NO. 16-0833

BEFORE THE BOARD OF COUNTY COMMISSIONERS
OF SPOKANE COUNTY, WASHINGTON

IN THE MATTER OF ADOPTING AN INTERIM ORDINANCE FOR PROCESSING OF BUILDING PERMITS IN RURAL AREAS OF UNINCORPORATED SPOKANE COUNTY	)))))	**RESOLUTION**

WHEREAS, pursuant to the provisions of RCW 36.32.210(6), the Board of County Commissioners of Spokane County, Washington (sometimes hereinafter referred to as the "Board"), has the care of County property and the management of county funds and business; and

WHEREAS, pursuant to the provisions of chapters 36.70 and 36.70A RCW, Spokane County plans under the Growth Management Act codified under chapter 36.70A RCW and in conjunction therewith has adopted a Comprehensive Plan for the unincorporated areas of Spokane County; and

WHEREAS, Spokane County's Comprehensive Plan addresses water in various Chapters and provides in part as follows:

(1) Chapter 10: Natural Environment

a. NE. 18.1 Manage surface and ground waters throughout the county to stay within recharge capabilities.
b. NE. 18.7 Discourage new water wells or increases in the extraction of water from existing wells in aquifers where water withdrawals exceed aquifer recharge, especially in the Little Spokane River Basin and the West Plains area. The provision of public water service to these areas from sources outside the area shall be encouraged.
c. NE. 18.9 Support efforts to limit water use allowed under the state domestic exemption rule to provide supplies for single-family residences.

; and

WHEREAS, pursuant to the provisions of chapters 36.70 and 36.70A, the Board has adopted a Spokane County Zoning Code for the unincorporated areas of Spokane County; and

WHEREAS, RCW 36.70.795 provides that:

"A board that adopts a moratorium, interim zoning map, interim zoning ordinance, or interim official control without holding a public hearing on the proposed moratorium, interim zoning map, interim zoning ordinance, or interim official control, shall hold a public hearing on the moratorium, interim zoning map, interim zoning ordinance, or interim official control within at least sixty days of its adoption, whether or not the board received a recommendation on the matter from the commission or department. If the board does not adopt findings of fact justifying its action before this hearing, then the board shall do so immediately after this public hearing. A moratorium, interim zoning map, interim zoning ordinance, or interim official control adopted under this section may be effective for not longer than six months, but may be effective for up to one year if a work plan is developed for related studies providing such a longer period. A moratorium, interim zoning map, interim zoning ordinance, or interim official control may be renewed for one or more

six-month periods if a subsequent public hearing is held and findings of fact are made prior to each renewal."

; and

WHEREAS, RCW 36.70A.390 provides that:

"A county or city governing body that adopts a moratorium, interim zoning map, interim zoning ordinance, or interim official control, shall hold a public hearing on the adopted moratorium, interim zoning map, interim zoning ordinance, or interim official control within at least sixty days of its adoption, whether or not the governing body received a recommendation on the matter from the planning commission or department. If the governing body does not adopt findings of fact justifying its action before this hearing, then the governing body shall do so immediately after this public hearing. A moratorium, interim zoning map, interim zoning ordinance, or interim official control adopted under this section may be effective for not longer than six months, but may be effective for up to one year if a work plan is developed for related studies providing for such a longer period. A moratorium, interim zoning map, interim zoning ordinance, or interim official control may be renewed for one or more six-month periods if a subsequent public hearing is held and findings of fact are made prior to each renewal."

; and

WHEREAS, moratoriums and interim zoning ordinances enacted under RCW 36.70.795 or RCW 36.70A.390 are methods by which local governments may implement planning measure within their respective jurisdictions; and

WHEREAS, RCW 36.70.795 and RCW 36.70A.390 authorize the enactment of a moratorium, interim zoning map, interim zoning ordinance or interim official control without holding a public hearing; and

WHEREAS, the State Environmental Policy Act codified in chapter 43.21C RCW provides that an environmental review must be conducted in conjunction with all major actions significantly affecting the quality of the environment. Washington Administrative Code provisions, specifically WAC 197-11-880 further provides:

"WAC 197-11-800 Emergencies.

Actions that must be undertaken immediately or within a time too short to allow full compliance with this chapter, to avoid an imminent threat to public health or safety, **to <u>prevent an imminent danger to public or private property</u>**, to prevent an imminent threat of serious environmental degradation, shall be exempt. Agencies may specify these emergency actions in their procedures." (Emphasis added.)

; and

WHEREAS, the specific provisions within the Growth Management Act address the County obligations to address water in rural areas. They include but are not necessarily limited to:

(1) RCW 36.70A.020(10),
(2) RCW 36.70A.030(15)(g), and
(3) RCW 36.70A.070(5)(c) (iv).

; and

WHEREAS, RCW 19.27.097 sets forth the responsibilities of an applicant for a building permit to provide evidence of an adequate water supply. It provides as follows:

> "RCW 19.27.097 Building permit application—Evidence of adequate water supply—Applicability—Exemption.
>
> (1) Each **applicant for a building permit** of a building necessitating potable water shall provide evidence of an **adequate water supply** for the intended use of the building. Evidence may be in the form of a water right permit from the department of ecology, a letter from an approved water purveyor stating the ability to provide water, or another form sufficient to verify the existence of an adequate water supply. In addition to other authorities, the county or city may impose conditions on building permits requiring connection to an existing public water system where the existing system is willing and able to provide safe and reliable potable water to the applicant with reasonable economy and efficiency. An application for a water right shall not be sufficient proof of an adequate water supply.
>
> (2) Within counties not required or not choosing to plan pursuant to RCW 36.70A.040, the county and the state may mutually determine those areas in the county in which the requirements of subsection (1) of this section shall not apply. The departments of health and ecology shall coordinate on the implementation of this section. Should the county and the state fail to mutually determine those areas to be designated pursuant to this subsection, the county may petition the department of enterprise services to mediate or, if necessary, make the determination.
>
> (3) Buildings that do not need potable water facilities are exempt from the provisions of this section. The department of ecology, after consultation with local governments, may adopt rules to implement this section, which may recognize differences between high-growth and low-growth counties." (Emphasis added.)

; and

WHEREAS, on October 6, 2016, the Washington State Supreme Court filed its decision in *Whatcom County v. Hirst ("Hirst")*. Prior to the *Hirst* decision, Spokane County would issue building permits within the unincorporated areas of Spokane County based upon permit-exempt wells authorized under RCW 90.44.050, the demonstration that water was physically available, and information, or lack thereof, from the Department of Ecology to determine if the water was legally available . The *Hirst* decision provides that the County has the sole responsibility to determine if water is both factually and legally available prior to issuing a building permit, and cannot rely on the department of ecology's inaction to determine that water is legally available Legal availability of potable water generally means that supply of water by a particular method will not impair a senior water right holder. Various means can be used to substantiate the "legal" availability of water. They are set forth in RCW 19.27.097 and include:

(1) A water right permit from the Department of Ecology,
(2) A letter from an approved water purveyor stating the ability to provide water, or
(3) Another form sufficient to verify the existence of an adequate water supply.

As a result of *Hirst*, the County can no longer simply accept a permit exempt well authorized under RCW 90.44.050 to satisfy a determination of the legal availability of water without a showing by the applicant that the use of a permit exempt well will not impair a senior water right holder. A senior water right can be a water right authorized under federal or state law, a water right established by an instream flow regulation

adopted by the Washington State Department Ecology under chapters 90.22 RCW and 90.54 RCW. Spokane County has six (6) Water Resource Inventory Areas ("WRIAs"), i. e. WRIA 55, 57, 56, 54, 34, and 43. The Washington State Department of Ecology has adopted instream flow regulations in WRIA 55 (WAC 173-555) and WRIA 57 (WAC 173-557) to protect senior water rights. Other WRIA's have senior water rights, both surface water and groundwater, but no adopted instream flow regulation; and

WHEREAS, under RCW19.27.097 referenced herein above, the applicant for a building permit has the responsibility to provide evidence to Spokane County of an "adequate" water supply. At the present time Spokane County Development Regulations do not address what evidence or analysis an applicant must provide to demonstrate "adequate" water supply especially in instances where the applicant desires to use an exempt well authorized under RCW 90.44.050 to satisfy his/her responsibility; and

WHEREAS, if the County were to begin public consideration of an amendment to its development regulations to address the terminology "adequate" without first adopting an interim zoning ordinance, those involved in the process of land use development would for all practical purposes be prohibited and/ or delayed in filing applications for building permits in rural area until the process was completed or they might argue that the County is required to process their building permit application under pre Hirst analysis; and

WHEREAS, Spokane County has experts in its Environmental Services Department who have developed a definition of "adequate" under RCW 19.27.097 to enable Spokane County to continue to process building permits in the rural areas of Spokane County consistent with its Comprehensive Plan and the holding in Hirst, which will address and resolve arguments by applicants for building permits that the County must process their applications for building permits in rural areas under pre-Hirst analysis; and

WHEREAS, it is in the best interest of the public health, safety and welfare to adopt an Interim Ordinance, as authorized under RCW 36.70.795 and RCW 36.70A.390, applicable to processing of building permits in rural areas in unincorporated Spokane County; and

WHEREAS, this measure is necessary to implement the court's decision in *Hirst*; and

WHEREAS, county staff estimates the completion of a new ordinance to implement the findings of *Hirst* could take between six (6) months and one (1) year; and

WHEREAS, pursuant to WAC 197-11-880, the adoption of this resolution is exempt from the requirements of a threshold determination under the State Environmental Policy Act.

