

**STARTING
LEFT
SIDE OF
FILE**

State of Idaho
Department of Water Resources
Permit to Appropriate Water

NO. 95-09385

Priority: March 27, 2007

Maximum Diversion Rate: 0.75 CFS

This is to certify, that NORTHERN WATER LLC
1831 LOST SPRINGS RANCH RD
POST FALLS ID 83854

has applied for a permit to appropriate water from:

Source: GROUND WATER

and a permit is APPROVED for development of water as follows:

<u>BENEFICIAL USE</u>	<u>PERIOD OF USE</u>	<u>RATE OF DIVERSION</u>
FIRE PROTECTION	01/01 to 12/31	0.50 CFS
MUNICIPAL	01/01 to 12/31	0.25 CFS

LOCATION OF POINT(S) OF DIVERSION:

GROUND WATER (SE¼SE¼) Sec. 3 Twp 51N Rge 05W B.M. KOOTENAI County

GROUND WATER (SE¼SE¼) Sec. 3 Twp 51N Rge 05W B.M. KOOTENAI County

PLACE OF USE: FIRE PROTECTION

Twp Rge Sec	NE				NW				SW				SE				Totals
	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
51N 05W 3																	X
51N 05W 4													X	X	X	X	

CONDITIONS OF APPROVAL

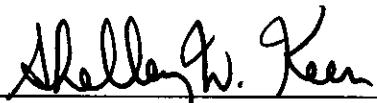
1. Proof of application of water to beneficial use shall be submitted on or before **January 01, 2013**.
2. Subject to all prior water rights.
3. A map depicting the place of use boundary for this water right at the time of this approval is attached to this document for illustration purposes.
4. Place of use is within the area served by the public water supply system of Northern Water LLC. The place of use is generally located within Section 3, Township 51N, Range 05W.
5. Prior to or in connection with the proof of beneficial use statement to be submitted for municipal water use under this right, the right holder shall provide the department with documentation showing that the water supply system is being regulated by the Idaho Department of Environmental Quality as a public water supply and that it has been issued a public water supply number.

State of Idaho
Department of Water Resources
Permit to Appropriate Water

NO. 95-09385

6. Project construction shall commence within one year from the date of permit issuance and shall proceed diligently to completion unless it can be shown to the satisfaction of the Director of the Department of Water Resources that delays were due to circumstances over which the permit holder had no control.
7. Right holder shall comply with the drilling permit requirements of Section 42-235, Idaho Code and applicable Well Construction Rules of the Department.
8. Water shall not be diverted for fire protection use under this right except to fight or repel an existing fire.
9. This right does not grant any right-of-way or easement across the land of another.
10. This right authorizes the diversion of ground water within the Rathdrum Prairie Ground Water Management Area (RPGWMA). Use of water under this right shall be subject to the provisions of the management plan approved by the director for the RPGWMA.
11. When notified by the Department, the right holder shall install and maintain a measuring device of a type acceptable to the Department as part of the diverting works.
12. Water may only be diverted and used for irrigation from March 15 through November 15.
13. When notified by the Department, the right holder shall record the quantity of water diverted and annually report diversions of water and/or other pertinent hydrologic and system information as required by Section 42-701, Idaho Code, and/or the management plan for the Rathdrum Prairie Ground Water Management Area.
14. The right holder shall comply with all water quality statutes and rules administered by the Idaho Department of Environmental Quality.
15. The diversion and use of water is subject to additional conditions and limitations agreed to by both Kootenai Environmental Alliance and the water right holder under a separate agreement to which the Department is not a party and which is independently enforceable by a court of law. A copy of the agreement shall be included in the Department water right file.
16. Failure of the right holder to comply with any condition of approval is cause for the Director to void this permit.

This permit is issued pursuant to the provisions of Section 42-204, Idaho Code. Witness the signature of the Director, affixed at Boise, this 30th day of January, 2007.

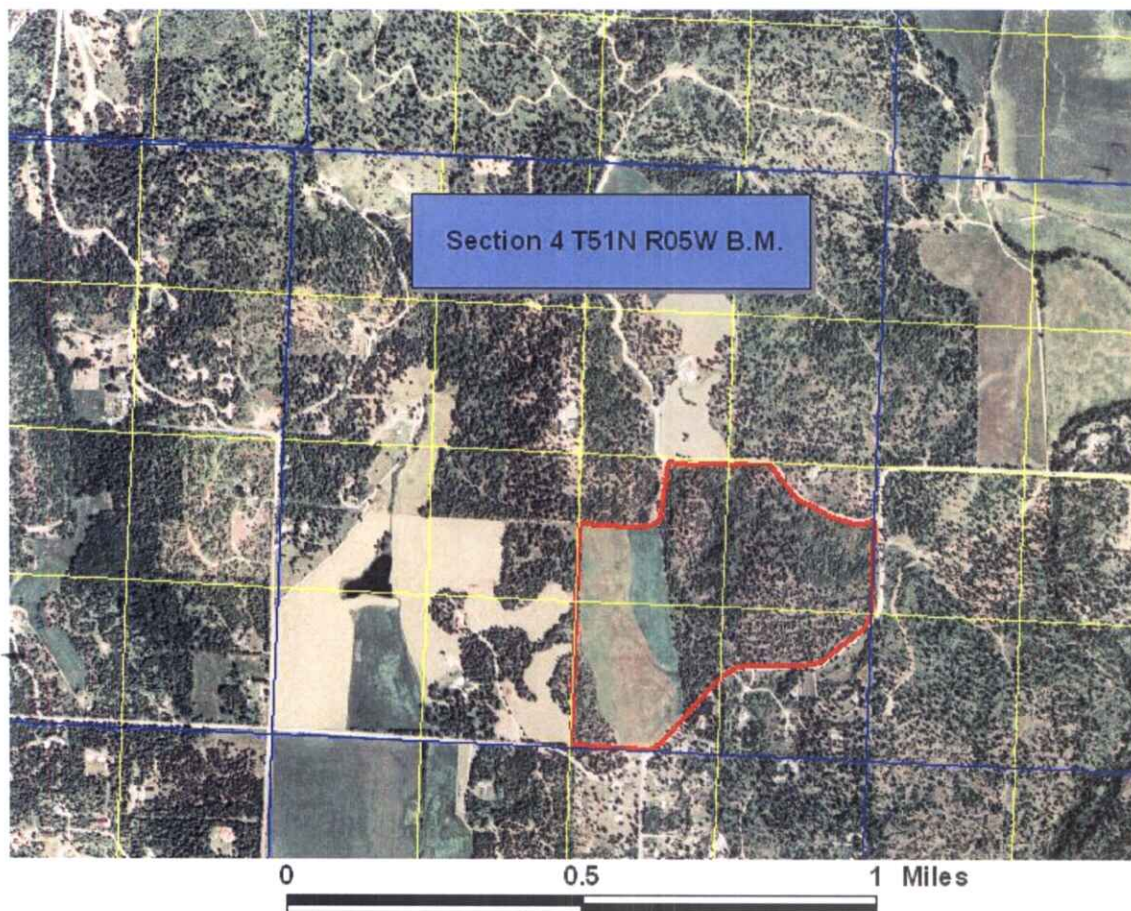

for DAVID R. LUTHELL, JR., Director

State of Idaho
Department of Water Resources
Permit to Appropriate Water

NO. 95-09385

Digital Boundary for Northern Water LLC

January 30, 2008



-  Sections
-  QQ
-  Large_pou.shp



BEFORE THE DEPARTMENT OF WATER RESOURCES

IN AND FOR THE STATE OF IDAHO

IN THE MATTER OF APPLICATION	)	
FOR PERMIT TO APPROPRIATE WATER	)	PRELIMINARY ORDER
NO. 95-9385 IN THE NAME OF NORTHERN	)	
WATER, LLC	)	
_____	)	

On March 27, 2007, Northern Water LLC ("Northern Water") filed an application to appropriate water with the Idaho Department of Water Resources ("IDWR" or "Department"). The application was assigned water right no. 95-9385.

Application to appropriate water no. 95-9385 seeks the appropriation from ground water of 0.25 cubic feet per second ("cfs") for municipal purposes and 0.50 cfs for fire protection for a total of 0.75 cfs.

Notice of application no. 95-9385 was published on May 3 and May 10, 2007 in the Coeur d'Alene Press. Shanna Bublitz protested the application.

On August 30, 2007, Wild Ridge, LLC ("Wild Ridge") filed a petition to intervene. On September 14, 2007, the hearing officer granted the petition to intervene.

On September 18, 2007, IDWR conducted a hearing for the protest. Malcolm Dymkoski, attorney at law, appeared on behalf of Northern Water. Erika B. Grubbs, attorney at law, appeared on behalf of Wild Ridge.

After presentation of testimony and other evidence, the hearing officer finds, concludes and orders as follows:

FINDINGS OF FACT

1. Application no. 95-9385 proposes the following:

Nature of Use:	Municipal and Fire Protection
Source	Ground water
Flow Rate	0.25 cubic feet per second ("cfs") (Municipal) 0.50 cfs (Fire Protection)
Points of Diversion	SESE ¹ , Section 3, Township 51 N, Range 5 W (Two wells at this location)
Place of Use	SE of Section 4, T 51 N, R 5 W

¹ In this decision, the public land survey numeric descriptor "1/4" is assumed to follow each two alpha character public land survey locator when the numeric descriptor is missing. For instance, in this example, the full description would be the SE1/4SE1/4, Section 3, Township 51 North, Range 5 West, Boise Meridian.

2. Wild Ridge owns 108 acres that include the entire place of use proposed by application no. 95-9385. Wild Ridge proposes a 54-lot subdivision on the 108 acres. The development will be referred to hereafter as “the Wild Ridge development.”

3. Northern Water constructed and owns a water system to supply municipal water to a development named “Lost Creek Estates.” The Lost Creek Estates development is adjacent to the 108 acres owned by Wild Ridge. Northern Water holds permit to appropriate water no. 95-9277. Permit no. 95-9277 authorizes the following use of water for Lost Creek Estates:

Nature of Use:	Municipal and Fire Protection
Source:	Ground water
Flow Rate:	0.25 cfs (Municipal) 0.50 cfs (Fire Protection)
Total flow rate:	0.50 cfs
Points of Diversion	SESE, Section 3, Township 51 N, Range 5 W (Two wells at this location)
Place of Use	SW & SE of Section 3, T 51 N, R 5 W

4. The homeowners of Lost Creek Estates are members/shareholders in a nonprofit corporation named the Lost Creek Estates Water Association, Inc. (“Lost Creek Association”). Lost Creek Association leases the water system providing water to Lost Creek Estates from Northern Water.

5. On March 13, 2007, Wild Ridge executed a contract with Northern Water and Lost Creek Association. The contract provides that the homeowners within the Wild Ridge development will become members in the Lost Creek Association, and that the Wild Ridge development may connect its municipal water service lines to the municipal water supply system owned by Northern Water and leased by the Lost Creek Association. Upon connection of the Wild Ridge development water lines to the water lines in Lost Creek Estates currently owned by Northern Water, the water system within the Wild Ridge development will become the property of Northern Water (see “Water Service Agreement,” Exhibit 103).

6. Lots within the Wild Ridge development will be $\frac{2}{3}$ to $2\frac{3}{4}$ acres in size. Covenants and restrictions for the subdivision will mandate that each home use shall not exceed 700 gallons per household per day. The covenants and restrictions will also require planting of native vegetation that is drought resistant and does not require as much water for survival. The covenants and restrictions will also encourage other water conservation measures set forth in an agreement between Kootenai Environmental Alliance and Wild Ridge.

7. Wild Ridge will construct and install a central septic system for the subdivision. Panhandle Health District reviewed the plans and specifications for the central septic system and has approved the conceptual proposal. Wild Ridge will comply with all health regulations.

8. Northern Water owns two existing wells currently providing municipal water to Lost Creek Estates. Application no. 95-9385 identifies the two Lost Creek Estates wells as proposed points of diversion.

9. Each Lost Creek Estates well has been pump tested and will produce 195 gallons per minute, or a total of 390 gallons per minute. This is equivalent to 0.87 cfs. The pumping system in each well is capable of pumping 142 gallons per minute, or a total of 284 gallons per minute. This is equal to 0.63 cfs. Both the well capacity and the system capacity exceed the combination of municipal flows authorized by the existing permit no. 95-9277 (0.25 cfs) and application to appropriate water no. 95-9385 (0.25 cfs), absent the additional flow needed for fire protection.

10. Northern Water constructed and owns a water storage reservoir located in Lost Creek Estates that provides fire protection for the subdivision. Wild Ridge proposes construction of a water storage reservoir in the Wild Ridge development to provide fire protection. Consequently, the capacity needed is the 0.50 cfs (the combined municipal flow rate of permit no. 95-9277 and application no. 95-9385), plus some additional flow to refill the water storage tanks if depleted by delivering water for fighting a fire. The existing piping system is designed to provide fire flows of 1,000 gpm, or 2.23 cfs.

11. There is mechanical and delivery capacity in the existing system to provide municipal water flows for Lost Creek Estates and the Wild Ridge development. In addition, the mechanical pumping works can be improved to provide additional water, if necessary.

12. Wild Ridge has secured financing for the subdivision development from Coastal Community Bank for six million dollars.

13. The points of diversion are located on the fringes of the Rathdrum Prairie Aquifer in what was characterized as an "abayment" of the aquifer. "Abayment" was defined as a bay or inlet with characteristics of the larger Rathdrum Prairie Aquifer.

14. Ground water in the Rathdrum Prairie Aquifer resides in formations of sands and gravels. The sands and gravels transmit water rapidly. In addition, the sands and gravels store a significant quantity of water within a unit volume of the Rathdrum Prairie Aquifer.

15. Ground water levels in the Rathdrum Prairie Aquifer are not declining. Withdrawals of water are not exceeding the average annual rate of natural recharge to the aquifer. The Rathdrum Prairie Aquifer contains sufficient water to sustain the proposed diversion of water without causing an overdraft of the ground water in the aquifer.

16. One of the Lost Creek Estates wells was pumped to determine well capacity. The rate and duration of the pump test was specifically identified in the evidence. The hearing officer assumes that the pumping flow rate for the test was the 195 gallons per minute previously discussed in this decision. Pumping caused a ground water draw down in the pumped well of not more than two feet. Draw downs in the pumped well did not cause any ground water declines in the second unpumped Lost Creek Estates well.

17. The nearest private well is approximately 500-1,000 feet from the Lost Creek Estates wells proposed by application no. 95-9385 as points of diversion. Because of the highly transmissive properties of the Rathdrum Prairie Aquifer resulting in insignificant or nonexistent draw downs during pumping at a rate of the magnitude sought by application no. 95-9385, the proposed appropriation will not cause a significant decline in the wells owned by other water right holders.

CONCLUSIONS OF LAW

1. Idaho Code § 42-203A states in pertinent part:

In all applications whether protested or not protested, where the proposed use is such (a) that it will reduce the quantity of water under existing water rights, or (b) that the water supply itself is insufficient for the purpose for which it is sought to be appropriated, or (c) where it appears to the satisfaction of the director that such application is not made in good faith, is made for delay or speculative purposes, or (d) that the applicant has not sufficient financial resources with which to complete the work involved therein, or (e) that it will conflict with the local public interest as defined in section 42-202B, Idaho Code, or (f) that it is contrary to conservation of water resources within the state of Idaho, or (g) that it will adversely affect the local economy of the watershed or local area within which the source of water for the proposed use originates, in the case where the place of use is outside of the watershed or local area where the source of water originates; the director of the department of water resources may reject such application and refuse issuance of a permit therefor, or may partially approve and grant a permit for a smaller quantity of water than applied for, or may grant a permit upon conditions.

2. The applicant bears the ultimate burden of proof regarding all the factors set forth in Idaho Code § 42-203A.

3. Northern Water and Wild Ridge have sufficient financial resources to complete the project.

4. The applications were not filed for speculation, delay, or in bad faith.

5. Idaho Code § 42-202B defines the local public interest as “the interests that the people in the area directly affected by a proposed water use have in the effects of such use on the public water resource.”

6. Careful development and use of the ground water in the Rathdrum Prairie Aquifer for domestic and municipal uses is in the local public interest. The municipal use of water proposed by application no. 95-9385 is in the local public interest.

7. Restrictive limits on water use and encouraged low water consumptive landscaping within the Wild Ridge development will result in conservation of the water of the state of Idaho.

8. Pumping the flow rates proposed by the application will not reduce the quantity of water under existing water rights.

9. The water supply in the Rathdrum Prairie Aquifer is sufficient for the purpose sought by the application.

ORDER

IT IS HEREBY ORDERED that application for permit to appropriate water no. 95-9385 is **Approved** subject to the following conditions:

Proof of beneficial use shall be submitted on or before January 1, 2013.

Subject to all prior water rights.

A map depicting the place of use boundary for this water right at the time of this approval is attached to this document for illustration purposes.

Place of use is within the area served by the public water supply system of Northern Water LLC. The place of use is generally located within Section 3, Township 51N, Range 05W.

Prior to or in connection with the proof of beneficial use statement to be submitted for municipal water use under this right, the right holder shall provide the department with documentation showing that the water supply system is being regulated by the Idaho Department of Environmental Quality as a public water supply and that it has been issued a public water supply number.

Project construction shall commence within one year from the date of permit issuance and shall proceed diligently to completion unless it can be shown to the satisfaction of the Director of the Department of Water Resources that delays were due to circumstances over which the permit holder had no control.

Right holder shall comply with the drilling permit requirements of Section 42-235, Idaho Code and applicable Well Construction Rules of the Department.

Water shall not be diverted for fire protection use under this right except to fight or repel an existing fire.

This right does not grant any right-of-way or easement across the land of another.

This right authorizes the diversion of ground water within the Rathdrum Prairie Ground Water Management Area (RPGWMA). Use of water under this right shall be subject to the provisions of the management plan approved by the director for the RPGWMA.

When notified by the Department, the right holder shall install and maintain a measuring device of a type acceptable to the Department as part of the diverting works.

When notified by the Department, the right holder shall record the quantity of water diverted and annually report diversions of water and/or other pertinent hydrologic and system information as required by Section 42-701, Idaho Code, and/or the management plan for the Rathdrum Prairie Ground Water Management Area.

Water may only be diverted and used for irrigation from March 15 through November 15.

The right holder shall comply with all water quality statutes and rules administered by the Idaho Department of Environmental Quality.

The diversion and use of water is subject to additional conditions and limitations agreed to by both Kootenai Environmental Alliance and the water right holder under a separate agreement to which the Department is not a party and which is independently enforceable by a court of law. A copy of the agreement shall be included in the Department water right file.

Failure of the right holder to comply with any condition of approval is cause for the Director to void this permit.

Dated this 6th day of December, 2007.

A handwritten signature in cursive script, reading "Gary Spackman", written over a horizontal line.

Gary Spackman
Hearing Officer

CERTIFICATE OF SERVICE

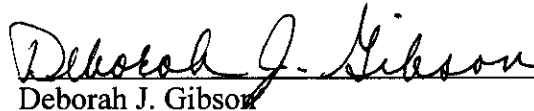
I HEREBY CERTIFY that on this 7th day of December, 2007, the above and foregoing document was served on the following by placing a copy of the same in the United States mail, postage prepaid and properly addressed to the following:

MALCOLM DYMKOSKI
2020 LAKEWOOD DR STE 210
COEUR D ALENE ID 83814

SHANNA BUBLITZ
PO BOX 827
RATHDRUM ID 83858

ERIKA B GRUBBS
525 CEDAR ST
WALLACE ID 83873

IDWR - NORTHERN REGION
7600 MINERAL DR STE 100
COEUR D ALENE ID 83815

A handwritten signature in cursive script, reading "Deborah J. Gibson", is written over a horizontal line.

Deborah J. Gibson
Administrative Assistant
Water Allocation Bureau

73485

Ident. No. 95-9385

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
APPLICATION FOR PERMIT

To appropriate the public waters of the State of Idaho

RECEIVED
MAR 27 2007
IDWR/North

1. Name of Applicant Northern Water LLC Phone 208 661-8609
Mailing address 1831 Lost Springs Ranch Rd., Post Falls, ID 83854
2. Source of water supply Groundwater which is a tributary of n/a
3. Location of point of diversion is Township 51N Range 05 WBM Sec. 3 in the SE $\frac{1}{4}$, SE $\frac{1}{4}$, Govt. Lot SE $\frac{1}{4}$, SE $\frac{1}{4}$, Govt. Lot SE $\frac{1}{4}$, B.M., Kootenai County;
additional points of diversion if any: X 2
4. Water will be used for the following purposes:
Amount .25 cfs for Municipal purposes from 01/01 to 12/31 (both dates inclusive)
(cfs or acre-feet per annum)
Amount .50 for Fire protection purposes from 01/01 to 12/31 (both dates inclusive)
(cfs or acre-feet per annum)
Amount _____ for _____ purposes from _____ to _____ (both dates inclusive)
(cfs or acre-feet per annum)
Amount _____ for _____ purposes from _____ to _____ (both dates inclusive)
(cfs or acre-feet per annum)
Amount _____ for _____ purposes from _____ to _____ (both dates inclusive)
(cfs or acre-feet per annum)
Amount _____ for _____ purposes from _____ to _____ (both dates inclusive)
(cfs or acre-feet per annum)
5. Total quantity to be appropriated is (a) .75 cfs and/or (b) _____
cubic feet per second acre feet per annum
6. Proposed diverting works:
 - a. Describe type and size of devices used to divert water from the source Well and storage resevoir
 - b. Height of storage dam _____ feet; active reservoir capacity _____ acre-feet; total reservoir capacity _____ acre-feet
 - c. Proposed well diameter is _____ inches; proposed depth of well is _____ feet
 - d. Is ground water with a temperature of greater than 85°F being sought? No
 - e. If well is already drilled, when? 2006 (2); Drilling firm United Drilling;
Well was drilled for (well owner) Northern Water LLC; Drilling Permit No. 838852, 838853
7. Time required for completion of works and application of water to proposed beneficial use is 5 years (minimum 1 year)
8. Description of proposed uses (if irrigation only, go to item 9):
 - a. Hydropower; show total feet of head and proposed capacity in kW. _____
 - b. Stockwatering; list number and kind of livestock. _____
 - c. Municipal; show name of municipality. Northern Water LLC
 - d. Domestic; show number of households. _____
 - e. Other; describe fully. _____

9. Description of place of use:

- If water is for irrigation, indicate acreage in each subdivision in the tabulation below.
- If water is used for other purposes, place a symbol of the use (example: *D* for Domestic) in the corresponding place of use below. See instructions for standard symbols.

TWP	RGE	SEC	NE				NW				SW				SE				TOTALS
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
51N	5W	04													M	M	M	M	

Total number of acres to be irrigated _____

10. Describe any other water rights used for the same purposes as described above. _____

11. a. Who owns the property at the point of diversion? Northern Water LLC

b. Who owns the land to be irrigated or place of use? Wild Ridge LLC, a Washington LLC

c. If the property is owned by a person other than the applicant, describe the arrangement enabling the applicant to make this filing: Water Service Agreement between the applicant and the landowner

12. Remarks: Please refer to the application and file in Permit #95-9277.

13. **MAP OF PROPOSED PROJECT REQUIRED** - Attach an 8½"x11" map clearly identifying the proposed point of diversion, place of use, section #, township & range. (A photocopy of a USGS 7.5 minute topographic quadrangle map is preferred.)

BE IT KNOWN that the undersigned hereby makes this application for permit to appropriate the public waters of the State of Idaho as herein set forth.

N. G. Webb
Signature of Applicant (and title, if applicable)

Received by [Signature] Date 3/27/07 Time 9:36a Preliminary check by [Signature]
Fee \$ 250.00 Received by [Signature] # N018230 Date 3/27/07
Publication prepared by [Signature] Date 4/25/07 Published in Idaho News 5/3-10/07
Publication approved [Signature] Date 5/15/07

RECEIVED
MAR 27 2007
IDWR/North

#20673
(1570)
29.210 Ac

(1750)
10.838 Ac

Zr #20413
338.78

Point of Use

#7164
(7300)
5.100 Ac

#14757
(7350)
1.982 Ac

(8330)
108.019 Ac

#13017
(8875)
2.320 Ac

(8910)
2.211 Ac

#19958
500.81

#19959

(9400)
5.576 Ac

(9375)
0.988 Ac

#13896
(9425)
3.878 Ac

#8970
(9550)
10.362 Ac

(9770)
5.152 Ac

#10415
228.00'

ASSESSED W/ 51N05W-09-0670

1" = 400 FEET

04 02
09 10

Sec. 4 Twp. 51N. R. 5W. B.M.

RECEIVED
MAR 27 2007
IDWR/North

#20673

1570
25.210 Ac

1750
10.838 Ac

#20413

Point of Use

#7164

7300
5.100 Ac

#14757

7350
1.982 Ac

8330
108.019 Ac

COPY

WINCH AVE

#8970

9550
10.362 Ac

#13017

8875
2.330 Ac

9400
5.576 Ac

#13896

9425
3.879 Ac

8910

2.211 Ac

#19958

500.81
#19959

9770

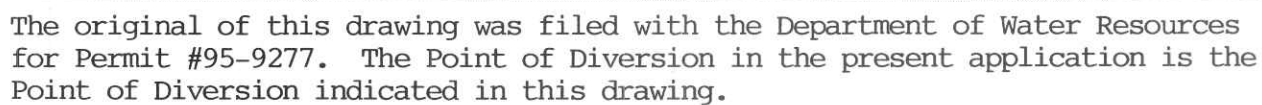
5.152 Ac

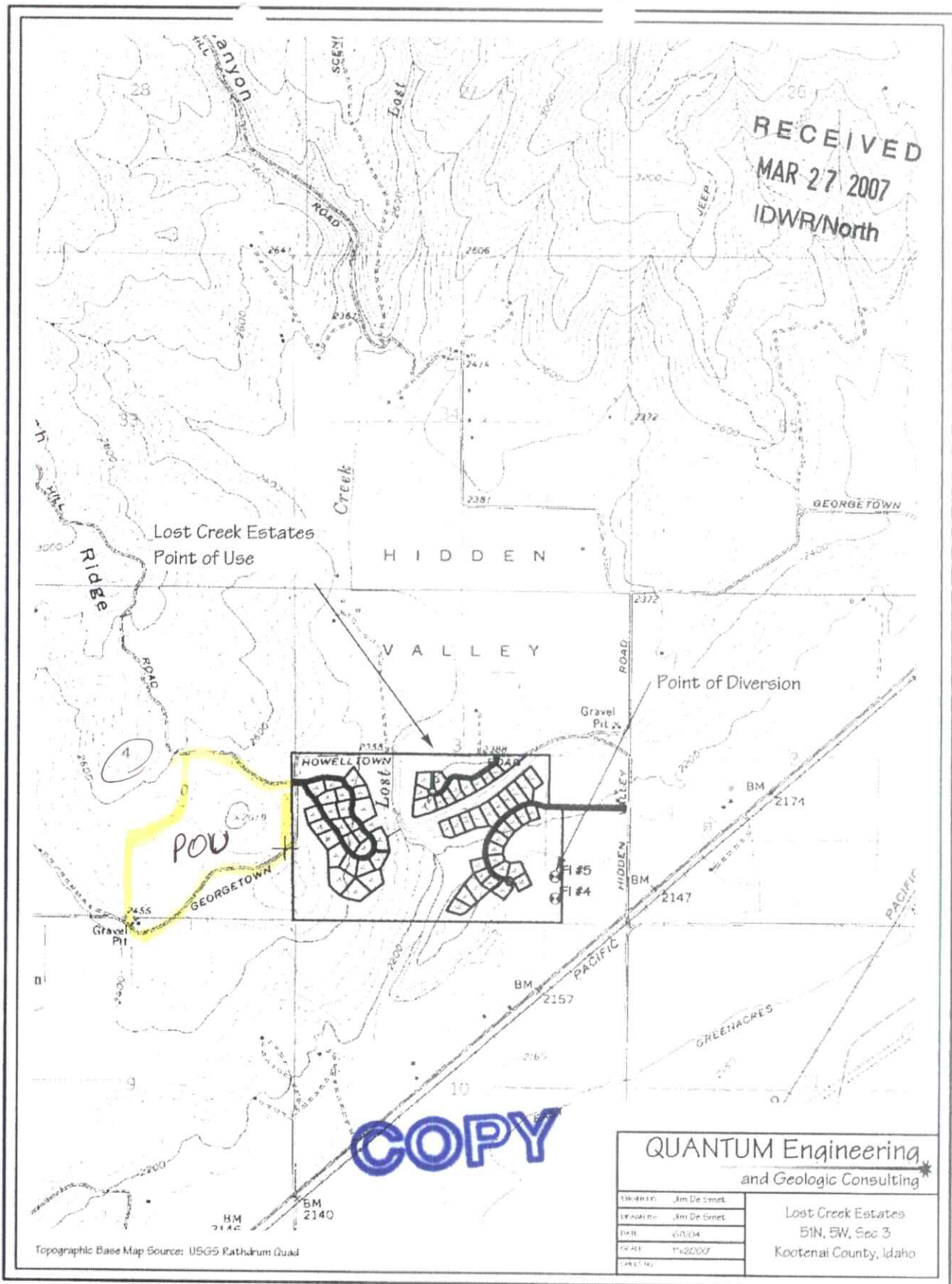
10415

1" = 400 FEET

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09 10

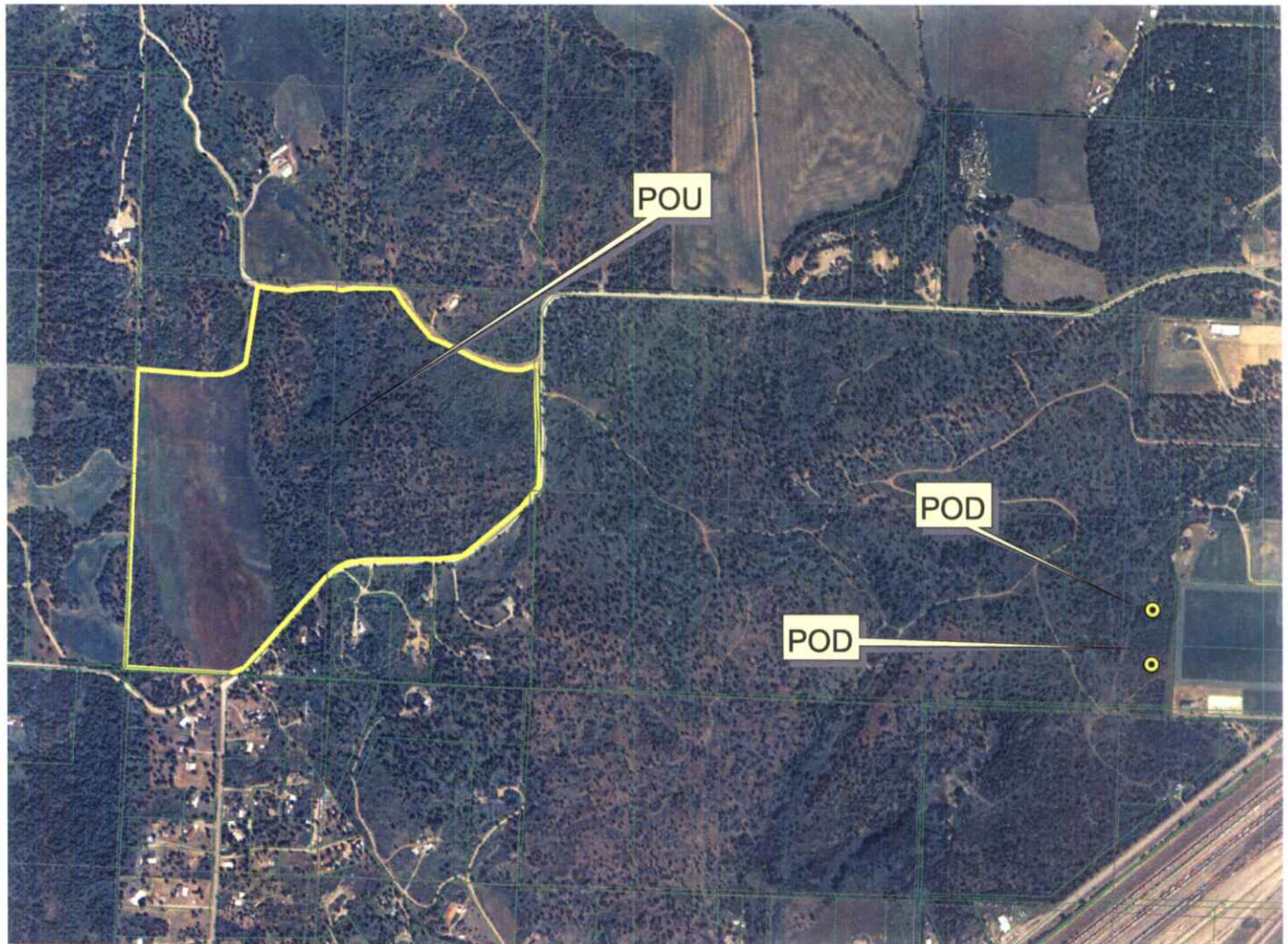
Sec. 4 Twp. 51N. R. 5W. B.M.





The original of this drawing was filed with the Department of Water Resources for Permit #95-9277. The Point of Diversion in the present application is the Point of Diversion indicated in this drawing.

95-9385



-  Kootenai taxlots
-  GCDB51N05W GCDB
-  Pou.shp
-  Pod.shp
-  Administrative BasinsAdminbas.shp



**STARTING
RIGHT
SIDE OF
FILE**



State of Idaho

DEPARTMENT OF WATER RESOURCES

322 East Front Street • P.O. Box 83720 • Boise, Idaho 83720-0098

Phone: (208) 287-4800 • Fax: (208) 287-6700 • Web Site: www.idwr.idaho.gov

February 1, 2008

C. L. "BUTCH" OTTER
Governor

DAVID R. TUTHILL, JR.
Director

NORTHERN WATER LLC
1831 LOST SPRINGS RANCH RD
POST FALLS ID 83854

RE: Permit to Appropriate Water No. 95-9385

Dear Permit Holder(s):

I have enclosed the Permit to Appropriate Water issued in connection with the December 6, 2007, preliminary order approving your application. If you have any questions regarding this matter, please call me at 208-287-4947.

Sincerely,

A handwritten signature in black ink, appearing to read 'Shelley W. Keen', is written over a horizontal line.

Shelley W. Keen, Manager
Water Right Permits Section

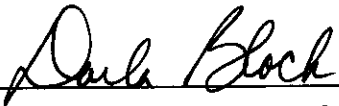
Enclosure

CERTIFICATE OF SERVICE

I hereby certify that on February 1, 2008 I mailed a true and correct copy, postage prepaid, of the foregoing (Permit to Appropriate Water) to the person(s) listed below:

RE: WATER RIGHT NO. 95-9385

**NORTHERN WATER LLC
1831 LOST SPRINGS RANCH RD
POST FALLS ID 83854**



**Darla Block
Technical Records Specialist**



State of Idaho

DEPARTMENT OF WATER RESOURCES

322 East Front Street • P.O. Box 83720 • Boise, Idaho 83720-0098

Phone: (208) 287-4800 • Fax: (208) 287-6700 • Web Site: www.idwr.idaho.gov

C. L. "BUTCH" OTTER
Governor

DAVID R. TUTHILL, JR.
Director

December 6, 2007

Re: In the matter of Application for Permit to Appropriate Water No. 95-09385 in the name of Northern Water, LLC.

Dear Interested Parties:

The Department of Water Resources has issued the enclosed **Preliminary Order** pursuant to section 67-5243, Idaho Code. **It can and will become a final order without further action of the Department unless a party petitions for reconsideration or files an exception and/or brief as described in the enclosed information sheet.**

Please note that water right owners are required to report any change of water right ownership and/or change of mailing address to the Department within 120 days of the change. Failure to report these changes could result in a \$100 late filing fee. Contact any office of the Department or visit our website at www.idwr.idaho.gov to obtain the proper reporting form.

If you have any questions, please call me at (208) 287-4942.

Sincerely,

Deborah J. Gibson
Administrative Assistant
Water Allocation Bureau

Enclosures

c: IDWR – Northern Regional Office

RESPONDING TO PRELIMINARY ORDERS ISSUED BY THE IDAHO DEPARTMENT OF WATER RESOURCES

The accompanying order is a **Preliminary Order** issued by the Idaho Department of Water Resources (Department) pursuant to section 67-5243, Idaho Code. **It can and will become a final order without further action of the Department unless a party petitions for reconsideration within fourteen (14) days after issuance as further described below:**

PETITION FOR RECONSIDERATION

Any party may file a petition for reconsideration of a preliminary order with the hearing officer within fourteen (14) days of the service date of the order as shown on the certificate of service. **Note: the petition must be received by the Department within this fourteen (14) day period.** The hearing officer will act on a petition for reconsideration within twenty-one (21) days of its receipt, or the petition will be considered denied by operation of law. See section 67-5243(3) Idaho Code.

EXCEPTIONS AND BRIEFS

Within fourteen (14) days after (a) the service date of a preliminary order, (b) the service date of a denial of a petition for reconsideration from this preliminary order, or (c) the failure within twenty-one (21) days to grant or deny a petition for reconsideration from this preliminary order, any party may in writing support or take exceptions to any part of a preliminary order and may file briefs in support of the party's position on any issue in the proceeding to the Director. Otherwise, this preliminary order will become a final order of the agency.

If any party appeals or takes exceptions to this preliminary order, opposing parties shall have fourteen (14) days to respond to any party's appeal. Written briefs in support of or taking exceptions to the preliminary order shall be filed with the Director. The Director retains the right to review the preliminary order on his own motion.

ORAL ARGUMENT

If the Director grants a petition to review the preliminary order, the Director shall allow all parties an opportunity to file briefs in support of or taking exceptions to the preliminary order and may schedule oral argument in the matter before issuing a final order. If oral arguments are to be heard, the Director will within a reasonable time period notify each party of the place, date and hour for the argument of the case. Unless the Director orders otherwise, all oral arguments will be heard in Boise, Idaho.

CERTIFICATE OF SERVICE

All exceptions, briefs, request for oral argument and any other matters filed with the Director in connection with the preliminary order shall be served on all other parties to the proceedings in accordance with Rules of Procedure 302 and 303.

FINAL ORDER

The Department will issue a final order within fifty-six (56) days of receipt of the written briefs, oral argument or response to briefs, whichever is later, unless waived by the parties or for good cause shown. The Director may remand the matter for further evidentiary hearings if further factual development of the record is necessary before issuing a final order. The Department will serve a copy of the final order on all parties of record.

Section 67-5246(5), Idaho Code, provides as follows:

Unless a different date is stated in a final order, the order is effective fourteen (14) days after its issuance if a party has not filed a petition for reconsideration. If a party has not filed a petition for reconsideration. If a party has filed a petition for reconsideration with the agency head, the final order becomes effective when:

- (a) the petition for reconsideration is disposed of; or
- (b) the petition is deemed denied because the agency head did not dispose of the petition within twenty one (21) days.

APPEAL OF FINAL ORDER TO DISTRICT COURT

Pursuant to sections 67-5270 and 67-5272, Idaho Code, if this preliminary order becomes final, any party aggrieved by the final order or orders previously issued in this case may appeal the final order and all previously issued orders in this case to district court by filing a petition in the district court of the county in which:

- i. A hearing was held,
- ii. The final agency action was taken,
- iii. The party seeking review of the order resides, or
- iv. The real property or personal property that was the subject of the agency action is located.

The appeal must be filed within twenty-eight (28) days of this preliminary order becoming final. See section 67-5273, Idaho Code. The filing of an appeal to district court does not itself stay the effectiveness or enforcement of the order under appeal.

**HEARING
ROSTER OF ATTENDANCE**

**IN THE MATTER OF APPLICATION)
FOR APPROPRIATION NO. 95-9385 IN THE)
NAME OF NORTHERN WATER LLC.)**

September 18, 2007
Beginning at 9:00 a.m.
Hearing Officer: Gary Spackman

NAME _____

ADDRESS

REPRESENTING

Norman Waldo 1831 Lost Springs Rd Post Falls Northern Water LLC.

KURT'S KIMBERLY 7904 HAWLER RD. S WILCO RIDGE, AL

Jim DeSmet S. 2641 Silver Beach Lp. Quantum Engr. / Wild Ridge
LLC.

Ernst Gerobius 525 Cedar St, Wallace, ID 83873 Wild Ridge, LLC

MALCOLM DEMKOSKI W. 1110 PARK PL. STE. 210, COEUR D'ALENE, ID 83814 NORTHERN WATER

SHANAJA BUBLITZ 14851 N FREDDI RD RATHORUM ED 83858

TESTIMONY LOG

**IN THE MATTER OF APPLICATION)
FOR APPROPRIATION NO. 95-9385 IN THE)
NAME OF NORTHERN WATER LLC.)**

September 18, 2007

Hearing Officer: Gary Spackman

TAPE NUMBER _____

[illegible]

HEARING EXHIBIT LIST

IN THE MATTER OF APPLICATION)
FOR APPROPRIATION NO. 95-9385 IN THE)
NAME OF NORTHERN WATER LLC.)
_____)

September 18, 2007
Hearing Officer: Gary Spackman

EXHIBIT NUMBER	EXHIBIT DESCRIPTION	STATUS OF EVIDENCE	
		INTRODUCED	ADMITTED
1	^{Northern Water LLC} Articles of Organization	✓	X
2	Articles of Incorporation Lost Creek	✓	X
101	MAP of LOCATION (POU) (POD)	✓	X
103	Water Service Agreement	✓	X
102	Letter from KEA	✓	X
104	Proposed ^{WILD RIDE} Subdivision	✓	X
105	SITE LAYOUT (SEWER)	✓	X
106	WATER SYSTEM LAYOUT	✓	X
107	Report Conceptual Design Planned Unit Development	✓	X
108	County Rule doc.	✓	X
109	^{Frank & Smeta} CAPACITY TO SUPPLY WATER	✓	X
110	Stanley DEQ Letter	✓	X
111	^{Received May 22/06} PANHANDLE Health Dist	✓	X
112	^{Received May 14 2007} PANHANDLE Health Dist Letter	✓	X
113	^{Spokane} Rathburn Perry Aquifer study	✓	X
D	MAP of Aquifer	✓	X
H	MAP & WELL DATA	✓	X
M	News PAPER CLIPPING	✓	X



ARTICLES OF ORGANIZATION LIMITED LIABILITY COMPANY

(Instructions on back of application)

FILED EFFECTIVE
2005 JUN 21 11:11 AM

1. The name of the limited liability company is:

Northern Water, LLC

2. The street address of the initial registered office is:

238 S. sequoia Court, Post Falls, ID

and the name of the initial registered agent at the above address is:

R. Bruce Noble

3. The mailing address for future correspondence is:

P.O. Box 3061, Post Falls, ID 83877

4. Management of the limited liability company will be vested in:

Manager(s) ☒ or Member(s) ☐ (please check the appropriate box)

5. If management is to be vested in one or more manager(s), list the name(s) and address(es) of at least one initial manager. If management is to be vested in the member(s), list the name(s) and address(es) of at least one initial member.

Name	Address
<u>R. Bruce Noble</u>	<u>P.O. Box 3061, Post Falls, ID 83877</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

6. Signature of at least one person responsible for forming the limited liability company:

Signature: R. Bruce Noble

Typed Name: R. Bruce Noble

Capacity: Manager

Signature: _____

Typed Name: _____

Capacity: _____

Secretary of State use only

g:\corpform\llc form\llcorg\organization.pdf
Revised 07/2002

IDaho SECRETARY OF STATE
07/28/2005 05:00
CX: 5302 CT: 170630 RH: 023689
1 @ 100.00 = 100.00 ORGAN LLC # 2
1 @ 20.00 = 20.00 EXPEDITE C # 3

EXHIBIT 1

W 41436

FILED EFFECTIVE

ARTICLES OF INCORPORATION
OF
LOST CREEK ESTATES WATER ASSOCIATION, INC.

IDAHO SECRETARY OF STATE
09/18/2006 05:00
CR: 5638 CT: 1981 RH: 975727
1 02000000 30.00 INC NONP 4 2
18 SEP 18 PM 2:28

SECRETARY OF STATE
STATE OF IDAHO

The undersigned incorporator(s), desiring to form a corporation pursuant to the provisions of the Idaho Nonprofit Corporation Act, adopt(s) the following articles of incorporation:

ARTICLE ONE

Name

The name of the corporation is Lost Creek Estates Water Association, Inc.

ARTICLE TWO

Purposes

The purpose of the corporation is to transact any or all lawful business for which corporations may be organized under the Idaho Nonprofit Corporation Act.

ARTICLE THREE

Duration

The period of duration of the corporation is perpetual.

ARTICLE FOUR

Registered Office and Agent

The address of the corporation's initial registered office in the State of Idaho is 1831 Lost Springs Ranch Rd., Post Falls, ID 83854. The name of the corporation's initial registered agent at such address is Norm Waldo.

ARTICLE FIVE

Members

The corporation will have members. Those members shall consist of the owners of record of the lots located in the Lost Creek Estates subdivision, located in Kootenai County, Idaho, and the owners of record of such additional lots as may be added from time to time pursuant to the agreements that will be entered into between this corporation and Northern Water L.L.C., an Idaho limited liability company.

ARTICLE SIX

Distribution of Assets

Upon dissolution of the corporation, the assets of the corporation shall be distributed in

EXHIBIT 2

C168926

accordance with the provisions of the Idaho Nonprofit Corporation Act.

ARTICLE SEVEN

Directors

The number of directors of the corporation shall be three. The number constituting the initial board of directors is three, and the names and addresses of the persons who are to serve as directors until the organizational meeting of the corporation or until their successors are elected and qualified are:

Name	Address
Norm Waldo	1831 Lost Springs Ranch Rd. Post Falls, ID 83854
R. Bruce Noble	238 S. Sequoia Ct. Post Falls, ID 83854
Charles E. Hughes	1924 NW Blvd. Coeur d'Alene, ID 83814

ARTICLE EIGHT

Incorporators

The names and addresses of each incorporator are:

Name	Address
Norm Waldo	1831 Lost Springs Ranch Rd. Post Falls, ID 83854

ARTICLE NINE

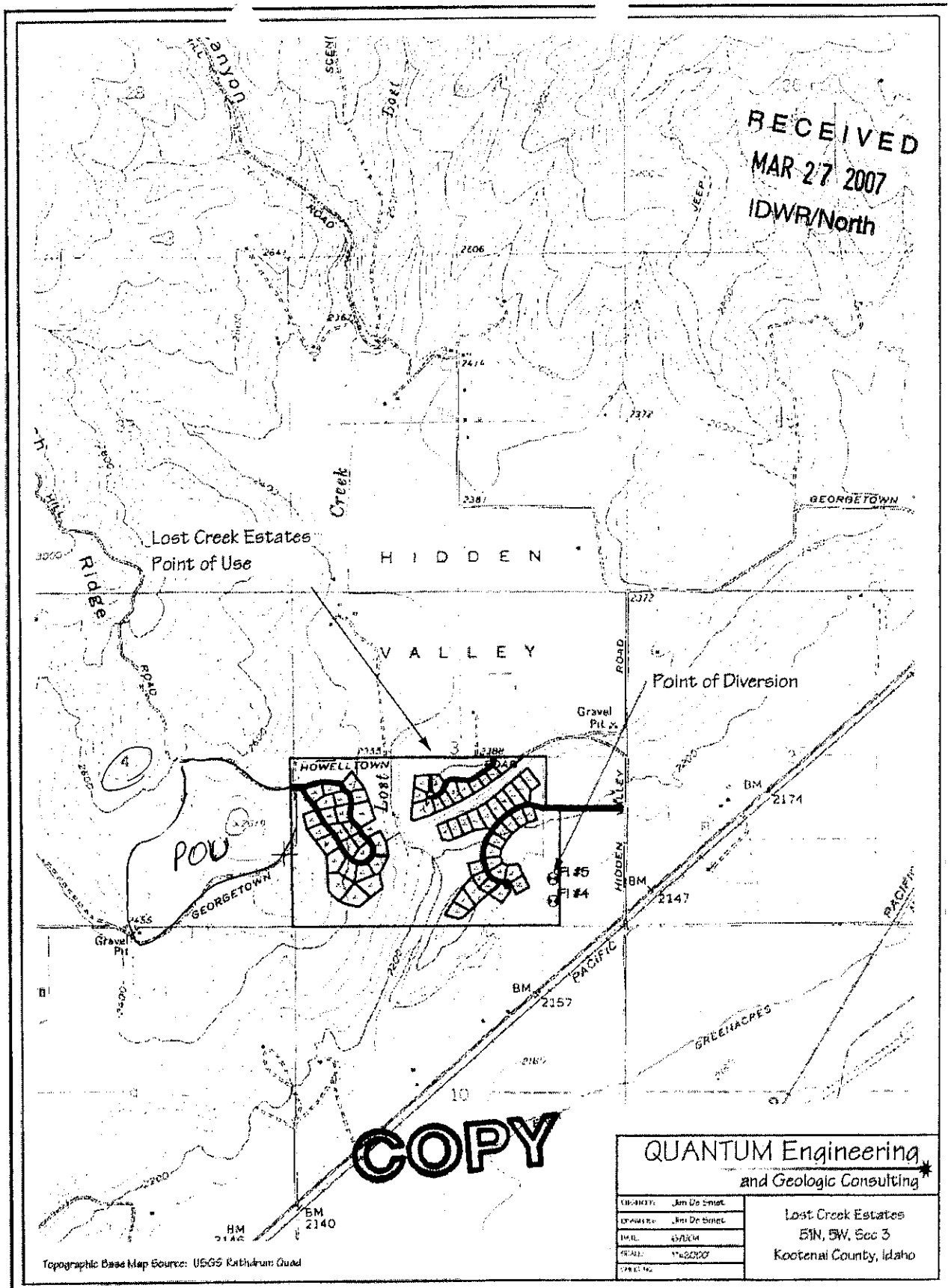
Additional Provisions

None.

Executed in duplicate on 9-14, 2006.



NORM WALDO



The original of this drawing was filed with the Department of Water Resources for Permit #95-9277. The Point of Diversion in the present application is the Point of Diversion indicated in this drawing.

February 14, 2007

Barry Rosenberg, Executive Director
Kootenai Environmental Alliance
408 Sherman Avenue, Ste 301
Coeur d'Alene, ID 83816-1598

Subject: Water Usage for Wild Ridge

Dear Barry,

On behalf of myself and two partners, I would like to thank you for meeting with me regarding our proposed development (Wild Ridge), and for discussing how Wild Ridge, LLC and Kootenai Environmental Alliance can work together to help promote water conservation on our project.

As you know, Wild Ridge, LLC has submitted development plans to Kootenai County Building and Planning Development in hopes of receiving preliminary plat approval to construct 54 homes (see attached drawings). Our ultimate goal is to be under construction this spring/summer.

Several months ago we began working with Mr. Norm Waldo of Lost Creek, LLC and Northern Water, LLC to develop an agreement in which his water system would provide service to our 54 homes. Although a final agreement has not yet been signed, I'm confident both parties are very close and eager to move forward. As part of this agreement we will be adopting the same water conservation principles as outlined within the Draft Lost Creek HOA listed below:

In the spirit of water conservation and as part of an agreement with Kootenai Environmental Alliance the following rules and control measures will be established and maintained by the HOA:

- 1. Each Owner shall retain at least 25% of native vegetation on their property and limit the size of irrigated lawns to ¼ of an acre.*
- 2. Moisture sensors shall be installed as an integral part of the constructed automatic irrigation systems on each Owner's property.*
- 3. Irrigation will not be allowed during the high evaporation times between 10:00 A.M and 8:00 P.M. The HOA will establish and enforce an odd only or even only watering schedule.*
- 4. Owners are encouraged to use landscape irrigation companies that are from a recommended list available from Northern Water LLC.*
- 5. Owners are encouraged to supplement existing soils, as necessary, to enhance the moisture retention characteristics of the soils that will be used in the irrigated portions of each lot in the development.*
- 6. Xeriscaping features for landscaping that preserve water use are encouraged. Reputable landscape firms are familiar with these techniques.*

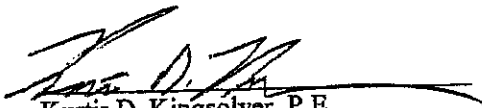
Page 2
Barry Rosenberg
February 14, 2007

In addition to the language above, to further promote water conservation efforts, Wild Ridge, LLC is in agreement with Kootenai Environmental Alliance that on average, 700 gallons per day per household (exclusive of fire flow) is adequate to supply water to our development. However, along with our 54 home sites, we plan to develop a small "tot lot" and a recreational area for our home owners (park benches, indoor/outdoor BBQ areas, etc.) and would like to request additional capacity (200 gal/day) for each additional hook-up. We are also currently working with Northern Lakes Fire Department in hopes of providing them a site for a volunteer un-manned fire station (SW corner). If approved, we would like the ability to supply them with 50 gallons per day for their volunteer station.

It is our intent that signature of this document solidifies an agreement between Kootenai Environmental Alliance and Wild Ridge, LLC and that Northern Water, LLC will apply for water on behalf of Wild Ridge, LLC as long as Wild Ridge, LLC follows the provisions outlined below.

1. Wild Ridge, LLC will incorporate within its CCR's the same rules and control measures listed within the Lost Creek CCR's designed to promote water conservation.
2. Wild Ridge, LLC through Northern Water, LLC will only apply for a maximum of 700 gal/per day per hook up for the 54 home sites, 50 gal/day for the volunteer fire station, 200 gal/day for the "tot-lot and 200 gal/day for the indoor/outdoor BBQ area from the State of Idaho DEPARTMENT OF WATER RESOURCES. This is however separate from water as required by Northern Lakes Fire Department for fire flow.
3. Wild Ridge, LLC will only seek water for 57 hook-ups.
4. Wild Ridge, LLC will incorporate further language within its CCR's to promote the use of drip systems for shrubs placed around homes rather than conventional sprinkler systems.

We look forward to continuing to work together with Kootenai Environmental Alliance to conserve and protect the Rathdrum-Spokane Aquifer.


Kurtis D. Kingsolver, P.E.
Wild Ridge, LLC

Date: 2/14/07


Barry Rosenberg, Executive Director
Kootenai Environmental Alliance

Date: 2/14/07

WATER SERVICE AGREEMENT

(Lost Creek/Wild Ridge Project)

This Agreement is entered into and effective March 13, 2007, by and between Northern Water, L.L.C., an Idaho limited liability company ("Northern Water"), Wild Ridge, L.L.C., a Washington limited liability company ("Wild Ridge"), and Lost Creek Estates Water Association, Inc., an Idaho non-profit corporation ("Water Association"), with reference to the following facts:

- A. Northern Water owns a well and domestic water system located in a residential subdivision known as Lost Creek Estates, located to the south and east of West Winch Avenue and North Freddie Road, near the City of Rathdrum, Kootenai County, Idaho (the "Water System").
- B. Wild Ridge is the owner and developer of property located to the north and west of West Winch Avenue and North Freddie Road, which is across the public right of way from Lost Creek Estates and the Water System. Wild Ridge is proposing to subdivide and develop its property into a residential subdivision to be known as "Wild Ridge" (the "Project"), which will require water service to its resulting lots. The Project is described on Exhibit "A" and depicted on Exhibit "B" attached hereto and incorporated herein by this reference.
- C. Water Association has entered into an agreement with Northern Water. That agreement provides that Water Association will lease the Water System from Northern Water in order to operate the Water System to provide water to its members. The members of Water Association will be the record owners of lots located in Lost Creek Estates plus any other lots outside of Lost Creek Estates as included at the discretion of Northern Water.
- D. Wild Ridge wishes to have the owners of lots that are to be platted in the Project ("the Project parcels"), become members of the Water Association. Wild Ridge also wishes to connect the water distribution system that is to be constructed in the Project ("the Project water distribution system") to the Water System. Northern Water wishes to add the Project parcels as members of the Water Association (which Northern Water has the authority and power to do, and which Water Association is willing to accept), and wishes to allow the connection, subject to the payment of costs and compliance with other terms and conditions set forth in this Agreement.

NOW, THEREFORE, THE PARTIES AGREE AS FOLLOWS:

1. Northern Water and Water Association hereby agree to have the owners of the Project parcels become members of the Water Association (as the individual Project parcels are sold by Wild Ridge), and to allow Wild Ridge, in its discretion, and according to its schedule, to connect the Project water distribution system to the Water System, upon payment of the costs described in Paragraph 4, below. Should Wild Ridge choose to connect to the Water System and have the Project parcels become members of the Water Association, all costs associated with

extending the Water System to and throughout the Project shall be borne by Wild Ridge, and all installations shall be designed according to generally acceptable engineering practices, and shall be subject to the approval of Northern Water, which approval shall not be unreasonably withheld. Such hook up to the Water System (both the main service line to the Project and also the individual services within the Project) shall occur, and the owners of the Project parcels shall become members of the Water Association, if at all, not later than two (2) years following Wild Ridge's receipt of preliminary plat approval for the Project; provided that if the hook up to the Water System is not completed by such time, Wild Ridge shall nevertheless have the right to extend the hook up and membership date for an additional two (2) years, by payment of the reserve fees described in Paragraph 4(b), below; and provided further that if the hook up to the Water System is not completed within such two (2) year extension, being four (4) years from the receipt of preliminary plat approval for the Project, all rights to hook up to the Water System and for Project lot owners to become members of the Water Association shall automatically terminate, unless Wild Ridge shall pay, prior to such termination date, the full hookup fees for all lots in Wild Ridge for which hook up and membership rights are desired.

2. Northern Water hereby represents and warrants that the Water System currently has the capacity to service the lots to be developed in the Project and for which capacity is reserved under this Agreement, and that it shall not commit water to any third party so as to render the capacity of the Water System incapable of servicing all lots referenced in Paragraph 4, below. Notwithstanding the foregoing, Wild Ridge specifically acknowledges that Northern Water has neither applied to the State of Idaho for water rights to appropriate water for the beneficial use of the land where the Project is located nor to draw sufficient water to supply the Project, and that Northern Water makes no such representation that it presently has any such water rights. Immediately upon the execution of this Agreement, Northern Water shall make application to the appropriate agencies to obtain a permit for sufficient water to service the domestic needs of all properties to be serviced by the Water System, and shall pursue such application diligently and in good faith until the necessary permit is granted. The effectiveness of this Agreement is expressly conditioned upon the ability of Northern Water to obtain all necessary permits for water.

Wild Ridge also specifically acknowledges that Northern Water or its agent shall have the right, at Northern Water's sole discretion, to sell or otherwise convey the Water System to any other person, organization, private entity, or governmental entity; provided that, upon and as a condition to the conveyance of the Water System to any third party, such third party shall agree to provide water to all Project parcels described in Paragraph 4, below (whether or not the owners of such Project parcels shall be members of the Association at the time of the transfer), on the same basis as water service is provided to all other customers of such third party. Should Northern Water sell or otherwise convey the Water System to a governmental entity which exists, in whole or in part, to provide water to the public, and provided the third party acquiring the Water System is committed to provide water service to the Project parcels as provided in this paragraph, then Northern Water, Wild Ridge, and the Water Association specifically agree that this Agreement shall immediately terminate, and that neither Northern Water nor the Water Association shall have any duties or responsibilities to provide water to Wild Ridge or to return any funds or ownership of the Project water distribution system to Wild Ridge.

3. At such time as Wild Ridge, or its successors with respect to the Project, connects the Project water distribution system to the Water System, then Northern Water shall be deemed to be the owner of the Project water distribution system.

4. In consideration of the hook up of the Project to the Water System, Wild Ridge or its successors with respect to the Project shall pay the following expenses:

a. All costs of design and installation of equipment necessary to deliver water from the current terminus of the Water System in Lost Creek Estates, across West Winch Avenue and/or North Freddie Road to and throughout the Project. Such equipment would include, without limitation, pipes, pumps, and storage reservoirs;

b. In the event that the hook up to the Water System shall not have been accomplished within the initial two (2) year time limit referenced in Paragraph 1, above, then Wild Ridge shall have the option to continue its reservation of hook up rights by paying cash to Northern Water (with payment to be made prior to the expiration of the two year period) in the amount of \$2,000 per lot in the Project anticipated to be hooking up to the Water System, for the first 25 lots, plus \$1,000 per lot in the Project for the next 29 lots in the Project anticipated to be hooking up to the Water System, for a total of up to 54 lots anticipated for the Project. Wild Ridge shall have the option to reserve any number of hookup rights for the Project, in its discretion, up to the maximum of 54 hookups. Any such amount paid by Wild Ridge shall be credited to the payment obligation set forth in Paragraph 4(c) below, on a lot by lot basis. Such reservation shall be effective for two (2) additional years, following which all rights of Wild Ridge under this Agreement will automatically terminate with respect to any lots not yet hooked up, unless Wild Ridge shall have paid, prior to the expiration of the total four years, all hook up costs described in Paragraph 4(c) below for the lots for which Wild Ridge wishes to provide water service under this Agreement.

c. Cash to Northern Water, in the amount of \$20,000 per lot in the Project hooking up to the Water System, for the first 25 lots; then \$10,000 per lot in the Project for the next 29 lots in the Project hooking up to the Water System, for a total of up to 54 lots anticipated for the Project; provided that the Wild Ridge shall be entitled to credit for each hook up in the amount of any reservation payment made pursuant to Paragraph 4(b) above. Payment of such amounts shall be made contingent upon and in connection with the hook up of each lot for which service is requested.

d. Notwithstanding the foregoing, if Wild Ridge shall sell all or substantially all of the Project or the resulting lots in the Project to a new owner ("Third Party"), without having paid for the hook ups described herein, then, in connection with such sale, and as a condition to assigning the hook up rights granted under this Agreement to the Third Party, Wild Ridge and/or the Third Party shall pay to Northern Water an amount equal to one-half of the total hook up fees not yet purchased under this Agreement. That is, if the entire Project is sold, Northern Water shall be entitled to a payment of \$395,000 cash (less credit for one-half of any amounts previously paid under Paragraphs 4(b) and 4(c) above), which amount shall be credited to future payments for hook ups required

under this Agreement. The application of the credits, as among Wild Ridge herein, the Third Party, and the purchasers of individual lots shall be as agreed among such parties. As used in this paragraph, a sale of substantially all of the Project or the resulting lots shall be deemed to have occurred if a single Third Party acquires eighty percent (80%) of the lots then held by Wild Ridge.

5. Miscellaneous and Procedural:

a. Binding Effect. This Agreement shall be binding upon and shall inure to the benefit of Wild Ridge, Water Company, and Water Association, and their respective successors and assigns with respect to the Water System and the Project, subject, however, to the obligation of Wild Ridge and/or any Third Party purchaser of the Project to make the partial payment for hook ups as described in Paragraph 4(d), above.

b. Attorney Fees. If any action at law or in equity shall be brought to enforce or interpret any of the terms of this Agreement, the prevailing party shall be entitled to recover from the other party as part of the prevailing party's costs, reasonable attorney's fees the amount of which shall be fixed by the court and shall be made a part of any judgment or decree rendered.

c. Notices. Any notice, demand, request, consent, approval, or communication that either party desires or is required to give to the other party or any other person shall be in writing and either served personally or sent by facsimile transmission or by prepaid, first-class mail, addressed to the other party at the appropriate address set forth below:

Northern Water, L.L.C.
1831 Lost Springs Ranch Road
Post Falls, Idaho 83854
Fax: (208) 773-8291

Wild Ridge L.L.C.
c/o Robert B. Nehring
3216 Wetmore Ave., Suite 202
Everett, WA 98201

Either party may change its address by delivering notice of the change of address in the manner prescribed in this paragraph.

Any such notice shall be deemed delivered upon personal delivery, upon confirmation of facsimile delivery, or within forty-eight (48) hours from the time of mailing if mailed as provided in this subparagraph.

d. Governing Law, Venue and Jurisdiction. This Agreement shall be construed and interpreted in accordance with the laws of the State of Idaho. Jurisdiction

and venue in any action to interpret or enforce any provisions of this Agreement shall lie, at the option of the party bringing the action, in Idaho County, Idaho.

IN WITNESS WHEREOF, the parties have entered into this Agreement as of the date first above written.

NORTHERN WATER, L.L.C.,
an Idaho limited liability company

By Norm G. Waldo
NORM G. WALDO, Managing Member

WILD RIDGE, L.L.C.,
a Washington limited liability company

By Robert Nehring
Robert Nehring, Managing Member

By Kurtis Kingsolver
Kurtis Kingsolver, Member

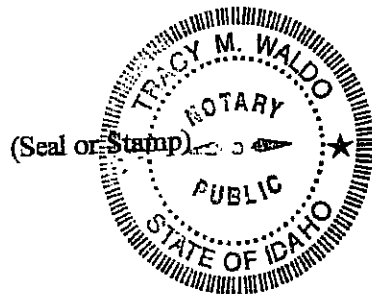
LOST CREEK ESTATES WATER
ASSOCIATION, INC.,
an Idaho non-profit corporation

By Norm G. Waldo

STATE OF IDAHO)
 : ss.
County of Kootenai)

On this 13 day of March, 2007, before me, Tracy M. Waldo, a Notary Public in and for the State of Idaho, personally appeared NORM G. WALDO, known or identified to me to be the Managing Member of NORTHERN WATER, L.L.C., an Idaho limited liability company, the company that executed the foregoing instrument and the person who executed the foregoing instrument on behalf of said company, and acknowledged to me that such company executed the same.

WITNESS my hand and official seal hereto affixed the day and year first above written.

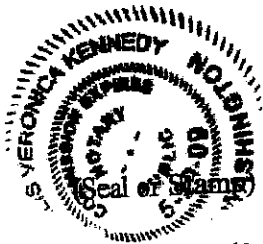


Tracy M. Waldo
Notary Public for State of Idaho
Residing at Post Falls, ID
Commission expires 6-24-07

WASHINGTON
STATE OF ~~IDAHO~~)
 : ss.
County of Kootenai)

On this 28th day of March, 2007, before me, PHILLIS VERONICA KENNEDY, a Notary Public in and for the State of WASHINGTON, personally appeared ROBERT NEHRING, known or identified to me to be the Managing Member of WILD RIDGE, L.L.C., a Washington limited liability company, the company that executed the foregoing instrument and the person who executed the foregoing instrument on behalf of said company, and acknowledged to me that such company executed the same.

WITNESS my hand and official seal hereto affixed the day and year first above written.



Phillis Veronica Kennedy
Notary Public for STATE OF WASHINGTON
Residing at BOTHELL, WASHINGTON
Commission expires 05.29.2009

WASHINGTON
STATE OF ~~IDAHO~~)
 : ss.
County of pierce)

On this 22 day of March, 2007, before me, Antonio Vasquez, a Notary Public in and for the State of WASHINGTON, personally appeared KURTIS KINGSOLVER, known or identified to me to be a Member of WILD RIDGE, L.L.C., a Washington limited liability company, the company that executed the foregoing instrument and the person who executed the foregoing instrument on behalf of said company, and acknowledged to me that such company executed the same.

WITNESS my hand and official seal hereto affixed the day and year first above written.

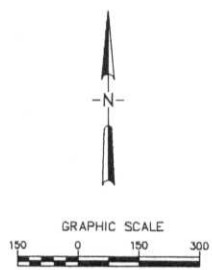
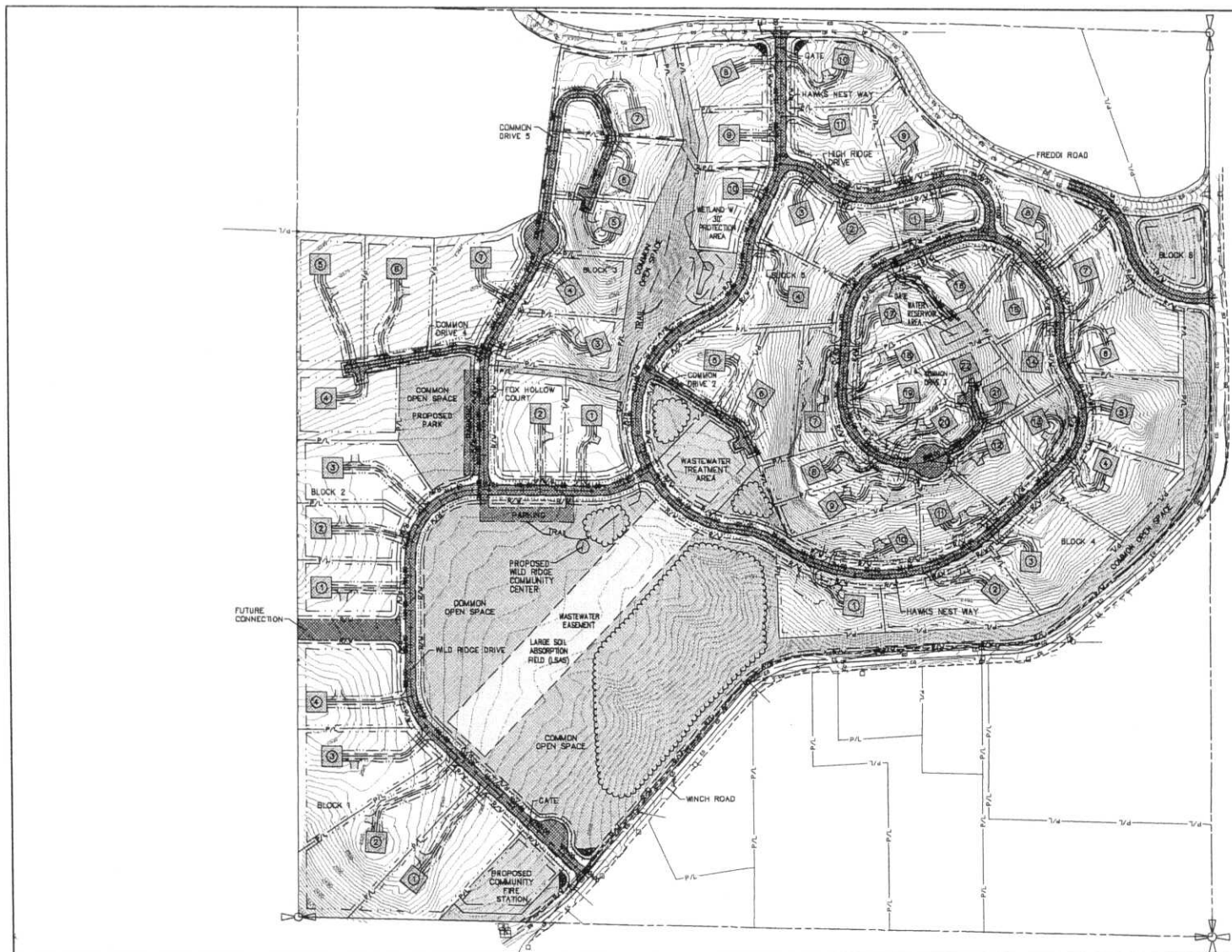
(Seal or Stamp)

Antonio Vasquez
Notary Public for STATE OF WASHINGTON
Residing at City of Tacoma, Washington
Commission expires 1/26/2010

**EXHIBIT "B" TO
WATER SERVICE AGREEMENT**

Graphic Depiction of Wild Ridge Project

Exhibit 104



- ROADWAY QUANTITIES**
 8,976 LF MAIN ROADS
 1,931 LF COMMON DRIVEWAYS
- SEWER SYSTEM QUANTITIES**
 13,000 LF PIPE
 36 EA MANHOLES
- WATER SYSTEM QUANTITIES**
 11,500 LF PIPE
 17 EA HYDRANTS
- LAND QUANTITIES**
 108,998 AC GROSS
 2,417 AC RW DEDICATION
 106,581 AC NET
- 23,528 AC OPEN SPACE
 3,363 AC UTILITY TRACTS
 84,422 AC LOTS
 12,163 AC PRIVATE ROAD TRACTS
 3,108 AC WASTEWATER EASEMENT
 106,581 AC NET

- LEGEND**
- OPEN SPACE
 - SIGN / LANDSCAPE AREA
 - WASTEWATER TREATMENT AREA
 - PUBLIC UTILITY TRACT
 - BUILDING PAD
 - PRIVATE DRIVEWAY
 - ROADWAY
 - FUTURE ROAD
 - WETLAND AREA
 - TRAIL
 - RETAINING WALL
 - TREED AREA

NO.	REVISION	BY	DATE	DESIGN BY

RUEN-YEAGER & ASSOCIATES, INC.
 CONSULTING ENGINEERS - LAND SURVEYORS - PLANNERS
 3201 N. HUETTER RD., STE. #102, COEUR D'ALENE, IDAHO 83814 (208)292-0820
 219 PINE ST. SANDPOINT, IDAHO 83864 (208)265-4629
 103 N. JACKSON MOSCOW, IDAHO 83843 (208)863-3755

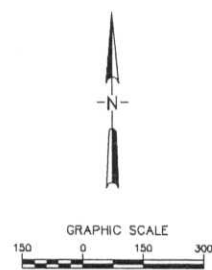
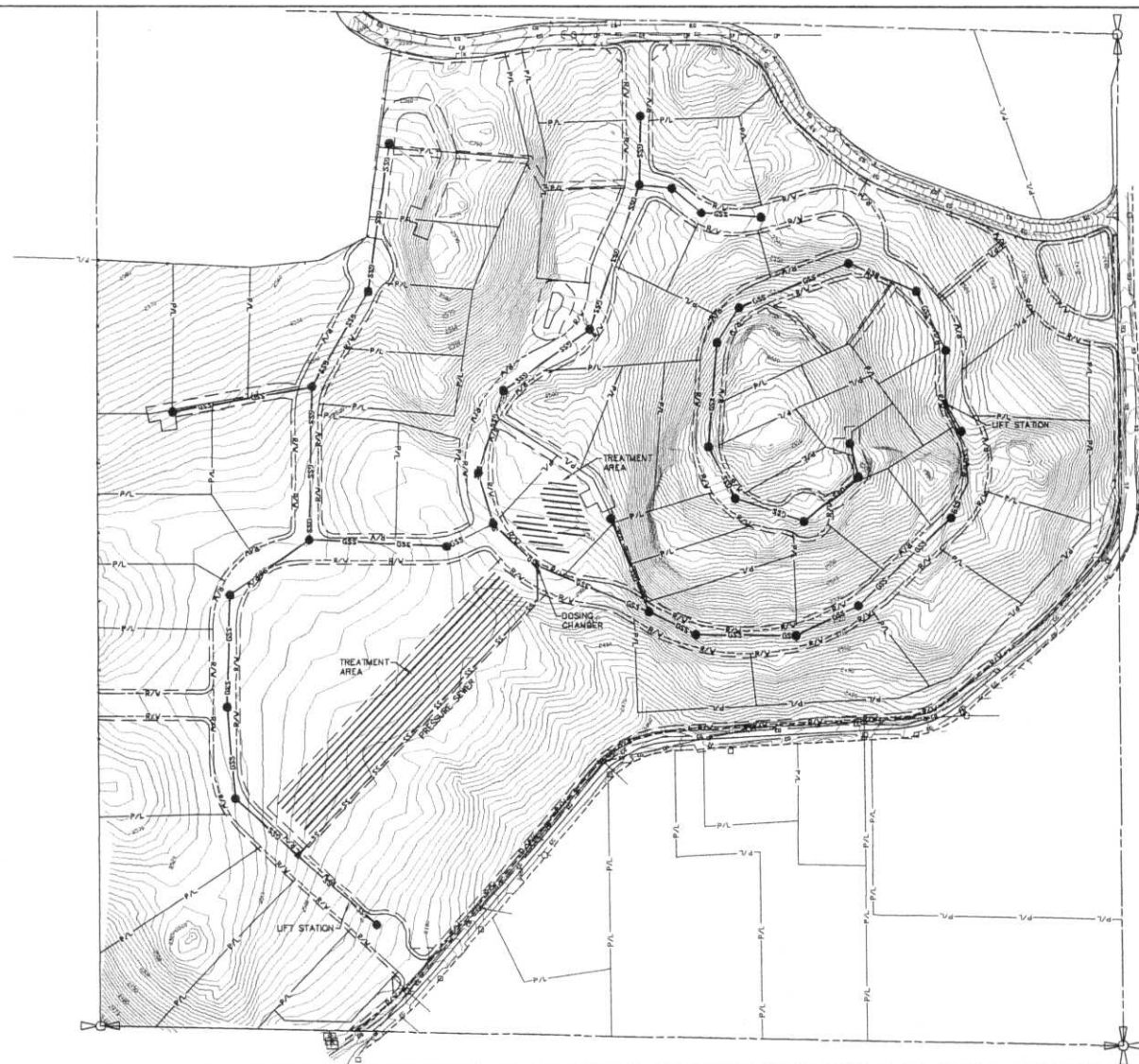


**WILD RIDGE
 CONCEPTUAL ENGINEERING PLAN
 SITE PLAN**

PROJECT:	P081035
CADD FILE NAME:	DE-Danish
PLDT DATE:	4/18/2007
SHEET NUMBER:	2

PRELIMINARY

Exhibit 105



NO.	REVISION	BY	DATE

DESIGN BY:	
DRAWN BY:	
CHECKED BY:	
SCALE:	

RUEN-YEAGER & ASSOCIATES, INC.
CONSULTING ENGINEERS - LAND SURVEYORS - PLANNERS
3201 N. HUETTER RD., STE. #102, COEUR D'ALENE, IDAHO 83814 (208)282-0820
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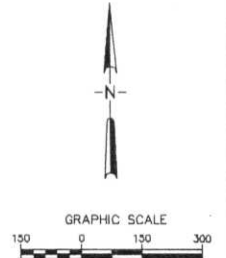
**WILD RIDGE
CONCEPTUAL ENGINEERING PLAN
SEWER SYSTEM LAYOUT**

PROJECT:	POB1039
CADD FILE NAME:	DE--Design
PLOT DATE:	4/18/2007
SHEET NUMBER:	5

PRELIMINARY



TIE-IN TO
LOST CREEK ESTATE



- NOTES:
1. ALL WATER MAINS TO BE 8".
 2. FIRE FLOW = 1,000 GPM.
 3. HOUSES ABOVE AN ELEVATION OF 2400' WILL BE PART OF THE HIGH ZONE TO MEET IDEO PRESSURE REQUIREMENT OF 40 PSI TO EACH HOUSEHOLD.
 4. BOOSTER STATION TO BE LOCATED AT RESERVOIR.

