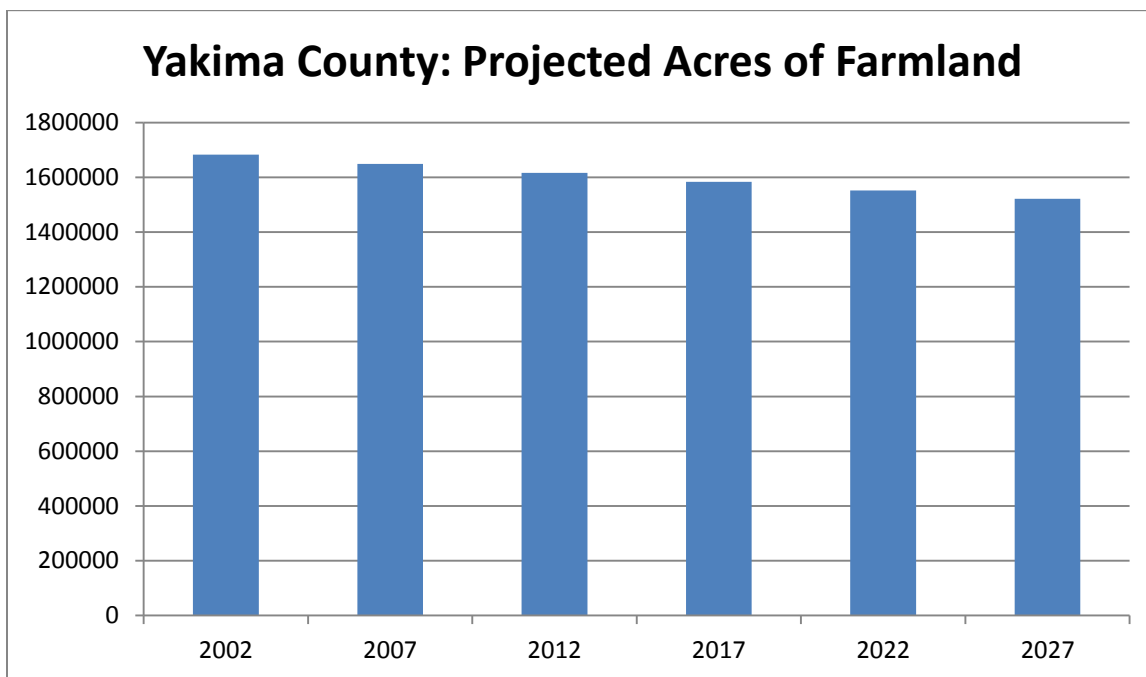


What will happen to the groundwater in the Lower Yakima Valley if we do nothing?

Acreage

- “Between the 1960’s and the early 2000’s the land in farms was relatively steady at about 1,750,000 acres.” (Agricultural History of Yakima County, SYCD)
- “The area of cropland harvested has consistently remained between 200,000 and 250,000.” (Agricultural History of Yakima County, SYCD)
- The number of acres in farm use (1,649,281 acres), which are not necessarily zoned AG, dropped 2% between 2002 and 2007 (Office of Farmland Preservation, Yakima County)

Graph 1. Hypothetical decrease in Yakima County acreage for farming at a rate of 2% decline every five years



