan Review Addendum

Dear Ms. Lukasik;

Please find attached a Plan Review Addendum in response to your Comments to Plan Review, dated December 1, 2008.

Please contact myself, or Steve Harris, with any questions, concerns or requirements.

Sincerely,

Amy Kraft, E.I.
(970) 259-1028

CERTIFICATION

I hereby certify that this Engineering Design Report Plan Review Addendum for the construction of a new well and treatment facility located at 265 Trust Drive, were prepared under my supervision for Happy Scenes Water System, PWSID #CO0234390, in January and February of 2009.

_____

Steven C Harris
Colorado Registration No. 14303

HAPPY SCENES WATER SYSTEM
ENGINEERING DESIGN REPORT
PLAN REVIEW ADDENDUM

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LIST OF ATTACHMENTS:

PLAN REVIEW ADDENDUM

1.0 Water Source

As per Christine Lukasik's Comments to Plan Review Letter (Plan Review), dated December 1st, 2008, the State database identifies D Creek and Springs 1 and 2 as water sources for the Happy Scenes Water System (system), PWSID # CO0234390. All existing water sources for the potable system will be abandoned, as the springs are under the influence of surface water. The new well, (Colorado Division of Water Resources (DWR) Permit #66887), will be the system's sole source and will provide a safer, more consistent water source.

2.0 Serviceable Lots

The Happy Scenes Water System (system) service area definition as described in the Engineering Report (Report), submitted in October 2008, Section 1.2.1 was not entirely correct and was slightly misleading. The system was described as a complete subdivision with 76 total lots, 68 of which are serviceable, with unserviceable lots being described as those too small to be individual lots as allowed by La Plata County land use and development codes. The DWR Well Permit #66887 limits the water system to 62 taps, thus causing a water supply deficiency.

Further research into the matter and thorough conversations with the system Board have resulted in a more accurate description of the lots served by the system. The system is a water system with members who are tap owners. The system is not a homeowners association and is not responsible for any other joint activity in the area, such as road maintenance. The system is not one complete and whole subdivision. The system actually serves lots in three different subdivisions: Happy Scenes Subdivision #5, #7 and #8, as well as lots that are not in any subdivision. The Happy Scenes Subdivisions were created in the 1960s and 1970s, when the county had more relaxed regulations and they were purely subdivisions as in the subdivision of land. They were not developments as in the subdivision of land and the development of infrastructure to support the new lots (as is currently the expected, normal, and required procedure). There are eight different Happy Scenes Subdivisions in the general area. At the time that the lots in the area of the subdivisions #5, #7 and #8 were created, the original landowner did offer to install a water system. He asked new owners and landowners in the general vicinity if they would be interested in receiving potable water from the water system. Fifty-two original owners were interested and the system has since grown to 61 current taps. The other landowners developed their own wells, do not rely on the water system for their domestic water supply, and are not members of the water system as defined by the system's bylaws.

Attached to this Addendum are Figures One and Two that illustrate the lots in the area. Figure One represents all eight of the Happy Scenes Subdivisions, as well as the lots served by the system. Figure Two is a more detailed view of the lots served by the system. Many of these lots are now too small to stand-alone and

support individual home site developments and are considered unserviceable. These lots are joined by private, individual ownership and are already developed with home sites, but have not been officially joined in the La Plata County records by lot consolidation. These lots are identified as joint lots, on the figures, and are owned by one owner and have one tap. There are 61 lots served by the system, and the system has 62 taps available.

If, for any reason, more than 62 homeowners desired to receive water from the water system, the system would request and acquire an amended well permit from the DWR. The well permit was originally requested to allow water for 62 taps, because that is what the system required. Water supply was not the limiting factor.

Figure Three has been included as a general location map of the system.

3.0 Storage Tank Volume

The system is proposing to install a 15,000 gallon underground storage tank as described in the Report. The storage tank will have an active capacity, or effective volume, of 14,237 gallons. This will increase the system's storage potential by more than 13,000 gallons, as the system currently has two separate 500 gallon cisterns for a total of only 1,000 gallons.