NOW, THEREFORE, BE IT RESOLVED by the Board of County Commissioners of Spokane County, Washington, pursuant to the provisions of RCW 36.32.120(6), RCW 36.70.795, RCW 36.70A.390, RCW 36.70A.130, Spokane County Comprehensive Plan provisions Chapter 10: Natural Environment: NE: 18.1, NE: 18.7 and NE: 18.9 and WAC 197-11-880, that the Board declares an emergency and in so doing does adopt an Interim Ordinance as set forth in Attachment "A" attached hereto and incorporated herein by reference.

BE IT FURTHER RESOLVED that the Board of County Commissioners adopts each and every recital herein above to support the above action and additionally the Board does:

1) Direct the staff of the Spokane County Division of Building and Planning together with the Spokane County Planning Commission to expeditiously initiate an amendment to Spokane County Code with respect to processing of building permits in rural areas.

2) Direct the Spokane County Division of Building and Planning to schedule and give proper notice of any hearings and meetings held under (1) above consistent with applicable regulations.

3) Determine to hold a public hearing on the Interim Ordinance within sixty (60) days of the adoption of this resolution.

4) Acknowledge that the Interim Ordinance adopted herein may be effective for not more than six (6) months but may be effective for up to one (1) year if a work plan is developed for a longer period; and

5) Acknowledge that an Interim Ordinance may be renewed for one or more six (6) month periods if subsequent public hearing is held and findings of fact are made prior to each renewal.

BE IT FURTHER REOLVED that the adoption of the Interim Ordinance is exempt from the requirements of the threshold determination under the State Environmental Policy Act pursuant to WAC 197-11-880.

PASSED, ADOPTED AND EFFECTIVE AS OF 2:28 **P.M. on the** 1st day of November, 2016.

BOARD OF COUNTY COMMISSIONERS
OF SPOKANE COUNTY, WASHINGTON

SHELLY O'QUINN, Chair

AL FRENCH, Vice-Chair

NANCY MCLAUGHLIN, Commissioner

ATTEST:

Ginna Vasquez, Clerk of the Board

ATTACHMENT "A"

INTERIM DEVELOPMENT REGULATION TO IMPLIMENT THE COURT'S HOLDING IN WHATCOM COUNTY V. HIRST

SECTION NO. 1: PURPOSE

The purpose of this regulation is to implement the Washington State Supreme Court's decision in *Whatcom County v. Hirst,* (No. 91475-3) filed on October 6, 2016.

SECTION NO. 2: DEFINITIONS

The following words and terms as used herein shall be held and construed to have the following meanings:

(1) "Water Resource Inventory Area or WRIA" means the regional segments developed by the Department of Ecology to implement a comprehensive state water program as directed by the Water Resources Act of 1971 (RCW 90.54)

(2) "WRIA's 55, 56, 57, 54, 34, and 43" shall be the same as identified and set forth in Washington Administrative Code (WAC) Chapter 173-500.

(3) "Rural area" shall mean lands located outside the Urban Growth Area established by Spokane County and those areas located inside the Urban Growth Area established by Spokane County not served by a municipal water system.

(4) "Beneficial Use" shall mean uses of water for domestic, stock watering, industrial, commercial, agricultural, irrigation, hydroelectric power production, mining, fish and wildlife maintenance and enhancement, recreational, and thermal power production purposes, and preservation of environmental and aesthetic values, and all other uses compatible with the enjoyment of the public waters of the state. (RCW 90.54.020)

SECTION NO. 3: REGULATON

RCW 19.27.097 provides as follows:

> "RCW 19.27.097 Building permit application—Evidence of adequate water supply—Applicability—Exemption.
>
> (1) Each applicant for a building permit of a building necessitating potable water shall provide evidence of an adequate water supply for the intended use of the building. Evidence may be in the form of a water right permit from the department of ecology, a letter from an approved water purveyor stating the ability to provide water, **or another form sufficient to verify the existence of an adequate water supply**. In addition to other authorities, the county or city may impose conditions on building permits requiring connection to an existing public water system where the existing system is willing and able to provide safe and reliable potable water to the applicant with reasonable economy and efficiency. An application for a water right shall not be sufficient proof of an adequate water supply.

(2) Within counties not required or not choosing to plan pursuant to RCW 36.70A.040, the county and the state may mutually determine those areas in the county in which the requirements of subsection (1) of this section shall not apply. The departments of health and ecology shall coordinate on the implementation of this section. Should the county and the state fail to mutually determine those areas to be designated pursuant to this subsection, the county may petition the department of enterprise services to mediate or, if necessary, make the determination.

(3) Buildings that do not need potable water facilities are exempt from the provisions of this section. The department of ecology, after consultation with local governments, may adopt rules to implement this section, which may recognize differences between high-growth and low-growth counties." (Emphasis added.)

In reviewing applications for building permits that were counter complete and submitted to the Spokane County Department of Building and Planning after October 26, 2016, the County shall implement the Comprehensive Plan and RCW 19.27.097 as follows:

The terminology "**another form sufficient to verify the existence of an adequate water supply**" referenced in RCW 19.27.097(1) above shall mean, for an applicant for a building permit in the rural area of Spokane County located in WRIA 55, the following:

- A valid water right or certificate in which the place of use is the same as the project location and has a priority date before January 6, 1976.

The terminology "**another form sufficient to verify the existence of an adequate water supply**" referenced in RCW 19.27.097(1) above shall mean, for an applicant for a building permit in the rural area of Spokane County and located in the area subject to WAC 173-557:

- A mitigation certificate issued by the Washington Department of Ecology that satisfies the requirements of WAC 173-557-060(4).

The terminology "**another form sufficient to verify the existence of an adequate water supply**" referenced in RCW 19.27.097(1) above shall mean, for an applicant for a building permit in the rural areas of Spokane County located in the areas of WRIA 54 and WRIA 57 not subject to WAC 173-557, WRIA 56, WRIA 34, and WRIA 43, the following:

- 500 feet of lateral distance between an existing, adjacent well that has been put to beneficial use.

Documents submitted by staff to the
Board of County Commissioners in conjunction with the
presentation and the Adoption of the Interim Ordinance.

TO: **CARA REVIEW COMMITTEE**

FROM: **MIKE HERMANSON**

SUBJECT: **SPOKANE COUNTY GROUND WATER RECHARGE ANALYSIS**

DATE: **MAY 2, 2013**

SPOKANE COUNTY
WATER RESOURCES

TECHNICAL MEMORANDOM

INTRODUCTION

This technical memorandum describes the analysis of groundwater recharge in Spokane County completed in conjunction with the *Spokane County Critical Aquifer Recharge Areas Review* project. In 2012 and 2013 Spokane County Utilities conducted a review of the Critical Aquifer Recharge Area (CARA) portion of the Spokane County Critical Areas Ordinance, Spokane County Code Chapter 11.20.075 (CAO). The review was specific to the non-residential onsite septic system provisions of the CARA. HDR Engineering (HDR) was hired to review the current regulation and recommend changes to the regulation if warranted.

HDR is recommending a site specific approach that utilizes information specific to the project (parcel size, septic effluent flow, septic effluent nitrate concentration), and information specific to the project location (soil type, average annual ground water recharge). Average annual groundwater recharge is an important variable in the determination of allowable septic effluent flow and nitrate concentration. Currently available groundwater recharge information for all areas of Spokane County is limited; therefore a county wide estimate of annual average recharge was developed to support the implementation of a new CARA regulation, if adopted.

APPROACH

A groundwater recharge model developed by the United States Geological Survey (USGS) described in *Techniques and Methods 6-A31, SWB-A Modified Thornthwaite-Mather Soil-Water-Balance Code for Estimating Groundwater Recharge* (USGS, 2010) was used to develop a county wide average annual recharge estimate. The model was chosen because it calculates groundwater recharge utilizing well established data sets, such as the USDA Soil Survey and USGS National Landcover Database, and incorporates the spatial variance of both climate and landscape found in the county. Data requirements for the model include: 1) hydrologic soil group 2) soil available water capacity 3) land-use classification 4) surface flow direction, and 5) precipitation and temperature. A complete description of the model can be found in the document given above.

INPUT DATA & MODEL IMPLEMTATION

The model domain covers the entire county and is comprised of 10 acre square (660 ft by 660 ft) model cells. There are a total of 114,501 model cells. A description of each data set used in the model follows.