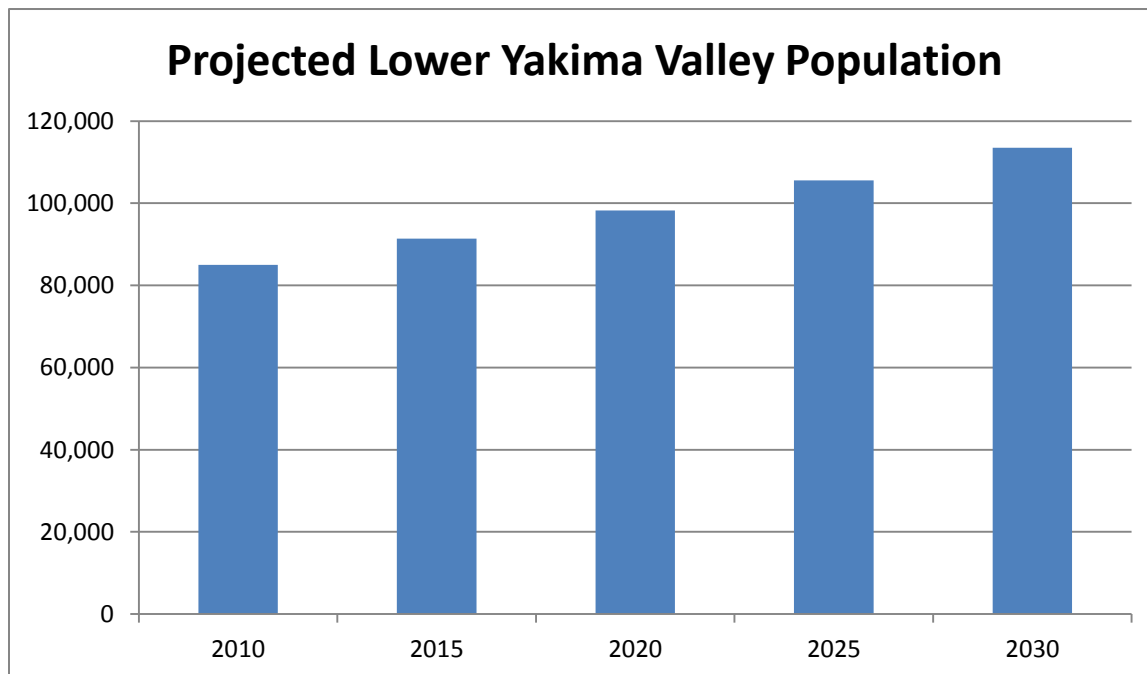
Population

- Population in 2000 – 222,581 (U.S. Census, 2000)
- Population in 2010 – 243,231 (U.S. Census, 2010)
- Change – 20,650 or 2,065 per year or approximately an increase of 0.8% per year
- By 2020 there will be about 263,881 people

- There will be an unknown increase in urban sprawl by 2020
- Yakima County grew at .93% per year
- The City of Yakima grew at 2.68% per year
- Selah grew at 1.33% per year
- Union Gap grew at .76% per year
- Toppenish did not grow
- Sunnyside grew at 1.4% per year
- Grandview grew at 2.97 % per year
- The Lower Valley grew at about 1.5% per year

Source: U.S. Census 2000 & 2010

Graph 2. Lower Yakima Valley Population based on a rate of increase at 1.5% per year



Crops

- Land in orchards and vineyards has stayed between 95,000 and 110,000 or almost 40% of cropland since 1997 (Agricultural History of Yakima County, SYCD)
- Between 25,000 and 40,000 acres has been planted in alfalfa between 1980 and the present. This is about 15% of cropland (Agricultural History of Yakima County, SYCD)

- Between 1988 and 2007 the land in corn increased from about 14,000 acres to about 42,000 acres. Corn is now planted on about 16.5% of cropland (Agricultural History of Yakima County, SYCD)
- Land in wheat has decreased from 73,000 acres in the 1970's to about 20,000 acres at present. This is a change from about 30% to about 8% of the cropland (Agricultural History of Yakima County, SYCD)
- Hops have been grown on 5% - 10% of the cropland or 16,000 to 27,000 acres since 1970 (Agricultural History of Yakima County, SYCD)
- Mint has been grown on 4% - 10% of cropland or 10,000 to 20,000 acres since 1980 (Agricultural History of Yakima County, SYCD)
- Land planted in vegetables has decreased from about 20,000 acres in 1980 to about 10,000 acres at present or a decrease of about 10% to about 5% (Agricultural History of Yakima County, SYCD)
- Most recent cropping patterns for the Lower Yakima Valley, according to WSDA, are: corn - 16%, CRP Conservation – 12%, Apples – 11%, Pasture – 9%, Wheat 9%, Hops – 7%, Alfalfa Hay – 6%, Juice Grapes – 5%, Fallow – 3%, Mint – 3%, Cherries – 3%, Fallow Wheat – 2%, Wine Grapes – 2% and Pears – 2%.

