WATER TRANSFER WORKING GROUP PROJECT DESCRIPTION

APPLICATION NO./COURT CLAIM NO. No. G4-33125		
APPLICANT NAME Naches Valley School District	CONTACT NAME Tyson Carlson	TELEPHONE NO. 509-895-5923
WATER RIGHT HOLDER'S NAME (if different)		EMAIL tcarlson@aspectconsulting.com

DATE OF APPLICATION	PRIORITY DATE
November 7, 2014	November 7, 2014

WATER SOURCE: Groundwater – Ellensburg Aquifer	CROP: N/A
INSTANTANEOUS QUANTITY: 300 gpm	ANNUAL QUANTITY: 484 ac-ft/yr (non-consumptive)
PERIOD OF USE: Continuous – year round	
PLACE OF USE: NVSD Elementary School (Yakima County Parcel No. 17141012403)	PURPOSE OF USE: Industrial (Heat Exchange)
IRRIGATION METHOD: N/A	

CONSUMPTIVE USE CALCULATION:

The open-loop GSHP will use extraction and injection wells to withdraw and return groundwater for use as a heat source and sink. Groundwater will be withdrawn from an extraction well, passed through a non-contact heat exchange, then returned to the same aquifer through an injection well.

An open-loop GSHP system is a beneficial use of groundwater that meets the definition of non-consumptive use of groundwater provided by POL-1020 (Ecology, 1991), will not diminish water availability, is water budget neutral with respect to Total Water Supply Available (TWSA), and meets the criterion for expedited review under Washington Administrative Code (WAC) 173-152-050(2)(c) and POL-2020 (Ecology, 2007).

NARRATIVE DESCRIPTION OF PROJECT:

The appropriation is sought for continuous (year-round) non-consumptive industrial use (heat exchange) in supplying non-contact cooling water to an open-loop groundwater source heat pump (GSHP) The application requested an instantaneous withdrawal (Qi) of 300 gpm and a cumulative annual quantity (Qa) of 484 acre-feet per year (ac-ft/yr). The non-consumptive use of water in a GSHP is one design element to

the new NVSD's Elementary School under construction in Naches, Washington. Groundwater will be withdrawn from one extraction well, passed through a non-contact heat exchanger and then returned to the same aquifer through one of two injection wells. The injection temperatures will fluctuate as a function of building load, and are anticipated to be approximately 13° F (7.2° C) higher during cooling days and about 13° F cooler during heating days. Total building energy use designs simulations indicate the annual cooling energy injected to the groundwater is more than offset by the heating energy extracted, which include approximately 198 days of heating and about 167 days of cooling each calendar year.

IMPACT ANALYSIS

A Preliminary Permit was issued by Ecology on January 26, 2015 authorizing NVSD to drill and test up to three water supply wells for the GSHP system. The objective of the testing performed under the Preliminary Permit was to obtain sufficient hydrogeologic and water quality data to support a decision on the water right application. This information is summarized in a test well (Well No. 3) Installation, Testing, and Hydrogeologic Impact Analysis Technical Memorandum (Aspect, 2015) and addendum (Aspect, 2016), which documented installation and testing of Well Nos. 1 and 2. The documents included a description of GSHP design and operation, regional geology, site hydrostratigraphic units, and information on groundwater-surface water continuity. The documents also describe the drilling, design, and testing of the GSHP wells, and included a numerical GSHP temperature impact analysis.

Based on the site-specific hydrogeologic conceptual model presented in the technical memoranda (Aspect, 2015 and 2016), it was determined that the three wells supporting the GSHP are completed in the Ellensburg Formation. The water-bearing intervals are isolated from overlying alluvium (and surface water) by a wide-spread depositional sheet of lower-permeability silt, clay, and fine-grained sandstone extending from the alluvium contact to about 145 feet bgs. Each of the wells were completed with an extended annular space well seal into sandstone.

Pumping tests were completed in each of the three GSHP wells. The pumping tests included a step-rate pumping test to evaluate well performance and yields, and a constant rate pumping or injection test to estimate aquifer parameters and longer-term sustainability. Further evaluation of pumping test data from each of the wells indicate confined aquifer conditions, with no apparent hydraulic boundary conditions—including significant leakage from overlying aquifers or continuity with the nearby reach of the Naches River.

Carey (2007) reported that the adjacent reach of the Naches River is losing 59.4 cubic feet per second (cfs), or about 12.3 cfs per mile water as it enters a broadening alluvial fan. This losing condition is expected to continue until the next bedrock constriction located near the Suntides Golf Course (River Mile (RM) 3.7), where the Naches River gains a up to 95.1 cfs, or an average of 7.7 cfs/mile to the confluence with the Yakima River. Groundwater in the Ellensburg Formation near the NVSD is expected to discharge to the Naches River over 8 miles downgradient.