Soil Hydrologic Group & Available Water Capacity:
The soil hydrologic group and the available water capacity data were derived from the NRCS USDA Soil Survey Geographic (SSURGO) database for Spokane County, Washington published July 16, 2012. Soil types were assigned to model cells based on the soil type that occupied the majority of each model cell. The resulting gridded data is shown in Figure 1 and Figure 2.

Land Use Classification:
Land Use data were derived from the USGS 2001 National Land Cover Database (2001 NLCD). The 2001 NLCD data resolution is 100 ft by 100 ft, therefore land cover classifications were assigned to model cells based on the land use type that occupied the majority of each model cell. The resulting gridded data is shown in Figure 3.

Surface Flow Direction:
The flow direction data was derived from a USGS digital elevation model. Flow directions were determined using the ArcGIS tool FLOWDIRECTION to process the elevation data using the D8 algorithm. The resulting gridded data is shown in Figure 4.

Climate Data:
The SWB model requires daily precipitation, daily maximum temperature (max temp), and daily minimum temperature (min temp) data. The model can utilize either single location (weather station) data or gridded data. Gridded data assigns a unique daily precipitation, max temp, and min temp for each model cell, and is preferable to using a single point such as the Spokane Airport to represent the entire county. Precipitation and temperature data was obtained from PRISM-derived data. PRISM is an acronym for "Parameter-elevation Regressions on Independent Slopes Model" and was developed by the Prism Climate Group of Oregon State University (http://www.ocs.orst.edu/prism/products/).

Gridded monthly precipitation, max temp, and min temp data is available from the Prism Climate Group, daily gridded values are not; therefore a method to distribute the single monthly value to each day of the month was used. In essence daily climate data from a weather station was used to distribute the single monthly value for each cell to daily values. Below is an example for a single cell:

If the monthly total precipitation, average max temp and average min temp for a model cell is 2 in., 28^0C, and 18^0C respectively the calculations in Table 1 would be used to develop daily values for that model cell.

January Climate Values for one cell:

Precipitation = 2 in.
Max Temp = 28^0C
Min Temp = 18^0C

Table 1: Model Cell Monthly Values to Daily Values

Date	Max Temp at Spokane Airport	% of Monthly Average Max Temp	Calculated Daily Cell Values	Min Temp at Spokane Airport	% of Monthly Average Min Temp	Calculated Daily Cell Values	Precipitation at Spokane Airport	% of Monthly Total	Daily Cell Values
1/1/2009	35	112%	31.4	26	126%	22.7	0.17	14%	0.28
1/2/2009	33	106%	29.7	-1	-5%	-0.9	0.34	28%	0.57
1/3/2009	16	51%	14.4	-8	-39%	-7.0	0	0%	0.00
1/4/2009	26	83%	23.4	13	63%	11.3	0.09	8%	0.15
									0.45
									0.37
									0.00
									0.02
									0.00
1/10/2009	36	116%	32.3	31	150%	27.0	0.06	5%	0.10
1/11/2009	38	122%	34.1	31	150%	27.0	0.02	2%	0.03
1/12/2009	38	122%	34.1	30	145%	26.2	0	0%	0.00
1/13/2009	37	119%	33.2	32	155%	27.9	0	0%	0.00
1/14/2009	32	103%	28.8	29	140%	25.3	0	0%	0.00
1/15/2009	32	103%	28.8	26	126%	22.7	0	0%	0.00
1/16/2009	32	103%	28.8	26	126%	22.7	0.001	0%	0.00
1/17/2009	30	96%	27.0	28	136%	24.4	0.001	0%	0.00
1/18/2009	34	109%	30.6	20	97%	17.4	0	0%	0.00
1/19/2009	25	80%	22.5	17	82%	14.8	0.001	0%	0.00
1/20/2009	24	77%	21.6	18	87%	15.7	0.001	0%	0.00
1/21/2009	23	74%	20.7	20	97%	17.4	0.001	0%	0.00
1/22/2009	23	74%	20.7	20	97%	17.4	0.01	1%	0.02
1/23/2009	25	80%	22.5	20	97%	17.4	0	0%	0.00
1/24/2009	24	77%	21.6	18	87%	15.7	0	0%	0.00
1/25/2009	24	77%	21.6	13	63%	11.3	0	0%	0.00
1/26/2009	20	64%	18.0	4	19%	3.5	0.001	0%	0.00
1/27/2009	26	83%	23.4	11	53%	9.6	0.001	0%	0.00
1/28/2009	30	96%	27.0	9	44%	7.8	0	0%	0.00
1/29/2009	37	119%	33.2	23	111%	20.1	0	0%	0.00
1/30/2009	43	138%	38.6	18	87%	15.7	0	0%	0.00
1/31/2009	34	109%	30.6	22	107%	19.2	0	0%	0.00
	Average Max Temp at Spokane Airport		**31.16**	Average Min Temp at Spokane Airport		**20.65**	Total Precipitation at Spokane Airpor		**1.20**

Example Calculation for max temp for 1/1/2009

1/1/2009 max temp at airport/Jan. average temp at airport =% of monthly average for 1/1/2009

35^0C / 31.6^0C = 112%

% of monthly average for 1/1/2009 x January max temp for cell = calculated max temp value for cell for 1/1/2009

112% x 28^0C = 31.4^0C

The length of time of the model run was an important consideration in the recharge modeling. The model runs on a daily time-step because recharge is dependent on climate changes on a daily basis. For example, groundwater recharge for a month that has many days of small amounts of rainfall is different than for a month with the same amount of rainfall all on the same day. Similarly the relationship of rainfall to temperature on a daily basis can impact groundwater recharge.

To capture the impact of daily climate dynamics on groundwater recharge an annual average based on 10 or more years of actual climate data is ideal. Using gridded climate data, though, is data intensive. For each day of the year precipitation, max temp, and min temp values for each model cell is needed. Climate data for one year totals 1,095 files of gridded climate data. Each month requires the conversion of monthly value to daily values. Therefore the average of the period 1981-2010 was utilized in lieu of 10 or more years of data.

Annual precipitation, average daily max temp, and annual daily min temp for the period 1981-2010 are shown in Figures 5, 6, and 7 respectively. The figures are included to show the spatial distribution of climate variables in Spokane County.

Additional Input Parameters:
In addition to the input data described above there are additional user defined input variables required by the SWB model.

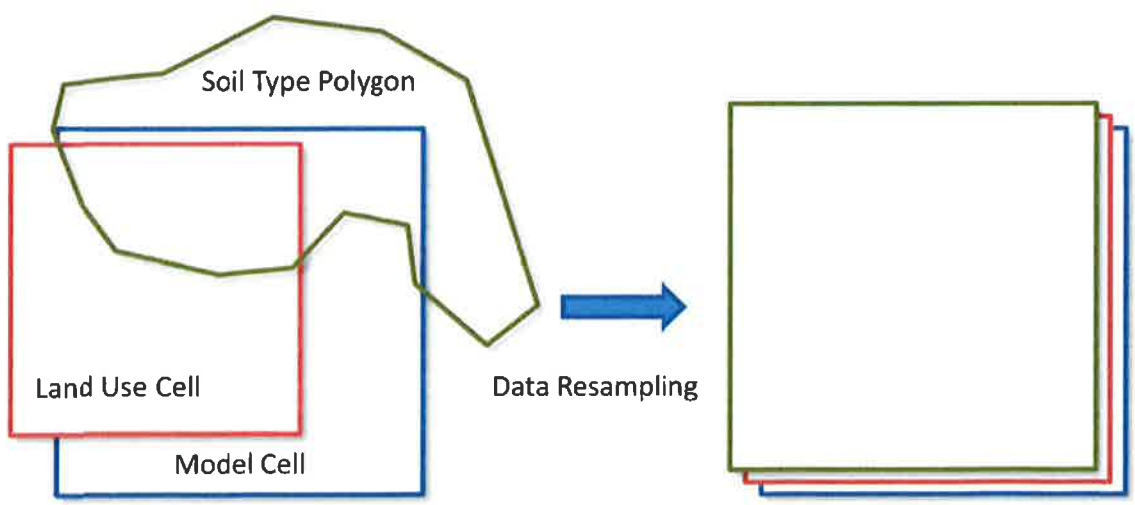
- **Growing season:** April 15th to October 15th
- **Initial Soil Moisture & Initial Snow Cover**: Previous year
    - The model was run for two years. The first year was an initialization period. The initial soil moisture and initial snow cover from the initialization year was used for the model year.
- **Evapotranspiration Method**: Hargreaves and Samani
    - Five different evapotranspiration methods are available for use in the SWB model: 1)The Thornthwaite-Mather; 2) Jensen-Haise; 3) Blaney-Criddle, 4) Turc; and 5) Hargreaves and Samani evapotranspiration methods are available for use in the model. The only method that utilizes gridded climate data is the Hargreaves and Samani; therefore that method was used.
- **Land Use Look Up Table**: Each cell has a designated land use. The parameters of each land use type used by the SWB model to calculate recharge are designated in the land use look up table. Values used in the Spokane County recharge estimate are presented in Table 2. Values provided in the model guidance document were utilized.
- **Soil Water Retention Table**: The soil water retention table is an extended version of the Thornthwaite-Mather soil-water-retention tables, which relate the accumulated potential water loss to the amount of soil moisture retained over a range of soil-water capacities. A standard table provided with the model was utilized.

