

PE Well Projections, Consumptive Use Estimates, and Technical Workgroup Update

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Committee Task

1. Project number of new domestic permit exempt wells in the next 20 years.
2. Estimate the amount of indoor and outdoor water used by the domestic permit-exempt wells.
3. Calculate consumptive water use.
4. Develop projects and actions to offset the amount of water calculated in #3 and meet NEB.



Recommendation Document

Ecology published [recommendations for estimating water use](#) by permit-exempt domestic wells in compliance with RCW 90.94.

The methods described here are described in that document, in addition to methods discussed by the technical workgroup.



ESSB 6091 – Streamflow Restoration Recommendations for Water Use Estimates

This document provides the Department of Ecology's recommendations for estimating water use by permit-exempt domestic wells in compliance with the provisions in Engrossed Substitute Senate Bill (ESSB) 6091. The methods described are not rigid requirements, and planning units and watershed restoration and enhancement committees can modify these methods based on credible, location-specific information with Ecology concurrence. Ultimately, restoration plans and plan updates will be judged by two tests: that the total quantity of water consumed by permit-exempt domestic wells is offset, and that a "net ecological benefit" is provided over the subsequent 20 years. Any methods used must be sufficient to allow Ecology to make that determination.

General approach

Permit-exempt domestic wells may be used to supply houses, and in some cases other Equivalent Residential Units (ERUs) such as small apartments. For the purposes of this document, the terms "house" or "home" refer to any permit-exempt domestic groundwater use, including other ERUs.

Interpretation of Law Requirements

Sections 202 and 203 of ESSB 6091 contain several provisions regarding how watershed restoration and enhancement plans and updated watershed plans are to offset or account for projected water use.

Specifically, sections 202(4)(b) and 203 (3)(b) state,

At a minimum, the [watershed] plan must include those actions that the planning units determine to be necessary to offset potential impacts to instream flows associated with permit- exempt domestic water use. The highest priority recommendations must include replacing the quantity of consumptive water use during the same time as the impact and in the same basin or tributary. Lower priority projects include projects not in the same basin or tributary and projects that replace consumptive water supply impacts only during critical flow periods.

Timeframe: To evaluate and offset potential consumptive impacts from permit-exempt domestic wells, a timeframe over which new domestic use will be considered must be designated. Since a "subsequent twenty years" is referenced throughout other sections of ESSB 6091 (such as sections 202(4)(c), 203 (3)(c), 203(3)(d), and 203(3)(e)), Ecology interprets the timeframe for 202(4)(b) and 203 (3)(b) to be the next twenty years.

Scope of "water use": Ecology interprets all projected water use referenced in sections 202(4)(c), 203(3)(c), 203(3)(d), and 203(3)(e) to refer to only consumptive permit-exempt domestic groundwater water use (as opposed to water use associated with municipalities, for example). Ecology's [Initial Policy Interpretations](#) publication provides additional explanation.

Consumptive use: Water Resources Program Policy 1020 (1991) states, "Consumptive water use causes diminishment of the source at the point of appropriation," and that, "Diminishment is defined as to make smaller or less in quantity, quality, rate of flow, or availability." This guidance document is focused on estimating only quantity diminishment, so for the purposes described here, consumptive

Ecology's Suggested Methods for Estimating Number of Future Permit-Exempt Domestic Wells



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1. Conduct GIS analysis of county building permits over time, zoning, and parcel information.
2. Use population data available from WA Office of Financial Management (OFM).
3. Use well log data.



Use Zoning and Parcel Information

- Use GIS data to identify buildable/developable land.
- Overlay zoning information to capture residential density potential.
- Remove areas with municipal/community water systems.
- Determine likelihood of development in the next 20 years based on growth rates.
 - Or, calculate for “full buildout” conditions.



Use Permit Exempt Well Data

1. Segregate data into sub-basins.
2. Evaluate data to estimate number of permit-exempt well permits issued over some previous time period (e.g. past 10 years).
3. Use results to predict permit-exempt domestic wells over subsequent 20-year period.



Modified Permit Exempt Well Data

1. Modification: Segregate data into sub-basins *and water system service areas*.
2. Evaluate data to estimate number of permit-exempt well permits issued over some previous time period (e.g. past 10 years).
3. Use results to predict permit-exempt domestic wells over subsequent 20-year period within and outside of water service areas.



