File No. G3-30623
WR Doc ID: 4687723

DEPARTMENT OF ECOLOGY
State of Washington

State of Washington
REPORT OF EXAMINATION
FOR WATER RIGHT APPLICATION

PRIORITY DATE
June 8, 2010

APPLICATION NUMBER
G3-30623

MAILING ADDRESS
Dale Spencer
Sabey Corporation
12201 Tukwila International Blvd, 4th Floor
Seattle, WA 98168-5121

SITE ADDRESS (IF DIFFERENT)
Quincy, WA

Quantity Authorized for Withdrawal or Diversion

DIVERSION RATE	UNITS	ANNUAL QUANTITY (AF/YR)
16,000	GPM	Non-consumptive

Purpose

PURPOSE	WITHDRAWAL OR DIVERSION RATE ADDITIVE	WITHDRAWAL OR DIVERSION RATE NON-ADDITIVE	UNITS	ANNUAL QUANTITY (AF/YR) ADDITIVE	ANNUAL QUANTITY (AF/YR) NON-ADDITIVE	PERIOD OF USE (mm/dd)
Heat Exchange	16,000		GPM		Non-consumptive	Year round

Source Location

WATERBODY	TRIBUTARY TO	COUNTY	WATER RESOURCE INVENTORY AREA
		Grant	

SOURCE FACILITY/DEVICE	PARCEL	TWN	RNG	SEC	QQ Q	LATITUDE	LONGITUDE
9 extraction and 8 injection wells	313185000	20N	24E	9	NENE	47.248°N	119.813°W

Datum: WGS84

Place of Use (See Map, Attachment 1)

PARCEL

313185000

LEGAL DESCRIPTION OF AUTHORIZED PLACE OF USE

NE ¼ NE ¼ Section 9, Township 20N, Range 24E, Grant County WA

Proposed Works

Construction of a large scale heating and cooling system for a 520,000 square feet data center consisting of multiple buildings located in northeast Quincy, and known as Intergate-Quincy Project. The project is intended to include construction of up to 8 extraction wells and the same number of recharge wells, with one additional backup extraction well from 300-450 feet in depth. Water use will be non-consumptive with all water that is pumped from the aquifer through the extraction wells to be returned to the same aquifer through the recharge wells. Water from the extraction wells will be pumped through piping systems within the buildings.

Development Schedule

BEGIN PROJECT	COMPLETE PROJECT	PUT WATER TO FULL USE
September 30, 2013	September 30, 2033	September 30, 2034

Measurement of Water Use

How often must water use be measured?	Weekly
How often must water use data be reported to Ecology?	Annually (Jan 31)
What volume should be reported?	Total Annual Volume
What rate should be reported?	Annual Peak Rate of Withdrawal (gpm)

Provisions

By December 31 each year, the permittee shall submit an annual progress report detailing the development of construction and projected work.

Wells, Well Logs and Well Construction Standards

All wells constructed in the state must meet the construction requirements of WAC 173-160 titled "Minimum Standards for the Construction and Maintenance of Wells" and RCW 18.104 titled "Water Well Construction". Any well which is unusable, abandoned, or whose use has been permanently discontinued, or which is in such disrepair that its continued use is impractical or is an environmental, safety or public health hazard must be decommissioned.

A completed well report for the well(s) shall be submitted by the driller to the Department of Ecology within 30 days of completing each well. All pump test data for the wells shall be submitted to Ecology when it is available.

Flowing wells must be constructed and equipped with valves to ensure that the flow of water can be completely stopped when not in use. Likewise, the well must be continuously maintained to prevent the waste of water through leaky casings, pipes, fittings, valves, or pumps-- either above or below land surface.

All the wells must be capped upon completion, and the Department of Ecology must be notified in order that a video scan of all the completed extraction and injection wells can be conducted. The Department of Ecology's Well Construction Coordinator must be provided five business days notice prior to commencing video scanning. The Permittee will be required to conduct the video scans.