Table 2: Spokane County SWB Recharge Model Land Use Look Up values

Land Use	CURVE NUMBER				MAX RECHARGE				Interception		Root Zone Depth			
	A	B	C	D	A	B	C	D	growing season	Non-growing season	A	B	C	D
Open water	100	100	100	100	2	0.6	0.12	0.24	0	0	0	0	0	0
low density residentia	75	80	83	84	2	0.6	0.24	0.12	0.0835	0	2	2	2	2
high density residentia	86	88	90	90.2	2	0.6	0.12	0.24	0.0835	0	2	2	2	2
commercial/industrial	93	93	94	93	2	0.6	0.12	0.24	0.0625	0	2	2	2	2
Bare exposed rock	71	82	88	90.5	2	0.6	0.12	0.24	0	0	1	1	1	1
deciduous	32	50	60	68.5	2	0.6	0.12	0.24	0.05	0	2	1.97	1.74	1.82
evergreen forest	39	55	64	71.4	2	0.6	0.12	0.24	0.05	0	2	1.97	1.74	1.82
mixed forest	46	60	68	74.2	2	0.6	0.12	0.24	0.05	0	2.67	2.79	2.17	2.61
shrubland	59	69	75	79.3	2	0.6	0.12	0.24	0.0625	0	3.33	3.61	2.59	3.4
grasslands/herbaceous	69	76	80	83.3	2	0.6	0.12	0.24	0.09	0	3.33	3.61	2.11	3.4
pasture	83	86	88	89	2	0.6	0.12	0.24	0.09	0	3.33	3.61	2.11	3.4
row crops	85	87	89	89.6	2	0.6	0.12	0.24	0.09	0	1.67	2	0.63	1.67
forested wetland	87	89	90	90.7	2	0.6	0.12	0.24	0.05	0	4.5	4.5	4.5	4.5
wetland	89	90	91	91.3	2	0.6	0.12	0.24	0	0	4.5	4.5	4.5	4.5
shrubland	59	69	75	79.3	2	0.6	0.12	0.24	0.0625	0	3.33	3.61	2.59	3.4
wetland	89	90	91	91.3	2	0.6	0.12	0.24	0	0	4.5	4.5	4.5	4.5
forested wetland	87	89	90	90.7	2	0.6	0.12	0.24	0.05	0	4.5	4.5	4.5	4.5

Curve Number-NRCS base curve numbers for hydrologic soil groups A-D. The curve numbers are those associated with antecedent runoff condition I
Max Recharge - Maximum infiltration rates (inches/day) for each soil type
Interception-Interception storage values for growing season and dorment season
Root Zone Depth-Depth of root zone in feet

Each of the spatial data sets has unique spatial characteristics, and required resampling to work in the SWB model. All model data inputs have to be in the same spatial input format, though the original data sources are not. Polygons in the soil layer do not match the model grid, nor do the



land use or climate gridded data match exactly with the model grid. This leads to some error in the spatial distribution of the results. To account for this the results were spatially averaged using the Block Statistics tool in the ArcGIS Spatial Analyst toolset. This tool works by taking the mean of all surrounding cells to arrive at the value of the cell.

Results

Average annual recharge for the period 1981-2010 for Spokane County estimated with the SWB model is presented in Figure 8.

Groundwater recharge is a dynamic process that is dependent on many factors. The results are a representation of estimated average groundwater recharge over many years based on the spatial and temporal variations within Spokane County of significant variables (temp, precip, soil type, etc.) that influence the process.