Indoor Water Use

- Average about 50-60 gallons per day (gpd) per person.
 - Homes on municipal water generally use less water.
 - Assumption of 60 gpd per person is reasonable for indoor water use.



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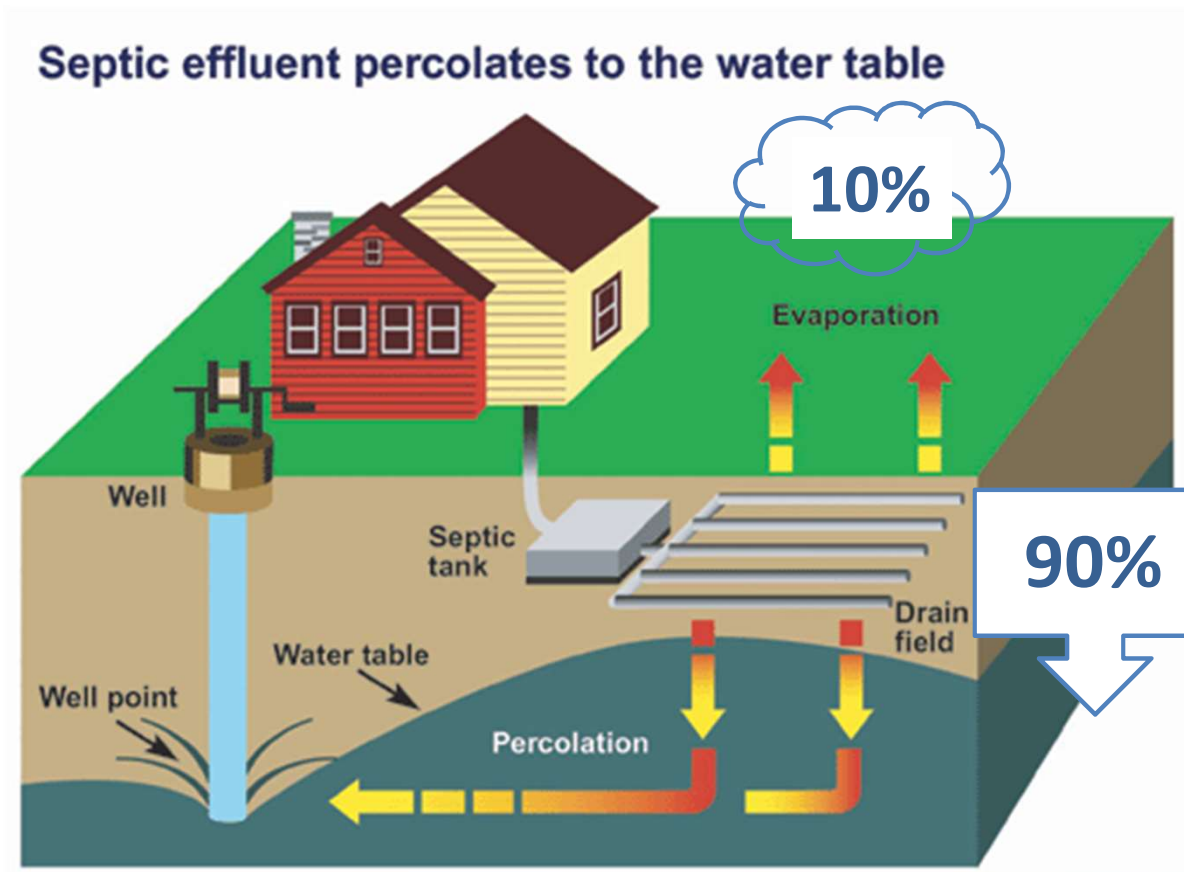




Consumptive Water:

Water that is evaporated, transpired, consumed by humans, or otherwise removed from an immediate water environment.

Indoor Consumptive Use



Household Consumptive Indoor Water Use Assumptions

Assumptions:

- 2.5 people per household.
- 60 gpd per person water use.
- 10% of indoor water use is consumptive.



