

# HERC/IGEM Project

Yr 2: Annual Progress Report

<b>Project Title:</b>	Sustaining the Competitiveness of the Food Industry in Southern Idaho: Integrated Water, Energy and Waste Management
<b>Principal Investigator:</b>	Dr. Karen Humes
<b>Institution:</b>	University of Idaho (lead) with subcontracts to Boise State University and Idaho State University
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### **1) Summary of project accomplishments for reporting period and Plans for Yr 3:**

The accomplishments and plans for the four primary tasks identified in the original proposal are summarized here (Tasks A-D). A summary of accomplishments for the overall project management and coordinated stakeholder engagement activities are also summarized below, listed as Task E.

*The team would like to stress that our partnerships with producers, processors, municipal treatment personnel and water management entities (private and public) are fundamental to all of our tasks and our project as a whole. Our Yr 2 activities have been influenced and enhanced by interactions with our Stakeholder Advisory Board (described in more detail under Task E below) and interactions with other stakeholders as well.*

#### ***Task A) Recovery of energy, nutrients, water and bioproducts from waste streams: bench to place-based pilot projects***

*Team:* Erik Coats (UI, environmental engineering/molecular biology; emphasis on resource recovery from waste streams); Armando McDonald (UI, biomass conversion and bioproducts); Kevin Feris (BSU, algae-based resource recovery and microbial ecology))

#### ***Team background and overall goals:***

This team collaborated for 10+ years and has the required multidisciplinary experience to integrate biological, chemical, physical and thermal approaches to the recovery of energy, bioproducts and nutrients from multiple waste streams. The team is leveraging investments made by the INL, CAES, HERC, and the IGEM incubation fund. Over the last 10 years our efforts have resulted in multiple extramurally funded awards, student training opportunities, scientific publications and a pending patent. We have worked across bench and pilot scales. Recent support from SBOE HERC allowed us to build a pilot scale system to convert dairy waste to value added products (biogas, bio-plastic, algal biomass); previous HERC funding supported construction of two pilot systems at UI by Dr. Coats—one located at the Moscow WWTP, designed for municipal wastewater and one mobile system (24 ft. trailer) designed for dairy manure resource recovery. We are engaged in testing, validating, and extending these systems to evaluate opportunities to recover high-value products (bioplastics, algae, biofuels) from industrial/municipal wastewater while achieving treatment. Research is focused on further understanding/optimizing our integrated system to maximize utility across input streams and demonstrate “real-world” applicability. Research objectives will further technology interrogations and advance wastewater as an economic resource. Ultimately, research will advance solutions that can be applied in Idaho agricultural and food processing sectors; producing economic value from waste will enhance Idaho-based industries by diversifying product portfolios.

#### ***Accomplishments this reporting period:***

The following provides detail of progress in the first half of Year 2, building from Year 1 successes, towards the aims described in the original proposal.