Figure 1:
Soil Hydrologic Group

Spokane County Groundwater
Recharge Estimate Data

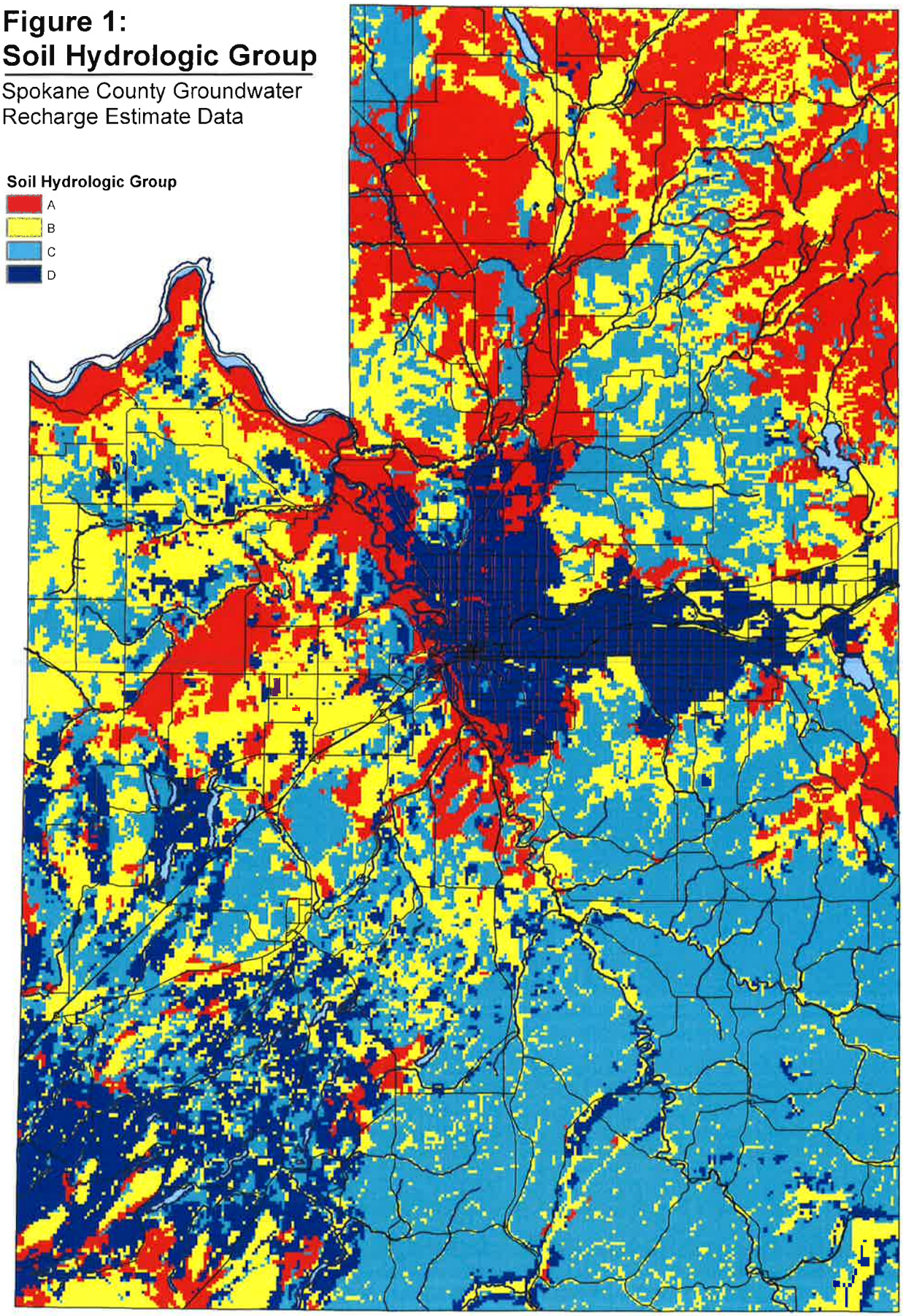


Figure 2: Soil Available Water Capacity

Spokane County Groundwater Recharge Estimate Data

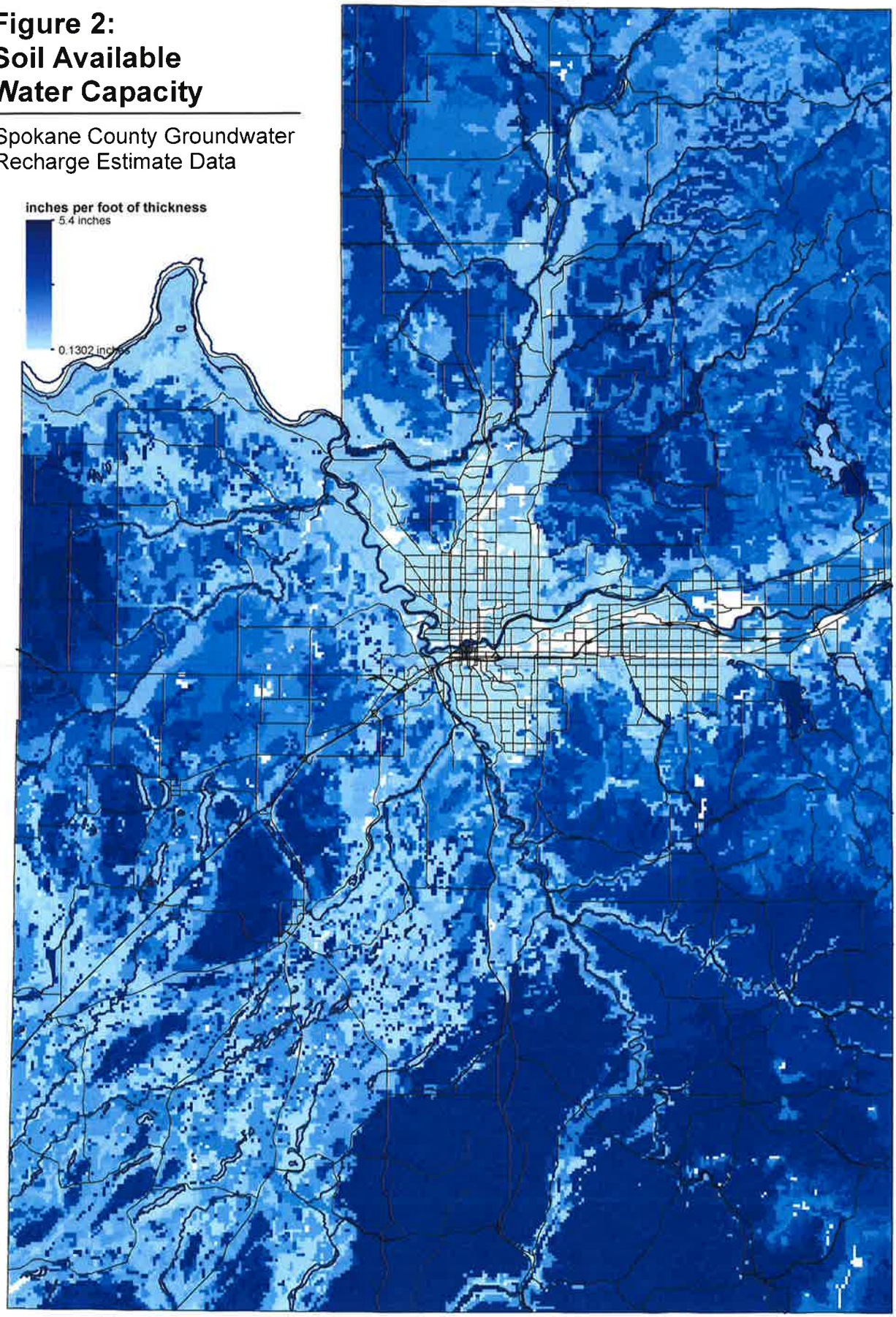


Figure 3:
Land Cover Designation

Spokane County Groundwater Recharge Estimate Data

- Open Water
- Low Density Residential
- High Density Residential
- Commercial/Industrial
- Commercial/Industrial*
- Bare Exposed Rock
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub Land
- Grasslands/Herbaceous
- Pasture
- Row Crops
- Forested Wetland
- Wetland

*There are two Commercial/Industrial classifications, the distiction does not impact SWB Model