The system Board recognizes the need for adequate storage and appreciates the Department's recommendation. However, neither the system nor its members can afford to increase the storage volume beyond the planned 15,000 gallons. The usual annual assessment of $350 per member has been enough to operate and maintain the existing system, as well as provide cash reserves at the end of each year. The system assessed each member an additional $900, a 250% increase, for the designed system improvements as detailed in the Report, and the annual assessment will have to be increased to $660 to provide operation, maintenance and replacement of the designed system. As stated in the Report, the system will be holding cash reserves at the end of each fiscal year and will continue planning for system improvements. However, at this time the system's top priority is to replace the existing water source, as it is under the direct influence of ground water, with a safe, reliable source and modern treatment plant.

The system's development plans in order of priority are:

- Replace GWUIS with new GW source,
- Provide reliable treatment,
- Provide increased storage,
- Replace and enlarge distribution system pipelines,
- Meter individual homes, and
- Additional storage, if cash reserves allow after all other system improvements.

The system Board has written a letter identifying their top priority of providing a safe drinking water source for the members. The Board has also contacted a local water hauler to investigate the availability of an emergency supply. The attached letter from Well on Wheels describes the company's customary and emergency services. The Board feels that 15,000 gallons of storage, along with available emergency services, provides adequate protection for the members and a vast improvement of the existing system. Please find both letters attached.

The board hopes that the Department can understand that this is not a new development, that all lots have been developed with homes or merely serve as seasonal cabin sites or RV pads, that the system is in a remote, resort community, and that less than half of the homes are regularly occupied, with the majority occupied between two weeks to two months per year.

4.0 Hydraulic Profile

The Micro Hardy Cross pipeline modeling program was used to analyze the distribution system and create a hydraulic profile. A profile was provided in the Engineering Report (Report), Appendix G, showing the hydraulic grade line elevation in feet and the accompanying pressure for various nodes throughout the distribution system. Attached herein, however, is a hydraulic profile incorporating the well, the storage tank, various system components and the high and low pressure nodes in the distribution system. Please find the hydraulic profile attached as Attachment Three.

5.0 Radon Analysis

Radon analysis has not yet been conducted. Radon is suspected to be the cause of the elevated Gross Alpha levels. As stated in the Report in Section 1.2.8, although the test results for Gross Alpha were approaching the MCL for Gross Alpha, the ensuing test results for Radium-226, Radium-228, and Uranium were all well below the MCL for each of these contaminants. This indicates that Radon may be the cause for the elevated Gross Alpha results. The system will test Radon levels as soon as the supply pump is approved for installation into the well.

As indicated in Report Sections 1.3.12 and 8.3.24 tank aeration has been provided in the system design and will be built into the tank. Aeration will alleviate the Gross Alpha levels if they are found to be caused by Radon (as they have not been found to be caused by Radium-226, Radium-228, or Uranium.)

6.0 PE Stamped Drawings

Please find a complete set of drawings as submitted with the original application in October of 2008, stamped and attached as Attachment Four. Please also find any new or revised drawings: Treatment Train, Spray Bar Detail, and Tank Profile, stamped and attached as Attachment Five.

7.0 Tank Drawings

Please find the drawing Tank Profile, Revised January 2009, in Attachment Seven. The drawing indicates details for the inlets and spray bar, outlets, vent, overflow and riser to gain entry to tank. A NSF 61 certified ladder will be provided with the tank by the manufacturer.

The 2-inch inlet is the well supply line, via the treatment plant. The 3-inch inlet will provide an attachment for emergency water delivery. The vent and overflow are included together in a 4" Schedule 40 PVC riser. This is customary for above ground tanks and reduces the possibility of contamination. The 2-inch outlet pipes will run from the 6-inch pump sleeves to the treatment plant.

