

Groundwater Management Plan

Appendix A

Table of Management Actions

City of Bainbridge Island Groundwater Management Plan Actions

Actions	Objective	Description	Benefits	Action Category	Notes	Planning Horizon	Work Plan	Cost (thousands; supplemental to base cost for 1 FTE @ \$150K annual)	Cost/Benefit Analysis Year 0-6)
Promote Water Conservation	Water usage is reduced, leading to improved aquifer health and longevity, preservation of natural environments, and postponement of the need for infrastructure expansion.	This action involves developing and promoting water conservation, which will minimize water wasting and leakage, improve water use efficiency, and potentially increase recycling and reuse of water. Programs could include measures to change behavior, adopt water-saving technologies, and improve water management practices.	Water conservation will result in reducing energy consumption, lowering water bills, protecting ecosystems, and mitigating the impacts of drought and water shortages. It also helps to maintain the health of aquatic habitats in wetlands and streams. Conservation can lower peak daily demand deferring the need for additional storage.	Proactive	The City has a water conservation plan that was included as part of the Water System Plan, developed in 2015. This plan provides a foundation for expanded conservation efforts.	Year 0-3	<ul style="list-style-type: none"> Update the water conservation plan outlined in the Water System Plan Develop a water conservation goal Develop and implement water conservation public outreach plan Evaluate past conservation measures for effectiveness Evaluate conservation impacts on water rates Develop "soft" and "hard" measures; pilot soft measures 	\$20	8.00
						Year 4-6	<ul style="list-style-type: none"> Analyze metrics to measure success of the soft strategies Pilot hard measures Implement rate changes to reflect conservation targets 	\$23	
						Year 7-10	<ul style="list-style-type: none"> Adaptively manage conservation plan and modify as needed 	\$26	
Enhance Storm and Surface Water Management	Storm and surface water quality and quantities are not damaging to the natural environment, and do not negatively impact groundwater.	This action involves increasing the use the Low Impact Development (LID) in new construction and existing development and ensuring Best Management Practices (BMPs) are implemented at all facilities handling, using and storing hazardous materials	Managing storm and surface water will result in the protection of streams and creeks, including related habitats, postponing the need for infrastructure replacement and/or expansion, and preventing groundwater contamination.	Proactive	The City has a storm and surface water program that can be tailored or adjusted to meet the needs associated with groundwater protection.	Year 0-3	<ul style="list-style-type: none"> Continue to implement source control and IDDE program with a focus on wellhead protection areas and priority recharge areas. Consider rebate/incentive program to improve retrofit/mitigation implementation. 	\$50	7.00
						Year 4-6	<ul style="list-style-type: none"> Examine the current Low Impact Design requirements for stormwater mitigation during development with a focus on clean groundwater recharge. Create a program to incentivize retrofits to mitigate runoff from existing development. 	\$50	
						Year 7-10	<ul style="list-style-type: none"> If needed, refine regulations to improve developed sites' ability to match preexisting hydrology using LID, considering new climate data. 	\$25	
Promote Rainwater Harvesting	Harvested rainwater is readily available to supplement household use for irrigation and emergency purposes.	This action involves promoting the creation of rainwater harvesting through rain barrels and other means for use as a supplemental source of water - primarily for households but also potentially for smaller commercial uses.	Integrating rainwater harvesting could help diversify water sources, reduce pressure on vulnerable aquifers, and enhance resilience to climate change, population growth, and potential future water scarcity.	Proactive	In 2009, Ecology issued a rainwater use interpretive policy, which clarifies that you may use water collected from your rooftop without a water right permit.	Year 0-3	<ul style="list-style-type: none"> Develop a policy on rainwater harvesting Develop promotional incentives and educational opportunities for the installation of household rain barrels Consider implementing rainwater harvesting at City facilities 	\$50	7.00
						Year 4-6	<ul style="list-style-type: none"> Continue expanding the rain barrel program to small commercial uses 	\$25	