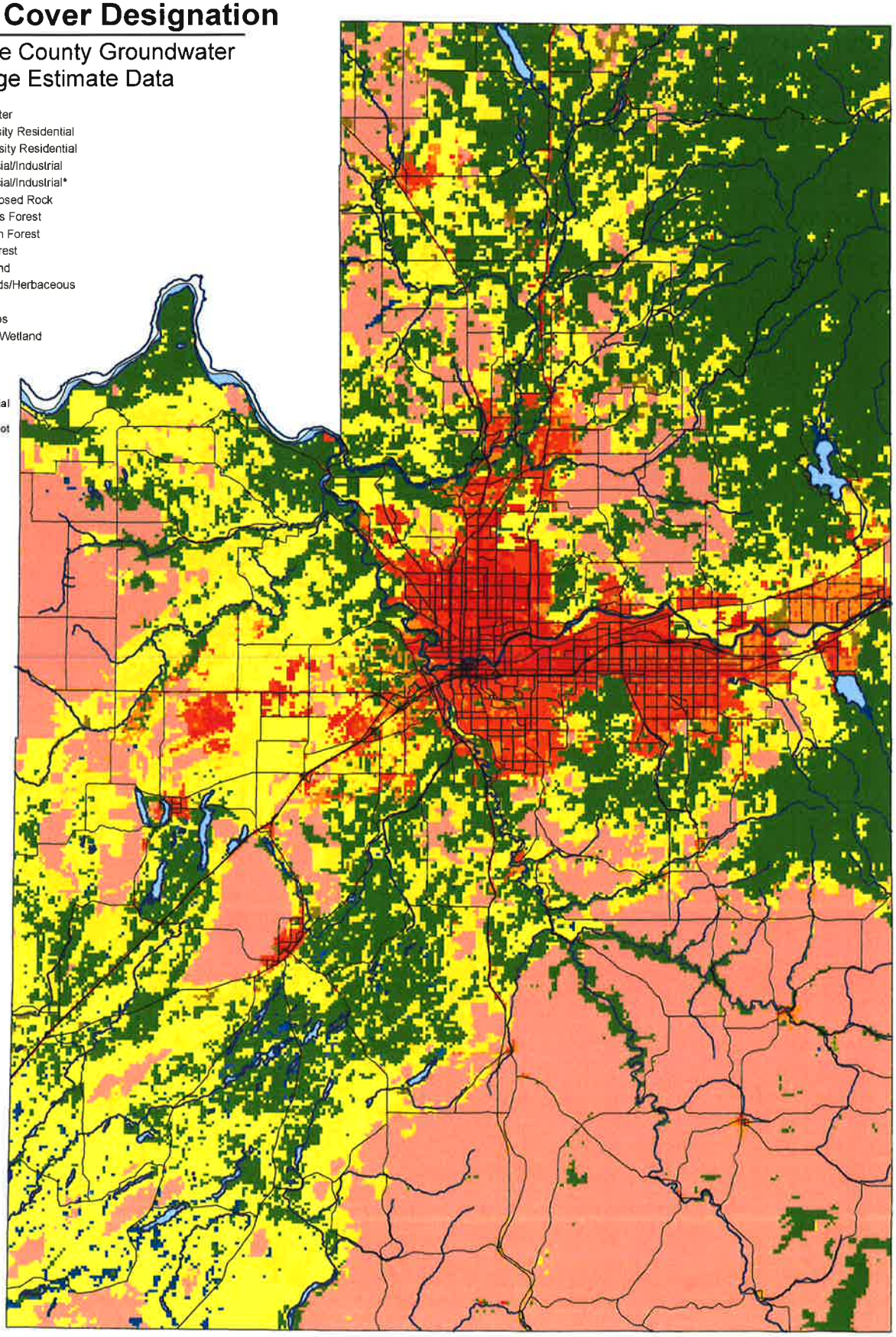


Figure 4:
Flow Direction

Spokane County Groundwater
Recharge Estimate Data

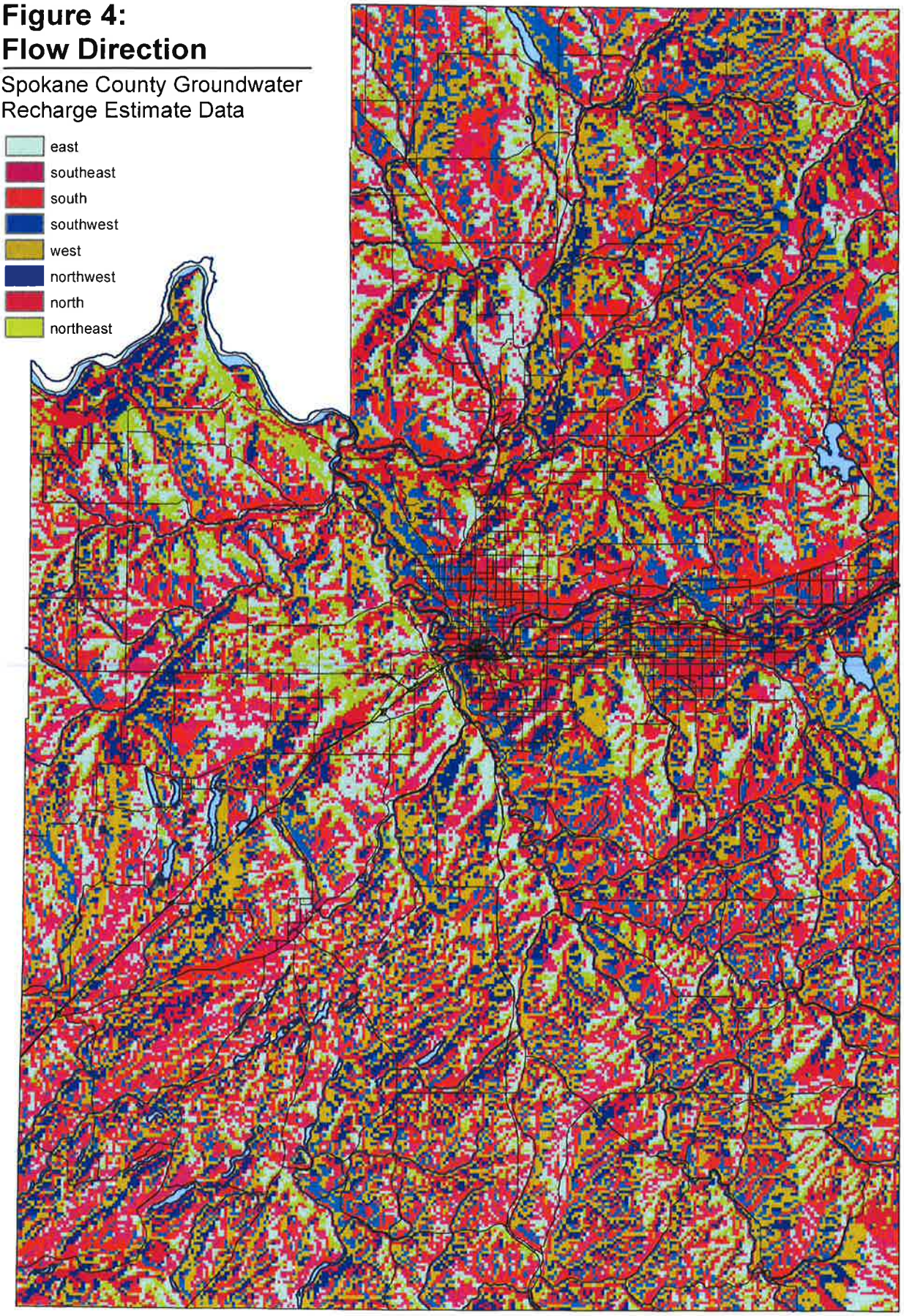


Figure 5:
Average Annual Precip 1981-2010

Spokane County Groundwater Recharge Estimate Data

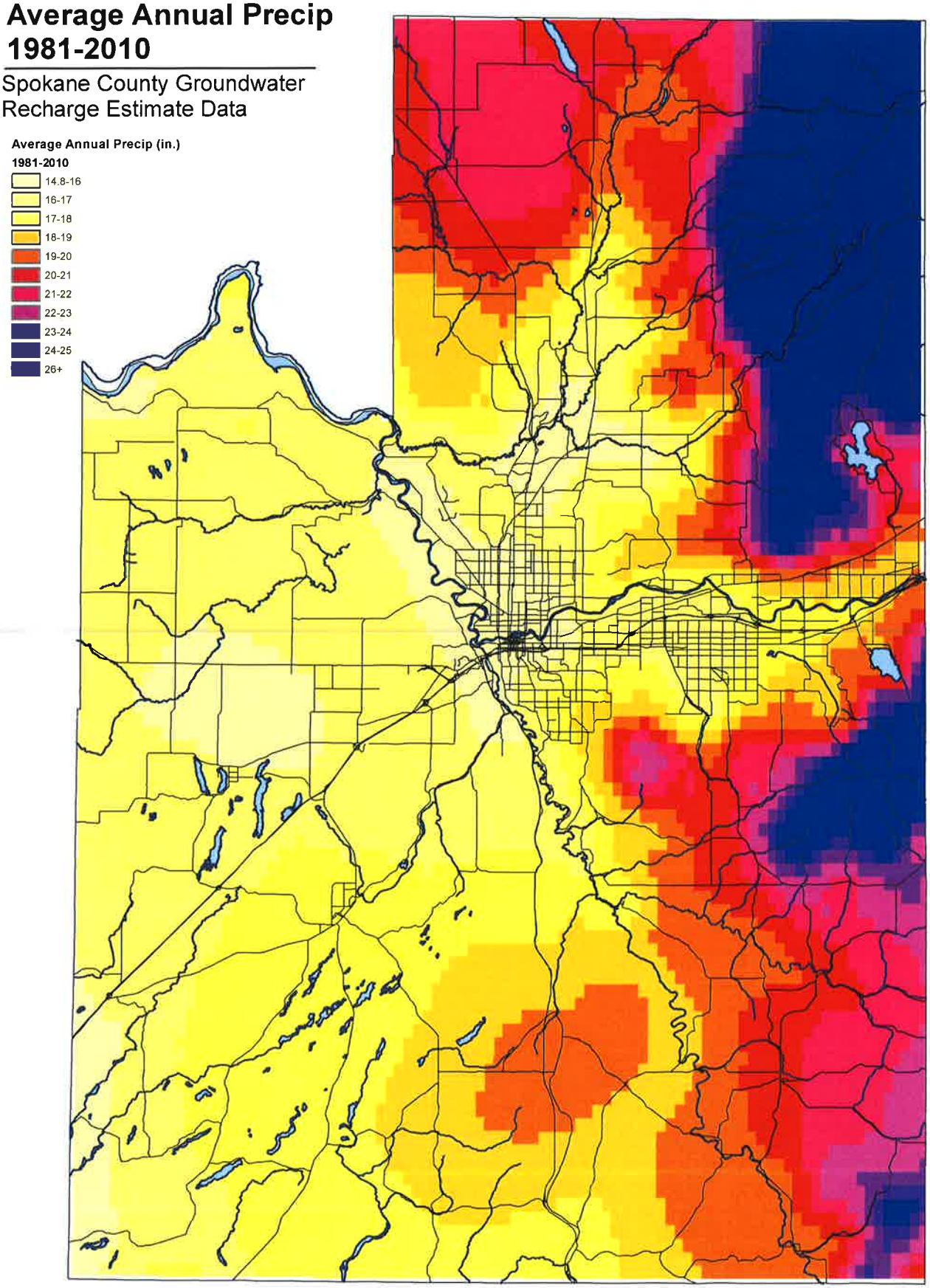


Figure 6:
Average Daily Max Temp 1981-2010