Household Consumptive Indoor Water Use Calculations

Annual household consumptive indoor water use equals:

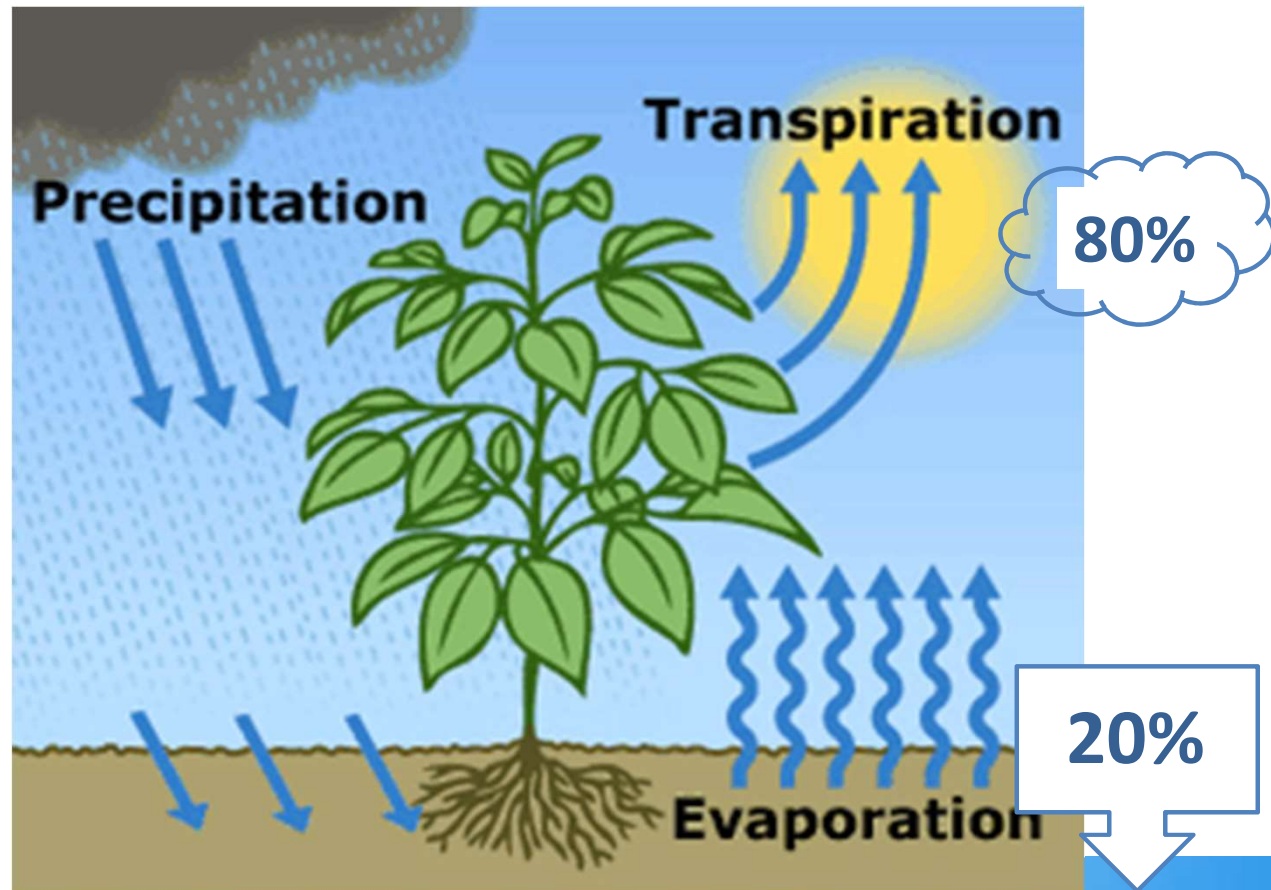
$$60 \text{ gpd} \times 2.5 \text{ people/house} \times 365 \text{ days} \times 3.07 \text{ (10}^{-6}\text{)AF/gal.} \times 10\% \\ = \mathbf{0.017 \text{ AF/YR}}$$



Outdoor Water Use



Outdoor Consumptive Use



Household Consumptive Outdoor Water Use Assumptions

Assumptions:

- 0.4 acre outdoor watering area.
- Irrigation requirements for turf grass
- 75% efficiency.
- 80% consumptive use.