- i. Bench scale: Assess and evaluate nutrient recovery, energy reduction, bioplastics production, and algal production strategies to inform pilot scale operations.
- a) Assessment of optimal process sequences (biological, chemical, physical, thermal) to recover energy, bioproducts (biofuels; bioplastics) and nutrients from mixed waste.
- (Coats) Bench-scale EBPR bioreactor operations continue to be operated and evaluated. One current focus is analysis of process “success” vs. “failure.” Stable operations of any resource recovery system at full scale demands intrinsic knowledge on what constitutes stable operation, and how unstable, or “failed,” operations might be recovered. Investigations are being conducted using macro- and molecular-level methods.
  - (Coats) Phosphorus recovery from wastewater is most sustainably and reliably achieved through a process known as enhanced biological phosphorus removal, EBPR. Bench-scale EBPR operations are ongoing, with a focus on ascertaining the effects of key process operational criteria on maximal P recovery. Building from past research efforts, current investigations are focused on two operational scenarios that integrate a new operational strategy. One operational scenario feeds all wastewater to the bioreactor at one time (beginning of the cycle), while the 2<sup>nd</sup> strategy feeds a more targeted, controlled wastewater (VFA-rich fermenter liquor) at the beginning of the cycle and then the raw wastewater stream at the end of the anaerobic period. The former operational strategy is identified as the A/O process, while the latter is known as the Westbank process. A central question relates to understanding the effect of adding VFAs outside of the anaerobic period. In Y2 research was expanded to incorporate a new operational strategy that involves oxidation-reduction (redox) control of the anaerobic period. Research suggests that “deep anaerobic” conditions can enhance and stabilize EBPR; we are utilizing real-time redox process control to further evaluate this operational strategy and its impact on operational “success” vs. “failure.” Results will ultimately inform pilot (2020) and full-scale operations.
  - (Coats) Another current focus is on achieving stable nitrification in an activated sludge wastewater treatment system achieving carbon, ammonia-N, nitrite-N, nitrate-N, and phosphorus removal. Nitrification is a biological process whereby ammonia-N is oxidized only to nitrite. Process success will result in significant energy savings in wastewater treatment. Process success was realized at both bench and pilot scale in late Y1 and in Y2; results are being reviewed to inform 2020 pilot operations, and also to generate a peer-reviewed publication
  - Complementing the nitrification research are efforts to understand and better characterize denitrification, with the aim to further optimize the EBPR process for energy efficient nutrient recovery. Nitrate is a contaminant of concern in drinking water, and often must be removed from wastewater prior to discharge to the water environment. A primary concern with conventional EBPR processes that integrate nitrite/nitrate reduction is the potential production of nitrous oxide, which is a very potent greenhouse gas (300X CO<sub>2</sub>). Bacteria exhibit variable metabolic pathways to reduce nitrate vs. nitrite; some bacteria cannot reduce nitrate to nitrite, which requires a more complex microbial culture to successfully eliminate nitrate from the wastewater. Ongoing efforts by one of Coats’ PhD students is

centered on better understanding the metabolic capabilities of bacteria and how they reduce nitrate vs. nitrite.

- One of Coats' PhD students conducted intense evaluations of the dairy-based PHA pilot in Y1/Y2, with very successful results. Ongoing efforts are focused on finalizing and submitting a peer-reviewed journal manuscript that details the results from these investigations; the publication will be submitted in June 2020. The manuscript includes numerous team members, including McDonald's research team. Coats' PHA pilot also went into operation in spring 2020; a primary focus is to couple Coats' PHA pilot with his EBPR pilot to evaluate broader process integration for enhance waste resource recovery.
- Algal cultivars were used throughout year 2 for routine experimental deployment. On-going experiments continue to be focused on cultivation at both bench and pilot scales employing wastewaters from multiple sources (e.g. currently dairy and municipal provided by the Coats lab and the City of Boise, respectively) to maximize nutrient capture and algal biomass production as well as production of high-value PUFA enriched algal biomass. Bench scale experiments have identified which strains produce optimal levels of biomass under various cultivation conditions and have been translated to pilot-scale operations of our greenhouse-based algal cultivation systems. Current bench scale experiments continue to assess the utility of municipal sourced struvite to cultivate high value algal biomass under controlled conditions, while simultaneously capturing struvite sourced nutrients (e.g. nitrogen (N) and phosphorus (P)). We are continuing to work with three algal strains known to produce high concentrations of omega-3 fatty acids under the proper cultivation conditions (i.e. *Chlamydomonas reinhardtii*, *Nannochloropsis oculata*, and *Paeodactylum tricornutum*). Initial experiments suggested that certain modifications to the cultivation conditions were required to obtain significant levels of growth when using struvite as the primary nutrient source. These experiments not only direct future work for optimization of algal cultivation on municipal struvite, but are also potentially applicable to struvite produced from agricultural resource recovery systems. As we hone our understanding of what cultivation media factors and growth conditions are required to maximize growth and high value biomass production we will then scaled these experiments up to pilot scales to evaluate high-value algae production at these larger scales.