NO.	REVISION	BY	DATE	DESIGN BY:

RUEN-YEAGER & ASSOCIATES, INC.
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**WILD RIDGE
 CONCEPTUAL ENGINEERING PLAN
 WATER SYSTEM LAYOUT**

PROJECT: POK1039
 CADD FILE NAME: DE-Design
 PLOT DATE: 4/16/2007
 SHEET NUMBER: 6

PRELIMINARY

Exhibit 100

**Wild Ridge Development
Conceptual Engineering Report**

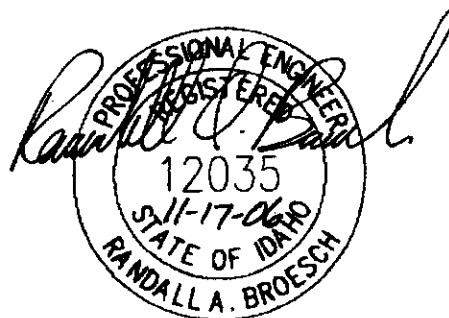
Engineer: Ruen-Yeager and Associates Inc.



Developer: Wild Ridge Development, L.L.C.

County: Kootenai

Date: November 17, 2006



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Water System Plan

Project Location and Layout

The Wild Ridge Development is located in the southeast ¼ of Section 4, Township 51 North Range 5 west. The total acreage is 109 Acres with 24% open space and a wetland preservation area 0.28 Acres in size. There are 54 units expected to be constructed within the Wild Ridge Development. This report addresses the expected water, sewer, and road facilities needed to accommodate the expected 54 units in this development.

Water System

Typical water system demands for the Wild Ridge are listed below. Water mains in the Wild Ridge Development will primarily remain in the roadway right-of-way corridor. Water utility easements will be established where the system requires deviating from the roadway right-of-way corridor. Construction of the water utility will meet construction standards established in the Idaho State of Public Works Construction (ISPWC) manual. Air/vacuum release valves will be installed as needed at the grade breaks in the distribution system. Non-looped portions of the distribution system will have blow-off assemblies to accommodate flushing the line, as needed. Also, provisions will be made to prevent erosion while flushing the main. Each house will be metered by a ¾" meter with a backflow prevention device incorporated into the setter for the meter units. Valving will be incorporated into the distribution system to isolate each fire hydrant and to isolate portions of the system for maintenance and emergency shutoff situations.

Average/ Typical Lot Size:	0.5-2.5 acres
Bedrooms / Lot:	3-5 rooms / lot
Occupants / Lot:	2.85 persons / lot
Lots:	54
Domestic Demand:	270 gal / lot
Irrigation Demand:	150 gal / lot
Water Demand / lot:	420 gal / lot
Total Demand:	21,840 gal / day
Structure Type:	TY. V-B (Timber Frame)
Minimum Flow:	1,500 gpm
Fire Flow Time:	120 min.
Reservoir Size:	180,000 gal. (w:30ft x l:50ft xh:18ft)
Distribution System:	6,000 LF (Pipe sizes 10" to 6")
Fire Hydrants:	17 shown
Booster Station:	1 each
Generator:	1 each

Distribution System

The distribution system will have gravity and booster systems to accommodate the Idaho Department of Environmental Quality (IDEQ) pressure requirement of 40 psi to each lot. Preliminarily, lots above an elevation of 2500 will be on the booster system and the lots below that elevation can be supplied by gravity flow. The system was looped to create an effective distribution and so the system has built in redundancy to accommodate isolating mains for emergency and maintenance purposes.

Water Source

There are two options for supplying water to the Wild Ridge Development. The first option is developing a well and creating a water district for the Wild Ridge development. A second option is tying into the Northern Water L.L.C. (NW L.L.C.) water system and increasing their zoning boundaries to incorporate the Wild Ridge Development. The site is currently not located within the NW L.L.C. district boundaries.

Option #1-On-site Well

Drilling a well on site for the Wild Ridge consists of a geotechnical exploration to find a well capable of producing sufficient quantity to maintain levels in the 180,000 gal reservoir. The Wild Ridge area is only capable of producing water from an underground source since there is no consistent surface water source in the area. A hydro-geologist would be hired to determine the best location for drilling a well and depth to which the well will reliably produce for the life of the development.

Ruen-Yeager and Associates Inc. (RYA) met with IDEQ regarding drilling a well in this area. IDEQ mentioned a well in this area may be potentially risky since wells in the location of Wild Ridge have problems of recharging over time. Current theory is there may be a local aquifer that has stored water in cracks and fissures for many years. Initially the water from the cracks provides sufficient quantity, but as time progresses the recharge rate of the well decreases as the water from the cracks are depleted. Additional information is needed for this option.

Option #2-NW L.L.C. Tie-in

The NW L.L.C. located across Winch Avenue is willing to supply water and extend its boundaries to include the Wild Ridge Development. An Intent to Enter Into an Agreement has been issued by Norm G. Waldo of the Northern Water L.L.C. This option utilizes an existing dependable source for water. The design would attempt to use two tie-in locations for system redundancy. Currently one tie-in is shown on the conceptual water plans.

RYA spoke with IDEQ regarding this option and IDEQ encourages extending the service boundaries of the Northern Water L.L.C. to incorporate the Wild Ridge development. Northern Water L.L.C. is anticipating installing a booster station in their existing system; including the Wild Ridge development in the Northern Water L.L.C. boundary would replace the booster station with a pressure reducing station and a booster station would then be used in conjunction with the new reservoir for the Wild Ridge development.

Recommendation

Option #2 to extend service of the Northern Water L.L.C. to the Wild Ridge development is recommended because it already uses a dependable source for water supply, aggregates water systems in the area, and creates a more unified water system in the area.

Sewer System Plan

Wild Ridge development sewage system has a building density large enough for the 109 Acre area classifying it as a community sewer system. A gravity and pressure sewer collection system is used as a medium to transport sewage to the treatment site. The treatment of sewage at this site is expected to be a Large Soil Absorption System (LSAS). Ruen-Yeager and Associates Inc. (RYA) has had preliminary discussions with the Idaho Department of Environmental Quality (IDEQ) regarding the treatment site requirements. The reviewing agency will be the IDEQ and the permitting agency will be the Panhandle Health District. Each aspect of the sewer system is explained in further detail below.

Collection System

A gravity system is utilized to its fullest potential in this system, however due to terrain variances over the site there are two locations requiring a Septic Tank Effluent Pump system (STEP system). The STEP System will tie-into the gravity sewer locations. Pressure sewer mains and gravity sewer mains will have sufficient cover to be out of the frost layer. The collection system will end at the dosing chamber to the LSAS.

Characteristics of the gravity system are listed below. Manhole placement in the sewer layout did not exceed 400 ft separation and alignment of the collection system remained in the roadway as much as possible. The STEP System is expected to be along the shoulder or ditches of the roadway. The STEP System will require a septic tank on each lot to retain solids on the site and only pump a clear effluent into the collection system.

Piping	Gravity: 8"-10" SDR 35 Piping (11,500 lf) Pressure: 1-1/2"-2" Schedule 80 (2,000 lf)
Manholes	36 manholes
Septic Tanks	14 each
Lift Stations	1 each
Sewer Easements	As required
Alarm System	Dial-up alarms for STEP and LSAS systems

Preliminarily it is expected sewer service easements will be established as needed to tie-into the gravity sewer mains. The lots on the STEP system will not require an easement.

Treatment System

For the treatment system there are many LSAS options to choose from. Preliminarily there can be a gravity drain field, pressurized distribution system, or drip system. An alternative has not been selected at this time. For a community system of this size it will require and Nutrient Pathogen (N-P) Study to be performed prior to selecting an alternative.

RYA has spoken with LFR Engineering about conducting a Level 1 N-P Study for the Wild Ridge development. The study would establish a groundwater gradient in the area of the LSAS and aid in the layout of the LSAS. Conclusions from the Level 1 N-P Study determine what level of treatment is necessary and how to configure the LSAS so the loading from the LSAS is perpendicular to the groundwater gradient established in the

study. Until those results have been determined, an alternative will not be selected. IDEQ will be involved in the review process and overall determination of the N-P Study.

RYA's selection and design will be based upon those results and submitted to IDEQ for approval once the design is complete.

Sewer System Maintenance

The community sewer system will be contracted out to a private maintenance organization to maintain regular pumping and cleaning and monitoring of the system. The alarm system will aid in notifying the private organization of any emergency problems or system failures.

As for the STEP system each one will have a dial-up system as well to notify the private organization and the owner of a failure. Since solids will be contained on the lot, the community sewer system will be responsible for pumping the septic tank at a required quantity or frequency. Should the pumping requirement for the lot increase in frequency or quantity established by the community, the lot owner shall pay for additional pumping.

Roadway System

General Layout

The Wild Ridge development is a private gated community offering two types of private roadways (main roads and cul-de-sacs) that are constructed to Post Falls Highway District standards and driveways consisting of two types (common and private) meeting county standards and the 2000 International Fire Code standards. A gated entrance will be provided at the north and south entrance to the Wild Ridge development which are accessed from Freddi Road and Winch Avenue, respectively. The entrance from the North off of Freddi road will be Hawks Nest way and from the South off of Winch Avenue will be Wild Ridge Drive. Hawks Nest Way winds around the existing hillside and ends near the top of the hill with a cul-de-sac. Wild Ridge Drive intersects with Hawks Nest Way and has a cul-de-sac intersecting it called Fox Hollow Court. Within the development there are five unnamed common driveways lending access to four or less lots. Common driveway #1 has provisions for an emergency exit access for the upper part of Hawks Nest Way in case the intersection of Hawks Nest Way and Wild Ridge Drive become blocked. Typical Roadway Dimensions and miscellaneous geometric criteria are listed below:

Private Roadway Width	24-28 ft
Common Driveway Width	20 ft
Private Driveway Width	14 ft
Shoulder width	2 ft
Private Roadway crown	2 %
Private Roadway Max Grade	10 %
Common Driveway Max Grade	10 %
Private Driveway Max Grade	12 %
Cul-de-sacs	2 each
Common Driveways	5 each
Total Private Roadway Length	7,658 lf
Total Common Driveway Length	2,269 lf
Right-of-Way Width	60 ft
Common Driveway Easement Width	40 ft
Pavement Depth	2 in
Base Depth	4 in
Ballast Depth	12 in
Cut Slopes	1.5:1 (H:V)
Fill Slopes	2:1 (H:V)

The five common driveways have provisions to aid a fire truck in turning about at the end of the driveway. All cul-de-sacs are large enough to accommodate a fire truck turning around according to the 2000 International Fire Code.

Private Roads

Private roadway widths range from 24 to 28 feet in width. Hawks nest Way north of the intersection with Wild Ridge Drive is 28 feet wide. All of Wild Ridge Drive is 28 ft wide while Hawks Nest Way south of the intersection with Wild Ridge Drive is 24 ft wide. The cul-de-sac off of Wild Ridge Drive (Fox Hollow Court) is also 24 ft wide. All of the

private roads have two feet shoulders on each side of the private roadway. The right-of-way corridor established for the private roadways is 60 ft wide. The private roadways were designed to Post Falls Highway District standards for roadways to possibly anticipate turning the private roads into public roads.

Driveways

Common driveways are 20 ft in width with two feet shoulders. Design standards for the common driveway were determined from the 2000 International Fire Code for Fire Apparatus Access Roads, and the grade requirements for roadways were used from the Post falls Highway District standards. An easement of 40 ft for the common driveways was established to preserve the access corridor. Near the end of the common driveways will be an alternative hammerhead access road turnaround as determined by the 2000 International Fire Code for fire vehicles.

Private driveways were designed based on the criteria established in the Kootenai County ordinances. The private driveways were designed not to exceed grades of 10% as practically as possible. However, there are some private driveways between 10% and 12%, and those portions of driveways 12% or less stretch for distances less than 100 ft except for seven private driveways. A variance from the Kootenai County Ordinance for the seven private driveways is being requested for distances up to 252 ft. Six of the seven private driveways requested for variance range in lengths from 110 ft to 187 ft.

Private approaches intersecting private roads have an approach pad six feet in length from the shoulder of the roadway at a two percent grade and the intersecting angles range from sixty degrees to ninety degrees. Review the cross sections and plan views of the private driveways attached with this submittal to Kootenai County.

Building Pad

Some lots within the Wild Ridge development exceed 15% slope. RYA has developed a building pad design for these lots exceeding 15% slope. The design criteria for these lots are a 60 ft square area graded to 14% maximum slope. The cut slopes were approved in the geotechnical evaluation for 1.5:1 (H:V) and fill slopes for 2:1 (H:V) and will be utilized in constructing the building pad. Using these criteria, three building lots will require retaining walls ranging in height from three to ten feet.

Revised Narrative
April 18, 2007
Wild Ridge
Narrative and Project Overview
Planned Unit Development
and Subdivision Plat

Introduction

The *Wild Ridge* Planned Unit Development offers a unique opportunity in Kootenai County to develop property with access to the Highway 53 corridor that preserves natural vistas with timber, meadows, and wetlands and provides open space in excess of the existing zoning requirements. The proposed project will create 54 single-family residential lots on approximately 109 acres in the Agricultural Suburban Zone that meet the minimum density requirements of one lot per two acres. The residential lots vary in size and shape to promote the best fit with the surrounding terrain and average between one and two acres in size. The project reserves more than 23.5 acres of common area that offer a wide variety of beautiful natural surroundings including timbered slopes, open meadows and a delineated wetland connected by a series of trails. Some of the open space will be utilized as buffers along the adjoining public roads and an outdoor community center will be placed in the open meadow connected to the community.

The project was designed to meet the goals and intent of the Comprehensive Plan. Common open space was maximized with more than 21.6 percent of the total acreage reserved. Experts were employed early in the design process to identify an existing wetland and explore options to avoid impacts and incorporate the wetland into the open space. Recreational facilities are planned for the open space including an outdoor community center, a neighborhood park, and a pedestrian trail system to connect these areas within convenient walking distances. Open space areas along the public roads will preserve the natural appeal of the region and buffer the project from adjacent land uses.

Great care was taken to develop a site design that incorporates consideration of the existing slopes to minimize site disturbances for the road layout and building sites. In an effort to tightly integrate the project with the surrounding terrain, the road layout has a unique character that provides an overall benefit for the land use with lower impacts. Lots were developed along the road layout to fit the terrain, provide privacy, and preserve the natural vistas available throughout the site. Geotechnical investigations and evaluations were utilized to identify the most suitable location for the community drain field and provide expert advice for the layout of roads, building sites and utility routing.

The *Wild Ridge* property encompasses a total area of approximately 109 acres located between Winch Road and Freddi Road approximately 3 miles southwest of Rathdrum, 3 miles northeast of Hauser Lake and 1 mile northwest of Highway 53. The property is a

portion of the southeast quarter of Section 4 in Township 51 North, Range 5 West of the Boise Meridian in Kootenai County, Idaho.

Site Characteristics

The site contains approximately a third of the area with rolling terrain and gentle slopes that consist of open meadow and sparse timber. Another third of the site can be described as a saddle that is bounded by hills with moderate slopes and covered with sparse to moderate timber and brush. The final third of the site is rocky, uneven with moderate to steep slopes, and moderate to heavy timber.

The composition of the soils varies from top soil, silty sand, silty gravel, and rock as identified and described in the Preliminary Geotechnical Evaluation. The engineering and design of the project has been performed with special care to minimize cuts and fill in the slopes for road and building site construction and to locate the community drain field in the most suitable location on the site.

An area within the project was identified as a wetland and our wetland biologist delineated the limits and provided a comprehensive report of his findings and recommendations. We also expanded the scope of services to include a review of our conceptual design and a request for recommendations on how to avoid impacts and preserve these wetlands. The project design was altered in accordance with the wetland biologist's recommendations to preserve this area and incorporate the wetlands into the open space area.

Site Layout

The subject property is proposed to be divided into 54 residential lots of various sizes and shape that range from 0.5 acres to 2.5 acres with the average lot sizes between approximately 1 and 2 acres. Each lot has a building pad approximately 60' x 60' with private driveway access to an adjoining private road or common driveway within the project.

Project Entrance Monuments will be built at both access points from the public roads to enhance the visibility of the project. Each project entry will be gated with a Knox Company Access System entry for emergency services with a battery back up for periods when power is unavailable.

Proposed residential buildings will provide a wide variety of floor plans and layouts and will be one or two stories in height with daylight basements on a portion of the lots.

Proposed on-site uses will include non-residential areas that include: a 3.1 acres common drain field site; 3.4 acres of Utility Tracts including a community water reservoir site and a proposed Community Fire Station; common open space totaling 23.5 acres including the neighborhood park, wetlands, forest areas, and trails; and, the remaining area for

private roadways within the project as shown on the Conceptual PUD and Preliminary Plat maps.

Access and Roads

Initial design and layout for the roads and driveways were coordinated with the Post Falls Highway District to ensure compliance with current requirements for access to the public roads and to incorporate the current requirements for the private roads within the project. The main roads, cul-de-sacs, and common driveways meet current requirements.

Access to the site will be from the adjoining public roads, being Winch Road and Freddi Roads, which are currently maintained by the Post Falls Highway District. Right of way and associated roadway, drainage, and utility easements will be dedicated along Winch Road for a half width of 30 feet from the road centerline. Right of way along Freddi Road is already dedicated for the full width of 60 feet. Associated roadway, drainage, and utility easements will be granted for both Freddi and Winch Roads to the Highway District. The internal roads will be built to meet Highway District Standards and privately maintained by the Homeowners Association.

Each project entrance will be gated and equipped with Knox Company Access System entry for emergency services with a battery back-up for periods when power is unavailable as required by the Fire and Emergency Services agencies.

Common driveways within the subdivision will meet highway district and fire code standards. Private driveways will be constructed to meet County requirements.

Please refer to the Conceptual Engineering Report for more information on roads.

Water and Wastewater

Water will be supplied by a connection to the Northern Water LLC on the adjoining parcel to the east of the project. Booster stations and a water reservoir will be designed and installed, and domestic water conveyed to each of the lots within the project.

A community wastewater treatment system will be constructed on site to serve the project. The collection system would consist of gravity and pressure lines for transport. The Large Soil Absorption Area system will be located at the optimal drain field location and designed with the capacity needed for the project.

Please refer to the Conceptual Engineering Report and Preliminary Geotechnical Evaluation for more information on the water and wastewater options and recommendations.

Project Phasing

The project will be constructed in three phases as shown on the Phasing Plan map included in the Conceptual Engineering Plans.

Phase I will consist of the main road (Wild Ridge Drive) between the access points on Winch Road and Freddi Road, High Ridge Drive, and one common driveway along with the adjoining lots, large open spaces with trails, and an outdoor community center in the southern region of the site. High Ridge Drive will be constructed to meet Highway District Standards and replaces one of the previous common driveways. The main water connection and reservoir will be constructed and the wastewater collection and treatment facilities will be included in this phase.

Phase II will include Fox Hollow Court, two common driveways, and adjoining lots with wastewater and water connections. The open space improvements for this phase include the wetland region, trails, and the neighborhood park.

Phase III will include the balance of the project along Hawks Nest Way and one remaining common driveway.

It is anticipated that one phase will be built per year.

Traffic Study

A traffic study was initiated for this project to document traffic counts at critical intersections and determine any level of service improvements required for the public roads surrounding the project. Line of sight measurements were also determined at the access points on Winch and Freddi Roads. As a result of the development, the existing Freddi/Winch Roads intersection will be relocated to improve the intersection to Highway District standards. Please refer to the traffic study results for more information.

Homeowner's Association

The Homeowner's Association (HOA) will manage the affairs of the subdivision, including oversight of architectural review control before, during, and after the completion of each home site and accessory building to be constructed on the property. The HOA will be the deeded owner of the common areas and all associated private road rights of way and common driveways, utility tracts, and easements dedicated as such on the final plat. The HOA will maintain the roads, common driveways, parking areas, trails, neighborhood park, and the outdoor community center. The subdivision Declarations and CC&Rs will be included as an integral part of the final plat process and approvals.

PUD Variances

The PUD process was utilized on this project to allow the clustering of building sites, creation of open spaces, and flexibility in the design and layout of roads and facilities to minimize impacts to the site during development. Some of the unique site characteristics necessitate some variation to a small portion of the zoning requirements.

- We are requesting a variation to the setback requirements for the Agricultural Suburban Zone for a portion of the lots. Specifically, the front yard setback for residential structures would change from 25 to 20 feet and the rear yard setback from 25 to 15 feet for lots within Blocks 4 and 5 as shown on the Conceptual PUD.
- Access to the Public Utility (water reservoir) tract is limited to maintenance and is designed to be accessed through a 20-foot wide easement between two adjoining lots. The gated entrance to the tract will include a Knox Company Access System entry for emergency services with a battery back up for periods when power is unavailable, if required by the Fire and Emergency Services. We are requesting a variance on this particular access since it is only serving the water reservoir and will have very limited use. We are requesting that this access be built to private driveway standards, not common driveway standards, in regards to driveway width, easement width, and turnarounds.
- Alternative Phasing (three phases for two years each) is requested to be consistent with the Subdivision Ordinance for a two-year timeframe for phasing and final platting, instead of the one-year timeframe within the PUD Ordinance.

Wild Ridge Submittal Addendum

April 18, 2007

The following items have been revised since the original submittal to Kootenai County to address either agency concerns and/or remove Variance requests:

1. The Common Driveway/Emergency Access Road in the northern portion of the site has been revised to a Highway District compliant private roadway meeting required roadway grades. The road name will be High Ridge Drive. This change was also made to provide for enhanced emergency access within the project. With this revision, the number of lots that are on a dead-end road decreases to 11 lots.
2. With the Addition of High Ridge Drive, Block 4 within the project has been split into Blocks 4 and 5.
3. The Freddi Road/Winch Road intersection has been revised to include the relocation of the intersection to the south to meet Highway District standards. With the relocation of Freddi Road, a Block 6 was created as a Public Utility Tract.
4. The Open Space buffer along the project perimeter has been increased along Winch Road.
5. The Public Utility Tracts have been designated to include a proposed Community Fire Station (reduced site size), water reservoir site, and the relocated Freddi Road/ Winch Road intersection. The Tract in the southwest corner of the project has been revised to reflect an Open Space buffer along Winch Road.
6. Each project entry will be gated with a Knox Company Access System entry for emergency services with a battery back-up for periods when power is unavailable.

7. The Maintenance drive to access the water reservoir location will be gated. The gated entrance to the tract will include a Knox Company Access System entry for emergency services with a battery back up for periods when power is unavailable, if required by the Fire and Emergency Services. Access to the Public Utility (water reservoir) tract is limited to maintenance and is designed to be accessed through a 20-foot wide easement between two adjoining lots. We are requesting a variance on this particular access since it is only serving the water reservoir and will have very limited use. We are requesting that this access be built to private driveway standards, not common driveway standards, in regards to driveway width, easement width, and turnarounds.
8. The Wastewater Treatment Area site has been reduced and has Open Space incorporated on both sides of the Treatment Area site.
9. The easement area for the Common drain field site has been extended to allow for a Large Soil Absorption Area drain field site.
10. The proposed outdoor Community Center has been relocated to be adjacent to the trail system and closer to the parking area for ease of access.
11. Six private driveways were modified to meet County grade standards and have been removed from the requested Variances list.
12. Alternative Phasing (three phases for two years each) is requested as a Variance to be consistent with the Subdivision Ordinance for a two-year timeframe for phasing and final platting, instead of the one-year timeframe within the PUD Ordinance.
13. The project narrative has been revised to reflect the changes.
14. Open Space within the project has changed from 26 acres to 23.5 acres as a result of the Large Soil Absorption Area, however still exceeds County requirements.
15. The setback Variance requested for Block 4 has been revised to reflect Blocks 4 and 5 due to the addition of High Ridge Drive to the project.

FRAME & SMETANA, P.A.
CONSULTING ENGINEERS
603 North 4th Street
Phone (208) 664-2121 - Fax (208) 765-5502
COEUR D'ALENE, IDAHO 83814

TO: NORM WALDO, NORTHERN WATER L.L.C.
FROM: JOHN A. SMETANA, P.E.
SUBJECT: WATER SERVICE FOR WILD RIDGE SUBDIVISION
DATE: MAY 14, 2007

At your request, I have made a preliminary analysis to determine the ability of the Lost Creek Estates water system (parent system) to be expanded to serve the proposed Wild Ridge Subdivision (Wild Ridge). This analysis considers the following system components:

1. Existing/future storage and distribution.
2. Well source capacity.
3. Well source expansion opportunity.
4. Well discharge piping to storage and distribution.

ANALYSIS

1. Existing/Future Storage and Distribution

The parent system includes a 120,000-gallon concrete reservoir and 8" diameter distribution lines. The reservoir is sufficient for peak domestic and fire flow demands at Lost Creek Estates but does not provide excess storage for Wild Ridge. It will be necessary for Wild Ridge to provide properly sized and positioned storage for its peak domestic and fire flow demands. It is assumed that the Wild Ridge infrastructure design is the subject of a developer-sponsored engineering report and is, therefore, not included in this analysis. The existing 8" distribution system would convey water to the connection point with Wild Ridge. The flow rate of conveyance to Wild Ridge will need to be restricted to the maximum average daily domestic flow plus an amount to allow reservoir recovery in the event of depletion of fire storage. As

before, it is not the purpose of this analysis to propose the Wild Ridge demand flows, but I anticipate a reservoir fill flow range of 50 to 100 g.p.m. may be identified in another report. Because the existing distribution system is sized for fire flows of $1,000 \pm$ g.p.m., it has the capacity to provide the anticipated Wild Ridge reservoir fill rate without diminishing water service to users on the parent system.

2. Well Source Capacity

The parent system includes two wells flow tested at 195 g.p.m. each. The existing well pumping systems are rated at 142 g.p.m. each and are configured in a duplex, alternating, both pumps on for high demand format. Assuming that peak use flows and fire flow storage are provided by reservoir sizing, average daily use will be considered in this analysis to evaluate source capacity requirements.

Both subdivisions feature water use and conservation restrictions by agreement, water rate schedules, C.C. & R.s and negotiated water rights. Nonetheless, this analysis will consider a higher than anticipated domestic and irrigation use of 1,500 g.p.d. per lot to allow a factor of safety. The combined projected use can be calculated as follows:

Lost Creek Estates: $64 \text{ lots} \times 1,500 \text{ g.p.d.} = 96,000 \text{ g.p.d.}$

Wild Ridge: $54 \text{ lots} \times 1,500 \text{ g.p.d.} = \underline{81,000 \text{ g.p.d.}}$

TOTAL = 177,000 g.p.d.

Therefore, average combined flow is 123 g.p.m.

There may be some incidental flows for common areas and entrance features, but they are considered negligible in this analysis. The projected average daily use during periods of potential high irrigation (123 g.p.m.) is less than the capacity of one well pump (142 g.p.m.). This allows the second well pump to serve in a redundant/back-up role and be available to supplement fire flows if necessary.

3. Well Source Expansion Opportunities

Assuming approval of the requested increase for water rights from 0.50 c.f.s. to 0.75 c.f.s., each well system could be expanded to approximately $170 \pm$ g.p.m. ($340 \pm$ g.p.m. total). The existing power supply and well construction is sized for expansion. The pumps, motors, drop pipe, pitless adaptors, electrical components and vault

piping will require upgrading to accommodate the expansion. As demonstrated in item 2 above, expansion of the source certainly will not be required in the initial phases of development but could be expanded in the future if desired.

4. Well Discharge Piping to Storage and Distribution

The existing well piping manifolds the discharge lines after the meter vault into a single 6" PVC pipe designed to accommodate the increased flow. At 340± g.p.m., the velocity is approximately 4 f.p.s. and the friction loss is in an acceptable range.

Summary

Based on this analysis, it is my opinion the Northern Water L.L.C. system currently serving Lost Creek Estates has the capacity to supply water to the proposed Wild Ridge Subdivision subject to conformance with the assumptions and expansion requirements outlined above. Furthermore, I recommend completion of the development final engineering reports, construction plans and water right request approval be conditions of final plat approval.

If you have any questions, please contact me.

JAS:cas

xc: Wild Ridge L.L.C.

Gary Gaffney, Idaho Department of Environmental Quality
Dave LePard, Idaho Department of Water Resources
Jay Lockhart, Kootenai County Planner

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STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

2110 Ironwood Parkway • Coeur d'Alene, Idaho 83814 • (208) 769-1422

C.L. "Butch" Otter, Governor
Toni Hardesty, Director

July 20, 2007

Mr. Robert Nehring
Wild Ridge Development, LLC
3216 Wetmore Ave, Ste 202
Everett, WA 98201

RE: **Wild Ridge Subdivision, Kootenai County**

Dear Mr. Nehring:

This office has now concluded review as follows of three items related to the drinking water and wastewater systems being planned for your proposed **Wild Ridge** subdivision of 109 acres into fifty-four (54) residential lots located in Section 3 of T51N R3W of Kootenai County.

- **Drinking Water Supply:** A memorandum dated May 14, 2007 by John Smetana, P.E. of Frame and Smetana described the ability of the existing public drinking water system owned by Northern Water LLC and presently serving the sixty-four (64) residential lots in Lost Creek Estates subdivision, to be expanded to provide drinking water to Wild Ridge. The two existing wells are extracting water from the Spokane Valley- Rathdrum Prairie Aquifer, have been found to produce water that complies with Idaho drinking water standards, were test pumped at 195 gallons per minute (gpm), and have installed pumps capable of 142 gpm. Based on reasonable water demand estimates, the memorandum concluded that these two wells should be capable of producing enough water to meet water demand from the 118 lots ultimately served in the two subdivisions. Prior to preparation of plans and specifications for construction of the expanded water system, the engineer indicated that a more detailed engineering report would be completed discussing in detail design of the water conveyance, storage, and distribution systems needed in Wild Ridge.

DEQ concurs with the engineer's conclusion that the water system serving Lost Creek Estates has the capacity to be expanded to serve the proposed subdivision called Wild Ridge. At the conclusion of preliminary plat reviews, DEQ will need to review the engineering report prepared to describe, select, and size the improvements needed to implement this expansion in accordance with the Idaho Rules for Public Drinking Water Systems (IDAPA 58.01.08)

- **Large Soil Absorption System - Site and Loading Rate Approval:** The design engineers for the wastewater systems serving the proposed subdivision at Ruen Yeager and Associates indicated that a large soil absorption system (LSAS) as defined in the Idaho Individual/Subsurface Sewage Disposal Rules (IDAPA 58.01.03) is being proposed for all 54 lots. The first step for review of a LSAS involves site and loading rate evaluation by the PHD.

On February 20, and March 9, 2007 the Panhandle Health District (PHD) evaluated a number of test holes in the vicinity of two proposed LSAS sites (Field 1 and Field 2) and issued conclusions in a letter dated May 10, 2007. The soil type was determined to be B-1 with an associated wastewater

Wild Ridge Subdivision

July 20, 2007

Page 2

application rate of 0.6 gallons per day per square foot (gpd/ft²). The PHD report included data on depth to ground water and distance to surface water that need to be reflected when the boundaries of the LSASs are established.

With 54 lots involving three bedroom homes producing 250 gallons per day (gpd) of sewage, the LSAS will need to accommodate up to 13,500 gpd. This will involve construction of two independent LSAS modules since the maximum size allowed by the Rules for a LSAS is 10,000 gpd. Two fully-sized drainfields and one replacement area must be provided for each module.

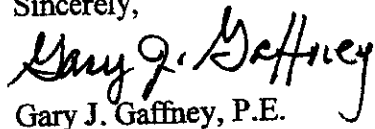
At the conclusion of preliminary plat reviews, DEQ will need to review an engineering report prepared by the design engineer describing design of the proposed LSAS.

- **Site Investigation:** Following LSAS site and loading rate evaluation, the next preliminary review step identified in the Individual/Subsurface Sewage Disposal Rules is that a site investigation be undertaken concluding that the effluent from the LSAS will not adversely impact or harm the waters of the State. Typically, this investigation has involved a Nutrient/Pathogen Evaluation as recommended by DEQ that models expected water quality impacts of the LSAS to ground water.

On May 16, 2007 this office received a Level 1 Nutrient-Pathogen Evaluation for Wild Ridge Subdivision as prepared by Thomas Mullen, P.G. with LFR Inc. Subsequent reviews of the report by Gary Stevens, P.G. at this office and submittals of additional documentation by Mr. Mullen was undertaken. The result of this review is that DEQ concurs with the conclusion of the report that the proposed LSAS can be constructed and operated without an adverse impact to ground water quality.

With satisfaction of our requirements as indicated above for water supply capacity, LSAS site and loading rate approval, and water quality impacts, DEQ has no objection to Kootenai County acceptance of the preliminary plat for Wild Ridge subdivision. Once this action has been completed, we will be prepared to review and approve engineering reports and plans and specifications related to construction of the public drinking water system extension and LSAS systems serving the proposed subdivision.

Sincerely,



Gary J. Gaffney, P.E.

- c: Tom Mullen, LFR Inc., 2310 N Molter Rd, Ste 101, Liberty Lake, WA 99019
Randy Broesch, Ruen-Yeager and Associates, 3201 N Huetter, CdA
Steve Syrcle, Tri-State Consulting Engineers, 1400 Northwood Center Court, CdA
Mark Mussman, Kootenai County Planning Dept., CdA
Norm Waldo, Northern Water LLC, 181 Lost Springs Ranch Rd, Post Falls
Robert Haynes, IDWR, CdA
Jack Smetana, Frame and Smetana, CdA
Nathan Church, PHD, Hayden
(#9909 filed with Wild Ridge LSAS sewer)

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PANHANDLE HEALTH DISTRICT

Healthy People in Healthy Communities

8500 N. ATLAS ROAD
HAYDEN, IDAHO 83835
<http://www2.state.id.us/phd1>

November 22, 2006

Randy Broesch
Wild Ridge Development, LLC (A.K.A. Wild Ridge, LLC)
3216 Wetmore Ave., Suite 202
Everett, WA 98201

RE: WILD RIDGE

To All Concerned:

The residential subdivision known as Wild Ridge, consisting of 54 lots, on 108.998 acres, located in 51N Township, 05W Range, 4 Section, in Kootenai County, in the State of Idaho has been reviewed by Panhandle Health District (PHD). PHD will grant final approval when the following conditions have been met:

- Test holes must be dug and approved drain field sites must be found for all lots within the subdivision. This may include test holes on each lot or test holes in a suitable location for a Large Soil Absorption System (up to 40 homes, or 10,000 gpd only) that the Department of Environmental Quality (DEQ) will review and PHD receives a letter from DEQ stating sewer services meet the State of Idaho Standards for the specified number of lots and/or tracts. A Nutrient-Pathogen (N-P) study may be required.
- PHD receives a letter from the water purveyor, (NORTHERN WATER, LLC), stating they will supply water to the subdivision and designate the number of lots and tracts for which each will supply.
- All shallow injection wells (drywells) must be registered with PHD and corresponding fees paid.
- Idaho Code §50-1334 requirements: The water source must be stated on the plat as part of the owner's certification signature block.
- Idaho Code §50-1326 to §50-1329 requirements: Two signature blocks must be included on the plat for Panhandle Health District one to approve the plat and one to lift the sanitary restrictions.
- Blue-line copies of the plat including signature page(s) must be supplied to the PHD.

If the above conditions are satisfied PHD will lift the sanitary restrictions when the final plat/mylar is signed. Please note that plat approval does not guarantee these lots/tracts are buildable. If you have any questions or require additional information please call Panhandle Health District.

Sincerely,

Justin Rader
Environmental Health Specialist

cc: City of Rathdrum
Mike Hathaway, Ruen-Yeager & Associates, 3201 N. Huettner Rd., Coeur d'Alene, ID 83814
DEQ
Cheri Howell, Planner II

Exhibit 112
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PANHANDLE HEALTH DISTRICT

Healthy People in Healthy Communities

ENVIRONMENTAL HEALTH
8500 N. ATLAS ROAD
HAYDEN, IDAHO 83835
(208) 415-5200
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SOIL ANALYSIS RESULTS

Randy Broesch
Ruen-Yeager & Associates
3201 N. Huetter Rd.
Coeur d'Alene, ID 83814

RE: WILD RIDGE LARGE SOIL ABSORPTION SYSTEM TEST HOLES DATA AND TYPE

Mr. Broesch:

On February 20, 2007 & March 9, 2007, a soil analysis was performed on parcel # 51N05W-04-8330. The results of that analysis are attached. **This soil analysis does not constitute approval or disapproval of the site in question with respect to potential development of any kind. This data is for information purposes only.** Proposed field 1 was conducted on February 20, 2007. Proposed field 2 was conducted on March 9, 2007.

TEST HOLE	SOIL ANALYSIS	COMMENTS
13001	Loamy Sand 0-48" Decomp. Granite/sand 48-60" Loamy Sand 60-75" Decomp. Granite 75-140"	Field 1 Ground Water Monitor
13007	Silt/Sandy loam 0-30" Decomp. Granite w/ sand 30-48" Decomp. Granite 48-168"	Field 1
13008	Silty Sand 0-14" Decomp. Granite with stones 14-162"	Field 1 Ground Water Monitor – about 150' from surface water runoff
13011	Silty/Sandy Loam 0-32" Silty Sand 32-46" Decomp. Granite 46-158"	Field 1 Ground Water Monitor – about 200' from surface water runoff
13012	Silty/Sandy Loam 0-72" Rock bed at 72"	Field 1 Bad Hole
13011.5	Silty Sand 0-19" Loamy Sand 19-46" Decomp. Granite with sand 46-158"	Field 1
13006.5	Same as TH 13011.5	Field 1
305.125N	Silt Loam 0-72" Silty Sand 72-168"	Field 2 Bad Hole, 75' from seasonal drainage – Ground water monitor Water level in sand 57" Surfaced water 156"
305.125SW	Silt Loam 0-24" Silty Sand 24-180"	Field 2 264' from seasonal drainage
306.175SE	Silt Loam 0-26" Silty Sand 26-180"	Field 2
305.250NW	Silt Loam 0-21" Silty Sand 21-72" Decomp. Granite w/ Sand & Stony	Field 2

Bonnors Ferry (208) 267-5558, Kellogg (208) 786-7474, Sandpoint (208) 265-6384, St. Maries (208) 245-4556

72-168"		
---------	--	--

Date:		2/23/2007	3/2/2007	3/9/2007	3/15/2007	3/23/2007
Piezometer Readings:						
Field 1 (TH 13008)	NW	0"	0	0	0	0
Field 1 (TH 13011)	NE	0"	0	0	0	0
Field 1 (TH 13001)	S	0"	0	0	0	0
Field 2 (TH 305.125N)	E			Surfaced water 13' in 14' hole, Water level in soil 57"	Water at 11.5' in 14' hole	0

Surface Water:	NW (TH 13008 area)	150' Away from NW piezometer & 50' from North LSAS marker	200' Away from NW piezometer & 125' away from northern LSAS marker	Same as 2/23/07	Same as 2/23/07	210' Away from NW piezometer & 135' away from northern LSAS marker
Surface Water:	NE (TH 13011 area)	200' Away from NW piezometer	Same as 2/23/07	Same as 2/23/07	Same as 2/23/07	Same as 2/23/07

Date:		3/30/2007	4/3/2007	4/10/2007
Piezometer Readings:				
Field 1 (TH 13008)	NW	0	0	0
Field 1 (TH 13011)	NE	0	0	0
Field 1 (TH 13001)	S	0	0	0
Field 2 (TH 305.125N)	E	0	0	0

Surface Water:	NW (TH 13008 area)	Same as 3/23/07	230' Away from NW Piezometer & 155' away from northern LSAS marker	Just muddy area at former surface water
Surface Water:	NE (TH 13011 area)	Same as 2/23/07	Same as 2/23/07	Just muddy area at former surface water

Piezometers for Field 1 display no ground water infiltration and Field 2 is temporary ground water at that one low area. The surface water is considered permanent and will require necessary setbacks to drainfields. Recommend moving the drainfield south enough meet setback of 300 feet to accommodate test hole variations of soil type from B to A. This is subject to change if Department of Environmental Quality (DEQ) has more stringent conditions.
 Bonners Ferry (208) 267-5558, Kellogg (208) 786-7474, Sandpoint (208) 265-6384, St. Maries (208) 245-4556

Individual test holes vary in soil type, but the overall soil type is a B-1. The loading rate will have a final determination when DEQ has reviewed all information and determines whether further steps will be taken to adjust it. Please refer to the November 22, 2006 letter with the rest of the requirements in order to lift the sanitary restrictions.

Sincerely,



Justin Rader
Environmental Health Specialist

encl: Test Hole Locations

cc: Thomas Mullan, P.G., LFR, 2310 North Molter Rd, Suite 101, Liberty Lake, WA 99019
Robert Nehring, Wild Ridge Development, LLC, 3216 Wetmore Ave., Suite 202, Everett, WA 98201
DEQ

Prepared in cooperation with the
IDAHO DEPARTMENT OF WATER RESOURCES
WASHINGTON STATE DEPARTMENT OF ECOLOGY
UNIVERSITY OF IDAHO
WASHINGTON STATE UNIVERSITY



Ground-Water Flow Model for the Spokane Valley-Rathdrum Prairie Aquifer, Spokane County, Washington, and Bonner and Kootenai Counties, Idaho



Scientific Investigations Report 2007-5044

U.S. Department of the Interior
U.S. Geological Survey

Cover: Photograph of Spokane Valley, Washington. The U.S. Geological Survey streamflow gaging station on the Spokane River at Greenacres, Washington, is to the right (upstream) of where Barker Road Bridge crosses the river. (Photograph taken by Paul Hsieh, U.S. Geological Survey, 2005.)

Ground-Water Flow Model for the Spokane Valley-Rathdrum Prairie Aquifer, Spokane County, Washington, and Bonner and Kootenai Counties, Idaho

By Paul A. Hsieh, Michael E. Barber, Bryce A. Contor, Md. Akram Hossain,
Gary S. Johnson, Joseph L. Jones, and Allan H. Wylie

Prepared in cooperation with the
Idaho Department of Water Resources,
Washington State Department of Ecology,
University of Idaho, and
Washington State University

Scientific Investigations Report 2007–5044

**U.S. Department of the Interior
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Conversion Factors and Datums

Conversion Factors

Multiply	By	To obtain
acre-foot (acre-ft)	1,233	cubic meter (m ³)
cubic foot per day (ft ³ /d)	0.02832	cubic meter per day (m ³ /d)
cubic foot per second (ft ³ /s)	0.02832	cubic meter per second (m ³ /s)
foot (ft)	2.54	centimeter (cm)
foot per day (ft/d)	0.3048	meter per day (m/d)
foot squared per day (ft ² /d)	0.09290	meter squared per day (m ² /d)
inch (in.)	2.54	centimeter (cm)
mile (mi)	1.609	kilometer (km)
square mile (mi ²)	2.590	square kilometer (km ²)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$^{\circ}\text{F} = (1.8 \times ^{\circ}\text{C}) + 32.$$

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) / 1.8.$$

Datums

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the vertical datum.

Ground-Water Flow Model for the Spokane Valley-Rathdrum Prairie Aquifer, Spokane County, Washington, and Bonner and Kootenai Counties, Idaho

By Paul A. Hsieh, Michael E. Barber, Bryce A. Contor, Md. Akram Hossain, Gary S. Johnson, Joseph L. Jones, and Allan H. Wylie

Abstract

This report presents a computer model of ground-water flow in the Spokane Valley-Rathdrum Prairie (SVRP) aquifer in Spokane County, Washington, and Bonner and Kootenai Counties, Idaho. The aquifer is the sole source of drinking water for more than 500,000 residents in the area. In response to the concerns about the impacts of increased ground-water withdrawals resulting from recent and projected urban growth, a comprehensive study was initiated by the Idaho Department of Water Resources, the Washington Department of Ecology, and the U.S. Geological Survey to improve the understanding of ground-water flow in the aquifer and of the interaction between ground water and surface water. The ground-water flow model presented in this report is one component of this comprehensive study. The primary purpose of the model is to serve as a tool for analyzing aquifer inflows and outflows, simulating the effects of future changes in ground-water withdrawals from the aquifer, and evaluating aquifer management strategies. The scale of the model and the level of detail are intended for analysis of aquifer-wide water-supply issues.

The SVRP aquifer model was developed by the Modeling Team formed within the comprehensive study. The Modeling Team consisted of staff and personnel working under contract with the Idaho Department of Water Resources, personnel working under contract with the Washington Department of Ecology, and staff of the U.S. Geological Survey. To arrive at a final model that has the endorsement of all team members, decisions on modeling approach, methodology, assumptions, and interpretations were reached by consensus.

The ground-water flow model MODFLOW-2000 was used to simulate ground-water flow in the SVRP aquifer. The finite-difference model grid consists of 172 rows, 256 columns, and 3 layers. Ground-water flow was simulated from September 1990 through September 2005 using 181

stress periods of 1 month each. The areal extent of the model encompasses an area of approximately 326 square miles. For the most part, the model extent coincides with the 2005 revised extent of the Spokane Valley-Rathdrum Prairie aquifer as defined in a previous report. However, the model excludes Spirit and Hoodoo Valleys because of uncertainties about the ground-water flow directions in those valleys and the degree of hydraulic connection between the valleys and northern Rathdrum Prairie. The SVRP aquifer is considered to be a single hydrogeologic unit except in Hillyard Trough and the Little Spokane River Arm. In those areas, a continuous clay layer divides the aquifer into an upper, unconfined unit and a lower, confined unit.

The model includes all known components of inflows to and outflows from the aquifer. Inflows to the SVRP aquifer include (1) recharge from precipitation, (2) inflows from tributary basins and adjacent uplands, (3) subsurface seepage and surface overflows from lakes that border the aquifer, (4) flow from losing segments of the Spokane River to the aquifer, (5) return percolation from irrigation, and (6) effluent from septic systems. Outflows from the SVRP aquifer include (1) ground-water withdrawals from wells, (2) flow from the aquifer to gaining segments of the Spokane River, (3) aquifer discharge to the Little Spokane River, and (4) subsurface outflow from the lower unit at the western limit of the model area near Long Lake. These inflow and outflow components are represented in the model by using MODFLOW-2000 packages.

The parameter-estimation program PEST was used to calibrate the SVRP aquifer model. PEST implements a nonlinear least-squares regression method to estimate model parameters so that the differences between measured and simulated quantities are minimized with respect to an optimal criterion. Calibration data include 1,573 measurements of water levels and 313 measurements of streamflow gains and losses along segments of the Spokane and Little Spokane Rivers.

Model parameters estimated during calibration include hydraulic conductivity, specific yield, vertical hydraulic conductivity of riverbed sediments, and hydraulic conductance of riverbed and lakebed sediments. Simulated water levels and streamflow gains and losses generally were in good agreement with measured water level and streamflow gains and losses throughout most of the aquifer. However, discrepancies between measured and simulated quantities do occur in local parts of the aquifer. The largest discrepancy between measured and simulated water levels occurs in the lower unit in northern Hillyard Trough and the Little Spokane River Arm. These discrepancies indicate that the lower unit might not be accurately represented by the model.

After the model was calibrated, five alternative models were evaluated. In each alternative model, one aspect of the calibrated model was varied and the alternative model was re-calibrated. Results of these alternative model analyses show that changes in certain model parameter values can result in changes to certain simulated flow components even though the overall fit of the alternative model to the measured quantities is nearly as good as the calibrated model. This suggests some degree of nonuniqueness in the ground-water flow simulated by the calibrated model.

The model presented in this report is calibrated using significantly more data than are used in previous models. The relatively good fit between simulated and measured quantities indicates that the overall simulated ground-water flow is a reasonable representation of ground-water flow in the SVRP aquifer. Nonetheless, the model is subject to limitations. In particular, there is insufficient hydrologic information to determine ground-water inflow from Spirit and Hoodoo Valleys to the SVRP aquifer. In Hillyard Trough and the Little Spokane River Arm, ground-water flow in the lower unit is not well understood, and simulated water levels do not fit measured water levels as well as in other parts of the aquifer. There also is significant uncertainty in the simulated seepages from Lake Pend Oreille and Coeur d'Alene Lake. Further investigations in these parts of the SVRP aquifer could provide valuable knowledge that can be used to improve the model in the future.

Introduction

The Spokane Valley-Rathdrum Prairie (SVRP) aquifer supplies water to more than 500,000 residents in Spokane County, Washington, and Bonner and Kootenai Counties, Idaho (fig. 1). In 1978, the U.S. Environmental Protection Agency designated the aquifer as a "Sole Source Aquifer" in response to concerns about aquifer vulnerability to water-quality degradation (Federal Register, 1978). Recent and

projected urban growth in the aquifer area, which includes Spokane, Spokane Valley, and Liberty Lake, Washington, and Post Falls and Coeur d'Alene, Idaho, has raised additional concerns about the effects of increased ground-water withdrawals from the aquifer. To address these concerns, a comprehensive hydrologic study was developed in 2004 by the Idaho Department of Water Resources, the Washington Department of Ecology, and the U.S. Geological Survey (USGS) to improve the understanding of ground-water flow in the aquifer and of the interaction between ground water and surface water. The purpose of the comprehensive study is to provide a scientific foundation for management of the aquifer and to provide tools that are needed to evaluate aquifer management strategies. Development of a ground-water flow model of the aquifer is one component of the comprehensive study.

The ground-water flow model presented in this report was developed by the Modeling Team formed within the comprehensive study. The Modeling Team (authors of this report) consisted of staff and personnel working under contract with the Idaho Department of Water Resources, personnel working under contract with the Washington Department of Ecology, and staff of the USGS. To arrive at a final model that has the endorsement of all team members, decisions on modeling approach, methodology, assumptions, and interpretations were reached by consensus. The Modeling Team operated under the management of the Project Technical Leadership Team and received advice and comments from the Technical Advisory Committee. In addition to undergoing the USGS report review process, the model was reviewed by the study's Peer Review Team.

Purpose and Scope

This report describes the development of a computer model to simulate ground-water flow in the SVRP aquifer. Steps in model development include: (1) defining the areal and vertical extents of the model, (2) defining boundary conditions, (3) estimating components and rates of inflows to and outflows from the aquifer, and (4) calibrating the model by adjusting model parameters (such as hydraulic conductivity and specific yield) so the differences between simulated and measured quantities (such as water levels and flows) are minimized with respect to an objective function. Model calibration uses a nonlinear least-squares regression method, which enables quantification of parameter uncertainty within the context of the regression problem.

The primary purpose of the model is to serve as a tool for analyzing SVRP aquifer inflows and outflows, simulating the effects of future changes in ground-water withdrawals from the aquifer, and evaluating aquifer management strategies.

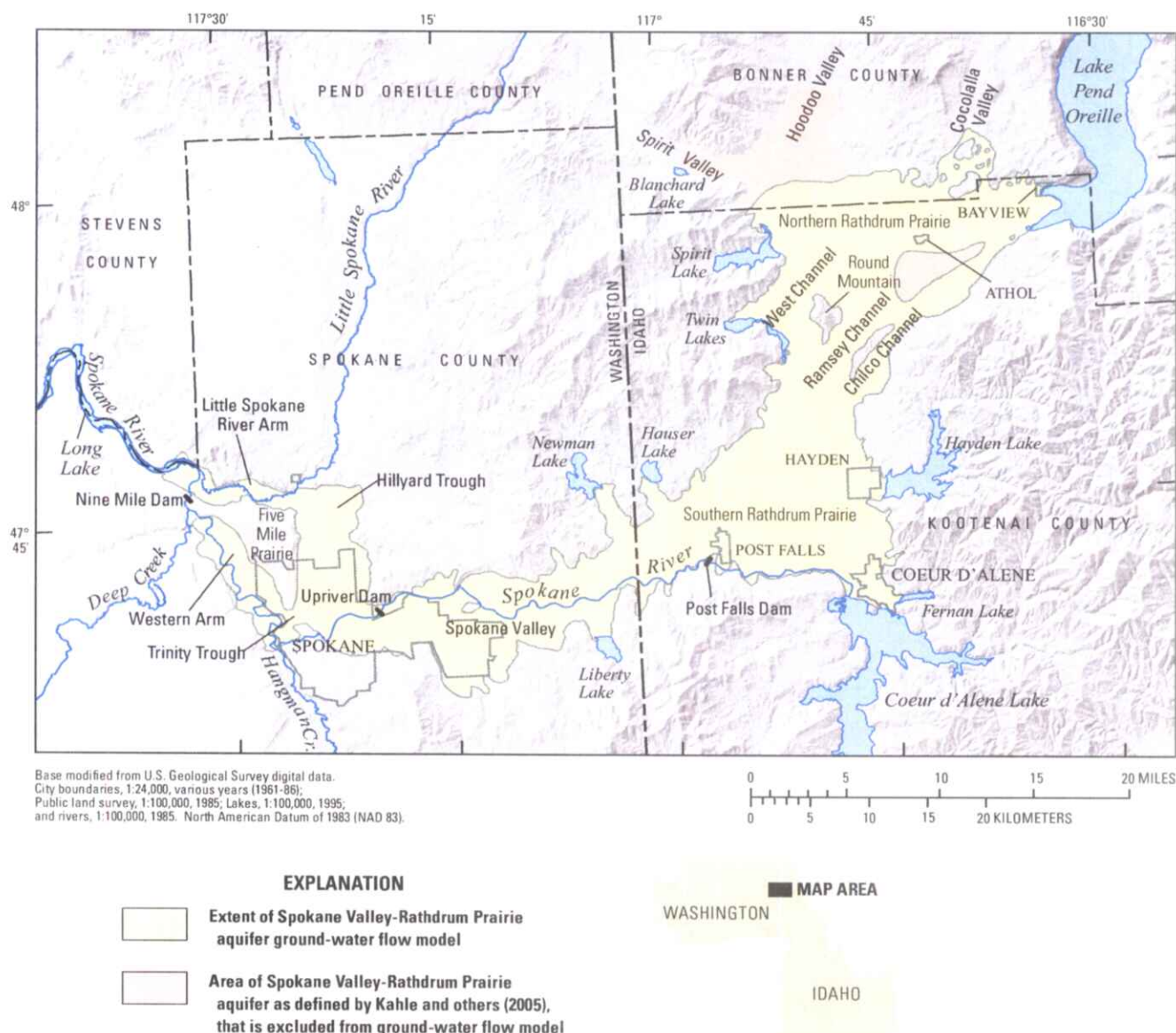


Figure 1. Location of the Spokane Valley-Rathdrum Prairie aquifer, Spokane County, Washington, and Bonner and Kootenai Counties, Idaho.

The scale of the model and the level of detail are intended for analysis of aquifer-wide water-supply issues. The model presented in this report is not intended for application to contaminant-transport issues such as the prediction of contaminant travel times or flow paths. A contaminant-transport model would require a substantially greater amount of hydrogeologic detail for the contamination site.

Although the areal extent of the model differs slightly from the areal extent of the SVRP aquifer as defined by Kahle and others (2005), this report does not redefine the aquifer

boundary. Because of the paucity of data for the northern extreme of Rathdrum Prairie, the model does not include Spirit and Hoodoo Valleys. Ground-water flow directions in Spirit and Hoodoo Valleys and the degree of hydraulic connections between those valleys and northern Rathdrum Prairie cannot be determined with certainty with the presently available data. Therefore, during model calibration, the uncertainty in ground-water inflow from the valleys is treated by assuming different inflow values along the model boundary.

Description of Study Area

The areal extent of the SVRP aquifer model is shown in [figure 1](#). The model encompasses an area of approximately 326 mi² in eastern Washington and northwestern Idaho. For the most part, the model extent coincides with the 2005 revised extent of the SVRP aquifer as defined by Kahle and others (2005). However, the model excludes Spirit and Hoodoo Valleys and three areas where bedrock is close to land surface and the aquifer sediments likely are unsaturated. Within the model extent, land-surface altitude ranges from about 2,600 ft in northern Rathdrum Prairie to about 1,500 ft at the western limit of the model near Long Lake. The climate varies from subhumid to semiarid and is characterized by warm, dry summers and cool, moist winters. Mean annual (1971–2000) precipitation is 16.7 in. at the Spokane International Airport, Washington; 25.9 in. near Bayview, Idaho; and 28.1 in. at the Coeur d'Alene Airport, Idaho (Kahle and others, 2005, p. 6).

The SVRP aquifer is divided into several subregions by bedrock outcrops and subsurface bedrock ridges. On the east side of the aquifer, a crystalline rock outcrop known as Round Mountain and a less prominent bedrock ridge divide the aquifer into three channels that connect northern and southern Rathdrum Prairie. From west to east, these channels are known as West Channel, Ramsey Channel, and Chilco Channel. On the west side of the aquifer, two subsurface bedrock ridges extend from a basalt highland known as Five Mile Prairie. The first ridge extends to the south and the second extends to the west. The south-extending ridge, along with Five Mile Prairie, divides the aquifer into two arms. The eastern arm is known as Hillyard Trough, and the western arm is known as Western Arm. At the north end of Hillyard Trough, the aquifer continues west in the valley containing the Little Spokane River. This part of the aquifer is referred to as the Little Spokane River Arm. At the north end of Western Arm, the aquifer terminates against the subsurface bedrock ridge that extends west from Five Mile Prairie (see Kahle and others, 2005, p. 18–19). The narrow channel between Western Arm and the rest of the aquifer is known as Trinity Trough.

Nine lakes are located along the perimeter of the model area. Because the water levels of those lakes are higher than the ground-water level in the SVRP aquifer, water seeps from the lakebed and recharges the aquifer. The two largest lakes are Lake Pend Oreille and Coeur d'Alene Lake. Water levels in those lakes are regulated by dams on the respective outlet rivers. The outlet of Lake Pend Oreille is the Pend Oreille River, which is north of the area shown in the location map in [figure 1](#). The outlet of Coeur d'Alene Lake is the Spokane River. The seven smaller lakes are Fernan Lake, Hauser Lake, Hayden Lake, Liberty Lake, Newman Lake, Twin Lakes, and Spirit Lake. These lakes do not have perennial outlet streams. However, during wet seasons, if the lake level rises above the outlet structure, lake water spills over the outlet structure and

exits the lake as surface flow. Because of the highly permeable nature of the surficial and aquifer material, the surface flow soaks into the ground within a short distance of the lake.

The Spokane and Little Spokane Rivers are the major surface-water drainages in the model area. The Spokane River originates at Coeur d'Alene Lake. Water discharge from that lake is regulated by Post Falls Dam. Downstream of the dam, the Spokane River is free flowing for about 16 river miles until it reaches Upriver Pool near the Centennial Trail Bridge. Downstream of Upriver Dam, the river is again free flowing for about 4.5 river miles until it enters downtown Spokane. In the next 2.5 river miles, the river flows over basaltic rocks outside the SVRP aquifer and is regulated by dams in the Spokane Falls area. The river re-enters the aquifer at the south end of Western Arm and is again free flowing for about 10 river miles as it meanders northwest to Nine Mile Reservoir. Downstream of Nine Mile Dam, the Spokane River is joined by the Little Spokane River, which enters the model area at the north end of Hillyard Trough and flows toward the west. Downstream of the confluence of the two rivers, the Spokane River becomes a reservoir known as Long Lake, which is regulated by Long Lake Dam.

Previous Investigations

In preparation for developing the ground-water flow model presented in this report, Kahle and others (2005) compiled geologic and hydrologic information available as of June 2005 for the SVRP aquifer. The geologic information includes the pre-Tertiary, Tertiary, and Quaternary geology of the aquifer and results of previous geophysical investigations. The hydrologic information includes the current understanding of the hydrogeologic framework, ground-water movement, water-budget components, and ground-water/surface-water interactions. The compilation also includes descriptions of previous ground-water flow models by Bolke and Vaccaro (1981), CH2M Hill (1998, 2000), Buchanan (2000), and Golder Associates, Inc. (2004). In another report, Kahle and Bartolino (2007) refined the hydrogeologic understanding of the aquifer. Using drillers' records and results of available geophysical investigations, they developed a contour map showing the altitude of the base of the aquifer, mapped the extent of a clay layer in Hillyard Trough and in the Little Spokane River Arm, and updated the aquifer water budget using recently compiled information.

Because previous ground-water flow models of the SVRP aquifer are described in detail in the report by Kahle and others (2005), the following discussion highlights only the similarities and differences among the models. The models by Bolke and Vaccaro (1981), CH2M Hill (1998, 2000), and Golder Associates, Inc. (2004) encompass the western (mostly Washington) part of the aquifer from Post Falls or the Idaho-Washington State line to the eastern end of Long Lake. The

model by Buchanan (2000) encompasses the entire aquifer in both States. All four models simulate the interaction between the aquifer and the Spokane and Little Spokane Rivers. In addition, the model by Golder Associates, Inc. (2004) simulates overland flow, river flow, and subsurface flow in the unsaturated and saturated zones of the aquifer.

Although evidence available since the late 1990s (see, for example, Gruenenfelder, 1997) indicates that an extensive clay layer divides the SVRP aquifer into an upper, unconfined unit and a lower, confined unit in Hillyard Trough and the Little Spokane River Arm, all four previous models treat the aquifer effectively as a single, unconfined, hydrogeologic unit. The clay layer is not mentioned in the reports by Bolke and Vaccaro (1981) and Buchanan (2000). In the reports by CH2M Hill (1998, 2000), the clay layer is discussed but the model excludes the lower, confined unit. In the report by Golder Associates, Inc. (2004), the clay layer is treated as a geologic lens within a model layer rather than as a separate model layer. Therefore, a single model layer represents both the upper and lower units.

The four models are calibrated using different amounts of measured data for different time periods. Bolke and Vaccaro (1981) presented both a time-averaged simulation and a transient simulation for May 1977–April 1978. The model by Bolke and Vaccaro (1981) is calibrated using measured water levels in 73 wells and ground-water discharge from the SVRP aquifer to the Little Spokane River (that is, streamflow gain on the river). The calibration is checked by a water-balance calculation and by comparing simulated streamflow with measured streamflow for three sites on the Spokane River. The model by CH2M Hill (1998, 2000) is a steady-state model and is calibrated using measured water levels in about 110 wells and streamflow gains and losses on the Spokane River during September 1994. The calibration is checked by comparing simulated and measured water levels and streamflow gains and losses for April 1995. The model by Buchanan (2000) also is a steady-state model and is calibrated using measured water levels in 15 wells during unspecified time periods. The calibration data do not include measured streamflow gains or losses. The model by Golder Associates, Inc. (2004) is a transient model and is calibrated using measured water levels in about 20 wells and measured streamflow on the Spokane and Little Spokane Rivers during 1994, 1997, and 1999.

An important assumption in the models by Bolke and Vaccaro (1981), CH2M Hill (1998, 2000), and Golder Associates, Inc. (2004) is the boundary condition at the eastern terminus of the model. This boundary condition controls ground-water flow from Rathdrum Prairie to the model. The model by Bolke and Vaccaro (1981) specifies the hydraulic head along the eastern boundary. The calibrated model simulates a ground-water inflow of about 400 ft³/s across the boundary. By contrast, the model by CH2M Hill (1998, 2000) specifies the ground-water inflow across the eastern boundary and inflow rate is adjusted during calibration. The

calibrated model simulates a ground-water inflow of 385 ft³/s. The model by Golder Associates, Inc. (2004) specifies a time-varying hydraulic head along the eastern boundary. The report by Golder Associates, Inc. (2004, fig. 9.8) does not give the simulated flow across the boundary but does indicate that the simulated flow across the Washington-Idaho State line, about 3.5 mi west of the eastern boundary, ranges from about 30 to 850 ft³/s.

Components of aquifer inflows and outflows are treated in somewhat different manners in the four models. In all four models, aquifer inflows include recharge from precipitation (that is, precipitation minus evapotranspiration), leakage from the losing segments of the Spokane River, and varying amounts of inflows from tributary basins, adjacent uplands, or lakes along the aquifer perimeter. The models by Bolke and Vaccaro (1981), CH2M Hill (1998, 2000), and Golder Associates, Inc. (2004) also include return percolation from irrigation, effluent from septic systems, and inflow across the eastern boundary as discussed in the previous paragraph. In all four models, ground water discharges to the Little Spokane River and to gaining segments of the Spokane River. The models by Bolke and Vaccaro (1981), CH2M Hill (1998, 2000), and Golder Associates, Inc. (2004) also include ground-water withdrawals by water purveyors and by industrial, commercial, agricultural, and domestic users. In the model by Bolke and Vaccaro (1981), ground-water outflow also occurs along a specified-hydraulic head boundary near the confluence of the Spokane and Little Spokane Rivers.

Hydrology of Aquifer

The geologic history and the hydrogeologic framework of the SVRP aquifer are presented in the reports by Kahle and others (2005) and Kahle and Bartolino (2007). The following discussion briefly summarizes the geologic setting of the study area. The remainder of the discussion focuses on the hydrologic information used to develop the ground-water flow model. Topics covered include the areal and vertical extent of the aquifer, hydraulic properties, inflows and outflows, interaction between the aquifer and the Spokane River, and ground-water levels and movement.

Geologic Setting

Kahle and Bartolino (2007) described three distinct hydrogeologic units in the study area: the SVRP aquifer, the Basalt and fine-grained interbeds unit, and the Bedrock unit. Together, the Basalt and fine-grained interbeds unit, which includes Columbia River basalt and interbedded lacustrine deposits of the Latah Formation, and the Bedrock unit, which includes Precambrian to Tertiary metamorphic and intrusive igneous rocks, laterally bound and underlie the SVRP aquifer.

The SVRP aquifer consists mostly of sands, gravels, cobbles, and boulders primarily deposited by a series of catastrophic glacial outburst floods from ancient glacial Lake Missoula during the Pleistocene Epoch. Kahle and Bartolino (2007) noted that most of the aquifer sediments deposited in such a high-energy depositional environment are coarse grained. However, they also noted that fine-grained layers of clay and silt are scattered throughout the aquifer and likely were deposited in large proglacial lakes in the path of the Missoula floods. From analysis of drillers' reports, Kahle and Bartolino (2007) found that

"The aquifer generally has a greater percentage of finer material near the margins of the valley and becomes more coarse and bouldery near the center throughout the Rathdrum Prairie and Spokane Valley. In the Hillyard Trough, the deposits generally are finer grained and the aquifer consists of sand with some gravel, silt, and boulders."

Areal Extent

The areal extent of the SVRP aquifer has been redefined several times in the past 30 years. The most recent definition is the 2005 revised extent of the SVRP aquifer shown in Kahle and others (2005, pl. 2). In most places, the aquifer boundary follows the contact between the coarse, highly permeable aquifer sediments and the surrounding less permeable bedrock and fine-grained material. The 2005 revised extent includes Ramsey Channel, Chilco Channel, the south part of Hoodoo Valley, and the south part of Cocolalla Valley (fig. 1). These four areas lie outside the Sole Source Aquifer as designated by the U.S. Environmental Protection Agency in 1978. In revising the aquifer boundary, Kahle and others (2005, p. 17) noted that

"For modeling purposes, it may be important to use a more inclusive aquifer boundary to better represent contributions from adjacent surficial deposits that are in hydraulic contact with the Sole Source Aquifer."

For the most part, the extent of the model in this report coincides with the 2005 revised extent. However, the model excludes Spirit and Hoodoo Valleys and three areas where bedrock is close to land surface and the aquifer sediments likely are unsaturated (fig. 1). The model extent is not intended to be a redefinition of the aquifer. As discussed in the following paragraphs, Spirit and Hoodoo Valleys are excluded from the model because of uncertainties about the ground-water flow directions in those valleys and the degree of hydraulic connection between the valleys and northern Rathdrum Prairie.

The 2005 revised extent of the SVRP aquifer extends into the west part of Spirit Valley and the south part of Hoodoo Valley (fig. 2). Kahle and others (2005, p. 20) stated that

"In the Hoodoo Valley, historical water-level elevations indicated that a water-table divide was between Edgemere and Harlem (Walker, 1964). Ground water north of the divide moved northward toward the Pend Oreille River; ground water south of the divide moved southward toward Athol. In Spirit Valley, the ground-water divide was near Blanchard Lake (Parlman and others, 1980). West of the divide, ground water flows northwestward toward the Pend Oreille River; east of the divide, ground water flows southeastward into the main body of the SVRP aquifer."

An examination of recent water-level data and drillers' reports indicates that the previous characterization is subject to uncertainty. During the synoptic water-level measurements of September 2004 (Campbell, 2005), water levels in wells 262 and 263, at the south end of Hoodoo Valley, were several feet higher than water levels in wells 260 and 261, which are farther to the north (fig. 2, table 1). These water levels indicate that ground water flows to the north (away from northern Rathdrum Prairie) in almost the entire length of Hoodoo Valley. In Spirit Valley, water levels were measured at only one well (well 267) during September 2004. However, a search of the USGS ground-water database produced several water-level measurements for wells in the valley during the late summer of 1998 and 1999. Water levels in wells S-1, S-2, and 267 (fig. 2, table 1) indicate that the ground water flows away from the Rathdrum Prairie in almost the entire length of Spirit Valley.

Table 1. Water levels in wells in and near Spirit and Hoodoo Valleys, Bonner County, Idaho.

[Well No.: Location of wells is shown in figure 2. Abbreviations: NAVD 88, North American Vertical Datum of 1988]

Well No.	Well name	U.S. Geological Survey site No.	Date of water-level measurement	Altitude of water level, in feet above NAVD 88
260	54N 04W 10BBA1	480300116492401	09-16-2004	2,148.52
261	54N 04W 10DCD1	480209116484201	09-16-2004	2,147.45
262	54N 04W 19BCD1	480051116532101	09-16-2004	2,158.17
263	54N 04W 29ABC1	480015116512901	09-16-2004	2,151
264	54N 04W 30BAB1	480021116531201	09-16-2004	2,044.18
266	54N 04W 31BCB1	475849116521601	09-16-2004	2,035.78
S-1	54N 05W 23DBA1	480046116552201	09-15-1999	2,214
267	54N 05W 22ACA1	480101116563601	08-06-1998	2,190
S-2	54N 05W 18AAA1	480207117001401	09-23-1998	2,185
			09-20-1999	2,189

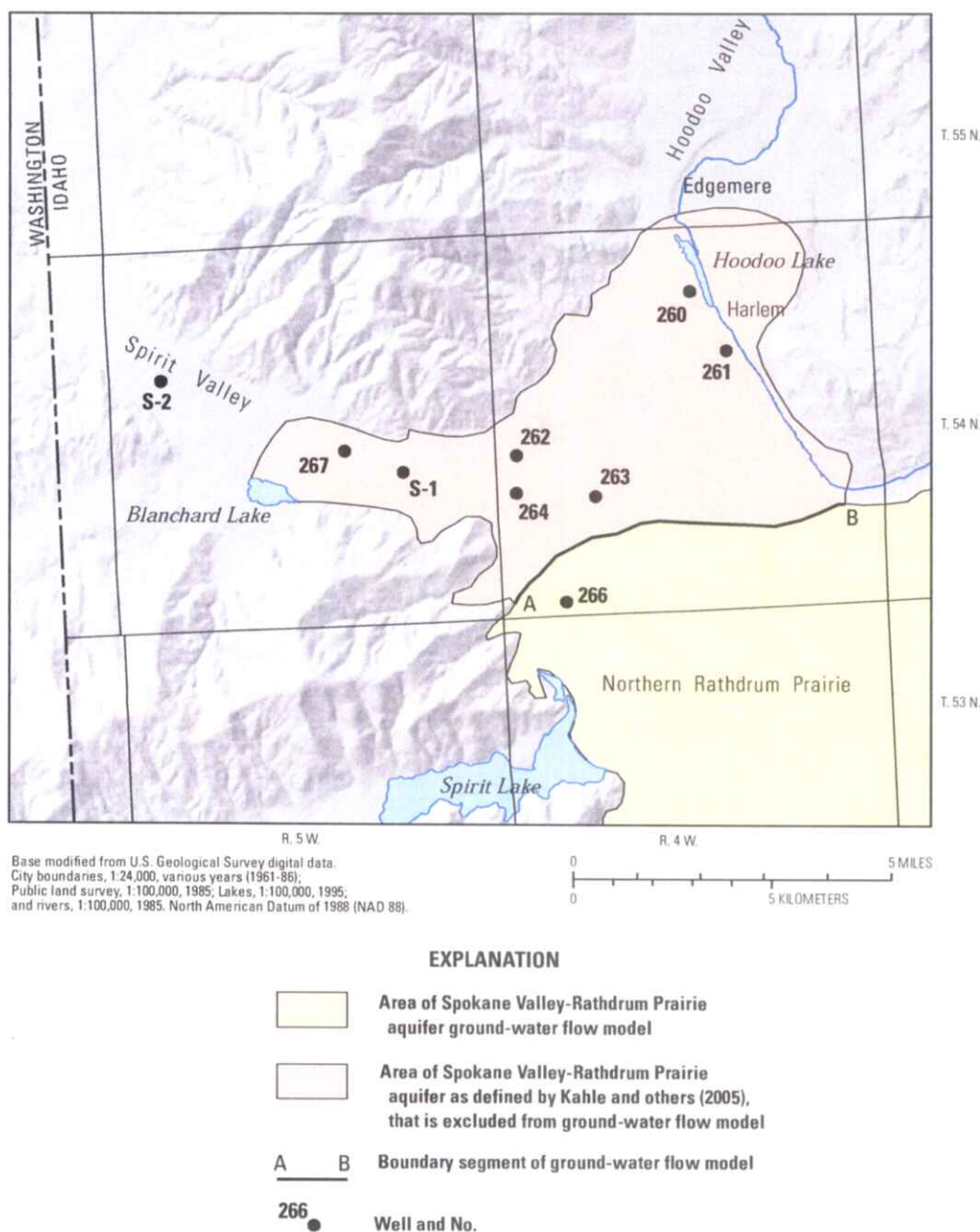


Figure 2. Locations of wells in and near Spirit and Hoodoo Valleys, Bonner County, Idaho.