All wells must be tagged with a Department of Ecology unique well identification number. If you have an existing well and it does not have a tag, please contact the well-drilling coordinator at the regional

Department of Ecology office issuing this decision. This tag must remain attached to the well. If you are required to submit water measuring reports, reference this tag number.

Installation and maintenance of an access port as described in WAC 173-160- 291(3) is required on all wells.

In addition to the required access port, the applicant must install and maintain, in operating condition, an airline and pressure gage. The pressure gage must be equipped with a standard tire valve and placed in a location accessible to Department of Ecology personnel. The airline must extend from land surface to the top of the pump bowls and the total airline length must be reported to the Department of Ecology upon completion of the pump system.

All extraction and injection wells shall be sealed with a cement grout surface seal and be cased to a depth of 300 feet below ground surface. Wells shall be constructed to a total depth not to exceed 450 feet below ground surface. Extracted water must be re-injected into the same aquifer.

Injection wells shall be constructed to limit vertical leakage and/or hydraulic fracturing near the borehole when the well is exposed to high injection pressures.

Underground Injection Control Program

The subject infiltration system shall be registered with and comply with Ecology's Underground Injection Control Program, Chapter 173-218 WAC, prior to discharge of any water withdrawn under this authorization. http://www.ecy.wa.gov/pubs/wac173218.pdf

Video Scans

Video scans are required to be performed by the permittee to ensure proper well construction for both the extraction and injection wells. The permittee will provide Ecology's Well Construction Coordinator five business days notice prior to commencing video logging.

Measurements, Monitoring, Metering and Reporting

An approved measuring device shall be installed and maintained for each of the sources identified by this water right in accordance with the rule "Requirements for Measuring and Reporting Water Use", Chapter 173-173 WAC.

Water use data shall be recorded weekly. The maximum rate of withdrawal and the annual total volume shall be submitted to Ecology by January 31st of each calendar year, along with the annual progress report.

Proof of Appropriation

The water right holder must file the notice of Proof of Appropriation of water (under which the certificate of water right is issued) when the permanent distribution system has been constructed and the quantity of water required by the project has been put to full beneficial use. The certificate will reflect the extent of the project perfected within the limitations of the permit. Elements of a proof inspection may include, as appropriate, the source(s), system instantaneous capacity, beneficial use(s), annual quantity, place of use, and satisfaction of provisions.

Schedule and Inspections

Department of Ecology personnel, upon presentation of proper credentials, will have access at reasonable times, to the project location, and to inspect at reasonable times, records of water use, wells, diversions, measuring devices and associated distribution systems for compliance with water law.

Findings of Facts

Upon reviewing the investigator's report, I find all facts, relevant and material to the subject application, have been thoroughly investigated. Furthermore, I concur with the investigator that water is available from the source in question; that there will be no impairment of existing rights; that the purpose(s) of use are beneficial; and that there will be no detriment to the public interest.

Therefore, I ORDER approval of Application No. G3-30623 subject to existing rights and the provisions specified above.

Your Right To Appeal

You have a right to appeal this Order to the Pollution Control Hearings Board (PCHB) within 30 days of the date of receipt of this Order. The appeal process is governed by Chapter 43.21B RCW and Chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2). To appeal you must do the following within 30 days of the date of receipt of the Order.

- File your appeal and a copy of this Order with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this Order on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.
  You must also comply with other applicable requirements in Chapter 43.21B RCW and Chapter 371-08 WAC.

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board 1111 Israel Road SW STE 301 Tumwater, WA 98501	**Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

Signed at Spokane, Washington, this _____ day of _____ 2012.

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Keith L. Stoffel, Section Manager
Water Resources Program/ERO
Department of Ecology

INVESTIGATOR'S REPORT

BACKGROUND

Project Description

An application to appropriate public ground water was submitted to Ecology on June 8, 2010 from Sabey Corporation (Sabey) for 20,000 gallons per minute (gpm) for a heat exchange system for a data center facility in Quincy, WA. The application was accepted and assigned Ground Water Application No. G3-30623.