Household Consumptive Outdoor Water Use Calculations

Irrigation requirements for turf grass:

$$11.11 \text{ in.}/12 \text{ in./ft.} \times 0.4 \text{ acres} = 0.37 \text{ AF/YR}$$

Accounting for sprinkler efficiency:

$$0.37 \text{ AF/YR} \div 75\% = 0.49 \text{ AF/YR}$$

Total Household Consumptive Outdoor Water Use:

$$0.49 \text{ AF/YR} \times 80\% = \mathbf{0.39 \text{ AF/YR}}$$



Average Household Total Consumptive Water Use

- Indoor consumptive use + outdoor consumptive use = total consumptive water use per well/connection.

$$\begin{array}{c} 0.017 \\ \text{AF/YR} \end{array} + \begin{array}{c} 0.39 \\ \text{AF/YR} \end{array} = \begin{array}{c} 0.407 \\ \text{AF/YR} \end{array}$$



Total Consumptive Water Use

- Total annual consumptive water use per well or well connection X total number of future PE wells = amount of water to offset in our plan.

$$\begin{array}{ccccc} \text{0.407} & & & & \\ \text{AF/YR} & \times & \text{\# PE} & = & \text{Offset} \\ & & \text{Wells} & & \text{Goal} \end{array}$$



WRIA 1 Example



WRIA 1 Well Projection

WRIA 1 used comprehensive plan growth projections for rural growth outside of UGA's, then made adjustments for public water system capacity.



METHODS USED

RH2 used the population data provided by BERK to estimate the number of new DGWPE connections over the next 20 years. BERK identified that between 2018 and 2038, there will need to be sufficient new housing units to accommodate a population increase of 8,163 outside of the established Urban Growth Areas (UGAs) in Whatcom County, using the adopted comprehensive plan growth projection. The adopted growth projection distributes the future population between urban and rural areas by allocating specific shares of growth to urban areas (UGAs) and less to rural areas (non-UGAs) (84 percent urban and 16 percent rural). This

Table 3
Options for Total Projected New Housing Units (outside UGAs) by Aggregated Sub-Basin, 2018 through 2038, Served by DGWPE Wells

Aggregated Sub-Basin	Option 1 All Growth outside UGAs	Option 2 Considering Public Water System Service Areas	Option 3 Historic Ratio*	Option 4 Highest of Options 2 and 3	Option 5 Option 3 Plus 15 Percent
1 - Coastal North	1,017	594	563	594	647
2 - Coastal South	351	241	177	241	204
3 - Coastal West	328	290	276	290	317
4 - Lake Whatcom	205	13	145	145	167
5 - Lower Nooksack	915	495	561	561	645
6 - Middle Fork Nooksack	9	9	9	9	9
7 - North Fork Nooksack	212	126	78	126	90
8 - South Fork Nooksack	27	20	22	22	25
9 - Sumas	196	162	129	162	148
Total	3,260	1,950	1,960	2,150	2,252
* Historic ratio of non-UGA growth served by DGWPE wells vs. water systems.					

WRIA 1 Outdoor Use Estimate

WRIA 1 calculated irrigated footprint of representative sample of domestic lots developed 2000 - 2014 to estimate outside lawn and garden irrigation requirements by subbasin.



Table 4
**Irrigated Acreage Analysis on Whatcom County Single-Family Homes Served by DGWPE Wells;
Building Permits Issued 2000 through 2014**

Aggregated Sub-Basin	Building Permits	Analyzed for Irrigated Area	Percent Analyzed
1 - Coastal North	440	57	13%
2 - Coastal South	192	53	28%
3 - Coastal West	107	59	55%
4 - Lake Whatcom	135	67	50%
5 - Lower Nooksack	672	63	9%
6 - Middle Fork Nooksack	9	9	100%
7 - North Fork Nooksack	148	66	45%
8 - South Fork Nooksack	29	29	100%
9 - Sumas	106	62	58%
Total	1,838	465	25%

