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Technical Proposal and Evaluation Criteria

1. Executive summary

Due: October 30, 2019

Applicant: Washington State University, PI: Alexandra (Richey) McLarty

City/County/State: Pullman/Whitman/Washington

The goal of the proposed work is to establish a long-term, stakeholder driven groundwater monitoring network in Eastern Washington. We propose to train conservation districts and water systems to monitor their groundwater levels, following protocol established by the Department of Ecology such that the data collected can be uploaded into Ecology's primary database, the Environmental Management System (EIM). EIM is the main groundwater data repository that supports decision making about water management as well as academic studies and any other public use for groundwater levels. Federal funds are primarily being requested to support personnel and travel time at conservation districts to conduct groundwater monitoring, in addition to equipment costs to provide project partners with the necessary monitoring tools. Some funds are requested for project administration and results analysis. Cost-share contributions are provided as in-kind contributions from multiple state agencies, a conservation district, and the project team. The proposed work meets the FOA's goal to "develop hydrologic information and water management tools" that will support improved modeling and forecasting. By increasing the availability of high-quality groundwater level data, more informed decisions can be made to ensure water supply reliability, drought management, conjunctive use of ground and surface water, water rights administration, and conservation and efficiency. The project duration is three years, ending at the end of summer 2023. The proposed project is not located on a Federal facility.

2. Technical project description and milestones

The primary outcome of the proposed work is a set of groundwater level monitoring data to supplement the existing monitoring data collected by the Department of Ecology. The primary objective is to train regional stakeholders to monitor their own groundwater levels, specifically at water systems and conservation districts. Training local stakeholders allows for a more sustained monitoring program than if project team members alone conducted the monitoring within a finite project period.

The project will identify a minimum of 50 groundwater monitoring well locations in areas with known or suspected declines in aquifer water levels, provide training and equipment to conservation districts and water systems. We will target two wells in each of the 27 conservation districts in the study area and five water systems. A groundwater monitoring program will be developed that includes field data collection, and long-term data management. Project data will be stored in Ecology's Environmental Information Management (EIM) System and will be required to adhere to field data collection procedures and data quality objectives specified in an Ecology-approved project-specific quality assurance project plan (QAPP). The QAPP will include minimum data requirements for inclusion in Ecology's EIM database for long-term data management. The proposed work will also produce publicly available GIS layers of aquifer extent and depth for the primary groundwater formations in the study area by querying well logs, geology logs, additional public data sources, and expert opinion.

The proposal team is a Category B applicant (university-led) and is partnering with the Department of Ecology’s Office of Columbia River (OCR) as the primary Category A partner (see Letter of Participation, T. Tebb). The Department of Ecology is the state agency responsible for administering and managing water rights for both surface and groundwater in Washington, as well as maintaining a long-term groundwater monitoring network. Revised Code of Washington (RCW) 90.90 was passed in 2006 and created OCR as a water supply development program to “aggressively pursue the development of water supplies to benefit both instream and out-of-stream uses.” OCR is responsible for allocating and developing water supplies in Eastern Washington, but is required to do a thorough evaluation of any new proposed storage facilities. The evaluation includes estimating water use, required water quantify, benefits and costs, and alternative water supply methods. RCW 90.90.040 legislatively mandates the completion of a “Long-term water supply and demand forecast” every five years starting in 2006 to create a water supply inventory for present and future needs. The “Forecast” is used to support new water supply development and to understand how water is being used in Eastern Washington.

Since 2006, Washington State University (WSU, the applicant) has led the completion of the forecast project. The 2006 and 2011 reports focused exclusively on surface water supply and demand. Groundwater was included in 2016 as a Module to Inform Key Policy Issues (Hall et al., 2016). The groundwater module conducted a trend analysis in 10 known declining groundwater areas, or “hot spots” using readily available data (Figure 1). Lead PI Richey and Co-I Turk or co-leads on the 2021 Forecast groundwater module. Co-I Padowski is the lead for the municipal demand module within the 2021 Forecast, focused on understanding water use and availability at a municipal level. Most of the water systems within the study domain exclusively use groundwater to meet their water supply needs. Therefore, the proposed work is directly building on the Forecast project, ensuring the results will be used by OCR, the primary Category A partner.

The 2021 groundwater module will build on 2016 by identifying and coordinating additional sources of groundwater level data beyond the Department of Ecology wells, for example through other state agencies that do or could collect groundwater data. It will also include a pilot monitoring program to establish 50 new monitoring sites. However, these monitoring sites will be monitored by project personnel within the Forecast duration and are therefore not sustainable to support long-term monitoring. The proposed work will train local stakeholders to take their own groundwater level measurements and will supply them with the equipment to continue doing so beyond the project duration. By training project participants on the appropriate data upload protocol, the collected data can continue to be utilized for long-term planning and management both by the Department of Ecology and other entities that use the EIM database. The collected data at ~50 sites will supplement the 50 sites from the Forecast to double the new monitoring capacity.

Five tasks are proposed that complete the full project cycle:

Task 1 – Logistics

Task 1.1. Determine well suitability – *Milestone: complete a list of wells that meet the necessary criteria for monitoring*

Task 1.2. Conduct outreach for volunteer monitors – *Milestone: compile a list of volunteer monitors within the well suitability list*

Task 2 – Data collection

Task 2.1. Water level monitoring training – *Milestone: complete annual water level monitoring training, grouped by conservation district regions*

Task 2.2. Site detail check – *Milestone: project team visit to participating wells to confirm monitoring site details for EIM quality control*

Task 2.3. Groundwater level collection – *Milestone: conservation district monitoring partners collect spring and fall water level measurements; water system partners collect monthly or seasonal measurements*

Task 3 – GIS mapping

Task 3.1. Analyze well and geology logs within the study area – *Milestone: complete analysis of available lithology information*

Task 3.2. Build lithologic layers in GIS – *Milestone: compile lithology information (spatial extent and depth) into a GIS database*

Task 3.3. QA/QC – *Milestone: finalize quality assurance/quality control on GIS lithologic layers*

Task 4 – Analysis

Task 4.1. Overall trend analysis – *Milestone: complete an overall trend analysis including study wells and Forecast wells*

Task 4.2. Analysis by aquifer layer – *Milestone: complete a trend analysis of the study wells and Forecast wells using the aquifer layers developed in Task 3*

Task 5 – Dissemination

Task 5.1. Final report – *Milestone: complete a final report on the study wells*

Task 5.2. Dissemination events – *Milestone: host dissemination events in each conservation district region*

Table 1. Project Gantt chart by task for each project quarter (Q). Milestones are achieved where the black dot marks the end of the project tasks.

	Year 1				Year 2				Year 3			
Tasks	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1.1	•											
1.2												
1.3		•										
2.1			•									
2.2				•								•
3.1						•						
3.2								•				
3.3										•		
4.1											•	
4.2												•
5.1												•
5.2												•

3. Project location

The project is located in Eastern Washington, east of the Cascade Mountain Range. Figure 1 highlights the study area in yellow. It is broken up into the conservation districts that sit within Eastern Washington. The majority of the study area sits within the Columbia Plateau Regional Aquifer System (CPRAS), with the exception of the northern portions of Okanogan, Ferry, Stevens

County, and Pend Oreille conservation districts. The CPRAS is approximately 44,000 square miles (mi²) of multilayered basalt, sitting in the heart of the Columbia River Basin. The complex geology of the CPRAS, limited natural recharge and regional importance of groundwater makes it a challenging yet crucially important system to study. The majority of agricultural production in the Pacific Northwest occurs not just within the Columbia River Basin, but within the CPRAS as well. Overlying the aquifer, the U.S. Bureau of Reclamation’s Columbia Basin Project (CBP) has brought Columbia River water to 671,000 acres of the originally planned 1.2 million acres of irrigated cropland. Groundwater provides the remaining 25% to 35% of irrigation water that helps support the region’s multi-billion dollar agricultural industry and provides drinking water for more than 1.3 million people (Vaccaro et al., 2015). Across the aquifer, an increased reliance is placed on groundwater during drought years, predominantly for high value crops such as apples, hops, wine grapes, and table grapes, which could increase into the future (Richey et al., 2018).