Current Irrigation Practices

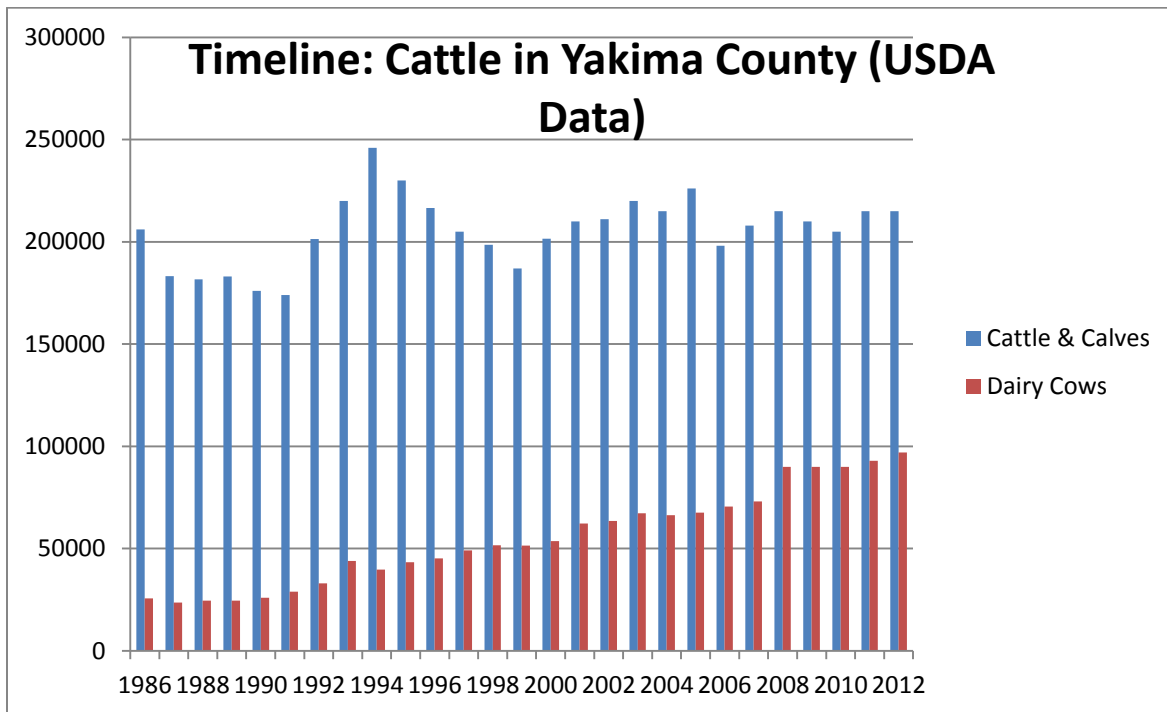
- Roza Irrigation District – 90 percent of total acreage in sprinkler or drip systems.
- Sunnyside Valley Irrigation District – 68 percent sprinkler or drip irrigated.
- Yakima-Tieton Irrigation District – More than 90 percent sprinkler irrigated
- Wapato Irrigation Project (WIP) – An estimated 55 percent sprinkler or drip irrigated.

Source: U.S. Bureau of Reclamation - Tables 6 and 7 of the Volume 2 Technical Memorandum, Water Needs for Out-of-Stream Uses.

All Cattle in Yakima County

- The number of cows increased from about 150,000 in 1980 to about 213,000 in 2007 at a rate of about 2,300 per year (Agricultural History of Yakima County, SYCD)
- The number of dairy cows increased from about 18,000 in 1980 to about 90,000 in 2007 at a rate of about 2,700 per year (Agricultural History of Yakima County, SYCD)