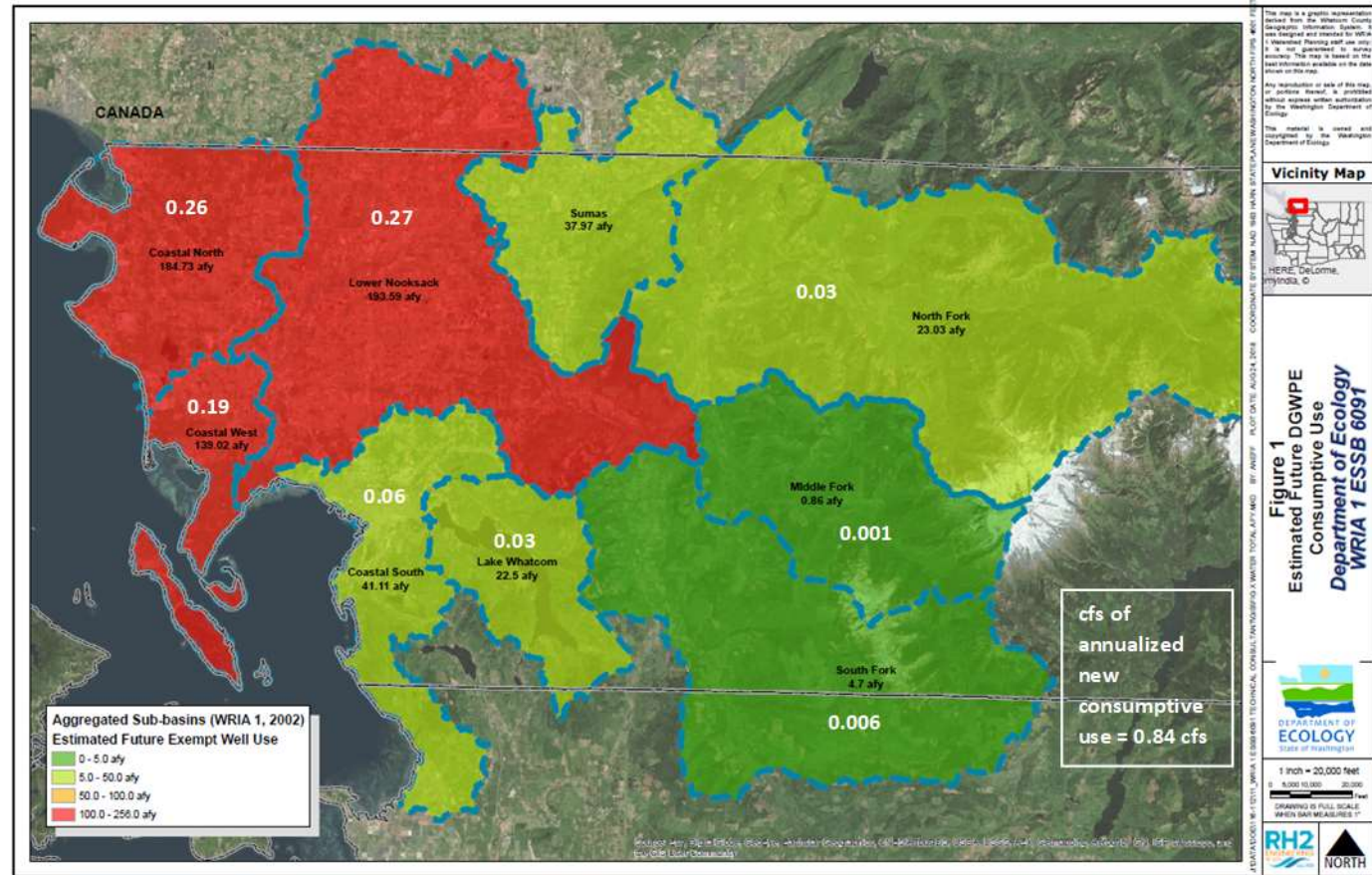
The aerial photo used in this analysis was from July 2017 (summer, when irrigation is expected most), and the area irrigated was calculated by creating polygons around the areas believed to be irrigated. Irrigated areas were identified as either those areas that appeared to have actively growing vegetation (a green color) or as gardens. Google Earth Pro was used to create the polygons, and ESRI's ArcMAP was used to calculate the area and correlate the areas to the aggregated sub-basins.