A Phase 1 Cost Recovery Agreement was performed by Pacific Groundwater Group (PGG), and is summarized in a letter report dated January 10, 2011. Sabey has requested that this application be processed through Ecology's Cost Reimbursement Program.

This application is being processed under a cost reimbursement agreement between the applicant and the Department of Ecology (Ecology). This report has been prepared by HDR Engineering under a contract and Work Assignment with Ecology. The Work Assignment for this project was authorized by Ecology on November 28, 2011.

The following table is a summary of the attributes of Application No. G3-30623

Table 1
Summary of Attributes of Application No. G3-30623

Attributes	
Applicant	Sabey Corporation
Application Received	June 8, 2010
Instantaneous Quantity	20,000 gpm
Source	Multiple extraction and recharge wells
Point of Withdrawal	NE ¼ NE ¼ Section 9, T 20N, R 24E
Purpose of Use	Heat Exchange
Period of Use	Year round
Place of Use	NE ¼ NE ¼ Section 9, T 20N, R 24E

This application requests a new appropriation of public groundwater from an aquifer within the Quincy Ground Water Subarea, as defined in Chapter 173-124A WAC. The Quincy Subarea was established after many years of studies, investigations, reports and hearings regarding the development of the Columbia Basin Irrigation Project (Project). The Project was designed and developed to divert irrigation water from the Columbia River (FDR Lake) into a series of canals and waterways for delivery to Project lands. The northern portion of the Columbia Basin Project has been designated as the Quincy Subarea (Chapters 173-124A WAC and 173-134A WAC).

The Quincy Subarea, commonly known as the Quincy Basin, is a saucer-like topographic and structural basin. The northern and southern boundaries are formed by the ridges of the Beezley and Frenchman Hills, respectively. The western boundary of the basin is formed by the Evergreen-Babcock Ridge, and the eastern boundary of the basin is coincident with the East Low Canal.

Irrigation blocks within the Quincy Subarea were developed in accordance with the Columbia Basin Project. By 1966, the irrigable area of the Project was approximately 290,000 acres. Drainage systems and wasteways were constructed to protect Project lands and to recover return flows and to store those flows in Potholes Reservoir behind O'Sullivan Dam. The stored water was then

conveyed to the South Columbia Basin Irrigation District for beneficial use. The development of the recapture facilities was essential to complete the Project water supply.

In 1967, the State of Washington made a tentative determination that all naturally-occurring ground water in the Quincy Subarea had been appropriated. As a result of a Memorandum of Understanding with the United States Bureau of Reclamation (USBR), a five year ground water study was undertaken to verify the tentative determination that all ground water available for appropriation had been appropriated. The study, which was substantially completed by December 31, 1972, confirmed the tentative determination.

On January 15, 1973, following completion of the study and confirmation that all ground water available for appropriation in the Quincy Basin Subarea had been appropriated, the Department of Ecology designated the Quincy Ground Water Subarea pursuant to RCW 90.44.130 as Chapter 173-124 WAC. The remaining artificially stored groundwaters within the Quincy Subarea were then claimed by the Bureau of Reclamation.

By the end of 1973, approximately 3.5 million acre-feet of imported waters were stored underground within the Quincy Subarea. A permitting program was required to manage this artificially stored groundwater. The program was created through adoption of the Quincy Ground Water Subarea Management Policy (Chapter 173-134A WAC) in 1975, which was later amended in 1979.

The Quincy Subarea management policy (Chapter 173-134A WAC) includes two sections that establish maximum allowable quantities of naturally-occurring groundwater that could be appropriated for two separate management units within the Subarea, known as the shallow and deep management units (WAC 173-134A-060 and 173-134A-080). The rule also established a maximum quantity of artificially stored ground water that could be withdrawn from the Quincy Subarea, without interfering with the operation of the recapture facilities and delivery of water to the South Columbia Basin Irrigation District. The rule also established a reserved quantity of artificially stored groundwater to be used for domestic and group domestic purposes.