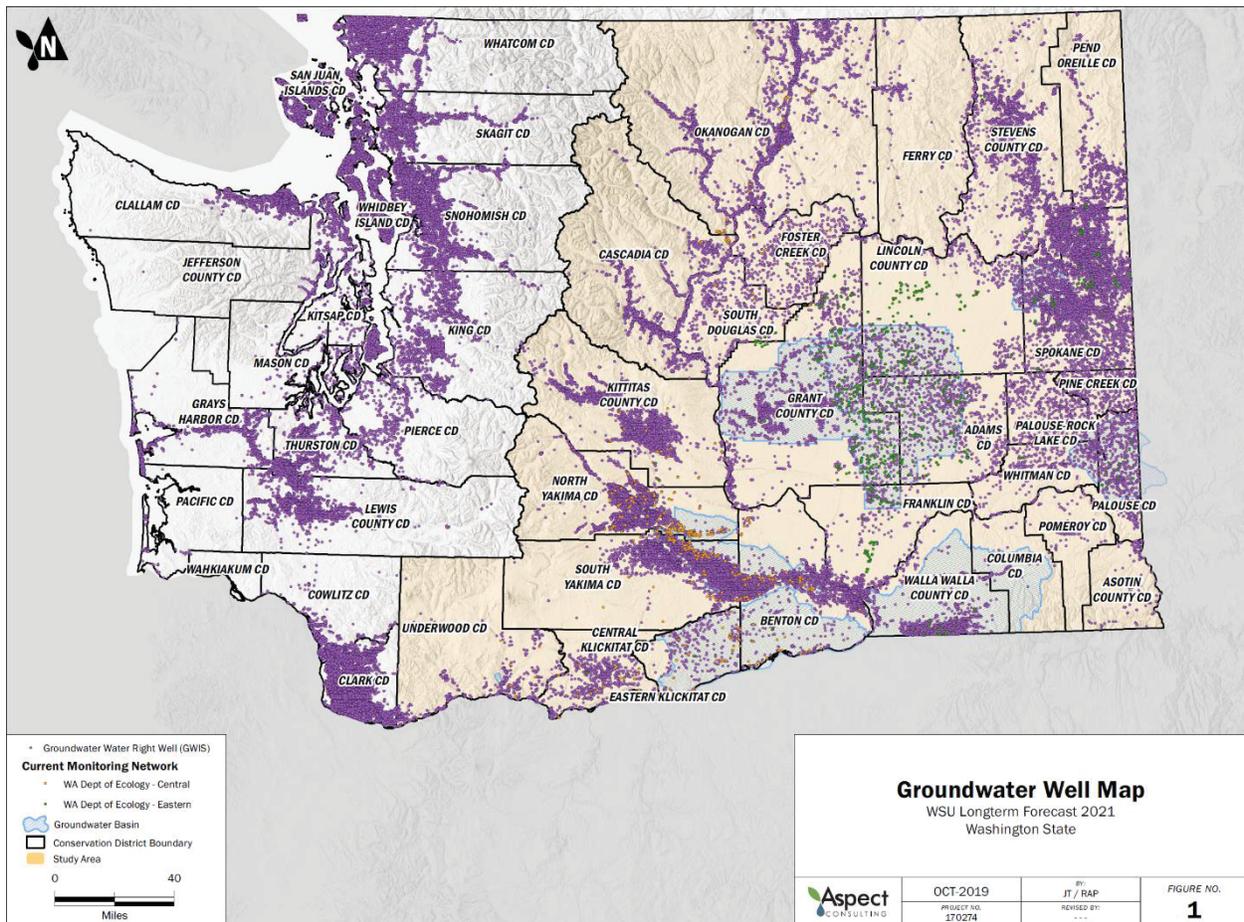


Figure 1. Study domain highlighted in pale yellow. Purple dots show the location of a groundwater right holder. Orange and green wells show the locations of wells currently monitored by the Department of Ecology’s Central and Eastern Regional Offices, respectively.

Groundwater is also the sole irrigation source in the Odessa Subarea, a region within the original extent of the CBP that never received surface water due to a delay in the expansion of the second half of the CBP in the early 1960s. The Washington State Department of Ecology issued “temporary” groundwater permits in the region, under the assumption that the CBP would continue its expansion after a few years. In just five years, pumping across the CPRAS tripled to 149,000

AF by 1968, the majority of which was in the Odessa Subarea (Luzier & Burt, 1974). This 2,000 mi² region has remained on groundwater to this day, with water level declines beginning in 1967 and continuing to the present at 10 feet per year in parts of the area (Vaccarro et al., 2015).

There are seven dominant hydrogeologic units that comprise the CPRAS, including an overburden aquifer, three basalt hydrogeologic units, two confining interbeds and a basement confining unit. The overburden aquifer is the smallest hydrogeologic unit in spatial extent and depth, consisting mainly of alluvial valley-fill deposits with a median thickness of 47 feet (Kahle et al., 2009). The Saddle Mountains (280 feet median thickness), Wanapum (330 feet median thickness) and Grande Ronde (3950 feet median thickness) units hold the majority of available water and are comprised of the Columbia River Basalt Group (CRBG). The Grande Ronde is the largest unit, reaching depths of 14,000 feet toward the center of the CPRAS and holding 96% of the aquifer volume (Kahle et al., 2009; Vaccarro et al., 2015). The Mabton and Vantage Interbed units are sedimentary layers comprised mainly of a mix of clays, shale, and sandstone. The low permeability Older Bedrock unit sits as the bottom of the CPRAS with a mix of rocks older than the CRBG of the upper layers and is considered the base of the flow system. Each layer is relatively disconnected vertically with the exception of uncased wells providing vertical connectivity across multiple layers, leading to drainage from shallower to deeper layers. The often-cascading effects of this drainage has led to noticeable declines in the shallower systems, particularly in the Odessa Subarea (Luzier & Burt, 1974). There are also four structural regions including the Yakima Fold Belt and Palouse Slope that sit beneath the Columbia River, the Clearwater Embayment in the foothills of the Rocky Mountains, and the Blue Mountains between the Snake and Columbia Rivers. The flow in each of these regions is governed by a combination of faults, folds, vertical dikes, and stepfolds (Porcello et al., 2009).

Natural recharge is relatively limited across the CPRAS. Neither the shallow nor deeper layers of the CRBG units appear to receive recharge from surface water, though small amounts of recharge can occur from precipitation in the interior and along coulees, where the deeper layers are exposed (Porcello et al., 2009). The deeper layers are predominantly recharged from drainage via uncased wells, if at all (Porcello et al., 2009). Recharge from precipitation at the surface can vary as a function of the local precipitation regime, but averages 6.1 inches per year (Vaccarro et al., 2015). The surficial alluvium has also received artificial recharge indirectly from irrigated surface water since CBP water first arrived in 1952 (Luzier & Burt, 1974). The artificial recharge has led to more than 11 MAF of increased storage in the aquifer, including a 6.9 MAF mound in the 508-14 administrative area in the Eastern Pasco Basin. Despite being in close proximity to the deep declines in the Odessa sub-region, this mound has contributed to landslides along the Columbia River and threatens a nearby national monument due to the water level rise (Heywood et al., 2016).