The synoptic water-level measurements of September 2004 (Campbell, 2005) also show a water-level difference of about 100 ft over a relatively short distance of about 1 mi from the south end of Hoodoo Valley to northern Rathdrum Prairie. Water levels in wells 262 and 263 were 2,158.17 and 2,151 ft, respectively. Water levels in wells 264 and 266 were 2,044.18 and 2,035.78 ft, respectively. Drillers' reports for T. 54 N., R. 4 W. and the north half of T. 53 N., R. 4 W. show a similar

water-level difference from the south end of Hoodoo Valley to northern Rathdrum Prairie. The relatively large water-level difference over a relatively short distance can indicate the presence of a low hydraulic conductivity barrier resulting in a poor hydraulic connection between Hoodoo Valley and northern Rathdrum Prairie. However, although clay layers are noted in some drillers' reports for the area, conclusive evidence of a low hydraulic conductivity barrier is lacking.

Considered together, available data indicate uncertainty in ground-water flow directions in Spirit and Hoodoo Valleys and in the degree of hydraulic connection between those valleys and northern Rathdrum Prairie. Because of this uncertainty, the model in this report terminates at boundary segment A-B (fig. 2) and does not extend into Spirit and Hoodoo Valleys. If ground-water inflow from these valleys to northern Rathdrum Prairie does occur, the inflow is assumed to be negligible. During model calibration, the uncertainty in ground-water inflow from Spirit and Hoodoo Valleys is treated by assuming different inflow values along boundary segment A-B.

In addition to Spirit and Hoodoo Valleys, three areas in the 2005 revised extent are excluded from the model (fig. 1). The first excluded area is on the east side of northern Rathdrum Prairie. Hydrogeologic sections *L-L'* and *O-O'* in Kahle and Bartolino (2007, pl. 2) indicate that bedrock is close

to land surface in this area and the aquifer sediments likely are unsaturated. The second and third excluded areas are two narrow zones that border Five Mile Prairie and the subsurface bedrock ridge that extends from the prairie toward the south. The aquifer sediments in the two narrow zones likely also are unsaturated as they lie on the slope of the basalt that outcrops to form Five Mile Prairie.

Vertical Extent

The sediments of the SVRP aquifer extend from land surface downward to either bedrock or the Latah Formation, which is composed predominantly of lacustrine and fluvial deposits of siltstone, claystone, and minor sandstone. The altitude of the base of the aquifer as determined by Kahle and Bartolino (2007) is shown in figure 3. Sediment thickness

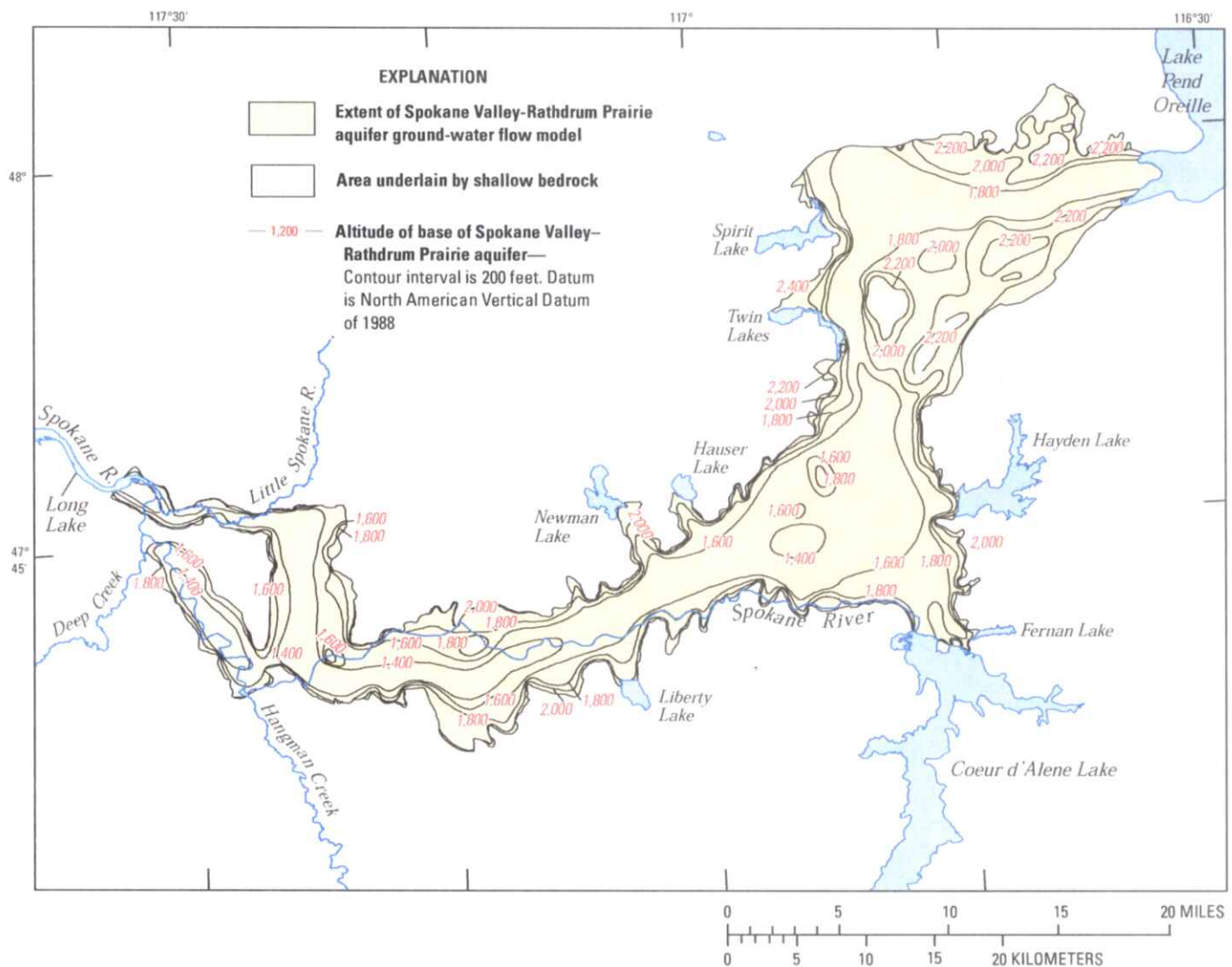


Figure 3. Approximate altitude of the base of the Spokane Valley-Rathdrum Prairie aquifer, Spokane County, Washington, and Bonner and Kootenai Counties, Idaho.

(from land surface to the base of the aquifer) is largest in the central part of the aquifer and thins to zero at the aquifer perimeter. The maximum sediment thickness is about 800 ft in northern Rathdrum Prairie, 500 ft near the Washington-Idaho State line, and 700 ft in Hillyard Trough. However, the saturated thickness (from the water table to the base of the aquifer) can be substantially less than the sediment thickness. For example, in northern Rathdrum Prairie, the depth from the land surface to the water table can exceed 500 ft, and the maximum saturated thickness is between 200 and 300 ft. In the area underlain by shallow bedrock (fig. 3) the saturated zone likely is a thin veneer overlying the bedrock or is entirely absent.

The SVRP aquifer is considered to be a single hydrogeologic unit except in Hillyard Trough and the Little Spokane River Arm. In those areas, a continuous clay layer divides the aquifer into an upper unconfined unit and a lower confined unit. Kahle and Bartolino (2007) characterize this clay layer as a "fine-grained layer." However, the term "clay layer" is used in this report to emphasize the low-permeability character of the layer. The areal extent of the clay layer as mapped by Kahle and Bartolino (2007) is shown in figure 4.

The vertical extent of the clay layer is shown in hydrogeologic section C-C' in figure 5. According to Kahle and Bartolino (2007), the average thickness of the clay layer is 215 ft in Hillyard Trough and 130 ft in the Little Spokane River Arm. In Hillyard Trough, the altitude of the top of the clay layer is between 1,660 and 1,720 ft. In the Little Spokane River Arm, the altitude of the top of the clay layer is between 1,500 and 1,700 ft.

Hydraulic Properties

The SVRP aquifer is a highly productive aquifer. Wells in the aquifer yield as much as several thousand gallons per minute with relatively little drawdown. Many wells penetrate only the upper part (less than 100 ft) of the aquifer's saturated thickness. Kahle and others (2005, p. 19-20) noted that hydraulic conductivity of the aquifer sediments is at the upper end of values measured in the natural environment. However, the aquifer also contains local zones of less permeable, fine-grained sedimentary materials.

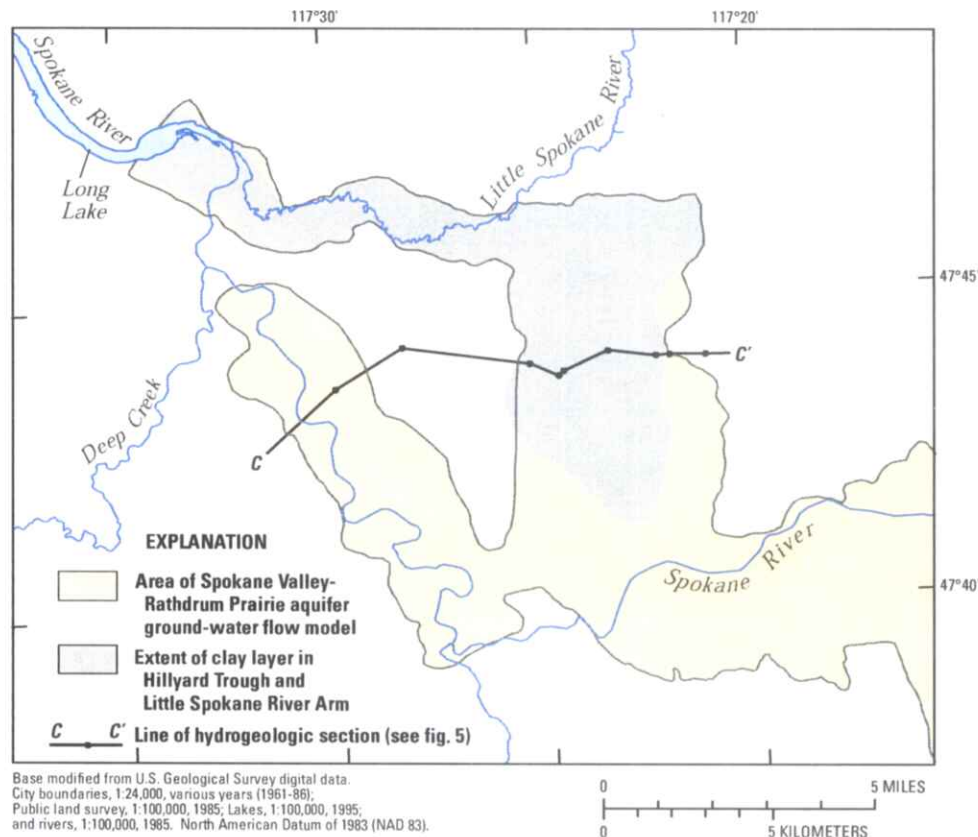


Figure 4. Areal extent of clay layer in Hillyard Trough and the Little Spokane River Arm, Spokane County, Washington.

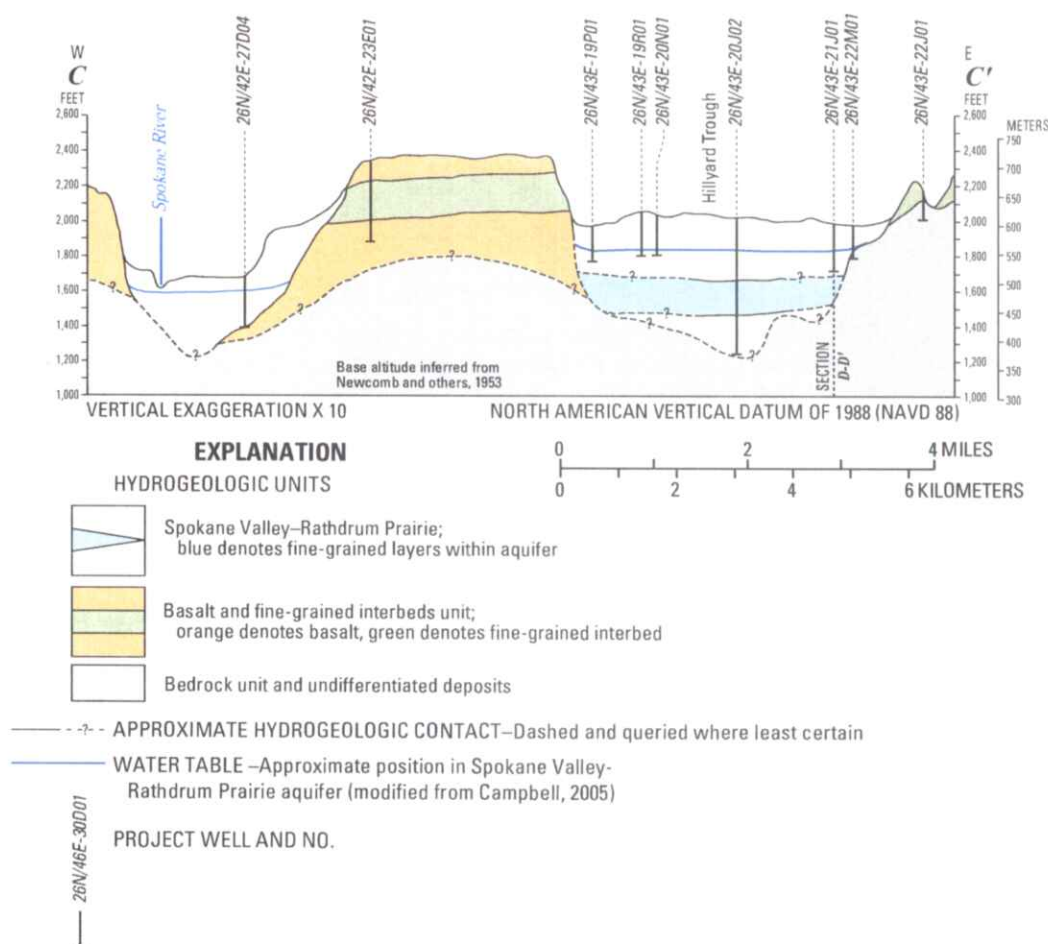


Figure 5. Generalized hydrogeologic section of the Spokane Valley-Rathdrum Prairie aquifer along hydrogeologic section C-C' (from Kahle and Bartolino, 2007).

Horizontal Hydraulic Conductivity

Multiple-well aquifer tests, specific-capacity data, and computer model analyses have been used in previous studies to estimate the horizontal hydraulic conductivity (K_h) of the SVRP aquifer. Aquifer tests and specific capacity data are more numerous in more populated regions of the SVRP aquifer—from the city of Spokane, Washington, on the west to Post Falls and Coeur d'Alene, Idaho, on the east. There is significantly less information on hydraulic properties in Rathdrum Prairie north of Post Falls and Coeur d'Alene.

Data for nine multiple-well aquifer tests conducted in the west half of the SVRP aquifer (fig. 6) are given by CH2M Hill

(1998, 2000). These data appear to be the only multiple-well aquifer-test data readily available from published sources. Estimated K_h values given in the reports range from 500 to 6,200 ft/d (CH2M Hill, 1998, p. 2-22 and tables 2-7; CH2M Hill, 2000, table E-2). However, analyses of the tests are complicated by the fact that the pumped and observation wells do not penetrate the entire thickness of the aquifer.

Specific capacity is the ratio of pumping rate to drawdown in a well after a given pumping duration. However, there is no commonly accepted pumping duration and it can be highly variable from one test to the next. Consequently, K_h values estimated from specific-capacity data are not as reliable as values estimated from multiple-well aquifer-test data.

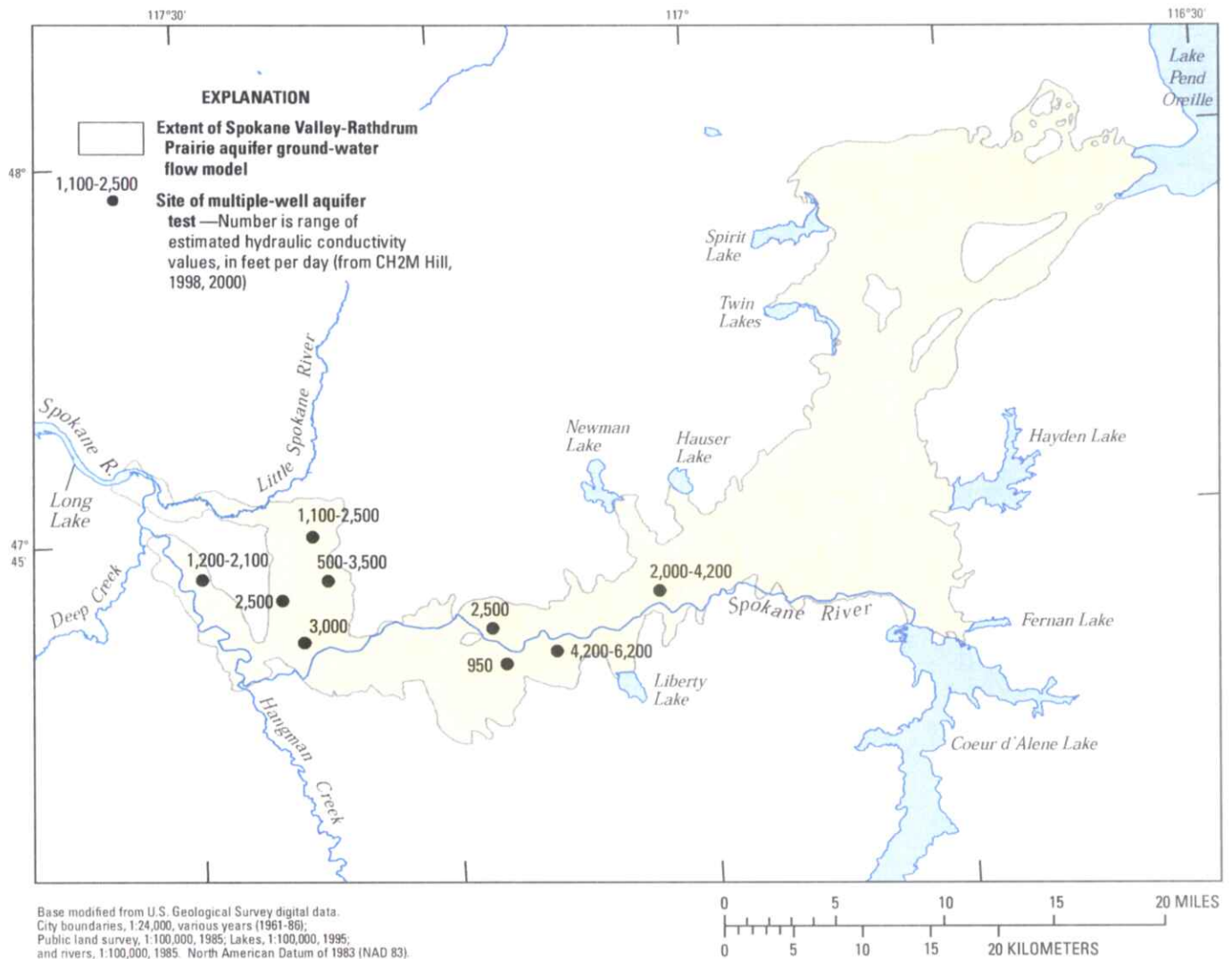


Figure 6. Locations of multiple-well aquifer-test sites in the west half of the Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

Sagstad (1977), Bolke and Vaccaro (1981), and CH2M Hill (1998) estimated K_h from single-well specific capacity data. Bolke and Vaccaro (1981, p. 18) indicated a decrease in K_h values in a westerly direction from the Post Falls area. They stated:

“The decrease in values in the down-valley direction is indicative of the change in valley-fill material, which, in general grades from coarse to fine in a westerly direction.”

The estimated K_h values given by Bolke and Vaccaro (1981) average about 6,000 ft/d in the Post Falls area, about 4,300 ft/d in Spokane Valley, about 2,600 ft/d near Spokane, and about 860 ft/d in Hillyard Trough and the Little Spokane River Arm.

CH2M Hill (1998, p. 2-24 and tables 2-8) indicated that K_h values estimated from analysis of 31 specific capacity tests range from 100 to 6,200 ft/d for the west half of the SVRP aquifer. The central 50 percent of the values range from 400 to 3,000 ft/d. However, CH2M Hill (1998) also noted that

“For many wells, including those closest to the State line, the computed transmissivities [horizontal hydraulic conductivity times saturated thickness] appear to underestimate the likely aquifer transmissivity because the wells pump at low rates or are shallow (for example, they penetrate only a very small fraction of the aquifer’s saturated thickness).”

In a hydrogeologic study of southern Rathdrum Prairie, Sagstad (1977, p. 39-40) analyzed specific-capacity data for 20 wells in the Post Falls area and 4 wells in the Coeur d'Alene area. The estimated K_h values given by Sagstad (1977) range from 250 to 2,100 ft/d in the Post Falls area and from 240 to 900 ft/d in the Coeur d'Alene area. Sagstad noted that

"Transmissive characteristics in the Post Falls area generally are higher than in the Coeur d'Alene area. Well logs show that greater percentages of coarse gravels, pebbles, and sands are present in the Post Falls area than in the Coeur d'Alene area."

This characterization is consistent with a steeper water-table gradient in the Coeur d'Alene area than in the Post Falls area, as shown by the ground-water level map of Campbell (2005).

Horizontal hydraulic conductivity values used in previous computer models generally were higher than values estimated from multiple-well aquifer tests and specific-capacity data. In the model by Bolke and Vaccaro (1981, p. 20), K_h values ranged from about 1,000 to 11,000 ft/d. These values result from an upward adjustment, by a factor of 1.9, of the initial values estimated from specific-capacity data. In the final model of CH2M Hill (2000, fig. J-4), K_h values ranged from 2,000 ft/d in northern Hillyard Trough to 7,000 ft/d at the Idaho-Washington State line. In the model by Golder Associates, Inc. (2004, fig. 6.8), K_h values ranged from about 260 ft/d in northern Hillyard Trough to about 57,000 ft/d at the Idaho-Washington State line.

The model by Buchanan (2000) is the only previous model that encompasses the entire SVRP aquifer. In that model, on the east side of the aquifer, a zone that has a K_h value of 11,000 ft/d extends from Lake Pend Oreille toward the west through northern Rathdrum Prairie and then toward the south through West Channel into southern Rathdrum Prairie. Lower K_h values (220 ft/d or less) are assigned to areas near the aquifer perimeter and in side valleys. This characterization is consistent with the steeper water-table gradients in side valleys in which Hauser, Hayden, Newman, and Spirit Lakes are located (see water-level map of Campbell, 2005). On the west side of the aquifer, K_h values are similar to those in the CH2M Hill (2000) model.

Considered together, available data indicate that K_h values in the central part of the SVRP aquifer range from about 1,000 ft/d to several tens of thousands of feet per day. In Hillyard Trough and in the vicinity of Coeur d'Alene, K_h values appear to be near the low end of the range. Near the aquifer perimeter and in side valleys, K_h values might be a few hundred feet per day or less.

Vertical Hydraulic Conductivity

Few field-measured vertical hydraulic conductivity (K_v) data were available for the SVRP aquifer and for the clay layer that separates the upper and lower aquifer units in Hillyard

Trough and the Little Spokane River Arm. In the models by CH2M Hill (1998, 2000) and Golder Associates, Inc. (2004), the ratio of K_h to K_v in the aquifer was assumed to be 10:1 and 3:1, respectively. The report by Golder Associates, Inc. (2003, p. 5-24) refers to an aquifer test conducted near the Colbert Landfill (about 10 mi north of Spokane) where a clay layer separates an upper aquifer from a lower aquifer. Both the clay layer in Hillyard Trough and the clay layer near the Colbert Landfill are believed to have been deposited within a glacial lake environment. Golder Associates, Inc. (2003, p. 5-24) noted that

"During pump tests at wells near the Colbert Landfill (Landau Associates, 1991) no response in the upper sands and gravels was observed during pumping from the lower sands and gravels, indicating that the glacial lake sediments act as a vertical hydraulic barrier between the upper and lower sand and gravel units in this area."

However, it is uncertain if this characterization also applies to the clay layer in Hillyard Trough and the Little Spokane River Arm.

Specific Yield

Few field-measured specific yield (S_y) data were available for the SVRP aquifer. In the model by Bolke and Vaccaro (1981), S_y values initially were estimated from published tables that relate S_y to grain size and subsequently adjusted during model calibration. Values of S_y in the calibrated model ranged from about 0.1 to 0.2. In the model by Golder Associates, Inc. (2004, fig. 6-8), a similar procedure yielded S_y values that ranged from 0.125 to 0.3. The models by CH2M Hill (1998, 2000) and Buchanan (2000) do not consider S_y because those models assume steady-state flow conditions.

Inflows to Aquifer

Inflows to the SVRP aquifer include (1) recharge from precipitation, (2) inflows from tributary basins and adjacent uplands, (3) subsurface seepage and surface overflows from lakes that border the aquifer, (4) flow from losing segments of the Spokane River to the aquifer, (5) return percolation from irrigation, and (6) effluent from septic systems. For the ground-water flow model in this report, monthly inflows were estimated for October 1990 through September 2005. Areally distributed inflow components, such as recharge from precipitation, are computed on a raster grid with a cell size of 1,320 by 1,320 ft. To facilitate preparation of model input data, the raster grid is aligned with the finite-difference grid used in the model.

Precipitation

Recharge from precipitation refers to that part of precipitation that infiltrates into the subsurface and percolates downward to reach the water table. Precipitation can enter the subsurface by falling on a permeable surface and infiltrating into the ground or falling on an impermeable (paved) surface and running off to a recharge ("dry") well, an infiltration basin, or an adjacent permeable surface. In both cases, part of the precipitation is consumed by evapotranspiration, either on land surface or as the water percolates through the root zone (typically, the top several feet of subsurface). The water that percolates below the root zone is referred to as deep percolation. The assumption is that evapotranspiration does not occur below the root zone, and water that becomes deep percolation eventually reaches the water table.

If precipitation falls on a permeable surface within the SVRP aquifer, the entire amount of precipitation is assumed to enter the ground and there is no overland runoff. This assumption is reasonable for the SVRP aquifer because the aquifer material is highly permeable. The monthly rate of deep percolation resulting from precipitation on a permeable surface is denoted by D_p and is expressed in units of length over time—for example, inches per month.

To estimate D_p , the FAO Penman-Monteith method developed by Allen and others (1998) was used to estimate evapotranspiration. Bartolino (2007) used the method to estimate daily evapotranspiration for 1990–2005 at six weather stations in the vicinity of the model area (fig. 7). Daily deep percolation at each weather station was determined from a daily soil-moisture balance calculation (Bartolino, 2007, p. 11, eq. 19). The daily deep percolation values then were aggregated over each month to determine the D_p value for each weather station.

The areal distribution of D_p is estimated by linearly interpolating the D_p values for the six weather stations. To perform the interpolation, an initial triangular network is constructed using the six weather stations as vertices. However, this initial network does not encompass the full extent of the model. Therefore, three auxiliary vertices are added to expand the network (fig. 7). The D_p at an auxiliary vertex is set equal to the D_p at the closest weather station. For any point within the expanded network, D_p is interpolated linearly from the D_p values for the three vertices of the triangle containing the point.

If precipitation falls on an impermeable surface and then runs off to a recharge well, an infiltration basin, or an adjacent permeable surface, the assumption is that 15 percent of the runoff is consumed by evapotranspiration and the remaining 85 percent becomes deep percolation. Because infiltration is focused into the recharge well, infiltration basin, or along the edges of the adjacent permeable surface, loss to

evapotranspiration probably is relatively low. The monthly rate of deep percolation resulting from precipitation on an impermeable surface is denoted by D_i .

Two data sets are used to estimate the areal distribution of D_i . The first contains values for the amount of impermeable surface in the model area, and the second contains values for precipitation throughout the model area. The amount of impermeable surface is estimated from aerial photographs and National Land-Cover Data (<http://erg.usgs.gov/isb/pubs/factsheets/fs10800.html>) for four periods: 1990–95, 1996–99, 2000–02, and 2002–05. Within each period, the amount of impermeable surface is assumed to remain constant in time. Precipitation throughout the model area is obtained from PRISM-derived data. PRISM is an acronym for "Parameter-elevation Regressions on Independent Slopes Model" and was developed by the Oregon Climate Service of Oregon State University (<http://www.ocs.orst.edu/prism/products/>). PRISM uses point data, a digital elevation model, and other spatial data sets to generate gridded estimates of several spatial and temporal climatic parameters, including precipitation.

The areal distribution of D_i is calculated on a raster grid with a cell size of 1,320 by 1,320 ft. For each cell in the grid, D_i is calculated as

$$D_i = P \times f_i \times 0.85, \quad (1)$$

where

P is the monthly precipitation rate, and
 f_i is the fraction of the cell's surface area that is impermeable.

Runoff from impermeable surfaces in certain parts of Spokane and Coeur d'Alene where the runoff is routed into a sewer overflow system that discharges to the Spokane River was excluded from the calculation.

Combining D_p and D_i , the monthly rate of deep percolation (D) at a cell is calculated as

$$D = (1 - f_i) D_p + D_i. \quad (2)$$

Note that for any given month, D is the downward flux at the base of the root zone. This downward infiltration must travel through the unsaturated zone to reach the water table. According to unsaturated flow theory, the transmission time of an infiltration front to a given depth depends on the prevailing moisture conditions in the unsaturated zone. In this study, a simple approximation is adopted in which the traveltime to the water table is linearly related to the depth of the water table.

To estimate the transmission time to the water table, water levels recorded at well 251 are compared to the monthly rates of deep percolation (D) for the well site (fig. 8). Well 251 is selected for analysis because the water level in the well is

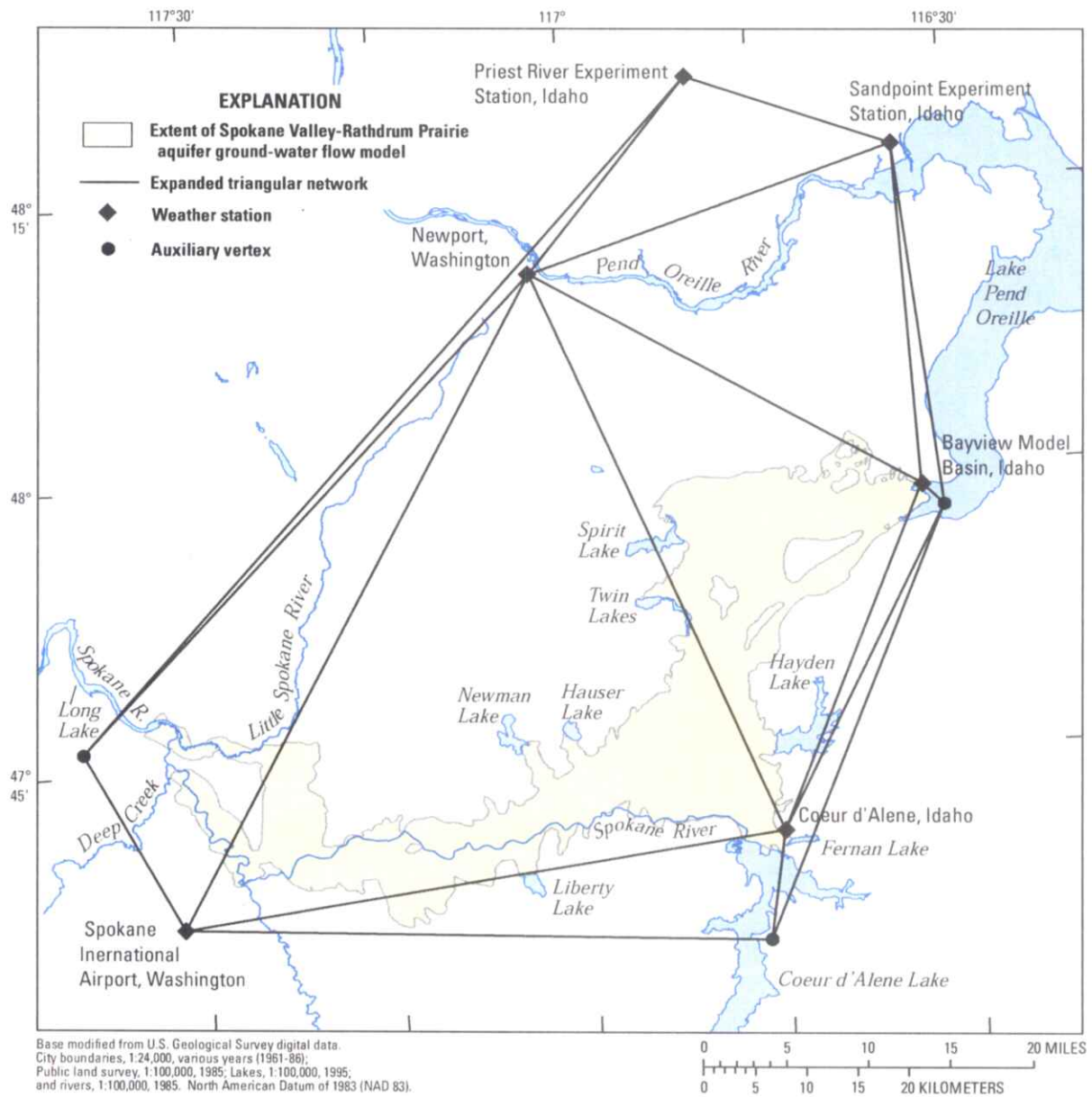


Figure 7. Locations of weather stations, auxiliary vertices, and expanded triangular network used for interpolation of recharge from precipitation on permeable surfaces, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

about 400 ft below land surface and the well has a long period of record. For each water year during which the hydrograph peak and trough are not masked by the long-term trend, the point of steepest water-level rise, assumed to be approximately halfway between the trough and the peak, is indicated by a triangle on the graph. The time of steepest water-level rise is assumed to correspond to the time of greatest recharge at the water table. The steepest water level rise typically occurs

around May (fig. 8). However, deep percolation at the base of the root zone is greatest around the preceding December or early January. This observation indicates a transmission time of about 5 months is needed for precipitation infiltration to reach the water table at a depth of about 400 ft. The estimated transmission time to reach the water table at different depths, based on linearly prorating the transmission time to the depth of 400 ft, is shown in table 2.

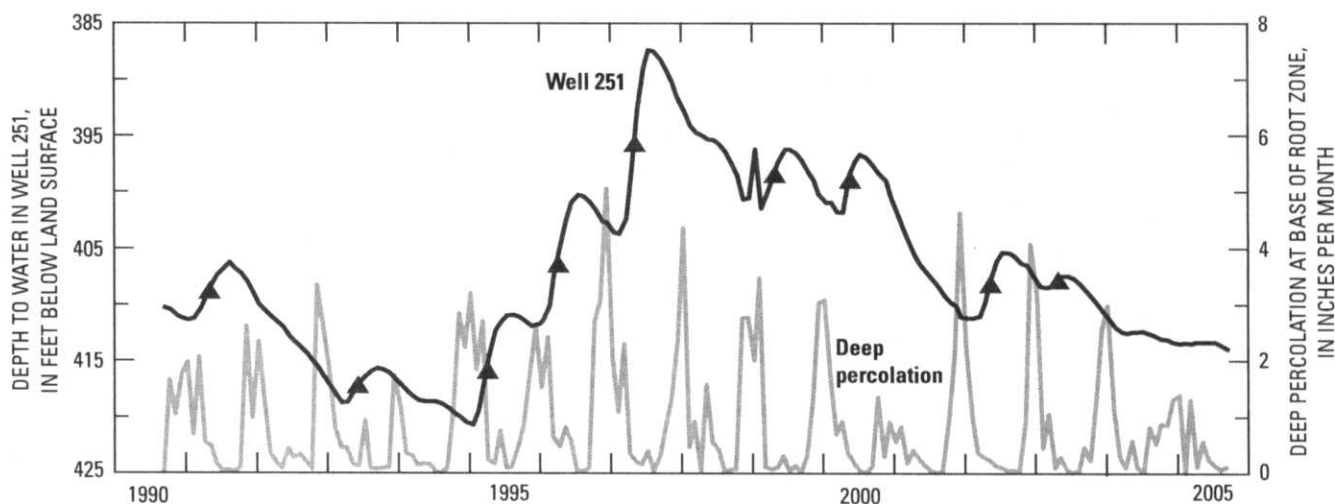


Figure 8. Depth to water in well 251 and monthly rate of deep percolation at the base of the root zone at the well site, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

Table 2. Estimated transmission time for precipitation infiltration to travel from base of root zone to water table, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

Depth from land surface to water table (feet)	Transmission time (months)
0 - 40	0
40 - 120	1
120 - 200	2
200 - 280	3
280 - 360	4
360 - 440	5

The monthly volumetric rate of recharge (in cubic feet per second) from precipitation to the (1) Idaho side of the SVRP aquifer model, (2) Washington side of the model, and (3) entire model is shown in [figure 9](#). The volumetric rate of recharge from precipitation is lower on the Washington side than on the Idaho side. Also, the recharge peaks earlier on the Washington side than on the Idaho side, because the water table generally is at a shallower depth on the Washington side than on the Idaho side.

The average volumetric rate of recharge and the average recharge flux from October 1990 through September 2005 is shown in [table 3](#). For the entire model, the average volumetric rate of recharge from precipitation is 228 ft³/s. The average volumetric rate of recharge on the Idaho side of the model is

about twice that on the Washington side. The average recharge flux is calculated as the average volumetric rate divided by the surface area. Although precipitation generally is higher on the Idaho side of the model than on the Washington side, the recharge flux is about the same on both sides. This is because a higher percentage of precipitation enters the subsurface through recharge wells and infiltration basins on the Washington side than on the Idaho side. Infiltration through recharge wells and infiltration basins generally is subject to less evapotranspiration loss than infiltration through permeable surfaces.

Table 3. Average volumetric rate of recharge and average recharge flux from precipitation, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho, October 1990 through September 2005.

[Volumetric rate of recharge: PS, recharge from precipitation on permeable surface; IS, Recharge from precipitation runoff from impermeable surface to recharge well, infiltration basin, or adjacent permeable surface; Abbreviations: ft³/s, cubic foot per second; mi², square mile; in/yr, inch per year; ft/d, foot per day]

Region	Volumetric rate of recharge (ft ³ /s)			Surface area (mi ²)	Recharge flux	
	PS	IS	Total		(in/yr)	(ft/d)
Idaho side	133	22	155	211	10.0	0.0023
Washington side	43	30	73	115	8.6	.0020
Entire model	176	52	228	326	9.5	.0022

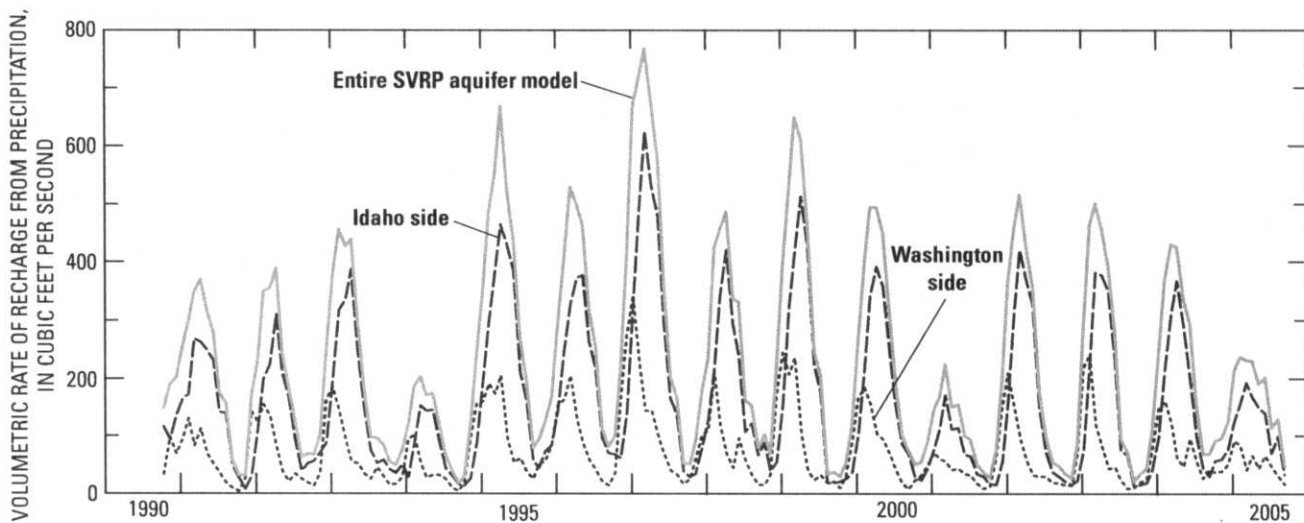


Figure 9. Volumetric rate of recharge from precipitation, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

Tributary Basins and Adjacent Uplands

The SVRP aquifer receives flow from higher altitude regions immediately adjacent to the aquifer. These regions are referred to as tributary basins and adjacent uplands or simply as tributary basins. A tributary basin might drain directly into the aquifer or drain into a lake that, in turn, recharges the aquifer. Tributary basins that drain directly to the aquifer are shown in figure 10. Recharge from these basins to the aquifer is estimated in this section of the report. Tributary basins that drain into seven of the nine lakes that border the aquifer are shown in figure 10—Lake Pend Oreille and Coeur d'Alene Lake are not included. Recharge from the lakes to the aquifer is estimated in section, "Lakebed Seepage and Surface Overflows."

Flow from tributary basins to the SVRP aquifer is estimated using regional regression equations developed by Hortness and Berenbrock (2001). These regression equations are developed for Idaho and parts of adjacent States to estimate the mean annual discharge at ungaged sites on streams that are unaffected by regulations and (or) diversions. The methodology uses the USGS StreamStats web application (Ries and others, 2004) and the ArcGIS-ArcHydro application developed by Environmental Systems Research Institute, Inc. Both tools make use of the same techniques and underlying data sets. In the following discussion, this methodology is referred to as StreamStats. The estimation of tributary basin discharge to the aquifer was performed by Jon Hortness and is included in the report by Kahle and Bartolino (2007).

The regression equations in StreamStats are developed by relating the mean annual discharge values for long-term gaging stations to various physical and climatic characteristics (basin characteristics) of the upstream drainage basin. For a gaged site, the mean annual discharge is the average of all annual discharges in the data record or during a specific period of years. For an ungaged site, the estimated mean annual discharge is a long-term average for a time period that is comparable to the length of record used to develop the regression equations. Typically, the data record spans tens of years.

To apply StreamStats, 72 tributary basin outlet points are selected along the model boundary (fig. 10). For each outlet point, the upstream drainage basin is delineated. The combination of all delineated basins encompasses most of the surrounding uplands that drain into the SVRP aquifer. Small gaps between adjacent basins are not included. For each delineated basin, StreamStats is used to estimate the mean annual discharge at the outlet point. Because bedrock occurs either at the basin surface or under a thin layer of soil, the assumption is that minimal subsurface discharge occurs at the outlet. Therefore, stream discharge accounts for nearly all discharge from the basin. However, as the stream crosses from the tributary basin onto the aquifer, all stream water quickly soaks into the ground because of the highly permeable nature of the aquifer material.

The 72 tributary basins range in area from 0.3 to 24 mi². The estimated mean annual discharge ranges from 0.0037 to 15 ft³/s, and the sum of the mean annual discharges of all 72

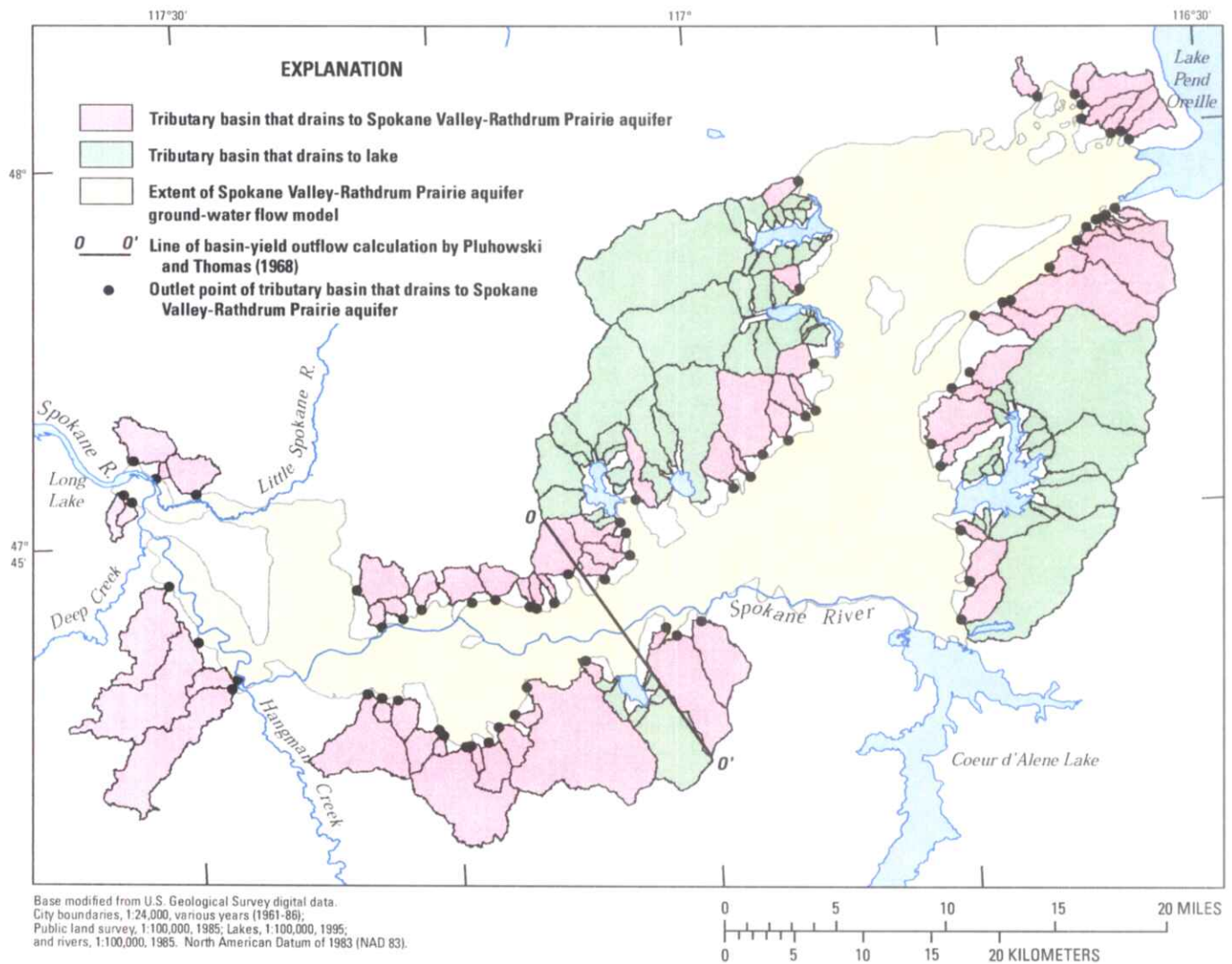


Figure 10. Tributary basins that drain to the Spokane Valley-Rathdrum Prairie aquifer and to seven lakes that border the aquifer, Washington and Idaho.

tributary basins is 112 ft³/s. StreamStats also provides error statistics on the estimated discharge values. Typically, the 67-percent confidence interval ranges from 0.4 to 1.6 times the estimated value. An assessment of the StreamStats estimates is included in the section, "Lakebed Seepage and Surface Overflow."

The mean annual discharge estimated by StreamStats is the long-term average flow from a tributary basin to the SVRP aquifer. For a particular month, the flow from the tributary basin is higher or lower than the long-term average value. To

allow for temporal (monthly) variability in flow, a scaling index is used to convert the long-term average flow into the flow for a particular month. In this study, monthly flow on the Little Spokane River at the gaging station at Dartford, Washington, is assumed to be an appropriate scaling index. Because the tributary basins that drain to the Little Spokane River are in close proximity to the tributary basins that drain to the aquifer, these two sets of basins likely share similar physical and climatic characteristics.

The monthly flow from a tributary basin to the SVRP aquifer is estimated as

$$Q_m = Q_a \times \frac{L_m}{L_a}, \quad (3)$$

where

- Q_m is the flow from the tributary basin for a given month,
- Q_a is the long-term average flow (mean annual discharge) estimated by StreamStats for the tributary basin,
- L_m is the corresponding flow on the Little Spokane River at the gaging station at Dartford for the given month, and
- L_a is the long-term average flow on the Little Spokane River at the gaging station at Dartford.

The scaling index (L_m / L_a) for each month from October 1990 to September 2005 is shown in [figure 11](#). The long-term average flow at the gaging station at Dartford is computed using discharge data for 1960–2000.

Lakebed Seepage and Surface Overflow

The SVRP aquifer is recharged by lakes that border the aquifer. Of the nine lakes along the perimeter of the model area, only the two largest lakes (Lake Pend Oreille and Coeur d'Alene Lake) have perennial outlet streams. For the seven smaller lakes, outflow occurs as subsurface seepage through the lakebed and occasional surface overflow when the lake level rises above the outlet structure. Because of the highly permeable nature of the aquifer material, the surface overflow soaks into the ground within a short distance of the lake. Therefore, the combined outflow from subsurface lakebed seepage and surface overflow is the amount of recharge from the seven smaller lakes to the aquifer.

In principle, the outflow from a lake can be estimated by the following water-balance equation:

$$O_L = I_L + P_L - E_L - S_L, \quad (4)$$

where

- O_L is rate of outflow from the lake,
- I_L is the rate of inflow to the lake from the surrounding tributary basins,
- P_L is the rate of direct precipitation on the lake surface,
- E_L is the rate of evaporation from the lake, and
- S_L is the rate of change in storage in the lake.

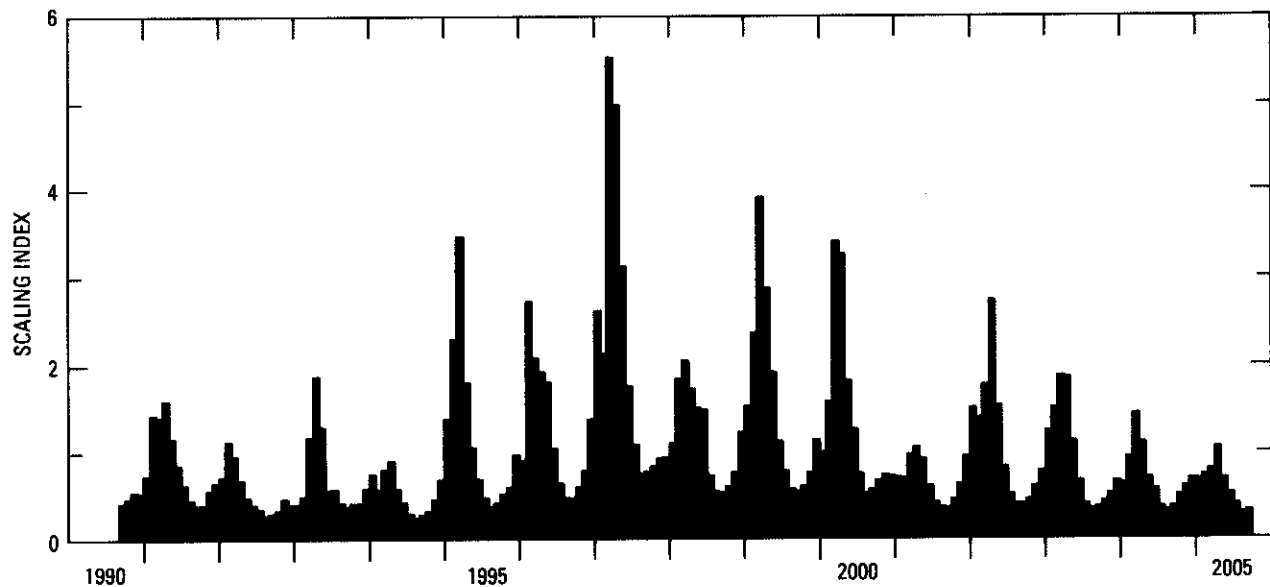


Figure 11. Scaling index used to compute monthly flow from tributary basins to the Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

Murray (2007) evaluated the terms on the right-hand side of equation 4 for Hayden Lake on a monthly basis from 1998 through 2005. She noted that $P_L - E_L - S_L$ typically is a small percentage of I_L . Therefore, monthly outflow from the lake can be approximated reasonably by the monthly inflow from surrounding tributary basins. This approximation is assumed to be applicable to the seven smaller lakes along the perimeter of the model area (that is, excluding Lake Pend Oreille and Coeur d'Alene Lake).

Murray (2007) estimated inflows to the seven lakes using the same procedure as that used to estimate flow from tributary basins to the SVRP aquifer. For each lake, outlet points are placed along the lake perimeter. For each outlet point, the upstream tributary basin is delineated (fig. 10) and StreamStats is used to estimate the mean annual discharge. The sum of the mean annual discharges for the surrounding tributary basins is the long-term average inflow to the lake (table 4). Finally, the monthly inflow to the lake is estimated by multiplying the long-term average inflow by the scaling index (L_m / L_n) in the same manner as that used to estimate monthly flow from a tributary basin to the aquifer (eq. 3). Assuming monthly inflow to the lake equals monthly outflow from the lake, the long-term average inflow to the lake times the scaling index is the monthly flow from the lake to the aquifer.

An assessment of the StreamStats methodology can be made by comparing the StreamStats estimates with basin water yields calculated by previous investigators. Pluhowski and Thomas (1968) estimated the water yield of the Rathdrum Prairie Basin, defined as all areas upstream of a north-northwest to south-southeast line drawn at the gaging station on the Spokane River near Otis Orchards (see line $O-O'$ in fig. 10). For this basin, they estimated a water yield of 530 ft³/s. When expressed in terms of the flow components used

in this study, this basin water yield represents the sum of (1) recharge from precipitation to that part of the SVRP aquifer upstream of line $O-O'$, (2) inflows from all tributary basins to that part of the aquifer upstream of line $O-O'$, and (3) inflows to the aquifer from Fernan, Hauser, Hayden, Newman, Spirit, and Twin Lakes. The second and third items are estimated by StreamStats. For the period of study (1990–2005), the average values of the three items are 165, 86, and 294 ft³/s, respectively, which sum to 545 ft³/s. Although this sum is somewhat higher than Pluhowski and Thomas's (1968) basin water yield of 530 ft³/s, especially because Pluhowski and Thomas's Rathdrum Prairie Basin includes Spirit Valley, which is excluded from the model extent in this study, the comparison does indicate that the StreamStats estimates used in this study are consistent with basin water yields calculated by previous investigators.

For Lake Pend Oreille and Coeur d'Alene Lake, a large part of the lake inflow is discharged to the outlet stream. By comparison, lakebed seepage is a relatively small quantity. Therefore, estimating lakebed seepage by a water-balance calculation for the lake might lead to results that are highly uncertain. Nonetheless, previous investigators have made water-balance calculations for Coeur d'Alene Lake. Seepage from Coeur d'Alene Lake often is estimated in combination with seepage from the segment of the Spokane River upstream of the gaging station near Post Falls. In a study of ground-water inflow to the Rathdrum Prairie, Anderson (1951, p. 20–21) stated that

"Some ground water is believed to be derived from Coeur d'Alene Lake (and the Spokane River between the lake and Post Falls). Approximately three-fourths of the inflow to the lake is gaged and a comparison of estimated total inflow with total surface outflow plus evaporation indicates a seepage loss of about 300 second-feet to ground water."

However, given that the mean annual flow measured at the gaging station near Post Falls for 1913–2001 is about 6,200 ft³/s (Kahle and others, 2005, p. 41), the calculated seepage loss of 300 ft³/s would be within the error in the discharge measurements and is therefore highly uncertain.

Sagstad (1977) applied Darcy's Law to estimate recharge to the SVRP aquifer from Coeur d'Alene Lake and from the segment of the Spokane River upstream of the gaging station near Post Falls. The Darcy's Law calculation was performed for three sections, with flow across section C-C' (Sagstad 1977, fig. 13 and table 7) approximately representing seepage from Coeur d'Alene Lake. Using a hydraulic conductivity of 535 ft/d, a saturated thickness of 150 ft, and a water-table gradient of 0.00303, the flow across section C-C' was calculated to be 37 ft³/s.

Table 4. Drainage area and long-term average inflow to seven lakes that border the Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

[Abbreviations: mi², square mile; ft³/s, cubic foot per second]

Lake	Drainage area (mi ²)	Long-term average inflow (ft ³ /s)
Fernan Lake	18.8	12.9
Hauser Lake	18.3	17.4
Hayden Lake	51.6	62.0
Liberty Lake	11.3	4.9
Newman Lake	24.8	20.2
Spirit Lake	32.8	48.4
Twin Lakes	26.9	35.1

For Lake Pend Oreille, Pluhowski and Thomas (1968) estimated lakebed seepage by a water-balance calculation for the east (mostly Idaho) part of the SVRP aquifer. Their seepage estimate for Lake Pend Oreille is 50 ft³/s. However, they noted that because of uncertainties in various flow components, "the actual contribution to the aquifer from Pend Oreille Lake may be as much as 200 cfs."

Losing Segments of Spokane River

Losing segments of the Spokane River occur where the stream level is higher than the hydraulic head in the aquifer directly under the streambed. Along a losing segment, water seeps from the stream and recharges the aquifer. Consequently, there is less streamflow at the downstream end of a losing segment than at the upstream end of the segment. The amount of flow from the Spokane River to the SVRP aquifer is discussed in the section, "Interaction between Aquifer and Spokane River."

Return Percolation from Irrigation

Return percolation from irrigation refers to that part of applied irrigation water that is not consumed by evapotranspiration but instead percolates downward past the root zone and eventually reaches the water table. Irrigation includes landscape irrigation (such as lawn watering), agricultural irrigation, and golf course irrigation. For the period of study (1990–2005), nearly all irrigation water applied within the model area is derived from ground-water pumpage. Therefore, return percolation from irrigation actually is water that came from the aquifer.

To estimate water use for landscape irrigation, monthly ground-water withdrawals by water purveyors and by domestic users outside water purveyor service areas is divided into an indoor-use component and an outdoor-use component. For each year, during January, February, March, November, and December, the outdoor-use component is assumed to be zero. Therefore, ground-water withdrawal during those 5 months is entirely for indoor use. For April through October, the indoor-use component is assumed to be the average withdrawal during the aforementioned 5 months with no outdoor use. The outdoor-use component is any withdrawal in excess of the indoor-use component. The entire outdoor-use component is assumed to be for landscape irrigation. Based on studies by Oad and others (1997) and Dukes and others (2005), landscape irrigation efficiency is estimated to be 60 percent. Therefore, 40 percent of the outdoor-use component percolates back to the aquifer.

In a water purveyor service area, ground water is pumped from supply wells and distributed to users in the service area. Water purveyor service areas are delineated for four periods: 1990–95, 1996–99, 2000–02, and 2003–05. Within each period, service areas are assumed to remain unchanged. Water purveyor service areas during 2000–02 are shown in [figure 12](#). For each service area, return percolation is computed from pumpage records for supply wells in the entire service area (see section, "Withdrawals from Wells") and then distributed uniformly over the service area. For the City of Spokane, however, the service area southwest of the city ([fig. 12](#)) is excluded from the return percolation calculation as that area is relatively undeveloped and landscape irrigation is expected to be minimal. Outside water purveyor service areas, ground-water withdrawals are estimated on a cell-by-cell basis on a raster grid (see section, "Withdrawals from Wells"). Return percolation is applied to the same cell from which ground water is withdrawn.

For agricultural irrigation outside water purveyor service areas and for self-supplied golf courses, ground-water withdrawals are estimated from crop acreage, irrigation demand, and an assumed irrigation efficiency of 60 percent. Therefore, 40 percent of the pumped water is assumed to percolate back to the aquifer.

The monthly rate of return percolation from all types of irrigation for the entire model area is shown in [figure 13](#). From October 1990 through September 2005, the average rate of return percolation from irrigation is 54 ft³/s for the entire model area.

Effluent from Septic Systems

For a water user who discharges to a septic system, 95 percent of the indoor use is assumed to become effluent from septic systems that percolates back to the aquifer. For a water user who discharges to a sewer system, the assumption is that none of the indoor use returns to the aquifer. To determine the areal distribution of effluent from septic systems, a raster of sewer hookup density is constructed for each year from 1990 to 2005 using spatial data of city limits, sewer district boundaries, and density of sewer hook-ups within each sewer district. The sewer hookup density raster for 2000 is shown in [figure 14](#). For each cell in the raster, the sewer hookup density is the fraction of homes in the cell that are connected to a public sewer system. If the sewer hookup density is zero, the cell is not in a sewer district and all homes in the cell discharge to septic systems. In this case, 95 percent of the indoor water use within the cell is returned to the aquifer. If the sewer hookup density is 1, then the cell is within a sewer district

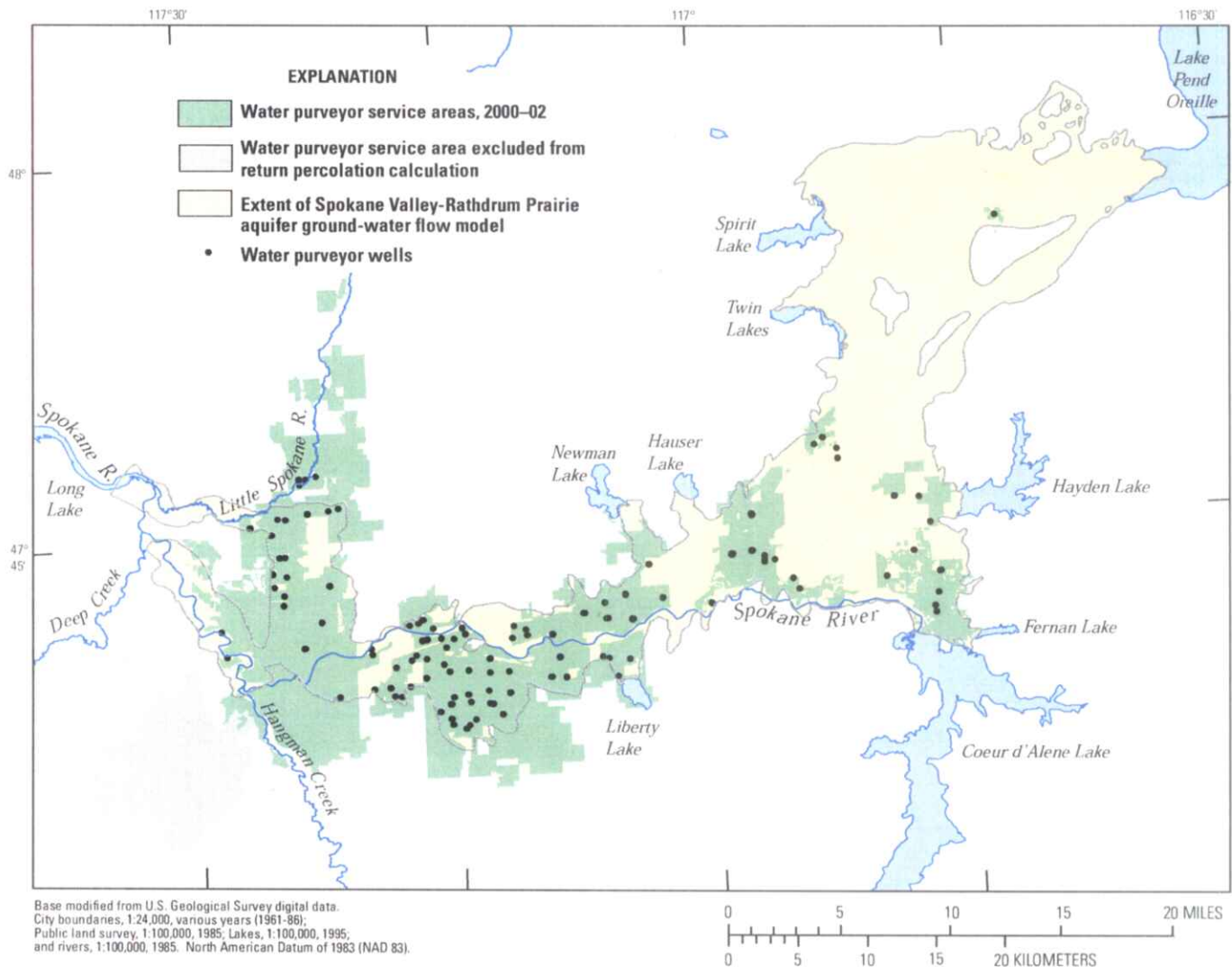


Figure 12. Water purveyor service areas and areal distribution of water purveyor wells, Spokane Valley-Rathdrum Prairie aquifer, 2000–02.

and all homes in the cell discharge to a sewer system. In this case, none of the indoor water use within the cell is returned to the aquifer. If the sewer hookup density is greater than zero but less than 1, then either the cell is partially within a sewer district or the cell is entirely within a sewer district but not all homes in the cell discharge to the sewer system. In this case, effluent from the septic system is $0.95(1 - d_s)$ times the indoor water use in the cell, where d_s is the sewer hookup density.

The monthly rate of effluent from septic systems for the entire model area is shown in [figure 13](#). The gradually declining rate is caused by expansion of sewer districts. From October 1990 through September 2005, the average rate of effluent from septic systems is $23 \text{ ft}^3/\text{s}$ for the entire model area.

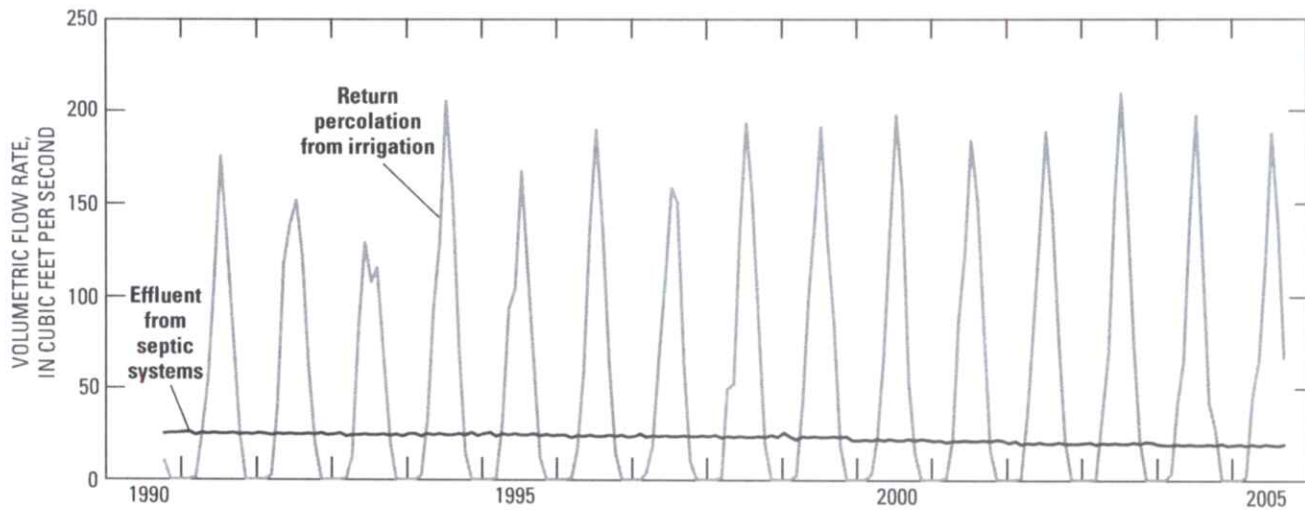


Figure 13. Volumetric rate of return percolation from irrigation and effluent from septic systems, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

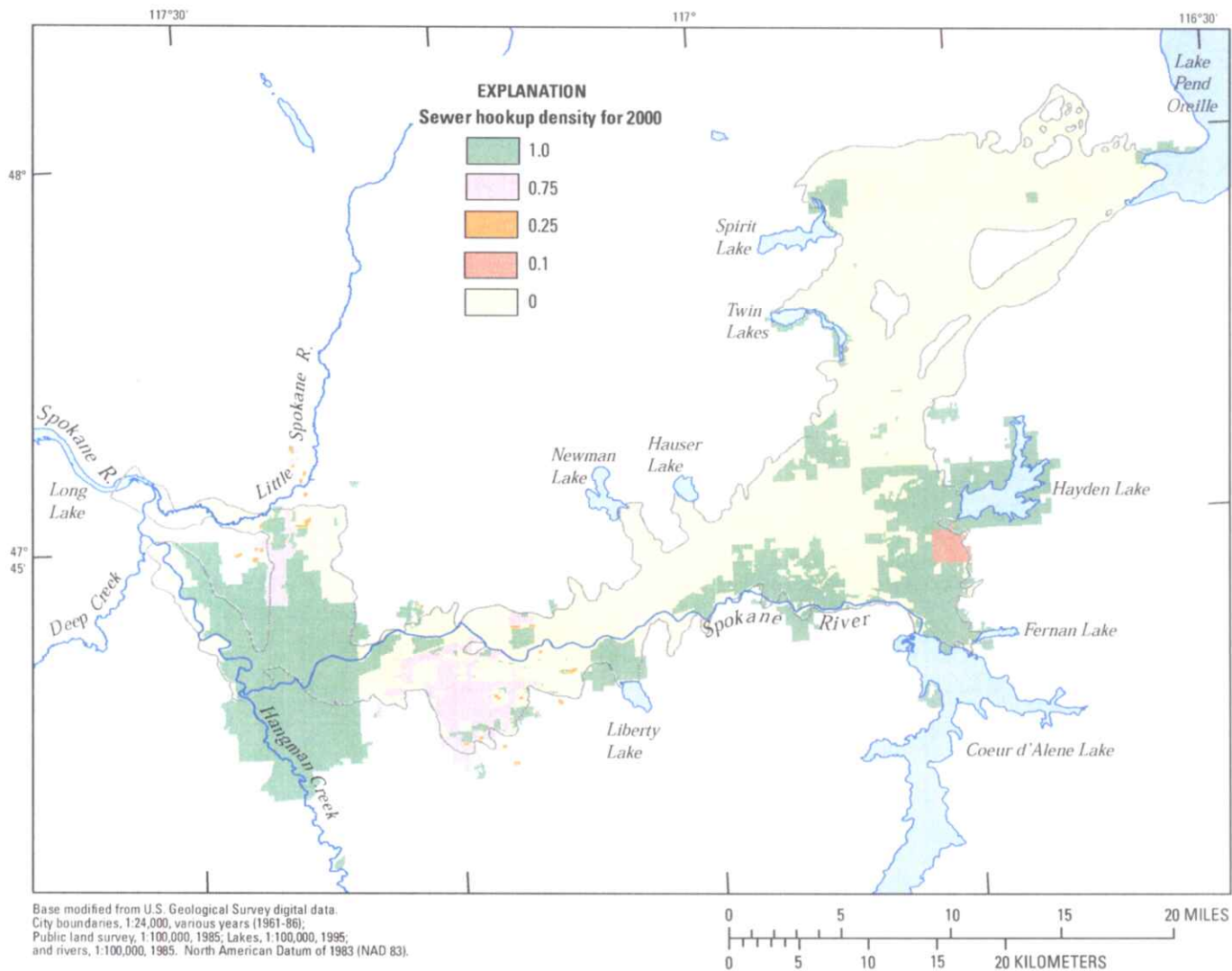


Figure 14. Sewer hookup density for 2000, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

Outflows from Aquifer

Outflows from the SVRP aquifer include (1) ground-water withdrawals from wells, (2) ground-water discharge from the aquifer to gaining segments of the Spokane River, (3) ground-water discharge from the aquifer to the Little Spokane River, and (4) subsurface outflow at the western limit of the model area near Long Lake. For the ground-water flow model in this report, monthly outflows were estimated for October 1990 through September 2005. Areally distributed outflow components were computed on a raster grid with a cell size of 1,320 by 1,320 ft that was aligned with the finite-difference grid used in the model.

Withdrawals from Wells

Withdrawals of ground water from the SVRP aquifer were estimated for four categories: (1) withdrawals by water purveyors, (2) withdrawals by domestic users outside water purveyor service areas, (3) withdrawals for agricultural irrigation outside water purveyor service areas and by self-

supplied golf courses, and (4) withdrawals by self-supplied industries. The combined monthly withdrawal rate for all four categories is shown in [figure 15](#). From October 1990 through September 2005, the average combined withdrawal rate is 317 ft³/s. Individual withdrawal rates for each category are discussed in the following paragraphs.

Data on withdrawals by water purveyors were obtained from 21 water purveyors in the model area for 1990–2005. This work was performed in conjunction with ongoing USGS water-use data collection (Molly Maupin, U.S. Geological Survey, written commun., 2006). The areal distribution of 159 water purveyor wells is shown in [figure 12](#). Monthly withdrawals were obtained for 125 of the 159 wells, and annual withdrawals were obtained for the other 34 wells. For wells with annual withdrawal data, monthly withdrawals are estimated by distributing the annual withdrawal to each month on the basis of the monthly pumping pattern of other wells operated by the same water purveyor or by another water purveyor serving a similar community. The estimated monthly withdrawal rate by all water purveyors is shown in [figure 15](#). From October 1990 through September 2005, the average withdrawal rate for this category is 205 ft³/s.