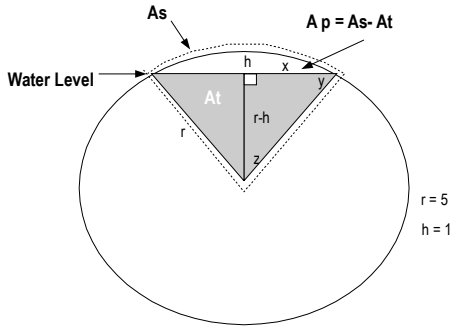
A sump pump will be used to drain the tank. It is not possible to install a drain in this underground tank. The drain line would not be able to daylight. The waste will be applied to the ground in the treatment plant easement.

The system will contract with a professional cleaner, experienced with cistern cleaning, to ensure that the tank will be drained, cleaned and disinfected as per industry standards. Generally, the tank will be cleaned by draining, suctioning out any remaining water, scrubbing the walls, power washing, suctioning out the residual again, disinfecting and filling. Disinfection will be applied by AWWA Standard C652.

8.0 Design Calculations

8.1 Effective Tank Volume

The inlet to the storage tank is equipped with a spray bar for radon removal, as well as sodium hypochlorite mixing. The 1.25 inch diameter spray bar will be located 3 inches below the tank ceiling. The normal water level will be 7.75 inches below the bar, resulting in a water depth of 9 feet in the horizontal tank. The resulting volume is 14,237 gallons.



To find the volume of the oblong tank with the water level at 9 feet instead of at the full diameter of 10 feet, the area of the piece above the water level (A_p) was found by finding the area of the section of circle (A_s) and deducting the area of the triangle (A_t) from it. The volume, resulting from A_p, was then found and deducted from the full volume of 15,000 gallons. Please see the following calculations.

$$A_t = \frac{1}{2}bh(2),$$

with b = x and h = (r-h), from the diagram above.

Equation 1)

$$x = \sqrt{2rh - h^2}$$
$$x = \sqrt{2 \cdot 5 \cdot 1 - 1^2}$$
$$x = 3$$

Equation 2)

$$A_t = \frac{1}{2}(x)ft \cdot (r-h)ft \cdot (2)$$
$$A_t = \frac{1}{2}(3)ft \cdot (5-1)ft \cdot (2)$$
$$A_t = 12\,ft^2$$

$$A_s = \pi r^2\left(\frac{\sigma}{360}\right),$$

with σ = 2z and z = 90-y, from the diagram above, and

Equation 3)

$$y = \arcsin\left(\frac{r-h}{5}\right)$$
$$y = \arcsin\left(\frac{5-1}{5}\right)$$
$$y = 53.1°$$

Equation 4)

$$z = 90° - y$$
$$z = 90° - 53°$$
$$z = 37°$$

Equation 5)

$$\sigma = 2z$$
$$\sigma = 2 \cdot (37°)$$
$$\sigma = 74°$$

Equation 6)

$$A_s = \pi r^2 \left(\frac{\sigma}{360} \right)$$

$$A_s = \pi \cdot (5\,ft)^2 \cdot \left(\frac{74}{360} \right)$$

$$A_s = 16\,ft^2$$

Equation 7)

$$A_p = A_s - A_t$$

$$A_p = (16 - 12)\,ft^2$$

$$A_p = 4\,ft^2$$

To find the volume of the 4 square foot area and the resulting volume of the tank with a water level of 9 feet.

Equation 8)

$$V = Area \cdot length$$

$$V = 4\,ft^2 \cdot 30\,ft$$

$$V = 120\,ft^3$$

Equation 9)

$$gal = V \cdot density$$

$$gal = (120)\,ft^3 \cdot (7.48)\frac{gal}{ft^3}$$

$$gal = 898\,gal$$

Reduce by 15% for end curvatures = 763 gallons.