The Columbia Basin Ground Water Management Area (CBGWMA) of Adams, Franklin, Grant, and Lincoln Counties within Washington State is a multi-partner effort to protect and improve groundwater resources. The GWMA was established in 1998 as Designation Order Number 16 from the Washington State Department of Ecology, establishing Adams, Franklin, and Grant Counties as the GWMA, and Lincoln County was designated as part of the GWMA in 2005. The first phase of the GWMA included research and development of a Ground Water Management Area Plan from 1998 – 2001. A second phase of subsurface mapping and aquifer assessments from 2001 through 2009 and was followed by reviews of municipal water supply current and future conditions completed for 25 incorporated municipalities.

The Department of Ecology’s Eastern (ERO) and Central (CRO) Regional Offices conduct annual, manual water level measurements in the study area during the spring and also deploy pressure transducers in a subset of their monitoring locations for continuous water level measurements. The number of monitoring sites in each location is shown in Figure 1. Figure 1 shows the high density of groundwater rights holders (purple) in comparison to monitoring locations in the Ecology regions. The blue “groundwater basin” areas in Figure 1 show the regions of known declining groundwater that were the focus of the 2016 Forecast’s groundwater module.

4. Data management practices

Two main data products will be produced. The first is the groundwater level monitoring data collected by the stakeholder partners. These data will be recorded as depth to water measurements. They will be recorded in the spring, prior to the start of the irrigation season, and the fall after the irrigation season has finished and before the start of the new water year begins to replenish the groundwater. These data will be uploaded into the Department of Ecology’s (ECY) Environmental Information Management (EIM) System. EIM is the central data repository for all ECY’s collected project data. It includes data collected on surface and groundwater quantity and quality in addition to physical, chemical, and biological data collected for a wide range of fresh and marine environments.

The EIM database manager has identified the minimum, medium and maximum data fields that must be documented to allow the collected groundwater levels to be uploaded into EIM, listed in Table 2. The maximum level of information will be collected

Table 2. Data collection requirements for EIM at monitoring sites with increasing level of detail.

<i>Minimum</i>	Well tag ID number
	Water level parameter (e.g. depth of water below the measuring point, top of casing, below ground surface, etc.)
<i>Medium</i>	Measuring point location (always measured from this point)
	Water level accuracy (within 0.01 ft, <1 ft, ~1 ft, >1 ft)
	Measuring device type (e.g. electric tape, pressure transducer, etc.)
<i>Maximum</i>	Location ID
	Location setting (e.g. on land, in water, etc.)
	Description of location (e.g. on a hill, behind a house, etc.)
	Location coordinates (latitude, longitude); accuracy of coordinates
	Elevation of top of casing OR measuring point OR land surface; accuracy of elevation; datum of elevation
	Is well log available (yes/no)
	Type of well (e.g. irrigation, production, environmental test well, temporary, etc.);
	Completion type (e.g. cased open-interval, cased open-ended, cased open-ended with perforations, etc.); screen interval depths if open-interval

	Maximum well casing diameter; well casing material
	Date of well construction; construction method; construction comments

One point of contact will be established by the monitoring partners to communicate with the EIM database manager to ensure efficient uploading and communication. Data in EIM is grouped and can be queried by specific study tags. The data collected by the monitoring partners will all be grouped under a single study tag. EIM recently released a new help document to assist in uploading groundwater observations, including water level measurements done manually at a discrete point in time (e.g. with an e-tape or airline) or as a continuous time series (e.g. from a pressure transducer). As described in Section 5.c., the monitoring partners will follow the established EIM guidelines on data uploading and will receive training in doing so by the Department of Ecology partners (see Letter of Participation, P. Cabbage).

The second type of data produced in the project will be GIS layers of the monitoring points and aquifer layers across the study domain. These data will be available through an online project page managed by the State of Washington Water Research Center (WRC) at WSU. Co-I Padowski is an environmental scientist with the WRC.

5. Evaluation criteria

a. Criterion A – Benefits to water supply reliability

i. Water management issue(s) and project benefits

The majority of water used for irrigation in Eastern Washington is sourced from surface water. Following global trends, there is an increasing reliance on groundwater in the study area both during drought and non-drought years. The proposed work contributes primarily to the following water management objectives:

- **Water supply reliability:** The majority of the study area relies either exclusively or partially on groundwater to meet water supply needs. Parts of the study area are in known “hot spots” or areas of declining groundwater. These regions are shown in Figure 1. In order to ensure water supply reliability, groundwater level assessments need to be completed by aquifer layer to understand how supplies have been changing over time. The Odessa Subarea is one of the hot spot areas and has experienced long-term declines since the 1960s. The U.S. Bureau of Reclamation’s groundwater replacement program is underway to offset some of the declines in the Odesa Subarea and the collected data will help track the progress of this program.
- **Drought management activities:** Starting in 2000, Washington State requires a permit for additional groundwater use during drought, termed “emergency permits,” which can only be used within the year when an official drought has been declared. This has happened in 2001, 2005, and 2015. The emergency permits are available to users who have a primary surface water right that can be interrupted or curtailed during drought. These rights holders are considered to be junior to users who do not experience interruption. Permitting for emergency rights can be improved with more monitoring data that can assess the post-drought rebound and long-term well status.
- **Conjunctive use of ground and surface water:** In parts of the study area, ground and surface water are connected, thus pumping from groundwater has the potential to negatively impact surface water flows due to reduced baseflow. By increasing monitoring capacity, we will be

able to better determine the connectivity of ground and surface water to manage them as a single unit where appropriate.

- Water rights administration: The Department of Ecology is responsible for administering water rights and for curtailing water rights during drought years. New groundwater rights must be evaluated in the context of water supply availability and local aquifer status. The proposed work will increase the number of monitoring sites that can be used to assess local aquifer status.
- Conservation and efficiency: Water utilities are required by law to push forward initiatives and other strategies for promoting water conservation and efficient water use by their customers and in their system operations. More efficient water use can help systems maintain more control over existing supplies; however, efforts to gain efficiency are dampened when there is a lack of knowledge about the volume of water supply available in the short and long-term. These proposed activities would help smaller water providers or those who have trouble characterizing their source water supplies, establish baseline information and monitoring techniques or partnerships for tracking water level increases or decreases of these supplies over time, which would help them make more informed plans for future water conservation or system operation. This can be important, since systems facing continual aquifer declines over time may need years to decades to make decisions and plans for costly future capital investments in new source water supplies.

ii. Project complementarity with other projects

The proposed work complements the work being conducted under the 2021 Forecast project for both the groundwater module and the municipal demand analysis. The goal of the groundwater module is in part to identify additional sources of groundwater monitoring data and to streamline the collection of the data into the EIM database. By partnering with conservation districts and water systems, the proposed work would add an additional 50+ monitoring sites on top of the 50 new monitoring sites being established within the Forecast project. The Forecast sites will only be monitoring by project personnel, and therefore will not necessarily continue being monitoring into the future. All these monitoring sites complement and add to the monitoring network that the Department of Ecology manages and uses to support water management decisions.

Since the 2016 CRB Water Supply and Demand Forecast report, OCR and WSU have recognized a need for an improved municipal demand forecast. This has been hampered in previous studies in part due to a lack of information about water levels and water use from municipal water providers across Washington state. Previous methods for estimating municipal water use have relied on county-level estimates of water use, which are not sufficient for assessing community-level changes. The impacts of domestic demands need to be more rigorously evaluated as they can have direct and serious consequences for water management decisions. The water level data collected from municipal water providers in this project would provide a useful stepping stone for understanding how water providers are managing resources. When combined with production data, water level information would provide a better estimate of where municipal water withdrawals may be increasing groundwater declines, and where potential surface/groundwater exchanges may be important for reshaping how water providers address water use efficiency concerns and work with other water users to ensure water supplies remain a local resources into the short and long-term future.