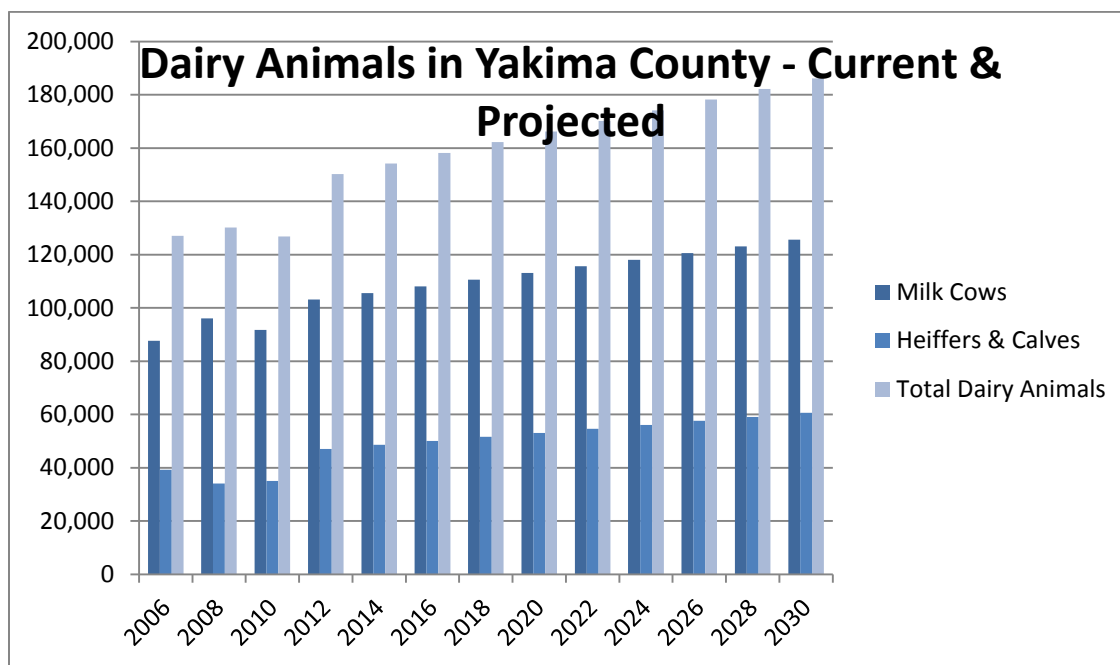
Graph 3. Cattle Timeline from USDA data



Dairy Concentrated Animal Feeding Operations (CAFOs) in Yakima County – Current and Projected

- Since 2006 the total number of dairy animals has increased by 4,000 head per year and the number of dairy cows has increased by 2,500 per year (WSDA – See Attachment A)
- Infrastructure is being built to process more milk. The port of Sunnyside is spending \$6 million to build a new pre-treatment waste-water facility and Darigold is planning a \$22 million expansion

Graph 4. Projected Increase in the Numbers of Dairy Animals in Yakima County from WSDA Data



Based on information provided by the WSDA Nutrient Management Program (Attachment A)

Fertilizer Application

- In the 1970's about 200,000 acres of agricultural land in the Yakima Valley was fertilized and about 100,000 of those acres received commercial fertilizer (Agricultural History of Yakima County, SYCD)
- In 1997 > 8,000 kg nitrogen/sq. kilometer of land were applied in the Lower Yakima Valley (County Level Estimates of Nutrient Inputs, USGS)
- In 1997 between 2,000 and 4,000 kg nitrogen from animal manure /sq. kilometer of land were applied in the Lower Yakima Valley (County Level Estimates of Nutrient Inputs, USGS)
- Between 1987 and 1997 the percentage of nitrogen from livestock manure in Yakima County increased between 10 and 50% (County Level Estimates of Nutrients, USGS)
- Approximately half of the current nitrogen from fertilizer in the Lower Yakima Valley comes from animal manure
- 63.6% of dairy owned land in Washington State where manure is over applied (3,420 acres) is in Yakima County (Dairy Nutrient Management Program, WSDA)

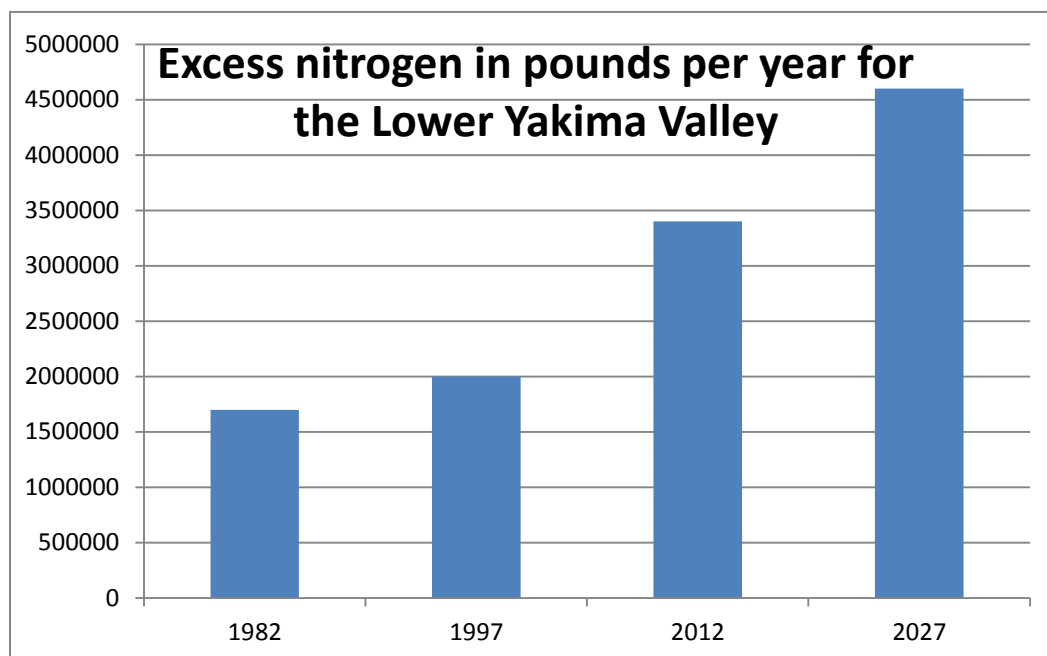
Excess Nitrogen

- According to the Natural Resources Conservation Service (NRCS) in 1997 Yakima County had the capacity to assimilate 25 million to 40 million pounds of nitrogen and 5 to 10 million pounds of phosphorous at a rate of > 140 pounds per acre for nitrogen and 15 to 20 pounds per acre for

phosphorous (Manure Nutrients Relative to the Capacity of Cropland and Pastureland to Assimilate Nutrients: Spatial and Temporal Trends for the United States, NRCS)