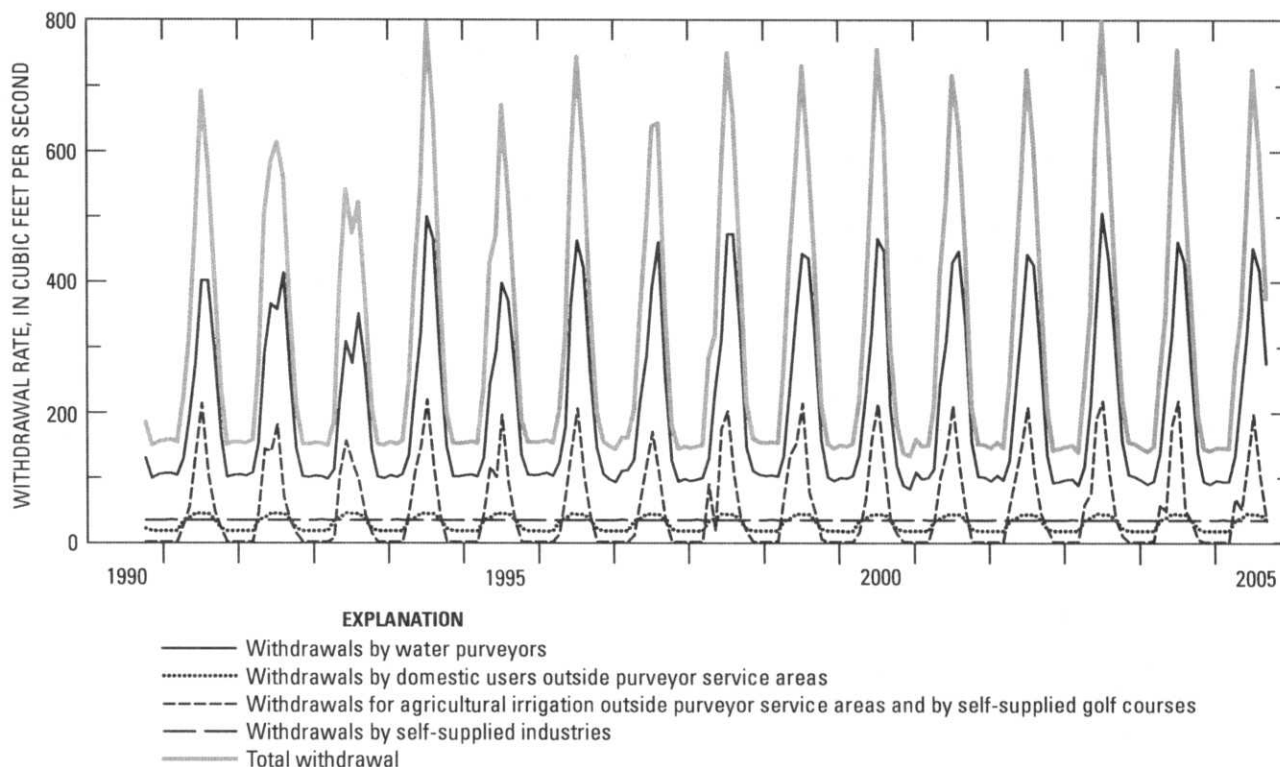


Figure 15. Withdrawal rates from wells, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

Data on withdrawals by domestic users outside water purveyor service areas were not available. Monthly withdrawals were assumed to be similar to the average monthly withdrawals for a water purveyor-supplied home in Spokane. The estimated monthly withdrawal rate for a home outside water purveyor service areas is shown in [figure 16](#). A study by the City of Spokane estimated the rate of indoor use for a home is 25.4 ft³/d (L. Brewer, oral commun., 2006). This indoor use rate is assumed to apply year round for a home outside water purveyor service areas. From April through October, an outdoor-use rate (for landscape irrigation) is added to the indoor-use rate. The outdoor-use rate is based on the outdoor-use pattern for Spokane.

To estimate the areal distribution of withdrawals by domestic users outside water purveyor service areas, the density of homes outside those areas was estimated on a raster grid. The number of homes in each cell was estimated from land-cover data and aerial photographs. The monthly withdrawal rate in each cell was computed as the number of homes in the cell times the monthly withdrawal rate of a home ([fig. 16](#)). The estimated monthly withdrawal rate for all homes outside water purveyor service areas is shown in [figure 15](#). From October 1990 through September 2005, the average withdrawal rate for this category is 28 ft³/s.

Withdrawals for agricultural irrigation outside water purveyor service areas and by self-supplied golf courses were estimated from irrigation acreages and irrigation demand. Nearly all withdrawals in this category were on the Idaho side of the SVRP aquifer. Irrigation acreages were estimated from Idaho water rights data and by inspection of aerial photographs. Irrigation acreages are shown on a raster grid of irrigation density in [figure 17](#). For each cell in the raster,

the irrigation density is the percentage of the cell's area that is irrigated. If the irrigation density is 1, all of the cell's area is irrigated. Conversely, if the irrigation is zero, no irrigation occurs in the cell.

To estimate irrigation demand, a single crop mix is calculated from data published by the National Agricultural Statistics Service (2003, 2004, 2005) and information obtained from the Jacklin Seed Company (G. Jacklin, oral commun., 2006) on grass-seed acreage. Average evapotranspiration rates for each crop are obtained from Allen and Brockway (1983) for Coeur d'Alene. The evapotranspiration rate for grass seed is based on the evapotranspiration rate for pasture but is adjusted to reflect a shorter irrigation season. For golf courses, the evapotranspiration rate for alfalfa is used. Monthly precipitation was obtained from PRISM-derived data downloaded from Oregon State University (<http://www.ocs.orst.edu/prism/products/>). Assuming that 75 percent of the monthly precipitation was effective in meeting crop needs, the monthly irrigation demand for a cell is calculated as:

$$R = A \times d_r \times \max(E_r - 0.75P, 0), \quad (5)$$

where

R is the monthly irrigation demand,
 A is the area of the cell,
 d_r is the irrigation density of the cell,
 E_r is the monthly evapotranspiration, and
 P is the monthly precipitation.

Assuming an irrigation efficiency of 60 percent, the monthly withdrawal for irrigation at a cell is calculated as R divided by 0.6. Therefore, 40 percent of the irrigation water percolates back to the SVRP aquifer. The estimated monthly withdrawal rate for agricultural irrigation outside water purveyor service areas and for self-supplied golf courses is shown in [figure 15](#). From October 1990 through September 2005, the average withdrawal rate for this category is 51 ft³/s.

For withdrawals by self-supplied industries, only users that withdraw more than 500 acre-ft/yr (0.7 ft³/s) were explicitly included in the model. On the Washington side of the SVRP aquifer, seven wells that meet this criterion were identified from a review of withdrawal data reported by CH2M Hill (1998) and Golder Associates, Inc. (2004). On the Idaho side, two wells were identified. Withdrawals for both wells were estimated from the Idaho water rights database (http://www.idwr.idaho.gov/gisdata/new%20data%20download/water_rights.htm). Typically, the actual withdrawal is somewhat less than the full water right. Therefore the actual withdrawal was assumed to be five-sevenths of the full water right. The estimated annual withdrawals from these nine wells and the withdrawal rates, assuming constant year-round pumping, are given in [table 5](#). The total estimated withdrawal rate is about 34 ft³/s. This rate is assumed to remain constant from October 1990 to September 2005 ([fig. 15](#)).

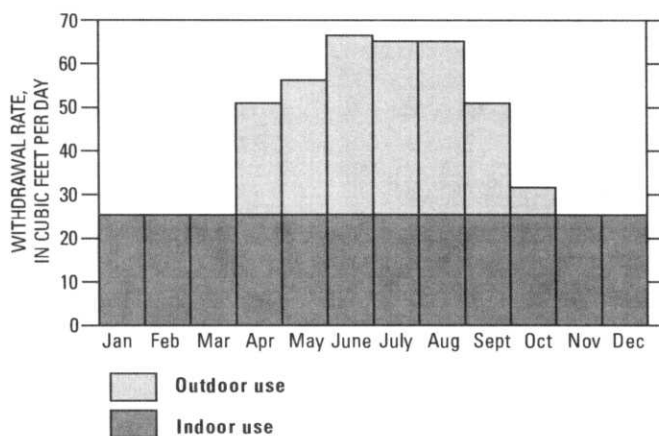


Figure 16. Estimated monthly withdrawal rate for a home outside water purveyor service areas, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

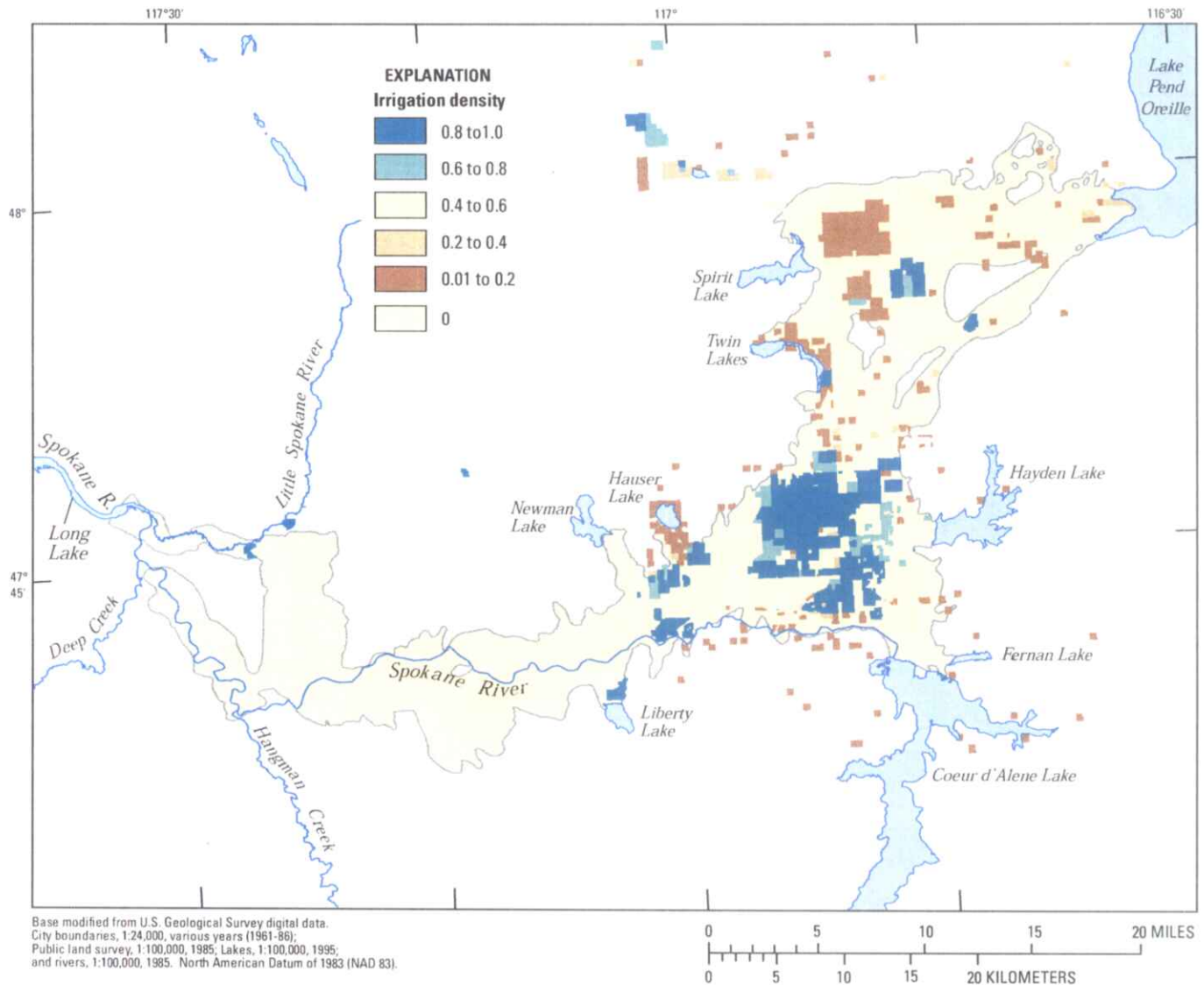


Figure 17. Irrigation density for acreages outside water purveyor service areas and for self-supplied golf courses, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

Table 5. Estimated annual withdrawals by self-supplied industries and withdrawal rates, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

[Abbreviations: acre-ft, acre-foot; ft³/s, cubic foot per second]

Well identification	State	Annual withdrawal (acre-ft)	Withdrawal rate (ft ³ /s)
Diamond National Corporation	Idaho	517	0.71
Riley Creek Lumber Company	Idaho	627	.87
Kaiser Mead N Plant	Washington	2,812	3.88
Kaiser Mead S Plant	Washington	565	.78
Kaiser Trentwood Section 2	Washington	4,098	5.66
Kaiser Trentwood Section 10	Washington	10,538	14.55
Kaiser Trentwood Section 11	Washington	398	.55
Honeywell-Johnson Matthey Electric	Washington	517	.71

Gaining Segments of Spokane River

Gaining segments of the Spokane River occur where the stream level is lower than the hydraulic head in the aquifer directly under the streambed. Along a gaining segment, ground water discharges from the aquifer and flows to the stream. Consequently, there is more streamflow at the downstream end of a gaining segment than at the upstream end of the segment. The amount of discharge from the SVRP aquifer to the Spokane River is discussed in the section, "Interaction Between Aquifer and Spokane River."

Little Spokane River

The SVRP aquifer discharges to the Little Spokane River along the valley north of Five Mile Prairie. This part of the aquifer is known as the Little Spokane River Arm. Ground-water discharge to the river can be estimated from the streamflow gain between two gaging stations on the Little Spokane River (fig. 18). In the following discussion, Q_{AD} refers to streamflow at the gaging station at Dartford, which is about 1 mi upstream of where the Little Spokane River enters the aquifer, and Q_{ND} refers to streamflow at the gaging station near Dartford, which is about 3 mi upstream of where the Little Spokane River flows into the Spokane River (fig. 18).

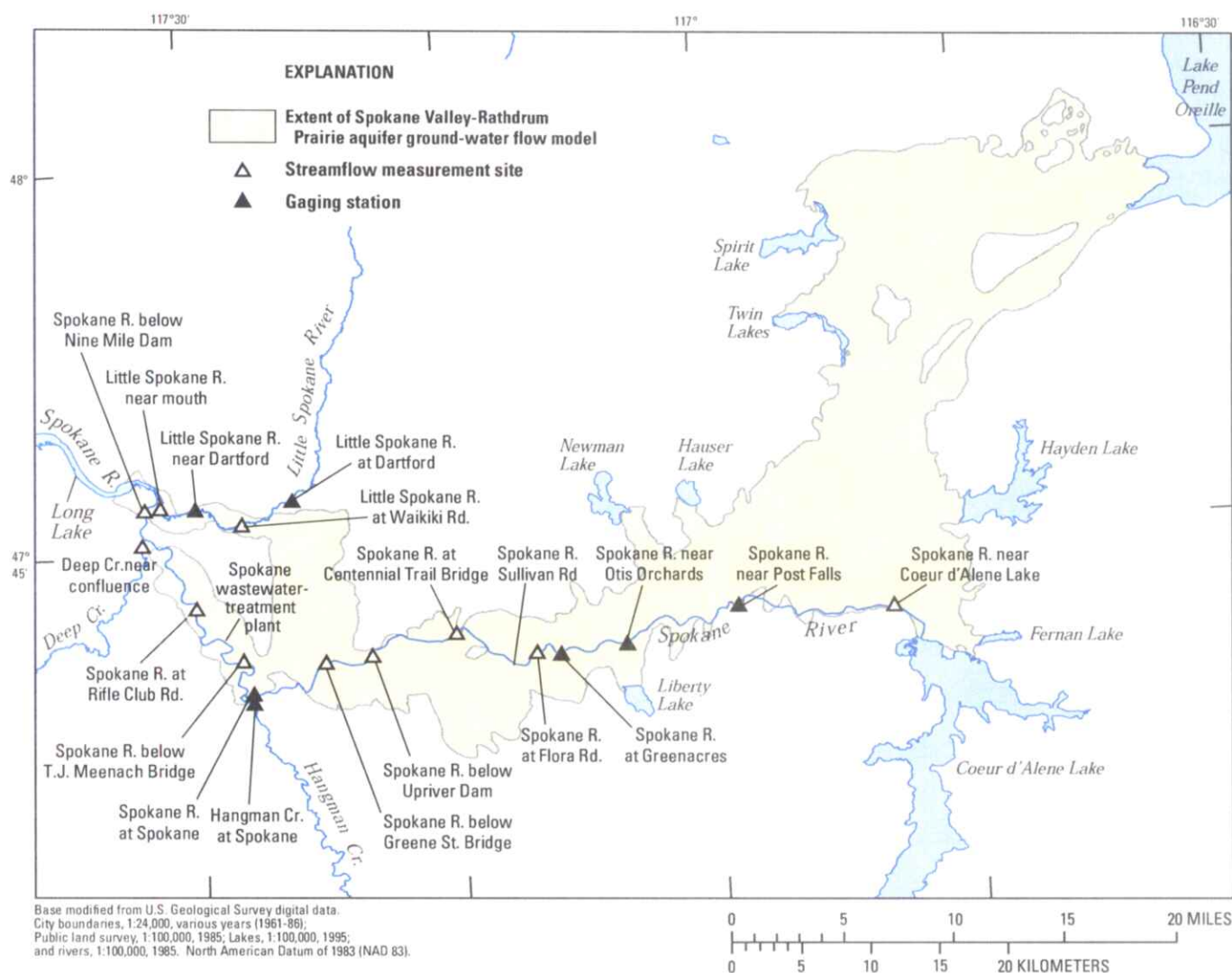


Figure 18. Locations of gaging stations and streamflow measurement sites on the Spokane and Little Spokane Rivers, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

The streamflow gain between the two gaging stations is $Q_{ND} - Q_{AD}$. The assumption is that this gain represents ground-water discharge from the aquifer.

Daily values of $Q_{ND} - Q_{AD}$ and Q_{AD} are shown in figure 19. The data record is from October 1997 through September 2005. The average streamflow gain for the entire data set is 248 ft³/s. There does not appear to be a strong trend of increasing or decreasing streamflow gain with Q_{AD} . However, when Q_{AD} is greater than 500 ft³/s, the scatter in the plotted points becomes much larger. The scatter likely is caused by inherent streamflow measurement error, estimated as 5 percent of the measured streamflow value (Sauer and Meyer, 1992). At higher streamflows, the computed streamflow gain can fall within the streamflow measurement error and, thus, become highly uncertain.

Streamflow measurements at a site near the mouth of the Little Spokane River during September 2004 and August 2005, indicate a streamflow loss of 16 to 31 ft³/s from the gaging station near Dartford to the streamflow measurement site near the mouth of the river. These results are unexpected in a ground-water discharge area of the SVRP aquifer and could be caused by inaccuracies in streamflow measurements. Because the streamflow loss is small, the interaction between the aquifer and the Little Spokane River downstream of the gaging station near Dartford might be justifiably characterized as minimal.

Subsurface Outflow

At the west end of the Little Spokane River Arm, the model terminates at the eastern end of Long Lake (the reservoir on the Spokane River behind Long Lake Dam). In this area, the aquifer is divided into an upper unit and a lower unit by a clay layer. The upper unit is in direct hydraulic contact with Long Lake. Ground-water discharge from the upper unit to Long Lake probably is minimal because most of the outflow likely has entered the Little Spokane River. Hydrologic conditions in the lower unit are not well known. Drillers' reports indicate that the lower unit remains confined under Long Lake for at least 1 or 2 mi beyond the model boundary, but the clay layer eventually pinches out, thus allowing outflow from the lower unit to Long Lake (John Covert, Washington State Department of Ecology, written commun., 2005). This interpretation is supported by an apparent correlation between the water level in well 99, which is completed in the lower unit, and the lake level of Long Lake (fig. 20). Declines in the water level in the well during January and March 2005 coincide with declines in the lake level. However, the rate of outflow from the lower unit is not known.

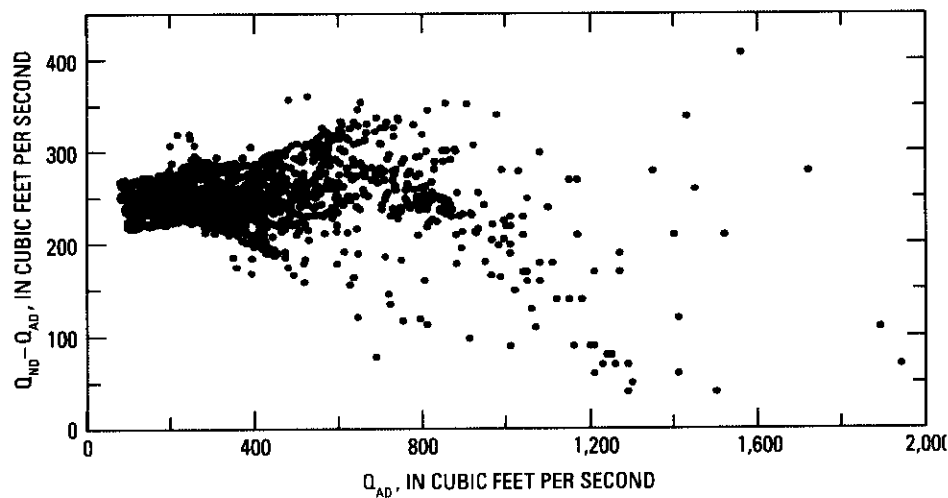


Figure 19. Daily streamflow gain on the Little Spokane River between gaging stations at Dartford (Q_{AD}) and near Dartford (Q_{ND}) and streamflow at the gaging station at Dartford, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

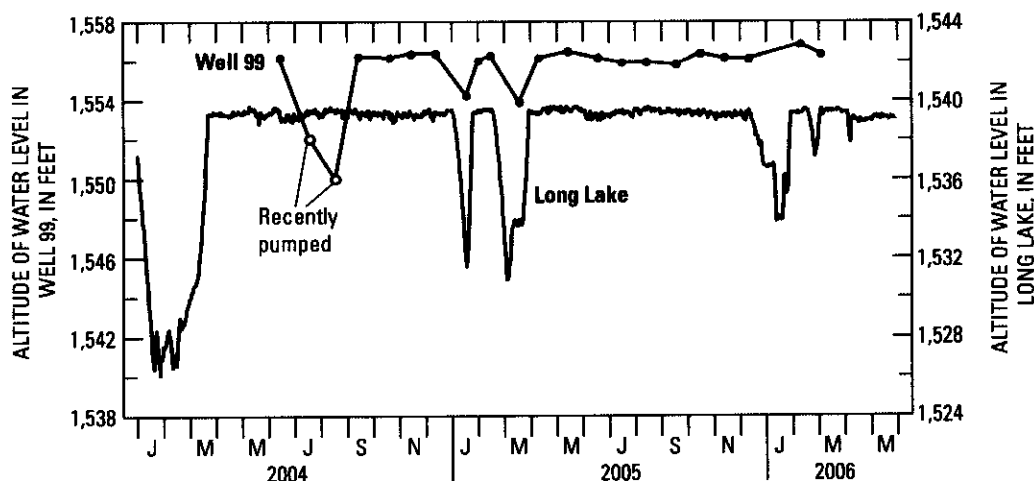


Figure 20. Water levels in well 99 and in Long Lake, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

Interaction Between Aquifer and Spokane River

For nearly its entire length within the study area, the Spokane River interacts dynamically with the SVRP aquifer. Kahle and others (2005) summarized previous investigations of this river-aquifer interaction. MacInnis and others (2004, p. 15) characterized segments of the Spokane River as gaining, losing, transitional (varying between gaining and losing depending on the magnitude of the river flow), or minimal. These characterizations were based on nearly simultaneous streamflow measurements (seepage run) made on the Spokane River during September 13-16, 2004 (Kahle and others, 2005, p. 44, table 15), and estimated low-flow values based on historical data and computer modeling. Therefore, these characteristics describe the Spokane River during low-flow conditions, which occur in late summer.

During 2005 and 2006, additional streamflow measurements were made on the Spokane River to refine the understanding of the river-aquifer interaction (table 6, fig. 18). The USGS conducted seepage runs along the Spokane River during August 26-31, 2005, and on August 8, 2006. The seepage run during August 26-31, 2005, encompassed nearly the entire length of the Spokane River in the study area (from just downstream of Coeur d'Alene Lake to below Nine Mile Dam). The seepage run on August 8, 2006, focused on the river segment from the Centennial Trail Bridge to the site below Greene Street Bridge (fig. 18). In addition, Gregory and Covert (2005) measured stream-water temperature along the Spokane River to detect ground-water discharge to the river.

They noted that

"In late summer/early autumn conditions, the Spokane River discharges to the SVRP aquifer upstream from Sullivan Road. Downstream from this point, the river receives aquifer water."

The seepage run during August 26-31, 2005, indicates that the Spokane River lost 606 ft³/s from the most upstream measurement site near Coeur d'Alene Lake to the measurement site at Flora Road (table 6). From the Flora Road to the Centennial Trail Bridge site, data indicate a net gain of 360 ft³/s. However, Gregory and Covert (2005) noted that the gaining segment actually occurs downstream of the Sullivan Road site (fig. 18). From the Centennial Trail Bridge site to the site below Greene Street Bridge, data indicate a net gain in streamflow of 233 ft³/s. However, the seepage run on August 8, 2006, indicates that this segment of the river actually comprises of a losing segment from the Centennial Trail Bridge site to the site downstream of Upriver Dam and a gaining segment from the site downstream of Upriver Dam to the site downstream of Greene Street Bridge. The river lost 112 ft³/s from the site downstream of Greene Street Bridge to the gaging station at Spokane. From this gaging station to the site downstream of Nine Mile Dam, after subtracting inflows from Hangman Creek and effluent from the Spokane wastewater-treatment plant, the net gain from ground-water discharge to the river is about 267 ft³/s. Overall, from the most upstream site near Coeur d'Alene Lake to the most downstream site below Nine Mile Dam, the Spokane River gained a net amount of 142 ft³/s from exchange with the aquifer based on the August 26-31, 2005 seepage run.

Table 6. Streamflow measurements made on the Spokane River and some tributaries to determine streamflow gains (positive values) and losses (negative values) between measurement sites, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho, August 26-31, 2005, and August 8, 2006.

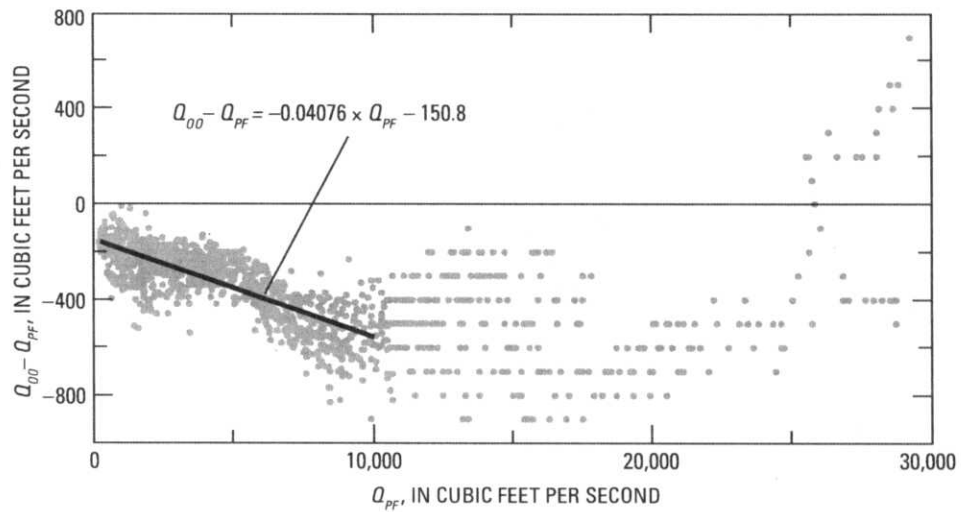
[Location of sites or gaging station shown in [figure 18](#). Abbreviations: ft³/s, cubic foot per second; —, not computed; —, not measured]

Measurement site or gaging station	August 26-31, 2005		August 8, 2006	
	Discharge (ft ³ /s)	Gain or loss (ft ³ /s)	Discharge (ft ³ /s)	Gain or loss (ft ³ /s)
Spokane River near Coeur d'Alene Lake	738	--	—	--
Spokane River near Post Falls	447	-291	—	--
Spokane River near Otis Orchards	256	-191	—	--
Spokane River at Greenacres	146	-110	—	--
Spokane River at Flora Road	132	-14	—	--
Spokane River at Centennial Trail Bridge	492	360	579	--
Spokane River below Upriver Dam	—	--	525	-54
Spokane River below Greene Street Bridge	725	233	869	344
Spokane River at Spokane	613	-112	767	-102
Hangman Creek at Spokane	1.5	--	—	--
Spokane River below T.J. Meenach Bridge	703	88.5	—	--
Spokane Wastewater Treatment Plant discharge ¹	56	--	—	--
Spokane River at Rifle Club Road	797	38	—	--
Deep Creek near confluence	0	--	—	--
Spokane River below Nine Mile Dam	938	141	—	--

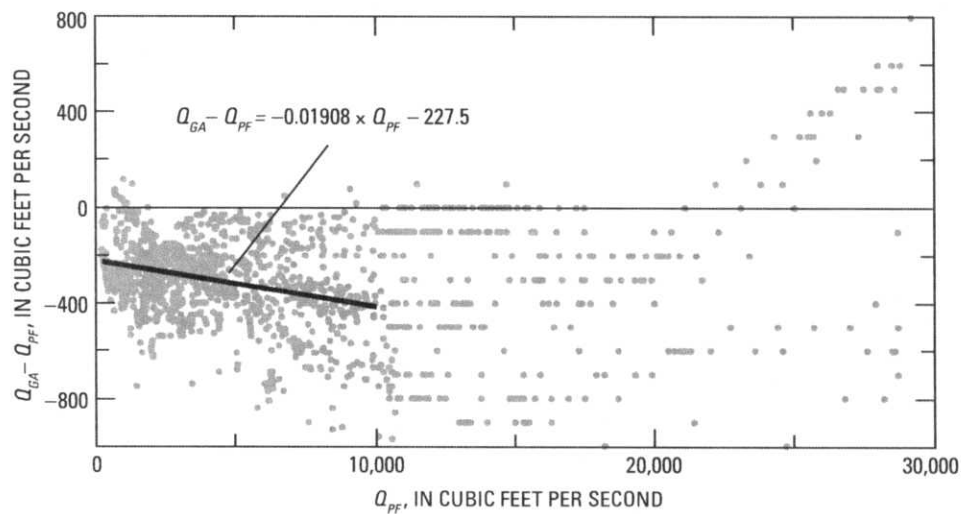
¹Spokane Wastewater Treatment Plant discharge value provided by John Convert, Washington State Department of Ecology, written, commun., 2005.

For times other than late summer, the characteristics of streamflow gains and losses on the Spokane River are less well known. Daily streamflow data are available since 1999 for four gaging stations on the Spokane River in the model area ([fig. 18](#)). Streamflow gains or losses between the various gaging stations and streamflow at the gaging station near Post Falls (Q_{PF}) are shown in [figure 21](#). Subtracting the streamflow at an upstream gaging stream from the streamflow at a downstream gaging station gives the streamflow gain between the two stations if the result is positive and the streamflow loss if the result is negative. Although [figure 21](#) shows significant scatter among the plotted points, a linear relation is fitted to that part of the data where Q_{PF} is less than or equal to 10,000 ft³/s. The fitted line provides an overall description of how the streamflow gains or losses vary with Q_{PF} . However, when Q_{PF} is greater than 10,000 ft³/s, the scatter is so large that it is difficult to discern a trend.

The fitted lines in [figures 21A](#) and [21B](#) indicate that the river segments from the gaging station at Post Falls to both the gaging stations near Otis Orchards and at Greenacres are net losing segments, and the magnitude of streamflow loss increases with increasing Q_{PF} . Conversely, the fitted lines in [figures 21C](#) and [21D](#) indicate that the river segments from both gaging stations near Otis Orchards and at Greenacres to the gaging station at Spokane are net gaining segments, and the magnitude of the streamflow gain decreases with increasing Q_{PF} . Lastly, the fitted line in [figure 21E](#) indicates that the river segment from gaging stations near Post Falls to at Spokane is a net gaining segment when Q_{PF} is less than about 7,000 ft³/s but is a net losing segment when Q_{PF} is greater than about 7,000 ft³/s. The river segment between the gaging stations near Otis Orchards and at Greenacres is not considered because the two gaging stations are close to each other and the computed gains or losses generally fall within the streamflow measurement errors except for very low streamflows.

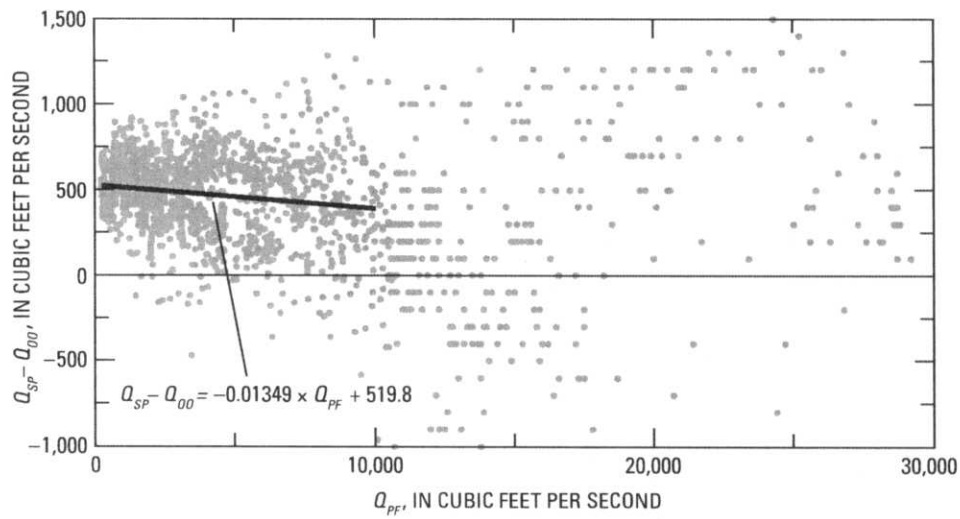


A. Daily streamflow gain (positive value) or loss (negative value) on the Spokane River between gaging stations near Post Falls (Q_{PF}) and near Otis Orchards (Q_{OO}) and streamflow at gaging station near Post Falls.

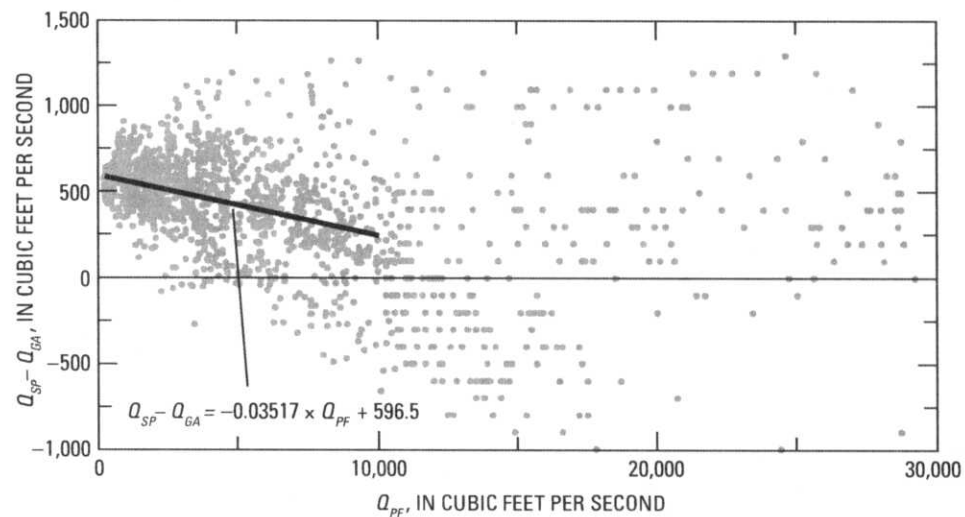


B. Daily streamflow gain (positive value) or loss (negative value) on the Spokane River between gaging stations near Post Falls (Q_{PF}) and at Greenacres (Q_{GA}) and streamflow at gaging station near Post Falls.

Figure 21. Streamflow gains or losses between the various gaging stations and streamflow at the gaging station near Post Falls, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

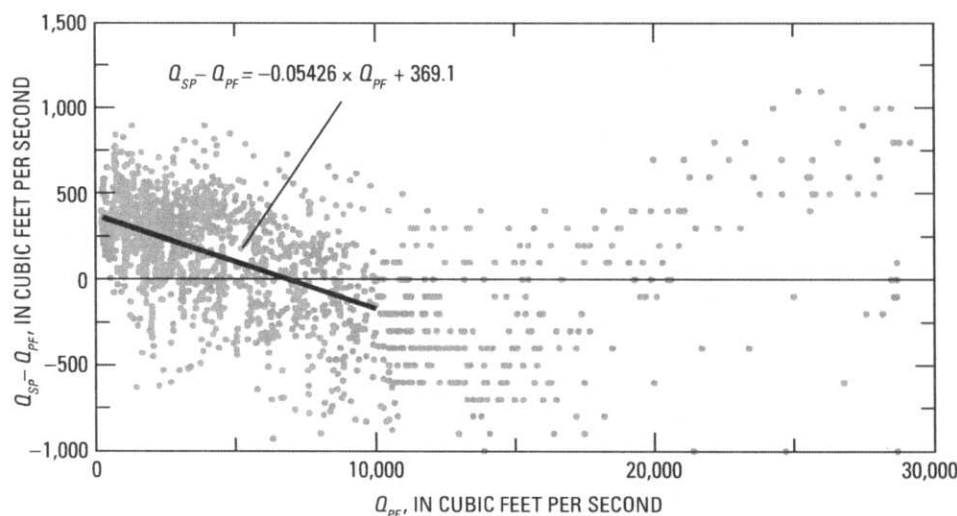


C. Daily streamflow gain (positive value) or loss (negative value) on the Spokane River between gaging stations near Otis Orchards (Q_{OO}) and at Spokane (Q_{SP}) and streamflow at gaging station near Post Falls (Q_{PF}).



D. Daily streamflow gain (positive value) or loss (negative value) on the Spokane River between gaging stations at Greenacres (Q_{GA}) and at Spokane (Q_{SP}) and streamflow at gaging station near Post Falls (Q_{PF}).

Figure 21.—Continued.



E. Daily streamflow gain (positive value) or loss (negative value) on the Spokane River between gaging stations near Post Falls (Q_{PF}) and at Spokane (Q_{SP}) and streamflow at gaging station near Post Falls.

Figure 21.—Continued.

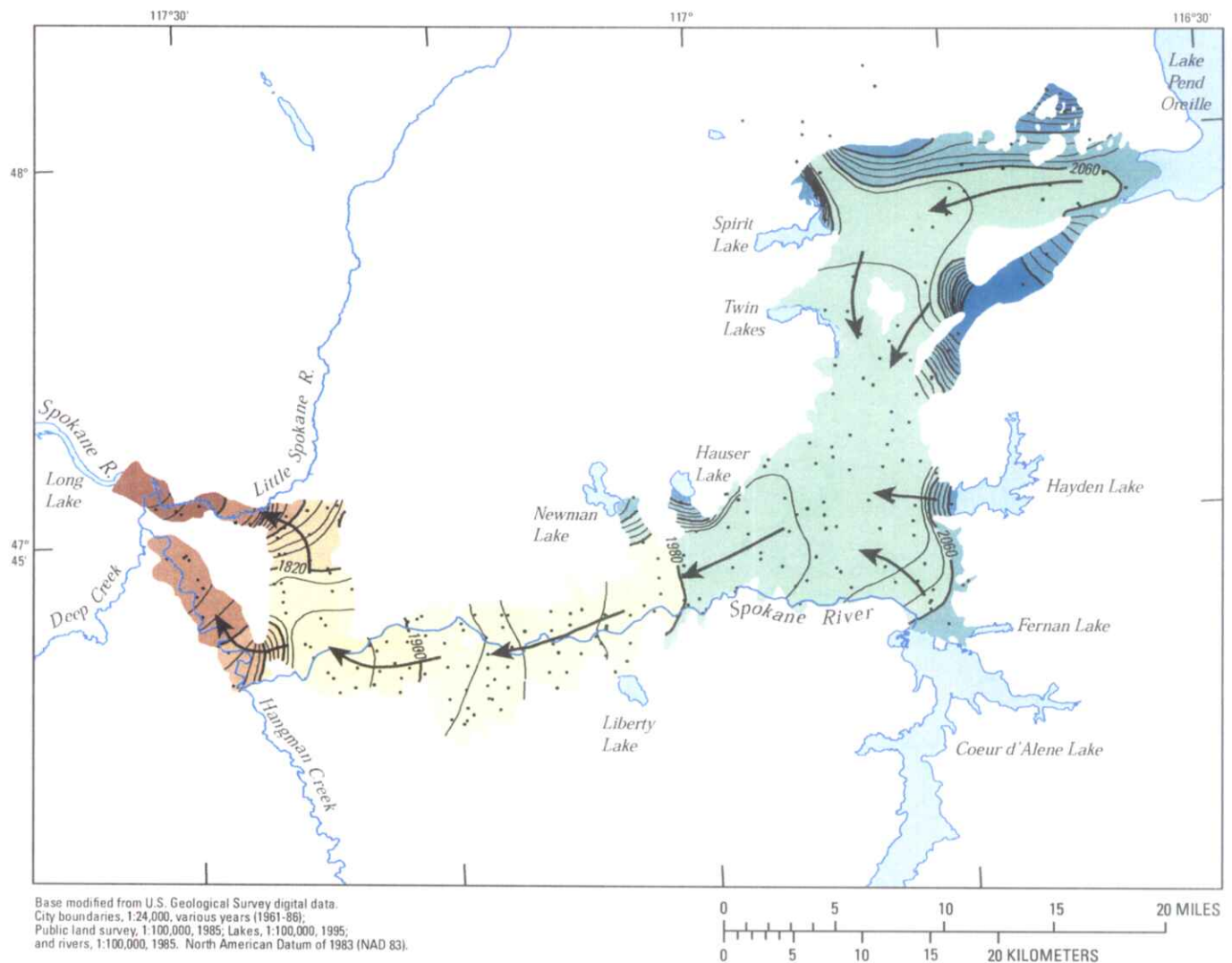
Ground-Water Levels and Movement

Campbell (2005) constructed a map of ground-water levels in the SVRP aquifer on the basis of water levels measured in 268 wells during September 2004. An updated version of the ground-water level map that takes into account more recent information, such as updated altitudes of well sites and the base of the aquifer, is shown in [figure 22](#). Notable features of the water-level map include the relatively flat hydraulic gradient in southern Rathdrum Prairie and the steeper gradients along the aquifer margins and in side valleys. On the Washington side of the aquifer, the hydraulic gradient tends to increase from east to west. In Hillyard Trough and the Little Spokane River Arm, water levels are shown for the upper unit. Too few data are available to construct a map of hydraulic head in the lower unit.

The generalized direction of ground-water flow is shown in [figure 22](#). Ground water flows from northern Rathdrum Prairie through West Channel and Ramsey (Middle) Channel into southern Rathdrum Prairie. Flow through Chilco Channel probably is small because of the small saturated thickness in the channel. From southern Rathdrum Prairie, ground water flows toward the west through Spokane Valley to the Spokane area, where the flow bifurcates. Part of the flow moves through Trinity Trough into the Western Arm of the aquifer. And part moves to the north into Hillyard Trough and finally to the west into the Little Spokane River Arm.

During the summer of 2004, a network of 56 wells was established to measure ground-water levels in the study area ([fig. 23](#), [table 7](#)). Measurements were made manually about once a month. Pressure transducers were installed in 8 of the 56 wells to automatically record water levels once an hour. Additional water-level data for certain wells in the network also are available from previous studies. Water levels measured during 2000 and 2001 by Caldwell and Bowers (2003) are available for 11 wells in the vicinity of the Spokane River. Historical water-level data dating back to 1993 and earlier are available for four wells in the network.

Data from the well network indicate that ground-water level fluctuations are characteristic of different parts of the aquifer. For example, in Spokane Valley, ground-water levels are strongly controlled by stage on the Spokane River. The water level in well 60 and the stage on the Spokane River at the gaging station near Otis Orchards from June 2004 to December 2005 are shown in [figure 24](#). To facilitate visual comparison, the well hydrograph is plotted with respect to the vertical axis on the left, and the stage on the Spokane River is plotted with respect to the vertical axis on the right. Individual peaks in the river stage during the high-flow period from December 2004 to June 2005 correspond closely to individual peaks in the well hydrograph.



Altitude of water level, in feet, of the Spokane Valley-Rathdrum Prairie aquifer, September 2004—
 Datum is North American Vertical Datum of 1988

2,220 to 2,300	1,820 to 1,900
2,140 to 2,220	1,740 to 1,820
2,060 to 2,140	1,660 to 1,740
1,980 to 2,060	1,580 to 1,660
1,900 to 1,980	1,500 to 1,580

EXPLANATION

—1400— **Water-level contour**—Shows altitude of water level, September 2004. Contour interval is 20 feet. Datum is North American Vertical Datum of 1988

← **Generalized direction of ground-water flow**

• **Site of water-level measurement**

Figure 22. Ground-water levels for the Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho, September 2004 (revised after Campbell, 2005).

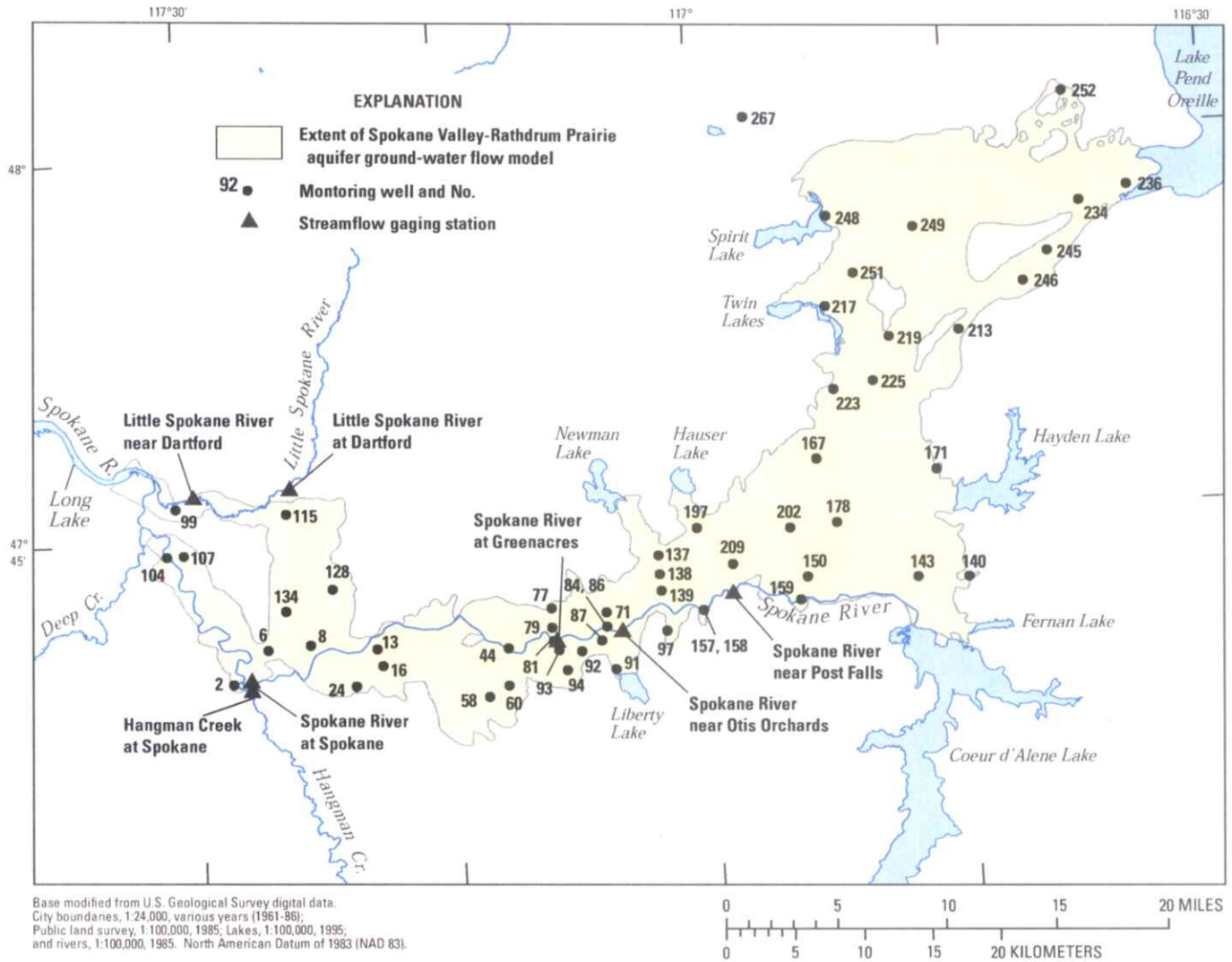


Figure 23. Locations of monitoring wells in the Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

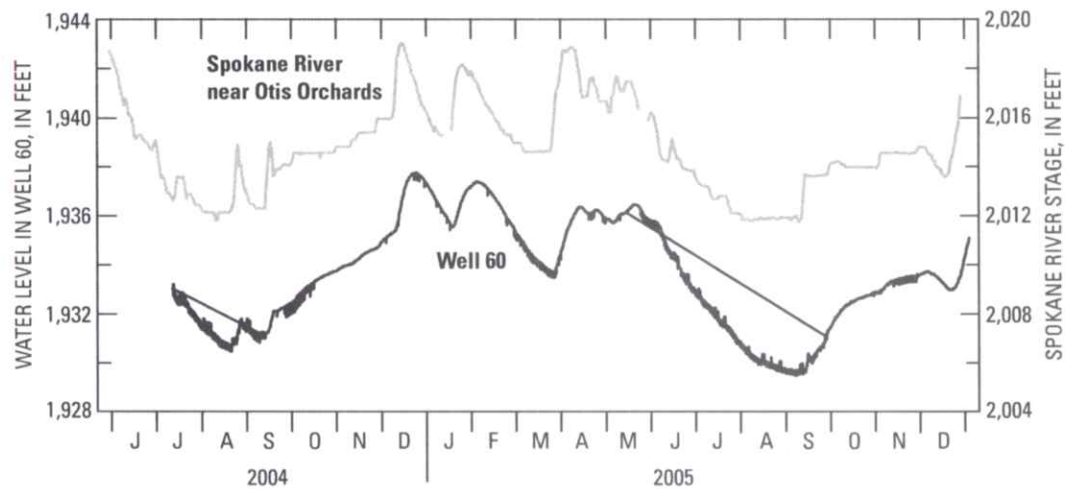


Figure 24. Water level in well 60 and stage on the Spokane River at the gaging station near Otis Orchards, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

Table 7. Physical data for wells in water-level monitoring network, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

[Abbreviations: USGS, U.S. Geological Survey; NAD 83, North American Datum of 1983; NAVD 88, North American Vertical Datum of 1988; ft, foot]

Well No.	USGS Site No.	USGS Site Name	Longitude (NAD 83)	Latitude (NAD 83)	Land surface altitude (ft, NAVD 88)	Hole depth (ft)	Aquifer unit
2	473928117275001	25N 42E 14CDD1	473928	1172757	1,801.50	136	Gravel
6	474045117255201	25N 43E 07CBB1	474045	1172552	1,904	258	Gravel
8	474054117232401	25N 43E 08ADD1	474054	1172324	1,948.42	101	Gravel
13	474037117193303	25N 43E 11DAA3	474037	1171933	1,952.16	120	Gravel
16	473958117185801	25N 43E 13BCD1	473956	1171913	1,943.34	85	Gravel
24	473912117205103	25N 43E 22ADA3	473912	1172051	1,932	108	Gravel
44	474026117115301	25N 44E 11DDAC1	474026	1171153	1,965.90	69	Gravel
58	473839117131101	25N 44E 22DDD1	473834	1171307	2,082.59	250	Gravel
60	473852117115301	25N 44E 23DAA1	473858	1171157	2,046.42	210	Gravel
71	474140117060401	25N 45E 03BDDA1	474140	1170604	2,056.37	117	Gravel
77	474156117091601	25N 45E 05BBBC1	474155	1170916	2,049.36	128	Gravel
79	474109117091701	25N 45E 07AAAA4	474109	1170917	2,025.36	100	Gravel
81	474038117091201	25N 45E 08CBBC1	474039	1170913	2,021.23	97	Gravel
84	474106117060501	25N 45E 10BAAA1	474106	1170605	2,034.34	72	Gravel
86	474107117060502	25N 45E 10BAAA3	474106	1170605	2,034.20	140	Gravel
87	474033117062501	25N 45E 10CBDA1	474034	1170625	2,041.70	97	Gravel
91	473925117053201	25N 45E 15DDCC1	473925	1170540	2,076.87	155	Gravel
92	474011117072901	25N 45E 16BAB1	474011	1170737	2,059.70	Unknown	Gravel
93	474016117085601	25N 45E 17BBAA5	474016	1170856	2,035.60	113	Gravel
94	473928117083001	25N 45E 17DCCB1	473928	1170830	2,047.74	287	Gravel
97	474049117023501	25N 46E 07BCAD1	474049	1170235	2,178.13	248	Gravel
99	474629117305101	26N 42E 04CCDB1	474627	1173055	1,729	321	Gravel
104	474427117312101	26N 42E 20ABAC1	474435	1173132	1,627.86	60	Gravel
107	474434117303201	26N 42E 21BAA1	474436	1173032	1,668.48	101	Gravel
115	474604117242901	26N 43E 08BCC1	474606	1172429	1,788.03	465	Gravel
128	474303117215901	26N 43E 27CCB1	474304	1172159	2,034	225	Gravel
134	474216117244501	26N 43E 31DAA1	474216	1172445	2,063.14	223	Gravel
137	474349117025201	26N 45E 24DDDA1	474349	1170252	2,107.97	178	Gravel
138	474304117025201	26N 45E 25DDAA1	474304	1170252	2,084.17	146	Gravel
139	474226117024801	26N 46E 31CBBC1	474225	1170248	2,094.02	151	Gravel
140	474226116444101	50N 03W 06DAA1	474224	1164448	2,220.91	185	Gravel
143	474229116474501	50N 04W 02ACC1	474229	1164745	2,224	440	Gravel
150	474242116540301	50N 05W 01ACBB1	474242	1165413	2,197.43	243	Gravel
157	474134117002201	50N 05W 07DABC1	474134	1170022	2,073.32	79	Gravel
158	474134117002202	50N 05W 07DABC2	474135	1170022	2,073.54	46	Gravel
159	474147116544001	50N 05W 12BCAD1	474147	1165440	2,130.58	200	Gravel
167	474720116532101	51N 04W 06CCDD1	474720	1165321	2,240.47	310	Gravel
171	474643116461901	51N 04W 12DBD1	474643	1164621	2,308.78	248	Gravel
178	474445116521601	51N 04W 20CCCC1	474447	1165221	2,249.18	298	Gravel
197	474450117003301	51N 05W 19DCAC1	474450	1170033	2,126.80	178	Gravel
202	474440116545801	51N 05W 26AAAA1	474440	1165506	2,232.79	268	Gravel
209	474329116582801	51N 05W 33CBA1	474320	1165832	2,145.42	Unknown	Gravel
213	475211116443801	52N 03W 07ADDA1	475211	1164438	2,313.98	147	Gravel
217	475322116522201	52N 04W 06AAAA1	475322	1165222	2,411.75	445	Gravel
219	475202116484301	52N 04W 10DAB1	475202	1164843	2,311.71	340	Gravel
223	475002116521101	52N 04W 20CCB1	475002	1165208	2,270.56	500	Multiple
225	475019116494701	52N 04W 21DAA1	475019	1164947	2,284.41	348	Gravel
234	475705116371201	53N 02W 07DBD1	475705	1163712	2,441.61	442	Gravel
236	475736116341701	53N 02W 09AAC1	475737	1163421	2,294.83	351	Gravel
245	475510116391201	53N 03W 24CCCD1	475509	1163912	2,457.37	340	Gravel
246	475400116404201	53N 03W 34ADAA1	475400	1164042	2,460.25	237	Gravel
248	475656116520401	53N 04W 08CCDA1	475656	1165204	2,548.30	503	Gravel
249	475622116470101	53N 04W 13CBBD1	475622	1164701	2,505.01	506	Gravel
251	475439116503401	53N 04W 28CAB1	475438	1165038	2,432.26	449	Gravel
252	480128116375301	54N 02W 18CBB1	480128	1163753	2,320.43	72	Gravel
267	480101116563601	54N 05W 22ACA1	480101	1165639	2,317.17	175	Gravel

In Hillyard Trough, ground-water level fluctuations are less dynamic than those in Spokane Valley. The water level in well 128 and the stage on the Spokane River at the gaging station at Spokane are shown in [figure 25](#). The rise and fall of the well hydrograph are more gradual than the rise and fall of the river stage because wells in Hillyard Trough are farther from the Spokane River than wells in Spokane Valley.

In the north part of Western Arm, ground-water levels are strongly controlled by the level of Nine Mile Reservoir. Water levels in wells 104 and 107 and the level of Nine Mile Reservoir are shown in [figure 26](#). Wells 104 and 107 are located, respectively, on the west and east sides of Nine Mile Reservoir. The rise and fall of the well hydrographs are closely correlated with the rise and fall of the reservoir. During periods when the level of the reservoir is constant, the water level in well 107 is nearly identical to level of the reservoir, but the water level in well 104 is about 0.5 ft above the level of the reservoir. This indicates that ground water discharges from the SVRP aquifer to Nine Mile Reservoir.

In northern Rathdrum Prairie, ground-water level fluctuations are substantially different from those in Spokane Valley. Long-term water levels in wells 92, 209, and 251 for 1990–2005 are shown in [figure 27](#). Well 92 is in Spokane Valley. The hydrograph of well 92 is similar to the hydrograph of well 60 ([fig. 24](#))—the water level exhibits multiple peaks that correlate to peaks in the stage on the Spokane River during winter and spring. By contrast, well 251 is in northern Rathdrum Prairie. The hydrograph of well 251 is controlled primarily by recharge from precipitation. Although most of the precipitation infiltrates into the land surface during winter and spring, the long transmission time from land surface to the water table at depths of 400–500 ft caused the hydrograph to peak in July and August. Well 209 is in the transition zone between southern Rathdrum Prairie and Spokane Valley. The hydrograph of well 209 exhibits characteristics that are intermediate between those of wells 92 and 251.

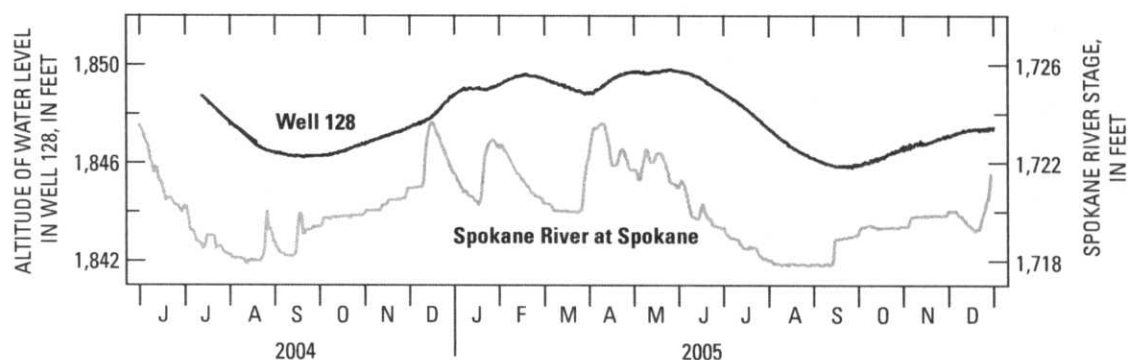


Figure 25. Water level in well 128 and stage on the Spokane River at the gaging station at Spokane, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

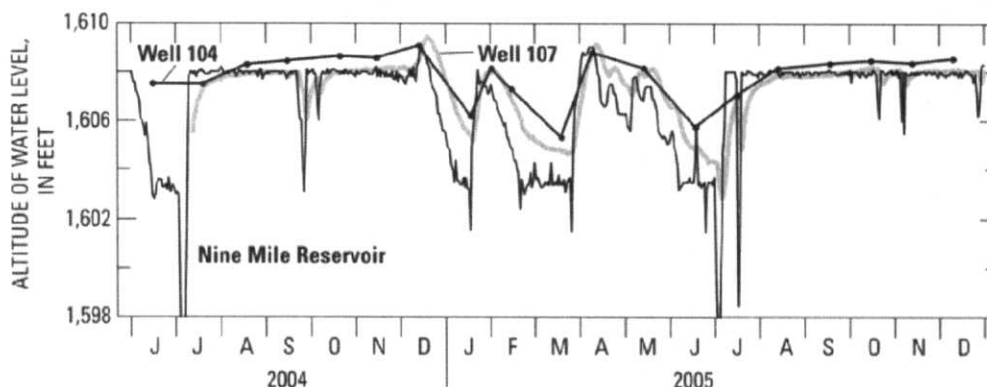


Figure 26. Water levels in wells 104 and 107 and in Nine Mile Reservoir, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

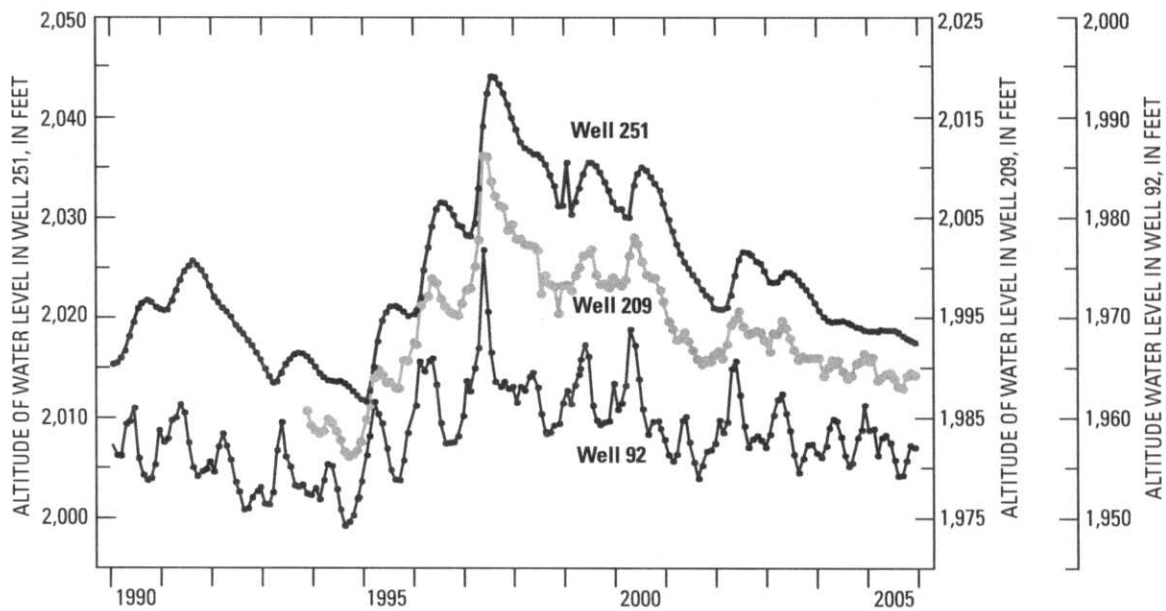


Figure 27. Water levels in wells 92, 209, and 251, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

The falling limbs of the hydrograph of well 251 are more gradual than the falling limbs of the hydrograph of well 92 (fig. 27). This may be explained by the fact that ground water in northern Rathdrum Prairie must discharge through West Channel and Ramsey Channel, which can constrict ground-water flow. During several years of higher-than-average recharge, such as from 1995 to 1997, ground-water levels in northern Rathdrum Prairie can exhibit an increasing trend over several years. Conversely, during several years of lower-than-average recharge, such as from 2000 to 2005, ground-water levels in northern Rathdrum Prairie can exhibit a declining trend over several years.

In the vicinity of Lake Pend Oreille, ground-water levels in the SVRP aquifer are strongly controlled by the lake level. The hydrographs of wells 234 and 236 and the level of Lake Pend Oreille are shown in figure 28. The lake level is maintained at about 2,066 ft during the summer and at a lower level during the rest of the year. This lake level signal is exhibited by the hydrographs of wells 234 and 236. The water levels shown in figure 28 also indicate that flow is from the lake toward wells 234 and 236.

In the vicinity of Coeur d'Alene Lake and Post Falls, ground-water levels do not show a clear relation to the level in the lake (and the arm of the Spokane River above Post Falls). The hydrographs of wells 143 and 159 and the level of Coeur d'Alene Lake are shown in figure 29. Note that the lake level is about 100 ft higher than the water levels in the wells. From June to mid-September, the lake level is maintained at about 2,132 ft. From mid-September to December, the gates at Post

Falls Dam are opened incrementally to lower the lake to its natural autumn level. From December to June, the dam gates usually are left open to allow the lake level to rise and fall in response to inflows from storms and snowmelt. The water levels in wells 143 and 159 do not follow the lake level. In well 143, the water level peaks in November when the lake level is declining. In well 159, the water level peaks in July when the lake level is high. Then, for the next 1 to 2 months, the water level declines when the lake level is constant. These fluctuations in ground-water levels are not explained readily by a simple conceptualization of lake-aquifer interaction in which ground-water levels near the lake are expected to rise in response to greater subsurface leakage from the lake during times of high lake levels, and fall in response to less subsurface leakage from the lake during times of low lake levels.

Water levels in wells along the perimeter of the SVRP aquifer generally are not indicative of hydrologic conditions in the main part of the aquifer. Along the perimeter of the aquifer, bedrock is close to land surface, the saturated zone is thin, hydraulic conductivity tends to be low, and ground-water levels can be tens to more than 100 ft higher than in the main part of the aquifer. In addition, ground-water levels along the perimeter can rise and decline abruptly in response to episodic inflows from surrounding uplands. The effects of these inflows typically are damped out in the main part of the aquifer. The hydrograph of well 245, which is located near the east boundary of northern Rathdrum Prairie, and the hydrograph of well 249, which is located in the central part of northern Rathdrum Prairie, are shown in figure 30.

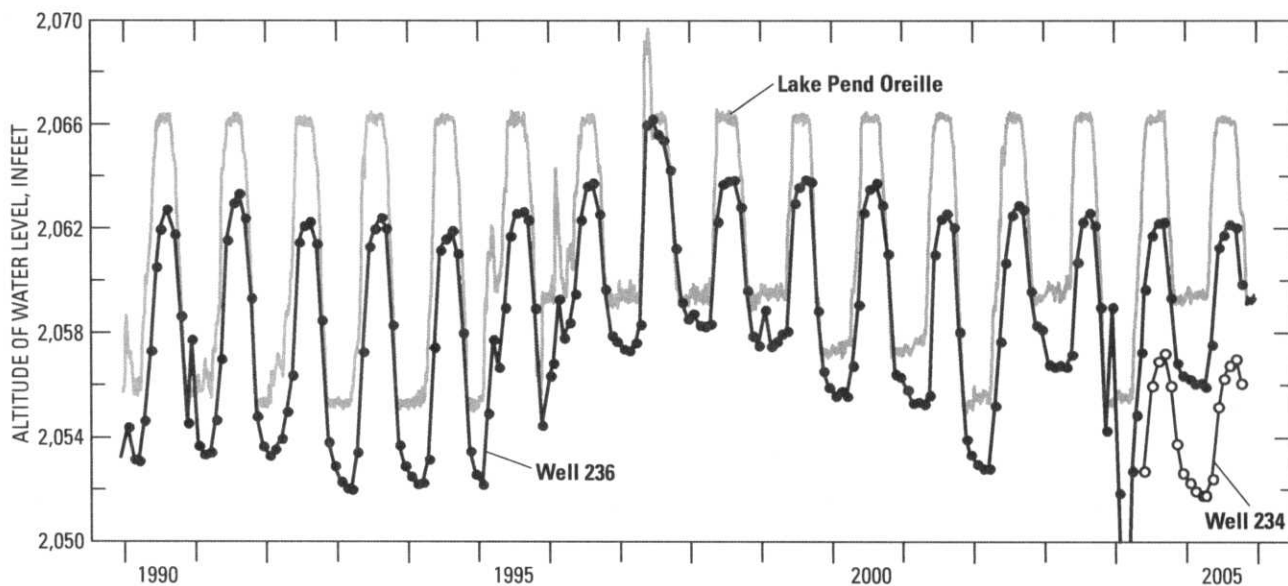


Figure 28. Water levels in wells 234 and 236 and in Lake Pend Oreille, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

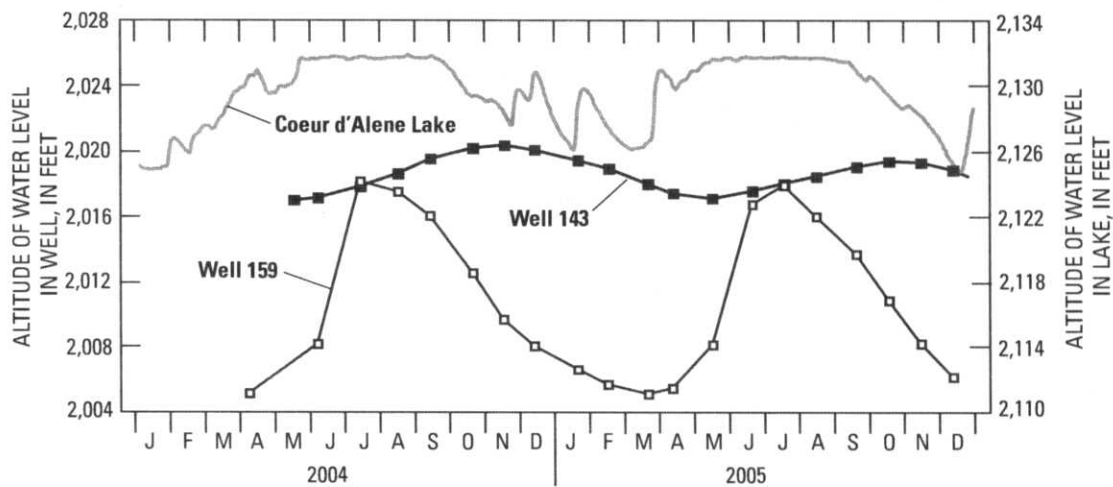


Figure 29. Water levels in wells 143 and 159 and in Coeur d'Alene Lake, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

The water level in well 245 is about 150 ft higher than the water level in well 249. During the period of record shown in [figure 30](#), the water level is relatively stable in the central part of northern Rathdrum Prairie. However, the water level near the east boundary indicates a substantial rise and fall during the winter and spring in response to storm and snowmelt runoff.

Along the losing segment of the Spokane River from the gaging stations near Post Falls to at Greenacres, the riverbed is above the regional water table and water leaks out of the river to recharge the aquifer. Caldwell and Bowers (2003, p. 18-19 and fig. 7) noted that a narrow ground-water mound can develop beneath the river as a result of vertical infiltration from the river. A well located close to the riverbank might penetrate the ground-water mound and encounter a water level that is substantially higher than the water level that predominates in regions away from the river. Wells 84, 157, and 158 in the well network appear to fit that description. For example, from June 2004 to December 2005, the average water level in well 84 is 1,990 ft. For the same period, the water levels in wells 71 and 87, both about 3,500 ft from well 84 and the Spokane River ([fig. 23](#)), are, respectively, 1,963 and 1,961 ft. The water levels in wells 71 and 87 are consistent with the regional trend of the water table, but the water level in well 84 likely characterizes the local ground-water condition immediately beneath the Spokane River.

During April 2006, synoptic water-level measurements were made in the same 268 wells used for the September

2004 synoptic water-level measurements (Campbell, 2005). The two water-level data sets provide an opportunity to compare spring and autumn water levels throughout the SVRP aquifer. The change in water level from September 2004 to April 2006 is shown in [figure 31](#). At each well, the change is computed as the water level in April 2006 minus the water level in September 2004. A positive change indicates a rise in water level from September 2004 to April 2006. A negative change indicates a decline in water level from September 2004 to April 2006. Excluded from [figure 31](#) are wells that were pumped prior to or during either synoptic measurement session.

The water-level changes shown in [figure 31](#) display many of the water-level characteristics discussed in the preceding paragraphs. For the most part, water levels rose in the aquifer in response to recharge from precipitation and river infiltration during the winter of 2005-06 and the spring of 2006. However, exceptions occur in the vicinity of Lake Pend Oreille and in the vicinity of Coeur d'Alene Lake. The level of Lake Pend Oreille is lower in spring than in autumn. [Figure 31](#) shows that ground-water levels in the vicinity of Lake Pend Oreille declined from September 2004 to April 2006. The magnitude of the water-level decline is largest close to the lake and decreases with distance away from the lake. The areal extent of the decline indicates that the lake level could influence ground-water levels over a distance from the lake to about halfway between Lake Pend Oreille and Spirit Lake.

In the vicinity of Coeur d'Alene Lake, ground-water levels also declined from September 2004 to April 2006.