						Year 7-10	<ul style="list-style-type: none"> TBD 	\$25	
Spacially Diversify Production Wells	Large water systems in the City are reliant upon wells that provide long-term stability and sustainability for the related aquifers.	This action involves shifting new large production wells further north on island to spread out groundwater extraction and provide longer-term sources for South Island users.	Spreading out production wells will result in relieving the pressure on certain groundwater systems, and preventing excessive drawdown, saltwater intrusion, and impacts to surface water environments.	Proactive	This action should be considered as part of a consolidated effort with other management actions, including the evaluation of interties and increases in water storage.	Year 0-3	<ul style="list-style-type: none"> Perform evaluation of production well options and cost/benefit along with study of intertie options 	\$50	6.00
						Year 4-6	<ul style="list-style-type: none"> Near the end of this planning horizon, begin evaluation of well siting costs and inter-agency agreements 	\$200	
						Year 7-10	<ul style="list-style-type: none"> Complete evaluation of well siting costs and inter-agency agreements; Consider potential for new production well implementation 	\$100	
Intertie and Coordinate Operations and Management with KPUD Systems	Large water systems in the City are connected north to south with a series of interties.	This action involves coordinating management (withdrawals, distribution, and monitoring) with KPUD and potentially other water systems on the Island.	Implementing water system interties will result in environmental and economic benefits, shared resources and information, and co-management of surface and groundwater resources on the island.	Proactive	This action should be considered as part of a consolidated effort with other management actions, including the evaluation of spreading out production wells and increases in water storage.	Year 0-3	<ul style="list-style-type: none"> Complete a formal cost/benefit analysis and evaluation of intertie options and consider costs as part of 2027-28 utility rate study 	\$50	6.00
						Year 4-6	<ul style="list-style-type: none"> Consider recommendations from analysis and evaluation in the planning and funding of intertie projects; design project 	\$200	
						Year 7-10	<ul style="list-style-type: none"> Complete at least one intertie project 	\$500	

Consolidate Smaller Water Systems with Larger Systems	Small water systems are systematically integrated into larger systems over time.	This action involves working to identify small water systems that could incorporate with nearby large public water systems. This would require extension of water lines, installation of meters and connections and decommissioning wells.	Consolidating water systems will result in improved operational efficiency, add enhanced financial stability through economies of scale, leading to lower per-customer costs and the ability to invest in infrastructure improvements and alternative water sources.	Proactive	A systematic approach to consolidation would allow for grant procurement, and would prevent the need for last-minute management agreements or isolated water system ownership.	Year 0-3	<ul style="list-style-type: none"> Complete Water System Business Plan and begin outreach to priority neighborhoods and/or water systems regarding potential consolidation Consider expansion/consolidation costs as part of 2027-28 utility rate study 	\$50	6.00
						Year 4-6	<ul style="list-style-type: none"> Plan and design near-term expansions/ consolidations 	\$200	
						Year 7-10	<ul style="list-style-type: none"> Implement priority expansions/consolidations 	\$1,000	
Increase Storage for Municipal Water	Large water systems in the City have coordinated storage systems that meet demand.	This action involves increasing storage volume for the municipal water systems to be able to provide enough water during peak demand. This could help spread out withdrawals and costs over a longer time period.	Increasing storage volume in the municipal water system provides several key benefits, including improving water pressure and availability, reducing peak demand costs, and enhancing emergency preparedness.	Proactive	This action should be considered as part of a consolidated effort with other management actions, including the evaluation of spreading out production wells and implementing water system inerties.	Year 0-3	<ul style="list-style-type: none"> Study storage issues/benefits as part of evaluation of intertie coordination 	\$50	6.00
