Liberty Lake Sewer and Water District

Lakemore - Ground Source Heat Pump Borings Proposal

Concerns and Questions

1. The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (P.L. 107-188) requires community drinking water systems serving populations of more than 3,300 persons to conduct assessments of their vulnerabilities to terrorist attack or other intentional acts and to defend against adversarial actions that might substantially disrupt the ability of a system to provide a safe and reliable supply of drinking water. How does the proposal intend to protect from bioterrorism and what measures will be in place to mitigate or eliminate potential threats to the water supply?
2. RCW 70.119A.060 (1)(b)(i) Group A public water systems are mandated to protect the water sources used for drinking water to assure safe and reliable public drinking water and to protect the public health. How does the proposal intend to protect drinking water and public health from intentional and unintentional acts?
3. In 1979, the U.S. EPA designated the Spokane Valley-Rathdrum Prairie Aquifer as a sole source aquifer under the requirements of the Safe Drinking Water Act (SDWA). The District under WAC 246-290-135 is responsible to provide for source water protection. Required under WAC 246-290-100 the District has developed and implemented a Wellhead Protection plan as part of its Water System Plan. According to the Wellhead Protection Plan, January 2000, Special Wellhead Protection Areas (SWHPAs) have been delineated using the water rights pumping scenario. The SWHPA represents the groundwater capture zone for the full well field. This project is within three (3) of the District's primary production wellhead protection capture areas (15D01, 14F01, 15C01). How does this proposal mitigate or eliminate the potential of pollution to the SWHPA's from intentional and unintentional acts?
4. In the worst case of groundwater contamination the District would experience millions of dollars in damages to our infrastructure, and cost associated with loss of drinking water sources that are beyond calculation not to mention the threat to human health. Who would be responsible for these damages and how are they insured? Could an HOA or maintenance contract be established with a financial bond guarantee?
5. The District recommends using the SAJB MicroFEM SVRP Model for delineating the Special Wellhead Protection Areas of all domestic wells in Liberty Lake. This is the recognized and universally used model by the Wellhead Protection Policy Coordinating Committee. This model is used to derive the regulated Special Wellhead Protection Areas in the Spokane Valley – Rathdrum Prairie aquifer in accordance with the Wellhead Protection plan as required by the State of Washington. Attachment A and B show the 1 year time of travel and 2 year time of travel for Washington's Special Wellhead Protection Areas over the SVRP Aquifer as produced by the Wellhead Protection Policy Coordinating Committee. Attachment B shows Special Wellhead Protection Areas for four of the Liberty Lake Sewer

and Water District's wells (Kenney, Mission, Schultz, and Valleyway), two of Consolidated Irrigation District's wells (Well 2 and 3) and two of Vera Water and Power's wells (Well 8 and 9) within two years' time of travel from the project site.