Equation 10)

$$15{,}000\,gal - 763\,gal = 14{,}237\,gal$$

8.2 Log Inactivation/Contact Time

Chlorine contact time was documented in the Report; however, groundwater systems must also demonstrate 4-log removal of viruses to be exempt from triggered source water monitoring. The CDPHE-WQCD provided a reference guide (guide) documenting this calculation. The guide is attached as Attachment Six and provides the equations used in determining 4-log removal of viral contaminants. Attachment Seven is a spreadsheet listing for 4-log removal values for various tank volumes and flow rates of the system.

8.3 Hydropneumatic Tanks

One 85 gallon Flexcon Industries Flow-Thru FT 266 hydro pneumatic tank will be installed for regulation of system pressure. The tank is designed to work with variable frequency drive pumps to allow all of the water in the pressure tank to be exchanged to avoid stagnation.

The tank has a drawdown volume of 22 gallons. The system pressure will be set at 90 psi and the pump set point will be 75 psi, so the pump will engage when the tank pressure drops to 75 psi. The pump will take approximately 2 seconds to get to full speed and less than 2 gallons will be used in this time.

$$\left(\frac{43gal}{\min}\right)\cdot 2\sec\cdot\left(\frac{\min}{60\sec}\right)=1.43gallons$$

Flexcon Industries uses a derivative of Boyle's Law ($P_1V_1=P_2V_2$) to calculate the drawdown volume used between the pump cut-in and pump cut-out pressures. The following equation uses the pump cut-in and cut-out pressures to find the drawdown factor. The pump cut-in pressure is 75 psi. The pump cut-out pressure is 90 psi. Atmospheric pressure of 11.12 psi was used for an elevation of 7,500 feet.

$$\left(\frac{P}{P_1}\right)-\left(\frac{P}{P_2}\right)=k$$

$$\left(\frac{86.12}{86.12}\right)-\left(\frac{86.12}{101.12}\right)=.148$$

The drawdown volume used before the pump starts is the total tank volume multiplied by the drawdown factor.

$$TotalVolume=\frac{DrawdownVolume}{DrawdownFactor}$$

$$(85gal)\cdot.148=12.6gal$$

Calculating in a factor of safety of 20% and 2 gallons required while the pump reaches full speed results in 17 gallons of required drawdown. The pressure tank holds more than enough water to meet this criteria. Equipment specification sheets are included in Attachment Eight.

8.4 Pump Sizing

Pump sizing is dependent on the flow rate and head. Pump curves, for the supply pump and delivery pump, were submitted in the Report and can be found in Appendix C – Equipment and Technical Specifications.

9.0 Backup Power

The propane generator discussed in the Engineering Report Section 1.2.10, will provide backup power to the supply and delivery pumps, as well as the treatment works, in the case of a power outage. The generator will be located in the treatment building along the northern wall. Please see Treatment Train Drawing, revised January 2009, attached in Attachment Five.

10.0 System Description

The system description outlined in the Plan Review is correct. The system improvements will generally be implemented in the following order to minimize disruption of the service currently provided by the system.

- Installation of Well #1, 50 gpm, DWR Permit #66887,
- Treatment building for water treatment plant,
- Installation of 15,000 gallon underground fiberglass tank for disinfection contact time and storage,
- Delivery Pump: Grundfos 4-inch submersible pump Model 75S75-12, with a Franklin Electric 4-inch Sand Fighter 7.5 hp Submersible Motor
- Supply Pump: Franklin Electric 6-inch High Capacity FPS 4000 75FA7S6-PE, with a Franklin Electric 6-inch Sand Fighter 7.5 hp Submersible Motor.
- Disinfection with sodium hypochlorite, chemical feed pump and spare, daytank, and associated piping and appurtenances.
- 85 gallon Flexcon Industries Flow-Thru FT 266 hydro pneumatic tank for regulation of system pressure,
- The new well will be connected to the treatment building, the water will be treated, and the system pressurized and tested, and then
- Abandonment of Springs 1 and 2, two collection boxes, two pump houses, two chlorination systems and two service pumps for PWSID CO0234390.