						Year 4-6	<ul style="list-style-type: none"> Study storage issues/benefits as part of evaluation of intertie coordination; consider storage needs resulting from potential new production wells 	\$200	
						Year 7-10	<ul style="list-style-type: none"> Consider implementation of storage facility resulting from new production wells 	TBD	
Pursue Managed Aquifer Recharge	Aquifer recharge opportunities are implemented in critical and available locations.	This action involves surface infiltration or injection directly into prioritized aquifers for later recovery. Source water for recharge could include stormwater, reclaimed water, and treated drinking water.	Aquifer recharge could augment stream baseflow, prevent seawater intrusion, increase recharge, and mitigate drawdown in aquifers.	Proactive	Reference Watershed Assessment of Manzanita as a template.	Year 0-3	<ul style="list-style-type: none"> Implement the Manzanita Stormwater Recharge Park project, and identify other potential projects within the Manzanita watershed for implementation. Coordinate work with projects and offset goals identified in the WRIA 15 Streamflow Restoration Plan. 	\$1,200 (grant received)	6.00
						Year 4-6	<ul style="list-style-type: none"> Expand the model of the Manzanita Watershed project to at least 2 additional priority watersheds. 	\$250	
						Year 7-10	<ul style="list-style-type: none"> Identify and implement priority projects from watershed analyses. 	TBD	
Provide Public Education and Involvement	The public is informed on the wise use of water resources and has a broadened interest in water-related environmental protection.	This action involves development and promoting public involvement/education programs to increase public awareness and participation in groundwater management monitoring, protection and use.	Public education and involvement will result in increased awareness of water conservation, greater community support for sustainable practices, and improved water quality. Educating the public empowers individuals to adopt sustainable habits, participate in decision-making processes, and advocate for environmental protection.	Prevention	Programs should target all age groups, and be tailored to user types.	Year 0-3	<ul style="list-style-type: none"> Develop a public education and involvement plan; consider the needs of other plan actions. Choose 1 audience per year for specific outreach material development. Implement a web-based dashboard to increase data transparency 	\$20	4.00
						Year 4-6	<ul style="list-style-type: none"> Analyze metrics to measure success of the outreach strategies 	\$23	
						Year 7-10	<ul style="list-style-type: none"> Adaptively manage the public education and involvement plan and modify as needed 	\$26	
Evaluate Limiting New Wells in Shallow Aquifer	Well limitations in specific areas relieve stress on streams and wetlands during the low flow season.	This action involves evaluating locations and depths where wells should be restricted, and/or where new wells should be at deeper depths.	Restricting some wells will improve conditions for streamflow, riparian habitat, salmonids and other wildlife	Prevention	Any restrictions could be based on existing state-level "Instream flow rules," water management act and ARPA in the Critical Areas Ordinance.	Year 0-3	<ul style="list-style-type: none"> Examine the process undertaken in the Chimacum watershed to protect instream flows and its relationship to the situation on Bainbridge Island. 	\$25	4.00
						Year 4-6	<ul style="list-style-type: none"> Develop policy 	\$25	
						Year 7-10	<ul style="list-style-type: none"> Implement policy 	\$52	

Develop Seawater Intrusion Mitigation Strategies	Indications of seawater intrusion are observed early, and mitigation strategies are in place to assist impacted well owners.	This action involves developing policies and management actions to address potential impacts from seawater intrusion.	Having a plan for addressing seawater intrusion will benefit homeowners or other well owners, and could provide advanced notice to large water purveyors regarding potential infrastructure expansion needs.	Prevention	One formal response to seawater intrusion has been completed in the Seabold neighborhood. Further investigation may be warranted north and east of the previous extent.	Year 0-3	<ul style="list-style-type: none"> Review and refine the City's policy for responding to a suspected saltwater intrusion event based on previous investigations. 	\$0	4.00
						Year 4-6	<ul style="list-style-type: none"> Develop policy for the City's response to a neighborhood scale intrusion event. Include in policy the process to protect water quality in existing wells from new nearby extraction (possibly similar to Island or San Juan Counties). Work with KPHD to define roles and responsibilities. 	\$20	