- In 1997 NRCS said that, assuming no manure export off the farm, we had > 2,000,000 excess pounds of nitrogen and > 2,000,000 excess pounds of phosphorous. At that time there were about 60,000 cows on dairy CAFOs here.
- Between 1982 and 1997 there was an increase of > 300,000 excess pounds of nitrogen and between 50,000 and 300,000 excess pounds of phosphorous in Yakima County. (Manure Nutrients Relative to the Capacity of Cropland and Pastureland to Assimilate Nutrients: Spatial and Temporal Trends for the United States, NRCS)
- In 2012 we had 103,000 cows on dairy CAFOs, an increase of 43,000 in 15 years or 72%. This implies that we now have at least 3,400,000 excess pounds of nitrogen and at least 3,400,000 pounds of excess phosphorous with the same acreage available for spreading.
- If the number of cows on dairy CAFOs continues to increase at a rate of 2,500 head per year there will be 140,500 dairy cows in 2027 and there will be at least 4,600,000 excess pounds of nitrogen and at least 4,600,000 excess pounds of phosphorous with the same acreage available for spreading.

Graph 6. Projected increase in nitrogen over time



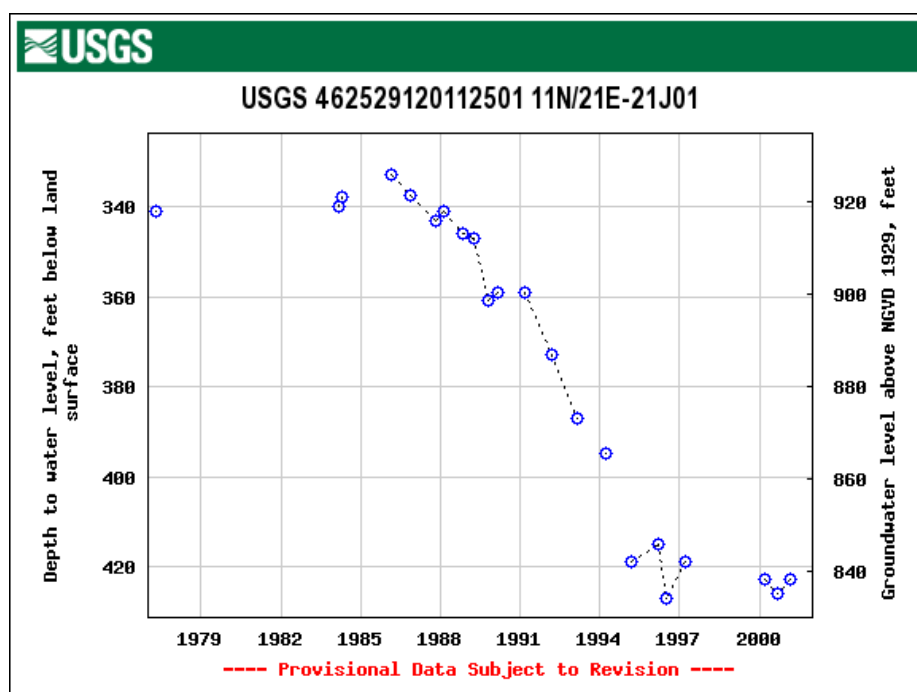
Groundwater Quantity

Deep Wells

Analysis of deep wells in the basalt aquifers from the United States Geological Service shows:

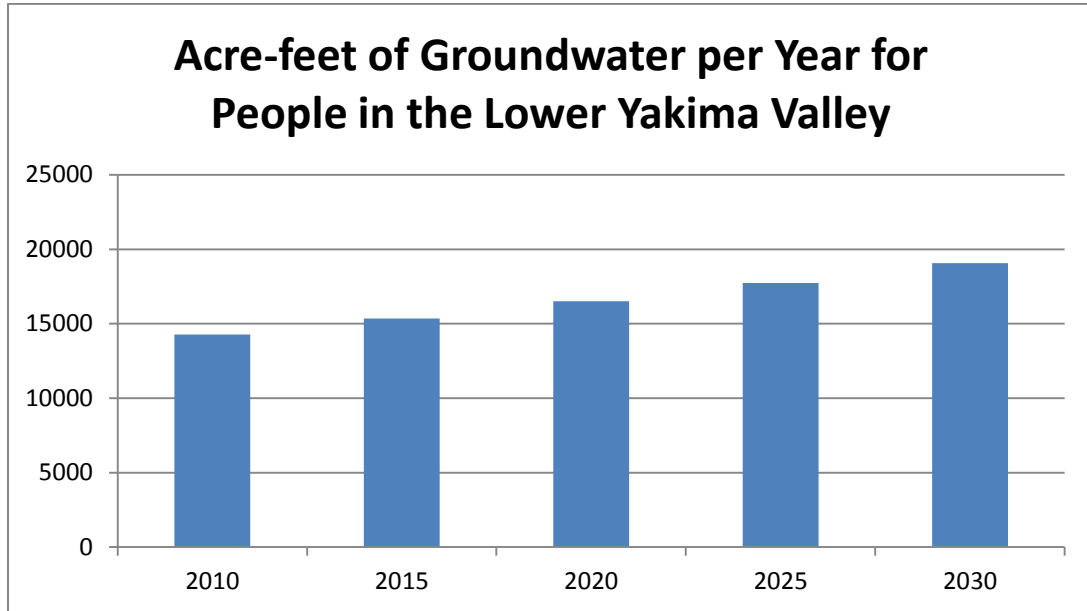
- In the area south of Mabton the only well studied had levels decreasing at a rate of 2.78 ft/year
- On the Yakama Reservation 21 wells showed levels decreasing in a range from 0.16 to 3.33 ft/year
- In the area north and east of Granger and south of Zillah 14 wells showed levels decreasing in a range from 0.25 to 9.58 ft/year
- In the area north of Sunnyside four wells showed a range from increasing at 0.83 ft/year to decreasing at 2.62 ft/year
- In the area north of Zillah and south of Konnowac Pass 12 wells showed a range from increasing at 7.5 ft/year to decreasing at 10.24 ft/year
- In the Moxee area and eastward 25 wells showed a range from increasing at 1.43 ft/year to decreasing at 16.67 ft/year
- In the Ahtanum and West Valley area 17 wells showed a range from increasing at 2.95 ft/year to decreasing at 4.17 ft/year
- In the Selah area 8 wells ranged from no change to decreasing at 1.14 ft/year
- In the Glead and Naches area one well decreased at 2 ft/year and one well decreased at 1.98 ft/year
- Overall 84 wells showed decreasing water levels, 8 showed increases and 10 stayed almost level