Lincoln County Conservation District (LCCD) has a current project underway funded by OCR. Co-I Lindsey is the lead hydrogeologist on the project. They are monitoring 70 sites within their

district, predominately at agricultural wells used for irrigation. The Odessa Subarea is partially in the LCCD and therefore the monitoring project is highly relevant to OCR's goal of focusing on alternative options to offset groundwater depletion in this region. The LCCD monitoring project ends in June 2020, so the proposed work will extend the lifespan of this monitoring network. Importantly, LCCD is already uploading their data into EIM and can therefore serve as a template for how additional conservation districts can manage and upload their data. The proposed work will also build on the CBGWMA study by continuing to study declines and aquifer characterization both in the CBGWMA region and all of Eastern Washington.

b. Criterion B – Need for project and applicability of project results

i. Project need

1. Source of project need

The need for improved groundwater assessment tools has been articulated in a diversity of places. First, the proposed work is building on the groundwater module that has already been funded by the Office of Columbia River. The 2016 Forecast report found widespread groundwater level declines from pumping and negative impacts on streamflow related to reduced baseflow that has effected surface water temperature and quality (Hall et al., 2016). They found groundwater declines up to 25 feet per year in the basin with declines increasing since the 1970s and 1980s. The report recommends continued long-term groundwater monitoring and emphasized the need to make groundwater level data more accessible. The recommendation includes the need to expand the well network and to reintroduce monitoring in Ecology and USGS wells that discontinued monitoring. It is these sites that will be targeted for the 2021 Forecast monitoring effort.

The Letter of Funding Commitment by Tom Tebb, OCR's director, demonstrates the clear prioritization by OCR to expand groundwater monitoring and assessment to support informed long-term water planning. The decision by OCR to fund the groundwater module is also supported by the Columbia River Policy Advisory Group (CRPAG) and a group of state agencies that have participated in semi-annual "state caucus" meetings. The Forecast groundwater module proposal was presented to the CRPAG, which is a group of state, local, federal, and tribal government representatives, irrigators, business and environmental groups that advises OCR. They supported the need to advance regional understanding of groundwater supplies.

The Washington State Departments of Commerce and Health and the Small Communities Initiative formed a partnership in 2017 to understand how groundwater depletion was impacting water systems in the Mid-Columbia Basin (Adams, Franklin, Grant, and Lincoln counties). The study team surveyed 137 Group A community water systems in the four-county area, responsible for providing water to approximately 92,000 people. Groundwater is the water supply source for these communities. In addition to the survey, the study partners identified groundwater data gaps and conducted meetings with the communities. The meetings summarized the state of groundwater as it was known from previous studies, talked about the importance of monitoring and discussed how to address the region's groundwater declines. The new Columbia Basin Sustainable Groundwater Coalition formed out of these meetings.

The Mid-Columbia Resiliency Coordination Final Report summarizes the main findings from the Commerce/Health project (Serr et al., 2019). Five main recommendations came out of the report:

1. Water system water level data reporting and repository: provide a place for water systems to report seasonal water level measurements
2. Long-term monitoring: develop a long term monitoring program, including support for this grant proposal
3. Support for the Columbia Basin Sustainable Groundwater Coalition: support and facilitate the formalization of the Coalition
4. Local, state, federal agency coordination: develop an interagency working group to focus on groundwater depletion
5. Regionalization: support regional efforts, such as the Coalition

The proposed work directly responds to the needs identified in this report by initializing a long-term monitoring program with data to be collected in a central repository and following a consistent monitoring protocol (first bullet). The Forecast project groundwater module's goal to coordinate groundwater data collection efforts across local, state, and federal agencies directly addresses the fourth recommendation. The groundwater data collected in the proposed work and through the Forecast project, in addition to the existing Ecology monitoring program will all be used to inform regional water system planning efforts focused around groundwater declines.

2. Letters of Support

Letters of Participation have been provided by:

- Washington State Department of Ecology Office of Columbia River (OCR, Letter by T. Tebb, Director) – OCR is the primary Category A partner. OCR has approved Forecast project funds to be used as a cost-share contribution by the lead applicant, WSU, and a sub-contract partner, Aspect Consulting. OCR will assist in developing and approving the Quality Assurance Project Plan (QAPP), the guiding document for the monitoring protocol. They will also assist in outreach efforts to conservation districts, water systems, other units within the Department of Ecology, and other state agencies. Activities managed by OCR and underway through the Forecast project can be leveraged for the proposed work, for example the state caucus meetings. These meetings can be used to gain support for stakeholder-driven monitoring programs and to raise awareness for the importance of groundwater monitoring, assessment, and management.
- Washington State Department of Ecology Eastern Regional Office (ECY ERO, Letter by P. Cabbage, Technical Unit Supervisor, Ecology Water Resources Program) – ECY ERO is an additional Category A partner. They will lead the water level measurement trainings within each conservation district region. The trainings will be conducted annually in each region, with the initial course being taught in the first year and refresher courses in the subsequent project years. ECY ERO is committing a total of \$16,248 as an in-kind contribution to travel to project sites and conduct the trainings. These are budgeted as \$1,354 per training, with four per year (one for each of four conservation district regions) for each of the three project years.
- Washington State Department of Health (DOH, Letter by M. Means, Director, Office of Drinking Water) – DOH will assist in disseminating project results. The proposed work builds on their recent work studying water systems in the Mid-Columbia Basin. They are contributing \$3,650 as an in-kind contribution in the final project year to support dissemination efforts.

- Washington State Conservation Commission (WSCC, Letter by S. Joy, Regional Manager Coordinator) – the WSCC is committing to act as the primary liaison between the project team and the volunteer monitoring partners. The WSCC is the coordinating agency for all the conservation districts in Washington State. Their role is to support cooperation and collaboration between the districts and with outside partners, to support the districts in their conservation efforts, to coordinate and administer programs, and to distribute state funds. Shana Joy is the Regional Manager Coordinator and will, along with the regional managers in the North Central, Northeast, South Central, and Southeast conservation district regions, assist the project team in identifying and contacting potential monitoring partners.
- Lincoln County Conservation District (LCCD, Letter by E. Bowen, Manager) – LCCD is contributing \$74,912.76 as an in-kind contribution. LCCD currently has an OCR-funded project to take monthly groundwater level measurements at 70 wells in their district. Their project originally targeted 50 wells for monitoring, however they gained additional volunteers for the monitoring program based on broad and enthusiastic interest.

Letter of Support have been provided by:

- City of Othello (Letter by S. Logan, Mayor) – Othello is a member of the newly formed Mid-Columbia Basin Coalition. They have eight active pumping wells that are in a known region of declining groundwater.
- City of Warden (Letter by T. Massa, Mayor) – Warden is a member of the Mid-Columbia Basin Coalition and has a mix of municipal and agricultural wells.

ii. Ready applicability of applied science information

The entities that wrote Letters of Participation will each benefit from the proposed work in different ways, all focused around supporting improved long-term management and availability of groundwater supplies.

1. Use of project results

Department of Ecology Office of Columbia River: OCR will directly benefit from and use the results of the proposed work as they are integrated into the 2021 Forecast. As described above, OCR is deeply invested in supporting groundwater sustainability.

Department of Ecology Regional Offices: The Washington State Department of Ecology’s Water Resources Program located in the Eastern Regional Office uses groundwater level monitoring data to make informed, scientifically-sound, and data-driven decisions. These decisions are primarily related to the management of water resources, usually in the form of water right decisions. Ecology’s Eastern Regional Office Water Resources Program annually measures the water level at approximately 150 wells throughout the Columbia Basin. Additionally, there are pressure transducers deployed in approximately 75 wells throughout eastern Washington which collect hourly groundwater level measurements. Data is routinely shared with many entities throughout the eastern region. ECY ERO welcomes the efforts of others to improve the quality of groundwater level monitoring data collected, and to make that data more readily available. The groundwater level monitoring data is used to consider the physical availability of water, including analyses of whether water rights decisions may impair existing water users. Groundwater level monitoring data is also used to enhance our knowledge of regional hydrogeology. ECY ERO also

works with local governments, other state agencies, and federal agencies through cooperatively sharing data and through contributing to regional geologic and hydrogeologic studies.