						Year 7-10	<ul style="list-style-type: none"> Collaborate with KPUD and other major water purveyors to prepare for policy implementation, as needed. 	\$20	
Manage and Expand Surface Water Monitoring, Including Metering	The City can identify surface water trends and risks with a wide and continually expanding surface water database.	This action involves managing and expanding the existing surface water monitoring program through prioritization of surface water locations and variables, and the deployment of monitoring equipment. In addition, permit-exempt wells are not required to monitor their water use. Without this data is impossible to know how much water is being used on the Island.	Managing and expanding the existing surface water monitoring program will result in the ability to effectively manage island surface water resources, such as streamflow, riparian habitat and salmonid and other wildlife habitat.	Data Collection	This program can provide data for future surface/groundwater interaction modeling, including generating streamflow characteristics. The results from this program can also help inform potential land use regulations. Meters help system managers track the effectiveness of efficiency programs and monitor water loss through leaks.	Year 0-3	<ul style="list-style-type: none"> Analyze the existing surface water monitoring program to identify data gaps and quality of current data sources from the current 5 automated flow gauging stations; Springbrook, Cooper, Ravine, Doe Qud Sake Qub (AKA Murden), and Manzanita Creeks (managed by KPUD). Work with Ecology to review other metering programs, success and failures. 	\$22	4.00
						Year 4-6	<ul style="list-style-type: none"> Develop a plan to expand the surface water monitoring program based on watersheds with greatest modeled impacts and highest priority resources. Possible streams include Dripping Water, Schel Chelb and Mac's Dam creeks and others that coincide with monitoring work by USGS in 2007/2008. Develop a program to subsidize metering hardware and organize metering data. 	\$25	
						Year 7-10	<ul style="list-style-type: none"> Implement an expansion of the surface water monitoring program with automated stream gauging stations in up to 5 new perennial fish bearing streams. Solicit volunteer water users to meter and report their use. 	\$50	
Reform Critical Area Aquifer Recharge Area Codes	Critical groundwater recharge areas are protected from development impacts.	This action involves evaluating land-use impacts and potential mitigation strategies in key watershed and groundwater recharge areas.	Identifying groundwater recharge protection areas will result in protecting shallow groundwater and surface waters on the island in the short-term, and will protect deep aquifers in the long-term.	Prevention	Some level of work on this effort was performed in 2018 as part of the development of the aquifer recharge protection area regulations. This program should include re-evaluating that work, and also identifying potential off-island areas that could also be protected through work with partner agencies.	Year 0-3	<ul style="list-style-type: none"> Building on existing data from the GWMP and the Beneficial Re-use Study, develop a prioritization of recharge protection areas. Evaluate effectiveness of the current Aquifer Recharge Protection Area regulations (BIMC 16.20.100). 	\$50	3.00
						Year 4-6	<ul style="list-style-type: none"> Develop potential land-use changes or other regulations that would implement protection for critical recharge protection areas Consider implementation as part of the Comprehensive Plan mid-term review process 	\$150	
						Year 7-10	<ul style="list-style-type: none"> TBD 	TBD	
Support Septic System Monitoring	All septic system are recharging the aquifer with treated water to the maximum extent possible.	Not all on-site septic systems (OSS) require regular monitoring by KPHD so it is unclear if all systems are working as designed.	By expanding monitoring requirements more OSSs that are not functioning as designed would be corrected and the quantity of treated recharge would be improved.	Prevention	Similar work is being undertaken in Pierce County and could be a model to review and emulate.	Year 0-3	<ul style="list-style-type: none"> Review programs at neighboring jurisdictions that are already piloting this action. 	\$20	2.83
						Year 4-6	<ul style="list-style-type: none"> Work with KPHD to develop regulations that require periodic inspections of all OSS. 	\$50	
						Year 7-10	<ul style="list-style-type: none"> Work with KPHD to implement the regulations and track progress. 	TBD	