Legal Requirements for Application Processing

The following requirements must be met prior to processing a water right application:

- **Public Notice**

  The public notice for this application was published in the Quincy Valley Post Register on December 29, 2011 and January 5, 2012. No protests were filed to this public notice.

- **State Environmental Policy Act (SEPA)**

  A City of Quincy Development Application and SEPA Environmental Checklist was submitted to the City on November 18, 2010, and an Addendum to this Checklist dated December 14, 2010 was also prepared and submitted. This addendum included the following statement on Page 6, under 3. Water, B. Ground: "Sabey is considering the installation of a non-contact ground source heat pump for cooling and heating purposes. Under this proposal, up to 20,000 gpm of groundwater would be withdrawn from the aquifer and re-injected into the same formation at the Sabey site. Water right application G3-30623 is pending for this element of the project. No withdrawals will occur until such time as the water right has been secured."

  These documents were filed by Sabey Corporation for the Intergate-Quincy Project, consisting of construction of a data center facility to be located on 39.02 acres in the City of Quincy, WA at the southwest corner of County Road 11W and County Road "O" NW (Grant County Parcel Number

313185000). A Determination of Nonsignificance (DNS) was issued by the Responsible Official for the City of Quincy, as the Lead Agency, on December 6, 2010. The appeal period for the DNS ended on January 4, 2011.

- **Water Resources Statutes and Case Law**

  Based on the provisions of RCW 43.21A.690 and RCW 90.03.265, this application has been processed by HDR Engineering, Inc. under Ecology Cost Reimbursement Work Assignment No. HDR004 signed November 28, 2011, under Master Contract No. C1000189

INVESTIGATION

Site Visit

A site visit was conducted on March 21, 2012 by Jerry Louthain of HDR Engineering with JR Chambers, Superintendent for Sabey Construction. At the time of the site visit, construction was essentially completed on Building C. Work had not been started on the proposed Building A, Building B, and the extraction and recharge wells. A schedule has not been set for construction on Buildings A and B or the wells, since Sabey wants to first secure contracts from leasing tenants. At the time of the site visit, only one of four possible tenants has been secured for leased space within Building C. Mr. Chambers described the work that has been done and what is proposed at the project site. Water provided from the City of Quincy is currently available on the site and is intended to always be used for domestic supply at the site. City water will likely also be used for heating and cooling in the buildings and be returned to the City wastewater system until the on-site extraction and recharge wells are available for use. There will be no recharge to groundwater of the City water used for heating and cooling. Aquifer recharge to groundwater will not be done until groundwater is withdrawn for heating and cooling.

Site Description

The site is located on 39.02 acres in the northeasterly portion of the City of Quincy, WA at the southwest corner of County Road 11W and County Road "O" NW (Grant County Parcel Number 31318500). The entire site is within the NE¼NE¼ of Section 9, Township 20N, Range 24E. The site is quite flat with some higher elevation land near the north property line, with a slight downward slope towards the southern end of the property.

Project Description

This project is for construction of a data center facility in Quincy (Intergate-Quincy site), which would include a non-consumptive open-loop geothermal heating and cooling system.

The January 10, 2011 Phase 1 letter report from PGG includes a description of the project, the hydrological setting, the potential for effects to other water users, discussion of the Quincy Basin regulatory status, a definition of the groundwater source, and a discussion of competing senior water right applications. In addition, PGG performed a feasibility study for Sabey for this project, which is entitled *Feasibility of a Groundwater Heat Exchange System for the Intergate-Quincy Data Center,* dated August 27, 2010. This study contains additional information developed by PGG that was incorporated into the Phase 1 letter report.