We also initiated greenhouse/pilot-scale cultivation experiments during Fall 2019 and Spring 2020 that are pursuing mixed-culture approaches for the capture of nutrients from liquid wastewaters. Produced algal biomass from these experiments has been dewatered and preserved for HTL processing by the McDonald lab. During year 3 nutrients captured from the HTL processing of algal biomass will then be tested as inputs to a struvite production system (either via modeling or bench scale struvite production). Struvite produced in this way will then either be tested similar to the municipal struvite experiments described above or analyzed for mineral content to allow accurate estimate of the utility of the algae-capture nutrients purified by struvite production. Based on this suite of experiments we will determine the most appropriate mechanism for algal cultivation and nutrient source in our integrated system. Initial greenhouse cultivation results suggest we can generate high levels of algal biomass on PHA reactor effluents. However, we need to continue this work to

determine stability of the production system (i.e. in terms of growth rates, yields, and nutrient capture rates) and repeatability of the HTL processing outputs.

We initially expected to have some biomass characteristics data acquired during the second half of year 2. However, due to experimental delays induced by the COVID-19 pandemic this effort will continue into year 3. We will build on these experiments in year 3 to enhance our focus on the quality of the produced algal biomass in the context of potential economic returns of a commercialized system and/or the influence of the nutrient capture on the potential to reach a “Net zero” status for a given agricultural system. These goals are informed by our discussions with our stake holder advisory group, as noted below.

- ii. Pilot scale assessments: Conduct pilot scale evaluations from mixed waste streams; implement/evaluate treatment resource recovery processes.
- Both Coats’ pilot systems were operational in Y1, and have been re-started for Y2, to continue into Y3. Coats’ research team was fully trained on systems operation.
  - Completed 2019 operations of Coats’ pilot operations at the UI dairy (PHA pilot) and at the city of Moscow, Idaho (EBPR/nitrification pilot). Former efforts were intensively focused on collecting data to facilitate ultimate transition to a full scale system; ongoing data interrogation is informing and being integrated into a journal manuscript. Moreover, PHA pilot data greatly informed potential future scale-up to commercial operations, and the team is evaluating potential new funding opportunities to make the transition to commercialization. Latter efforts focused on preliminary assessment of integrated EBPR-nitrification, with an emphasis on integrating ammonia-based aeration control (ABAC) to enhance nitrification over nitrification. Successful nitrification was achieved for the entire month of August 2019 (early Y2); data evaluation is ongoing, with the aim to inform 2020 pilot operations.
  - The initial pilot scale greenhouse systems have been constructed at the Boise State research greenhouse and were validated for suitability for cultivation of multiple algal strains. We purchased, installed and tested a new 20L flow through centrifuge for rapid collection and concentration of the algal biomass produced in our pilot-scale greenhouse cultivation experiments. Installation and safety checking of the centrifuge took longer than expected slowed the rate of optimization of operational conditions in the first half of year 2. However, final installation and testing of the centrifuge was completed prior to December 2019. In Jan 2020 we initiated our greenhouse scale experiments, employing both controlled media and effluent sourced from the pilot-scale PHA system operated by the Coats lab. Initial cultivation experiments were successful and produced significant quantities of algal biomass for testing in our HTL process development (McDonald lab). Although the full suite of proposed greenhouse scale experiments for year 2 may not be completed in year 2, the majority of the experimental operation and sample collection will likely occur in year 2. However, completion of data collection and analysis will most likely be delayed until the start of year 3. This additional delay is due to the COVID-19 pandemic and associated temporary closures of research facilities at Boise State University. During the last month of year 2 and first months of year 3 we will do our best to accelerate the rate of these experiments to facilitate our ability to inform decisions about which types of algal

cultivation systems to couple with the AD/PHA aspects of our integrated system. We will continue to operate the pilot scale algal cultivation systems through 2020 in collaboration with the Coats and McDonald labs at UI.