Manage and Expand Existing Groundwater Well Monitoring Program	The City can identify groundwater trends and risks with a wide and continually expanding groundwater database.	This action involves managing and expanding the existing groundwater well monitoring program through outreach to existing well owners and deployment of monitoring equipment.	Managing and expanding the existing groundwater well monitoring program will result in identifying trends and potential risks, and allowing for more regular updates to the groundwater model.	Data Collection	The program should consider locating new monitoring wells with GPS, connect well logs, aquifer IDs, pumping rates, water levels, and quality data. Consider manual vs automated level logging.	Year 0-3	<ul style="list-style-type: none"> Maintain existing monitoring well locations where changes in ownership have occurred Develop and manage an outreach and implementation program aimed at encouraging the installation of monitoring equipment on private wells in highest priority areas. Goal is to add 5 new monitoring wells to the monitoring network, from preexisting sources, in the Perched and Sea Level aquifers. 	\$10	2.67
						Year 4-6	<ul style="list-style-type: none"> Expand existing well monitoring program by up to 3 wells per year; 	\$12	
						Year 7-10	<ul style="list-style-type: none"> Expand existing well monitoring program by up to 3 wells per year or until target number is reached Begin expanding monitoring program into secondary prioritization areas. 	\$15	

Update the Groundwater Model, Test New Scenarios	The City has access to an up-to-date groundwater model that can be used to evaluate current and future conditions.	This action involves updating the groundwater model with the most recently collected data, and running planning scenarios.	Updating the groundwater model and testing new scenarios will result in benefits such as informing policy development and data collection strategies, and identifying risk-management actions.	Information Management	Model scenarios could be used to assess the best locations for new wells or other potential projects such as managed aquifer recharge.	Year 0-3	• No action	\$0	2.00
						Year 4-6	• At year 6 run 5-10-year modeling scenarios using new data captured from expansion of well monitoring and new monitoring wells • include information from observed and newly predicted conditions	\$35	
						Year 7-10	• At year 9 run 5-10-year modeling scenarios using new data captured from expansion of well monitoring and new monitoring wells • Include information from observed and newly predicted conditions. • Recalibrate model based on new well reports and monitoring data. Revisit recharge variables based on best available science.	\$40	
Install New Groundwater Monitoring Wells	The City has access to monitoring wells in critical locations.	This action involves expanding the groundwater monitoring network in priority locations and depths to verify model results and identify potential risks.	Installing new monitoring wells will result in comprehensive data collection and management that is critical to effectively managing island groundwater resources and avoiding degradation of the aquifer system.	Data Collection	Existing wells that can be monitored in priority locations is preferred over the expense of new wells.	Year 0-3	• Identify possible locations for new monitoring wells.	\$10	1.67
						Year 4-6	• Install 1 new monitoring well in the Fletcher Bay aquifer.	\$400	
						Year 7-10	• Install 1 new monitoring well in the Glaciomarine aquifer.	\$500	
Evaluate and Implement Reclaimed Water Use	Wastewater is re-used in lieu of being discharged to Puget Sound.	This action involves processing wastewater from the Winslow Wastewater Treatment Plant for re-use in the Winslow area for groundwater recharge, irrigation and other non-potable uses.	Beneficial reuse of wastewater offers several benefits, including drought resilience, reduced reliance on freshwater sources, and support for agriculture and other non-potable uses. It also helps protect ecosystems by reducing the discharge of treated water into Puget Sound.	Proactive	The City is currently working on a preliminary concept for wastewater beneficial re-use that would serve as irrigation and potentially groundwater recharge.	Year 0-3	• Continue with ongoing wastewater beneficial re-use study and field investigations; Develop 30% design. • Begin discussions on agreements with high water users for re-use substitution.	\$500	1.25
						Year 4-6	• Complete 100% design of re-use infrastructure.	\$1,000	
						Year 7-10	• Implementation	TBD	