6. The State of Washington's Wellhead Protection Program requires the delineation of the capture zones for the SWHPAs that contribute groundwater to pumping wells over periods of one year, five years, and ten years. What impact(s) does this proposal have on aquifer flow and temperature over periods of one year, five years, and ten years?
7. The SEPA checklist indicates there is limited potential for leaks and does not recognize the adjacent wells are used for drinking water sources; 3. Water. The checklist also does not recognize the potential for toxic chemicals being injected into the closed loop systems either by accident or on purpose (terrorist acts). This potential is also not addressed in; 7. Environmental Health. This lack of recognition of risk and not providing sufficient risk analysis and mitigation measures is a significant deficiency in the environmental review process.
8. Due to the limitations inherent to results derived from analytical equations, especially in complex sub-surface zones, please show the transport and fate of any thermal plume from the proposed project. Please use a numerical model, which has been designed for use in modeling groundwater temperature.
9. The District recommends modeling for aquifer flow and temperature on all of the primary production wells in Liberty Lake: 15D01 (Kenny), 14F01 (Schultz), 15C01 (Mission), 15R01 (Sprague), and 14M02 (Valleyway). The District also recommends looking at well 11M01 (Meadowwood Tech) – closest well to the site.
10. Most of these types of wells are drilled using a mud rotary. Mud drilling can have some serious impacts especially when boulders are encountered. In boulders, the mud (as well as bentonite slurry) flows outward and much of the material is lost to the formation. This is called Loss of Circulation and materials such as cotton husks are pumped down the bore hole to try and plug the gaps in the boulders. Having this much mud go out into the formation, especially in the water bearing strata would be potentially harmful. While bentonite itself is a naturally occurring clay which is designed to swell up to many times its original size, the effect of "plugging" off transmissivity in this zone could be a potential. In the drilling process, how deep with the casing go? Will the casing only be used near the surface or the entire 450 feet?
11. What is the volume of the drillers mud per bore? What impact would this volume (times 700) of drillers mud extending to a depth of 450' have on the District's Special Wellhead Protection Areas of its primary production wells?
12. How does the addition of >2,300 cubic yards of bentonite clay extending to a depth of 450' affect the flow of the aquifer as it moves thought the site? What impacts would this have to the District's Special Wellhead Protection Areas of its primary production wells?
13. What is the velocity of the aquifer at the proposed site? Aquifer flow can be in excess of 60'/day (USGS WRI Report 03-4239). The aquifer is constrained at the State Line creating some of the highest flows seen in the aquifer. How would the high flow affect the drillers

mud in the bore holes? How would the high flow affect the bentonite in the bore holes? Would/could the drillers mud and bentonite migrate from the boreholes? The 2003 USGS Surface-Water/Ground-water Interaction of the SVRP Aquifer report shows a steep slope of the water table adjacent to this area. How does this affect the drillers mud and bentonite and bore holes and migration to the District's primary production wells?

14. Provide modeled results showing the potential migration and fate of drillers mud and the bentonite slurry from the bores to the aquifer, including any chemical changes which may take place (pH, specific conductivity, hardness, mineral solution, etc.). Theoretical models have been developed for transport in saturated and unsaturated porous media.
15. What ingredients will be used in the drilling mud, including any and all potential additives that may be used during the boring? Please provide a full list of constituents, including chemistry of any proprietary compounds, any available MSDS sheets, and contact information for all of the different manufacturer(s).
16. Please provide a full, detailed resume of the driller's experience with rotary mud drilling, especially within unconsolidated materials.
17. How will the driller prevent from iron bacteria contamination in the wells?
18. Could the drilling be done via an auger/rotary-type method eliminating the use of drillers mud?
19. What would the threshold be for borehole integrity? In other words, what is the cut off point for drilling mud volume, where you would have to abandon the bore and start a new hole?
20. What would the threshold be for bentonite volume if you cannot get the borehole full and completely "sealed"?
21. How do you propose keeping the HDPE pipe in the center of the bore? Without more detailed information on the bottom "U" it is difficult to tell what the entire span of the loop is. However, assuming that there is a 1" gap between the two pipes there will only be 1 ¼" between the outside of the HDPE and the edge of the borehole. This appears to be very little tolerance considering the pipe extends 450 feet into the ground.
22. How is the "U" at the end of the loop constructed and assembled? How would this withstand the pressure of the drill rig pressing it to 450 feet?
23. What size tremie tube will be used to seal the borehole? Is the 6" borehole sufficient to comply with WAC 173-160-453 (30) (e) "Bore hole size. The hole size for ground source heat pump borings must be of sufficient size to allow placement of the heat exchange loop and tremie tube to the bottom of the hole."
24. If the HDPE pipe is not centered and is installed against the abrasive soils in the borehole could the pipe over time be "worn through" with the movement that occurs through the pumping cycles? If the grout truly continues to act as a liquid as stated what will hold the HDPE pipe in place. Under the assumed conditions the pipe and liquid have equivalent specific gravities as the surrounding grout resulting in a state of "suspension" with little to no weight hold the pipe in place.
25. Are there other fluids used in closed loop systems? Fluids and/or denaturing agents of a more toxic or corrosive nature? Fluids such as methanol, denatured ethanol, ethyl alcohol,

Ethylene Glycol, propylene glycol, Calcium Chloride are commonly used in closed loop ground-source heat pumps.