- iii. Produce prototype products (bioplastic mulch film, biochar, biofuel) for evaluation.
  - One PhD student in McDonald's lab has been working on extracting and isolating pure PHA bioplastic generated from eight trials on the pilot plant over 84 days of operation. Each batch of PHA was produced under slightly different operating conditions (see section ii). The eight batches of the purified PHA bioplastic are being characterized for their thermal and rheological properties in order to determine their suitability for producing bioplastic films. We have been evaluating different extraction and purification methods to improve the recovery of PHA from biomass and the purified PHAs are being characterized.
  - With the on-ramping of the greenhouse scale experiments in Fall 2019/Spring 2020 in the Feris lab we will begin to produce suitable quantities of algal biomass for use in HTL experiments by the McDonald lab. Primary outputs of HTL processing of algal biomass will include biofuel (i.e. biooil), biochar, and aqueous phase nutrients. The aqueous phase will be recycled to the algal cultivation system to enhance algal biomass production.
  
- iv. Partnerships with producers, processors and municipal treatment personnel are fundamental to all of these tasks. Team will build on existing relationships with Twin Falls wastewater treatment facility, Food Northwest, Chobani, Amalgamated Sugar, J.R. Simplot, Idaho Dairymen's Association, and Glanbia, and expand to new partners throughout this project
  - a. A second SAG meeting was held virtually on December 17<sup>th</sup>, 2019. This meeting focused on providing research updates to our SAG committee members and inquiring with them on where they felt we should focus our efforts over the remainder of year 2. SAG members were supportive of the direction of the research but provided feedback that the team should continue to focus on potential routes towards commercialization of the technologies under investigation. SAG members renewed their commitments to help the team pursue potential routes for commercialization as opportunities arise. Additionally, the SAG provided additional detail on how to best help move portions of our work towards commercialization. These included suggestions to focus interpretation and analyses of experimental outcomes in the context of typical or example real world systems. Specifically, to look into how our technology would translate to implementation at a 1500 head dairy (the typical dairy size in ID). The SAG also suggested we look into how implementation of our technology would help Idaho Dairies reach a net zero status. One means by which the team could achieve these goals would be to engage students and faculty from the Business schools in our respective universities.
  - b. Additionally, our SAG engagement resulted in leadership from the Idaho Dairymen's Association inviting two members of our team (Feris, Coats) to the joint Idaho/Utah Dairymen's association meeting in Salt Lake City, UT in July 2019. This meeting provided an opportunity to further develop relationships with regional dairy producers and to introduce them to the potential outcomes of our project. Additionally, the Idaho Dairymen's Association networked Coats/Feris with Newtrient LLC (Steve Rowe, CEO). Newtrient is advancing an integrated set of technologies focused on achieving 'net zero' emissions from dairies. Discussions will continue with Newtrient to i) potentially ascertain how the PHA

- technology might be integrated, and ii) potentially collaborate on future commercialization funding.
- c. Research plan adjustments in response to our Stakeholder Advisory Group (SAG): SAG feedback from the mid-year meeting in December 2020 continued to support our focus on the utilization of struvite as a nutrient source for algal cultivation for production of high value biomass. Further, current algal cultivation experiments are being planned within the context of potential future application at a typically sized ID dairy and in the context of net economic return. We are also investigating the effect of our integrated technology on the ability of an agricultural system to achieve net zero status, however this work is in its early stages and will require more effort during year 3 to make significant progress. The Feris lab also intends to seek out a suitable and interested business student to help us translate our algal productivity data to economic value projections during year 3.
  - d. Another recommendation from our December 2019 SAG meeting was to evaluate i) the greenhouse gas footprint of Coats' PHA process, and ii) evaluate the potential of Coats' PHA process to remove phosphorus. These evaluations are ongoing.
  - e. One of our goals for year 2 of this project was to continue to build on our budding Stakeholder relationship with the hopes that they will blossom into partnerships for seeking pre-commercialization funding in year 3. We continue to work towards this goal and during year 3 we will focus our data collection efforts on system development and scale up as well as communication of research findings with our stakeholder group.
  - f. **Research plan adjustments in response to the COVID-19 pandemic:** Research facilities at the University of Idaho and Boise State University were shut down for a significant component of the second half of year 2 of this project. During the facility shut down research activities were focused on data analysis, literature reviews, and planning for experiments once facilities were reopened. Although some delays in data collection were experienced due to the COVID-19 pandemic, as of early June 2020, research facilities at both institutions are re-opening and we hope to make significant progress towards our year 2 research goals in the last month of FY20. Travel to and attendance at conferences/meetings that were planned were halted during this period and delivery of presentations impeded. Additionally, Dr. Feris' sabbatical plans were interrupted by the COVID-19 outbreak and corresponding limitations on travel around the state. However, we plan to utilize our team's stakeholder meetings to enhance our relationships with local municipalities and regional agricultural representatives.