Department of Health: Over 130 communities in the Mid-Columbia Basin depend on groundwater as their lone supply of drinking water. These communities need to understand how the aquifers (Grande Ronde Basalts & Wanapum) in this basin are functioning and if they are likely to experience declines in water available for their users. One way to better understand and evaluate the condition of the aquifers in this area is to do depth to water measurements. They need to be able to forecast the water available today, tomorrow and decades into the future. The data gathered during this study will be instrumental to these communities in their ability to plan and budget for the future. It will allow them to plan for change to ensure they have a resilient and dependable source of drinking water into the future. The Mid-Columbia Resiliency Coordination Report, 2019, states, “There is a need for developing a more robust groundwater monitoring network in the Mid-Columbia Basin that includes water systems.”

To be eligible for a loan from the Drinking Water State Revolving Fund water systems are required to have a current approved water system plan (WSP), WAC 246-296-100. The WSP must meet all requirements outlined in WAC 246-290-100 to be approved by the department. The WSP will demonstrate the system’s ability to achieve and maintain compliance with all relevant local, state, and federal plans and regulations.

Department of Commerce: The Washington State Department of Commerce recognizes the importance of managing groundwater resources in the Columbia Basin. Commerce supports the agricultural sector and the marketing of products both domestically and overseas. Farming in the basin produces a large portion of Washington’s agricultural products and is economically important to the state. Agriculture was a \$20.1 billion industry in 2016, employing approximately 164,000 workers statewide. Availability of water is necessary to support the current farming practices in the basin. Many of the irrigated acres have been utilizing groundwater while waiting for the completion of the East High Canal, a proposed canal was planned to be a part of the U.S. Bureau of Reclamation’s Columbia Basin Project. The use of groundwater for crop irrigation in this area is unsustainable and is depleting the aquifers. Understanding the availability of groundwater and the effect that irrigation has is very important for continuing to support this economic sector. In the long-term, an alternative water source will be required to maintain irrigation.

Commerce is also the agency that oversees the state’s Growth Management Act (GMA). The GMA was adopted to address ways to accommodate land use and growth. It requires that the fastest-growing cities and counties complete comprehensive plans and development regulations to guide future development. All jurisdictions are required to protect critical environmental areas and conserve natural resource lands, such as farms and forests. The GMA calls for communities to review and, if necessary, revise their plans and regulations every eight years to ensure they remain up-to-date.

The availability of water is fundamental to future development. In Washington State, applicants must show availability of water before building permits for houses and commercial buildings are approved. Similarly, the planning process for creating new lots has to show how those lots will be able to obtain water for development. This means that there must be available groundwater, or a

water system who can serve the site. With water being so critical to the development process, the GMA has four of its fourteen goals related to the provision of water and its availability.

Beyond the GMA goals, all cities, counties, and towns must protect the quality and *quantity* of groundwater as part of their comprehensive planning. This project will provide much needed data in an area that is known to be experiencing groundwater decline. The area is geologically complex, having multiple aquifers sandwiched on top of one another, and the groundwater sees little to no recharge. The information that this project will provide will be critical in getting a better understanding of how the groundwater is responding to the demands being placed on it, and will help inform ways to manage the resource into the future at the city, county, and regional levels.

Lincoln County Conservation District: The overall mission of the Lincoln County Conservation District is to assist citizens of the county to protect, conserve, and enhance natural resources.

In Lincoln County, ground water is essentially the only source of water supply for municipalities, homes, industry and agriculture in the county. Recent studies on existing well level measurements show groundwater levels are decreasing in most of the wells that have available, long-term measuring data. These studies, including a 2018 technical memorandum and the Ground Water Management Area (CWMA) study for Adams, Franklin, Grant, and Lincoln counties (2008 and 2010), as well as public concern, have made ground water levels a priority concern for LCCD. A current project funded through the Department of Ecology has combined historical well data information to a county-level geospatial database to characterize water level changes. This information, and information from recent well measurements (while limited in scope and time) will be analyzed to develop a long-term monitoring effort. Additional information gathered through the proposed efforts will strengthen this analysis and push closer to the goal of understanding, managing, revitalizing and ultimately preventing wells from declining in the future. The impact of declining well levels to the environment, and the economic and social status of LCCD's citizens is too great to ignore.

Mid-Columbia Basin Coalition: The conservation districts within the Mid-Columbia Basin area are in the process of developing an interdistrict agreement to formalize the Columbia Basin Sustainable Water Coalition (CBSWC). The agreement supports the partnering districts in collaborating on regional water issues, sharing data on water including groundwater, and jointly pursuing funds. The agreement also identifies Grant County Conservation District as the "administering district." As a formal entity, the Coalition could act on behalf of its partners to continue supporting groundwater monitoring as proposed herein.

2. Immediate utility of results

The results of the project will be immediately useful to inform water resource management. Final reports will inform water systems and conservation districts of locations with heightened challenges for groundwater sustainability. The reports will be shared with these groups upon completion and will be presented at in-person dissemination events. The data collected will be publicly available via EIM and therefore accessible by any unit that is interested in supporting groundwater sustainability plans. By being collected with the Department of Ecology partners, they will be immediately used for decisions regarding water rights access for new water rights and for emergency groundwater permits among other applications.

3. Transferability of results

Although the data itself won't be transferrable to other users and locations outside of the study domain, the approach of training local stakeholders to conduct monitoring is highly transferrable. The training materials are building on materials already available online and will be made publicly available via the Washington State Water Research Center housed at WSU.

4. Project beneficiaries

The applicant directly benefits from the project by having additional sources of groundwater data to use in analyzing the current state of groundwater for the Forecast project. A primary objective is to develop robust trend analyses by aquifer layer to make recommendations on sustainable groundwater management planning.

The Category A primary partner (Department of Ecology Office of Columbia River) is directly involved in the project through outreach efforts, dissemination activities, and will be the main beneficiary of additional groundwater data to support water supply planning. The other Category A partners (Department of Ecology regional offices, Department of Health) also use groundwater data to inform water management decisions, from supply funding to water systems to approving new water rights applications. The increased availability of groundwater level data will directly support these management goals. The Department of Ecology regional offices are direct participants in the project through the monitoring training. They will conduct the water level and data upload training so the protocol follows their monitoring standards. The Department of Health is a direct participant by helping to organize and facilitate dissemination activities. They have also taken the lead on communicating with water systems that may be interested in participating as monitoring volunteers.

c. Criterion C – Project implementation

i. Project implementation plan

1. Project objectives

Project implementation relies on the partnership of the entities who wrote Letters of Participation in order to expand Ecology's groundwater level monitoring network in areas where declining trends in aquifer levels present risk to water supplies. Five tasks are proposed to accomplish the work that together will 1) establish a groundwater monitoring network, 2) prepare GIS layers of aquifer extents, and 3) analyze and disseminate results. The monitoring will be conducted following the same protocol that Ecology already uses for their current monitoring sites.

2. Work plan

The details of the five projects tasks are listed below. Although Year 1/Quarter 1 is slated to begin in summer 2020, project tasks begin based on the estimated date of selection in January 2020.