Graph 7. A 605 foot well north of Granger and east of Zillah

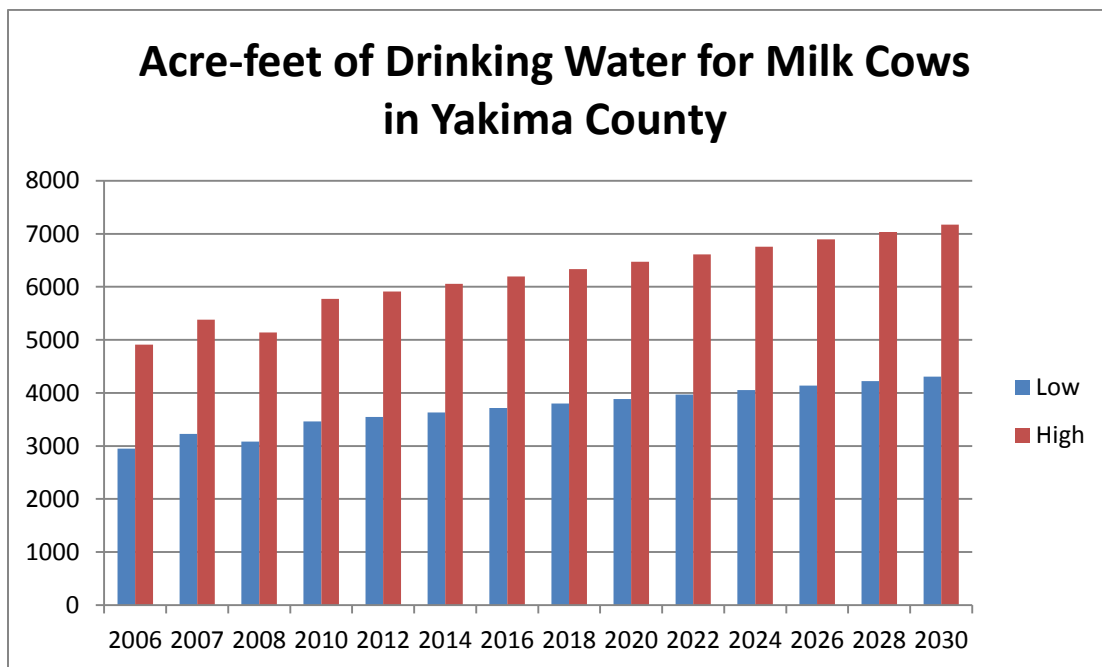


Groundwater Withdrawals

Graph 8. Groundwater demands if the population in the Lower Yakima Valley grows at a rate of 1.5% per year and need is 150 gallons per day per person:



Graph 9. Groundwater demand for dairy cows (A producing milk cow requires from 30 to 50 gallons of drinking water per day or 10,950 to 18,250 gallons per year)



- Between 2000 and 2030 the quantity of groundwater required for people and for drinking water for dairy cows is projected to increase by 31%
- We do not know how much ground water is used for washing milk cows and flushing barns
- This estimate does not include groundwater for beef cattle, dairy heifers and calves, or other domestic animals

Groundwater Quality

The Pacific Groundwater Group identified 7 wells from 46 frequently sampled sites with increasing nitrate trends and 9 with decreasing trends. Six of the seven wells had maximum nitrate levels greater than 8 mg/L and three had nitrate levels above the safe standard of 10 mg/L. The shallowest well was 130 feet.

Well ID	Number of Samples	Max Nitrate	Well Depth & Capacity	Location
2897001	32	9.0 to 10.0 mg/L	180 ft, 180 gpm	Grandview
2897010	139	> 12.5 mg/L	620 ft, 410 gpm	Grandview
2897011	29	8.0 to 9.0 mg/L	250 ft, 60 gpm	Grandview
6494002	21	10.0 to 11.0 mg/L	130 ft, 75 gpm	Outlook School
6591901	37	11.0 to 12.5 mg/L	280 ft, 360 gpm	Panorama Place
8540005	12	2.0 to 4.0 mg/L	166 ft, 500 gpm	Sunnyside
AB 70001	10	11.0 to 12.5 mg/L	Unknown	Wineglass Cellars

(If one accepts a value of $p < 0.10$ there are 13 wells out of 46 with increasing trends and 10 with decreasing trends.)

Factors that point to decreasing groundwater quality

- Increasing demands on the aquifer
- Growing nitrogen imbalance
- Municipalities are already forced to drill new wells
- Decreasing acreage in farmland – more farming on less acreage
- In 1990 only eight out of twenty seven wells in a lower valley study had detectable nitrates. In 2000 21% of the wells in the lower valley had nitrate levels above the safe drinking water standard. (Sell & Knutson, 2002).

Mitigating Factors

- Opportunity to improve irrigation practices in the Sunnyside and Wapato Irrigation Districts

Costs

- \$ 1 – 2 million per year public expenditure for bottled water
- Drill new wells - \$18 to \$20 per foot
- Water treatment systems at \$1,000 to \$12,000 per home
- Groundwater Management Area - \$2.3 million so far
- WSDA Nutrient Management Program - \$0.6 million per year
- New wells for cities and schools
- Annual well water testing for 2,200 wells at \$75 per well = \$165,000 per year
- Health effects have not been quantified

Respectfully Submitted to the Lower Yakima Valley Groundwater Management Area – August 21, 2014

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Attachment A

Washington State Department of Agriculture Data on Dairies – Yakima County

Source: Maia Bellon, Director of WA State Dept. of Ecology, who cites Ginny Prest from the WSDA Nutrient Management Program

	2012	2010	2008	2006
Number of dairies	68	67	68	65
Mature animals (milking and dry)	103,088	91,726	96,076	87,694
Heifers (heifers and calves)	47,085	35,076	34,048	39,298
Acreage for land application (owned and rented)	35,727	31,520	27,426	34,044
Number of dairies reporting exporting manure	57	57	No data collected	No data collected
Number of dairies reporting composting	37	No data collected	No data collected	No data collected
Number of dairies reporting animals offsite	37	No data collected	No data collected	No data collected
Number of routine inspections	58	55	64	80
Number of other inspections	14	25	83	33

Attachment B (Please note the difference in numbers between survey data and census data).