Spokane County Groundwater Recharge Estimate Data

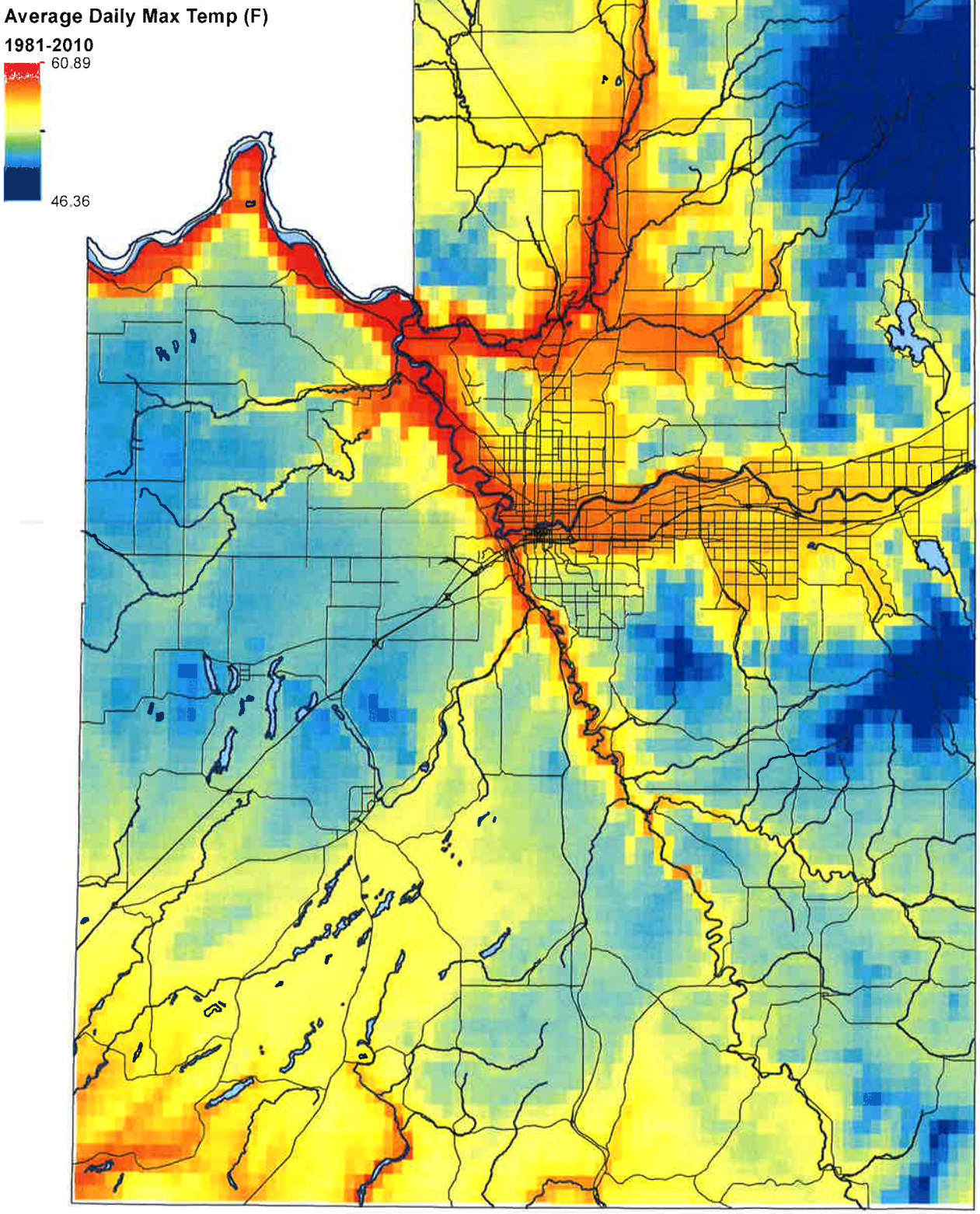


Figure 7:
Average Daily Min Temp 1981-2010

Spokane County Groundwater Recharge Estimate Data

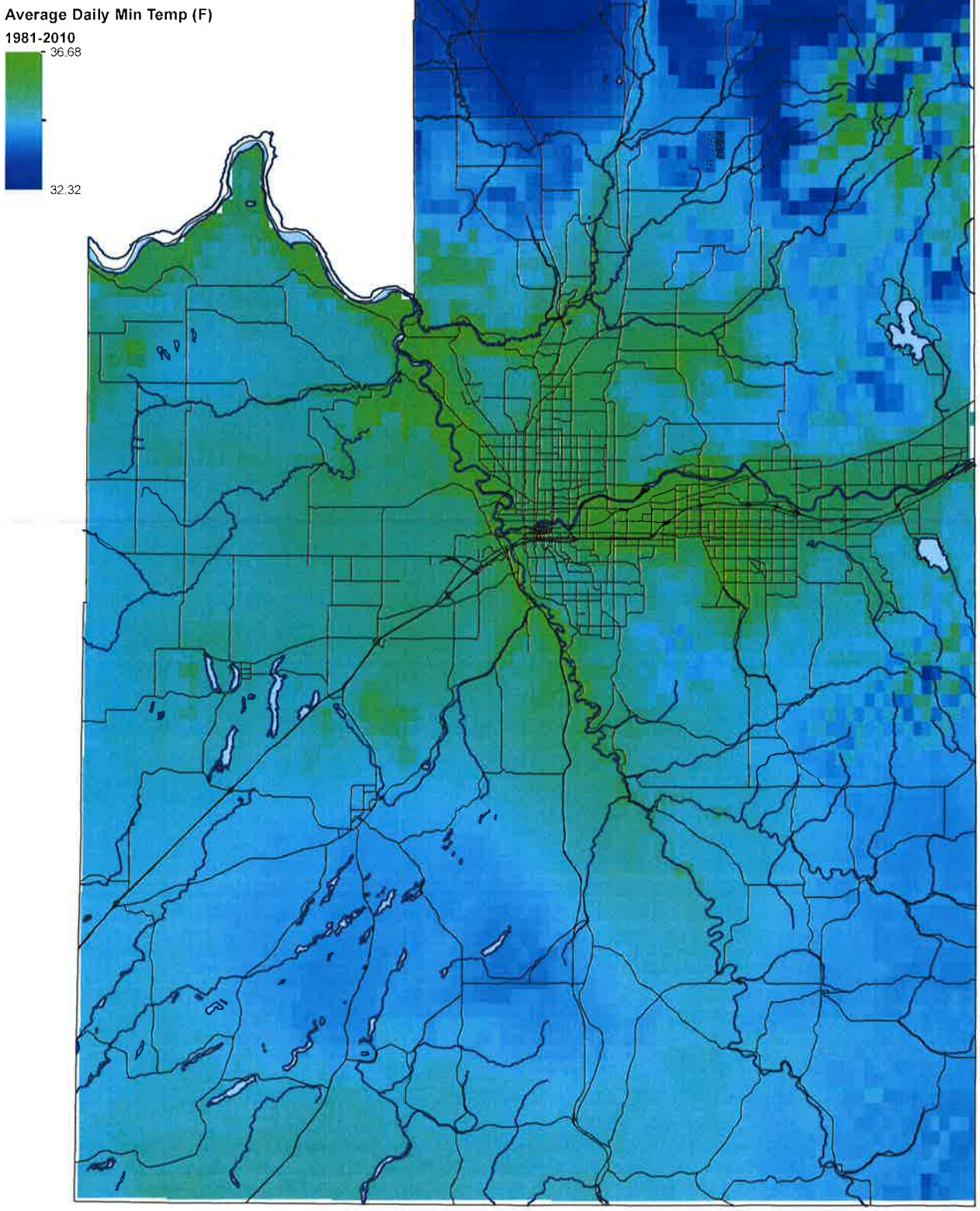
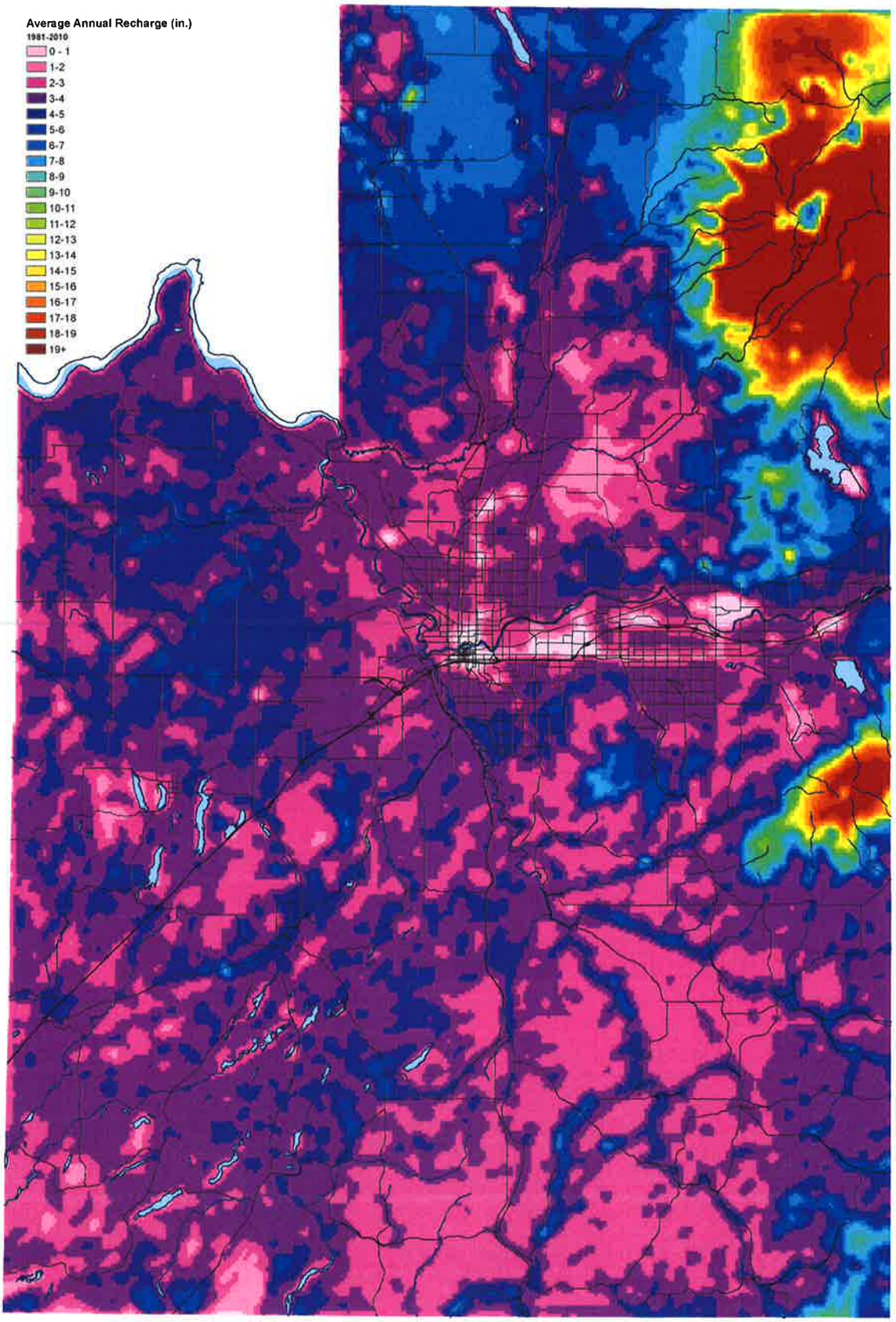
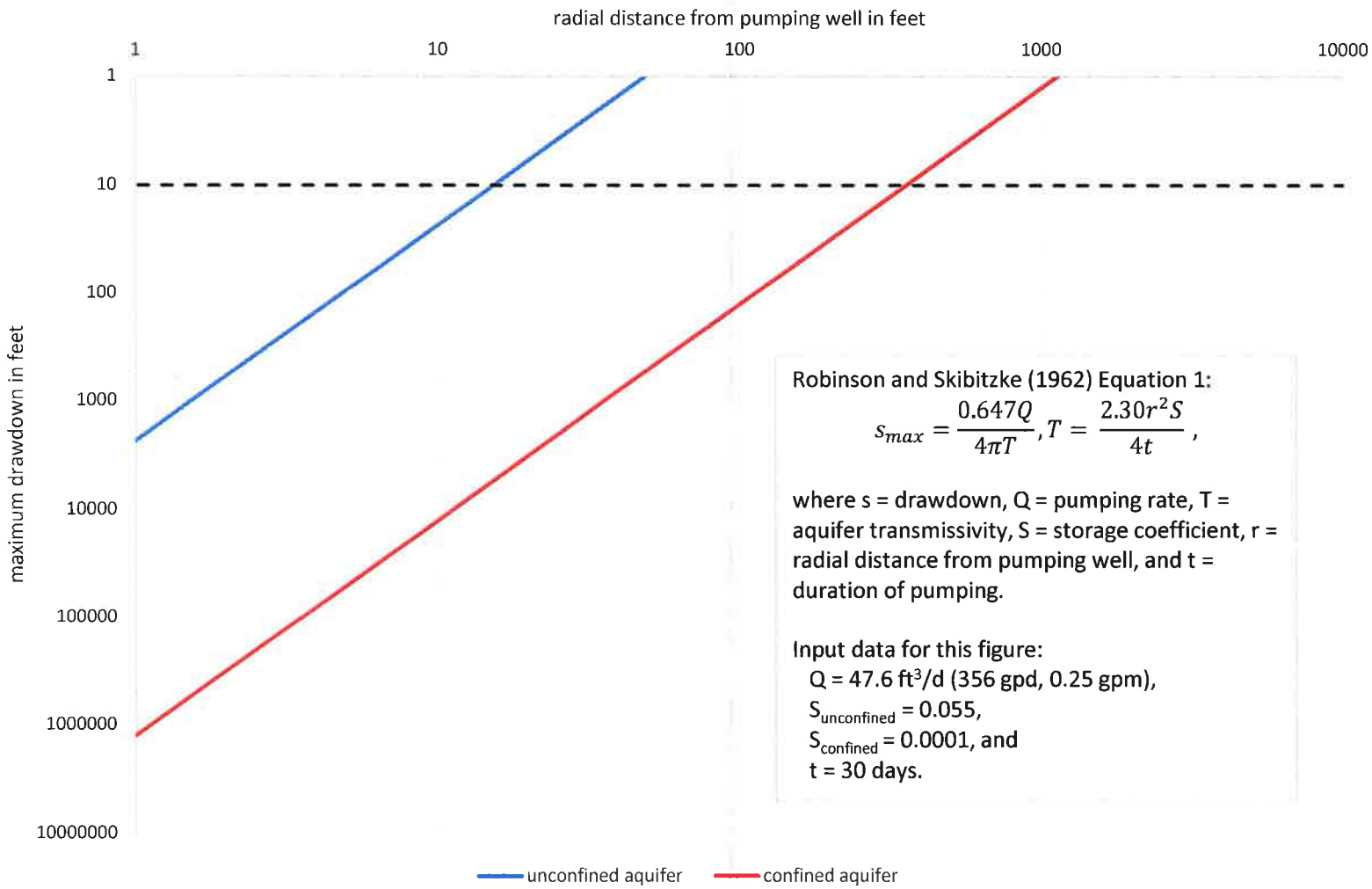