Ground Water Application No. G3-30623 was filed with Ecology on June 8, 2010 for 20,000 gpm to be used for the heating and cooling system. This project involves the drilling of multiple extraction wells to be located along the north property line and upgradient (at a higher groundwater elevation) from an equal number of injection wells which are proposed to be drilled along the south property line. Water is proposed to be extracted from these wells for cooling, with the warmer water to be re-injected into the aquifer through the injection wells. The extraction and injection wells are to be completed in the same

aquifer unit at a depth of about 300-450 feet below ground surface. The heat returned to the aquifer would be carried downgradient and dissipated by natural ground water cooling. The intended water use is non-consumptive with an equal volume of water injected into the aquifer as the volume of water withdrawn. The only change to the water will be an increase in temperature, which is expected to attenuate to background conditions within one mile of the site, based on the results of the heat transport modeling conducted by PGG.

The type of system proposed is referred to as a groundwater heat exchange system (GHE system) with the pumped groundwater from the extraction wells making a single pass through the system with heat from the facility being transferred to the groundwater, which is then discharged back to the aquifer through injection wells. This type of system is also referred to as an *open-loop geothermal system.* The groundwater makes a single pass through the system staying entirely within the piping system with no addition of any chemicals, or loss of water due to evaporation.

Sabey is also considering options involving other cooling technologies that would use less water. The proposed withdrawal/injection rate of 20,000 gpm is a maximum limit used during warmer periods from June through September. The GHE isn't operated from October through May because outside air and direct evaporation cools the building. Even during the warmer months supplemental cooling from the GHE is only required for several hours at a time.

As stated in the PGG Phase 1 report, the GHE system water demands would only require 16,000 gpm as a peak flow instead of the requested 20, 000 gpm for this application. This is based on the HVAC engineering analysis for the facility's peak-hour 13,270-ton cooling load. Accordingly, the modeling performed by PGG as described in **Groundwater Flow and Heat Transport Modeling** was based on a peak rate of withdrawal of 16,000 gpm.

Because of the reduced rate of withdrawal from 20,000 gpm to 16,000 gpm, and based on a rate of withdrawal and injection of 2,000 gpm per well, the applicant's representative, PGG, has requested that this application be approved for a maximum of 8 extraction and 8 injection wells, plus one additional extraction well to be used as a backup well, for a total maximum of 17 wells.

Administrative Status

Management of ground water in this locality is described under the rules established in the Quincy Ground Water Subarea Management Policy, under Chapter 173-134A WAC. Within this area of the Quincy Basin, artificially stored ground water has occurred through water imported from the federal government's Columbia Basin project. Most of this imported water is located within the shallow management unit, where it commingles with naturally occurring public ground waters. The shallow management unit is defined in WAC 173-134A-040 as "ground water hydraulically continuous between land surface and a depth of 200 feet into the Quincy basalt zone and includes all the Quincy unconsolidated zone". The deep management unit is defined as "all ground waters underlying the shallow management unit".

The United States Bureau of Reclamation (Bureau) submitted declarations of artificially stored waters which were accepted by Ecology for the Quincy subarea and zones. Water use within this upper management unit is co-managed by Ecology and the Bureau, in accordance with Chapter 173-134A WAC through the issuance of Quincy Basin (QB) permits, which are issued by Ecology under Chapter 173-136 WAC. Ground water in the lower management unit is managed by Ecology under Chapter 90.44 RCW with no involvement by the Bureau. Limits have been established under Chapter 173-134A on the amounts of water that can be allocated from both the shallow and deep management units.

The target aquifer for the Sabey project is within the deep management unit, and as such would be managed by Ecology. Although the quantities of water that Ecology can legally allocate in both zones are generally considered fully appropriated, Ecology differentiates between consumptive and non-consumptive uses. In consumptive uses, the amount of water withdrawn from the system is greater than the amount returned to the hydraulic system, such as water use for irrigation or municipal supply. In non-consumptive uses, the amount of water withdrawn from the hydraulic system is the same as the amount returned, for example, fish rearing, power generation, and GHE systems.

Ecology has accepted this application for processing as a non-consumptive water use and being approvable if it can be determined that the project truly is non-consumptive, despite regulatory restrictions on the issuance of new water rights for consumptive use in the Quincy Basin.