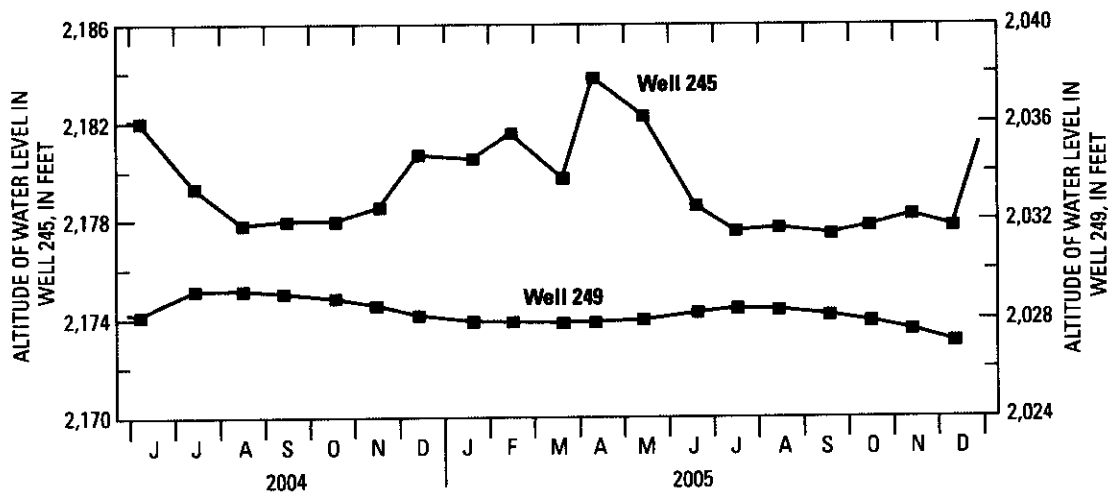


Figure 30. Water levels in wells 245 and 249, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

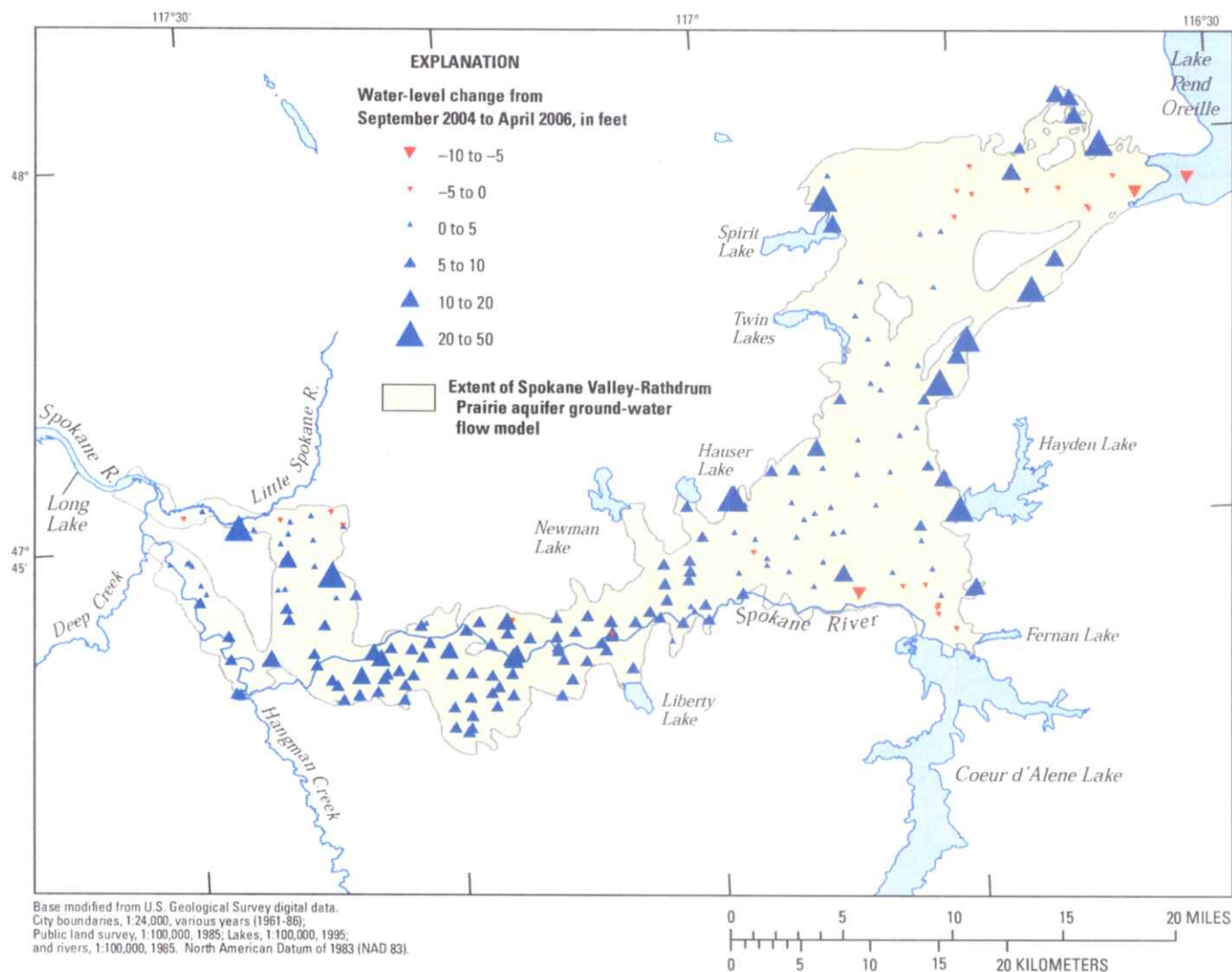


Figure 31. Changes in water levels, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho, September 2004 to April 2006.

September 2004 is the end of the summer period when Coeur d'Alene Lake was maintained at about 2,132 ft. During April 2006, the lake level rose from about 2,129 to 2,132 ft. However, as discussed previously, the ground-water levels in the vicinity of Coeur d'Alene Lake do not show a clear relation to the lake level. Therefore, it is difficult to provide a clear explanation for the decline in ground-water levels in the vicinity of the lake from September 2004 to April 2006.

Along the margins of Rathdrum Prairie, water levels rose by tens of feet. By contrast, in the central part of Rathdrum Prairie, the water level rose by a few feet. The data support the concept that water levels along the aquifer margins are strongly controlled by inflows from adjacent uplands and tributary basins. The large fluctuations in water levels along the aquifer margins are damped out in the central part of the aquifer.

The water-level rise in Spokane Valley is substantially larger than the water-level rise in Rathdrum Prairie (excluding the wells along the prairie margins). This is due to the presence of the Spokane River, which is a major source of recharge to Spokane Valley. In addition, the greater depths to the water table in Rathdrum Prairie require a longer time for precipitation infiltration to reach the water table. Thus, water-level rises in Rathdrum Prairie generally lag behind the water-level rise in Spokane Valley.

Ground-Water Flow Model

The ground-water flow model known as MODFLOW-2000 (Harbaugh and others, 2000) is used to simulate ground-water flow in the SVRP aquifer. MODFLOW-2000 is a computer program that numerically solves the three-dimensional ground-water flow equation for a porous medium by using the finite-difference method. The modular design of MODFLOW-2000 uses packages to represent various components of the ground-water flow system, such as recharge, withdrawal from wells, and interactions between the aquifer and surface-water bodies.

Spatial Discretization

A model grid of 172 rows, 256 columns, and 3 layers is used to represent the SVRP aquifer. In the horizontal direction, each cell has a dimension of 1,320 by 1,320 ft. The areal extent of the grid is larger than the model area. The larger grid is intended to accommodate possible enlargements of the model area in future studies. Cells outside the model area are designated as inactive in MODFLOW-2000. The active cells in model layers 1 and 3 and shown in [figures 32 and 33](#).

Vertically, the SVRP aquifer is represented by either one or three model layers. Except in Hillyard Trough and Little Spokane River Arm, the aquifer is represented by the top model layer (layer 1); cells in model layers 2 and 3 are inactive. In Hillyard Trough and the Little Spokane River Arm, the aquifer is represented by three model layers. Vertical section A-B-C-D in [figure 34](#) shows how the model layers represent the dividing of the aquifer from a single hydrogeologic unit into an upper and a lower unit separated by a clay layer. From A to B, the aquifer exists as a single hydrogeologic unit and is represented solely by model layer 1. Model layers 2 and 3 have zero thicknesses and are

designated as inactive. From B to C, the aquifer exists as a single hydrogeologic unit but is represented by all three model layers. Model layer 2 has a uniform thickness of 1 ft, but model layer 3 gradually thickens from B to C. Point C marks the location where the aquifer divides into an upper and a lower unit. From C to D, model layer 1 represents the upper unit, model layer 2 represents the clay layer, and model layer 3 represents the lower unit. The altitude at the top of the clay layer is set at 1,700 ft in Hillyard Trough and decreases to 1,500 ft in the Little Spokane River Arm. The thickness of the clay layer is assumed to be 150 ft in both Hillyard Trough and the Little Spokane River Arm. In the input data for MODFLOW-2000, model layer 1 is specified as an unconfined layer. Model layers 2 and 3 are specified as confined layers.

Temporal Discretization

Ground-water flow in the SVRP aquifer is simulated for September 1990 through September 2005. The simulation period is divided into 181 stress periods of 1 month each. Monthly stress periods are needed to simulate the dynamic interaction between the aquifer and the Spokane River as shown by the hydrograph in [figure 24](#). Each stress period consists of one time step. Using one time step per stress period was determined to be adequate because trial simulations using several time steps per stress period yielded essentially the same results.

Because the distribution of heads in the aquifer is unknown at the beginning of the simulation period, the initial heads are computed assuming a steady-state ground-water flow system during the first stress period (September 1990). The heads simulated during the first stress period serves as the initial conditions for the rest of the transient simulation. In reality, flow in the aquifer is not at steady state during September 1990, and the simulated heads for that month do not accurately represent the actual heads in the aquifer. To eliminate the effects of this error, the first 5 years of the simulation is considered a start-up period. No attempt is made to fit simulated quantities to measured quantities during the start-up period. Instead, hydrologic data from October 1995 to September 2005 are used for model calibration. The calibrated model is expected to produce simulated conditions at the end of the start-up period (October 1995) that are close to the corresponding actual conditions in the aquifer, because the error caused by the assumed initial conditions would have dissipated.

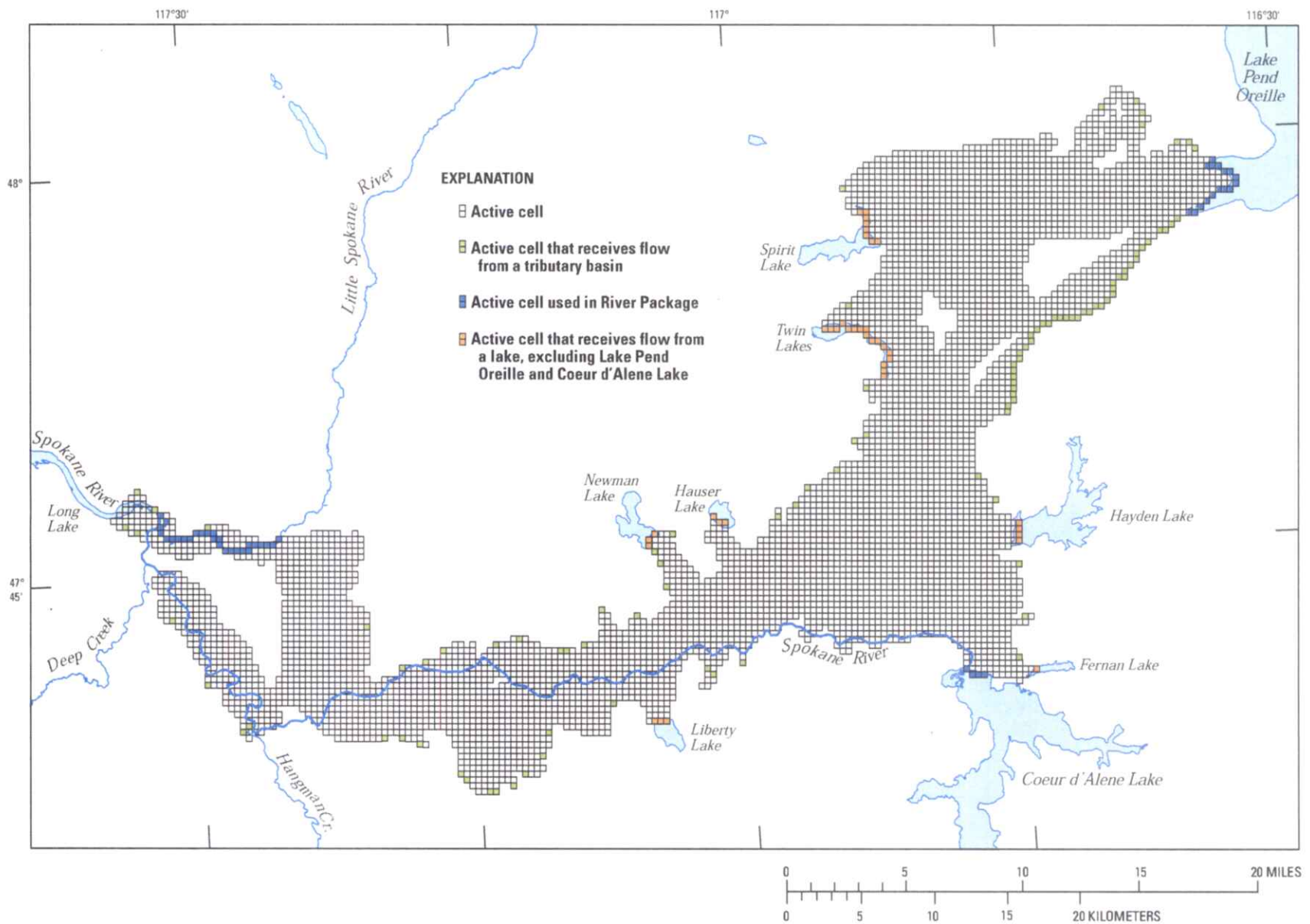


Figure 32. Active cells in model layer 1, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

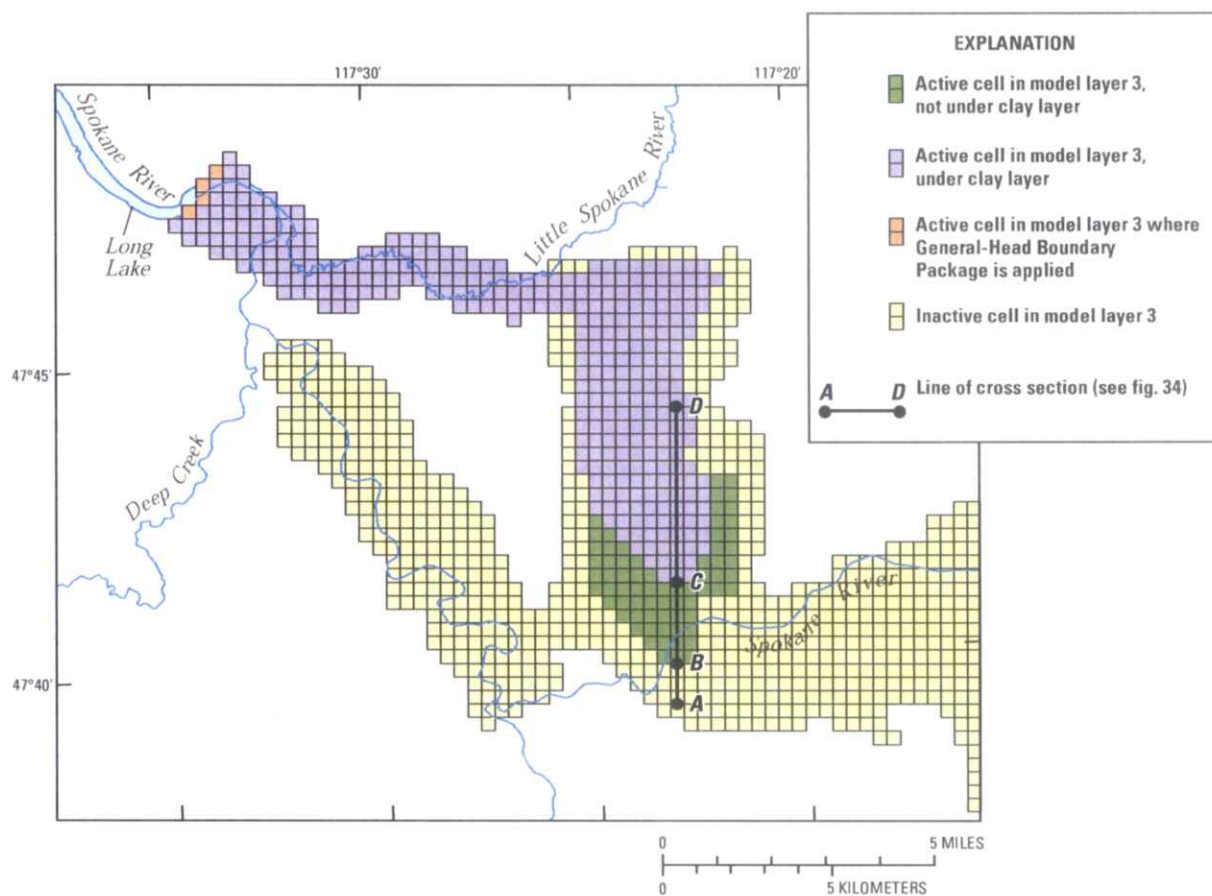


Figure 33. Active cells in model layer 3, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

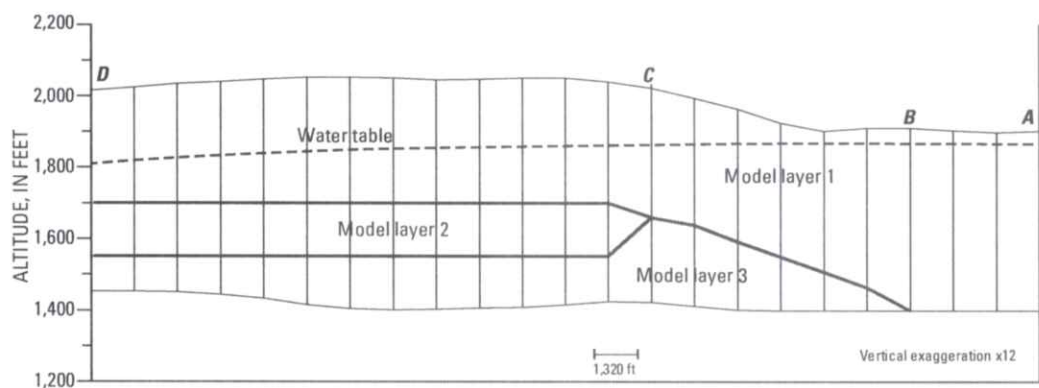


Figure 34. Vertical section A-B-C-D showing how model layers represent the dividing of the aquifer from a single hydrogeologic unit into an upper and lower unit separated by a clay layer, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

Boundary Conditions and Implementation of MODFLOW Packages

A no-flow boundary is specified on the bottom of the model domain. Along the sides of the model domain, the no-flow boundary is specified except for locations where the aquifer receives inflow from tributary basins and lakes and where ground water exits the lower unit at the west end of the Little Spokane River Arm. Boundary conditions other than the no-flow boundary are implemented in the model using various MODFLOW packages. These packages represent inflow and outflow components discussed previously in the sections, "Inflows to Aquifer" and "Outflows from Aquifer."

Recharge Package

The Recharge Package is used to simulate recharge from precipitation. Recharge is applied to the top model layer. For each active cell and for each stress period (that is, for each month), the recharge is the precipitation infiltration flux (in units of feet per day) that enters the ground-water table. This recharge is derived from (1) precipitation that infiltrates into permeable land surfaces and (2) precipitation runoff from impermeable land surfaces to recharge wells, infiltration basins, or adjacent permeable surfaces.

Well Package

The Well Package is used to simulate withdrawals from wells, return percolation from irrigation, and effluent from septic systems. For each active cell and for each stress period, a positive well flow value (in units of cubic feet per day) indicates a volumetric recharge rate, and a negative well flow value indicates a volumetric withdrawal rate. In the model, the well flow value for each cell is the net result of well withdrawals, return percolation from irrigation, and effluent from septic systems. For example, within a water purveyor service area, a cell that contains a water-supply well has a large negative well flow value, which is dominated by the well withdrawal rate. By contrast, a cell that does not contain a water-supply well has a small positive well flow value, which represents return percolation from landscape irrigation.

Flow and Head Boundary Package

The Flow and Head Boundary Package (Leake and Lilly, 1997) is used to simulate flows to the SVRP aquifer from tributary basins and from all lakes except Lake Pend Oreille and Coeur d'Alene Lake. For each tributary basin that drains to the aquifer (fig. 10), flow from the basin is assigned as specified flow to the active cell that contains or is closest to the outflow point. An exception to this procedure is made along the east margin of northern Rathdrum Prairie. In that area, the saturated zone is a thin layer overlying bedrock. If

flow from the tributary basin is applied to a single cell, a very large buildup in head would result. To avoid this situation, flow is distributed uniformly among active cells along the model boundary. The cells that receive flow from tributary basins are shown in figure 32. For the lakes, flow to the aquifer is distributed uniformly among active model cells along the lakeshore (fig. 32).

River Package

The River Package is used to simulate the Little Spokane River, Lake Pend Oreille, and Coeur d'Alene Lake. In the River Package, a river reach refers to the section of a river with a model cell. For a river reach, the volumetric flow rate across the riverbed to the underlying model cell is computed as

$$Q_{rb} = C_{rb}(h_r - h_a), \quad (6)$$

where

- Q_{rb} is the flow rate across the riverbed,
- C_{rb} is the conductance of the riverbed,
- h_r is the river stage, and
- h_a is the hydraulic head in the cell underlying the riverbed, if the bottom of the riverbed is below the water table in the cell, or the altitude of the bottom of the riverbed, if the bottom of the riverbed is above the water table in the cell.

The conductance of the riverbed is given by

$$C_{rb} = \frac{K_v w L}{m}, \quad (7)$$

where

- K_v is the vertical hydraulic conductivity of the riverbed sediment,
- w is the width of the river reach,
- L is the length of the river reach, and
- m is the thickness of the riverbed sediment.

However, K_v , w , L , and m are not individually specified in the River Package. Instead, conductance of the riverbed, C_{rb} , is specified. Model cells used in the River Package are shown in figure 32.

To apply the River Package to the Little Spokane River, the following procedure is used to determine the river stage, h_r . For each stress period, the average stage (over the stress

period) is computed at the gaging stations on the Little Spokane River at Dartford and near Dartford from daily recorded values. Because no gaging stations are located on the Little Spokane River downstream of the gaging station near Dartford, the stage at the mouth of the river (where the river joins the Spokane River) is estimated from the Nine Mile Falls USGS 7.5-minute topographic quadrangle to be 1,544 ft. For each river reach between the gaging stations at Dartford and near Dartford, the stage is estimated by assuming a uniform gradient in river level between the two gaging stations. A similar procedure is used to estimate the stage of a river reach between the gaging station near Dartford and the mouth of the river.

For each reach of the Little Spokane River in the model, the altitude of the bottom of the riverbed is assumed to be 10 ft below the river stage. This assumption is inconsequential to the simulation because the simulated head in the cell underlying the river reach is always higher than the bottom of the riverbed. Therefore, h_b in equation 6 is always the hydraulic head in the cell. A single riverbed conductance is assigned to all reaches of the Little Spokane River. This conductance value, denoted as C-LSR, is estimated by model calibration.

Because equation 6 also can be used to describe lakebed seepage, the River Package is used to simulate subsurface seepage from Lake Pend Oreille and Coeur d'Alene Lake. For this usage, the terms river and riverbed in the definitions of variables in equation 6 are replaced, respectively, by lake and lakebed. The River Package is implemented at model cells underlying the near-shore region of the lake. For each stress period, the lake stage is specified as the average of the daily recorded lake levels over the stress period. Based on lake bathymetry data, the altitude of the bottom of the lakebed in the near-shore region is set to 1,860 ft for Lake Pend Oreille and 2,090 ft for Coeur d'Alene Lake. As in the case of the Little Spokane River, a single lakebed conductance is assigned to each lake. These two conductance values, denoted as C-PO for Lake Pend Oreille and C-CDA for Coeur d'Alene Lake, are estimated by model calibration.

Streamflow-Routing Package

The Streamflow-Routing Package (Prudic and others, 2004) is used to simulate the interaction between the Spokane River and the SVRP aquifer. In the Streamflow Routing Package, equations used to compute flow between the stream and the aquifer were the same as equations 6 and 7 in the River Package. However, the Streamflow-Routing Package is more powerful than the River Package because it provides various methods for routing water through a stream network.

The Streamflow-Routing Package requires data on stream-channel geometry. In the SVRP aquifer model, the channel of the Spokane River is approximated as having a rectangular cross section. Channel width and the altitude of

the top of the streambed are estimated at 16 control points along the river from field measurements and data from previous studies (Seitz and Jones, 1981; Annear and others, 2001) and then linearly interpolated between control points. The thickness of the streambed sediments (m) is assumed to be 1 ft. This assumption is not critical to the simulation because the streambed conductance depends on K_v/m , where K_v is the vertical hydraulic conductivity of the streambed sediments. Thus, the actual variation in m can be included in the variability of K_v .

To represent K_v of the streambed sediment, the Spokane River in the model area is divided into 11 sections (fig. 35). Within each section, K_v is assumed to be uniform. Selection of the 11 river sections is based partially on factors that might affect K_v . For example, the character of the streambed sediment in a free-flowing part of the river might be different from the character of the streambed sediment where the river is a reservoir behind a dam. In addition, Caldwell and Bowers (2003) noted that the transport of fine-grained material with the leaking water from the Spokane River might decrease K_v of the streambed sediments along a losing section of the river. The K_v values of the 11 river sections are denoted by KVS-1 through KVS-11 and are estimated by model calibration.

Although the Streamflow-Routing Package is capable of simulating stream depth as a function of stream discharge using either Manning's equation or a rating curve, this capability is not used in the SVRP aquifer model because of the presence of dams, spillways, and reservoirs on the Spokane River. Instead, for every time step, stream stage is specified for every stream reach in the model. In this usage, the Streamflow-Routing Package functions in a manner similar to the River Package with the added capability of calculating a stream water budget for each stream reach.

Data used to determine stream stages include: (1) stage measurements at the four gaging stations on the Spokane River, (2) stage measurements for 1999 and 2000 for seven bridges across the Spokane River (Reanette Boese, Spokane County Utilities, written commun., 2006), and (3) levels of Coeur d'Alene Lake, Long Lake, and Nine Mile Reservoir. The altitude of Upriver Reservoir is assumed to be constant at 1,914 ft. The given data provide stream stages at 15 control points along the Spokane River. Between control points, stream stage is estimated by linear interpolation. If the stage data at a control point do not span the entire simulation period (1990–2005), a mathematical relation is developed between the available stage measurements at the control point and the corresponding stage at the gaging station near Post Falls (which has stage data for the entire simulation period). The relation between the stage at the Sullivan Road Bridge (where stage data are available for 1999 and 2000) and the stage at the gaging station near Post Falls is shown in figure 36. The equation shown in figure 36 is used to estimate the stage at Sullivan Road Bridge for periods with no stage data.

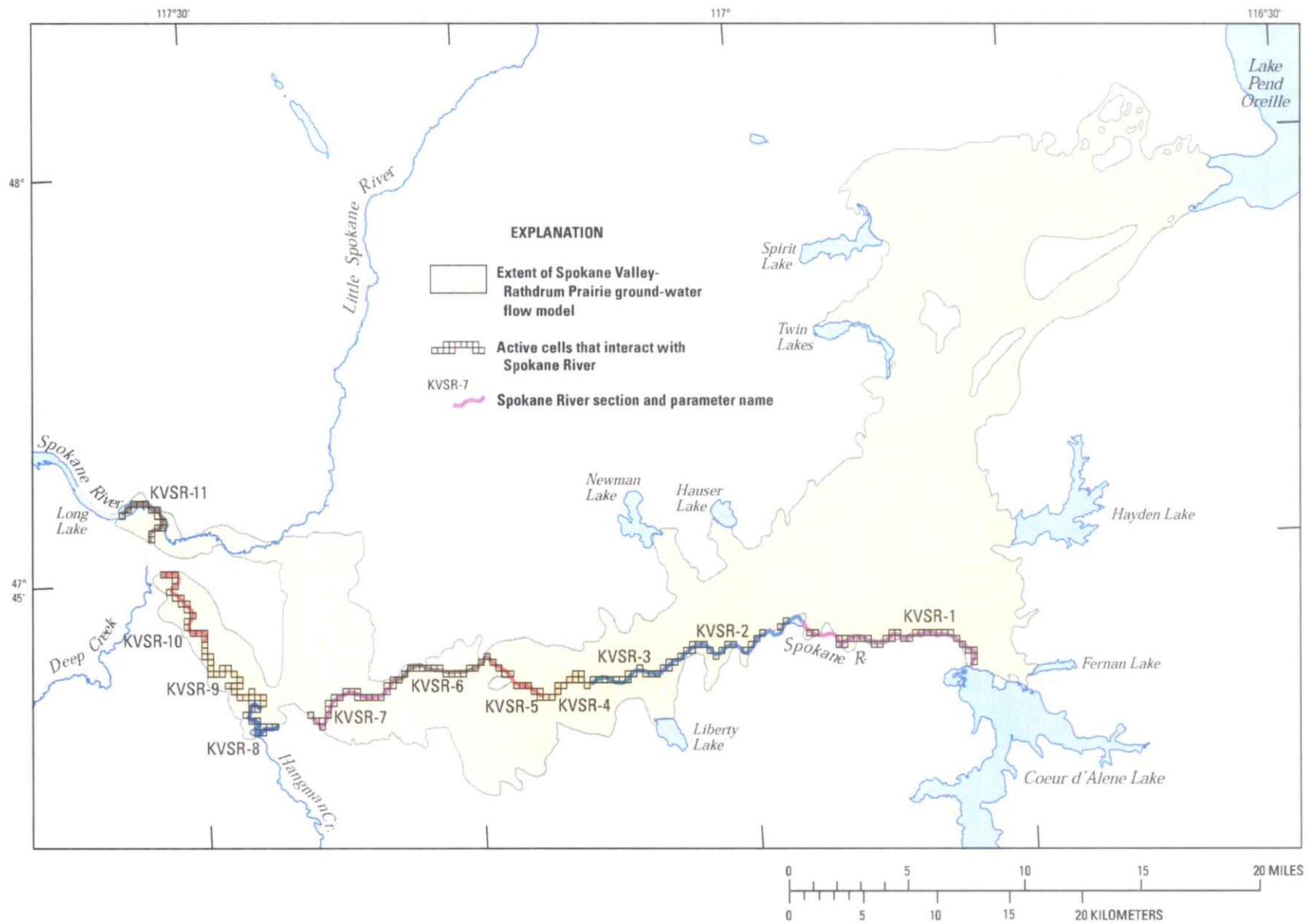


Figure 35. Sections of Spokane River used in the Streamflow-Routing Package, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

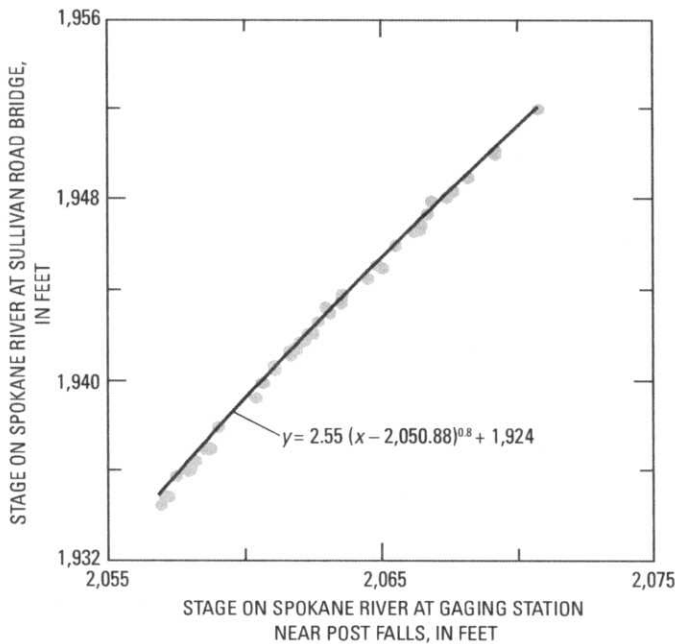


Figure 36. Relation between stage on the Spokane River at Sullivan Road Bridge (y) and stage at the gaging station near Post Falls (x), Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

General-Head Boundary Package

The General-Head Boundary Package is used to simulate ground-water outflow from the lower unit at the west end of the Little Spokane River Arm. Available field data indicate that the lower unit extends beyond the model boundary, and ground water flows in the unit for an unknown distance before eventually discharging into Long Lake. The General-Head Boundary Package is used as an approximate representation of this conceptualization and is applied to four active cells at the west edge of model layer 3 (fig. 33). Ground-water outflow from each cell is computed as

$$Q_b = C_b(h_b - h_a), \quad (8)$$

where

- C_b is the boundary conductance,
- h_b is the water level in Long Lake, and
- h_a is the hydraulic head in the cell.

For each stress period, h_b is the average of the daily recorded levels of Long Lake over the stress period. A single boundary conductance, denoted as C-OUT, is assigned to all four cells, and the conductance is estimated by model calibration.

Hydraulic Conductivity

To represent the spatial distribution of K_h in the SVRP aquifer, active cells in model layer 1 are grouped into 22 zones, denoted by HK1-1 through HK1-22, as shown in figure 37. Within each zone, K_h is uniform. Zones HK1-1 through HK1-11 represent the central part of the aquifer in Rathdrum Prairie, Spokane Valley, and the upper unit in Hillyard Trough and the Little Spokane River Arm. Zones HK1-12 and HK1-13 represent Trinity Trough and Western Arm, respectively. Zones HK1-14 and HK1-15 represent the areas in the vicinity of Hayden and Coeur d'Alene. Zones HK1-16 through HK1-22 represent side valleys and regions of shallow bedrock along the aquifer margins. Zone HK1-22 is included as a separate zone to represent a small side valley north of Coeur d'Alene. This arrangement provides greater flexibility during model calibration to simulate water levels in well 140, which is located in the side valley. The K_h values for zones HK1-1 through HK1-22 are estimated by model calibration. For all active cells in model layer 1, K_v is set to 3,000 ft/d. This K_v value is intended to allow water to flow freely from model layer 1 into model layer 3 in the region south of the clay layer in Hillyard Trough.

Active cells in model layer 2 are grouped into two zones as indicated in figure 38. One zone represents the clay layer in Hillyard Trough and the Little Spokane River Arm. K_h and K_v values of these cells are set to 10^{-8} ft/d. The other zone provides hydraulic connection between model layers 1 and 3 in the region south of the clay layer. These are the 1-ft thick cells shown along section B-C in figure 34. K_h and K_v values of these cells are set to 3,000 ft/d.

Active cells in model layer 3 are grouped into two zones as shown in figure 39. Zone HK3-1 consists of cells in Hillyard Trough. Zone HK3-2 consists of cells in the Little Spokane River Arm. K_h values of both zones are estimated by model calibration. As in the case of model layer 1, all active cells in model layer 3 are assigned a K_v value of 3,000 ft/d to establish a direct hydraulic connection between model layers 1 and 3 in the region south of the clay layer in Hillyard Trough.

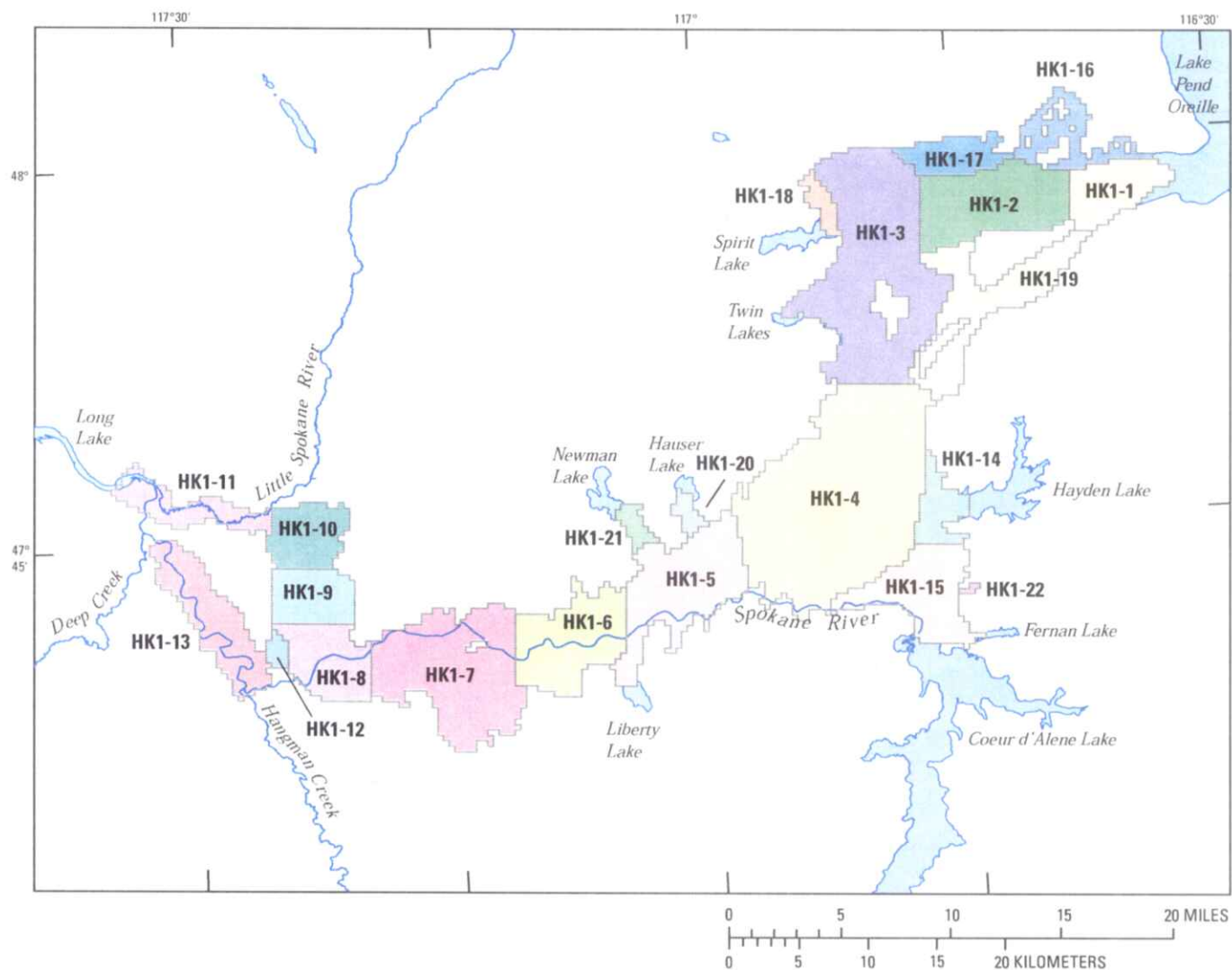


Figure 37. Horizontal hydraulic conductivity zones in model layer 1, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

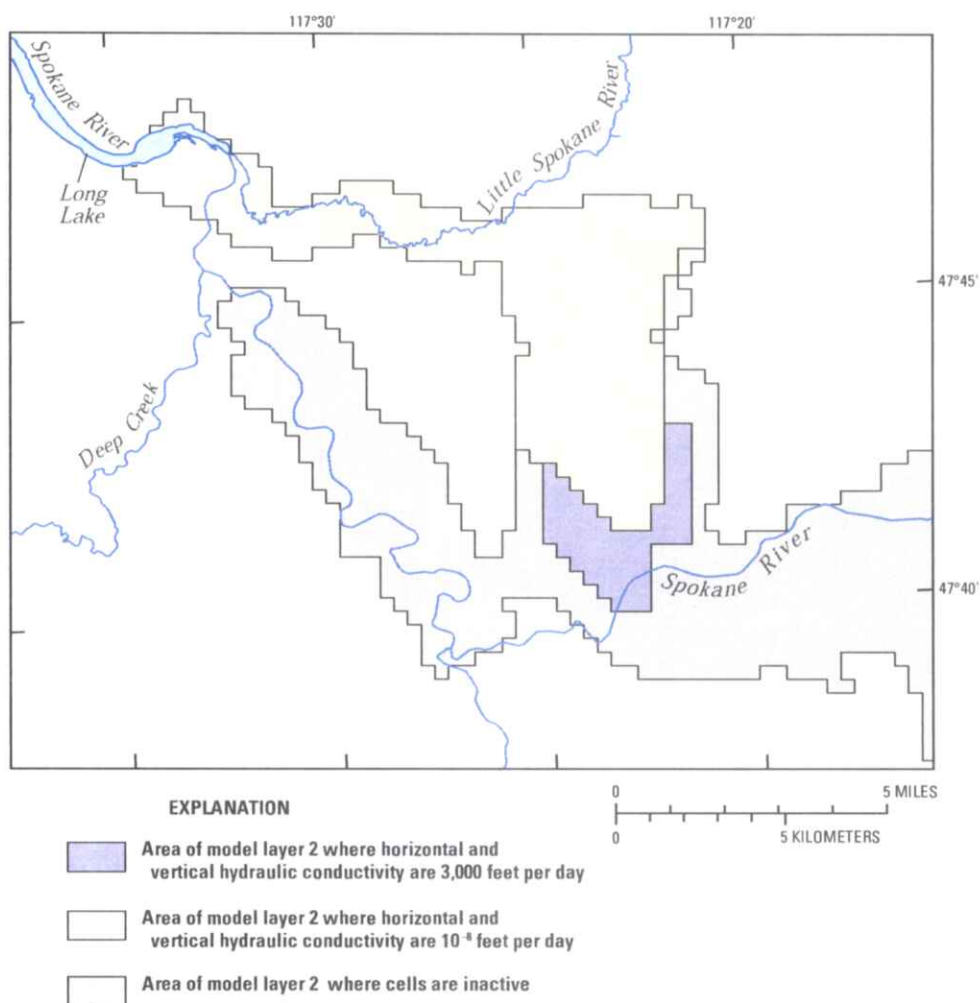


Figure 38. Hydraulic conductivity zones in model layer 2, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

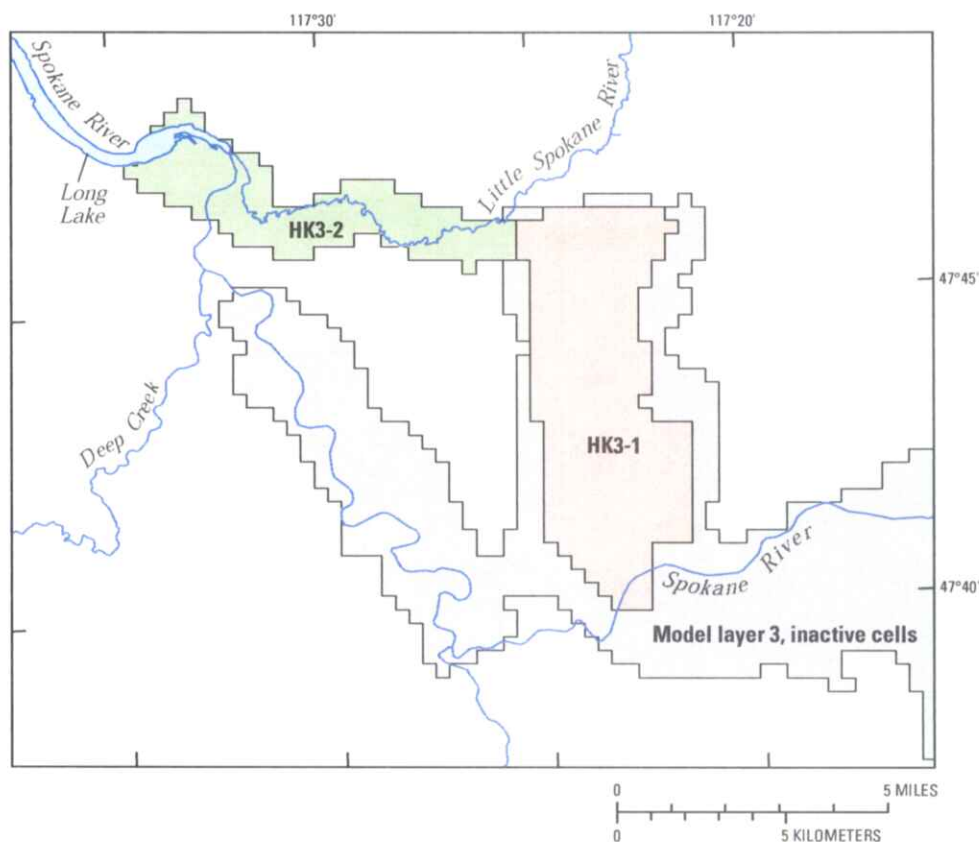


Figure 39. Horizontal hydraulic conductivity zones in model layer 3, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

Specific Yield

The spatial distribution of S_y is represented by three zones as shown in [figure 40](#). Because S_y values are expected to fall within a relatively limited range (0.1 – 0.3), fewer zones are used to represent the spatial distribution of S_y than to represent the spatial distribution of K_p . Zone SY-1 represents, approximately, that part of the SVRP aquifer where water-level fluctuations are controlled primarily by

recharge from precipitation. By contrast, zone SY-2 represents, approximately, that part of the aquifer where water-level fluctuations are controlled primarily by the Spokane River. Zone SY-3 represents regions of shallow bedrock along the margins of Rathdrum Prairie where water-level fluctuations are controlled by both recharge from precipitation and inflows from tributary basins and adjacent uplands. The three S_y values are estimated by model calibration.

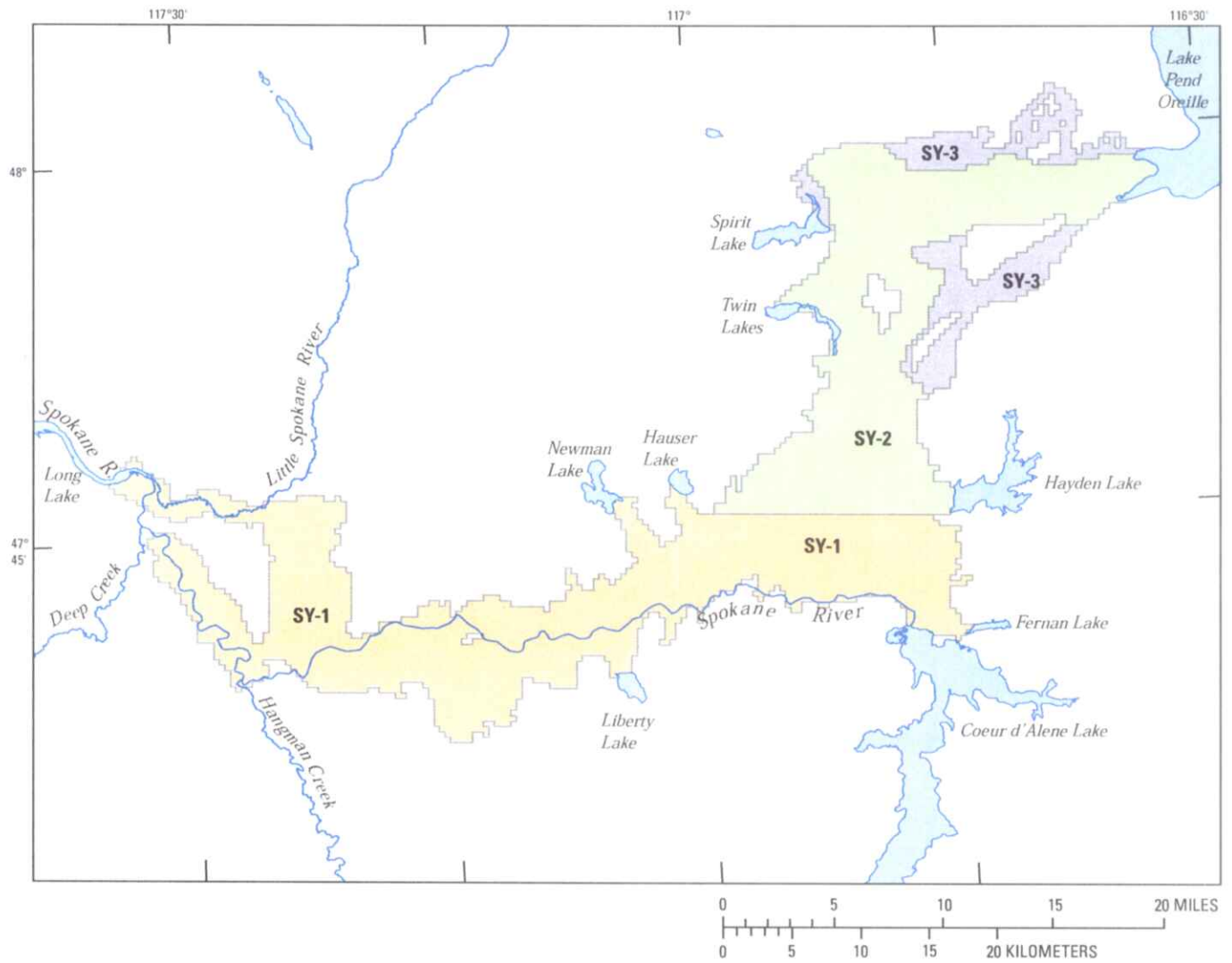


Figure 40. Specific yield zones, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

Model Calibration

Model calibration is the adjustment of model parameters (such as hydraulic conductivity and specific yield) so that the differences between simulated and measured quantities (such as water levels and flows) are minimized with respect to an objection function. This section of the report describes the nonlinear least-squares regression method used for calibration, the calibration data, and the calibration results. The calibration is assessed by examining how well the simulated quantities fit the measured quantities. Model assumptions are examined by comparing the calibrated model with several alternative models.

Nonlinear Least-Squares Regression Method

The parameter estimation program PEST version 10 (Doherty, 2004) is used to calibrate the SVRP aquifer model. PEST implements a nonlinear least-squares regression method to estimate model parameters by minimizing the sum of squared weighted residuals:

$$\Phi = \sum_{i=1}^N (w_i r_i)^2, \quad (9)$$

where

- N is the number of measurements,
- w_i is the weight for the i^{th} measured quantity, and
- r_i is the i^{th} residual, defined as the i^{th} measured quantity minus the corresponding i^{th} simulated quantity.

The sum of squared weighted residuals, Φ , also is known as the objective function. PEST uses the Gauss-Marquardt-Levenberg method to minimize Φ . Details of this method are given in the PEST user's manual (Doherty, 2004).

The weight, w_i , reflects the importance of the i^{th} measured quantity on the regression. A measurement with a large w_i asserts a large influence on the regression and, therefore, the estimated parameter values. Conversely, a measurement with a small w_i asserts a small influence on the regression and estimated parameter values. Note that the notation for w_i follows the convention used in the PEST manual. Other authors (for example, Hill, 1998) express equation 9 as

$$\Phi = \sum_{i=1}^N \omega_i r_i^2, \quad (10)$$

and define ω_i as the weight. Therefore, w_i as used in this report is equivalent to the square root of ω_i in equation 10.

Calibration Data

The SVRP aquifer model is calibrated using both water-level and flow measurements. Water-level measurements include:

1. Synoptic water-level measurements for 268 wells during September 2004,
2. Monthly water-level measurements for 55 monitoring wells from the summer of 2004 through September 2005,
3. Water-level measurements by Caldwell and Bowers (2003) for 11 wells in the vicinity of the Spokane River during 2000 and 2001, and
4. Historical water-level data for four wells in the monitoring network (wells 92, 209, 236, and 251) from October 1995 to September 2005.

A total of 1,573 water-level measurements are used in the model calibration. Water-level measurements for several wells are excluded as calibration data. A well is excluded if it meets one of the following criteria: (a) the well is completed in bedrock or in both bedrock and in aquifer sediments, (b) the well encounters the narrow ground-water mound beneath the losing segment of the Spokane River upstream of the gaging station at Greenacres, and (c) the well is located along the aquifer boundary where water levels differ by more than several tens of feet from those of nearby wells.

Flow measurements consist of streamflow gains and losses along segments of the Spokane and Little Spokane Rivers. Flow measurements include:

1. Monthly average streamflow gains and losses from October 1995 to July 1999 on the segment of the Spokane River from the gaging stations near Post Falls to at Spokane,
2. Monthly average streamflow gains and losses from August 1999 to September 2005 on the segment of the Spokane River from the gaging stations near Post Falls to at Greenacres,
3. Monthly average streamflow gains and losses from August 1999 to September 2005 on the segment of the Spokane River from the gaging stations at Greenacres to at Spokane,
4. Monthly average streamflow gains from October 1997 to September 2005 on the segment of the Little Spokane River from the gaging stations at Dartford to near Dartford,
5. Synoptic streamflow gains and losses on the Spokane and Little Spokane Rivers during the seepage run during September 13–16, 2004, and

6. Synoptic streamflow gains and losses on the Spokane and Little Spokane Rivers during the seepage run during August 26–31, 2005.

A total of 313 flow measurements are used in the model calibration.

Weights for Measured Quantities

A standard approach to determining the weight for a measured quantity is to calculate w_i as the inverse of the standard deviation of the error associated with the i^{th} measured quantity (Hill, 1998). To apply this approach, the following sources of error are evaluated for water-level measurements:

1. Error in the altitude of land surface datum at the well site. For all wells used in this study, the land surface datum errors are given in the column under the heading "Accuracy of land-surface altitude" in table 1 of the water-level map by Campbell (2005). These errors range from 0.01 to 20 ft. The altitudes of several well sites have been re-surveyed since the publication of the water-level map.
2. Error in the measurement method. For the September 2004 synoptic water-level data listed in table 1 of the water-level map by Campbell (2005), the measurement method is given in the column under the heading "Method of water-level measurement." Six measurement method codes are listed: A (airline), C (calibrated airline), G (pressure gage), S (steel tape), T (electric tape), and V (calibrated electric tape). For the weight calculation, the error is assumed to be 5 ft for A, C, and G, and 0.02 ft for S, T, and V. For all other water-level measurements used in the model calibration, the measurement method is assumed to be S, T, or V, and the error is assumed to be 0.02 ft.
3. Error from local disturbance, such as pumping. This error is inferred from a water-level status code that is recorded with each water-level measurement. If the code is P (the well is being pumped at the time of measurement), the error is assumed to be 10 ft. If the code is R (the well was recently pumped prior to the time of measurement), the error is assumed to be 2 ft. If the code is S (a nearby well is being pumped at the time of measurement) or T (a nearby well was recently pumped prior to the time of measurement), the error is assumed to be 1 ft. If no code is recorded, the error is assumed to be zero.

Following Hill's (1998, p. 46) suggestion, each of the above error values is interpreted as a 95-percent confidence interval. For example, a land-surface datum error of 10 ft is

interpreted to mean that the probability is 95 percent that the actual land-surface datum is within ± 10 ft of the measured datum. If the error is assumed to be a normally distributed random variable, then a 10-ft error is equal to 1.96 times the standard deviation. Therefore, the standard deviation is 5.1 ft. To account for multiple sources of errors, the variance (square of standard deviation) for each error source is computed, the variances are summed, and the square root of the sum is calculated. This gives the standard deviation of the total error. The weight then is computed as the inverse of this standard deviation.

A similar procedure (Hill, 1998, p. 46–47) is used to determine the weights of the flow measurements (streamflow gains and losses). Because the streamflow gain or loss on a river segment is determined from the difference between streamflows at the upstream and downstream ends of the river segment, the variances of the errors of the two streamflow values are summed. Based on the study by Sauer and Meyer (1992), the error of a streamflow measurement is estimated to be 5 percent of the measured value. To illustrate the weight calculation, suppose the streamflow at the upstream gaging station is 1,000 ft³/s and the streamflow at the downstream gaging station is 800 ft³/s, giving a streamflow loss of 200 ft³/s. For the streamflow at the upstream gaging station, the error is 50 ft³/s. Interpreting this error to equal 1.96 times the standard deviation gives a standard deviation of 25.5 ft³/s, or a variance of 651 (ft³/s)². By the same reasoning, the error of the streamflow at the downstream gaging station is 40 ft³/s, giving a standard deviation of 20.4 ft³/s and a variance of 416 (ft³/s)². The variance of the error of the streamflow loss (200 ft³/s) is the sum of the variances of the upstream and downstream streamflows, or 1,067 (ft³/s)². The standard deviation is 32.7 ft³/s, and the weight is the inverse of the standard deviation.

Initial calibration runs using weights determined by the previously described procedure indicated that the sum of squares of weighted residuals is heavily dominated by the water-level measurements, and the fit to flow measurements is poor. This results from the fact that (1) the number of water-level measurements is five times the number of flow measurements, and (2) relative errors in water-level measurements generally are much smaller than relative errors in flow measurements. To create a more even balance between the weighted water-level residuals and the weighted flow residuals, the weights for water-level measurements are reduced by adding 5 ft to the standard deviations of the water-level errors. This adjustment improves the fit to flow measurements without substantially degrading the fit to water-level measurements.

Estimated Parameters

The calibration set-up as previously described involves 42 parameters. These parameters are listed in the first column of [table 8](#). During the initial calibration phase, it was determined that calibration data were insensitive to HK1-21 (the horizontal hydraulic conductivity of the side valley in which Newman Lake is located) and KVS-11 (the vertical hydraulic conductivity of the streambed sediments in the segment of the Spokane River in the Little Spokane River Arm). In addition, initial calibration runs yielded relatively high values of C-OUT (the boundary conductance for outflow from the lower unit to Long Lake), but the estimated C-OUT was nonunique and varied from one calibration run to another depending on starting parameter values. In addition, the estimated value of HK3-2 (horizontal hydraulic conductivity of the lower unit in the Little Spokane Arm) was unreasonably high. Therefore, the four previously mentioned parameters are not estimated by calibration but are assigned as follows. HK1-21 is set to 150 ft/d. This K_h value results in a simulated water level of about 2,100 ft in the vicinity of Newman Lake. This water level is about 30 ft below the level of Newman Lake. KVS-11 is set to 0.1 ft/d. This K_v value limits the interaction between the aquifer and the segment of the Spokane River in the Little Spokane River Arm. The limited interaction is reasonable because most of the ground-water discharge in the Little Spokane River Arm would enter the Little Spokane River. C-OUT is set to a relatively high value of 10^6 ft²/d. Increasing or decreasing this value by one order of magnitude has little or no effect on the simulation results. However, setting a high value for C-OUT is nearly equivalent to setting the head at the outflow boundary close to the level of Long Lake. HK3-2 is set to 2,000 ft/d. This value based on K_h values estimated for the Hillyard Trough area (see [fig. 6](#)).

The PEST program requires specifying an acceptable interval for each estimated parameter. The lower and upper limits defining this interval are given in the third and fourth columns of [table 8](#). For hydraulic conductivity and conductance, the acceptable interval is set fairly wide, with the expectation that the estimated value would fall within the acceptable interval. For specific yield, the acceptable interval is set from 0.1 to 0.3. PEST always yields an estimated value that is within the parameter's acceptable interval (inclusive of the upper and lower limits).

Estimated values obtained from the calibration are given in the fifth column of [table 8](#). A value in **bold** indicates that the estimated value is at either the upper or lower limit of the acceptable interval. In the central part of the aquifer in Rathdrum Prairie and in Spokane Valley, estimated K_h values ranged from 6,170 to 22,100 ft/d. In Hillyard Trough, the Little Spokane River Arm, and Western Arm, estimated K_h values ranged from 1,980 to 3,110 ft/d. In the Coeur d'Alene area, the estimated K_h value is 1,290 ft/d. For side valleys and regions of shallow bedrock along the margins of the aquifer, estimated K_h values ranged from 5 to 140 ft/d. These estimated K_h values generally are consistent with K_h values estimated in previous studies (see the discussion in the section, "Hydraulic Properties.").

Estimated S_y values are 0.1 for SY-1, 0.19 for SY-2, and 0.21 for SY-3. The estimated SY-1 value is at the lower limit of the acceptable range. The implication of this calibration result is explored using alternative model C in the section, "Alternative Models."

Estimated K_v values of streambed sediments indicate that these parameters are related to gaining and losing segments of the Spokane River. Along losing segments of the Spokane River, estimated K_v values of streambed sediments are less than 1 ft/d (parameters KVS-1 to KVS-4, KVS-6, and KVS-8). Along gaining segments of the Spokane River, estimated K_v values of streambed sediments are greater than 1 ft/d (parameters KVS-5, KVS-7, KVS-9, and KVS-10). These results support the suggestion by Caldwell and Bowers (2003) that the transport of fine-grained material with the leaking water from the Spokane River might decrease K_v of the streambed sediments along a losing segment of the river.

The sixth and seventh columns of [table 8](#) give the linear, 95-percent confidence interval for the estimated parameter values. These confidence intervals should be interpreted with caution. The confidence intervals are approximate and are computed under the assumption that the model is linear with respect to the parameters in the vicinity of the estimated values. If this linearity assumption is not valid, then the confidence intervals are inaccurate.

Table 8. Model parameters, acceptable intervals, estimated values, and 95-percent confidence intervals.

[Value in *italic* indicates parameter is specified and not estimated; value in **bold** indicates that estimated value is at either upper or lower limit of acceptable interval. Abbreviations: ft/d, foot per day; --, dimensionless; ft²/d, foot squared per day; n.a., not assigned; n.c., not calculated]

Parameter	Units	Acceptable interval		Estimated value	95-percent confidence interval	
		Lower limit	Upper limit		Lower limit	Upper limit
HK1-1	ft/d	100	50,000	13,000	6,440	26,400
HK1-2	ft/d	100	50,000	6,170	4,300	8,860
HK1-3	ft/d	100	50,000	17,100	13,500	21,700
HK1-4	ft/d	100	50,000	12,100	10,800	13,500
HK1-5	ft/d	100	50,000	22,100	20,200	24,300
HK1-6	ft/d	100	50,000	19,100	17,800	20,400
HK1-7	ft/d	100	50,000	7,470	6,820	8,170
HK1-8	ft/d	100	50,000	9,500	8,040	11,200
HK1-9	ft/d	1	5,000	2,630	2,400	2,870
HK1-10	ft/d	1	5,000	2,180	2,020	2,360
HK1-11	ft/d	1	5,000	1,980	1,710	2,300
HK1-12	ft/d	1	5,000	608	485	762
HK1-13	ft/d	1	5,000	3,110	2,470	3,920
HK1-14	ft/d	1	5,000	90	82	98
HK1-15	ft/d	1	5,000	1,290	755	2,190
HK1-16	ft/d	1	5,000	55	53	56
HK1-17	ft/d	1	5,000	5	4	7
HK1-18	ft/d	1	5,000	78	74	82
HK1-19	ft/d	1	5,000	95	93	97
HK1-20	ft/d	1	5,000	64	55	76
HK1-21	ft/d	n.a.	n.a.	150	n.c.	n.c.
HK1-22	ft/d	1	5,000	140	131	150
HK3-1	ft/d	1	5,000	207	155	276
HK3-2	ft/d	n.a.	n.a.	2,000	n.c.	n.c.
SY-1	--	.1	.3	.1	.08	.13
SY-2	--	.1	.3	.19	.16	.21
SY-3	--	.1	.3	.21	.18	.23
KVSR-1	ft/d	.01	10	.054	.047	.062
KVSR-2	ft/d	.01	10	.25	.23	.27
KVSR-3	ft/d	.01	10	.27	.24	.29
KVSR-4	ft/d	.01	10	.14	.10	.20
KVSR-5	ft/d	.01	10	9.4	7.3	12.2
KVSR-6	ft/d	.01	10	.01	.005	1.8
KVSR-7	ft/d	.01	10	10	5.6	18
KVSR-8	ft/d	.01	10	.3	.20	.45
KVSR-9	ft/d	.01	10	10	1.70	59
KVSR-10	ft/d	.01	10	10	.63	159
KVSR-11	ft/d	n.a.	n.a.	.1	n.c.	n.c.
C-LSR	ft ² /d	10 ⁻¹⁰	10 ¹⁰	40,600	36,100	45,700
C-PO	ft ² /d	10 ⁻¹⁰	10 ¹⁰	241,000	102,000	572,000
C-CDA	ft ² /d	10 ⁻¹⁰	10 ¹⁰	77,800	40,000	151,000
C-OUT	ft ² /d	n.a.	n.a.	10 ⁶	n.c.	n.c.

Assessment of Calibration

The results of the calibration can be assessed by comparing simulated and measured quantities and by examining the weighted residuals. Simulated and measured water levels in selected wells in various parts of the SVRP aquifer are shown in [figure 41](#). Except as noted, the same scale is used for all vertical axes for ease of comparison of water-level fluctuations in different wells.

For the upgradient end of the aquifer near Lake Pend Oreille, simulated and measured water levels in well 236 are in close agreement ([fig. 41A](#)). For northern Rathdrum Prairie, simulated and measured water levels in well 251 ([fig. 41B](#)) and well 249 ([fig. 41C](#)) are compared. In well 251, the simulated rise in water level during 1996 and 1997 is not as large as the measured rise. In both wells 249 and 251, the simulated fluctuations during 2004 and 2005 are somewhat larger in magnitude than the measured fluctuations. These discrepancies likely are due to two simplifying assumptions used in calculating recharge from precipitation: (1) use of a triangular network to linearly interpolate recharge from precipitation ([fig. 7](#)), and (2) use of a linear relation between depth of water table and transmission time for precipitation infiltration to reach water table ([table 2](#)).

For southern Rathdrum Prairie, simulated and measured water levels in well 225 ([fig. 41D](#)) and well 178 ([fig. 41E](#)) are compared. In both wells, the simulated water levels are close to the measured water levels, but the character of the simulated fluctuations during 2004–05 does not match the character of the measured fluctuations. The same discrepancy is shown in the simulated and measured water levels in well 143 ([fig. 41F](#)), which is near Coeur d'Alene Lake. These discrepancies indicate that the temporal distribution of recharge to southern Rathdrum Prairie (including the Coeur d'Alene area) might not be represented accurately in the model for 2004–05.

Simulated and measured water levels in well 246 near the east edge of Rathdrum Prairie and in well 140 in a side valley between Coeur d'Alene and Hayden are shown in [figures 41G](#) and [41H](#), respectively. Note that the vertical axes in both figures span 120 ft. Although these wells have few long-term historical data for calibration, the simulation indicates that water levels along the margins of Rathdrum Prairie can rise and decline by substantial amounts.

Simulated and measured water levels in wells in various parts of Spokane Valley are shown in [figures 41I](#) to [41M](#). Overall, the seasonal rise and decline of simulated water levels reproduce the measured water levels. However, simulated fluctuations on short time scales do not always match the measured fluctuations. For example, each year during September, the measured water level in well 92 ([fig. 41K](#)) rises in response to the rise in Spokane River stage as the gates

at the Post Falls Dam are opened. However, the simulated water level during September does not always follow the rises in the measured water level. This discrepancy might be a consequence of assuming a rectangular cross-section for the channel of the Spokane River. Under this assumption, the streambed area through which seepage occurs is independent of river stage. In reality, under low-flow conditions typical of later summer, the river might occupy only a portion of the streambed. As the river stage rises in September, the river might occupy a larger area of streambed. Because the model does not simulate this increase in wetted streambed area, the simulated exchange between the aquifer and the Spokane River might be inaccurate during early autumn.

Simulated and measured water levels in well 6 in Trinity Trough are shown in [figure 41N](#). The magnitude of the simulated water-level fluctuation is substantially smaller than the magnitude of the measured fluctuation. During 2004–05, the water level in well 6 rose and declined by about 15 ft. This is nearly double the magnitude of the fluctuations in other wells in Spokane Valley. Well 6 is located in an area of steep hydraulic gradient as ground water is channeled through Trinity Trough into Western Arm ([fig. 22](#)). The discrepancy between simulated and measured water levels in well 6 might indicate that a finer model grid (with smaller model cells) is needed to more accurately represent Trinity Trough.

Simulated and measured water levels in well 128 in Hillyard Trough and in well 107 in Western Arm are shown in [figures 41O](#) and [41P](#), respectively. For both wells, the simulated water levels are in fairly good agreement with the measured water levels.

Simulated and measured water levels in the lower unit are shown in [figures 41Q](#) and [41R](#). Well 115 ([fig. 41Q](#)) is at the north end of Hillyard Trough. The drawdowns during 2004–05 are a result of pumping of a nearby production well. However, the simulated drawdowns were substantially larger than the measured drawdowns, indicating that the estimated value of KH3-1 might be too low. Well 99 ([fig. 41R](#)) is located on the west side of the Little Spokane River Arm. In this well, simulated water levels were about 15 ft higher than the measured water levels. Considered together, the relatively poor fits to measured water levels in wells 115 and 99 indicate that the lower unit might not be represented accurately by the model.

Simulated water levels in model layer 1 during September 2004 are shown in [figure 42](#). The contours of simulated water levels shown in [figure 42](#) are in good agreement with the contours of measured water levels shown in [figure 22](#). Simulated water levels in model layer 3 during September 2004 are shown in [figure 43](#). Because water-level measurements are available for only two wells in the lower unit, too few data are available to construct a map of measured water levels in the lower unit.

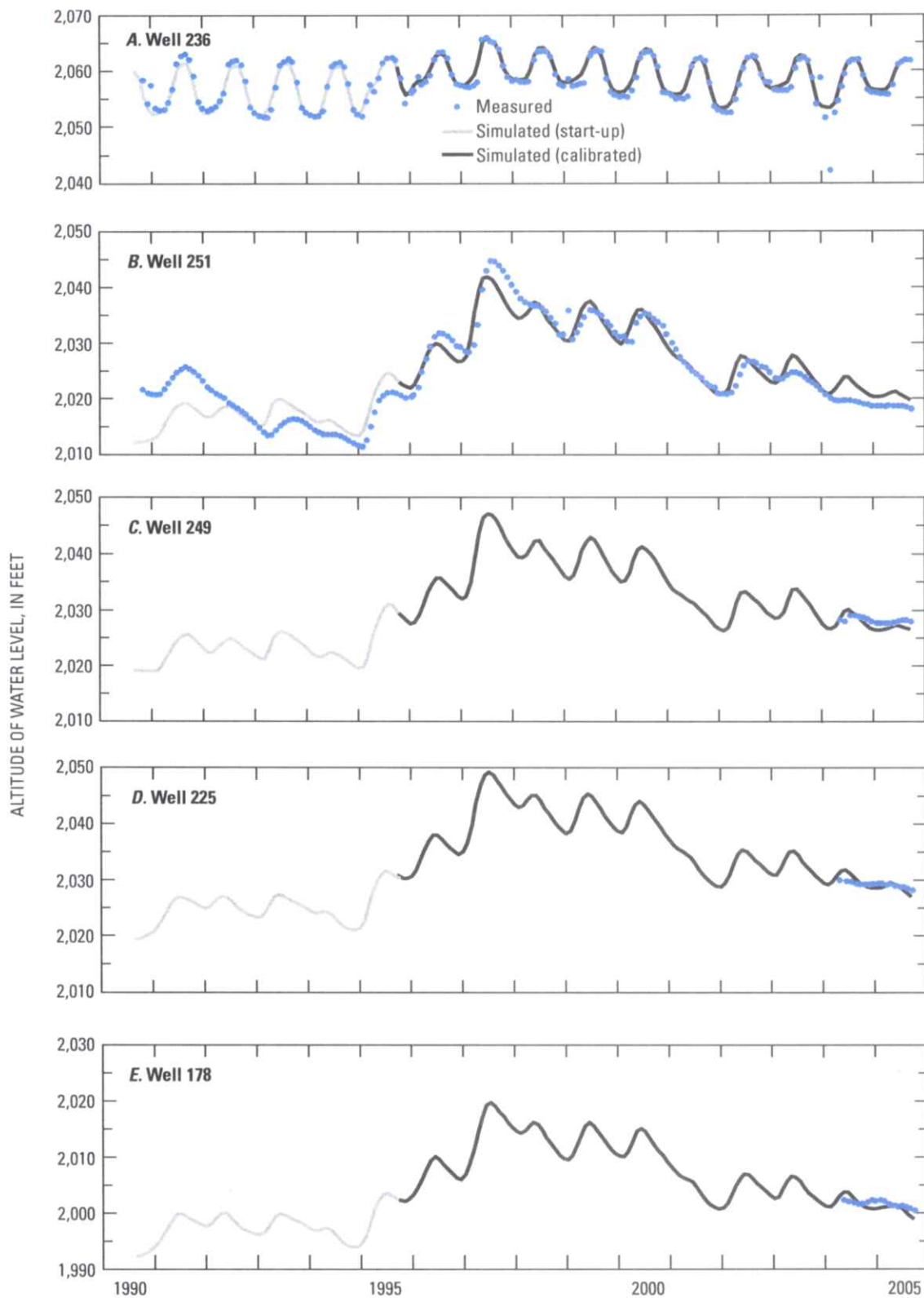


Figure 41. Simulated and measured water levels in selected wells in various parts of the Spokane-Rathdrum Prairie aquifer, Washington and Idaho.

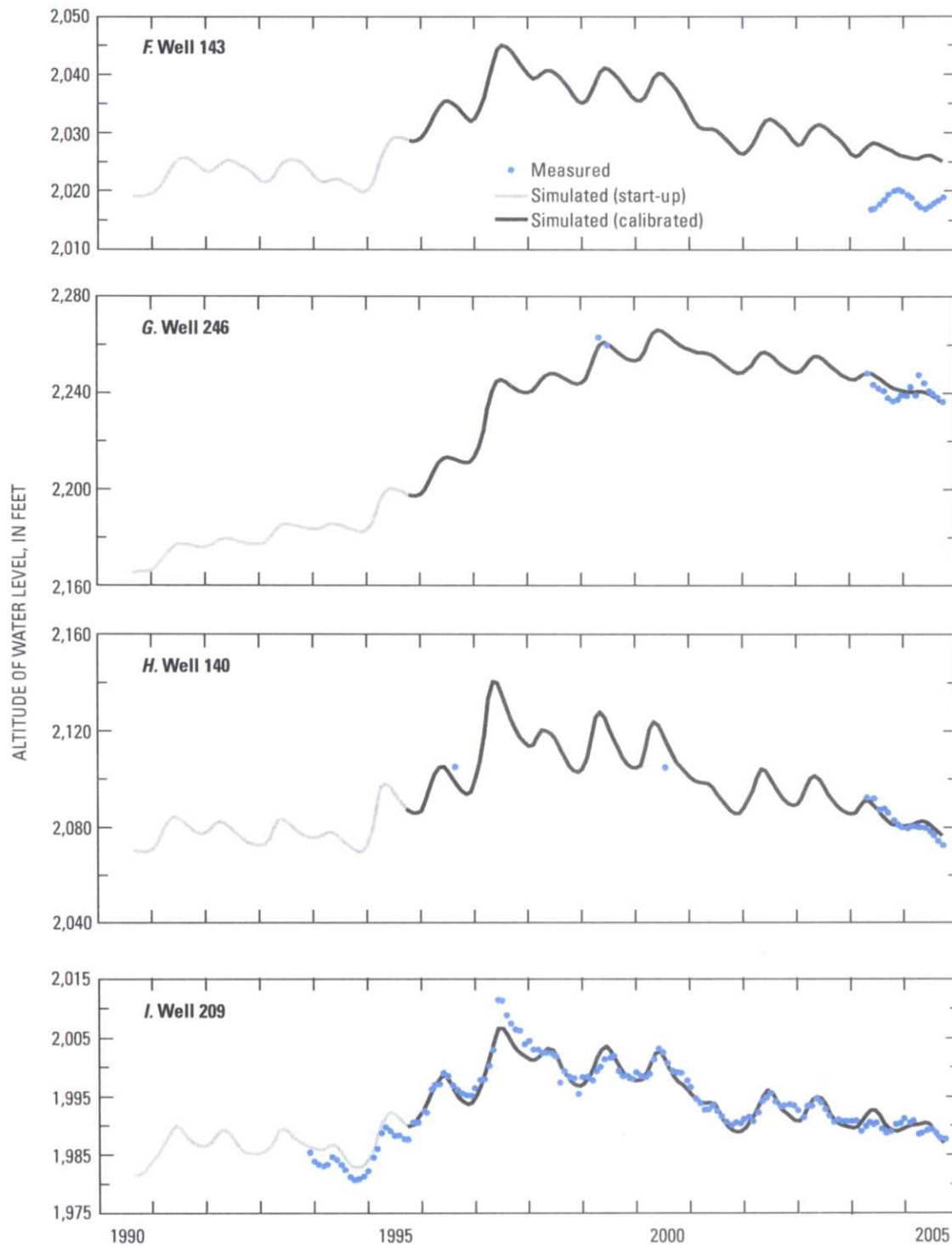


Figure 41.—Continued.