Task 1 – Logistics

Task 1.1. Determine well suitability (Year 1/Quarter 1) – Milestone: complete a list of wells that meet the necessary criteria for monitoring

The first project task is to identify a set of possible wells that could be included in the monitoring network. We will not be drilling any new wells but will identify wells that are currently or formerly in use and are accessible. The identification of potential groundwater level monitoring sites will begin with GIS analyses of Ecology's existing groundwater monitoring network and mapped points of withdrawal for groundwater rights (Figure 1 - well site map). Within each Conservation District, approximately 10 wells will be identified for further evaluation. Selection criteria and

scoring metrics are summarized in Table 3, which is intended to provide a framework for prioritizing site selection. Inactive wells will be prioritized so a static water level can be measured without the influence of pumping. However, final site selection will be based on the results of outreach to owners and field reconnaissance.

Task 1.2. Conduct outreach for volunteer monitors (Y1/Q1-Q2) – *Milestone: compile a list of volunteer monitors within the well suitability list*

We will work closely with the Washington State Conservation Commission (WSCC) to conduct outreach to the well owners from the list of possible wells in Task 1.1. We will also work with the Department of Health and the Columbia Basin Sustainable Water Coalition to identify volunteer water systems. The volunteer monitors will need to commit to annual water level measurement training. Each conservation district and a minimum of five water systems will receive an electrical tape (“e-tape”) for participating in the project.

Table 3. Scoring system to determine well suitability.

Selection Criteria Categories	Selection Criteria	Scoring metric	Expected Result
Geospatial	Areas of known groundwater decline	In or out	Filters data set for areas with known problems
	Intensity of groundwater rights	Low, medium, high	Identifies areas with greatest risk
	Aquifer boundary conditions	known/unknown	Helps inform trend analyses
	Proximity to other monitoring sites	Fills data gap	Enhances spatial coverage of water level data
Well log reliability	Well construction details support designation of Aquifer Units	Well open to Wanapum, Grande Ronde, both, or unknown	Wells with insufficient construction/geologic details may be filtered out from consideration
	Driller or geologist description supports differentiation of Formations	Yes/no	Prefer yes
	Driller or geologist description supports differentiation of flow zones	Yes/no	Prefer yes
	Additional reports for well construction and testing, or other data available	Yes/no	Prefer yes
Accessibility	Property ownership	Documentation of existing ownership	Facilitates outreach
	Proximity to monitoring route (travel)	Low, medium, high, distance/travel time from other monitoring locations	Fieldwork travel efficiency

	Site protection/security	Property access, well access	Accessible without owner
	Pumping status	Active/inactive	Determines appropriate measurement device and frequency
Equipment	Access port on well allows measurement without well head disassembly	Yes/No	Prefer yes
	Existing equipment	Airline, transducer, sounding tube, none	Field verification, equipment deployment

Task 1.3. Site detail check (Y1/Q1-Q2) – Milestone: project team visit to participating wells to confirm monitoring site details for EIM quality control

A site reconnaissance trip by the project team to suitable wells (identified in Task 1.1) and with well owners open to volunteering (identified in Task 1.2) will be conducted to confirm viability of potential monitoring sites. The site visits will confirm the well is accessible and has an Ecology well tag ID for record keeping. The site visit will survey each wellhead to record the location coordinates, accuracy of the coordinates, elevation of the measuring point, elevation accuracy and datum, using a handheld GPS unit already owned by the project team. The water level measuring point will be the access port at the top of the well casing/measurement port unless otherwise specified by the project team. The team will also take note of the type of well, completion information, well casing diameter and material, and location information including setting and description. This information will be used to initiate the EIM data upload.

The task will conclude with the establishment of site access agreements for monitoring purposes. The site checks will also determine the feasibility of installing a pressure transducer in each well. Twenty percent of the study wells will receive a pressure transducer. If more than 20% of the wells can have a transducer installed, the wells with the highest score from Table 3 will be prioritized. The project team will finalize the list of selected wells based on the selection criteria.

Task 2 – Data collection

Task 2.1. Water level monitoring training (Y1/Q1-Q3) – Milestone: complete annual water level monitoring training, grouped by conservation district regions

The Department of Ecology Eastern Regional Office (ECY ERO) will conduct trainings in each conservation district region. The trainings will include two parts, first on how to take water level measurements and second on how to upload collected data to EIM. All volunteer monitors will be trained on how to take a manual, discrete water level measurement using an e-tape. The locations that have pressure transducers installed will also be trained on how to download the transducer data and prepare it for upload. The training, for both discrete and continuous measurements, will follow the established EIM protocol for data uploading.

Waterline e-tapes have been included in the budget, allotting one e-tape per conservation district in the study region as well as up to five water systems for a total of 32 sites. These e-tapes were recommended for use by ECY ERO as they are thinner than other brands and thus can fit through a 0.5 inch hole. They measure water level to the tenth of an inch. Following the recommendation by ECY ERO, half of the budgeted e-tapes are for 300-foot reels and half are for 500-foot reels given the deep depth to water in the study area. Pressure transducers were budgeted for 20% of the 32 monitoring sites. A smaller number of transducers is included given that they are generally not

recommended for use in active pumping wells, and we anticipate the majority of the study wells to have pumps.

Task 2.2. Groundwater level collection (Y1/Q2-Q4, Y2/Q2/Q4, Y3/Q2/Q4) – *Milestone: conservation district monitoring partners collect spring and fall water level measurements; water system partners collect monthly measurements*

Groundwater level collection will begin in the second project quarter (after project selection, e.g. spring 2020). Each participating conservation district will travel to the study wells in their region to conduct two water level measurements per year, one in the spring and one in the fall. The project budget utilized the Lincoln County Conservation District monitoring program based on their average monthly budget to conduct their current well monitoring route. Their budget was evaluated for the cost per well and multiplied for two wells per conservation district and twice per year. The conservation districts may choose to collect more frequent data throughout the year, but will not be funded by this project to do so. Spring measurements are critical to capture the long-term state of the groundwater system. The pumping or irrigation season begins in the spring, which draws the groundwater level down. Winter rains and snowmelt recharge the aquifer through the fall and winter, thus the spring water level is representative of the equilibrium state of the aquifer. The fall measurements will be taken after the irrigation season ends and prior to recharge, allowing us to understand how water is being used throughout the later spring and summer.

The water systems will be encouraged to take monthly or seasonal water level measurements. This will allow us to better understand how municipal water use is impacting the groundwater system. Equipment has been budgeted for up to five water systems, however the monitoring itself will be the financial responsibility of the systems as they are legally mandated to take water level measurements in addition to reporting water use via the Department of Health's Water Use Efficiency forms.

Task 3 – GIS mapping

Task 3.1. Analyze well and geology logs within the study area (Y1Q3-Y2/Q2) – *Milestone: complete analysis of available lithology information*

The project team will analyze well logs, available geology logs, USGS study reports, and information available through the Washington State Department of Natural Resources's Geologic Information Portal to map lithologies in the study area with the goal of identifying the spatial extent and vertical depth of the dominant aquifer layers in the study domain. By comparing the screened intervals (determined from the well logs) to the aquifer layers, we can determine the layers from which groundwater is being pumped.

Task 3.2. Build lithologic layers in GIS (Y2/Q1-/Q4) – *Milestone: compile lithology information (spatial extent and depth) into a GIS database*

Over the last six months as time has allowed, sub-contract GeoEngineers (led by Co-I Lindsey) has been converting Columbia Basin Ground Water Management Area (CBGWMA) databases, including the subsurface geologic maps, into a webviewer-based platform where data, information, and interpretations for specific locations and attributes can be queried. This work will continue into 2020 and as beta test versions become available, they can be contributed to the project as in-kind support. We will build on these efforts and expand the GIS database development across the whole study domain, beyond the CBGWMA boundaries. Although GIS layers of dominant aquifer layers is available through the USGS Columbia Plateau Regional Aquifer System model, the USGS layers are too coarse in resolution (3 kilometers) to use for determining groundwater trends at the scale of water systems.