26. How does the licensed technician know what fluid to use in the HDPE pipe? If indicated by a tag on the heating/cooling unit, how would the maintenance technician know if the tag were removed?
27. What is the MSDS of any denaturing agents, additives, or "other ingredients" to the Environol 2000 ethanol being proposed?
28. Some ground-source heat pump fluids have viscosity problems that limit their use as an antifreeze for flowing fluids (i.e. too fast in the summer and too slow in the winter). Was viscosity considered when determining the pipe sizing?
29. Some ground-source heat pump fluids are denatured with petroleum-based products that dissolve the HDPE pipe. Has this been considered?
30. What stresses are there on the HDPE pipe during construction? I.e. moving a warm pipe into a cold wet environment? Shrinkage?
31. What are the details of the 4 geothermal wells in Post Falls, ID? Are aquifer flows equivalent to the proposed installations? What monitoring or post construction review has been done?
32. What are the details of the geothermal wells in Sandpoint, ID? What monitoring or post construction review has been done?
33. The July 21, 2014 letter from Maul Foster Alongi sites a similar borehole constructed near Twin Lakes, ID. What information is available for this installation with regards to; sub-surface materials encountered, size and depth of borehole, type of grout, and depth to water? What evidence exists that grout migration has not occurred subsequent to installation? How long has grout been in place? Are aquifer flows equivalent to the proposed installations? What monitoring or post construction review has been done?
34. What investigation has been done to determine the conditions that will be encountered in the proposed boreholes to support the conclusions and comparisons made in the various reports? The well logs provided only extend to a maximum depth of 236 feet. This leaves 215 feet of proposed drilling with no supporting information on what conditions might exist. If rock or other confining layers are encountered will the borehole be shortened, and if so will additional boreholes be necessary to get the desired heat exchange? What impacts could there be to the SVRP aquifer and bore hole if a confining layer were breached creating a connection between water bearing zones? There does not appear to be sufficient data available to comply with WAC 173-160-453 (3) "Site specific conditions shall be assessed to determine the best method and materials to be used for sealing the well annulus to protect the groundwater."
35. Please provide any information you may have on the characteristics of any bedrock or other strata underlying this part of the SVRP aquifer. We have concerns that if there is water in the bedrock, it could cross-contaminate the larger aquifer body, and down gradient production wells with water high in iron and other minerals.

36. Many of the soils encountered in the Spokane Valley and documented in the well driller reports provided in the ARCADIS November, 2013 report are composed of cobbles, gravels and sand that often have little cohesive properties and often "run" or slough. If the grout stays in a "liquid like" state will it provide enough support to prevent borehole collapse? If the borehole collapsed causing crushing of the HDPE pipe could it fail initially or over time?
37. What is the process if a well loses pressure or fails? Whose responsibility will it be to decommission the well(s)? If it is the owner's responsibility, the owner will have sufficient motivation to make their own repairs to the well(s) prior to investing in the cost of decommissioning and installing new traditional heating/cooling equipment. What assurance is there that the well(s) will be decommissioned properly and in accordance with WAC 173-160-381?
38. The May 1, 2014 letter from Maul Foster Alongi calculates leakage through a "pinhole" in the HDPE pipe. The calculations assume that the grout applies an external pressure to the pipe equivalent to water if it were fully submerged. This assumes that the grout is and stays in a state that has no cohesive properties and experiences no friction between particles. Given the description of the material in the meeting as "slurry" this assumption is suspect. In the case that the grout solidifies in the hole above the water layer an additional 65 psi differential pressure would be experienced at the bottom of the HDPE pipe.