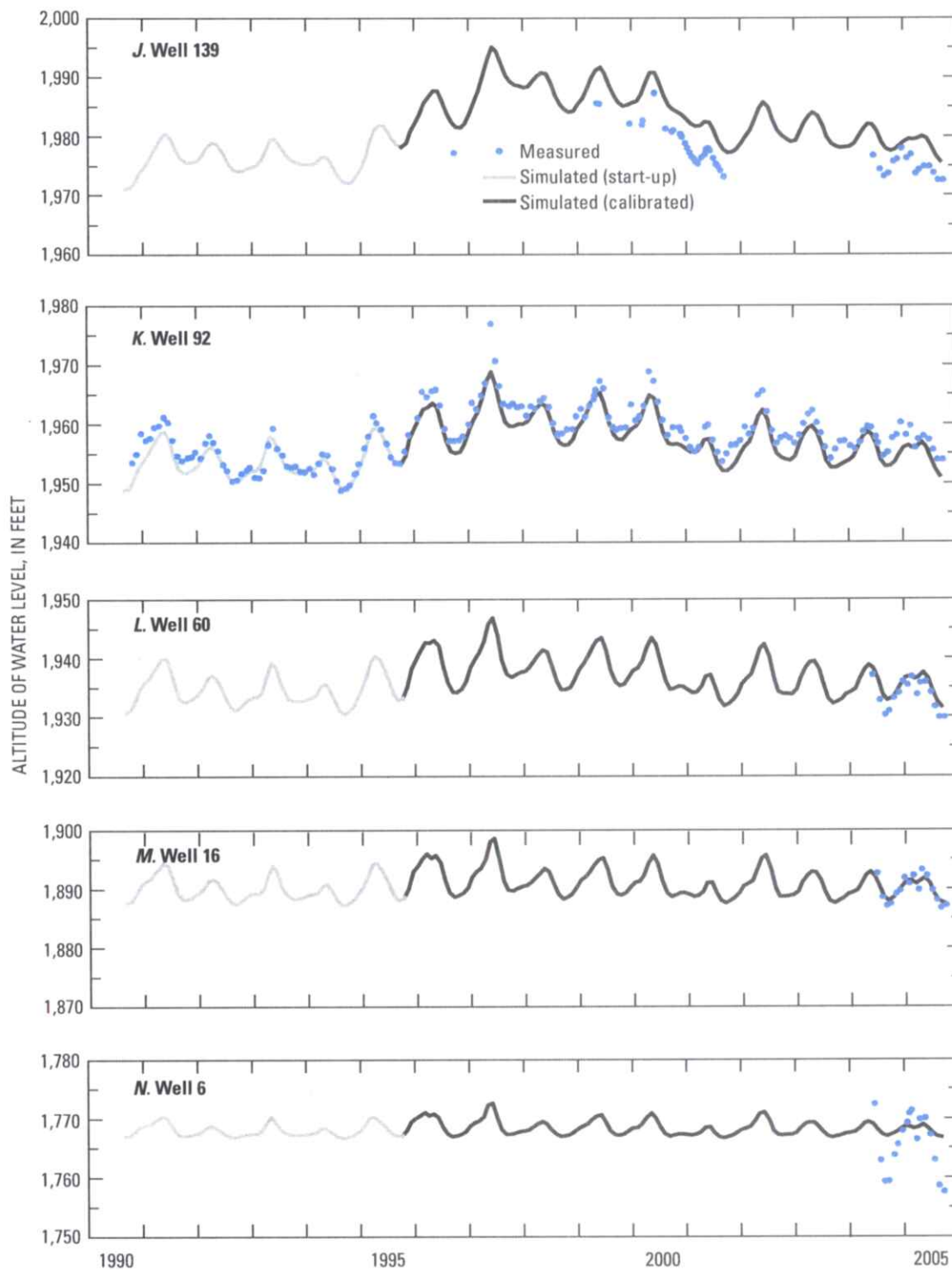


Figure 41.—Continued.

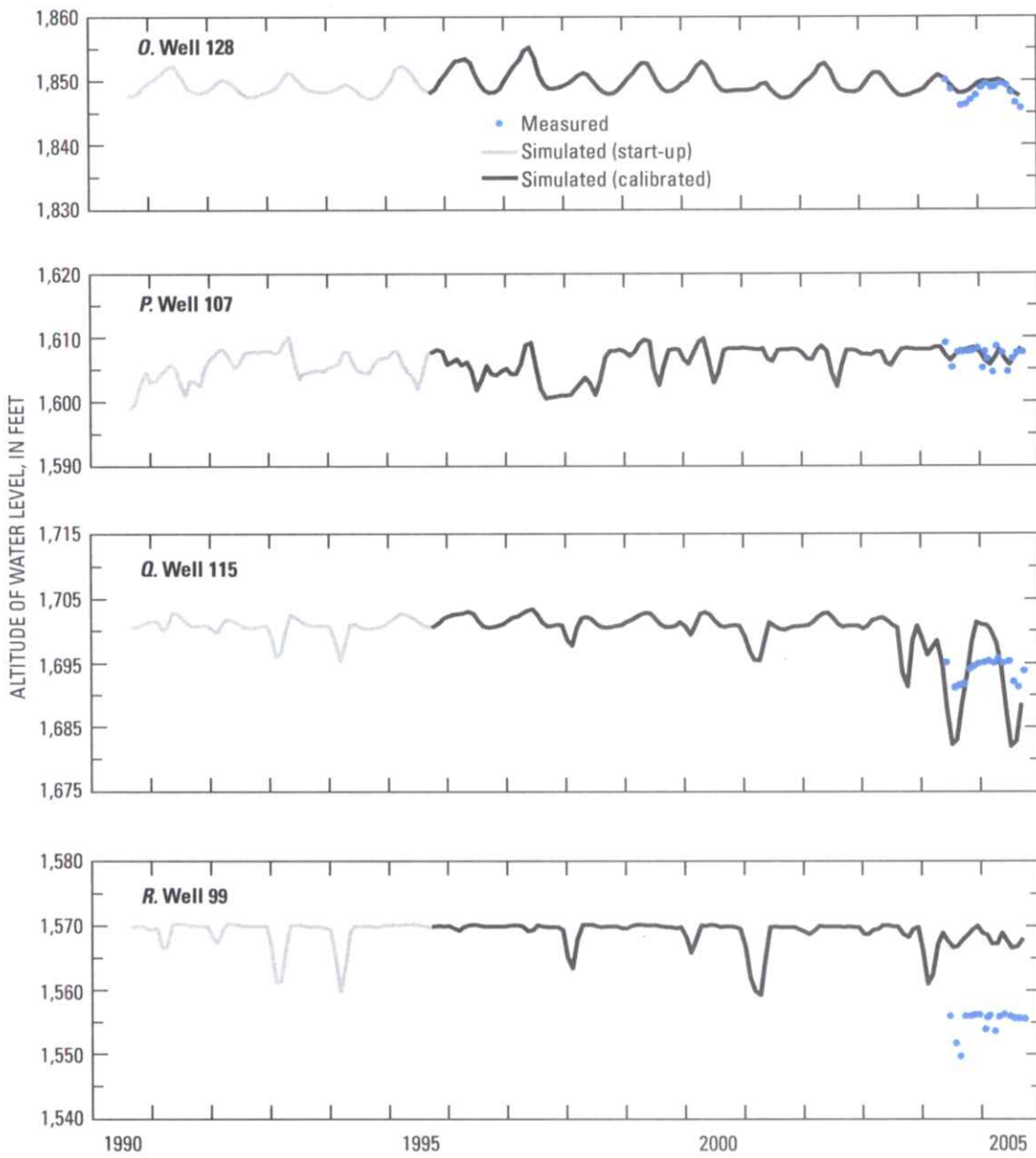


Figure 41.—Continued.

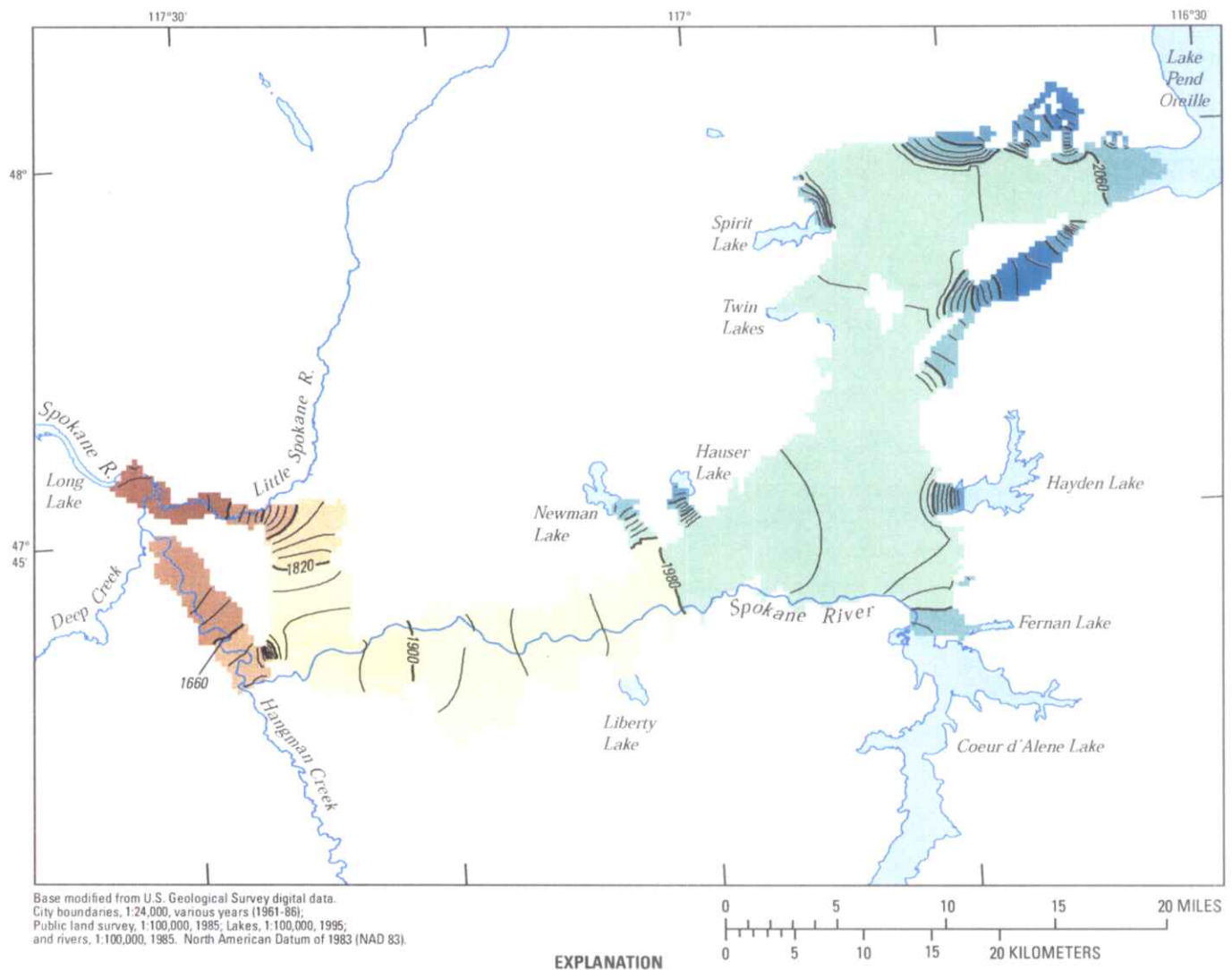


Figure 42. Simulated water levels in model layer 1, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho, September 2004.

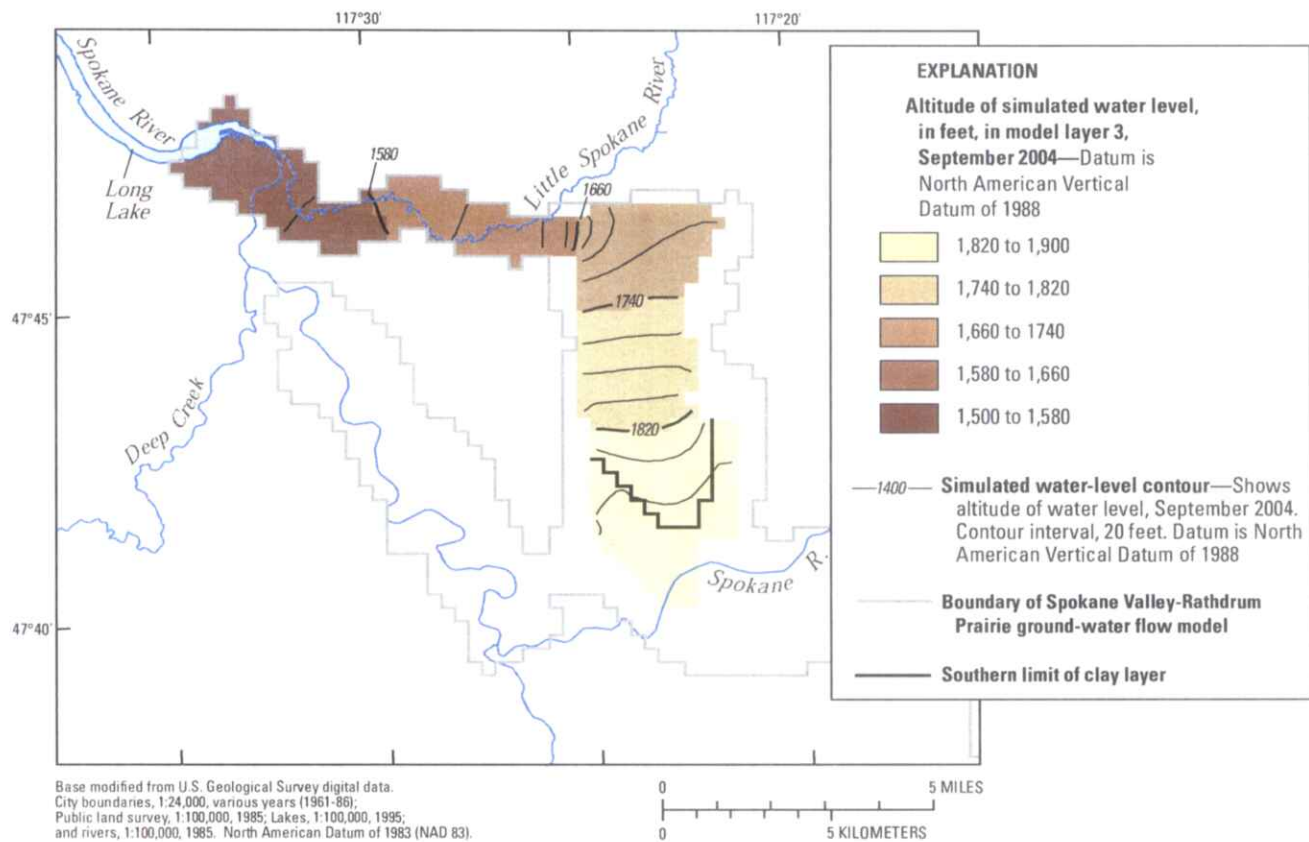


Figure 43. Simulated water levels in model layer 3, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho, September 2004.

Simulated and measured monthly average streamflow gains and losses for the Spokane River segments from the gaging stations near Post Falls to at Spokane, near Post Falls to at Greenacres, and at Greenacres to at Spokane are shown in [figure 44](#). The length of the vertical line extending above or below a plotted point indicates the measurement error, calculated as 1.96 times the standard deviation used in the calculation of measurement weights. During times of high streamflow (winter and spring), measurement errors can be very large. The simulated streamflow gains and losses generally agree with the measured gains and losses during late summer, when streamflow is low and the measurement error is small.

For the Spokane River segment from the gaging stations near Post Falls to at Greenacres ([fig. 44B](#)), data show a decrease in the magnitude of streamflow loss during the first halves of 2003 and 2004 when the river stage is high. This is an unexpected phenomenon because the altitude of the bottom of the riverbed from the gaging stations near Post Falls to at Greenacres is always above the water table. Therefore, the magnitude of streamflow loss is expected to increase (as indicated by the simulated quantity) during winter and spring

when the river stage is high. If the measured streamflow at the gaging station at Greenacres is inaccurate (too low) during the first halves of 2003 and 2004, the error might account for the poorer fit during the same two periods for the segment from gaging stations at Greenacres to at Spokane ([fig. 44C](#)).

The simulated and measured monthly average streamflow gains on the Little Spokane River from the gaging stations at Dartford to near Dartford are in overall agreement as shown in [figure 45](#). The simulated streamflow gain represents the regional discharge from the SVRP aquifer and is remarkably constant. The measured streamflow gain exhibits fluctuations during winter and spring. Nonetheless, the simulated gains are within the error bounds of the measured gains.

Simulated and measured streamflow gains and losses on various Spokane River segments during the seepage runs of September 13-16, 2004, and August 26-31, 2005, are shown in [figure 46](#). The measurements made during the seepage runs might be characterized as nearly instantaneous. By contrast, the simulated streamflow gains and losses represent quantities averaged over a stress period (1 month). Nonetheless, the simulated and measured quantities are in relatively good agreement.

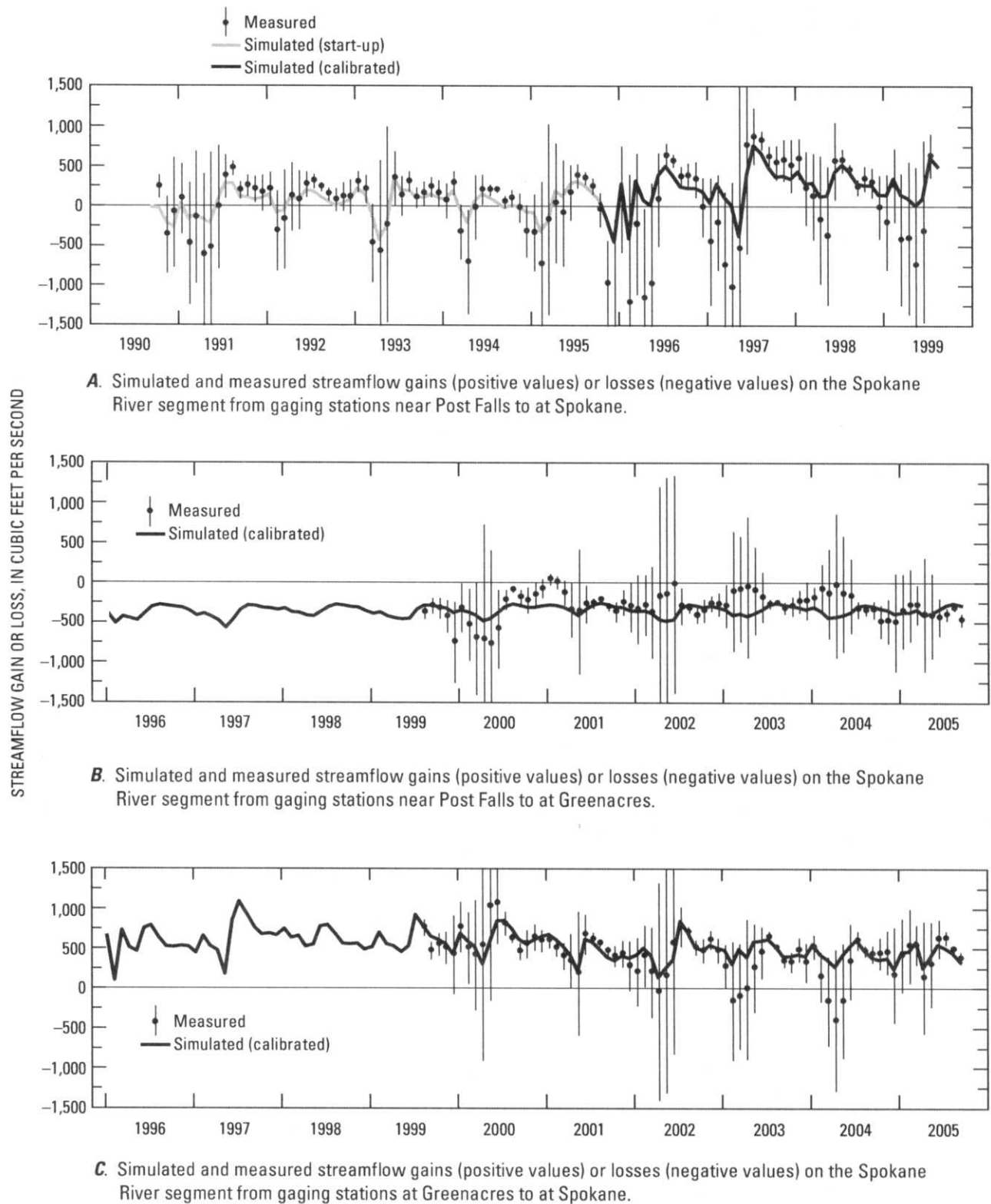


Figure 44. Simulated and measured monthly average streamflow gains and losses for three Spokane River segments, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

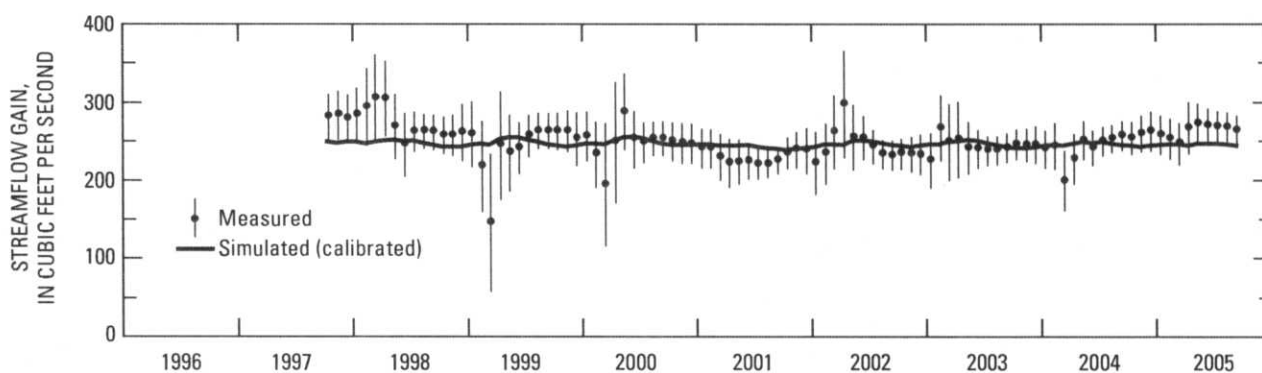


Figure 45. Simulated and measured monthly average streamflow gains on the Little Spokane River from the gaging stations at Dartford to near Dartford.

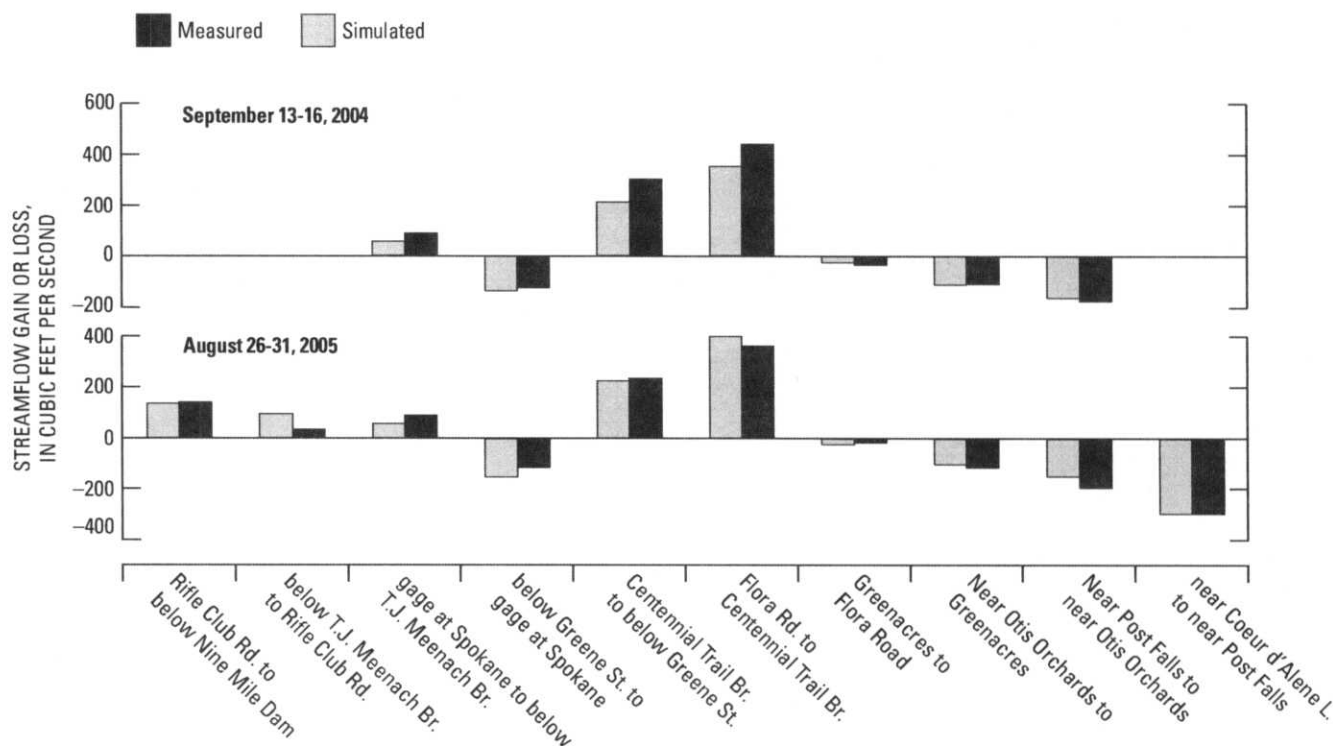


Figure 46. Simulated and measured streamflow gains (positive values) and losses (negative values) on various segments of the Spokane River during seepage runs of September 13-16, 2004, and August 26-31, 2005.

Simulated and measured streamflow gains and losses on three Little Spokane River segments during the seepage runs of September 13-16, 2004, and August 26-31, 2005, are shown in [figure 47](#). The simulated streamflow gains and losses are close to the measured streamflow gains and losses except for the river segment from the gaging station near Dartford to the streamflow measurement site near the mouth of the river. For this segment, the data indicate a small streamflow loss. As discussed previously, this Little Spokane River is not expected to lose streamflow in the Little Spokane River Arm of the SVRP aquifer because this is an area of ground-water discharge. The calibrated model simulates essentially no interaction between the aquifer and this segment of the Little Spokane River.

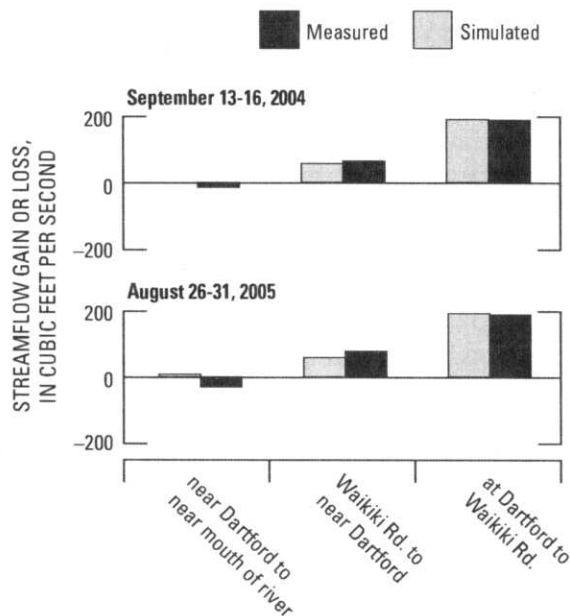


Figure 47. Simulated and measured streamflow gains (positive values) and losses (negative values) on three Little Spokane River segments during seepage runs of September 13-16, 2004, and August 26-31, 2005.

The spatial distribution of weighted water-level residuals in model layer 1 during September 2004 is shown in [figure 48](#). Ideally, weighted residuals should be distributed randomly throughout the model area. In [figure 48](#), however, the positive weighted residuals tend to cluster locally with other positive weighted residuals, and the negative weighted residuals tend to cluster locally with other negative weighted residuals. The clustering likely is caused by the representation of aquifer properties by zones of uniform values. This simplification might be considered a source of model error in the sense that such error can be reduced by implementing a more complex distribution of aquifer properties in the model. Nonetheless, zonation is widely accepted as a useful approach for model calibration. Although the spatial distribution of weighted residuals shown in [figure 48](#) cannot be characterized as an ideal distribution, the distribution does not show signs of gross model errors over large parts of the aquifer.

The weighted water-level residuals and simulated water levels are shown in [figure 49](#). The plotted points show a fairly random distribution of weighted residuals above and below zero for all simulated water levels. This feature indicates that the simulated water levels fit measured water levels as well in an upgradient region (such as northern Rathdrum Prairie) as in a downgradient region (such as Western Arm). Similarly, the plotted points for weighted flow residuals and simulated streamflow gains and losses ([fig. 50](#)) show a fairly random distribution of points above and below zero for all simulated quantities. This feature indicates that the simulated flows fit the measured flows as well in a gaining river segment as in a losing river segment. The vertical band of points shown in [figure 50](#) corresponds to weighted flow residuals for the Little Spokane River. The cluster pattern results from the fact that simulated streamflow gains on the Little Spokane River are relatively constant over time whereas the measured streamflow gains show fluctuations during the winter and spring ([fig. 45](#)).

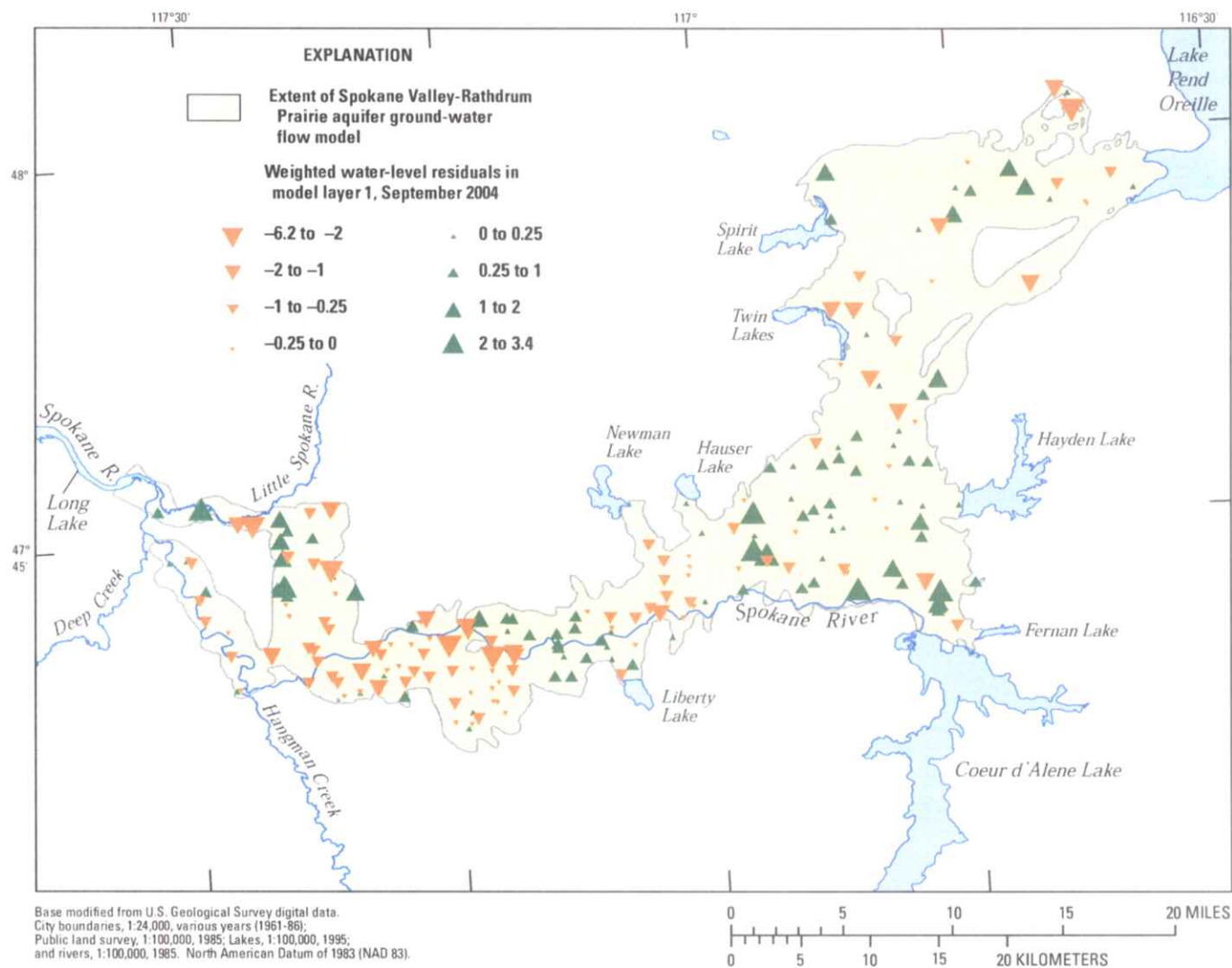


Figure 48. Spatial distribution of weighted water-level residuals in model layer 1, September 2004, Spokane Valley-Rathdrum Prairie aquifer, Washington and Idaho.

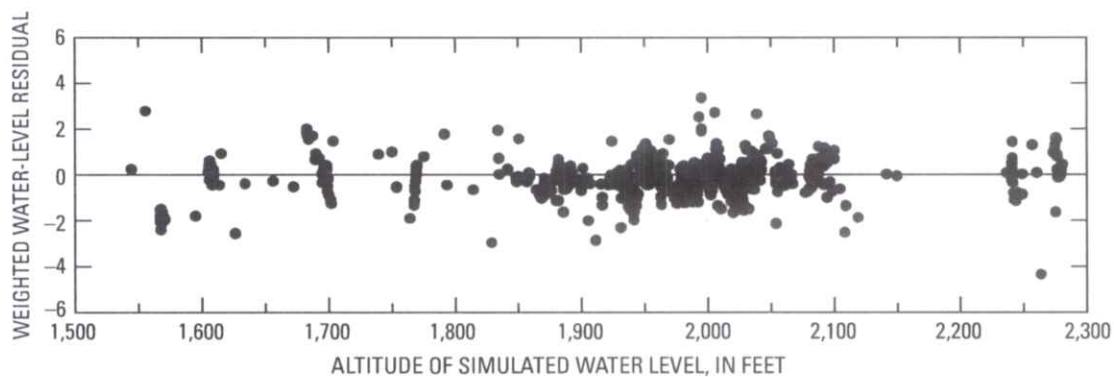


Figure 49. Weighted water-level residuals and simulated water levels.

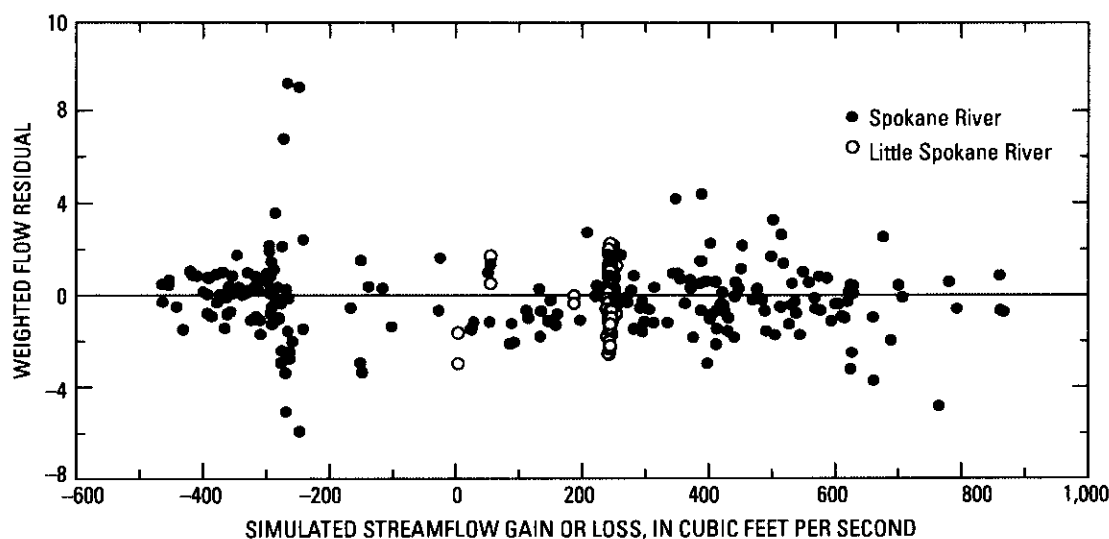


Figure 50. Weighted flow residuals and simulated streamflow gains (positive values) or losses (negative values).

Simulated Flows in Aquifer

To examine simulated ground-water movement, the SVRP aquifer is divided into eight subregions, seven of which are shown in [figure 51](#). The eighth subregion is the lower unit, which underlies Hillyard Trough and the Little Spokane River Arm. For each subregion, simulated inflows, outflows, and change in storage are averaged over the model calibration period from October 1995 to September 2005 and are given under the Calibrated Model column in [table 9](#). Additional columns in [table 9](#) contain water-budget components for alternative models discussed in the next section of this report. Note that quantities averaged over the 10-year calibration period have slightly different values than the corresponding 15-year averaged quantities given in the sections, "Inflows to Aquifer" and "Outflows from Aquifer".

For each subregion, inflow components include recharge from precipitation, flow from tributary basins, flow from lakes and losing segments of rivers, and flow from the upstream subregion. Outflow components include net water use (well withdrawals minus return percolation from irrigation and effluent from septic systems), flow to gaining segments of rivers, and flow to the downstream subregion.

Many of the flow components in the subregional water budget are specified in the model. These components are shown in *italic* and include recharge from precipitation, net water use, and flow to the aquifer from tributary basins and from all lakes except Lake Pend Oreille and Coeur d'Alene Lake. In addition, the model is calibrated to fit measured flows between the aquifer and the Spokane and Little Spokane

Rivers. Therefore, the flow components that are neither specified nor constrained by calibration data are: (1) inflow to the aquifer from Lake Pend Oreille, (2) inflow to the aquifer from Coeur d'Alene Lake, and (3) outflow from the aquifer (lower unit) to Long Lake. The calibrated model gives a 10-year average flow of 67 ft³/s from Lake Pend Oreille to the aquifer, 138 ft³/s from Coeur d'Alene Lake to the aquifer, and 27 ft³/s from the lower unit to Long Lake.

On the east side of the aquifer, flow from a subregion to the adjacent downgradient subregion increases along the direction of ground-water flow. The simulated 10-year average flow from northern Rathdrum Prairie to southern Rathdrum Prairie is 286 ft³/s, of which 72 percent flows through West Channel, 26 percent flows through Ramsey Channel, and 2 percent flows through Chilco Channel ([table 9](#), [fig. 51](#)). The simulated 10-year average flow from southern Rathdrum Prairie to eastern Spokane Valley is 823 ft³/s. The boundary between eastern Spokane Valley and the Spokane area coincides with Sullivan Road, which crosses the Spokane River near the point where the river changes from a losing stream to a gaining stream. The simulated 10-year average flow from eastern Spokane Valley to the Spokane area is 1,280 ft³/s.

From the Spokane area, the simulated 10-year average outflows are 623 ft³/s to the Spokane River, 288 ft³/s to Hillyard Trough, and 264 ft³/s through Trinity Trough to Western Arm. From Hillyard Trough, the simulated 10-year average outflows are 254 ft³/s to the upper unit in Little Spokane River Arm (and eventually to the Little Spokane River) and 27 ft³/s to the lower unit (and eventually to Long Lake).

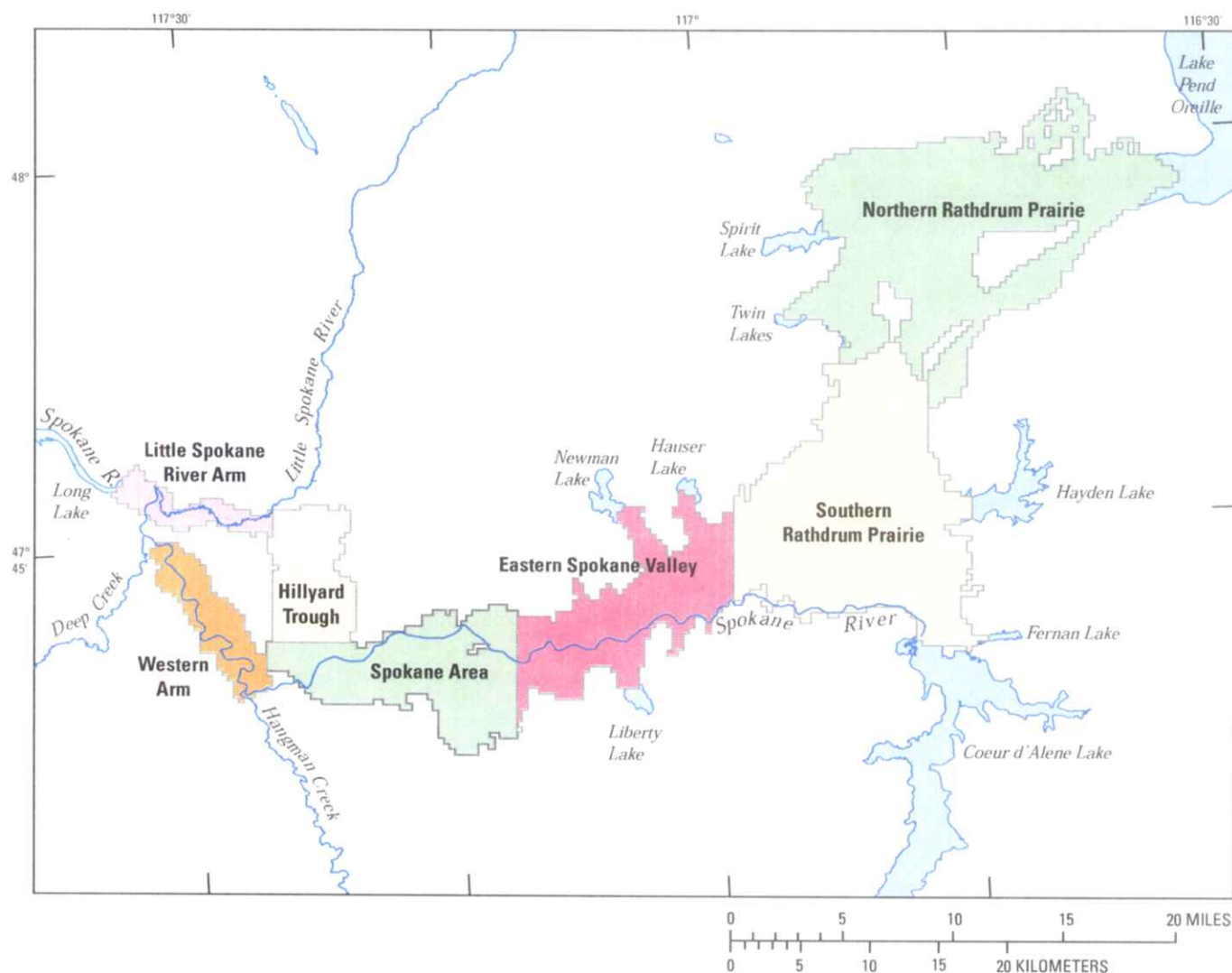


Figure 51. Subregions of the Spokane Valley-Rathdrum Prairie aquifer for water-budget calculations.

Alternative Models

To examine the assumptions in the SVRP aquifer model, five alternative models are analyzed. In each alternative model, one aspect of the calibrated model is modified and the alternative model is recalibrated. Estimated values of parameters and regression statistics from the calibrated and alternative models are given in [tables 10](#) and [11](#).

In alternative model A, the value of HK1-15 (K_p of the zone next to Coeur d'Alene Lake) is set to 500 ft/d ([table 9](#)). This value is similar to the hydraulic conductivity value used in Sagstad's (1977) Darcy's Law calculation of seepage from Coeur d'Alene Lake (see section, "Lakebed Seepage and Surface Overflow"). In the calibrated model, the value of HK1-15 is 1,290 ft/d and the simulated 10-year average seepage from Coeur d'Alene Lake is 138 ft³/s. Using a lower

value of HK1-15 in alternative model A effectively limits the seepage from Coeur d'Alene Lake. Compared to the calibrated model, alternative model A has higher K_h values in northern Rathdrum Prairie (HK1-1, HK1-2, and HK1-3) and a lower conductance value for the Coeur d'Alene lakebed sediments (C-CDA) (table 10). The simulated 10-year average seepage from Lake Pend Oreille to the aquifer increases to 107 ft³/s (table 9), and the simulated 10-year average seepage from

Coeur d'Alene Lake to the aquifer decreases to 29 ft³/s, which is close to Sagstad's (1977) estimated of 37 ft³/s. However, as shown in table 11, the sum of squared weighted residuals from alternative model A is only about 1 percent higher than that from the calibrated model. This indicates that the simulated quantities from alternative model A fit the measured quantities nearly as well as the simulated quantities from the calibrated model.

Table 9. Simulated 10-year average water budget for subregions of the Spokane Valley-Rathdrum Prairie aquifer.

[Values are in cubic foot per second. Value in *italic* indicates flow component is specified; value in **bold** indicates flow component is not specified]

			Calibrated model	Alternative model				
				A	B	C	D	E
northern Rathdrum Prairie	Inflow	recharge from precipitation	77	77	77	77	77	77
		tributary basins	63	63	63	63	108	63
		Lake Pend Oreille	67	107	65	64	95	75
		Spirit Lake	55	55	55	55	55	55
		Twin Lakes	40	40	40	40	40	40
	Outflow	net water use	-6	-6	-6	-6	-6	-6
		West Channel	-206	-235	-204	-204	-259	-212
		Ramsey Channel	-75	-87	-75	-75	-96	-78
		Chilco Channel	-5	-5	-5	-5	-5	-5
	Decrease in Storage		-9	-9	-9	-9	-9	-9
southern Rathdrum Prairie	Inflow	West Channel	206	235	204	204	259	212
		Ramsey Channel	75	87	75	75	96	78
		Chilco Channel	5	5	5	5	5	5
		recharge from precipitation	74	74	74	74	74	74
		tributary basins	20	20	20	20	20	20
		Hayden Lake	70	70	70	70	70	70
		Fernan Lake	15	15	15	15	15	15
		Coeur d'Alene Lake	138	29	175	132	104	137
		Spokane River	274	287	276	272	265	273
	Outflow	net water use eastern Spokane Valley	-57	-57	-57	-57	-57	-57
eastern Spokane Valley	Inflow	southern Rathdrum Prairie	823	769	861	813	855	830
		recharge from precipitation	30	30	30	30	30	30
		tributary basins	16	16	16	16	16	16
		Hauser Lake	20	20	20	20	20	20
		Newman Lake	23	23	23	23	23	23
		Liberty Lake	6	6	6	6	6	6
		Spokane River	377	378	378	377	377	378
	Outflow	net water use Spokane area	-16	-16	-16	-16	-16	-16
	Decrease in Storage		-1,280	-1,227	-1,319	-1,270	-1,312	-1,288
			2	2	2	2	2	2

Table 9. Simulated 10-year average water budget for subregions of the Spokane Valley-Rathdrum Prairie aquifer—Continued.

[Values are in cubic foot per second. Value in *italic* indicates flow component is specified; value in **bold** indicates flow component is not specified]

			Calibrated model	Alternative model					
				A	B	C	D	E	
Spokane area	Inflow	eastern Spokane Valley recharge from precipitation tributary basins	1,280 30 4	1,227 30 4	1,319 30 4	1,270 30 4	1,312 30 4	1,288 30 4	
		Outflow	net water use	-133	-133	-133	-133	-133	-133
			Spokane River	-623	-616	-620	-618	-625	-628
	Hillyard Trough		-293	-293	-349	-293	-293	-293	
	Western Arm	-264	-218	-249	-260	-295	-268		
Decrease in Storage			0	0	0	0	0	0	
Western Arm	Inflow	Spokane area recharge from precipitation tributary basins	264 7 16	218 7 16	249 7 16	260 7 16	295 7 16	268 7 16	
		Outflow	net water use	-3	-3	-3	-3	-3	-3
			Spokane River	-283	-238	-269	-280	-314	-287
	Decrease in Storage			0	0	0	0	0	0
Hillyard Trough	Inflow	Spokane area recharge from precipitation tributary basins	293 14 3	293 14 3	349 14 3	293 14 3	-293 14 3	293 14 3	
		Outflow	net water use	-28	-28	-28	-28	-28	-28
			Little Spokane River Arm	-254	-254	-254	-254	-254	-254
	Lower Unit	-27	-27	-84	-27	-27	-27		
	Decrease in Storage			0	0	0	0	0	0
Little Spokane River Arm	Inflow	Hillyard Trough recharge from precipitation tributary basins	254 5 6	254 5 6	254 5 6	254 5 6	254 5 6	254 5 6	
		Outflow	net water use	0	0	0	0	0	0
			Little Spokane River	-257	-257	-257	-257	-257	-257
	Spokane River/Long Lake	-8	-8	-8	-8	-8	-8		
Decrease in Storage			0	0	0	0	0	0	
Lower Unit	Inflow	Hillyard Trough	27	27	84	27	27	27	
	Outflow	net water use	0	0	0	0	0	0	
		Long Lake	-27	-27	-84	-27	-27	-27	
Decrease in Storage			0	0	0	0	0	0	

Table 10. Estimated values of parameters for calibrated and alternative models.[ft/d; foot per day; --, dimensionless; ft²/d, foot squared per day; value in italic indicates that parameter is specified and not estimated]

Parameter	Units	Calibrated model	Alternative model				
			A	B	C	D	E
HK1-1	ft/d	13,000	17,700	12,600	12,600	18,400	14,300
HK1-2	ft/d	6,170	8,340	6,100	6,050	7,660	6,610
HK1-3	ft/d	17,100	21,000	16,600	17,200	23,200	17,800
HK1-4	ft/d	12,100	11,900	12,600	11,800	13,200	12,200
HK1-5	ft/d	22,100	20,700	23,100	21,900	22,700	22,400
HK1-6	ft/d	19,100	18,300	19,700	19,000	19,600	19,100
HK1-7	ft/d	7,470	7,020	7,830	7,400	7,720	7,520
HK1-8	ft/d	9,500	8,480	10,400	9,410	10,200	9,610
HK1-9	ft/d	2,630	2,690	2,650	2,630	2,590	2,620
HK1-10	ft/d	2,180	2,170	2,170	2,180	2,190	2,190
HK1-11	ft/d	1,980	1,990	1,990	1,990	1,990	1,990
HK1-12	ft/d	608	501	571	599	681	617
HK1-13	ft/d	3,110	2,600	2,960	3,070	3,440	3,160
HK1-14	ft/d	90	89	90	85	90	90
HK1-15	ft/d	1,290	500	1,580	1,240	1,000	1,280
HK1-16	ft/d	55	55	55	54	54	55
HK1-17	ft/d	5	5	5	5	5	5
HK1-18	ft/d	78	78	78	78	78	78
HK1-19	ft/d	95	95	95	95	94	95
HK1-20	ft/d	64	64	65	65	64	64
HK1-21	ft/d	150	150	150	150	150	150
HK1-22	ft/d	140	145	140	141	142	140
HK3-1	ft/d	207	208	619	207	206	206
HK3-2	ft/d	2,000	2,000	7,030	2,000	2,000	2,000
SY-1	--	.10	.10	.10	.081	.10	.10
SY-2	--	.19	.19	.19	.19	.19	.18
SY-3	--	.21	.21	.21	.21	.21	.21
KVSR-1	ft/d	.054	.057	.055	.054	.052	.054
KVSR-2	ft/d	.25	.25	.25	.25	.25	.25
KVSR-3	ft/d	.27	.27	.27	.27	.27	.27
KVSR-4	ft/d	.14	.14	.14	.14	.14	.14
KVSR-5	ft/d	9.4	10	8.7	9.1	9.1	9.4
KVSR-6	ft/d	.01	.01	.01	.01	.01	.01
KVSR-7	ft/d	10	10	10	10	10	10
KVSR-8	ft/d	.30	.26	.29	.30	.33	.31
KVSR-9	ft/d	10	10	10	10	10	10
KVSR-10	ft/d	10	10	10	10	10	10
KVSR-11	ft/d	.1	.1	.1	.1	.1	.1
C-LSR	ft ² /d	40,600	40,800	40,700	40,700	40,500	40,600
C-PO	ft ² /d	241,000	388,000	233,000	235,000	330,000	267,000
C-CDA	ft ² /d	77,800	16,100	98,600	74,693	59,000	40,600
C-OUT	ft ² /d	10 ⁶	10 ⁶	10 ⁶	10 ⁶	10 ⁶	10 ⁶

Table 11. Regression statistics for calibrated and alternative models.

Regression statistic		Calibrated model	Alternative model				
			A	B	C	D	E
Sum of squared weighted residuals	All	1,500	1,512	1,472	1,497	1,514	1,520
	Water levels, model layer 1	590	601	590	589	598	602
	Water levels, model layer 3	74	74	47	74	74	77
	Spokane River gains and losses	682	682	681	679	688	685
	Little Spokane River gains and losses	155	155	154	155	154	156
Standard error of weighted residuals		0.901	0.905	0.893	0.900	0.905	0.896

In alternative model B, the value of HK3-2 (K_h values for the lower unit in the Little Spokane River Arm) is not specified but is estimated. The calibration yields an HK3-2 value of 7,030 ft/d (table 10). The simulated 10-year average flow from the lower unit to Long Lake increases to 83 ft³/d (table 9). The sum of squared weighted residuals decreases to less than that of the calibrated model, indicating an improved fit to measured water levels in wells 99 and 115. However, this improved fit is attained at the cost of allowing HK3-2 to take on a value substantially higher than the upper limit of the acceptable range for this parameter. The occurrence of this trade-off is an additional indication that the model might not accurately represent the lower unit.

In alternative model C, the lower limit of the acceptable range for SY-1 is decreased from 0.1 to 0. In this case, the calibration yields an SY-1 value of 0.08 (table 10). However, the estimated values and the regression statistics from alternative model C are very close to those from the calibrated model (table 9 and 11). This indicates that setting a lower limit of 0.1 for SY-1 results in just as good a fit as allowing SY-1 to take on an estimated value less than 0.1.

In alternative model D, an inflow of 40 ft³/s is applied to the model boundary near Spirit and Hoodoo Valleys (boundary segment A-B in fig. 2). In the calibrated model, there is no inflow across this boundary segment to the aquifer. Compared to the calibrated model, alternative model D has higher K_h values in northern Rathdrum Prairie (HK1-1, HK1-2, and HK1-3) (table 10). The simulated 10-year average seepages are 95 ft³/s from Lake Pend Oreille and 104 ft³/s from Coeur d'Alene Lake (table 9). As in alternative model A, the sum of squared weighted residuals from alternative model D is just slightly higher than that from the calibrated model (table 11). This indicates that amount of inflow from the model boundary near Spirit and Hoodoo Valleys cannot be determined reliably from calibration of the SVRP aquifer model with the present calibration data.

Alternative model E is a hybrid calibration that consists of a steady-state model in addition to the transient model. The steady-state model simulates average conditions for water year 2005 (October 2004 through September 2005). Simulated water levels and flows from the steady-state model are fitted to averages of water levels and flows measured during water year 2005. The purpose of simultaneously calibrating a transient and a steady-state model is to examine the use of the SVRP aquifer model for steady-state simulations.

In general, a steady-state model can be used to simulate average conditions over a period (for example, one year) if (1) heads throughout the aquifer at the beginning of the period are similar to the heads at the end of the period and (2) the model is linear or nearly linear with respect to head. Because the SVRP aquifer is a water-table aquifer, nonlinearity can occur along the aquifer margins, where saturated thickness is small. To avoid such nonlinearity, measured water levels along the aquifer margins are excluded from the steady-state calibration data, with the understanding that the steady-state model might not accurately simulate water levels along the aquifer margins.

The sum of squared weighted residuals from alternative model E is higher than that from the calibrated model (table 11), because the hybrid calibration involves additional residuals. However, the estimated parameter values in alternative model E are in close agreement with the corresponding values in the calibrated model (table 10). This indicates that a steady-state model can be used to simulate average conditions during water year 2005 with reasonable accuracy (except for water levels along the aquifer margins). The applicability of the steady-state model is due to the fact that heads throughout the aquifer at the beginning of the water year (October 2004) are similar to heads at the end of the water year (September 2005). By contrast, applying the steady-state model to simulate average conditions for water year 1998 might lead to inaccurate results because water levels in Rathdrum Prairie rose about 15 ft from the beginning of the water year to the end of the water year (fig. 27).

Model Limitations and Suggestions for Future Work

Although the SVRP aquifer model presented in this report provides a relatively good fit between simulated and measured quantities, indicating that the overall simulated ground-water flow is a reasonable representation of ground-water flow in the SVRP aquifer, the model is subject to limitations. These limitations, discussed in the following paragraphs, should be taken into consideration when using the model.

In general, the scale of the model and the level of detail are intended for analysis of aquifer-wide water-supply issues. Although the model might be useful for providing boundary conditions for smaller scale investigations, the model lacks sufficient details for direct application to small-scale investigations such as the analysis of capture zone for an individual well. Additionally, the model is not intended for application to contaminant-transport issues such as the prediction of contaminant travel times or flow paths. A contaminant-transport model would require a substantially greater amount of hydrogeologic detail for the contamination site.

There is insufficient hydrologic information to determine ground-water inflow from Spirit and Hoodoo Valleys to the SVRP aquifer. The calibrated model in this report assumes no inflow from Spirit and Hoodoo Valleys. However, alternative model D indicates that the amount of inflow from the Spirit and Hoodoo Valleys cannot be determined reliably from model calibration with the present calibration data. Monitoring water levels in and near Spirit and Hoodoo Valleys could provide important data to better evaluate inflows from those valleys to the SVRP aquifer.

In Hillyard Trough and the Little Spokane River Arm, ground-water flow in the lower unit is not well understood. Water levels in the lower unit are monitored in only two wells, and the horizontal and vertical extents of the clay layer separating the upper and lower units are not well known. The model assumes that the clay layer completely isolates hydraulic contact between the lower and upper units, but this assumption requires critical evaluation. Monitoring water levels and conducting aquifer tests in both the upper and lower units might lead to better understanding of the hydrogeology in Hillyard Trough and Little Spokane River Arm.

There is significant uncertainty in the simulated seepages from Lake Pend Oreille and Coeur d'Alene Lake. In addition, the water-level fluctuations in wells near Coeur d'Alene Lake are not well understood. A detailed study of ground-water flow in the Coeur d'Alene area, including aquifer tests to estimate hydraulic conductivity in the vicinity of Coeur d'Alene Lake, might provide data that can be used to constrain the simulated seepage from Coeur d'Alene Lake.

Summary and Conclusions

The ground-water flow model presented in this report is a component of a comprehensive study initiated by the Idaho Department of Water Resources, the Washington Department of Ecology, and the U.S. Geological Survey to improve the understanding of ground-water flow in the Spokane Valley-Rathdrum Prairie (SVRP) aquifer and of the interaction between ground water and surface water. The model was developed by the Modeling Team formed within the comprehensive study. The Modeling Team consisted of staff and personnel working under contract with the Idaho Department of Water Resources, personnel working under contract with the Washington Department of Ecology, and staff of the U.S. Geological Survey. To arrive at a final model that has the endorsement of all team members, decisions on modeling approach, methodology, assumptions, and interpretations were reached by consensus. The primary purpose of the model is to serve as a tool for analyzing aquifer inflows and outflows, simulating the effects of future changes in ground-water withdrawals from the aquifer, and for evaluating aquifer management scenarios. The scale of the model and the level of detail are intended for analysis of aquifer-wide water-supply issues.

The SVRP aquifer model encompasses an area of approximately 326 square miles. For the most part, the model extent coincides with the 2005 revised extent of the SVRP aquifer as defined in previous reports. However, the model excludes Spirit and Hoodoo Valleys because of uncertainties about the ground-water flow directions in those valleys and the degree of hydraulic connection between the valleys and northern Rathdrum Prairie. In addition, the model excludes three areas, one in northern Rathdrum Prairie and two in the vicinity of Five Mile Prairie, because the aquifer sediments in those areas likely are unsaturated.

The SVRP aquifer is considered to be a single hydrogeologic unit except in Hillyard Trough and the Little Spokane River Arm. In those areas, a continuous clay layer divides the aquifer into an upper, unconfined unit and a lower, confined unit. Both the upper and lower units extend from Hillyard Trough toward the west through the Little Spokane River Arm. The model terminates at the east end of Long Lake, a reservoir on the Spokane River. At this model boundary, the upper unit is in direct hydraulic connection with Long Lake. Available field data indicate that the clay layer and lower unit extend beyond the model boundary for an unknown distance. However, the confining clay layer eventually pinches out, allowing ground water in the lower unit to discharge into Long Lake.

The SVRP aquifer model includes all known components of inflows to and outflows from the aquifer. Inflows to the SVRP aquifer include (1) recharge from precipitation, (2) inflows from tributary basins and adjacent uplands,

(3) subsurface seepage and surface overflows from lakes that border the aquifer, (4) flow from losing segments of the Spokane River to the aquifer, (5) return percolation from irrigation, and (6) effluent from septic systems. Outflows from the SVRP aquifer include (1) ground-water withdrawals from wells, (2) flow from the aquifer to gaining segments of the Spokane River, (3) aquifer discharge to the Little Spokane River, and (4) subsurface outflow from the lower unit at the western limit of the model area near Long Lake.

The ground-water flow model MODFLOW-2000 is used to simulate ground-water flow in the SVRP aquifer. The finite-difference model grid consists of 172 rows, 256 columns, and 3 layers. Ground-water flow is simulated for September 1990 through September 2005 using 181 stress periods of 1 month each. Aquifer heads at the start of the simulation period are unknown, and the ground-water flow system was assumed to be at a steady state during the first stress period. Because aquifer heads simulated during this stress period serve as the initial conditions for the rest of the transient simulation, the first 5 years of the simulation period is considered to be a start-up period. No attempt is made to fit simulated quantities to measured quantities during the start-up period. Instead, the model is calibrated using water-level and flow data for October 1995 to September 2005.

Boundary conditions representing inflow and outflow components are implemented using packages in MODFLOW-2000. The Recharge Package is used to simulate recharge from precipitation. The Well Package is used to simulate withdrawals from wells, return percolation from irrigation, and effluent from septic systems. The Flow and Head Boundary Package is used to simulate flows to the aquifer from tributary basins and from all lakes except Lake Pend Oreille and Coeur d'Alene Lake. The River Package is used to simulate the Little Spokane River, Lake Pend Oreille, and Coeur d'Alene Lake. The Streamflow-Routing Package is used to simulate the interaction between the Spokane River and the aquifer. The General-Head Boundary Package is used to simulate ground-water outflow from the lower unit at the west end of the Little Spokane River Arm. The spatial distribution of aquifer properties such as hydraulic conductivity and specific yield are represented by dividing the aquifer into zones. Within each zone, the aquifer property is assumed to be uniform.

The parameter estimation program PEST is used to calibrate the SVRP aquifer model. PEST implements a nonlinear least-squares regression method to estimate model parameters by minimizing the sum of squared weighted residuals. Calibration data include 1,573 measurements of water levels and 313 measurements of streamflow gains and losses along segments of the Spokane and Little Spokane Rivers. Weights for the measurements initially are determined from errors associated with the measurements and subsequently adjusted to balance the influence of water-level measurements and flow measurements on the regression.

A total of 38 model parameters are estimated during calibration. These parameters include 22 values of horizontal hydraulic conductivity, 3 values of specific yield, 10 values of vertical hydraulic conductivity of riverbed sediments of the Spokane River, and 3 values of hydraulic conductances for riverbed sediments in the Little Spokane River and for lakebed sediments in Lake Pend Oreille and Coeur d'Alene Lake. An additional four model parameters are not estimated by calibration because the calibration data are insensitive to these parameters. Instead, the parameters are assigned reasonable values.

Model calibration gives the following results. In the central part of the aquifer in Rathdrum Prairie and in Spokane Valley, estimated horizontal hydraulic conductivity (K_h) values range from about 6,200 to 22,000 feet per day. In Hillyard Trough, the Little Spokane River Arm, and Western Arm, estimated K_h values range from about 2,000 to 3,000 feet per day. In the Coeur d'Alene area, the estimated K_h value is 1,290 feet per day. For side valleys and regions of shallow bedrock along the margins of the aquifer, the estimated K_h values range from 4 to 137 feet per day. Estimated specific yield values range from 0.10 to 0.21. For the Spokane River bed sediments, estimated values of vertical hydraulic conductivity range from 0.01 to 10 feet per day.

In general, the simulated water levels and flows (streamflow gains and losses) are in good agreement with the measured water levels and flows throughout most of the aquifer. The greatest discrepancies between measured and simulated quantities occur in the two wells (wells 99 and 115) completed in the lower unit. These discrepancies indicate that the lower unit might not be represented accurately by the model. For southern Rathdrum Prairie (including the Coeur d'Alene area), simulated water-level fluctuations during 2004–05 do not agree with the observed measured fluctuation. This discrepancy indicates that the temporal distribution of recharge to southern Rathdrum Prairie might not be represented accurately in the model for 2004–05.

The calibrated model gives a 10-year average flow of 67 cubic feet per second (ft^3/s) from Lake Pend Oreille to the aquifer, 138 ft^3/s from Coeur d'Alene Lake to the aquifer, and 27 ft^3/s from the lower unit to Long Lake. To examine the assumptions in the SVRP aquifer model, five alternative models are analyzed. In each alternative model, one aspect of the calibrated model is modified and the alternative model is recalibrated. Results of these alternative model analyses show that changes in certain model parameter values can result in changes to certain simulated flow components even though the overall fit of the alternative model to the measured quantities is nearly as good as the calibrated model. This suggests some degree of nonuniqueness in the ground-water flow simulated by the calibrated model.

The SVRP model presented in this report is calibrated using significantly more data than are used in previous models. The relatively good fit between simulated and measured quantities indicates that the overall simulated ground-water flow is a reasonable representation of ground-water flow in the SVRP aquifer. Nonetheless, the model has limitations. In particular, there is insufficient hydrologic information to determine ground-water inflow from Spirit and Hoodoo Valleys to the SVRP aquifer. In Hillyard Trough and the Little Spokane River Arm, ground-water flow in the lower unit is not well understood, and simulated water levels do not fit measured water levels as well as in other parts of the aquifer. There also is significant uncertainty in the simulated seepages from Lake Pend Oreille and Coeur d'Alene Lake. Further investigations in these parts of the SVRP aquifer could provide valuable knowledge that can be used to improve the model in the future.

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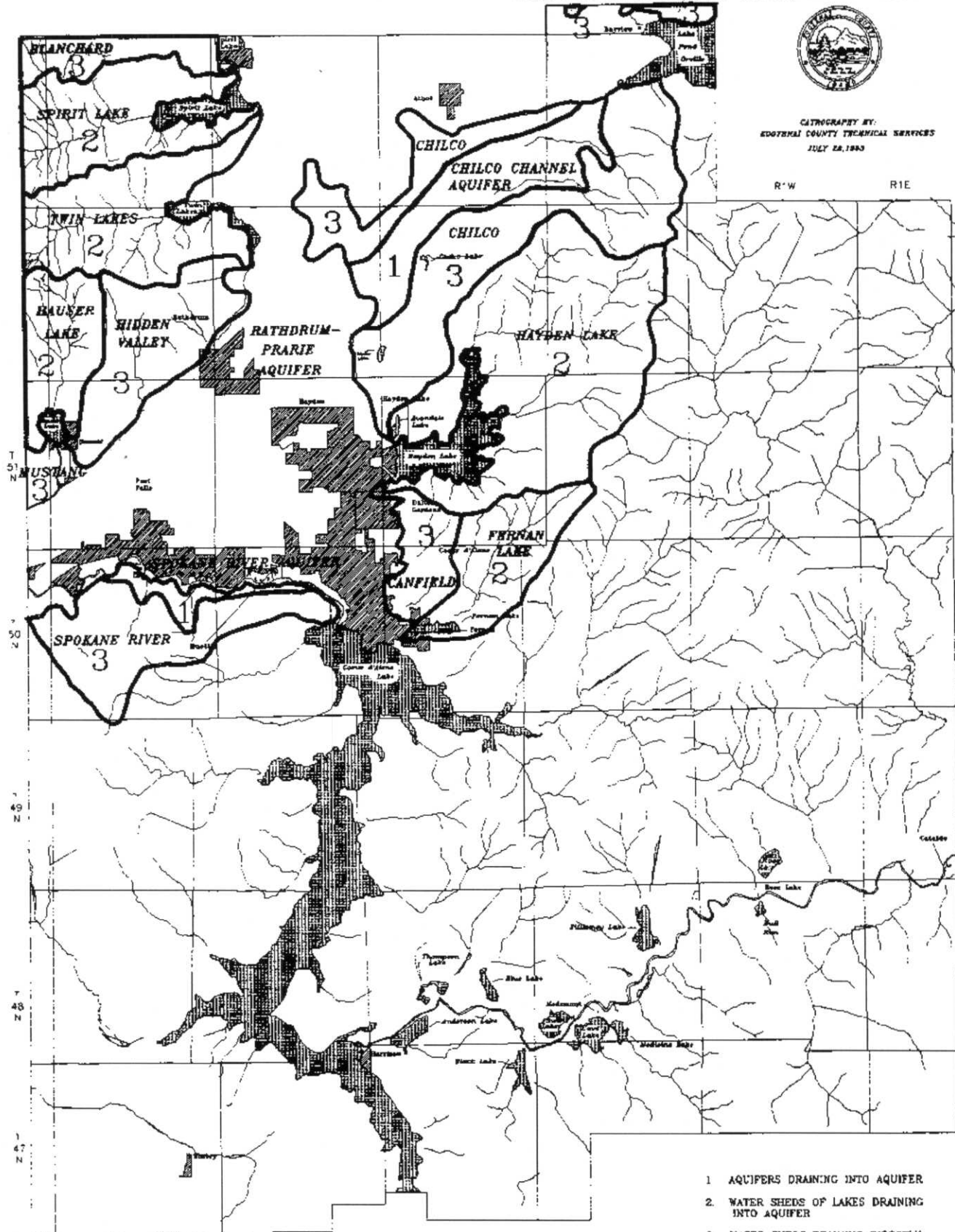
Hsieh and others

**Ground-Water Flow Model for the Spokane Valley-Rathdrum Prairie Aquifer,
Spokane County, Washington, and Bonner and Kootenai Counties, Idaho**

SIR 2007-5044



CARTOGRAPHY BY:
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JULY 28, 1983



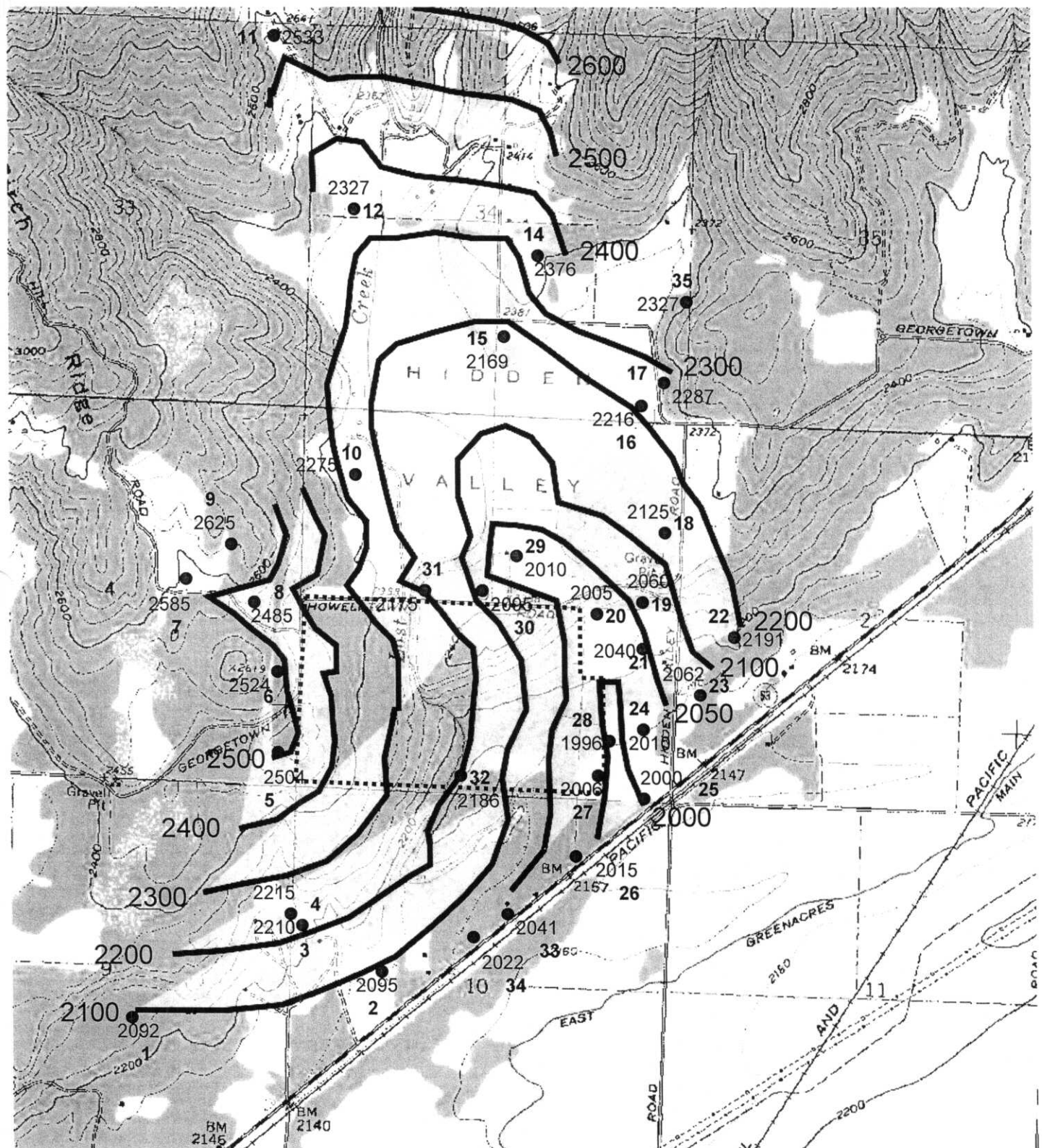
1. AQUIFERS DRAINING INTO AQUIFER
2. WATER SHEDS OF LAKES DRAINING INTO AQUIFER
3. WATER SHEDS DRAINING DIRECTLY INTO AQUIFER

WATER RESOURCES

Lost Creek NP Groundwater Potentiometric Surface Map Well Locations						
Map Number	Well Name	Measuring Point Elevation (feet)		Static Water Level (feet)		Groundwater Elevation (feet)
1	H18	2252		160		2092
2	H42	2140		45		2095
3	Burns #1	2240		30		2210
4	Burns #2	2260		45		2215
5	Dunphy	2516		12		2504
6	Barnes	2538		14		2524
7	Ripple	2600		15		2585
8	Armstrong	2555		70		2485
9	Scott	2640		15		2625
10	Akers	2375		100		2275
11	Rogers	2560		25		2533
12	Kern	2377		50		2327
13	Frei/H9	2798		20		2778
14	Myers	2416		40		2376
15	Staeb/HV-4/H30	2380		211		2169
16	Coles/HV-3/H39	2360		144		2216
17	Gagliand	2379		92		2287
18	Van Slate	2380		255		2125
19	D. Pruitt/HV-2	2260		200		2060
20	Winkler	2280		275		2005
21	Brazil/HV-7/H2	2180		140		2040
22	Faulkner	2241		50		2191
23	Grubbs	2150		88		2062
24	B. Kiefer	2160		150		2010
25	H Kiefer	2150		150		2000
26	Britton	2150		135		2015
27	IFI #4	2150		144		2006
28	IFI #5	2150		154		1996
29	B. Pruitt/HV-1	2350		340		2010
30	Nelson	2380		285		2095
31	Leach	2365		190		2175
32	IFI #2	2180		0		2180
33	Kirsche/HV-6/H40	2160		119		2041
34	Graham/H12	2140		117		2022
35	Agate/H1	2395		68		2327

13 2778

Lost Creek NP GW Potentiometric Surface



● 2010 Groundwater Elevation

— 2100 Groundwater Potentiometric Surface Elevation

.... Project Boundary

16 Well Location

1000 feet

Brett down year r-mil-ssional Boekel ight, Boekel park ter erry e will ll e en-ire s." g n - d or er n

"...about five years." we assign one of our existing employees to work on this?" Hayes opened. "We're spending way too much as is on employee salaries. I have friends working at Home Depot, Costco, places like that, that aren't making the kind of money we pay our employees. "We try to provide a wage to keep our employees," Boyer tried to explain, noting the expense involved in hiring, then training a new hire and the money lost if that employee goes down the road. "We're not considering the people out there paying these salaries! It's those people I represent; the poor taxpayer," Hayes came back.