Legal Availability

In Chapter 173-134A WAC, the limit of natural occurring groundwater to be appropriated in the Quincy Subarea was established as 58,000 acre-feet per year from the shallow management unit and 97,901 acre-feet per year from the deep management unit. Based on an evaluation of existing water rights (permits and certificates) conducted in 1974, Ecology determined that these quantity limits had been reached, and therefore all naturally occurring public water had been allocated. The evaluation of existing water rights in 1974 did not include water right claims that were subsequently filed under the Claims Registration Act. Review of the water right claims filed between 1974 and 1998 reveals that up to an additional 35,000 acre-feet of naturally occurring groundwater could be appropriated for beneficial use under claims indicating a first use prior to 1945.

In Chapter 173-134A-080, the rule established a reservation of 4000 acre-feet annually for domestic and group domestic uses. Review of the records confirms Ecology has issued permits and certificates that exceeded the established reservation for domestic and group domestic supplies. Water is not available from the reservation.

Review of water right permits and certificates records currently on file with Ecology within the Quincy Basin indicate state-issued water right permits and certificates authorize beneficial use of approximately 157,000 acre-feet of naturally occurring groundwater each year. As much as an additional 35,000 acre-feet of naturally occurring groundwater could be used each year under water right claims.

Based on this recent review of water rights and the limits established in Chapter 173-134A, naturally occurring public waters in the Quincy Subarea have been fully appropriated and no naturally occurring public waters are legally available for issuance of a new permits.

Several cases, including Postema vs PCHB, the Skane Case, Shinn PCHB 798-A, and Jensen PCHB 1980-23, resulted in the conclusion that additional water is not available for consumptive use within the Quincy Basin.

The approval of this application in this Basin for non-consumptive use by re-injecting of the same amount of water that is to be withdrawn is also supported by the premise described in the Attorney General Opinion, AGO 1968 No. 8.

Based on the precedence established in the above cases and this Attorney General Opinion, it can be concluded that water is legally available for this application.

Hydrogeology

The PGG August 27, 2010 report, "*Feasibility of a Groundwater Heat Exchange System for the Intergate-Quincy Data Center*" contains a detailed description of the hydrogeology of the Quincy Basin, with the key points relating to this project summarized as follows:

- The Quincy Basin is located within the Columbia Plateau extending throughout Washington, Oregon, and Idaho. A thick sequence of basalt flows, collectively known as the Columbia River Basalt Group (CRBG) is the major water-bearing geologic formation on the Plateau.
- The Columbia Basin Irrigation Project (CBIP) has had a significant impact on water levels and groundwater movement in the Quincy basin since it was first introduced in 1952. Before irrigation, the overburden materials and upper portions of the CRBG were largely unsaturated. However, the additional recharge from irrigation water resulted in a dramatic rise in water table, on the order of 250 feet, which brought water levels to near land surface in the Quincy area.
- Three major hydrostratigraphic units occur beneath the Sabey site including:
  - Overburden aquifer
  - Wanapum Basalt aquifer
  - Grande Ronde Basalt aquifer
- The specific targeted production zone for the Sabey project is the interflow/fracture zones within the Frenchman Springs unit of the Wanapum Basalt Formation. The aquifer is confined.
- Ground water flows from the north near the Beezley Hills to the southeast. The PGG report states that the depth to ground water at Quincy ranges from above land surface expressed as flowing artesian wells to about 25 feet below ground surface.
- As discussed above in **Administrative Status**, Chapter 173-134A established shallow and deep management units within the Quincy Subarea. This chapter includes a restriction that wells in the shallow management unit are completed no deeper than 200 feet into the basalt, and that they not penetrate the top of the Grande Ronde Basalt unit.
- The aquifer hydraulic characteristics can be determined from the City of Quincy wells. PGG (2010) reports a transmissivity of 11,600 ft^2/day from a review of the specific capacity for the City wells. A pumping test of Quincy Well No. 5 involving water level monitoring of 11 observation wells showed a transmissivity range of 14,500 to 17,900 ft^2/day and a storage coefficient of 8.0 x 10^{-5}.