Task 3.3. QA/QC (Y2/Q3, Y3/Q2) – *Milestone: finalize quality assurance/quality control on GIS lithologic layers*

The final part of this task will be a detailed quality assurance/quality control evaluation of the GIS layers, led by Co-I Lindsey. Lindsey has an extensive history working on groundwater projects through the Columbia Basin and is well known for his institutional and hydrogeologic knowledge of the area. The final GIS layers will be made publicly available through the State of Washington Water Research Center. Co-I Lindsey will review provide reviews on: (1) evaluating well hydrostratigraphy and aquifer conditions for defined locations, (2) summarizing nature and extent of hydrostratigraphic units/intervals of interest, or (3) correlating well construction to aquifer intervals, to name a few. Generally, this work would be done under the Grant, but given resource limitations topics that are quickly resolved might be done pro-bono (or in-kind). In addition, in some cases work funded by OCR or other entities might be able to be provided as in-kind support to the project. We are currently tracking several hundred thousand dollars of OCR project opportunities in the Washington portion of the Columbia Basin for the 2019/2021 biennium.

Task 4 – Analysis

Task 4.1. Overall trend analysis (Y2/Q3-Y3/Q2) – *Milestone: complete an overall trend analysis including study wells and Forecast wells*

Understanding long-term groundwater dynamics is crucial in planning for present and future sustainable groundwater management. PI Richey and Co-I Turk will incorporate the proposed monitoring data into the trend analysis for the 2021 Forecast. We are currently in the process of selecting wells for the long-term trend analysis, prioritizing locations with long and/or continuous records. Although the proposed monitoring sites will not have long-term records yet, they will add to the existing monitoring capacity to allow for improved trend analysis in the future.

Task 4.2. Analysis by aquifer layer (Y3/Q1- Q4) – *Milestone: complete a trend analysis of the study wells and Forecast wells using the aquifer layers developed in Task 3*

The study area is comprised of complex, multi-layer basalt formations. Ely et al. (2014) showed that the long-term trends in the Columbia Plateau Regional Aquifer System vary depending on the aquifer layer. The Overburden and Saddle Mountain layers generally had increasing water level trends, while the Wanapum and Grande Ronde, especially in the latter layer. However, their estimates were based on model simulations that only ran through 2007 and therefore missed the impact of the 2015 drought. In the 1990's, the Lower Yakima Valley Wanapum layer was found to experience heavy drawdown after drought and the Department of Ecology Central Regional Office has denied all emergency groundwater drought well requests since. This demonstrates the utility to Ecology in having an understanding of groundwater trends by layer, since a new water right could be issued for one aquifer layer and not the either in exactly the same location in space. The layers produced in Task 3 will be used to analyze water level trends in each aquifer unit.

Task 5 – Dissemination

Task 5.1. Final report (Y3/Q3-Q4) – *Milestone: complete a final report on the study wells*
Final reports will be developed for the overall project and, as requested, for specific conservation districts and/or regions. The reports will communicate findings from the trend analyses using the project wells, Forecast wells, and exiting Ecology monitoring wells. We will develop options and recommendations for expanding the declining aquifer level monitoring network through collaboration with Ecology, Conservation Districts, and private entities, and other state agencies.

Task 5.2. Dissemination events (Y3/Q4) – *Milestone: host dissemination events in each conservation district region*

See Criterion D – Dissemination of Results.

3. Existing data and models

High quality groundwater level data is available through the Department of Ecology’s regular well monitoring, available on EIM. The discrete measurements are typically updated in the spring and sometimes fall, in addition to continuously collected pressure transducer data. The CBGWMA project produced high quality data and analysis on the state of groundwater in their study domain. Aquifer extent information is available from this study. The USGS developed a groundwater flow model for the Columbia Plateau Regional Aquifer System; however, the model runs ended in 2007 and have not been updated since.

4. Project team

PI Richey has conducted groundwater trend analyses previously, analyzing and aggregating point measurements across large aquifer areas, for example in the High Plains Aquifer. She is currently studying the role groundwater plays in mitigating drought in Washington State and the economic value of groundwater during drought. She is leading the groundwater module for the 2021 Forecast. She was also the lead PI on a project that trained community members to monitor their own groundwater in the state of Ceara, Brazil, a rural and semi-arid landscape. The project used groundwater level sensors that she designed to be cost effective and fixable in rural settings.

Co-I’s Turk and Lindsey have extensive experience working on groundwater projects in the Columbia Basin. Lindsey has over 25 years of hydrogeologic experience working with municipalities, watershed entities, and private groundwater users in the Columbia Basin. This experience includes over 15 years of work with the now inactive Columbia Basin Ground Water Management Area (CBGWMA) where Lindsey was a project geologist/hydrogeologist, senior investigator, and project manager on CBGWMA’s groundwater nitrate distribution and mapping efforts, subsurface geologic mapping projects, regional conceptual and digital groundwater modeling, and long-term municipal groundwater supply forecasts. With this work he and his team compiled geologic interpretations of thousands of well logs, collected several hundred detailed geologic control points, compiled hydrographs and groundwater geochemistry for dozens of wells, and collected pumping tests and hydrostratigraphic interpretations from numerous wells. Although the CBGWMA is now inactive Dr. Lindsey has retained copies of most of the databases, maps, and reports produced by CBGWMA.

Co-I Padowski has been working with the Department of Health to find ways to more accurately quantify water provider production over sub-annual time steps. She is currently funded on the Forecast project to build up-to-date, more accurate assessments of how municipal drinking water needs will change in the future. While she hasn’t worked directly with utilities to collect data, this project will build a base for not only increasing the quality and quantity of groundwater measurements available but build stronger connections between WSU and water providers throughout the basin.

Given the current Forecast project aims and the close alignment of those aims with the ones presented here, we foresee no complications with immediately proceeding with the proposed tasks to complete this project.

5. Products

Discrete and continuous water level data at individual monitoring sites will be produced and available through Ecology's EIM system. GIS layers of aquifer extent and depth, and appropriate metadata, will be available through the State of Washington Water Research Center. Trend analyses on collected and other available data will be available through the 2021 Forecast report and reports prepared for the conservation district regions.

d. Criterion D – Dissemination of Results

Groundwater monitoring data and results will be made available to managers, academics, and agencies via a number of different pathways, including in-person community meetings, inclusion within ongoing larger-scale supply and demand forecasting efforts, and in the form of publicly available spatial and tabular data.

In-person meetings will be used to communicate information about water level changes to water provider staff and customers. We will plan to hold four regional meetings in the final year of the project, one in each conservation district region. Partners will help advertise these events to their customers and affiliates. The meetings will consist of the team leads presenting a brief summary of the project and the overarching results, along with water level trends and other regionally relevant results. Water level data will also be incorporated into the 2021 Forecast and hopefully future Forecasts as funding allows. With the data, state agencies, including the Office of the Columbia River and Department of Ecology, will have a clearer understanding of how groundwater resources are changing in the short-term, but will also benefit from the modeling efforts that will estimate changes 30 years into the future. These data will directly support state-level efforts to provide early assistance to locations where water stress may increase in the future. Finally, the State of Washington Water Research Center will maintain a webpage that describes the project effort and will host, update, and archive all other project-derived data, maps, reports, and other product to make them publicly accessible.