BIRD from Page 1

The next day, a phone call: "As I understand it, my parakeet - a quite friendly little guy - landed on this man's shoulder, clear out on Wyoming Avenue," Wiemers said, who lives one street north of Highway 53, behind Granny's Pantry.

"This man was telling his friend about the parakeet landing on his shoulder...and this man said he'd seen the ad in The Star. A phone call later and, voila, I got my little pet back.

"Only problem: I missed my little guy so much I had gone out and purchased two little baby parakeets. So, when my Number One little bird came back home, there were two new roommates in his cage.

"They're learning to get along just fine!"

nesses in Spirit Lake. A town hall meeting is scheduled for 6:30 p.m., Monday, July 30 in the commons/lunch room at Timberlake Sr. High School, 5973 W. Highway 54, to help inform residents about the project.

The construction of a six-mile natural gas line extension along Highway 54 into Spirit Lake is expected to be completed by mid-October. Construction of distribution lines within the city is expected to be completed by the end of 2007. Avista anticipates that some customers could begin receiving

able natural gas service," said Mike Daniels, Avista gas construction manager.

"At our upcoming town hall meeting, residents can learn more about the new natural gas service and about energy efficiency rebates and incentives that will help them enjoy the value of natural gas while better managing their energy use and costs."

Spirit Lake residents can contact Avista at 1-877-GAS-TEAM (1-877-427-8326) for more information.

Avista Utilities provides service to 346,000 electric and 306,000 natural gas customers in three western states.

No Shortage of Vacant Lots!

At last count, there existed 593 vacant, buildable lots in the city of Rathdrum, according to figures released during the 2008 city budget review last week.

At the top of the list, Golden Spike Estates at the west end of Nagel Street, lists a total of 335 lots, 125 lots with houses, leaving 210 empty. Radiant Lake Subdivision has 211 lots, 13 built on and 198 empty.

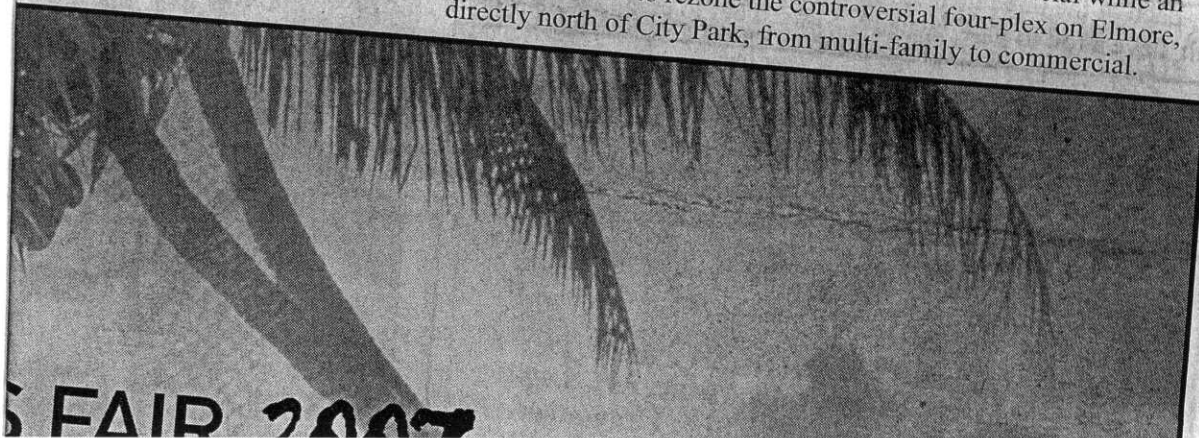
Skyline Meadows claims a total of 177 lots, 51 built on and 126 vacant with Boekel Ranch listing 76 total lots, 48 with houses and 28 vacant.

Meanwhile, the city approved or gave preliminary approval for three subdivisions last year: the 32-lot Park Rose Estates on Meyer Road; Pleasant View Equine complex and Prairie Sky Subdivision, just south of Skyline Meadows.

The equine center calls for the creation of 7 commercial, 21 multi-family and 97 single-family lots while Prairie Sky - formerly called Lancaster Heights - calls for 157 lots.

Also during the year, there were nine short plats - meaning less than 10 lots. The largest being the old Milwaukie Road Railway station and its surrounding four lots between Mill and McCartney Streets.

There were a pair of zone changes proposed this year - both denied. Troy Bice asked the city to rezone the corner of Stevens and Highway 41 from residential to limited commercial while an effort was made to rezone the controversial four-plex on Elmore, directly north of City Park, from multi-family to commercial.



**BEFORE THE DEPARTMENT OF WATER RESOURCES
OF THE STATE OF IDAHO**

IN THE MATTER OF APPLICATION TO)
APPROPRIATE WATER NO. 95-9385)
IN THE NAME OF NORTHERN WATER LLC)
_____)

**ORDER GRANTING
PETITION TO INTERVENE**

On August 30, 2007, Wild Ridge, LLC ("petitioner") by and through its attorney of record Erika B. Grubbs, submitted to the Department of Water Resources ("Department") a petition to intervene in the matter of application to appropriate water no. 95-9385 in the name of Northern Water, LLC. as authorized in Rule of Procedure IDAPA 37.01.01350 (Rule 350).

Petitioner has shown sufficient direct and substantial interest in the above captioned matter without unduly broadening the issues. The department should grant the petitioner intervention into the matter.

ORDER

IT IS HEREBY ORDERED that the petition of Wild Ridge, LLC, requesting intervention in the above-referenced matter is **GRANTED**.

DATED 14th day of September, 2007.



Gary Spackman
Hearing Officer

CERTIFICATE OF SERVICE

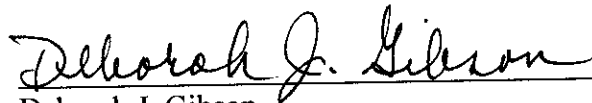
I HEREBY CERTIFY that on this 14th day of September, 2007, the above and foregoing document was served on the following by placing a copy of the same in the United States mail, postage prepaid and properly addressed to the following:

NORTHERN WATER LLC
1831 LOST SPRINGS RANCH RD
POST FALLS ID 83854

ERIKA B GRUBBS
525 CEDAR ST
WALLACE ID 83873

SHANNA BUBLITZ
PO BOX 827
RATHDRUM ID 83858

IDWR - NORTHERN REGION
7600 MINERAL DR STE 100
COEUR D ALENE ID 83815

A handwritten signature in cursive script, reading "Deborah J. Gibson", is written over a horizontal line.

Deborah J. Gibson
Administrative Assistant
Water Allocation Bureau



RECEIVED
AUG 30 2007
IDWR/North

The Law Office of Erika B. Grubbs

Licensed in Idaho, Washington and Georgia

grubbslaw@suddenlink.net

525 Cedar Street
Wallace, Idaho 83873
(208) 556-0439
FAX (208) 556-0519

213 North Fourth Street
Coeur d'Alene, Idaho 83814
(208) 664-8509
FAX (208) 664-2240

August 29, 2007

Idaho Department of Water Resources
Bob Haynes
7600 Mineral Drive, Suite 100
Coeur d'Alene, ID 83815

*In re: THE MATTER OF APPLICATION FOR PERMIT NO. 95-9385, In the Name of
NORTHERN WATER LLC*

To Whom It May Concern:

Please find enclosed an original and a copy of the follow in the above named matter:

- Memorandum in Support of Petition to Intervene
- Petition to Intervene
- Notice of Appearance

If you have any questions or concerns, please do not hesitate to contact our office.

Respectfully,

Natalie Bailey

Secretary to:

Erika B. Grubbs, Esquire

:nb
enclosures

Erika B. Grubbs
ISB #4664
Law Office of Erika B. Grubbs
525 Cedar Street
Wallace, Idaho 83873
Phone: 208-556-0439
Fax: 208-556-0519

BEFORE THE DEPARTMENT OF WATER RESOURCES

OF THE
STATE OF IDAHO

RECEIVED
AUG 30 2007
IDWR/North

IN THE MATTER OF APPLICATION FOR
PERMIT NO. 95-9385
In the name of
NORTHERN WATER LLC

NOTICE OF APPEARANCE

Notice is hereby given that ERIKA B. GRUBBS, of the Law Office of Erika B. Grubbs, HEREBY APPEARS as attorney of record on behalf of Intervenor, WILD RIDGE, LLC in the above-entitled action. Further, Wild Ridge, LLC hereby notifies the Court and all parties that all papers to be served in this matter, shall be served on Erika B. Grubbs, at the Law Office of Erika B. Grubbs, 525 Cedar Street, Wallace, Idaho 83873, until further notice or order.

Dated this 28th day of August, 2007.

LAW OFFICE OF ERIKA B. GRUBBS
Attorney for Intervenor

By: _____

Erika B. Grubbs

CERTIFICATE OF MAILING

I, Natalie Bailey, hereby certify that on the 29 day of August, 2007, a true and correct copy of the foregoing NOTICE was:

- ☒ mailed, with first class postage prepaid thereon;
☐ hand delivered;
☐ faxed;

To:

Northern Water LLC
1831 Lost Springs Ranch Rd.
Post Falls, Idaho 83854

Malcom S. Dymkoski
1110 W. Park Place, Ste. 210
Coeur d'Alene, Idaho 83814

Shanna Bublit
PO Box 827
Rathdrum, Idaho 83858


Natalie Bailey

Erika B. Grubbs
ISB #4664
Law Office of Erika B. Grubbs
525 Cedar Street
Wallace, Idaho 83873
Phone: 208-556-0439
Fax: 208-556-0519

RECEIVED
AUG 30 2007
IDWR/North

BEFORE THE DEPARTMENT OF WATER RESOURCES
OF THE
STATE OF IDAHO

IN THE MATTER OF APPLICATION FOR
PERMIT NO. 95-9385
In the name of
NORTHERN WATER LLC

PETITION TO INTERVENE

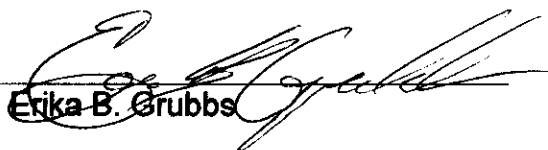
COMES NOW Intervenor WILD RIDGE, LLC, by and through its attorney Erika B. Grubbs, and petitions to intervene as party Applicants in the above-captioned matter.

This Petition is based upon IDAPA Rules of Procedure 37.01.01350-354, the memorandum filed herewith and on the Department's files and records in this matter.

Dated this 28th day of August, 2007.

LAW OFFICE OF ERIKA B. GRUBBS
Attorney for Intervenor

By:


Erika B. Grubbs

Petition to Intervene

1

CERTIFICATE OF MAILING

I, Natalie Bailey, hereby certify that on the 29 day of August, 2007, a true and correct copy of the foregoing NOTICE was:

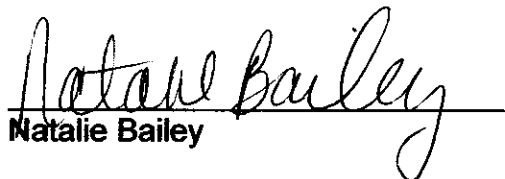
- ☒ mailed, with first class postage prepaid thereon;
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To:

Northern Water LLC
1831 Lost Springs Ranch Rd.
Post Falls, Idaho 83854

Malcom S. Dymkoski
1110 W. Park Place, Ste. 210
Coeur d'Alene, Idaho 83814

Shanna Bublitz
PO Box 827
Rathdrum, Idaho 83858


Natalie Bailey

Petition to Intervene

2

Erika B. Grubbs
ISB #4664
Law Office of Erika B. Grubbs
525 Cedar Street
Wallace, Idaho 83873
Phone: 208-556-0439
Fax: 208-556-0519

RECEIVED
AUG 30 2007
IDWR/North

BEFORE THE DEPARTMENT OF WATER RESOURCES
OF THE
STATE OF IDAHO

IN THE MATTER OF APPLICATION FOR
PERMIT NO. 95-9385
In the name of
NORTHERN WATER LLC

MEMORANDUM IN SUPPORT
OF PETITION TO INTERVENE

I. INTRODUCTION

This case arises out of Applicant Northern Water LLC's (hereinafter referred to as "Northern Water") Application for Permit to appropriate the public waters of the State of Idaho. The Permit would enable Northern Water's existing water system to serve the residents of a proposed neighboring subdivision which will be developed by Wild Ridge, LLC (hereinafter referred to as "Wild Ridge"). Northern Water and Wild Ridge have entered into an agreement for this existing adequate water source to service the Wild Ridge development. As such, Wild Ridge has a direct and substantial interest in the proceeding and requests permission to intervene as party Applicants.

II. FACTUAL AND PROCEDURAL BACKGROUND

Northern Water owns an existing well and domestic water system (hereinafter referred to as "the water system") located in a residential subdivision known as Lost Creek Estates, located in Rathdrum, Kootenai County, Idaho. Northern Water obtained a permit, #95-09277, for the water system to serve the residents of the Lost Creek development. (Permit is attached to and incorporated herein as Exhibit "A".) The water system will be leased by the Lost Creek Estates Water Association (hereinafter "Water Association") which will be comprised primarily of property owners in Lost Creek Estates.

Wild Ridge is the owner and developer of approximately 109 acres of property adjoining Lost Creek Estates. Wild Ridge seeks to create a 54 lot residential subdivision on their property. Wild Ridge will necessarily require water service to the 54 residential lots in its development.

Northern Water, the Water Association, and Wild Ridge have entered into an agreement whereby the property owners in the Wild Ridge development may become members of the Water Association, Wild Ridge may connect to the existing water system, and fees will be paid for the provision of services pursuant to the agreement. (See Water Service Agreement, attached to and incorporated herein as Exhibit "B".)

On March 27, 2007, Northern Water filed Application for Permit 95-9385 to enable the existing system to service the additional residents who will come to live in Wild Ridge. On the last day of the protest period, Shanna Bublitz (hereinafter "Protestor") filed her Notice of Protest to the application.

On June 27, 2007, The Department conducted a pre-hearing conference in accordance with applicable rules. The presiding officer at the conference was Robert G. Haynes, P.E., Northern Regional Manager. Prior to that conference, Wild Ridge, through its representatives, had several communications with the protestor in an effort to explain the scope of the proposal as well as the benefits of utilizing the existing ample source rather than drilling additional wells to serve the development. These communications were unsuccessful. At the hearing with Mr. Haynes, Northern Water and its counsel, Wild Ridge and its engineer and counsel, and Mr. Haynes also attempted to communicate with the protestor about these issues.

Protester expressed concerns about the impact of the proposal on water quality; however, indicated that in the event that the Department of Environmental Quality (DEQ) approved the plan, she would consider withdrawing her protest. DEQ issued a letter on July 20, 2007 concurring with the engineer's conclusion that the water system has capacity to serve Wild Ridge and that the proposed large soil absorption system will not adversely impact ground water quality, and stating that DEQ had no objection to the proposed subdivision provided Wild Ridge comply with certain requirements. (A copy of the DEQ letter is attached to and incorporated herein as Exhibit "C")

Wild Ridge, through its owners and representatives, continued to attempt to negotiate with protestor until the day before Wild Ridge subdivision and planned unit development hearing with the Kootenai County Board of Commissioners in hopes that this matter could be resolved in a manner which would not significantly delay the development process. Wild Ridge was unsuccessful in these negotiations.

attempts. Protestor elected, just prior to the County public hearing on the subdivision and PUD, to proceed to hearing before the Department of Water Resources. The hearing was then scheduled for its present date of September 18, 2007.

III. STANDARD OF REVIEW

IDAPA Rule of Procedure 37.01.01350 provides that persons who are not applicants or claimants to an action may intervene as a party when they have a "direct and substantial interest" in the proceeding. IDAPA Rule of Procedure 37.01.01353 provides that the presiding officer will grant intervention if the party does have a direct and substantial interest and if granting the intervention will not unduly broaden the issues.

IV. DISCUSSION

Wild Ridge endeavors to build a responsible, high quality residential subdivision development. To do so, the incorporation of a solid, enduring, and proven water source will be critical. Northern Water has such a source and it is the subject of this Application for Permit. The future residents of Wild Ridge will be direct beneficiaries of the water provided pursuant to Northern Water's permit.

If the subject Permit is not granted, Wild Ridge will be forced to pursue the provision of water via individual wells. The property lies within an aquifer recharge area and in an area which has experienced water issues in the past. Individual wells would not enable Wild Ridge to be the best water stewards possible, nor would it be in keeping with their philosophies and goals of optimal responsibility to future homeowners and to the environment and creating the highest quality development possible. Wild Ridge would

not have standing to apply for a permit for the Northern Water / Water Association existing water system alone. Patently, Wild Ridge has a direct and substantial interest in the outcome of these proceedings.

The evidence and testimony which Wild Ridge will proffer in these proceedings will only supplement and compliment those presented by Northern Water. Because the issues are complimentary, and because protestor's concerns of the impact of this permit upon water quality will not change as a result of Wild Ridge's involvement in this process, granting Wild Ridge's intervention will not unduly broaden the issues presented at hearing and is, therefore, appropriate.

Wild Ridge files its Petition to Intervene at this time because negotiations have failed with Protestor and it is evident that this matter will proceed to formal hearing on the 18th of September. Given the direct and substantial nature of Wild Ridge's interest in this proceeding, Wild Ridge desires participation in the upcoming hearing.

V. CONCLUSION

Based on the foregoing, Wild Ridge respectfully requests that the Department grant its Petition to Intervene.

Dated this 28th day of August, 2007.

LAW OFFICE OF ERIKA B. GRUBBS
Attorney for Intervenor

By: 
Erika B. Grubbs

CERTIFICATE OF MAILING

I, Natalie Bailey, hereby certify that on the 29 day of August, 2007, a true and correct copy of the foregoing NOTICE was:

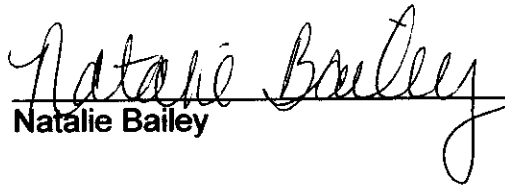
- ☒ mailed, with first class postage prepaid thereon;
☐ hand delivered;
☐ faxed;

To:

Northern Water LLC
1831 Lost Springs Ranch Rd.
Post Falls, Idaho 83854

Malcom S. Dymkoski
1110 W. Park Place, Ste. 210
Coeur d'Alene, Idaho 83814

Shanna Bublitz
PO Box 827
Rathdrum, Idaho 83858


Natalie Bailey

State of Idaho
Department of Water Resources

Permit to Appropriate Water

NO. 95-09277

Priority: June 15, 2005

Maximum Diversion Rate: 0.50 CFS
Maximum Diversion Volume: 72.0 AF

This is to certify, that NORTHERN WATER LLC
C/O NORM WALDO
1831 LOST SPRINGS RANCH RD
POST FALLS ID 83854

has applied for a permit to appropriate water from:

Source: GROUND WATER

and a permit is APPROVED for development of water as follows:

<u>BENEFICIAL USE</u>	<u>PERIOD OF USE</u>	<u>RATE OF DIVERSION</u>	<u>ANNUAL VOLUME</u>
FIRE PROTECTION	01/01 to 12/31	0.50 CFS	
MUNICIPAL	01/01 to 12/31	0.25 CFS	72.0 AF

LOCATION OF POINTS OF DIVERSION:

GROUND WATER SE¼ SE¼ Sec. 3, Twp 51N, Rge 05W, B.M. KOOTENAI County
GROUND WATER SE¼ SE¼ Sec. 3, Twp 51N, Rge 05W, B.M. KOOTENAI County

CONDITIONS OF APPROVAL

1. Proof of application of water to beneficial use shall be submitted on or before April 01, 2011.
2. Subject to all prior water rights.
3. The diversion and use of water described in this right may be subject to additional conditions and limitations agreed to by the protestant and the right holder under a separate agreement to which the Department is not a party and which may be enforceable by a court of law. A copy of the agreement can be found in Water Right file No. 95-9277.
4. Place of use is within the area served by the public water supply system of Northern Water LLC. The place of use is generally located within Section 3, Township 51N, Range 5W.
5. A map depicting the place of use boundary for this water right at the time of this approval is attached to this document for illustration purposes.
6. Prior to or in connection with the proof of beneficial use statement to be submitted for municipal water use under this right, the right holder shall provide the department with documentation showing that the water supply system is being regulated by the Idaho Department of Environmental Quality as a public water supply and that it has been issued a public water supply number.
7. Water shall not be diverted for fire protection use under this right except to fight or repel an existing fire.
8. Right holder shall comply with the drilling permit requirements of Section 42-235, Idaho Code and applicable Well Construction Rules of the Department.
9. Project construction shall commence within one year from the date of permit issuance and shall proceed diligently to completion unless it can be shown to the satisfaction of the Director of the Department of Water Resources that delays were due to circumstances over which the permit holder had no control.

"Exhibit A"

State of Idaho
Department of Water Resources

Permit to Appropriate Water

NO. 95-09277

10. This right does not grant any right-of-way or easement across the land of another.
11. When notified by the Department, the right holder shall install and maintain a measuring device of a type acceptable to the Department as part of the diverting works.
12. This right authorizes the diversion of ground water within the Rathdrum Prairie Ground Water Management Area (RPGWMA). Use of water under this right shall be subject to the provisions of the management plan approved by the director for the RPGWMA.
13. When notified by the Department, the right holder shall record the quantity of water diverted and annually report diversions of water and/or other pertinent hydrologic and system information as required by Section 42-701, Idaho Code, and/or the management plan for the Rathdrum Prairie Ground Water Management Area.
14. There is an agreement between the permit holder and Kootenai Environmental Alliance to which the Department is not a party and which may be enforceable by a court of law. A copy of the agreement can be found in Water Right file No. 95-9277.

This permit is issued pursuant to the provisions of Section 42-204, Idaho Code. Witness the signature of the Director, affixed at Boise, this 7th day of April, 2006.


KARL J DREHER, Director

State of Idaho
Department of Water Resources

Permit to Appropriate Water

NO. 95-09277

Digital Boundary for Northern Water, LLC

April 5, 2006



0.3 0 0.3 0.6 Miles

95-09277.shp

Sections
QQ



RECEIVED

FORM 202
12/99

MAR 20 2006

72039
DEPARTMENT OF
WATER RESOURCES

Ident. No.

95-9277

RECEIVED

JUN 15 2005

IDWR/North

DEPARTMENT OF WATER RESOURCES
APPLICATION FOR PERMIT

To appropriate the public waters of the State of Idaho

1. Name of Applicant Northern Water LLC Phone 208 661 8609

Mailing address 1831 Lost Creek Springs Ranch Road Post Falls ID 83854 *Per Nam Waldo 6/16/05*

2. Source of water supply Groundwater which is a tributary of N/A

3. Location of point of diversion is Township 51N Range 5W Sec. 3 in the NW 1/4
SE 1/4 SE 1/4 Govt. Lot B.M. Kootenai County

additional points of diversion if any: N/A

4. Water will be used for the following purposes:

Amount 0.5 for Municipal purposes from 1/1 to 12/31 (both dates inclusive)
(cfs or acre-feet per annum)
Amount for purposes from to (both dates inclusive)
(cfs or acre-feet per annum)
Amount for purposes from to (both dates inclusive)
(cfs or acre-feet per annum)
Amount for purposes from to (both dates inclusive)
(cfs or acre-feet per annum)
Amount for purposes from to (both dates inclusive)
(cfs or acre-feet per annum)
Amount for purposes from to (both dates inclusive)
(cfs or acre-feet per annum)

5. Total quantity to be appropriated is (a) 0.5 cubic feet per second and/or (b) acre feet per annum

6. Proposed diverting works:

a. Describe type and size of devices used to divert water from the source Well and storage reservoir

b. Height of storage dam N/A feet; active reservoir capacity acre-feet; total reservoir capacity acre-feet

c. Proposed well diameter is 8" inches; proposed depth of well is 225 feet

d. Is ground water with a temperature of greater than 85°F being sought? No

e. If well is already drilled, when? Test Well; Drilling firm H2O-171003
Well was drilled for (well owner) Idaho Forest Industries #5; Drilling Permit No. 50022005

7. Time required for completion of works and application of water to proposed beneficial use is 5 years (minimum 1 year)

8. Description of proposed uses (if irrigation only, go to item 9):

a. Hydropower; show total feet of head and proposed capacity in kW.
b. Stockwatering; list number and kind of livestock.
c. Municipal; show name of municipality. Northern Water LLC
d. Domestic; show number of households.
e. Other; describe fully.

3. Description of place of use:

- a. If water is for irrigation, indicate acreage in each subdivision in the tabulation below.
- b. If water is used for other purposes, place a symbol of the use (example: D for Domestic) in the corresponding place of use below. See instructions for standard symbols.

TWP	RGE	SEC	NE				NW				SW				SE				TOTALS
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
5N	SW	3									M	M	M	M	M	M	M	M	

Total number of acres to be irrigated _____

10. Describe any other water rights used for the same purposes as described above. _____

11. a. Who owns the property at the point of diversion? Northern Water LLC

b. Who owns the land to be irrigated or place of use? Future property owners in Lost Creek Estates

c. If the property is owned by a person other than the applicant, describe the arrangement enabling the applicant to make this filing: _____

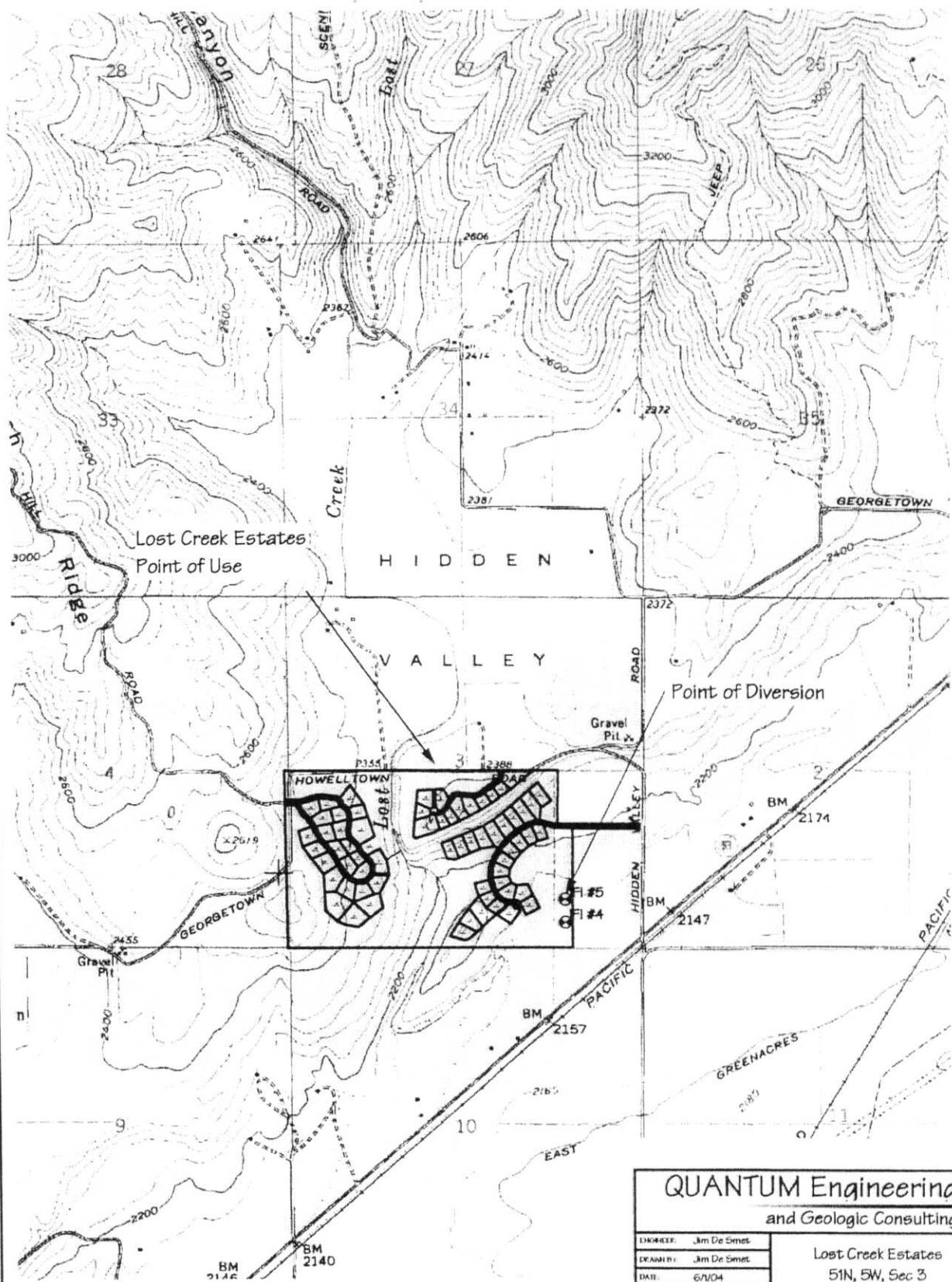
12. Remarks: Water association paperwork attached. Test well (IFW5) was drilled in 2003 and pump tested in 2004. Proposed production well (8") will be drilled upon obtaining water right.

13. MAP OF PROPOSED PROJECT REQUIRED - Attach an 8½"x11" map clearly identifying the proposed point of diversion, place of use, section #, township & range. (A photocopy of a USGS 7.5 minute topographic quadrangle map is preferred.)

BE IT KNOWN that the undersigned hereby makes this application for permit to appropriate the public waters of the State of Idaho as herein set forth.

Nora G. Waldo (member)
Signature of Applicant (and title, if applicable)

Received by PKA Date 6/15/05 Time _____ Preliminary check by _____
Fee \$ 250 _____
Publication prepared by PKA Date 7/1/05 Published in CBA Press Date 7/14/05
Publication approved PKA Date 7/15/05



Topographic Base Map Source: USGS Rathdrum Quad

QUANTUM Engineering
and Geologic Consulting

DRAWN BY:	Jim De Smet
DATE:	6/1/04
SCALE:	1"=2000'
SHEET NO:	

Lost Creek Estates
51N, 5W, Sec 3
Kootenai County, Idaho

WATER SERVICE AGREEMENT

(Lost Creek/Wild Ridge Project)

This Agreement is entered into and effective March 13, 2007, by and between Northern Water, L.L.C., an Idaho limited liability company ("Northern Water"), Wild Ridge, L.L.C., a Washington limited liability company ("Wild Ridge"), and Lost Creek Estates Water Association, Inc., an Idaho non-profit corporation ("Water Association"), with reference to the following facts:

A. Northern Water owns a well and domestic water system located in a residential subdivision known as Lost Creek Estates, located to the south and east of West Winch Avenue and North Freddie Road, near the City of Rathdrum, Kootenai County, Idaho (the "Water System").

B. Wild Ridge is the owner and developer of property located to the north and west of West Winch Avenue and North Freddie Road, which is across the public right of way from Lost Creek Estates and the Water System. Wild Ridge is proposing to subdivide and develop its property into a residential subdivision to be known as "Wild Ridge" (the "Project"), which will require water service to its resulting lots. The Project is described on Exhibit "A" and depicted on Exhibit "B" attached hereto and incorporated herein by this reference.

C. Water Association has entered into an agreement with Northern Water. That agreement provides that Water Association will lease the Water System from Northern Water in order to operate the Water System to provide water to its members. The members of Water Association will be the record owners of lots located in Lost Creek Estates plus any other lots outside of Lost Creek Estates as included at the discretion of Northern Water.

D. Wild Ridge wishes to have the owners of lots that are to be platted in the Project ("the Project parcels"), become members of the Water Association. Wild Ridge also wishes to connect the water distribution system that is to be constructed in the Project ("the Project water distribution system") to the Water System. Northern Water wishes to add the Project parcels as members of the Water Association (which Northern Water has the authority and power to do, and which Water Association is willing to accept), and wishes to allow the connection, subject to the payment of costs and compliance with other terms and conditions set forth in this Agreement.

NOW, THEREFORE, THE PARTIES AGREE AS FOLLOWS:

1. Northern Water and Water Association hereby agree to have the owners of the Project parcels become members of the Water Association (as the individual Project parcels are sold by Wild Ridge), and to allow Wild Ridge, in its discretion, and according to its schedule, to connect the Project water distribution system to the Water System, upon payment of the costs described in Paragraph 4, below. Should Wild Ridge choose to connect to the Water System and have the Project parcels become members of the Water Association, all costs associated with

"Exhibit B"

extending the Water System to and throughout the Project shall be borne by Wild Ridge, and all installations shall be designed according to generally acceptable engineering practices, and shall be subject to the approval of Northern Water, which approval shall not be unreasonably withheld. Such hook up to the Water System (both the main service line to the Project and also the individual services within the Project) shall occur, and the owners of the Project parcels shall become members of the Water Association, if at all, not later than two (2) years following Wild Ridge's receipt of preliminary plat approval for the Project; provided that if the hook up to the Water System is not completed by such time, Wild Ridge shall nevertheless have the right to extend the hook up and membership date for an additional two (2) years, by payment of the reserve fees described in Paragraph 4(b), below; and provided further that if the hook up to the Water System is not completed within such two (2) year extension, being four (4) years from the receipt of preliminary plat approval for the Project, all rights to hook up to the Water System and for Project lot owners to become members of the Water Association shall automatically terminate, unless Wild Ridge shall pay, prior to such termination date, the full hookup fees for all lots in Wild Ridge for which hook up and membership rights are desired.

2. Northern Water hereby represents and warrants that the Water System currently has the capacity to service the lots to be developed in the Project and for which capacity is reserved under this Agreement, and that it shall not commit water to any third party so as to render the capacity of the Water System incapable of servicing all lots referenced in Paragraph 4, below. Notwithstanding the foregoing, Wild Ridge specifically acknowledges that Northern Water has neither applied to the State of Idaho for water rights to appropriate water for the beneficial use of the land where the Project is located nor to draw sufficient water to supply the Project, and that Northern Water makes no such representation that it presently has any such water rights. Immediately upon the execution of this Agreement, Northern Water shall make application to the appropriate agencies to obtain a permit for sufficient water to service the domestic needs of all properties to be serviced by the Water System, and shall pursue such application diligently and in good faith until the necessary permit is granted. The effectiveness of this Agreement is expressly conditioned upon the ability of Northern Water to obtain all necessary permits for water.

Wild Ridge also specifically acknowledges that Northern Water or its agent shall have the right, at Northern Water's sole discretion, to sell or otherwise convey the Water System to any other person, organization, private entity, or governmental entity; provided that, upon and as a condition to the conveyance of the Water System to any third party, such third party shall agree to provide water to all Project parcels described in Paragraph 4, below (whether or not the owners of such Project parcels shall be members of the Association at the time of the transfer), on the same basis as water service is provided to all other customers of such third party. Should Northern Water sell or otherwise convey the Water System to a governmental entity which exists, in whole or in part, to provide water to the public, and provided the third party acquiring the Water System is committed to provide water service to the Project parcels as provided in this paragraph, then Northern Water, Wild Ridge, and the Water Association specifically agree that this Agreement shall immediately terminate, and that neither Northern Water nor the Water Association shall have any duties or responsibilities to provide water to Wild Ridge or to return any funds or ownership of the Project water distribution system to Wild Ridge.

3. At such time as Wild Ridge, or its successors with respect to the Project, connects the Project water distribution system to the Water System, then Northern Water shall be deemed to be the owner of the Project water distribution system.

4. In consideration of the hook up of the Project to the Water System, Wild Ridge or its successors with respect to the Project shall pay the following expenses:

a. All costs of design and installation of equipment necessary to deliver water from the current terminus of the Water System in Lost Creek Estates, across West Winch Avenue and/or North Freddie Road to and throughout the Project. Such equipment would include, without limitation, pipes, pumps, and storage reservoirs;

b. In the event that the hook up to the Water System shall not have been accomplished within the initial two (2) year time limit referenced in Paragraph 1, above, then Wild Ridge shall have the option to continue its reservation of hook up rights by paying cash to Northern Water (with payment to be made prior to the expiration of the two year period) in the amount of \$2,000 per lot in the Project anticipated to be hooking up to the Water System, for the first 25 lots, plus \$1,000 per lot in the Project for the next 29 lots in the Project anticipated to be hooking up to the Water System, for a total of up to 54 lots anticipated for the Project. Wild Ridge shall have the option to reserve any number of hookup rights for the Project, in its discretion, up to the maximum of 54 hookups. Any such amount paid by Wild Ridge shall be credited to the payment obligation set forth in Paragraph 4(c) below, on a lot by lot basis. Such reservation shall be effective for two (2) additional years, following which all rights of Wild Ridge under this Agreement will automatically terminate with respect to any lots not yet hooked up, unless Wild Ridge shall have paid, prior to the expiration of the total four years, all hook up costs described in Paragraph 4(c) below for the lots for which Wild Ridge wishes to provide water service under this Agreement.

c. Cash to Northern Water, in the amount of \$20,000 per lot in the Project hooking up to the Water System, for the first 25 lots; then \$10,000 per lot in the Project for the next 29 lots in the Project hooking up to the Water System, for a total of up to 54 lots anticipated for the Project; provided that the Wild Ridge shall be entitled to credit for each hook up in the amount of any reservation payment made pursuant to Paragraph 4(b) above. Payment of such amounts shall be made contingent upon and in connection with the hook up of each lot for which service is requested.

d. Notwithstanding the foregoing, if Wild Ridge shall sell all or substantially all of the Project or the resulting lots in the Project to a new owner ("Third Party"), without having paid for the hook ups described herein, then, in connection with such sale, and as a condition to assigning the hook up rights granted under this Agreement to the Third Party, Wild Ridge and/or the Third Party shall pay to Northern Water an amount equal to one-half of the total hook up fees not yet purchased under this Agreement. That is, if the entire Project is sold, Northern Water shall be entitled to a payment of \$395,000 cash (less credit for one-half of any amounts previously paid under Paragraphs 4(b) and 4(c) above), which amount shall be credited to future payments for hook ups required

under this Agreement. The application of the credits, as among Wild Ridge herein, the Third Party, and the purchasers of individual lots shall be as agreed among such parties. As used in this paragraph, a sale of substantially all of the Project or the resulting lots shall be deemed to have occurred if a single Third Party acquires eighty percent (80%) of the lots then held by Wild Ridge.

5. Miscellaneous and Procedural:

a. Binding Effect. This Agreement shall be binding upon and shall inure to the benefit of Wild Ridge, Water Company, and Water Association, and their respective successors and assigns with respect to the Water System and the Project, subject, however, to the obligation of Wild Ridge and/or any Third Party purchaser of the Project to make the partial payment for hook ups as described in Paragraph 4(d), above.

b. Attorney Fees. If any action at law or in equity shall be brought to enforce or interpret any of the terms of this Agreement, the prevailing party shall be entitled to recover from the other party as part of the prevailing party's costs, reasonable attorney's fees the amount of which shall be fixed by the court and shall be made a part of any judgment or decree rendered.

c. Notices. Any notice, demand, request, consent, approval, or communication that either party desires or is required to give to the other party or any other person shall be in writing and either served personally or sent by facsimile transmission or by prepaid, first-class mail, addressed to the other party at the appropriate address set forth below:

Northern Water, L.L.C.
1831 Lost Springs Ranch Road
Post Falls, Idaho 83854
Fax: (208) 773-8291

Wild Ridge L.L.C.
c/o Robert B. Nehring
3216 Wetmore Ave., Suite 202
Everett, WA 98201

Either party may change its address by delivering notice of the change of address in the manner prescribed in this paragraph.

Any such notice shall be deemed delivered upon personal delivery, upon confirmation of facsimile delivery, or within forty-eight (48) hours from the time of mailing if mailed as provided in this subparagraph.

d. Governing Law, Venue and Jurisdiction. This Agreement shall be construed and interpreted in accordance with the laws of the State of Idaho. Jurisdiction

and venue in any action to interpret or enforce any provisions of this Agreement shall lie, at the option of the party bringing the action, in Idaho County, Idaho.

IN WITNESS WHEREOF, the parties have entered into this Agreement as of the date first above written.

NORTHERN WATER, L.L.C.,
an Idaho limited liability company

By Norm G. Waldo
NORM G. WALDO, Managing Member

WILD RIDGE, L.L.C.,
a Washington limited liability company

By Robert Nehring
Robert Nehring, Managing Member

By Kurtis Kingsolver
Kurtis Kingsolver, Member

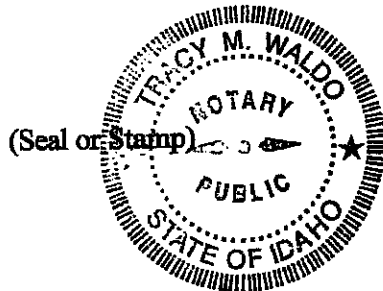
LOST CREEK ESTATES WATER
ASSOCIATION, INC.,
an Idaho non-profit corporation

By Norm G. Waldo

STATE OF IDAHO)
 : ss.
County of Kootenai)

On this 13 day of March, 2007, before me, Tracy M. Waldo, a Notary Public in and for the State of Idaho, personally appeared NORM G. WALDO, known or identified to me to be the Managing Member of NORTHERN WATER, L.L.C., an Idaho limited liability company, the company that executed the foregoing instrument and the person who executed the foregoing instrument on behalf of said company, and acknowledged to me that such company executed the same.

WITNESS my hand and official seal hereto affixed the day and year first above written.



Tracy M. Waldo
Notary Public for State of Idaho
Residing at Post Falls, ID
Commission expires 6-24-07

WASHINGTON
STATE OF ~~IDAHO~~)
: ss.
County of Kootenai)

On this 28th day of March, 2007, before me, PHILLIS VERONICA KENNEDY, a Notary Public in and for the State of WASHINGTON, personally appeared ROBERT NEHRING, known or identified to me to be the Managing Member of WILD RIDGE, L.L.C., a Washington limited liability company, the company that executed the foregoing instrument and the person who executed the foregoing instrument on behalf of said company, and acknowledged to me that such company executed the same.

WITNESS my hand and official seal hereto affixed the day and year first above written.



Phillis Veronica Kennedy
Notary Public for STATE OF WASHINGTON
Residing at Bothell, WASHINGTON
Commission expires 05.29.2009

WASHINGTON
STATE OF ~~IDAHO~~)
: ss.
County of pierce)

On this 22 day of March, 2007, before me, Antonio Vasquez, a Notary Public in and for the State of WASHINGTON, personally appeared KURTIS KINGSOLVER, known or identified to me to be a Member of WILD RIDGE, L.L.C., a Washington limited liability company, the company that executed the foregoing instrument and the person who executed the foregoing instrument on behalf of said company, and acknowledged to me that such company executed the same.

WITNESS my hand and official seal hereto affixed the day and year first above written.

(Seal or Stamp)

Antonio Vasquez
Notary Public for STATE OF WASHINGTON
Residing at City of Tacoma, Washington
Commission expires 1/24/2010

**EXHIBIT "B" TO
WATER SERVICE AGREEMENT**

Graphic Depiction of Wild Ridge Project

059

July 20, 2007

Mr. Robert Nehring
Wild Ridge Development, LLC
3216 Wetmore Avenue, Suite 202
Everett, WA 98201

RE: **Wild Ridge Subdivision, Kootenai County**

Dear Mr. Nehring:

This office has now concluded review as follows of three items related to the drinking water and wastewater systems being planned for your proposed **Wild Ridge** subdivision of 109 acres into fifty-four (54) residential lots located in Section 3 of T51N R3W of Kootenai County.

- **Drinking Water Supply:** A memorandum dated May 14, 2007 by John Smetana, P.E. of Frame and Smetana described the ability of the existing public drinking water system owned by Northern Water LLC and presently serving the sixty-four (64) residential lots in Lost Creek Estates subdivision, to be expanded to provide drinking water to Wild Ridge. The two existing wells are extracting water from the Spokane Valley- Rathdrum Prairie Aquifer, have been found to produce water that complies with Idaho drinking water standards, were test pumped at 195 gallons per minute (gpm), and have installed pumps capable of 142 gpm. Based on reasonable water demand estimates, the memorandum concluded that these two wells should be capable of producing enough water to meet water demand from the 118 lots ultimately served in the two subdivisions. Prior to preparation of plans and specifications for construction of the expanded water system, the engineer indicated that a more detailed engineering report would be completed discussing in detail design of the water conveyance, storage, and distribution systems needed in Wild Ridge.

DEQ concurs with the engineer's conclusion that the water system serving Lost Creek Estates has the capacity to be expanded to serve the proposed subdivision called Wild Ridge. At the conclusion of preliminary plat reviews, DEQ will need to review the engineering report prepared to describe, select, and size the improvements needed to implement this expansion in accordance with the Idaho Rules for Public Drinking Water Systems (IDAPA 58.01.08)

- **Large Soil Absorption System - Site and Loading Rate Approval:** The design engineers for the wastewater systems serving the proposed subdivision at Ruen Yeager and Associates indicated that a large soil absorption system (LSAS) as defined in the Idaho Individual/Subsurface Sewage Disposal Rules (IDAPA 58.01.03) is being proposed for all 54 lots. The first step for review of a LSAS involves site and loading rate evaluation by the PHD.

On February 20 and March 9, 2007 the Panhandle Health District (PHD) evaluated a number of test holes in the vicinity of two proposed LSAS sites (Field 1 and Field 2) and issued conclusions in a letter dated May 10, 2007. The soil type was determined to be B-1 with an associated wastewater application rate of 0.6 gallons per day per square foot (gpd/ft.²). The PHD report included data on

"Exhibit C"

depth to ground water and distance to surface water that need to be reflected when the boundaries of the LSASs are established.

With 54 lots involving three bedroom homes producing 250 gallons per day (gpd) of sewage, the LSAS will need to accommodate up to 13,500 gpd. This will involve construction of two independent LSAS modules since the maximum size allowed by the Rules for a LSAS is 10,000 gpd. Two fully-sized drainfields and one replacement area must be provided for each module.

At the conclusion of preliminary plat reviews, DEQ will need to review an engineering report prepared by the design engineer describing design of the proposed LSAS.

- **Site Investigation:** Following LSAS site and loading rate evaluation, the next preliminary review step identified in the Individual/Subsurface Sewage Disposal Rules is that a site investigation be undertaken concluding that the effluent from the LSAS will not adversely impact or harm the waters of the State. Typically, this investigation has involved a Nutrient/Pathogen Evaluation as recommended by DEQ that models expected water quality impacts of the LSAS to ground water.

On May 16, 2007 this office received a Level 1 Nutrient-Pathogen Evaluation for Wild Ridge Subdivision as prepared by Thomas Mullen, P.G. with LFR Inc. Subsequent reviews of the report by Gary Stevens, P.G. at this office and submittals of additional documentation by Mr. Mullen was undertaken. The result of this review is that DEQ concurs with the conclusion of the report that the proposed LSAS can be constructed and operated without an adverse impact to ground water quality.

With satisfaction of our requirements as indicated above for water supply capacity, LSAS site and loading rate approval, and water quality impacts, DEQ has no objection to Kootenai County acceptance of the preliminary plat for Wild Ridge subdivision. Once this action has been completed, we will be prepared to review and approve engineering reports and plans and specifications related to construction of the public drinking water system extension and LSAS systems serving the proposed subdivision.

Sincerely,

Gary J. Gaffney, P.E.

c: Tom Mullen, LFR Inc., 2310 North Molter Road, Suite 101, Liberty Lake, WA 99019
Randy Broesch, Ruen-Yeager and Associates, 3201 N. Huetter, CdA
Steve Syrcle, Tri-State Consulting Engineers, 1400 Northwood Center Court, CdA
Mark Mussman, Kootenai County Planning Dept., CdA
Norm Waldo, Northern Water LLC. 181 Lost Springs Ranch Road, Post Falls
Robert Haynes, IDWR, CdA
Jack Smetana, Frame and Smetana, CdA
Nathan Church, PHD, Hayden
(#9909 filed with Wild Ridge LSAS sewer)

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Shanna Bublitz
PO Box 807
Redrum ID 83858

2. Article Number

(Transfer from service label)

7004 2510 0000 4999 0097

PS Form 3811, February 2004

Domestic Return Receipt

102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X Shanna Bublitz

☐ Agent☒ Addressee

B. Received by (Printed Name)

SHANNA BUBLITZ

C. Date of Delivery

8/20/07

D. Is delivery address different from item 1? ☐ YesIf YES, enter delivery address below: ☐ No

RECEIVED

AUG 21 2007

3. Service Type

IDWR/North

☒ Certified Mail☐ Express Mail☐ Registered☐ Return Receipt for Merchandise☐ Insured Mail☐ C.O.D.

4. Restricted Delivery? (Extra Fee)

☐ Yes

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Northern Water LLC
1831 Lost Spgs Ranch Rd
Post Falls ID 83857

2. Article Number

(Transfer from service label)

7004 2510 0000 4999 9794

PS Form 3811, February 2004

Domestic Return Receipt

102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X Tracy Waldo

☐ Agent☒ Addressee

B. Received by (Printed Name)

Tracy Waldo

C. Date of Delivery

8-20-07

D. Is delivery address different from item 1? ☐ YesIf YES, enter delivery address below: ☒ No

RECEIVED

AUG 21 2007

3. Service Type

IDWR/North

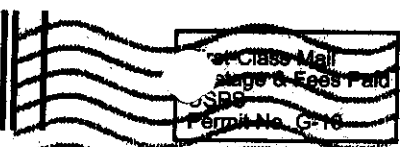
☒ Certified Mail☐ Express Mail☐ Registered☐ Return Receipt for Merchandise☐ Insured Mail☐ C.O.D.

4. Restricted Delivery? (Extra Fee)

☐ Yes

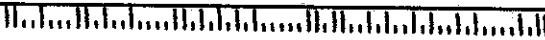
UNITED STATES POSTAL SERVICE
COEUR D'ALENE WA 992

20 AUG 2007 PM 2 L



• Sender: Please print your name, address, and ZIP+4 in this box •

**DEPT OF WATER RESOURCES
7600 N MINERAL DR - STE 100
COEUR D ALENE ID 83815-7763**



UNITED STATES POSTAL SERVICE



First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Sender: Please print your name, address, and ZIP+4 in this box •

**DEPT OF WATER RESOURCES
7600 N MINERAL DR - STE 100
COEUR D ALENE ID 83815-7763**



Robert G. Haynes, P.E.
Regional Manager, IDWR
7600 Mineral Ridge Drive, Suite 100
Coeur d'Alene, ID 83815

RECEIVED
AUG 13 2007
IDWR/North

August 9, 2007

Dear Mr. Haynes,

I opened this letter yesterday from the attorney that I had hired to give me legal advice about the issue of protest that I am involved in regarding the water application No. 95-9385. I thought you should have a copy, as I was telling you that I had not received any information from my attorney even though I had called and was waiting for his reply.

Best regards,


Shanna Bublitz
P.O. Box 827
Rathdrum ID 83858

CRAIG R. WISE, P.A.
ATTORNEY AT LAW
1801 N. Government Way, Suite 2B
P.O. Box 1354
Coeur d'Alene, Idaho 83816-1354

(208) 664-0610
Fax: (208) 667-4930
Email: craigwise@icehouse.net

RECEIVED
AUG 13 2007
IDWR/North

August 4, 2007

copy

Shanna Bublitiz
P.O. Box 827
Rathdrum, ID 83858

Re: Pending legal matters

Dear Shanna:

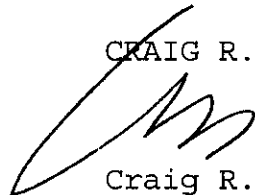
I received your phone messages, and apologize for the delay. Shanna, I am closing my law office August 31 of this year, after 29 years of practice. I am in the process of either closing out files, or handing them over to other attorneys. I am not going to have the time to get to your file, so I am requesting that you contact someone else to assist you in the pending matters.

Enclosed are the documents that you trusted with me.

Good luck, and have a great rest of your summer.

Sincerely,

CRAIG R. WISE, P.A.



Craig R. Wise

Enclosures



State of Idaho

DEPARTMENT OF WATER RESOURCES

Northern Region, 7600 N. Mineral Drive, Suite 100 • Coeur d'Alene, Idaho 83815

Phone: (208) 762-2800 • Fax: (208) 762-2819 • Web Site: www.idwr.idaho.gov

C. L. "BUTCH" OTTER
Governor

DAVID R. TUTHILL, JR.
Director

MEMORANDUM

August 15, 2007

MEMO TO: File – 95-9385 Northern Water LLC

FROM: Dianne

A handwritten signature in black ink, appearing to be 'Dianne', written over the name 'Dianne' in the 'FROM' field.

RE: Notice of Hearing After Conference

A copy of the Notice of Hearing After Conference was sent via regular mail, to Malcolm Dymkoski, Attorney at Law, 2020 Lakewood Drive, Suite 210, Coeur d Alene, ID 83814, mailed 8/15/07.

MALCOLM DYMKOSKI
ATTORNEY-AT-LAW

2020 Lakewood Dr. Suite 210
Coeur d'Alene, ID 83814

Tel: (208) 765-6077
Fax: (208) 664-6089

E-mail: dymkoskimal@imbris.net

**BEFORE THE DEPARTMENT OF WATER RESOURCES
OF THE
STATE OF IDAHO**

IN THE MATTER OF APPLICATION)
FOR PERMIT NO. 95-9385)
IN THE NAME OF NORTHERN WATER LLC)

NOTICE OF HEARING AFTER CONFERENCE

On March 27, 2007, NORTHERN WATER LLC (applicant) filed with the Department of Water Resources (department), application for permit No. 95-9385. The application was protested by SHANNA BUBLITZ. The conference held by the department on June 27, 2007, did not resolve the matter of protest.

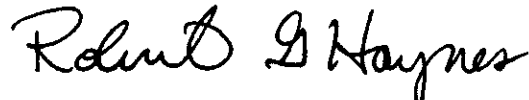
The department has scheduled the matter for hearing on **September 18, 2007, at 9:00 am** at the **Department of Water Resources conference room, 7600 N Mineral Drive, Coeur d'Alene, ID**. The hearing will be held in accordance with provisions of Chapters 2 and 17, Title 42 and Chapter 52, Title 67, Idaho Code, the adopted Rules of Procedure of the department and Water Appropriation Rules 40 and 45. A copy of the rules may be obtained from the department upon request. The presiding officer at the hearing will be Gary Spackman.

If you plan to offer exhibits for the record, note that IDAPA Rule of Procedure 37.01.01606 requires that you provide a copy of exhibits to each party and to the presiding officer.

The hearing will be conducted in a facility which meets the accessibility requirements of the Americans with Disabilities Act. If you require special accommodations in order to attend, participate in or understand the hearing, please advise the department within ten (10) days prior to the hearing.

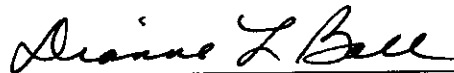
All parties to the matter will have the opportunity to respond and present information and argument on all issues involved.

Dated this 15th day of August 15, 2007.



Robert G. Haynes, Regional Manager

I hereby certify that on the 15th day of 2007, I mailed a true and correct copy of this document, postage prepaid, to the applicant(s) and protestant(s) listed below:



Dianne L. Ball, Administrative Assistant

Certified Mail

NORTHERN WATER LLC, 1831 LOST SPRINGS RANCH RD., POST FALLS, ID 83854
SHANNA BUBLITZ, PO BOX 827, RATHDRUM, ID 83858

CONFERENCE AND HEARING PROCEDURE

APPLICATION FOR PERMIT

ISSUES

Section 42-203A, Idaho Code, requires the department to consider the following issues in connection with an application for permit:

1. Will the proposed appropriation injure other water rights?
2. Is the water supply sufficient for the purpose for which it is sought to be appropriated?
3. Was the application made in good faith or for delay or speculative purposes?
4. Does the applicant have sufficient financial resources with which to complete the proposed project?
5. Will the proposed use conflict with the local public interest, where local public interest is defined as interests that the people in the area directly affected by a proposed water use have in the effects of such use on the public water resource?
6. Will the proposed use be contrary to the conservation of water resources within the State of Idaho?
7. Will the proposed use adversely affect the local economy of the watershed or local area within which the source of water for the proposed use originates, in the case where the place of use is outside of the watershed or local area where the source of water originates?

BURDEN OF PROOF

The applicant has the initial burden of proof for issues 1, 2, 3, 4, 6 and 7 above and must provide evidence for the department to evaluate these criteria.

The initial burden of proof on issue 5 above lies with both the applicant and protestant as to factors of which they are most knowledgeable and cognizant. The applicant has the ultimate burden of persuasion, however, for this issue.

PROCEDURE

The department generally conducts an informal conference with the parties to determine the issues and to try to settle a protested matter before a hearing is scheduled. If a hearing is held, the department will issue a written decision based on the hearing record.

CONFERENCE

The purpose of a prehearing conference is to provide the opportunity for the parties and the department to familiarize themselves with a contested matter and to attempt to resolve the matter. At the conference, the department may also formulate and simplify the issues, identify documents to avoid unnecessary proof, exchange proposed exhibits or prepared testimony, limit witnesses, discuss settlement or make settlement offers, schedule hearings, establish procedure at hearing and address other matters that may expedite orderly conduct and disposition of the proceeding or its settlement.

HEARING

The department will tape record the hearing. Copies of a hearing are available upon request and the payment of the cost of reproducing the tape.

The hearing likely will be conducted by a hearing officer appointed by the Director rather than by the Director himself. If so, the hearing officer will prepare a recommended order for the Director's consideration. Parties can file exceptions to a recommended order, briefs in support of the exceptions or may request oral argument. Parties may seek judicial review of any final order issued by the director.

Parties may by written stipulation waive the right to a recommended order, particularly when a shortened decision process is desirable or necessary. Such a waiver does not eliminate any rights of the parties in connection with the final order and judicial review of the order.

EXHIBITS

A party who plans to offer an exhibit as part of the hearing record must provide a copy of the proposed exhibit to the parties and to the hearing officer.

AMERICANS WITH DISABILITIES ACT

Any hearing scheduled will be conducted in a facility which meets the accessibility requirements of the Americans with Disabilities Act. If you require special accommodations in order to attend, participate in or understand the hearing, please advise the department within ten (120) days prior to the hearing.



RUEN-YEAGER & ASSOCIATES, INC.
CONSULTING ENGINEERS, PLANNERS, AND LAND SURVEYORS

Record of Transmittal

Date: July 30, 2007

TO: Bob Haynes
Idaho Department of Water Resources
7600 Mineral Drive, Suite 100
Coeur d'Alene, ID 83815

FROM: Randall A. Broesch, P.E.
PROJECT NO. P061035
PROJECT NAME: Wild Ridge

RECEIVED

JUL 30 2007

THE FOLLOWING DOCUMENTS ENCLOSED:

Quantity	Date	Pages	Description
			IDWR/North

☐ For approval

☐ For review and comment

☒ For your use

☐ Approved as submitted

☐ As requested

☐ Other: _____

NOTE:

Please find attached letters from Panhandle Health District.

CC: File

3201 North Huetter Road, Suite 102, Coeur d'Alene, Idaho 83814, Phone: (208) 292-0820 Fax: (208) 292-0821

219 Pine Street, Sandpoint, Idaho 83864, Phone: (208) 265-4629 Fax: (208) 263-0404

RECEIVED NOV 27 2006



PANHANDLE HEALTH DISTRICT

Healthy People in Healthy Communities

8500 N. ATLAS ROAD
HAYDEN, IDAHO 83835
<http://www2.state.id.us/phd1>

November 22, 2006

Randy Broesch
Wild Ridge Development, LLC (A.K.A. Wild Ridge, LLC)
3216 Wetmore Ave., Suite 202
Everett, WA 98201

RE: WILD RIDGE

To All Concerned:

RECEIVED

JUL 30 2007

IDWR/North

The residential subdivision known as Wild Ridge, **consisting of 54 lots**, on 108.998 acres, located in 51N Township, 05W Range, 4 Section, in Kootenai County, in the State of Idaho has been reviewed by Panhandle Health District (PHD). PHD will grant final approval when the following conditions have been met:

- Test holes must be dug and approved drain field sites must be found for all lots within the subdivision. This may include test holes on each lot or test holes in a suitable location for a Large Soil Absorption System (up to 40 homes, or 10,000 gpd only) that the Department of Environmental Quality (DEQ) will review and PHD receives a letter from DEQ stating sewer services meet the State of Idaho Standards for the specified number of lots and/or tracts. A Nutrient-Pathogen (N-P) study may be required.
- PHD receives a letter from the water purveyor, (NORTHERN WATER, LLC), stating they will supply water to the subdivision and **designate the number of lots and tracts** for which each will supply.
- All shallow injection wells (drywells) must be registered with PHD and corresponding fees paid.
- Idaho Code §50-1334 requirements: The water source must be stated on the plat as part of the owner's certification signature block.
- Idaho Code §50-1326 to §50-1329 requirements: Two signature blocks must be included on the plat for Panhandle Health District one to approve the plat and one to lift the sanitary restrictions.
- Blue-line copies of the plat including signature page(s) must be supplied to the PHD.

If the above conditions are satisfied PHD will lift the sanitary restrictions when the final plat/mylar is signed. Please note that plat approval does not guarantee these lots/tracts are buildable. If you have any questions or require additional information please call Panhandle Health District.

Sincerely,

Justin Rader
Environmental Health Specialist

cc: City of Rathdrum
Mike Hathaway, Ruen-Yeager & Associates, 3201 N. Huetter Rd., Coeur d'Alene, ID 83814
DEQ
Cheri Howell, Planner II



PANHANDLE HEALTH DISTRICT

Healthy People in Healthy Communities

8500 N. ATLAS ROAD
HAYDEN, IDAHO 83835
<http://www2.state.id.us/phd1>

February 23, 2007

Randy Broesch
Ruen-Yeager & Associates
3201 N. Huetter Rd.
Coeur d'Alene, ID 83814

RECEIVED

JUL 30 2007

IDWR/North

RE: WILD RIDGE LARGE SOIL ABSORPTION SYSTEM TEST HOLES

To All Concerned:

The residential subdivision known as Wild Ridge, consisting of 54 lots, on 108.998 acres, located in 51N Township, 05W Range, 4 Section, in Kootenai County, in the State of Idaho has conducted test holes for the Large Soil Absorption System (LSAS) by Panhandle Health District (PHD). The area has not been given final approval until ground water monitoring of three test holes and nearby surface water runoff monitoring has been conducted to ensure the area can meet the minimum depth requirements and setbacks at this time. The Department of Environmental Quality (DEQ) will review the LSAS (up to about 40 homes, or 10,000 gpd only) and PHD receives a letter from DEQ stating sewer services meet the State of Idaho Standards for the specified number of lots and/or tracts. The test hole information for the LSAS area is attached. The remaining lots that are not included in the LSAS will still require approved test holes. A Nutrient-Pathogen (N-P) study is required that Mr. Mullan was on-site with me to review the area as well. Please refer to the November 22, 2006 letter with the rest of the requirements in order to lift the sanitary restrictions.

If you have any questions or require additional information please call Panhandle Health District at 415-5209 or use our address in the letterhead.

Sincerely,

Justin Rader
Environmental Health Specialist

encl: Test Hole Data
Test Hole Locations

cc: Thomas Mullan, P.G., LFR, 2310 North Molter Rd, Suite 101, Liberty Lake, WA 99019
Robert Nehring, Wild Ridge Development, LLC, 3216 Wetmore Ave., Suite 202, Everett, WA 98201
DEQ

Attachment to Wild Ridge CC 06-28-2601:
Test hole Data: 2/20/07:

RECEIVED

JUL 30 2007

IDWR/North

- ① TH 13001: (Ground Water Monitor)
Loamy Sand 0-48"
Decomp. Granite/sand 48-60"
Loamy Sand 60-75"
Decomp. Granite 75-140"

- ② TH 13007:
Silt/Sandy loam 0-30"
Decomp. Granite w/ sand 30-48"
Decomp. Granite 48-168"

- ③ TH 13008: (Ground Water Monitor – about 150' from surface water runoff)
Silty Sand 0-14"
Decomp. Granite with stones 14-162"

- ④ TH 13011 (Ground Water Monitor – about 200' from surface water runoff)
Silty/Sandy Loam 0-32"
Silty Sand 32-46"
Decomp. Granite 46-158"

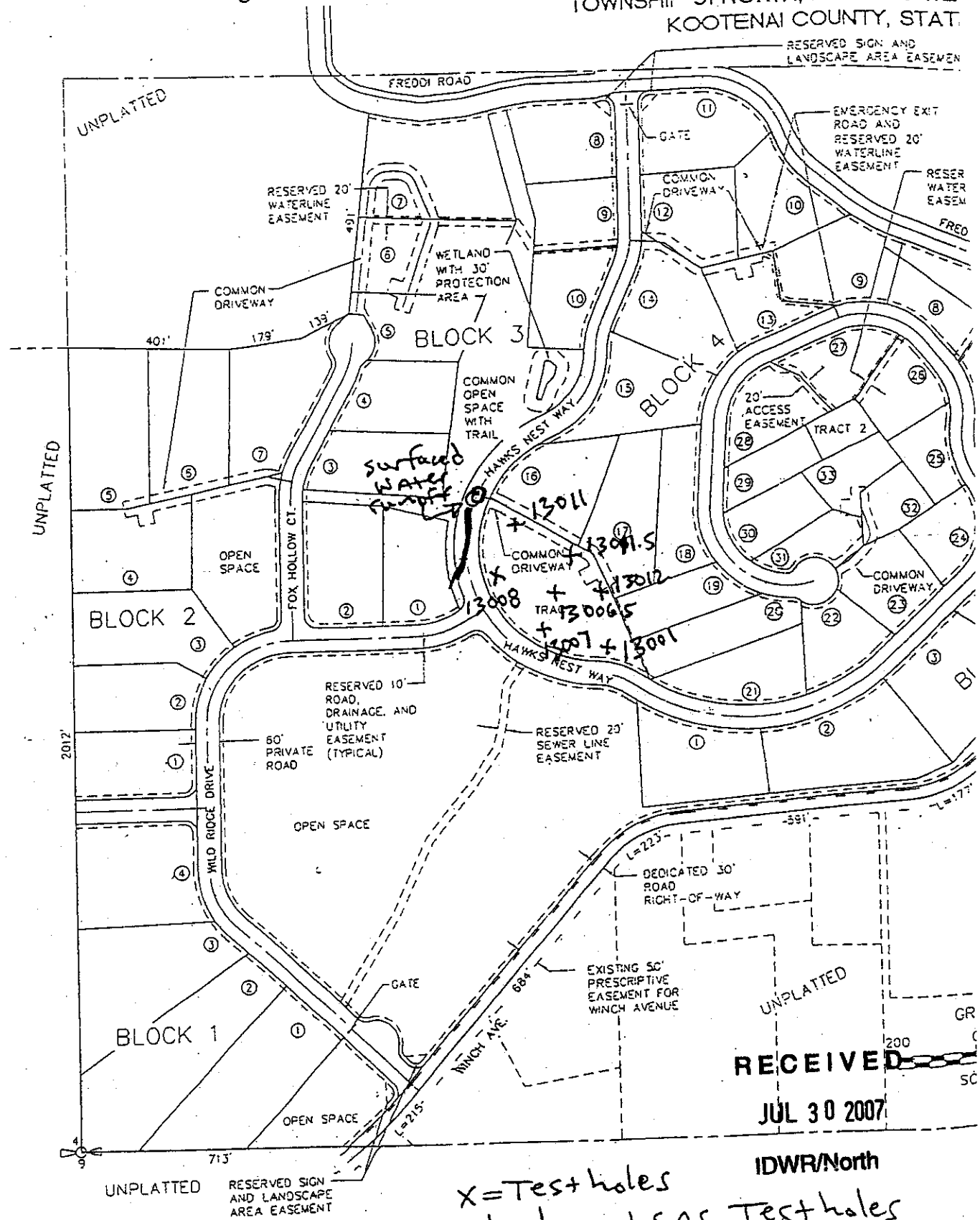
- ⑤ TH 13012 (Bad Hole)
Silty/Sandy Loam 0-72"
Rock bed at 72"

- ⑥ TH 13011.5
Silty Sand 0-19"
Loamy Sand 19-46"
Decomp. Granite with sand 46-158"

- ⑦ TH 13006.5
Same as TH 13011.5

Attachment 1 Wild Ridge
CC 06-28-2601

PRELIMINARY PLAN OF
LOCATED IN THE SOUTHEAST QUARTER
TOWNSHIP 51 NORTH, RANGE 5 WEST
KOOTENAI COUNTY, STATE OF IDAHO



RECEIVED MAY 14 2007



PANHANDLE HEALTH DISTRICT

Healthy People in Healthy Communities

ENVIRONMENTAL HEALTH

8500 N. ATLAS ROAD

HAYDEN, IDAHO 83835

(208) 415-5200

<http://www2.state.id.us/phd1>

SOIL ANALYSIS RESULTS

RECEIVED

JUL 30 2007

IDWR/North

Randy Broesch
Ruen-Yeager & Associates
3201 N. Huetter Rd.
Coeur d'Alene, ID 83814

RE: WILD RIDGE LARGE SOIL ABSORPTION SYSTEM TEST HOLES DATA AND TYPE

Mr. Broesch:

On February 20, 2007 & March 9, 2007, a soil analysis was performed on parcel # 51N05W-04-8330. The results of that analysis are attached. **This soil analysis does not constitute approval or disapproval of the site in question with respect to potential development of any kind. This data is for information purposes only.** Proposed field 1 was conducted on February 20, 2007. Proposed field 2 was conducted on March 9, 2007.

TEST HOLE	SOIL ANALYSIS	COMMENTS
13001	Loamy Sand 0-48" Decomp. Granite/sand 48-60" Loamy Sand 60-75" Decomp. Granite 75-140"	Field 1 Ground Water Monitor
13007	Silt/Sandy loam 0-30" Decomp. Granite w/ sand 30-48" Decomp. Granite 48-168"	Field 1
13008	Silty Sand 0-14" Decomp. Granite with stones 14-162"	Field 1 Ground Water Monitor – about 150' from surface water runoff
13011	Silty/Sandy Loam 0-32" Silty Sand 32-46" Decomp. Granite 46-158"	Field 1 Ground Water Monitor – about 200' from surface water runoff
13012	Silty/Sandy Loam 0-72" Rock bed at 72"	Field 1 Bad Hole
13011.5	Silty Sand 0-19" Loamy Sand 19-46" Decomp. Granite with sand 46-158"	Field 1
13006.5	Same as TH 13011.5	Field 1
305.125N	Silt Loam 0-72" Silty Sand 72-168"	Field 2 Bad Hole, 75' from seasonal drainage – Ground water monitor Water level in sand 57" Surfaced water 156"
305.125SW	Silt Loam 0-24" Silty Sand 24-180"	Field 2 264' from seasonal drainage
306.175SE	Silt Loam 0-26" Silty Sand 26-180"	Field 2
305.250NW	Silt Loam 0-21" Silty Sand 21-72" Decomp. Granite w/ Sand & Stony	Field 2

Bonnors Ferry (208) 267-5558, Kellogg (208) 786-7474, Sandpoint (208) 265-6384, St. Maries (208) 245-4556

	72-168"	
--	---------	--

Date:		2/23/2007	3/2/2007	3/9/2007	3/15/2007	3/23/2007
Piezometer Readings:						
Field 1 (TH 13008)	NW	0"	0	0	0	0
Field 1 (TH 13011)	NE	0"	0	0	0	0
Field 1 (TH 13001)	S	0"	0	0	0	0
Field 2 (TH 305.125N)	E			Surfaced water 13' in 14' hole, Water level in soil 57"	Water at 11.5' in 14' hole	0

Surface Water:	NW (TH 13008 area)	150' Away from NW piezometer & 50' from North LSAS marker	200' Away from NW piezometer & 125' away from northern LSAS marker	Same as 2/23/07	Same as 2/23/07	210' Away from NW piezometer & 135' away from northern LSAS marker
Surface Water:	NE (TH 13011 area)	200' Away from NW piezometer	Same as 2/23/07	Same as 2/23/07	Same as 2/23/07	Same as 2/23/07

Date:		3/30/2007	4/3/2007	4/10/2007
Piezometer Readings:				
Field 1 (TH 13008)	NW	0	0	0
Field 1 (TH 13011)	NE	0	0	0
Field 1 (TH 13001)	S	0	0	0
Field 2 (TH 305.125N)	E	0	0	0

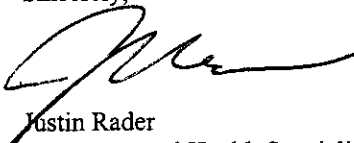
RECEIVED
JUL 30 2007
IDWR/North

Surface Water:	NW (TH 13008 area)	Same as 3/23/07	230' Away from NW Piezometer & 155' away from northern LSAS marker	Just muddy area at former surface water
Surface Water:	NE (TH 13011 area)	Same as 2/23/07	Same as 2/23/07	Just muddy area at former surface water

Piezometers for Field 1 display no ground water infiltration and Field 2 is temporary ground water at that one low area. The surface water is considered permanent and will require necessary setbacks to drainfields. Recommend moving the drainfield south enough meet setback of 300 feet to accommodate test hole variations of soil type from B to A. This is subject to change if Department of Environmental Quality (DEQ) has more stringent conditions.
Bonners Ferry (208) 267-5558, Kellogg (208) 786-7474, Sandpoint (208) 265-6384, St. Maries (208) 245-4556

Individual test holes vary in soil type, but the overall soil type is a B-1. The loading rate will have a final determination when DEQ has reviewed all information and determines whether further steps will be taken to adjust it. Please refer to the November 22, 2006 letter with the rest of the requirements in order to lift the sanitary restrictions.

Sincerely,



Justin Rader
Environmental Health Specialist

encl: Test Hole Locations

cc: Thomas Mullan, P.G., LFR, 2310 North Molter Rd, Suite 101, Liberty Lake, WA 99019
Robert Nehring, Wild Ridge Development, LLC, 3216 Wetmore Ave., Suite 202, Everett, WA 98201
DEQ

RECEIVED
JUL 30
IDWR/North

CONFERENCE

File: 95-9385
Northern Water LLC

Date: June 27, 2007

Time: 9:00 a.m.

Place: Department of Water Resources
7600 Mineral Drive
Coeur d Alene, ID 83815

ROSTER OF ATTENDANCE

[illegible]



STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

2110 Ironwood Parkway • Coeur d'Alene, Idaho 83814 • (208) 769-1422

C.L. "Butch" Otter, Governor
Toni Hardesty, Director

July 20, 2007

RECEIVED
JUL 20 2007
IDWR/North

Mr. Robert Nehring
Wild Ridge Development, LLC
3216 Wetmore Ave, Ste 202
Everett, WA 98201

RE: **Wild Ridge Subdivision, Kootenai County**

Dear Mr. Nehring:

This office has now concluded review as follows of three items related to the drinking water and wastewater systems being planned for your proposed **Wild Ridge** subdivision of 109 acres into fifty-four (54) residential lots located in Section 3 of T51N R3W of Kootenai County.