USDA Census Data for Yakima County

	Cattle Inventory	Beef Cattle	Milk Cows	Cattle and Calves
2007	118,169	28,594	89,575	212,762
2002	90,209	22,866	67,343	230,275
1997	82,813	31,676	51,137	192,271

National Agricultural Statistics Service - <http://quickstats.nass.usda.gov/results/3864427B-6E95-3506-926A-5EA71B3442CD> , <http://quickstats.nass.usda.gov/results/1D0A8BFB-20CB-349A-AA6E-9D8FDD410CCF> , <http://quickstats.nass.usda.gov/results/A504D574-A9E8-3D48-AA61-FD1A28B2E443> and <http://quickstats.nass.usda.gov/results/FF9658AF-4CB9-381A-AB4A-FAEF52171DD0>

USDA Survey Estimates for the Number of Cattle in Yakima County

Year	Cattle, including Calves	Dairy Cows
2012	215,000	97,000
2011	215,000	93,000
2010	205,000	90,000
2009	210,000	90,000
2008	215,000	90,000
2007	208,000	73,000
2006	198,000	70,500
2005	226,000	67,600
2004	215,000	66,300
2003	220,000	67,200
2002	211,000	63,500
2001	210,000	62,200
2000	201,500	53,700
1999	187,000	51,400
1998	198,500	51,600
1997	205,000	49,200
1996	216,500	45,200
1995	230,000	43,300
1994	246,000	39,800
1993	220,000	44,000
1992	201,400	33,000
1991	174,000	29,000
1990	176,000	25,900
1989	183,000	24,500
1988	181,700	24,600
1987	183,200	23,700
1986	206,000	25,700

Source: National Agricultural Statistics Service - <http://quickstats.nass.usda.gov/results/A504D574-A9E8-3D48-AA61-FD1A28B2E443> and <http://quickstats.nass.usda.gov/results/FF9658AF-4CB9-381A-AB4A-FAEF52171DD0>

Attachment C

Washington State Department of Agriculture Statistics on Cropping Patterns in the Yakima Valley
supplied by Kirk Cook, WSDA

	Acres	# Parcels	Percentage
Corn, Field	48785	1520	16%
CRP/Conservation	38175	291	12%
Apple	33451	1555	11%
Pasture	28514	1442	9%
Wheat	27009	527	9%
Hops	21110	684	7%
Alfalfa Hay	19848	671	6%
Grape, Juice	13882	775	5%
Fallow	10277	824	3%
Mint	9432	319	3%
Cherry	7737	831	3%
Wheat Fallow	7068	58	2%
Grape, Wine	5650	352	2%
Pear	5299	535	2%
GrassHay	4135	265	1%
Alfalfa Grass	3972	204	1%
Asparagus	2344	115	1%
Nectarine/Peach	1847	170	1%
Timothy	1618	32	1%
Dill	1609	38	1%
Sudan Grass	1404	54	
Triticale	1236	29	
Developed	1211	169	
Potato	1187	21	
Market Crops	1107	82	
Green Bean	855	65	
Wildlife Feed	750	17	
Onion	634	26	
Dry Bean	504	12	
Apricot	444	73	
Pepper	430	21	
Nursery Ornamental	426	28	
Barley	410	23	
Driving Range	317	16	

Squash		317	20		
Orchard Nursery		311	20		
Green Manure		289	13		
Oat		272	21		
Plum		261	52		
Sunflower Seed		197	6		
Bluegrass Seed		188	6		
Carrot Seed		183	6		
Pumpkin		182	13		
Sage		156	4		
Alfalfa Seed		136	2		
Cucumber		128	9		
Rye		116	6		
Caneberry		107	6		
Research Station		77	6		
Blueberry		73	9		
Unknown		67	1		
Tomato		61	8		
Sorghum		40	1		
Clover Seed		35	2		
Sugar Beet Seed		32	1		
Corn, Seed		30	1		
Iris		17	3		
Artichoke		16	1		
Poplar		14	3		
Walnut		12	4		
Cantelope		10	1		
Watermelon		8	2		
Nursery		7	2		
Driving Range		6	2		
Christmas Tree		4	1		
Rhubarb		3	1		
Silviculture		3	1		
Green Pea		2	1		
Nursery Lavender		1	1		
Total		306038	12080		

Note: According to the WA State Dept. of Ecology, there were 1,211,127 square meters or 299 acres of manure lagoons in Yakima County in 2003. (Summer PM 2.5 Non-attainment Process)