ESSB 6091 WRIA 1 (Whatcom and Skagit County) Future Use (2018 through 2038) Scenarios and Calculated Total Consumptive Water Use													
New DGWPE Served Home Options			Aggregated Subbasins									Total Homes	
			1 - Coastal North	2 - Coastal South	3 - Coastal West	4 - Lake Whatcom	5 - Lower Nooksack	6 - Middle Fork Nooksack	7 - North Fork Nooksack	8 - South Fork Nooksack	9 - Sumas		
Option 1: Total Homes Outside UGA - BERK data			1,017	351	328	205	915	9	212	27	196	3,260	
Option 2: All Water Districts and avail. Water Assoc. provide water			594	241	290	13	495	9	126	20	162	1,950	
Option 3: Historic (2000-2014) Ratio			563	177	276	145	561	9	78	22	129	1,960	
Option 4: Take the larger number from Options 2 & 3			594	241	290	145	561	9	126	22	162	2,150	
Option 5: Take Option 3 and apply buffer/ factor of safety (15%)			647	204	317	167	645	9	90	25	148	2,252	
Scenario	Square Feet Irrigated	Acres Irrigated	Option	Aggregated Subbasin Household Total Consumptive Water Use (acre-feet per year)									Total (acre-feet per year)
1	0	0.000	1	17.50	6.04	5.64	3.53	15.74	0.15	3.65	56.09		
			2	10.22	4.15	4.99	0.22	8.52	0.15	2.17	33.55		
			3	9.69	3.05	4.75	2.49	9.65	0.15	1.34	33.72		
			4	10.22	4.15	4.99	2.49	9.65	0.15	2.17	36.99		
			5	11.13	3.51	5.45	2.87	11.10	0.15	1.55	38.75		
2	2,500	0.057	1	98.80	32.57	32.69	18.18	85.26	0.78	18.47	306.18		
			2	57.71	22.36	28.90	1.15	46.12	0.78	10.98	183.87		
3	5,625	0.128									184.49		
											201.90		
											211.99		
											618.79		
											371.76		
4	Variable by Subbasin	Variable by Subbasin									372.95		
											408.02		
											428.53		
											972.27		
											603.82		
5A	21,750 & excess at ~68% using 3,000 gpd	0.500									603.73		
											647.51		
											693.80		
											7,452.50		
											4,460.81		
5B	21,750 & excess at ~68% using 3,000 gpd	0.500									4,482.37		
											4,914.70		
											5,150.18		
											2,234.85		
											1,343.08		
6	21,780 & excess at ~68% consumptive using 5,000 gpd	0.500	3	401.01	119.01	203.01	92.79	380.95	5.64	48.83	1,347.22		
			4	423.94	162.06	213.31	92.79	380.95	5.64	78.91	1,473.61		
			5	461.76	137.06	233.17	106.87	437.99	5.64	56.36	1,547.98		
			1	3,899.04	1,334.87	1,262.92	773.07	3,482.33	33.82	796.72	12,420.83		
			2	2,277.32	916.53	1,116.61	49.02	1,883.88	33.82	473.52	7,434.68		
Scenario 4	Acres Irrigated by Subbasin			0.211	0.116	0.322	0.111	0.248	0.064	0.136	0.161	0.178	
Scenario Descriptions:													
Scenario 1 One home and no outdoor irrigation													
Scenario 2 One home and 50'x50' outdoor irrigation													
Scenario 3 One home and 75'x75' outdoor irrigation													
Scenario 4 One home and results of irrigated acreage analysis by aggregated subbasin (modified mean)													
Scenario 5A 3,000 gpd used for one home and 1/2 acre (66'x330') outdoor irrigation, using WST and PU recommended consumptive use ratios (approximately 68 percent) on excess water													
Scenario 5B One home and 1/2 acre of outdoor irrigation, using strictly Ecology guidance for consumptive use													
Scenario 6 5,000 gpd used for one home and 1/2 acre (66'x330') outdoor irrigation, using WST and PU recommended consumptive use ratios (approximately 68 percent) on excess water													

WRIA 1 calculated suite of potential outcomes based on a matrix of possible irrigation scenarios.

WRIA 1 Offsets

WRIA 1 concluded consumptive use from new domestic uses over 20-year horizon will likely be about 647 AF/year (equal to about 0.9 cfs), apportioned out by subbasin based on expected new well locations.



A photograph of a forest stream with moss-covered branches and dense vegetation. The stream flows through a lush, green forest. The banks are covered in moss and ferns. The water is clear and flows over rocks. The overall scene is a serene, natural landscape.

Questions and Discussion

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