- **Drinking Water Supply:** A memorandum dated May 14, 2007 by John Smetana, P.E. of Frame and Smetana described the ability of the existing public drinking water system owned by Northern Water LLC and presently serving the sixty-four (64) residential lots in Lost Creek Estates subdivision, to be expanded to provide drinking water to Wild Ridge. The two existing wells are extracting water from the Spokane Valley- Rathdrum Prairie Aquifer, have been found to produce water that complies with Idaho drinking water standards, were test pumped at 195 gallons per minute (gpm), and have installed pumps capable of 142 gpm. Based on reasonable water demand estimates, the memorandum concluded that these two wells should be capable of producing enough water to meet water demand from the 118 lots ultimately served in the two subdivisions. Prior to preparation of plans and specifications for construction of the expanded water system, the engineer indicated that a more detailed engineering report would be completed discussing in detail design of the water conveyance, storage, and distribution systems needed in Wild Ridge.

DEQ concurs with the engineer's conclusion that the water system serving Lost Creek Estates has the capacity to be expanded to serve the proposed subdivision called Wild Ridge. At the conclusion of preliminary plat reviews, DEQ will need to review the engineering report prepared to describe, select, and size the improvements needed to implement this expansion in accordance with the Idaho Rules for Public Drinking Water Systems (IDAPA 58.01.08)

- **Large Soil Absorption System - Site and Loading Rate Approval:** The design engineers for the wastewater systems serving the proposed subdivision at Ruen Yeager and Associates indicated that a large soil absorption system (LSAS) as defined in the Idaho Individual/Subsurface Sewage Disposal Rules (IDAPA 58.01.03) is being proposed for all 54 lots. The first step for review of a LSAS involves site and loading rate evaluation by the PHD.

On February 20, and March 9, 2007 the Panhandle Health District (PHD) evaluated a number of test holes in the vicinity of two proposed LSAS sites (Field 1 and Field 2) and issued conclusions in a letter dated May 10, 2007. The soil type was determined to be B-1 with an associated wastewater

Wild Ridge Subdivision

July 20, 2007

Page 2

application rate of 0.6 gallons per day per square foot (gpd/ft²). The PHD report included data on depth to ground water and distance to surface water that need to be reflected when the boundaries of the LSASs are established.

With 54 lots involving three bedroom homes producing 250 gallons per day (gpd) of sewage, the LSAS will need to accommodate up to 13,500 gpd. This will involve construction of two independent LSAS modules since the maximum size allowed by the Rules for a LSAS is 10,000 gpd. Two fully-sized drainfields and one replacement area must be provided for each module.

At the conclusion of preliminary plat reviews, DEQ will need to review an engineering report prepared by the design engineer describing design of the proposed LSAS.

- **Site Investigation:** Following LSAS site and loading rate evaluation, the next preliminary review step identified in the Individual/Subsurface Sewage Disposal Rules is that a site investigation be undertaken concluding that the effluent from the LSAS will not adversely impact or harm the waters of the State. Typically, this investigation has involved a Nutrient/Pathogen Evaluation as recommended by DEQ that models expected water quality impacts of the LSAS to ground water.

On May 16, 2007 this office received a Level 1 Nutrient-Pathogen Evaluation for Wild Ridge Subdivision as prepared by Thomas Mullen, P.G. with LFR Inc. Subsequent reviews of the report by Gary Stevens, P.G. at this office and submittals of additional documentation by Mr. Mullen was undertaken. The result of this review is that DEQ concurs with the conclusion of the report that the proposed LSAS can be constructed and operated without an adverse impact to ground water quality.

With satisfaction of our requirements as indicated above for water supply capacity, LSAS site and loading rate approval, and water quality impacts, DEQ has no objection to Kootenai County acceptance of the preliminary plat for Wild Ridge subdivision. Once this action has been completed, we will be prepared to review and approve engineering reports and plans and specifications related to construction of the public drinking water system extension and LSAS systems serving the proposed subdivision.

Sincerely,



Gary J. Gaffney, P.E.

- c: Tom Mullen, LFR Inc., 2310 N Molter Rd, Ste 101, Liberty Lake, WA 99019
Randy Broesch, Ruen-Yeager and Associates, 3201 N Huetter, CdA
Steve Syrcle, Tri-State Consulting Engineers, 1400 Northwood Center Court, CdA
Mark Mussman, Kootenai County Planning Dept., CdA
Norm Waldo, Northern Water LLC, 181 Lost Springs Ranch Rd, Post Falls
~~Robert Haynes~~, IDWR, CdA
Jack Smetana, Frame and Smetana, CdA
Nathan Church, PHD, Hayden
(#9909 filed with Wild Ridge LSAS sewer)

CONFERENCE

File: 95-9385
Northern Water LLC

Date: June 27, 2007

Time: 9:00 a.m.

Place: Department of Water Resources
7600 Mineral Drive
Coeur d Alene, ID 83815

RECEIVED
SEP 05 2007
DEPARTMENT OF
WATER RESOURCES

ROSTER OF ATTENDANCE

NAME _____

ADDRESS

Shanna Bublitz

PO BOX 827 Rathdrum ID 83858

Erika Grubbs

525 Cedar St., Wallace, ID 83873

Malcolm Dymkowski

1110 W PARK PL. SUITE 210, COEUR D'ALENE, ID 83814

Norm Waldo

1831 Lost Springs Ranch Rd Post Falls ID 83854

Star Species

1400 NORTHWOOD CENTRAL CT. STE A, CDA, ID 83814

EXISTING KNOWLEDGE

7904 WALKER RD. E. TOLSON, WA 98004

BEFORE THE DEPARTMENT OF WATER RESOURCES
OF THE
STATE OF IDAHO

IN THE MATTER OF APPLICATION)
FOR PERMIT NO. 95-9385 in the name of)
NORTHERN WATER LLC)
_____)

NOTICE OF CONFERENCE

On March 27, 2007, NORTHERN WATER LLC filed with the Department of Water Resources (department) Application for Permit No. 95-9385. The application was protested by SHANNA BUBLITZ.

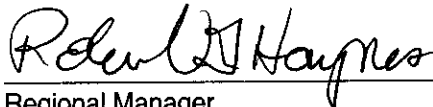
The department has scheduled the matter for hearing on June 27, 2007 at 9:00 am at the Department of Water Resources, 7600 Mineral Drive, Coeur d Alene, Idaho. The hearing will be held in accordance with provisions of Chapters 2 and 17, Title 42 and Chapter 52, Title 67, Idaho Code, the adopted Rules of Procedure of the department and Water Appropriation Rules 40 and 45. A copy of the rules may be obtained from the department upon request. The presiding officer at the conference &/or hearing will be Robert G. Haynes, P.E., Northern Regional Manager.

If you plan to offer exhibits for the record, note that IDAPA Rule of Procedure 37.01.01606 requires that you provide a copy of exhibits to each party and to the presiding officer.

The conference &/or hearing will be conducted in a facility which meets the accessibility requirements of the Americans with Disabilities Act. If you require special accommodations in order to attend, participate in or understand the conference &/or hearing, please advise the department within ten (10) days prior to the conference &/or hearing.

All parties to the matter will have the opportunity to respond and present information and argument on all issues involved.

Dated this 12th day of June, 2007.


Regional Manager

I hereby certify that on the 12th day of June, 2007, I mailed a true and correct copy, postage prepaid, of this document to the applicants(s) and protestant(s) listed below:


Administrative Assistant

Certified Mail

Northern Water LLC, 1831 Lost Springs Ranch Rd., Post Falls, ID 83854
Shanna Bublitz, PO Box 827, Rathdrum ID 83858

CONFERENCE AND HEARING PROCEDURE

APPLICATION FOR PERMIT

ISSUES

Section 42-203A, Idaho Code, requires the department to consider the following issues in connection with an application for permit:

1. Will the proposed appropriation injure other water rights?
2. Is the water supply sufficient for the purpose for which it is sought to be appropriated?
3. Was the application made in good faith or for delay or speculative purposes?
4. Does the applicant have sufficient financial resources with which to complete the proposed project?
5. Will the proposed use conflict with the local public interest, where local public interest is defined as interests that the people in the area directly affected by a proposed water use have in the effects of such use on the public water resource?
6. Will the proposed use be contrary to the conservation of water resources within the State of Idaho?
7. Will the proposed use adversely affect the local economy of the watershed or local area within which the source of water for the proposed use originates, in the case where the place of use is outside of the watershed or local area where the source of water originates?

BURDEN OF PROOF

The applicant has the initial burden of proof for issues 1, 2, 3, 4, 6 and 7 above and must provide evidence for the department to evaluate these criteria.

The initial burden of proof on issue 5 above lies with both the applicant and protestant as to factors of which they are most knowledgeable and cognizant. The applicant has the ultimate burden of persuasion, however, for this issue.

PROCEDURE

The department generally conducts an informal conference with the parties to determine the issues and to try to settle a protested matter before a hearing is scheduled. If a hearing is held, the department will issue a written decision based on the hearing record.

CONFERENCE

The purpose of a prehearing conference is to provide the opportunity for the parties and the department to familiarize themselves with a contested matter and to attempt to resolve the matter. At the conference, the department may also formulate and simplify the issues, identify documents to avoid unnecessary proof, exchange proposed exhibits or prepared testimony, limit witnesses, discuss settlement or make settlement offers, schedule hearings, establish procedure at hearing and address other matters that may expedite orderly conduct and disposition of the proceeding or its settlement.

HEARING

The department will tape record the hearing. Copies of a hearing are available upon request and the payment of the cost of reproducing the tape.

The hearing likely will be conducted by a hearing officer appointed by the Director rather than by the Director himself. If so, the hearing officer will prepare a recommended order for the Director's consideration. Parties can file exceptions to a recommended order, briefs in support of the exceptions or may request oral argument. Parties may seek judicial review of any final order issued by the director.

Parties may by written stipulation waive the right to a recommended order, particularly when a shortened decision process is desirable or necessary. Such a waiver does not eliminate any rights of the parties in connection with the final order and judicial review of the order.

EXHIBITS

A party who plans to offer an exhibit as part of the hearing record must provide a copy of the proposed exhibit to the parties and to the hearing officer.

AMERICANS WITH DISABILITIES ACT

Any hearing scheduled will be conducted in a facility which meets the accessibility requirements of the Americans with Disabilities Act. If you require special accommodations in order to attend, participate in or understand the hearing, please advise the department within ten (120) days prior to the hearing.

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Northern Water LLC
1831 Lost Springs Ranch Rd
Apost Falls ID 83854

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X

Norma G. Waldo

☐ Agent☐ Addressee

B. Received by (Printed Name)

Norma Waldo

C. Date of Delivery

6-15-07

D. Is delivery address different from item 1? ☐ YesIf YES, enter delivery address below: ☒ No

RECEIVED

JUN 18 2007

3. Service Type

IDWR/North

☒ Certified Mail☐ Express Mail☐ Registered☐ Return Receipt for Merchandise☐ Insured Mail☐ C.O.D.

4. Restricted Delivery? (Extra Fee)

☐ Yes

2. Article Number

(Transfer from service label)

7004 2510 0000 4998 9732

PS Form 3811, February 2004

Domestic Return Receipt

102595-02-M-1540

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Shanna Bublitz
PO Box 827
Rathdrum ID 83858

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X

Shanna Bublitz

☐ Agent☐ Addressee

B. Received by (Printed Name)

Shanna Bublitz

C. Date of Delivery

6-15-07

D. Is delivery address different from item 1? ☐ YesIf YES, enter delivery address below: ☐ No

RECEIVED

JUN 18 2007

3. Service Type

IDWR/North

☒ Certified Mail☐ Express Mail☐ Registered☐ Return Receipt for Merchandise☐ Insured Mail☐ C.O.D.

4. Restricted Delivery? (Extra Fee)

☐ Yes

2. Article Number

(Transfer from service label)

7004 2510 0000 4998 9725

PS Form 3811, February 2004

Domestic Return Receipt

102595-02-M-1540

• Send a **POSTAL CARD** and please print your name, address, and ZIP+4 in this box •

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

UNITED STATES POSTAL SERVICE

UNITED STATES POSTAL SERVICE

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Sender: Please print your name, address, and ZIP+4 in this box •

DEPT OF WATER RESOURCES
7600 N MINERAL DR - STE 100
COEUR D'ALENE ID 83815-7763

FRAME & SMETANA, P.A.
CONSULTING ENGINEERS
603 North 4th Street
Phone (208) 664-2121 - Fax (208) 765-5502
COEUR D'ALENE, IDAHO 83814

RECEIVED
MAY 16 2007
IDWR/North

TO: NORM WALDO, NORTHERN WATER L.L.C.
FROM: JOHN A. SMETANA, P.E. 
SUBJECT: WATER SERVICE FOR WILD RIDGE SUBDIVISION
DATE: MAY 14, 2007

At your request, I have made a preliminary analysis to determine the ability of the Lost Creek Estates water system (parent system) to be expanded to serve the proposed Wild Ridge Subdivision (Wild Ridge). This analysis considers the following system components:

1. Existing/future storage and distribution.
2. Well source capacity.
3. Well source expansion opportunity.
4. Well discharge piping to storage and distribution.

ANALYSIS

1. Existing/Future Storage and Distribution

The parent system includes a 120,000-gallon concrete reservoir and 8" diameter distribution lines. The reservoir is sufficient for peak domestic and fire flow demands at Lost Creek Estates but does not provide excess storage for Wild Ridge. It will be necessary for Wild Ridge to provide properly sized and positioned storage for its peak domestic and fire flow demands. It is assumed that the Wild Ridge infrastructure design is the subject of a developer-sponsored engineering report and is, therefore, not included in this analysis. The existing 8" distribution system would convey water to the connection point with Wild Ridge. The flow rate of conveyance to Wild Ridge will need to be restricted to the maximum average daily domestic flow plus an amount to allow reservoir recovery in the event of depletion of fire storage. As

before, it is not the purpose of this analysis to propose the Wild Ridge demand flows, but I anticipate a reservoir fill flow range of 50 to 100 g.p.m. may be identified in another report. Because the existing distribution system is sized for fire flows of $1,000\pm$ g.p.m., it has the capacity to provide the anticipated Wild Ridge reservoir fill rate without diminishing water service to users on the parent system.

2. Well Source Capacity

The parent system includes two wells flow tested at 195 g.p.m. each. The existing well pumping systems are rated at 142 g.p.m. each and are configured in a duplex, alternating, both pumps on for high demand format. Assuming that peak use flows and fire flow storage are provided by reservoir sizing, average daily use will be considered in this analysis to evaluate source capacity requirements.

Both subdivisions feature water use and conservation restrictions by agreement, water rate schedules, C.C. & R.s and negotiated water rights. Nonetheless, this analysis will consider a higher than anticipated domestic and irrigation use of 1,500 g.p.d. per lot to allow a factor of safety. The combined projected use can be calculated as follows:

Lost Creek Estates: $64 \text{ lots} \times 1,500 \text{ g.p.d.} = 96,000 \text{ g.p.d.}$

Wild Ridge: $54 \text{ lots} \times 1,500 \text{ g.p.d.} = \underline{81,000 \text{ g.p.d.}}$

TOTAL = 177,000 g.p.d.

Therefore, average combined flow is 123 g.p.m.

There may be some incidental flows for common areas and entrance features, but they are considered negligible in this analysis. The projected average daily use during periods of potential high irrigation (123 g.p.m.) is less than the capacity of one well pump (142 g.p.m.). This allows the second well pump to serve in a redundant/back-up role and be available to supplement fire flows if necessary.

3. Well Source Expansion Opportunities

Assuming approval of the requested increase for water rights from 0.50 c.f.s. to 0.75 c.f.s., each well system could be expanded to approximately $170\pm$ g.p.m. ($340\pm$ g.p.m. total). The existing power supply and well construction is sized for expansion. The pumps, motors, drop pipe, pitless adaptors, electrical components and vault

piping will require upgrading to accommodate the expansion. As demonstrated in item 2 above, expansion of the source certainly will not be required in the initial phases of development but could be expanded in the future if desired.

4. Well Discharge Piping to Storage and Distribution

The existing well piping manifolds the discharge lines after the meter vault into a single 6" PVC pipe designed to accommodate the increased flow. At 340± g.p.m., the velocity is approximately 4 f.p.s. and the friction loss is in an acceptable range.

Summary

Based on this analysis, it is my opinion the Northern Water L.L.C. system currently serving Lost Creek Estates has the capacity to supply water to the proposed Wild Ridge Subdivision subject to conformance with the assumptions and expansion requirements outlined above. Furthermore, I recommend completion of the development final engineering reports, construction plans and water right request approval be conditions of final plat approval.

If you have any questions, please contact me.

JAS:cas

xc: Wild Ridge L.L.C.

Gary Gaffney, Idaho Department of Environmental Quality

Dave LePard, Idaho Department of Water Resources

Jay Lockhart, Kootenai County Planner



State of Idaho

DEPARTMENT OF WATER RESOURCES

7600 Mineral Drive, Suite 100 • Coeur d'Alene, Idaho 83815

Phone: (208) 762-2800 • Fax: (208) 762-2819 • Web Site: www.idwr.idaho.gov

NORTHERN REGION

C. L. "BUTCH" OTTER
Governor

DAVID R. TUTHILL, JR.
Interim Director

May 21, 2007

NORTHERN WATER LLC
1831 LOST SPRINGS RANCH RD
POST FALLS ID 83854

Re: Application to Permit No. 95-9385

Enclosed is a copy of a protest filed against the approval of the above referenced application. The Department suggests you contact the protestant directly to determine the nature of the protest and, if possible, to resolve the matter without action by the Department. In our experience, informal discussion between the parties prior to initiation of formal proceedings often leads to resolution of the protest.

If the protest cannot be resolved informally, the matter will be scheduled for conference and/or hearing. The following are the criteria the Department must consider in either approving or denying the application (Section 42-203, Idaho Code):

1. Will the proposed use reduce the quantity of water under existing water rights?
2. Is the proposed water supply insufficient for the purpose intended?
3. Is the application made in good faith or for delay or speculative purposes?
4. Has the applicant sufficient financial resources with which to complete the project?
5. Will the proposed use conflict with the local public interest?
6. Will the proposed use be contrary to the conservation of water resources within the State of Idaho?
7. Will the proposed use adversely affect the local economy of the watershed or local area within which the source of water for the proposed use originates, in the case where the place of use is outside of the watershed or local area where the source of water originates?

You will be notified at a later date of the time and place of the conference and/or hearing. Please contact this office if you have any questions regarding this procedure.

Sincerely,

ROBERT G. HAYNES, P.E.
Regional Manager

RGH:db

Enclosure



State of Idaho

DEPARTMENT OF WATER RESOURCES

7600 Mineral Drive, Suite 100 • Coeur d'Alene, Idaho 83815

Phone: (208) 762-2800 • Fax: (208) 762-2819 • Web Site: www.idwr.idaho.gov

NORTHERN REGION

May 21, 2007

C. L. "BUTCH" OTTER
Governor

DAVID R. TUTHILL, JR.
Interim Director

SHANNA BUBLITZ
PO BOX 827
RATHDRUM ID 83858

Re: Application to Permit No. 95-9385 Northern Water LLC

Dear Ms. Bublitz:

The Department of Water Resources acknowledges receipt of your protest against the approval of the above referenced application. A copy of your protest has been sent to the applicant. The Department suggests that you contact the applicant directly for details regarding the application, and if possible, to resolve the matter without action by the Department. In our experience, informal discussion between the parties prior to initiation of formal proceedings often leads to resolution of the protest.

If the protest cannot be resolved informally, the matter will be scheduled for conference and/or hearing. The following are criteria the Department must consider in either approving or denying the application (Section 42-203, Idaho Code):

1. Will the proposed use reduce the quantity of water under existing water rights?
2. Is the proposed water supply insufficient for the purpose intended?
3. Is the application made in good faith or for delay or speculative purposes?
4. Has the applicant sufficient financial resources with which to complete the project?
5. Will the proposed use conflict with the local public interest?
6. Will the proposed use be contrary to the conservation of water resources within the State of Idaho?
7. Will the proposed use adversely affect the local economy of the watershed or local area within which the source of water for the proposed use originates, in the case where the place of use is outside of the watershed or local area where the source of water originates?

You will be notified at a later date of the time and place of the conference and/or hearing. Please contact this office if you have any questions regarding this procedure.

Sincerely,

ROBERT G. HAYNES, P.E.
Regional Manager

RGH/db

November 26, 1999

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

RECEIVED

MAY 21 2007

NOTICE OF PROTEST

IDWR/North

This form may be used to file a protest with the department under sections 42-108B, 42-203A, 42-203C, 42-211, 42-222 and 42-224, Idaho Code. The department will also accept a timely protest not completed on this form if it contains the same information.

1. Matter being protested WATER APPLICATION: WATER RIGHT # 95-9385 NORTHERN
WATER,
LLC
2. Name of protestant SHANNA BUBLITZ
3. Protestant's Representative for service (If different than protestant)
N/A
4. Service mailing address P.O. Box 827, RATHDRUM, ID 83858
5. Service telephone no. 208-687-0903
6. Basis of protest (including statement of facts and law upon which the protest is based) See attached (page 3)
 1. original water right application
 2. Kootenai County Comprehensive Plan: Goal 2 Water Quality
 3. " " " " : Goal 3 Water: Sustainable Yield.

(additional pages may be attached to describe nature of the protest)
7. What would resolve your protest? See attached (page 3)

I hereby, acknowledge that if I, or my designated representative, fails to appear at any regularly scheduled conference or hearing in the matter of which I have been notified at the address above, the department may issue a notice of proposed default against me in this matter for failure to appear. I also verify that I have served a copy of this protest upon the applicant.

Signed this 21ST day of May, ~~2000~~ 2007

Shanna Bublitz
Protestant

N/A
Protestant's Representative

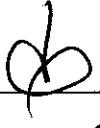
NOTE:

A protestant is required to timely file a protest with the department together with a \$25.00 protest fee for each application being protested in order for the protestant to be considered a full party by the department. In addition, the department's Rule of Procedure, IDAPA 37.01.01203, requires a protestant to send a copy of a protest to the applicant.

INSTRUCTIONS

1. The matter being protested must be clearly identified. A typical matter is identified by the application number such as "Application for Permit No. _____ in the name of _____" or "Application for Transfer No. _____ in the name of _____."
 2. Show the name of the protestant. Only one (1) protestant may be shown per protest form. If this protest form is signed by more than one person, the hearing officer will consider the first signer as the official protestant and the representative for service of documents.
 3. If the protestant is represented by an attorney or other authorized representative, show the representative's name. The department then will serve documents on the representative and upon the protestant if specifically requested.
 4. Show the address where the department is to serve the documents. This should be the address of the authorized representative unless the protestant does not designate a representative.
 5. Show the telephone number of the authorized representative unless the protestant does not designate a service representative.
 6. Specifically describe the nature of the protest.
 7. Describe the relief being sought by the protestant.
-

FOR DEPARTMENT USE ONLY

Received by  Date 5/21/07 Time 2:09 p
\$25.00 fee Received by  # N018386 Date _____

Item 6. Basis of Protest:

1. The original application for water rights (ID#95-9123) for Lost Creek Estates (LCE), now managed by Northern Water, LLC, specified the Description of place of use as *"within Service Area of Lost Creek Development."* (see item 9.) This application is for use outside the property owned and managed by Northern Water, LLC.

2. Kootenai County Comprehensive Plan

Goal 2: *Maintain the existing high quality of groundwater in Kootenai County.*

Objective 3: *Recognize that the Rathdrum Prairie Aquifer has been designated as a "sole-source" drinking water supply" by the Federal government, and its protection is vital to the overall well-being of the Kootenai, County, Idaho, and Spokane County, Washington.*

The Hidden Valley drainage area, which includes Lost Creek, is designated a "Critical Aquifer Recharge Area" (CARA), located at the Northern perimeter of the Rathdrum Prairie Aquifer. This is an exceptionally sensitive area which resulted in the placing of strict conditions on the treatment of wastewater from the Lost Creek Estates (estimated at 19,200 gallons per day). In addition, a seven-page letter from Gary Stevens, Hydrologist with Idaho DEQ, dated November, 2004, made every effort to outline false assumptions and possible risk encountered with the clustering of 64 homes at this site. The actual data will not be known until the final phase is complete and studies are made on the effect on local wells and the quality of drinking water that will enter the aquifer at sites below gradient.

3. Kootenai County Comprehensive Plan, Goal 3: *Ensure that the demand of groundwater resources does not exceed sustainable yield.*

The only data available in the surrounding region of the proposed request is at the Hoyt Ranch near the intersection of N. Church and W. Hoyt Rd. In 2002, the IDWR estimated in excess of 120 GPM from the wells that service this cluster of approximately 37 homes. The summer water production for 2 years was approximately 25 GPM, causing emergency wells to be dug and placed in the water system at great expense to the home owners. The Washington/Idaho bi-state study has recently been completed and will give more real data for the flow of water in this area.

Item 7. What would resolve your protest?

1. Northern Water, LLC, provides water within the boundaries of Lost Creek Estates (LCE), which is stated in the original application. If it's jurisdiction is outside the boundaries of LCE.

2. Completion of the existing subdivision plan at Lost Creek Estates to ensure that the quality of water at the Critical recharge area is not degraded; written input from DEQ that the existing homes did not ruin the sole-source water supply and that an additional 54 homes will fulfill the same goal.

3. In light of the new data provided by the Federal Bi-State study, allow time for both Kootenai County and Spokane County experts to give written consideration to the critical nature of the area and agreement to allow new municipal water rights, which will set a precedent for this recharge area.

JB
5/21/07

Idaho Department of Water Resources Receipt

Receipt ID N018386

Payment Amount	\$25.00	Date Received	5/21/2007 2:10:40 PM	Region	Northern	Status	
Payment Type	Cash						

Payer SHANNA BUBLITZ

Comment Protest re: 95-9385 - Northern Water LLC

Fee Detail

Amount	Description	Fund	FD	PCA	SO
\$25.00	PROTESTS	0229	21	65103	1155

_____
Signature Line (Dept. Representative)

AFFIDAVIT OF PUBLICATION

STATE OF IDAHO, }
County of Kootenai, } ss.

Heather Bump being first duly sworn
upon oath deposes and says:

1. I am now and at all times hereinafter mentioned was a citizen of the United States, resident of the State of Idaho, over the age of twenty-one years and not a party of the above entitled action.

2. I am now and at all times hereinafter mentioned was the printer (principal clerk) of the "Coeur d'Alene Press," a newspaper printed and published daily except Sunday in Coeur d'Alene, Kootenai County, Idaho, and having a general circulation in said county.

3. The Legal Notice

of which the annexed is a printed copy, was published in the regular Thursday issue of said newspaper for 2 consecutive weeks commencing on the 3 day of May 20 07, and ending on the 10 day of May 20 07, and such publication was made as often during said period as said daily newspaper was regularly issued.

4. That said newspaper has been continuously and uninterruptedly published in said Kootenai County, during a period of more than seventy-eight consecutive weeks immediately prior to the first publication of said notice. Heather Bump
On this 10 day of May in the year of 2007, before me, a Notary Public, personally appeared Heather Bump, known or identified to me to be the person whose name subscribed to the within instrument, and being by me first duly sworn, declared that the statements therein are true, and acknowledged to me that he executed the same.

Begina Mason

Notary Public for the State of Idaho,
residing at Coeur d'Alene, Idaho.

MY COMMISSION EXPIRES 6/18/09

RECEIVED

MAY 14 2007

IDWR/North

LEGAL NOTICE

The following application(s) have been filed to appropriate the public waters of the State of Idaho:

95-9385
NORTHERN WATER LLC
1831 LOST SPRINGS RANCH RD
POST FALLS ID 83854
Point(s) of Diversion(2) SESE S3 T51N R05W KOOTENAI County
Source GROUND WATER
Use: MUNICIPAL 01/01 To 12/31 0.25 CFS
Use: FIRE PROTECTION 01/01 To 12/31 0.5 CFS
Total Diversion: 0.75 CFS

Date Filed: 03/27/2007
Place Of Use: FIRE PROTECTION
T51N R05W S4 NESE NWSE SESE
Place Of Use: MUNICIPAL
Remark: Municipal use is within service area of applicant.
95-9386

DAVID RILEY
9630 BENTLEY CIR
CATALDO ID 83810
Point(s) of Diversion L1 (NENE) S5 T49N R02W KOOTENAI Co.
Source GROUND WATER
Use: COMMERCIAL 01/01 To 12/31 0.1 CFS
Total Diversion: 0.1 CFS

Date Filed: 03/05/2007
Place Of Use: COMMERCIAL
T49N R02W S5 NENE Lot 1 NWNE Lot 2
Remark: Commercial use is for 55 RV sites, 3 cabins, laundry room, 3 restrooms and irrigation of small common area.
95-9387

FOX COURT HOMEOWNERS ASSN INC.
PO BOX 741
POST FALLS ID 83877
Point(s) of Diversion SWSW S29 T51N R05W KOOTENAI County
Source GROUND WATER
Use: IRRIGATION 04/01 To 11/30 0.06 CFS
Use: STOCKWATER 01/01 To 12/31 0.02 CFS
Use: DOMESTIC 01/01 To 12/31 0.1 CFS
Total Diversion: 0.18 CFS

Date Filed: 04/17/2007
Place Of Use: DOMESTIC
T51N R05W S29 SWSW SESW
Place Of Use: IRRIGATION & STOCKWATER same as DOMESTIC
T51N R05W S29 SWSW SESW
Number of Acres 2
Remark: Domestic use is for 4 homes.
Stockwater use is for 8 head of mixed stock.

95-9388
DAVID P GIBSON
LINDA K GIBSON
GARY L GIBSON
PO BOX 2421
POST FALLS ID 83877
Point(s) of Diversion SESW S29 T51N R05W KOOTENAI County
Source GROUND WATER
Use: IRRIGATION 04/01 To 11/30 0.16 CFS
Use: STOCKWATER 01/01 To 12/31 0.02 CFS
Total Diversion: 0.18 CFS

Date Filed: 04/17/2007
Place Of Use: IRRIGATION
T51N R05W S29 SESW
Number of Acres 8
Place Of Use: STOCKWATER same as IRRIGATION
Remark: Stockwater use is for 15 head of mixed stock
Permits will be subject to all prior water rights. Protests may be submitted based on the criteria of Sec 42-203A, Idaho Code.
Any protest against the approval of this application must be filed with the Director, Dept. of Water Resource, Northern Region, 7600 Mineral Drive, Suite 100, Coeur d'Alene ID 83815 together with a protest fee of \$25.00 for each application on or before 05/21/2007.
The protestant must also send a copy of the protest to the applicant.
DAVID R. TUTHILL, JR., Director

The following application(s) have been filed to appropriate the public waters of the State of Idaho:

95-9385

NORTHERN WATER LLC

1831 LOST SPRINGS RANCH RD

POST FALLS ID 83854

Point(s) of Diversion(2) SESE S3 T51N R05W KOOTENAI County

Source GROUND WATER

Use: MUNICIPAL 01/01 To 12/31 0.25 CFS

Use: FIRE PROTECTION 01/01 To 12/31 0.5 CFS

Total Diversion: 0.75 CFS

Date Filed: 03/27/2007

Place Of Use: FIRE PROTECTION

T51N R05W S4 NESE NWSE SESE

Place Of Use: MUNICIPAL

Remark: Municipal use is within service area of applicant.

95-9386

DAVID RILEY

9630 BENTLEY CIR

CATALDO ID 83810

Point(s) of Diversion L1 (NENE) S5 T49N R02W KOOTENAI County

Source GROUND WATER

Use: COMMERCIAL 01/01 To 12/31 0.1 CFS

Total Diversion: 0.1 CFS

Date Filed: 03/05/2007

Place Of Use: COMMERCIAL

T49N R02W S5 NENE Lot 1 NWNE Lot 2

Remark: Commercial use is for 55 RV sites, 3 cabins, laundry room, 3 restrooms and irrigation of small common area.

95-9387

FOX COURT HOMEOWNERS ASSN INC.

PO BOX 741

POST FALLS ID 83877

Point(s) of Diversion SWSW S29 T51N R05W KOOTENAI County

Source GROUND WATER

Use: IRRIGATION 04/01 To 11/30 0.06 CFS

Use: STOCKWATER 01/01 To 12/31 0.02 CFS

Use: DOMESTIC 01/01 To 12/31 0.1 CFS

Total Diversion: 0.18 CFS

Date Filed: 04/17/2007

Place Of Use: DOMESTIC

T51N R05W S29 SWSW SESW

Place Of Use: IRRIGATION & STOCKWATER same as DOMESTIC

T51N R05W S29 SWSW SESW

Number of Acres 2

Remark: Domestic use is for 4 homes.

Stockwater use is for 8 head of mixed stock.

95-9388

DAVID P GIBSON

LINDA K GIBSON

GARY L GIBSON

PO BOX 2421

POST FALLS ID 83877

Point(s) of Diversion SESW S29 T51N R05W KOOTENAI County

Source GROUND WATER

Use: IRRIGATION 04/01 To 11/30 0.16 CFS

Use: STOCKWATER 01/01 To 12/31 0.02 CFS

Total Diversion: 0.18 CFS

Date Filed: 04/17/2007

Place Of Use: IRRIGATION

T51N R05W S29 SESW

Number of Acres 8

Place Of Use: STOCKWATER same as IRRIGATION

Remark: Stockwater use is for 15 head of mixed stock

Permits will be subject to all prior water rights. Protests may be

submitted based on the criteria of Sec 42-203A, Idaho Code.

Any protest against the approval of this application must be filed with

the Director, Dept. of Water Resource, Northern Region, 7600

Mineral Drive, Suite 100, Coeur D'Alene ID 83815 together with a

protest fee of \$25.00 for each application on or before 05/21/2007.

The protestant must also send a copy of the protest to the applicant.

DAVID R. TUTHILL, JR., Director ~ Published on May 3 & 10, 2007



State of Idaho

DEPARTMENT OF WATER RESOURCES

Northern Region, 7600 Mineral Drive, Suite 100, Coeur d'Alene, Idaho 83815

Phone: (208) 762-2800 FAX: (208) 762-2819 www.idwr.idaho.gov

C.L. "BUTCH" OTTER
Governor

DAVID R. TUTHILL, JR
Director

*Please FAX proof copy before this goes to press, to 762-2819
Thanks, Dianne*

April 25, 2007

**DEE DUQUETTE &/OR GLENDA JEFFERSON
LEGAL NOTICE DEPARTMENT
COEUR D ALENE PRESS
201 N 2ND
COEUR D ALENE ID 83814**

RE: Application for Permit No. 95-9385, 95-9386, 95-9387 & 95-9388

Dear Dee & Glenda:

Enclosed you will find a legal notice which we wish to have published in your newspaper on the dates indicated, May 3 and 10, 2007, (once a week for two consecutive weekly issues). If you cannot publish the notice on the proposed dates, please contact us immediately.

An affidavit of publication must be submitted to the Department along with the publication bill. Please send the affidavit and bill to this office before 05/21/2007. Your cooperation is greatly appreciated, as always.

Thank you for all your help.

Sincerely

Dianne

Dianne Ball
Administrative Assistant

Ball, Dianne

From: Ball, Dianne
Sent: Wednesday, April 25, 2007 11:16 AM
To: Legal Notices-CdA Press (E-mail); Legal Notices-CdA Press2 Glenda Jefferson (E-mail);
Legal Notices-CdA Press3 Dee Duquette (E-mail)
Subject: Legal notice for publication on May 3 and 10, 2007

Good morning, Dee and Glenda,

Attached is our cover letter requesting publicaion of a legal notice on May 3 & 10, 2007. The legal notice is also attached.

Please fax a proof before this goes to press, to 762-2819.

I will follow up this e-mail with a FAX of the same documents as attached to cover all bases.

If you have ANY questions, please call me at 762-2800.

Thanks for all your good work, and have a marvelous day.

Dianne

*Dianne Ball
Administrative Assistant
Idaho Dept of Water Resources
7600 Mineral Drive Suite 100
Coeur d'Alene, ID 83815
Phone (208)762-2800 FAX (208)762-2819*



CoverLetter
4-25-07 CdA e-mai.



LegalNotice
4-25-07 CdA e-mai.



State of Idaho

DEPARTMENT OF WATER RESOURCES

7600 Mineral Drive, Suite 100 • Coeur d'Alene, Idaho 83815

Phone: (208) 762-2800 • Fax: (208) 762-2819 • Web Site: www.idwr.idaho.gov

NORTHERN REGION

C. L. "BUTCH" OTTER
Governor

DAVID R. TUTHILL, JR.
Interim Director

April 25, 2007

NORTHERN WATER LLC
1831 LOST SPRINGS RANCH RD
POST FALLS ID 83854

RE: Application for Permit No 95-9385

Dear Applicant(s):

The Department of Water Resources acknowledges receipt of your water right application. Please refer to the above referenced number in all future correspondence regarding this application.

A legal notice of the application has been prepared and is scheduled for publication in the Coeur d Alene Press on May 3 and 10, 2007. Submittal of protests to this application will be allowed for a period ending ten days after the second publication.

If the application is protested you will be sent a copy of the protest(s). All protests must be resolved before the application can be considered for approval. If the protest(s) cannot be resolved voluntarily, the Department will conduct a conference and/or hearing on the matter.

If the application is not protested, it will be forwarded to our State Office in Boise for final processing. The State Office will notify you of any action taken on the application and will send you a copy of the permit if approved. A typical processing time for an unprotested application is about eight to twelve weeks.

Please feel free to contact this office if you have any questions.

Sincerely,

Keith E. Franklin
Senior Water Resource Agent

MALCOLM DYMKOSKI

ATTORNEY AT LAW

April 11, 2007

Keith Franklin
Idaho Department of Water Resources
7600 Mineral Dr.
Coeur d'Alene, ID 83815

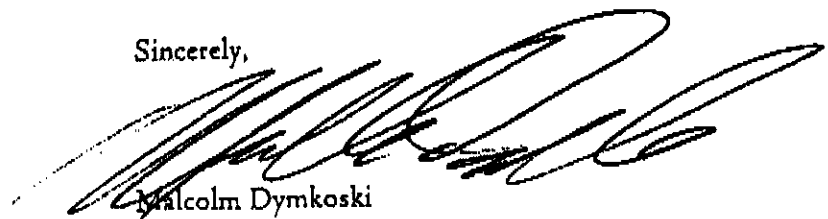
By fax: 762-2819

Re: My client: Northern Water LLC
Water Rights Permit Application

Dear Mr. Franklin:

I have been advised that the agreement with the Kootenai Environmental Alliance is not 43 acre-feet per year. Rather, my client's *Application* should be construed to allow 42.66 acre-feet per year and .75 cfs. If you have any questions or comments, please contact me. Thank you.

Sincerely,



Malcolm Dymkoski

MD/iti
enc.

Franklin, Keith

From: Barry Rosenberg [barry@kealliance.org]
Sent: Friday, April 06, 2007 12:21 PM
To: Kurtis Kingsolver
Cc: Norm Waldo; Franklin, Keith
Subject: WILD RIDGE APPLICATION FOR PERMIT NUMBERS

Kurtis,

I went to the IDWR today and spoke to Keith Franklin to make sure that we were computing your Application for Permit correctly. Keith showed me a different way, one that remains municipal and does not have a separate irrigation component. He computed it figuring the acre-feet per annum for each of the hook ups, homes, fire station and common areas.

54 Homes @	700 gallons/day =	42.3 acre-feet per annum
Fire Station @	50 gallons/day =	~~0.6~~ 0.06
Common areas @	400 gallons/day (April 1-October 30)=	.3
	14,168,205 gallons/year =	~~43.2 AF/annum~~ 2.66

I decided to use Keith's method of computation. On line 5 your permit should read total appropriated .75 CFS and/or 43.2 AF/annum.

If you have any questions call. I will be back in the office at 1:30.

Barry

Barry Rosenberg
 Executive Director
 Kootenai Environmental Alliance
 408 Sherman, # 301
 Coeur d'Alene, ID 83814
 (208) 667-9093
barry@kealliance.org

4/6/2007

4/6/07

1.) $54 \text{ homes} \times 700 \text{ gpd} = 37,800 \text{ gpd} \times 365 \text{ days/yr.}$
 $= 13,797,000 \text{ gpyr} / 7.4805 \text{ gal / ft}^3$
 $= 1,844,395.43 \text{ ft}^3 / 43,560 \text{ ft}^2/\text{AF}$
 $= 42.34 \text{ AF or } 42.3$

2.) $1 \text{ Fire Station} \times 50 \text{ gpd} = 50 \text{ gpd} \times 365 \text{ day/yr}$
 $= 18,250 \text{ gpyr} / 7.4805 \text{ gal / ft}^3$
 $= 2,439.68 \text{ ft}^3 / 43,560 \text{ ft}^2/\text{AF}$
 $= 0.06 \text{ AF}$

3.) $\text{Commons Area} \times 400 \text{ gpd} = 400 \text{ gpd} \times 214 \text{ days/yr}$
 $= 85,600 \text{ gpyr} / 7.4805 \text{ gal / ft}^3$
 $= 11,443.1 \text{ ft}^3 / 43,560 \text{ ft}^2/\text{AF}$
 $= 0.26 \text{ AF or } 0.3$

42.3

0.06

0.30

42.66 AF

Franklin, Keith

From: Kingsolver, Kurtis [KKingsol@ci.tacoma.wa.us]
Sent: Friday, April 06, 2007 2:33 PM
To: Malcolm Dymkoski
Cc: Barry Rosenberg; Darrel Ramus; Randall Broesh; Lepard, Dave; Norm Waldo; Franklin, Keith
Subject: RE: Water Agreement

Malcomb,

This is what Barry and I agreed upon for water usage:

728 gallons per day per hookup (54 hook-ups)
50 gallons per day for the fire station
400 gallons per day for common areas (6 months only)

This amounts to 14,168,205 gallons per year which equates to 43.2 AF/annum or 0.75 cfs.

According to Barry, line 5 on the permit should read total appropriated 0.75 cfs and/or 43.2AF/annum. I spoke with Keith Franklin earlier this afternoon and I think we all now have the same understanding. From what I understand, the only real change adding the 43.2 A/annum to the application. Please submit this next week as soon as possible. If not, according to Dave at Water Resources, we will miss our window for public comment. If we miss this window we will not be able to move forward with our May 17th hearing date.

Please call me if you have any questions.

Thanks

Darrel,

When I spoke with Malcomb earlier today he said Department of Water Resources needs a scalable drawing of our site in order to proceed with their process. Will you please provide this to Malcomb as soon as possible. Malcomb is Norm's attorney and can be reached at 208-756-6077.

Thanks.

4/6/2007

MALCOLM DYMKOSKI

ATTORNEY AT LAW

April 4, 2007

Keith Franklin
Idaho Department of Water Resources
7600 Mineral Dr.
Coeur d'Alene, ID 83815

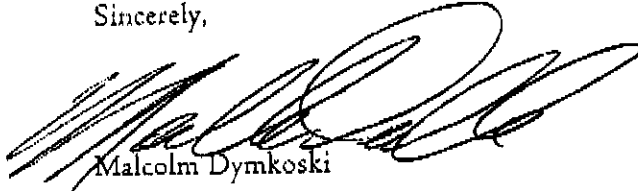
By fax: 762-2819

Re: My client: Northern Water LLC
Water Rights Permit Application

Dear Mr. Franklin:

As you and I discussed by telephone a few moments ago, my client has advised me that, pursuant to an agreement with the Kootenai Environmental Alliance, the water usage will be 43 acre-feet per year. Accompanying this letter is a copy of the *Articles of Organization* of Northern Water, LLC. I will advise my client that your office requires a more particular map of the parcel where the appropriated water is to be applied. If you have any questions or comments, please contact me. Thank you.

Sincerely,



Malcolm Dymkoski

MD/iti
enc.

MALCOLM DYMKOSKI

ATTORNEY AT LAW

April 4, 2007

Keith Franklin
Idaho Department of Water Resources
7600 Mineral Dr.
Coeur d'Alene, ID 83815

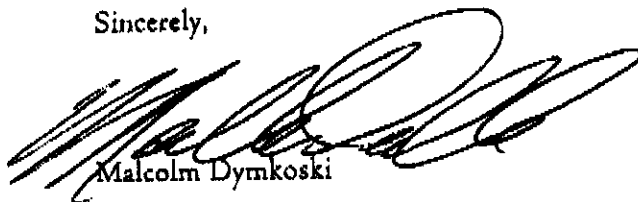
By fax: 762-2819

Re: My client: Northern Water LLC
Water Rights Permit Application

Dear Mr. Franklin:

As you and I discussed by telephone a few moments ago, my client has advised me that, pursuant to an agreement with the Kootenai Environmental Alliance, the water usage will be 43 acre-feet per year. Accompanying this letter is a copy of the *Articles of Organization* of Northern Water, LLC. I will advise my client that your office requires a more particular map of the parcel where the appropriated water is to be applied. If you have any questions or comments, please contact me. Thank you.

Sincerely,



Malcolm Dymkoski

MD/iti
enc.

Franklin, Keith

From: Lepard, Dave
Sent: Wednesday, February 28, 2007 10:50 AM
To: Franklin, Keith
Subject: FW: Wild Ridge Water Agreement



SKMBT_C45007022
011540.pdf

For your info.

Dave

-----Original Message-----

From: Kingsolver, Kurtis [mailto:KKingsol@ci.tacoma.wa.us]
Sent: Friday, February 23, 2007 8:49 AM
To: Lepard, Dave
Subject: Wild Ridge Water Agreement

Dave,

This is a copy of the signed water agreement between Wild Ridge, LLC and KEA. To refresh your memory, Wild Ridge, LLC has an agreement with Northern Water, LLC such that Northern Water, LLC will provide us water. However, Northern Water, LLC had a contract with KEA that they would only apply for enough water to serve their site. This agreement allows Northern Water, LLC to apply for water on our behalf as long as they follow the agreement as outlined.

Please let me know if you have any questions.

February 14, 2007

Barry Rosenberg, Executive Director
Kootenai Environmental Alliance
408 Sherman Avenue, Ste 301
Coeur d'Alene, ID 83816-1598

Subject: Water Usage for Wild Ridge

Dear Barry,

On behalf of myself and two partners, I would like to thank you for meeting with me regarding our proposed development (Wild Ridge), and for discussing how Wild Ridge, LLC and Kootenai Environmental Alliance can work together to help promote water conservation on our project.

As you know, Wild Ridge, LLC has submitted development plans to Kootenai County Building and Planning Development in hopes of receiving preliminary plat approval to construct 54 homes (see attached drawings). Our ultimate goal is to be under construction this spring/summer.

Several months ago we began working with Mr. Norm Waldo of Lost Creek, LLC and Northern Water, LLC to develop an agreement in which his water system would provide service to our 54 homes. Although a final agreement has not yet been signed, I'm confident both parties are very close and eager to move forward. As part of this agreement we will be adopting the same water conservation principles as outlined within the Draft Lost Creek HOA listed below:

In the spirit of water conservation and as part of an agreement with Kootenai Environmental Alliance the following rules and control measures will be established and maintained by the HOA:

- 1. Each Owner shall retain at least 25% of native vegetation on their property and limit the size of irrigated lawns to ¼ of an acre.*
- 2. Moisture sensors shall be installed as an integral part of the constructed automatic irrigation systems on each Owner's property.*
- 3. Irrigation will not be allowed during the high evaporation times between 10:00 A.M and 8:00 P.M.. The HOA will establish and enforce an odd only or even only watering schedule.*
- 4. Owners are encouraged to use landscape irrigation companies that are from a recommended list available from Northern Water LLC.*
- 5. Owners are encouraged to supplement existing soils, as necessary, to enhance the moisture retention characteristics of the soils that will be used in the irrigated portions of each lot in the development.*
- 6. Xeriscaping features for landscaping that preserve water use are encouraged. Reputable landscape firms are familiar with these techniques.*

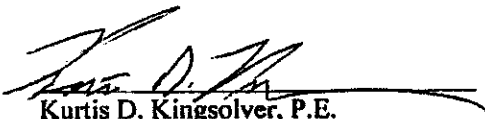
Page 2
Barry Rosenberg
February 14, 2007

In addition to the language above, to further promote water conservation efforts, Wild Ridge, LLC is in agreement with Kootenai Environmental Alliance that on average, 700 gallons per day per household (exclusive of fire flow) is adequate to supply water to our development. However, along with our 54 home sites, we plan to develop a small "tot lot" and a recreational area for our home owners (park benches, indoor/outdoor BBQ areas, etc.) and would like to request additional capacity (200 gal/day) for each additional hook-up. We are also currently working with Northern Lakes Fire Department in hopes of providing them a site for a volunteer un-manned fire station (SW corner). If approved, we would like the ability to supply them with 50 gallons per day for their volunteer station.

It is our intent that signature of this document solidifies an agreement between Kootenai Environmental Alliance and Wild Ridge, LLC and that Northern Water, LLC will apply for water on behalf of Wild Ridge, LLC as long as Wild Ridge, LLC follows the provisions outlined below.

1. Wild Ridge, LLC will incorporate within its CCR's the same rules and control measures listed within the Lost Creek CCR's designed to promote water conservation.
2. Wild Ridge, LLC through Northern Water, LLC will only apply for a maximum of 700 gal/per day per hook up for the 54 home sites, 50 gal/day for the volunteer fire station, 200 gal/day for the "tot-lot and 200 gal/day for the indoor/outdoor BBQ area from the State of Idaho DEPARTMENT OF WATER RESOURCES. This is however separate from water as required by Northern Lakes Fire Department for fire flow.
3. Wild Ridge, LLC will only seek water for 57 hook-ups.
4. Wild Ridge, LLC will incorporate further language within its CCR's to promote the use of drip systems for shrubs placed around homes rather than conventional sprinkler systems.

We look forward to continuing to work together with Kootenai Environmental Alliance to conserve and protect the Rathdrum-Spokane Aquifer.


Kurtis D. Kingsolver, P.E.
Wild Ridge, LLC

Date: 2/14/07


Barry Rosenberg, Executive Director
Kootenai Environmental Alliance

Date: 2/14/07

253



APPLICATION FOR REGISTRATION OF FOREIGN LIMITED LIABILITY COMPANY

(Instructions on back of application)

FILED EFFECTIVE

2006 JUL 13 AM 8:44

SECRETARY OF STATE
STATE OF IDAHO

1. The name of the limited liability company is:
WILD RIDGE, LLC
2. If the name of the limited liability company is not permissible or is not available in Idaho, the name the foreign limited liability company will use in Idaho is:
DBA: WILD RIDGE DEVELOPMENT, LLC
3. The jurisdiction under whose laws the limited liability company is organized is: WASHINGTON
and the date of its formation was: 05.23.2006 STATE
4. The name and address of the registered agent in Idaho is:
CHUCK RYAN, 1836 NW BOULEVARD, COEUR D'ALENE, ID 83814
5. The address of the limited liability company's office in the jurisdiction under whose laws it is organized is:
3216 WETMORE AVENUE, SUITE 202, EVERETT, WA 98201
6. The address of the limited liability company's principal office, if other than the address in #5 above, is:
SAME
7. The address to which correspondence should be addressed is:
3216 WETMORE AVENUE, SUITE 202, EVERETT, WA 98201
8. Signature of a manager, if any, or a member
if there are no managers.

Signature

Typed Name

ROBERT B. NEHRINGManager ☐ Member ☒

Secretary of State use only

IDAHO SECRETARY OF STATE
07/13/2006 05:00
CK: 2272 CT: 202314 NH: 964686
1 @ 100.00 = 100.00 REGFORLLC # 2
1 @ 20.00 = 20.00 CORP SUR # 3
1 @ 20.00 = 20.00 EXPDITE C # 4

W 52458



ARTICLES OF ORGANIZATION LIMITED LIABILITY COMPANY

(Instructions on back of application)

FILED EFFECTIVE
2005 JUN 21 11:10 AM

1. The name of the limited liability company is:

Northern Water, LLC

2. The street address of the initial registered office is:

238 S. sequoia Court, Post Falls, ID

and the name of the initial registered agent at the above address is:

R. Bruce Noble

3. The mailing address for future correspondence is:

P.O. Box 3061, Post Falls, ID 83877

4. Management of the limited liability company will be vested in:

Manager(s) ☒ or Member(s) ☐ (please check the appropriate box)

5. If management is to be vested in one or more manager(s), list the name(s) and address(es) of at least one initial manager. If management is to be vested in the member(s), list the name(s) and address(es) of at least one initial member.

Name	Address
<u>R. Bruce Noble</u>	<u>P.O. Box 3061, Post Falls, ID 83877</u>
_____	_____
_____	_____
_____	_____
_____	_____

6. Signature of at least one person responsible for forming the limited liability company:

Signature: R. Bruce Noble

Typed Name: R. Bruce Noble

Capacity: Manager

Signature: _____

Typed Name: _____

Capacity: _____

Secretary of State use only

IMHO SECRETARY OF STATE
07/28/2005 05:00
CL: 5382 CT: 170630 NH: 023609
1 0 100.00 = 100.00 DMMAN LLC 0 2
1 0 20.00 = 20.00 EXPEDITE C 0 3

W 41436



ARTICLES OF ORGANIZATION LIMITED LIABILITY COMPANY

(Instructions on back of application)

FILED EFFECTIVE
2005 JUN 20 11:10 AM

1. The name of the limited liability company is:

Northern Water, LLC

2. The street address of the initial registered office is:

238 S. sequoia Court, Post Falls, ID

and the name of the initial registered agent at the above address is:

R. Bruce Noble

3. The mailing address for future correspondence is:

P.O. Box 3061, Post Falls, ID 83877

4. Management of the limited liability company will be vested in:

Manager(s) ☒ or Member(s) ☐ (please check the appropriate box)

5. If management is to be vested in one or more manager(s), list the name(s) and address(es) of at least one initial manager. If management is to be vested in the member(s), list the name(s) and address(es) of at least one initial member.

Name	Address
<u>R. Bruce Noble</u>	<u>P.O. Box 3061, Post Falls, ID 83877</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

6. Signature of at least one person responsible for forming the limited liability company:

Signature: R. Bruce Noble

Typed Name: R. Bruce Noble

Capacity: Manager

Signature: _____

Typed Name: _____

Capacity: _____

Secretary of State use only

g:\compliance\LLC forms\Articles of Organization 100
Revised 07/2002

IDaho SECRETARY OF STATE
07/28/2005 05:00
CX: 5382 CT: 170638 BH: 023689
1 @ 100.00 = 100.00 ORGAN LLC # 2
1 @ 20.00 = 20.00 EXPEDITE C # 3

W 41436

UNITED STATES OF AMERICA

The State of Washington

Secretary of State

I, SAM REED, Secretary of State of the State of Washington and custodian of its seal, hereby issue this

CERTIFICATE OF EXISTENCE/AUTHORIZATION
OF
WILD RIDGE, LLC

I FURTHER CERTIFY that the records on file in this office show that the above named Limited Liability Company was formed under the laws of the State of WA and was issued a Certificate Of Formation in Washington on 5/23/2006.

I FURTHER CERTIFY that as of the date of this certificate, WILD RIDGE, LLC remains active and has complied with the filing requirements of this office.

Date: July 10, 2006

UBI: 602-616-912



Given under my hand and the Seal of the State of Washington at Olympia, the State Capital

Sam Reed, Secretary of State

Form 235-1 (N)
10/98WD Tag No. D0041375
Drilling Permit No. _____
Water Right Permit No. 95-9277
Injection Permit No. _____

Receipt #201741

838852

State of Idaho
Department of Water ResourcesAPPLICATION FOR DRILLING PERMIT
(FOR THE CONSTRUCTION OF A WELL)

1. Applicant (property owner): NORTHERN WATER LLC - WELL #1
(PLEASE PRINT)
2. Mailing Address: C/O NORM WALDO 1831 LOST SPRINGS RANCH RD.
City & State POST FALLS ID Zip Code 83854 Telephone (208) 661-8609
☐ Well Owner ☐ Well Operator ☐ Contractor or Other, specify: _____
3. Proposed Well Location: Twp. 51N, Rge. 05W, Sec. 03, NW 1/4 SE 1/4 SE 1/4;
Gov't Lot No. _____ County KOOTENAI Lat. _____:_____:_____ Long. _____:_____:_____
Street Address of Well Site 1/2 MILE OFF NORTH IDAHO RD FROM HWY 53- ON THE LEFT SIDE
Give at least name of road + distance to road or landmark
Lot, block and subdivision _____

4. Proposed Use of Well:

- ☐ DOMESTIC: The use of water for homes, organization camps, public campgrounds, livestock (1,000 head or less) and for any other purpose in connection therewith, including irrigation of up to 1/2 acre of land, if the total use is not in excess of 13,000 gpd; or any other uses, if the total use does not exceed a diversion rate of 0.04 cfs and a diversion volume of 2500 gpd.

Domestic does not include water for multiple ownership subdivision, mobile home parks, commercial or business establishments, unless the use does not exceed a diversion rate of 0.04 cfs and a diversion volume of 2500 gpd.

NON-DOMESTIC: ☐ Irrigation ☐ Municipal ☐ Industrial
☐ Stock ☐ Test ☒ Other COMMUNITY WELL
(Over 1,000 head) (Describe)

☐ INJECTION

- ☐ MONITORING: A well bore schematic and map is required for each blanket permit.
No. of proposed wells: _____

5. Well Construction Information:

- A. ☒ New well ☐ Modify ☐ Replace
B. Proposed Casing Diameter 8" Proposed Maximum Depth 220

C. Anticipated bottom hole temperature:

☒ 85°F or less ☐ 85°F to 212°F ☐ 212°F or more
(Cold Water Well) (Low Temp. Geo. Well) (Geothermal Well)

6. Construction Start Date: MARCH 30, 20067. Anticipated Well Driller (Firm): UNITED DRILLING INC. Driller's Lic. No. 414

NOTE: The actual well drilling firm must be identified prior to drilling.

8. Applicant's Signature: [Signature] Date 3-17-06Title PRESIDENT

(Applicant, Firm Representative, Driller, Other)

ACTION OF THE DEPARTMENT OF WATER RESOURCES

This Permit is APPROVED Date 3-21-06

If approved, this permit authorizes the construction or modification of a well subject to the following conditions. **READ CAREFULLY!**

GENERAL CONDITIONS:

1. This drilling permit is valid for two (2) months from the above approval date for the start of construction and is valid for one(1) year from the approval date for completion of the well unless an extension has been granted.
2. This permit does not constitute an approval of the District Health Department or the Idaho Department of Health and Welfare, which may be required before construction of the well. All wells must be drilled a minimum distance of 100 feet from a drain field. Domestic and Public Water Supply wells must be drilled a minimum of 50 feet and 100 feet respectively from a septic tank.
3. The well shall be constructed by a driller currently licensed in the State of Idaho who must maintain a copy of the drilling permit at the drilling site.
4. Approval of this drilling permit does not authorize trespass on the land of another party.
5. This permit does not constitute other local, county, state or federal approvals, which may be required for construction of a well.
6. This drilling permit does not represent a right to divert and use the water of the State of Idaho.
7. If a bottom hole temperature of 85 or greater is encountered, well construction shall cease and the well driller and the well owner shall contact the Department immediately.
8. Idaho Code, S 55-2201 - 55-2210 requires the applicant and/or his contractors to contact "Digline" (DigLine is a one-call center for utility notification) not less than 2 working days prior to the start of any excavation for this project. The "DigLine" Number for your area is 1-800-342-1585.
9. Please be advised that this drilling permit should be considered and treated as a preliminary permit. If you are in disagreement with this preliminary permit you have fourteen (14) days of the service date of this permit to petition the Department for reconsideration pursuant to Section 67-5243, Idaho Code.
10. The well tag for the drilling permit/start card shall be securely and permanently attached to the well casing through welding or by the use of four closed end domed stainless steel pop rivets. The tag attachment will be done at the time of completion of the well, and prior to removing the drill rig from the drill site.

SPECIFIC CONDITIONS:

Robert B. Haynes

Signature of Authorized Department Representative

Title

Receipt No. NB1749 Received by cm Fee \$200.00 Date 3-20-06

EXTENSION OF DRILLING PERMIT

Extension approved by _____ Approval Date _____

This extension expires: _____

IDAHO DEPARTMENT OF WATER RESOURCES WELL DRILLER'S REPORT

Office Use Only			
Inspected by _____			
Twp _____	Rge _____	Sec _____	
1/4 _____	1/4 _____	1/4 _____	
Lat: : : _____	Long: : : _____		

1. WELL TAG NO. D0041375

DRILLING PERMIT N 838852

Other IDWR No _____

2. OWNER:

Name Waldo Construction, Inc.

Address 1831 Lost Springs Ranch Road

City Post Falls State ID _____ Zip 83854

3. LOCATION OF WELL by legal description:

N		Twp <u>51N</u>	North ☒ or South ☐
Rge <u>05W</u>		East ☐ or West ☒	
Sec <u>03</u>		1/4 SE 1/4 SE 1/4	
Gov't Lot _____		County <u>Kootenai</u>	
Lat _____		Long _____	

Address of Well Site: (see next line)

North Idaho Rd, Production Well #1

City Post Falls

Lot _____ Blk _____ Sub. Name (see next line)

4. USE:

- ☐ Domestic ☒ Municipal ☐ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other _____

5. TYPE OF WORK check all that apply (Replacement etc.)

- ☒ New Well ☐ Modify ☐ Abandonment ☐ Other _____

6. DRILL METHOD

- ☒ Air Rotary ☐ Cable ☐ Mud Rotary ☐ Other _____

7. SEALING PROCEDURES

SEAL/FILTER PACK			Amount	Method
Material	From	To	Sacks/Lbs	
Bentonite	0	65	52 Sacks	Dry Pour
Granular				

Drive Shoe Used? ☒ Y ☐ N Shoe Depth(s) _____ Ring Bit 223

Drive Shoe Seal Tested? ☐ Y ☒ N How? _____

8. CASING/LINER

Diam	From	To	Gauge	Material	Casng	Liner	Weld	Thrded
8"	+2	-213	0.322	Steel	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length Headpipe _____ Length Tailpipe _____

9. PERFORATIONS/SCREENS

- ☐ Perforations? Method _____
☒ Screens? Screen Type Stainless Steel

From	To	Slot	Nmbr	Diam	Material	Casng	Liner
212	222	.6		7	Stainless	☒	☐
						☐	☐
						☐	☐

10. STATIC WATER LEVEL or ARTESIAN PRESSURE

147 ft. below ground. Artesian pressure _____ lb.
Depth flow encountered 147 ft. Describe access port or control devices: Steel Cap Welded

11. WELL TESTS:

- ☐ Pump ☐ Bailor ☒ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pump Level	Time
150-200	100%	210	2 HR

Water Temp. _____ Cold Bottom hole temp. _____ Cold

Water Quality test or comments: (below) Depth first Water Encountered 147

Clear, Cold, No Smell

12. LITHOLOGIC LOG (Describe repairs or abandonment)

Bore Diam	From	To	Remarks: Lithology, Water Quality and Temperature	Water	
				Y	N
12	0	1	Top Soil	☐	☒
12	1	65	Sand & Gravel Medium	☐	☒
10	65	135	Sand & Gravel Medium	☐	☒
10	135	180	Sand & Gravel Small	☒	☐
10	180	187	Sand & Gravel Medium	☒	☐
10	187	223	Sand & Gravel Small to Medium	☒	☐

RECEIVED
APR 19 2006
IDWR/North

Completed Depth 222 (Measurable)
Date: Started 4/3/06 Completed 4/6/06

13. DRILLERS CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm United Drilling Inc. Firm No 414
Name _____
Firm Official Jason C. Beckham Date 4/12/06
and _____
Supervisor or Operator Jason C. Beckham Date 4/12/06

51N 5W 3

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only
Inspected by _____
Twp _____ Rge _____ Sec _____
1/4 1/4 1/4
Lat: : : Long: : :

1. WELL TAG NO. D0041376

DRILLING PERMIT N

83853

Other IDWR No _____

2. OWNER:

Name Waldo Construction, Inc.

Address 1831 Lost Springs Ranch Road

City Post Falls

State ID

Zip 83854

3. LOCATION OF WELL by legal description:

N
W E S
Twp 51N North ☒ or South ☐
Rge 05W East ☐ or West ☒
Sec 03 1/4 SE 1/4 SE 1/4
10 Ac 40 Ac 160 Ac
Gov't Lot _____ County Kootenai
Lat _____ Long _____
Address of Well Site: (see next line)

.5 Mi off NO RD from HWY 53 On L Well #2

City Post Falls

Lot _____ Blk _____ Sub. Name (see next line) _____

4. USE:

- ☐ Domestic ☒ Municipal ☐ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other _____

5. TYPE OF WORK check all that apply (Replacement etc.)

- ☒ New Well ☐ Modify ☐ Abandonment ☐ Other _____

6. DRILL METHOD

- ☒ Air Rotary ☐ Cable ☐ Mud Rotary ☐ Other _____

7. SEALING PROCEDURES

SEAL/FILTER PACK			Amount	Method
Material	From	To	Sacks/Lbs	
Bentonite	0	65	68 Sacks	Dry Pour
Granular				

Drive Shoe Used? ☒ Y ☐ N Shoe Depth(s) _____ Ring Bit 223

Drive Shoe Seal Tested? ☐ Y ☒ N How? _____

8. CASING/LINER

Diam	From	To	Gauge	Material	Casng	Liner	Weld	Thrded
8"	+2	-211	0.322	Steel	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length Headpipe _____ Length Tailpipe _____

9. PERFORATIONS/SCREENS

- ☐ Perforations? Method _____
☒ Screens? Screen Type Stainless Steel

From	To	Slot	Nmbr	Diam	Material	Casng	Liner
210	220	.6		7	Stainless	☒	☐
						☐	☐
						☐	☐

10. STATIC WATER LEVEL or ARTESIAN PRESSURE

147 ft. below ground. Artesian pressure _____ lb.
Depth flow encountered 147 ft. Describe access port or
control devices: Steel Cap Welded

11. WELL TESTS:

- ☐ Pump ☐ Bailor ☒ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pump Level	Time
150-200	100%	218	2Hr

Water Temp. _____ Cold Bottom hole temp. _____ Cold
Water Quality test or comments: (below) Depth first Water Encountered 147
Clear, Cold, No Smell

12. LITHOLOGIC LOG (Describe repairs or abandonment)

Bore Diam	From	To	Remarks: Lithology, Water Quality and Temperature	Water	
				Y	N
12	0	1	Top Soil	☐	☒
12	1	65	Sand & Gravel Medium	☐	☒
10	65	135	Sand & Gravel Medium	☐	☒
10	135	180	Sand & Gravel Small	☒	☐
10	180	187	Sand & Gravel Medium	☒	☐
10	187	223	Sand & Gravel Small to Medium	☒	☐

RECEIVED
APR 19 2006
IDWR/North

Completed Depth 220 (Measurable)
Date: Started 4/7/06 Completed 4/11/06

13. DRILLERS CERTIFICATION

I/We certify that all minimum well construction standards were
compiled with at the time the rig was removed.

Firm United Drilling Inc. Firm No 414
Name _____
Firm Official Tim M. Valby pers. Date 4/12/06
and _____
Supervisor or Operator Jason C. Beckham Date 4/12/06

Idaho Department of Water Resources Receipt

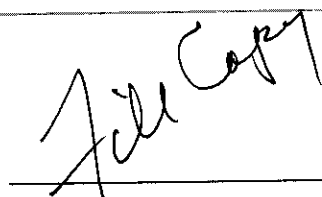
Receipt ID N018230

Payment Amount	\$250.00	Date Received	3/27/2007 9:36:59 AM	Region	Northern	Status	
Payment Type	Check	Check Number	5975				

Payer WALDO CONSTRUCTION FOR NORTHERN WATER**Comment** WR Permit App Fee for Northern Water LLC

Fee Detail

Amount	Description	Fund	FD	PCA	SO
\$250.00	PERMITS	0229	21	65103	1155

_____
Signature Line (Dept. Representative)



STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

*From: Frame
Smetana*

2110 Ironwood Parkway • Coeur d'Alene, Idaho 83814-2848 • (208) 769-1422

Dirk Kempthorne, Governor
Toni Hardesty, Director

December 19, 2005

Mr. Norm Waldo
Lost Creek Estates
1831 Lost Springs Ranch Rd
Post Falls, ID 83854

RE: Public Drinking Water System for Lost Creek Estates Subdivision

Dear Mr. Waldo:

On September 29, 2005, this office received from John Smetana, P.E. of Frame and Smetana Consulting Engineers, and from James DeSmet of Quantum Engineering and Consulting the three following items regarding the drinking water and wastewater systems planned to serve the sixty-four (64) lots in the proposed Lost Creek Estates subdivision:

- A response to the review comments in our August 10, 2005 letter.
- Well drilling plans and specifications.
- Revised water system construction plans and specifications.

In the order listed above, we have the following responses to these submittals:

August 10, 2005 review comments:

1. **Advanced Wastewater Treatment:** In order to satisfy ground water quality requirements, Quantum Engineering has proposed that 62 of the 64 lots be provided with individual sewage systems for the residences that involve additional treatment capable of reducing the concentration of nitrate in the septic tank effluent to below 27 mg/l. The design engineers have proposed advanced wastewater treatment by installing either an extended treatment package system (ETPS) or a recirculation gravel filter (RGF) at each household. These units will be installed between the standard septic tank and the subsurface sewage disposal drainfield. This is acceptable to DEQ but needs to be formalized into an advanced wastewater treatment plan for the subdivision addressing the following conditions:
 - The design engineer needs to select specific treatment systems required for installation at all 62 lots. The engineer needs to demonstrate with certification by the Technical Guidance Committee and/or other performance data that the selected treatment units will satisfy the minimum nitrate performance standard.
 - A standard on-site sewer system detail needs to be submitted showing the septic tank, advanced treatment unit, and drainfield design that will be mandated at each lot. A copy of the subdivision documents requiring all lot owners to install a system that complies with this standard detail needs to be submitted. A map of the subdivision showing the approved locations for the subsurface sewage disposal systems on each lot and identifying the two lots exempt from the special systems is recommended.
 - A mechanism needs to be established to ensure that these alternative on-site sewage systems are installed in accordance with the approved standard detail. Inspection and verification of

RE: Public Drinking Water System for Lost Creek Estates Subdivision

December 19, 2005

Page 2

- Arrangements for Operation and Maintenance of these units need to be made to ensure long-term success of the facilities. DEQ recommends that subdivision documents provide the homeowners association with the authority to charge a service fee from all lot owners that allows the association to retain the services of a qualified operator for these units. An O&M Manual for the alternative systems will need to accompany the standard detail.

2. **Water System Engineering Report:** The submittal indicated that five test wells had been drilled (IFI#1-5) and that the information from these five wells was used to locate the two proposed water production wells for the Lost Creek Estates drinking water system. The engineer has proposed maintaining four of the test wells for uses other than supplying drinking water. As long as the five test wells are properly secured so as not to pose a contamination threat to the aquifer and the Department of Water Resources requirements are satisfied, we have no objection to this proposal for the test wells.

The submittal indicated that information on previous submittals and Master Plan information on Drawing 2 of 5 adequately described the water system design and sizing criteria. While we would have preferred an engineering report that compiled this information in one document, we have reviewed these sources and found them acceptable based on the information provided.

3. **Well Site Approval:** The proposed 120-foot by 140-foot well lot is located along the east property line as shown on the Master Plan. ~~The two proposed production wells within this well lot was~~
~~located within the well lot.~~
4. **Public Water Supply Well Setbacks:** The two proposed and approved well sites are shown about 60 feet west of the east property line for Lost Creek Estates. The adjoining property owner will be restricted from installing any septic tank or sewage drainfield within a 100 foot radius of either well. ~~The proposed production wells are located within the well lot. The setbacks from the adjoining property line are 100 feet. The setbacks from the property line are 100 feet. The setbacks from the property line are 100 feet.~~
5. **Two Sources:** The design calls for installation of two water production wells. Any public water system serving more than 25 users is required to have two sources of water supply.
6. **Well Seal Thickness and Depth:** The well drilling specifications have been changed to require a sanitary seal of 2-inches in thickness extending 58 feet below the ground surface. The seal protects the well from being impacted by surface drainage.
7. **Completion of Production Wells:** Test pumping, water quality sampling, and other requirements for the production wells are discussed below.
8. **TFM Demonstration:** Section 549 of the Idaho Rules for Public Drinking Water Systems requires that, concurrent with submittal of construction plans and specifications, a demonstration be made of the technical, financial, and managerial (TFM) capacities of the water system owner to construct and operate the proposed public drinking water system. A letter was submitted indicating the Lost Creek Estates public drinking water system would be owned by "Northern Water, LLC" as owned

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by the Lost Creek Homeowners Association. However, nothing was provided to document this relationship.

Additional information needs to be provided to document that you have, or will have, the technical, financial, and managerial capacity to construct and operate the proposed water system. This needs to be done per the Rules before water system construction is fully approved. Please refer to http://www.deq.state.id.us/water/assist_business/pws/managerial_capacity_guidance.pdf for more guidance. A comprehensive TFM report is required now.

9. **Fire Flow:** A copy of the August 16, 2005 letter from the Northern Lakes Fire Protection District (NLFPD) indicated that a minimum fire flow of 1000 gpm for two hours was required. The design has proposed construction of a 120,000 gallon water reservoir to supply fire flows in addition to the two wells.

It appears that this fire flow only applies if structures in the development are all less than 3600 square feet in area. If the development might involve larger structures, then it would be prudent to consider increasing the volume of the water reservoir and/or requiring that all structures have approved automatic sprinkling systems. This needs to be affirmed with NLFPD.

10. **ANSI/NSF Standard 61 Listed Materials:** The specifications now reflect that all equipment in contact with the drinking water must be listed under NSF Standard 61, blowoff devices or fire hydrants are to be installed on the end of all dead ending water mains, the diameter of the water mains is clearly indicated on Drawing Number 2, and a description of the control system for the wells needs was added.
11. **Disinfection:** Provisions for disinfection during construction was added to Sheets 4 and 5. Usually, the system design needs to include provisions for chlorination in the event continuous disinfection is required of the water system. The design engineer has proposed adding a contact basin and chlorinator at the well site in the future if this type of treatment is mandated.
12. **Automatic Booster Pump Shutoff:** The booster pump is now equipped with low pressure automatic shutoff device. The design engineer has indicated that in his opinion a Cycle Stop Valve is an effective and reliable method for controlling pump cycles.

In conclusion, all of the comments have been resolved except item #1 pertaining to advanced wastewater treatment needs and item #8 pertaining to the TFM demonstration. Future submittals on this project will be expected to address these two items.

Well drilling plans and specifications:

On September 29, 2005 Quantum Engineering and Surveying submitted well drilling plans and specifications for two 8-inch diameter wells drilled to a depth of 250-feet below ground surface and intended to produce 120 gallons per minute. ~~The well drilling plans and specifications have been reviewed and approved in accordance with the Idaho Rules for Public Drinking Water Systems and Section 39-100, Idaho Code.~~