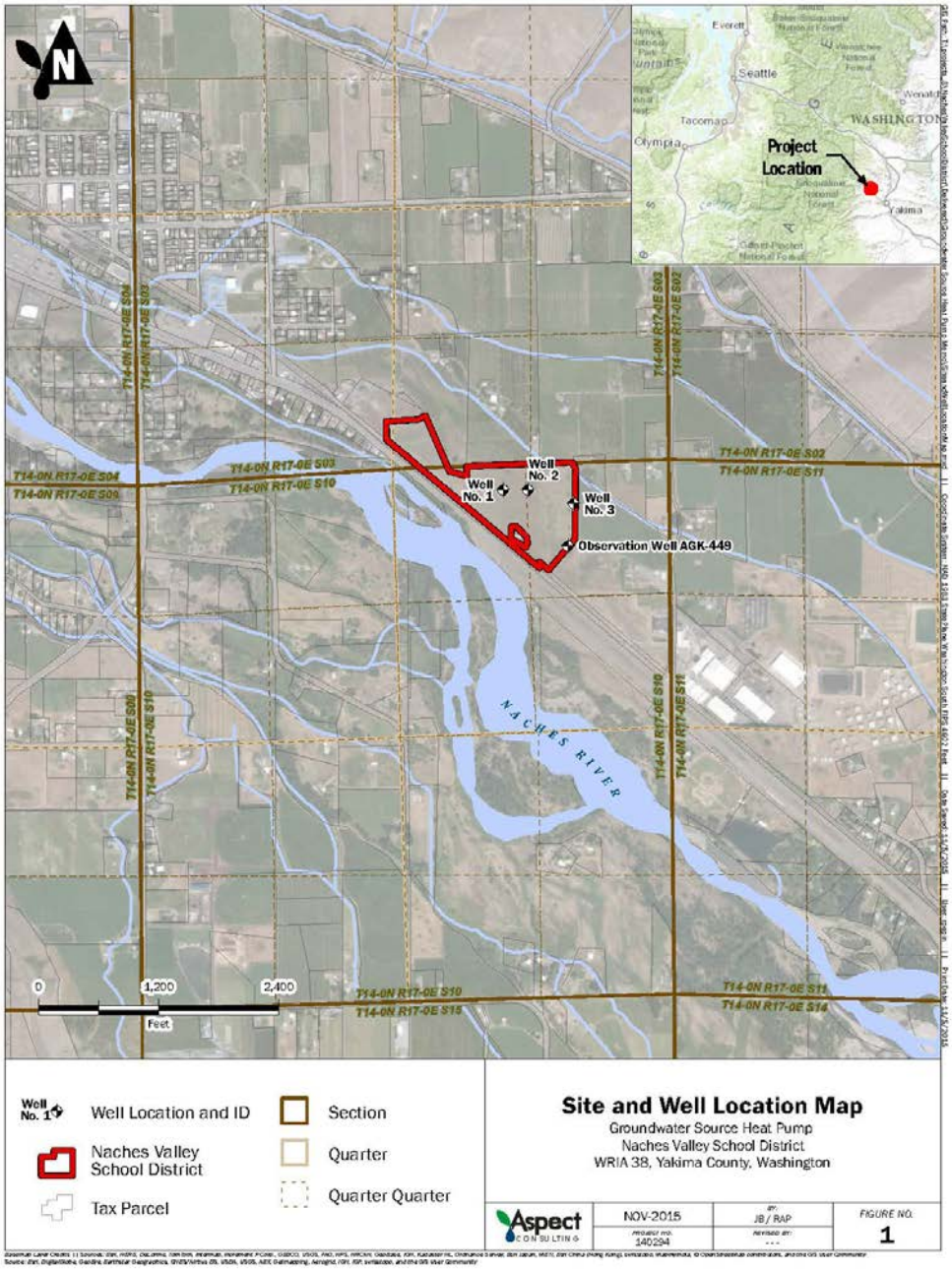
To evaluate the change in groundwater temperature and possible downgradient effects to the Naches River, numerical model simulations (Aspect, 2015) were run at a constant injection rate equal to the average design flowrate (90 gpm) for the entire year. Temperature model inputs for a single year mimicked those simulated during GSHP design, including: 5.6o C for 121 days (winter into spring), 20.0o C for 167 days (summer), and 5.6o C for 77 days (fall into winter).

This scenario was repeated, representing continuous GSHP operation for 10 consecutive years. Evaluation of the model results indicate that, after 10 years of continuous operation, elevated temperature (>12.80 C) impacts dissipate within 165 feet downgradient from Well No. 3. Following dissipation of elevated temperature, long-term cooling (about 12.20 C) of the groundwater is observed to 650 feet downgradient before groundwater temperatures return to background. Worst case simulations including the continuous operation of the GSHP system at the maximum design rate (300 gpm) for 10 years indicate that elevated temperature (>12.80 C) impacts dissipate within 285 feet downgradient, then a net cooling of groundwater to about 1,200 feet downgradient.

CONCLUSION

Based on the site-specific information submitted, it was concluded that that water-bearing zones of the Ellensburg Formation are physically and hydraulically isolated from the adjacent temperature-impaired reach of the Naches River, and injection of water from the GSHP system will not impair beneficial uses of groundwater or contribute additional temperature loading to nearby surface water. Moreover, the predicted long-term temperature effects are within—if not below—the natural variability of observed background groundwater temperatures at the NVSD site.

PROJECT LOCATION MAP



Well No. 1 Well Location and ID

Naches Valley School District

Tax Parcel

Section

Quarter

Quarter Quarter

Site and Well Location Map

Groundwater Source Heat Pump
Naches Valley School District
WRIA 38, Yakima County, Washington

Aspect CONSULTING	NOV-2015	JB / RAP	FIGURE NO.
	Project no. 140294	Revised on: ---	1