Figure 8:
Modeled Average Annual Recharge

Spokane County Groundwater
Recharge Estimate





Robinson and Skibitzke (1962) Equation 1:

$$s_{max} = \frac{0.647Q}{4\pi T}, T = \frac{2.30r^2S}{4t},$$

where s = drawdown, Q = pumping rate, T = aquifer transmissivity, S = storage coefficient, r = radial distance from pumping well, and t = duration of pumping.

Input data for this figure:
Q = 47.6 ft^3/d (356 gpd, 0.25 gpm),
$S_{unconfined}$ = 0.055,
$S_{confined}$ = 0.0001, and
t = 30 days.

Robinson, G.M., and H.E. Skibitzke, 1962, USGS Water-Supply Paper 1536-F: A Formula for Computing Transmissibility Causing Maximum Possible Drawdown Due to Pumping, in *Ground-Water Hydraulics* 179.

Figure 1
Exempt Well Maximum Drawdown Scenarios
Spokane County, WA

Aspect Consulting
11/1/2016

Aspect Consulting
11/1/2016

Figure 1
Exempt Well Maximum Drawdown Scenarios
Spokane County, WA

Subbasin Analysis of Total Cosumptive Water Use and Groundwater Recharge

Spokane County, Washington

Subbasin	WRIA	Groundwater Recharge (GPD)	Ag (GPD)			Exempt Wells (GPD)			Public Supply (GPD)			Self Supplied Industrial (GPD)			Demand met by SVRP (GPD)			Net Water Balance (GPD)	Percent of Recharge Remaining
			Total	Non Comsumptive	Consumptive	Total	Non Consumptive	Consumptive	Total	Non Consumptive	Consumptive	Total	Non Consumptive	Consumptive	Total	Non Consumptive	Consumptive		
Palouse	34	55,989,124	1,764,723	301,792	1,462,931	1,283,009	510,312	772,697	191,224	96,968	94,255	-	-	-	-	-	-	53,659,240	96%
Upper Crab Wilson	43	7,758,854	1,952,881	335,299	1,617,582	365,108	160,464	204,644	54,606	28,801	25,805	-	-	-	-	-	-	5,910,823	76%
Coulee Creek	54	9,760,533	288,594	49,126	239,468	340,966	146,712	194,253	14,148	8,961	5,187	-	-	-	-	-	-	9,321,624	96%
Deep Creek	54	17,182,819	5,169,901	887,471	4,282,430	1,366,127	582,915	783,212	142,766	104,051	38,715	-	-	-	-	-	-	12,078,462	70%
Lower Long Lake	54	5,601,725	1,571,868	270,137	1,301,731	138,110	59,369	78,740	921	509	412	-	-	-	-	-	-	4,220,842	75%
Nine Mile Reservoir	54	2,704,948	7,099	710	6,389	378,417	147,007	231,410	300,737	160,053	140,684	-	-	-	9,133	4,861	4,272	2,330,738	86%
Upper Long Lake	54	4,399,394	2,022,678	347,281	1,675,397	508,133	193,210	314,923	278,140	129,538	148,602	-	-	-	-	-	-	2,260,472	51%
West Plains Central	54	3,346,976	78,080	13,134	64,947	746,387	319,696	426,691	766,818	630,039	136,779	-	-	-	-	-	-	2,718,559	81%
California Lower Rock	56	19,386,445	12,705	1,271	11,435	639,860	244,574	395,286	283,010	142,109	140,901	-	-	-	-	-	-	18,838,823	97%
Latah Spangle	56	8,892,846	286,324	48,897	237,428	242,784	92,435	150,349	187,820	90,026	97,793	-	-	-	-	-	-	8,407,276	95%
Lower Latah	56	9,089,362	1,509,212	257,881	1,251,332	1,896,723	722,969	1,173,753	274,810	130,679	144,131	88,813	29,604	59,208	-	-	-	6,460,938	71%
Marshall Creek	56	11,563,865	816,456	138,328	678,128	1,686,247	693,728	992,519	549,360	302,813	246,547	-	-	-	4,391	2,420	1,971	9,648,641	83%
Tekoa	56	13,541,365	3,160	316	2,844	114,978	51,753	63,225	230,059	127,979	102,079	-	-	-	-	-	-	13,373,216	99%
Upper Rock Creek	56	8,822,613	2,239	224	2,015	125,344	45,588	79,756	21,378	9,137	12,241	-	-	-	-	-	-	8,728,601	99%
Blanchard Creek	57	39,531,394	1,715	172	1,544	39,995	21,691	18,304	22,733	13,918	8,814	-	-	-	-	-	-	39,502,732	100%
Liberty Creek	57	9,135,844	2,620	262	2,358	216,243	74,610	141,633	130,233	56,390	73,843	-	-	-	23,140	10,020	13,121	8,931,131	98%
Spokane Urban North	57	3,708,869	6,448	645	5,803	469,464	191,101	278,363	83,457	39,991	43,466	-	-	-	2,006	961	1,045	3,382,282	91%
Spokane Urban South	57	8,297,424	404,226	68,669	335,557	1,055,607	372,857	682,750	44,873	28,394	16,479	-	-	-	532	337	195	7,262,835	88%
Thompson Creek	57	22,945,135	41,801	5,986	35,815	714,939	290,979	423,960	196,570	87,914	108,656	-	-	-	7,194	3,217	3,976	22,380,680	98%

Consumptive use from the Spokane County Water Use and Demand Model

Groundwater recharge data from analysis according to *USGS Techniques and Methods 6-A31, SWB-A Modified Thornthwaite-Mather Soil-Water-Balance Code for Estimating Groundwater Recharge*

11/1/2016