Water managers and community members will benefit from locally hosted, public presentations that provide context for why groundwater level monitoring is important, as well as a succinct overview of how groundwater levels may be changing in their region. Sharing this information with managers and the public is important for building awareness about water use and empowering communities to make informed decisions about future water management. State agencies will benefit from the new data collected, providing them with the ability to more accurately assess water supply and demand at finer spatial and temporal resolutions throughout the CRB, which in turn can help them allocate where resources and support would benefit communities the most. Finally, academics will benefit from having access to the publicly available data and reports from this project, both to help better inform state agency research efforts, but to pursue further research that can support community and agricultural development throughout the basin into the future.

e. Criterion E – Department of Interior Priorities

The project supports the priority of “utilizing our natural resources” and “striking a regulatory balance” by improving how decision are made to sustainably manage groundwater in the study area. It also supports the goal of “restoring trust with local communities” by enabling the study communities themselves to monitor their own natural resources.

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Funding Plan

The non-Federal share of project costs will be obtained from the project team and from third-party contributions. The WSU and Aspect team members will contribute in-kind contributions from the 2021 Long-term Water Supply and Demand Forecast project, which has already been awarded by the Department of Ecology Office of Columbia River (OCR). OCR has approved the use of these funds for cost share (Letter of Funding Commitment by T. Tebb, J. Turk). GeoEngineers will contribute cost-share by equally matching Co-I Lindsey’s Federal budget request (Letter of Funding Commitment by K. Lindsey).

Third party contributions will be obtained from:

- Department of Ecology Eastern Regional Office (Letter of Funding Commitment by P. Cabbage): in-kind contribution to conduct groundwater level monitoring training.
- Department of Health (Letter of Funding Commitment by M. Means): in-kind contribution to support dissemination events in the final project year.
- Lincoln County Conservation District (Letter of Funding Commitment by E. Bowen): in-kind contribution to monitor ~70 well on a monthly timescale from January – June 2020 via an already-funded project by OCR.

The cost share breakdown is shown in Table 1.

Table 1. Cost share contributions by project team and partners.

	Year 1	Year 2	Year 3	Total
WSU Forecast budget project	140,486			140,486
GeoEngineers	6,000	6,000	6,000	18,000
Aspect	47,728	50,325	21,957	120,010
Department of Health			2,000	2,000
Department of Ecology Eastern Region	5,416	5,416	5,416	16,248
Lincoln County Conservation District	74,913			74,913
Total	274,543	61,741	35,373	371,657

Budget Proposal

BUDGET ITEM DESCRIPTION	COMPUTATION		Quantity Type	TOTAL COST
	\$/unit	Quantity		
Salaries and Wages				
Dr. Alexandra Richey	\$11,334.44	.50	Months/year	\$17,691
Dr. Julie Padowski	\$6,520.15	.50	Months/year	\$10,176
Dr. Kevin Lindsey	\$150	120	\$/hour	\$18,000
J. Turk	\$214	160	\$/hour	\$34,240
R. Pepin	\$140	80	\$/hour	\$11,200
P. Price	\$120	80	\$/hour	\$9,600
Fringe Benefits				
Full-Time Employees (Richey, Padowski)	29.4% of salary			\$8,193
Equipment				
E-Tapes				\$26,304
Pressure Transducers				\$7,767
Supplies and Materials				
Conservation District Purchased Services				\$59,524
Miscellaneous Supplies				\$3,750
Contractual/Construction				
NA				\$55,040
Third-Party In-Kind Contributions				
Lincoln County Conservation District				\$74,913
GeoEngineers, Inc.				\$6,000
Aspect Consulting				\$120,010
Department of Health				\$3,650
Department of Ecology Eastern Region				\$16,248
Department of Ecology office of Columbia River				\$140,486
<i>Total Cost Share Contributions</i>				\$373,307
Other				
NA				
TOTAL DIRECT COSTS				\$206,445
Indirect Costs				
Facilities and Administrative Costs	53%	\$176,405		\$93,495
TOTAL ESTIMATED PROJECT COSTS				\$673,247

Budget Narrative – Federal Request

A. Personnel:

Alexandra Richey McLarty, PI

Dr. Richey will commit the equivalent of 0.5 month/year in addition to the 1.5 months/year contributed as cost share. Dr. Richey is the lead PI of the proposed project and the co-lead on the Forecast project groundwater module that the proposed work is building from. She will lead outreach to stakeholders in partnership with the Conservation Commission. She will advise the students funded in the cost-share commitment from the Forecast project via the Department of Ecology, including on trend analysis and GIS mapping. She will assist in groundwater level training and will coordinate between monitoring volunteers and the Department of Ecology database management as necessary.

Year 1: \$5,667; Total: \$17,691.

Julie Padowski, Co-I

Dr. Padowski will commit the equivalent of 0.5 month/year. She will lead interactions with the water systems, will assist in data analysis, and will assist in results dissemination. She is the lead on the municipal water demand module within the Forecast project.

Year 1: \$3,260; Total: \$10,176

B. Other Personnel:

NA

C. Fringe Benefits:

Year 1: \$2,624; Total: \$8,193

D. Goods & Services:

Conservation district purchased services

Funds are requested in each project year for a purchased services contract with the Washington State Conservation Commission to fund participating conservation districts to monitor groundwater, assuming two wells are monitored twice a year in each of the 27 conservation districts in Eastern Washington. *Year 1: \$19,841; Total: \$59,524.*

Monitoring Equipment

Funds are requested to purchase one water level meter (“e-tape”) for each of the 27 conservation districts and a target of five water systems. They are budgeted at \$732 for a 300 feet reel and \$912 for a 500 feet reel. We estimate half will be 300 feet and half will be 500 feet. The product costs come from the Waterline Envirotech Ltd website (<https://www.waterlineusa.com/product/water-level-meter-tape-engineering-scale/>), in

keeping with the brand and lengths most used by the Department of Ecology Eastern Regional Office. *Total: \$26,304.*

Funds are requested to purchase pressure transducers to be installed in 20% of the study wells. Each transducer costs \$1,213.65, as quoted by Geotech Environmental Equipment, Inc. for a vented PT2X, also in keeping with the brand and model most used by the Department of Ecology Eastern Office. *Total: \$7,767.*

Additional funds are requested for miscellaneous supplies. These supplies will be used to ensure adequate supplemental equipment to use the transducers, access the wells, and to make repairs/adjustments at study wells as necessary. *Total: \$3,750.*

E. Travel:

NA

F. Total Direct Costs:

\$206,445

G. Indirect Costs:

\$93,495

H. Total Direct and Indirect Costs: \$299,940

SOURCE	AMOUNT
Costs to be reimbursed with the requested Federal funding	\$299,940
Costs to be paid by the applicant	\$187,282
Value of third-party contributions	\$231,169.76
TOTAL PROJECT COST	\$718,391.76

Budget Narrative – non-Federal Request

A. Personnel:

Alexandra Richey McLarty, PI

Dr. Richey will commit the equivalent of 1.5 month/year to lead the Forecast groundwater module, including outreach to well-owners, results analysis, and reporting.
Year 1: \$17,682; Total: \$17,682.

Julie Padowski, Co-I

Dr. Padowski will commit the equivalent of 1 month/year to lead the Forecast sub-team on municipal demand.
Year 1: \$3,391; Total: \$3,391.

B. Other Personnel:

PhD Student

Funding for one PhD student is included to support the groundwater results analysis, advised by Richey. *Year 1: \$26,189; Total: \$26,189.*

MS Student

Funding for one MS student is included to support groundwater data coordination and collection, advised by Richey. *Year 1: \$10,842; Total: \$10,842.*

MS Student

Funding for one MS student is included to support the municipal demand estimations.
Year 1: \$15,945; Total: \$15,945.

C. Fringe Benefits:

Year 1: \$43,863; Total: \$43,863

D. Goods & Services:

NA

E. Travel:

NA

F. Total Direct Costs:

\$117,912

G. Indirect Costs:

\$22,574

H. Total Direct and Indirect Costs: *\$140,486*