The Grande Ronde Basalt aquifer is underlying the Wanapum Basalt. PGG (2010) reports that wells in the Quincy and project area do not extend into the Grande Ronde Basalt. The top of the Grande Ronde is estimated to be about 500 feet below ground surface at the Sabey site. Groundwater in the Grande Ronde Basalt flows south and west toward the Columbia River.

Well Construction Requirements

The targeted aquifer for the extraction and injection wells is the Frenchman Springs Unit of the Wanapum Basalt Formation with the depth of the extraction and injection wells to be between 300 and 450 feet below ground surface. The Grande Ronde Basalt formation will not be utilized for this permit.

In order to prevent withdrawal or recharge of water from the Overburden Aquifer and the underlying Grande Ronde Basalt Aquifer, all the extraction wells and injection wells are to be cased and sealed

according to the provisions for **Wells, Well Logs and Well Construction Standards** on Pages 2 and 3 of this report.

The injection wells shall be designed and constructed to limit vertical leakage and/or hydraulic fracturing near the borehole.

Groundwater Flow and Heat Transport Modeling

The heat exchange project will affect ground water levels and temperature. Ground water levels in the aquifer will decrease at the extraction wells and will increase at the injection wells. Ground water temperature will increase at the injection wells. PGG (2010) constructed a ground water flow and heat transport model to evaluate these effects. The model evaluated the extent of drawdown at the extraction wells and the mounding at the injection wells. They also evaluated whether heat buildup at the injection wells would increase ground water temperature at the extraction wells. If significant heat recirculation were to occur, the temperature of the "cool wells" could become too warm to effectively cool the facility.

PGG constructed the ground water flow model using MODFLOW to simulate ground water hydraulics, MODPATH to predict flow paths and MT3D to simulate heat transport. The MODFLOW model was approximately 14 miles by 14 miles using cell sizes ranging from 100 to 2,400 feet. The model was constructed with 17 layers ranging from 15 to 300 feet thick. The Frenchman Springs unit was assigned a thickness of 15 feet. The model was run at steady-state assuming a 16,000 gpm injection and extraction rate to evaluate worst-case conditions. A transient simulation was then run simulating 14 to 28 day pumping and injection scenarios up to 3,600 gpm. More details on the model design are presented in PGG feasibility study report (2010).

The PGG Phase 1 report, (PGG 2011) evaluated maximum drawdown at the extraction wells and mounding at the injection wells. Figure 11 of the PGG (2011) report shows the contours of drawdown predicted by the model for a steady-state simulation representing maximum pumping (16,000 gpm total pumping out of 5 "cool" wells, injected into 5 "warm" wells). The model predicts 30 feet of drawdown will occur 1,000 feet from the pumping wells and 10 feet of drawdown will occur at a distance of 4,000 feet from the pumping wells. This is not likely to cause a problem to existing water users because there is 300 to 400 feet of hydraulic head in the existing Frenchman Springs-aquifer wells in the area. .

PGG (2011) evaluated the effects of injecting higher temperature water into the aquifer. PGG simulated 2-week average pumping rates over a 50 year period using the "maximize outdoor air" scenario. Figure 13 from PGG (2011) shows the mapped distribution of heat within the target aquifer at 50 years. The figure presents a "snapshot" of the model-predicted heat distribution at the end of the 2-week period of highest heat injection (from 43 to 56 days of system operation). The heat plume is predicted to advance to the south following the regional groundwater flow path. The results show that the heat plume will not exceed 70 degrees within 1,500 feet downgradient from the injection wells and completely dissipates within 3,000 feet of the injection wells.

EFFECTS TO OTHER WATER USERS

Figure 11 from PGG (2011) shows the predicted drawdown and water level rise near the proposed Sabey data center site. The predicted water-level changes are for the targeted Frenchman Springs aquifer zone. The water-level changes are based on 16,000 gpm of pumping and reinjection. Given the configuration of the extraction and injection wells and the local hydraulic gradient (north to south), a cone of depression is predicted north of the site, whereas a water-level mound is predicted south of the site. The water-level changes should occur fairly quickly in the deeper flow system, given the

relatively high transmissivity and low storativity of the aquifer, and since all water that is pumped from the system will be re-injected at the site.