### **Goals/Plans for Year 3 (Task A):**

#### **i: Bench scale**

- In year 3 nutrients captured from the HTL processing of algal biomass will then be tested in a secondary stage algae production system for high value commodity production either directly as aqueous nutrients or via production of struvite. Based on these experiments and those of the primary stage algal cultivation we will determine the most opportune mechanism for algal cultivation in our integrated system as a primary

nutrient capture stage and a secondary high value biomass production stage or as a single primary or secondary stage system. Our evaluation will be based on the algae growth rates, yields, biomass characteristics, and economic potential when grown in the different wastewater nutrient sources.

- Advance new knowledge on operational criteria to discern between process “failure” and “success” for enhanced biological phosphorus removal. Generate a publication.
- Advance new knowledge on achieving shortcut nitrogen removal in biological wastewater treatment. Emphasis will be both on reactors performing enhanced biological phosphorus removal and on reactors just performing ammonia-nitrogen removal. Generate a publication.
- Finalize a metabolic model for producing biodegradable plastics from fermenter dairy manure. Generate a publication.

#### ii: Pilot scale:

- Operate and analyze performance of Dr. Coats’ bioplastics pilot system at the UI dairy.
  - Refine and evaluate operational criteria based on successes from Y2 operations.
  - Produce quantities of bioplastic material from Coats’ pilot scale system for McDonald’s ongoing polymer characterization work.
  - Undertake blown film trials using pilot scale produced bioplastics
- Operate and analyze performance of Dr. Coats’ municipal enhanced biological phosphorus removal system located at the city of Moscow wastewater treatment system. Focus on translating/assessing operational criteria from Coats’ bench scale reactors to his pilot scale systems. Specific focus will be:
  - Achieve and assess shortcut nitrogen removal
  - Evaluate the impacts of the return activated sludge flow rate on process stability and performance
  - Evaluate the impacts of integrating effluent from Dr. Coats’ bioplastics pilot on overall wastewater treatment and resource recovery
- We will continue to operate the pilot scale algal cultivation systems through 2020-2021 in collaboration with the Coats and McDonald labs at UI.

#### iii: Producing prototype products:

- Ongoing experiments in the Feris lab will begin to produce suitable quantities of algal biomass in year 2 and 3 for use in HTL experiments by the McDonald lab. Primary outputs of HTL processing of algal biomass will include biofuel (i.e. biooil), biochar, and aqueous phase nutrients. The aqueous phase will be recycled to the algal cultivation system to enhance algal biomass production.
- Produce bioplastic blown films for assessment

#### iv: Training:

- Conducting training for the city of Moscow, Idaho wastewater treatment staff, focused on the basics of biological wastewater treatment and integrating knowledge on the operation of their enhanced biological phosphorus removal system.