Much smaller amounts of drawdown and mounding would occur in shallower aquifers due to the presence of lower permeability (dense basalt) confining units that separate the deeper and shallower flow systems. The shallower flow system should respond more slowly to deeper pumping stresses, due to the presence of the confining layers, and would be influenced more by average pumping stresses rather than by short-term fluctuations in the pumping rate.

The groundwater-flow model was used to assess water-level changes in the shallower aquifers by simulating the maximum average monthly production required under the "maximize outside air" scenario. A steady-state simulation was performed using an average rate of 2,832 gpm (average of stress periods 4 and 5), distributed between five extraction wells on the north side of the property, with reinjection of the same amount of water at five wells on the south side of property. The total simulated drawdown in the shallower aquifers (model depth of 150 feet) was less than 0.3 feet.

Drawdown in the Frenchman Springs supply aquifer would occur mostly north of the Sabey site. The closest well completed in this aquifer zone is owned by Morrison (Table 2 from PGG 2011). This well was drilled to a depth of 457 feet. The only reported water level (Walters, et al., 1960) was a reading of 362 feet below ground surface on 9/8/1949, prior to the introduction of USBR irrigation water. Water levels have since risen to within about 40 to 50 feet of ground surface (Figure 8, PGG, (2011). The estimated drawdown at this site under a GHE operational rate of 16,000 gpm would be less than 10 feet. This amount of interference drawdown should not impair the performance of the Morrison well, since there would still be about 400 feet of available drawdown for well operation.

The next closest Frenchman Springs aquifer supply wells are located at the Cedargreen facility which lies about ¼ to ½ mile west of the Sabey site (Table 2 PGG, 2011)). There are four wells at this site that are completed at depths between 345 feet and 425 feet. Very little drawdown is expected in this area, because the extraction-well drawdown is largely cancelled out by injection- well mounding.

The five City of Quincy wells are also completed in the Frenchman Springs aquifer. All of them lie south and west of the Sabey site and in areas where water-level mounding is expected to occur. The groundwater-flow model predicts about 3 feet of water-level mounding at Quincy Well 5 and correspondingly lesser amounts at the other City wells. Therefore, none of the municipal supply wells would be adversely impacted by Sabey's GHE system operation.

Most of the wells in the Sabey site vicinity are completed in shallower aquifers at depths of less than 250 feet. These wells should not be impaired, given the small amount of drawdown (< 0.3 feet) that is estimated for this area.

Four Statutory Tests

This Report of Examination (ROE) evaluates the application based on the information presented above. To approve the application, Ecology must issue written findings of fact and determine that each of the following four requirements of RCW 90.03.290 has been satisfied:

1. The proposed appropriation would be put to a beneficial use;
2. Water is available for appropriation;
3. The proposed appropriation would not impair existing water rights; and
4. The proposed appropriation would not be detrimental to the public welfare.

CONCLUSIONS

The conclusions based on the above investigation are as follows:

1. The proposed appropriation for heat exchange is a beneficial use of water;
2. The requested rate of withdrawal of 20,000 gpm should be reduced to 16,000 gpm based on the peak rate of withdrawal requirements determined from the HVAC engineering analysis and the results of the modeling that was based on 16,000 gpm that was performed related to this project. This rate of withdrawal is available for appropriation as a non-consumptive use;
3. This appropriation will not impair senior water rights, including water rights for USBR facilities; and
4. This appropriation will not be detrimental to the public interest.

RECOMMENDATION

Based on the information presented above, the author recommends that the request to appropriate non-consumptive ground water for heat exchange be approved in the amount of 16,000 gpm as described, limited, and subject to the provisions on page 1 through 4 of this report.

Report by: _____

Jerry Louthain, PE, HDR Engineering Date

Reviewed by: _____

Kevin Brown, Water Resources Program Date

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