***Task B) Decision-support tools for industry and community leaders to quantify and visualize trade-offs among water, energy, land use and municipal growth***

*Team:* Jae Ryu, UI, systems dynamics modeling, water resources; Karen Humes (UI, water/energy nexus, geospatial analysis)

*Overall Goals:*

The goal of this task is to integrate energy components into an updated version of a pre-existing system dynamics model for water supply, use and flows in the region of the Eastern Snake Plain Aquifer. The model which will serve as a decision-support tool for stakeholders (including the food producers, food processors, irrigation districts, water and energy providers and municipal communities/citizens). The tool will quantify and provide users with visuals on the linkages between water, energy, land use and municipal growth, to be used for planning and decision-making by producers, water users, businesses, utilities, state agencies and communities.

*Accomplishments this period:*

- Evaluated the existing model to determine how to implement water management options (e.g., managed aquifer recharge) given the existing data types available
- Interacted with IDWR on their newest ESPAM (Eastern Snake Plain Aquifer Model) model version and updated data needs
- Evaluated the feedback from IDWR and Surface Water User's Association at the stakeholder meetings in May 2019 and Dec 2019 and how the model could be more useful for stakeholders
- Incorporated new features that are available in Stella Architect into the system dynamics model and user interface.
- Performed a quality analysis of the most recent data available from IDWR and completed the integration process to bring the model up to date.
- Completed data placeholders for the updated water data from the ESPAM ground model
- Explored available data on energy use in irrigation, including interactions with IDWR and collaboration with experts on energy use in irrigation at Idaho Power.
- Further evaluation of spatial patterns in energy use for irrigation in the ESPA and controlling factors in order to identify key variables to relate water and energy use in irrigation (i.e., crop type, irrigation system characteristics, water source, etc.). Data analysis nearly complete, with publication to be submitted in August 2020.

*Plans for Yr 3 (Task B):*

- We will update available water and energy data for Stella Architect once the latest version of ESPAM model becomes available to the public
- We will continue exploring management options to incorporate into the model, such as water conservation, managed recharge, etc.
- We will be developing system evaluation criteria associated with new data inputs and potential uses for the expanded and update model, such as system reliability, vulnerability, resilience, etc.
- We will complete our analysis of available data on energy use in irrigation

- We will complete the development of a module for the system dynamics model that quantifies energy use in irrigation for two meteorological scenarios (average and above average demand in a growing season) and number of acres with other key variable combinations (eg., crop type, irrigation source/type)
- We will begin incorporating supply side scenarios to quantify the linkages between water, energy and land use and address the uncertainty of the water/energy nexus in the Eastern Snake Plain Aquifer.
- Submit draft of journal article describing the linkages between water and energy use in Idaho
- We will continue to seek input from our Stakeholder Advisory Board and other water and energy providers, managers and community leaders on how to make the tool/model most useful to them.
- We will explore water supply uncertainties driven by climate variability in the ESPA, particularly the impacts of more frequent drought conditions.

***Task C) Technical innovations/sensing systems to reduce water/energy/nutrient use in targeted production systems:***

*Primary team members:* Donna Delparte, (ISU, drone and satellite-based sensing systems) and partners among growers and crop consultants.

*Accomplishments this period:*

Progress in the following task area has been made through the subcontract award to Idaho State University and included:

- **Goal 1 – Decision Support Systems**
  - Decision support online tool prototype for sustainable agriculture decisions making: <https://avalanche.geology.isu.edu/i2i/osgood.html>
  - This decision support tool was developed by working with stakeholders and our Advisory Board member (Brandon Vining, ProGro) to provide remote sensing data/tools to aid decision making that is relevant to business decision making and operations
  - Stakeholders are excited about the potential of the tool to improve ROI, reduce fertilizer inputs and improve precision farming techniques for sustainable agriculture
- **Goal 2 - Pilot projects to use drone-based, other field-based and satellite sensors to reduce water/nutrient/energy use in production of targeted crops**
  - Conducted remote sensing analysis to forecast yield for potato growers based on a growing season of high-resolution satellite imagery (submitted for publication in 2019 to *ASPRS Pecora Conference Proceedings* by Masters student)
  - Conducted thermal camera surveys of irrigated cropland using UAS in the 2019 growing season to assess efficiency and support water reduction efforts. Data collected and analysis in progress.
  - Hyperspectral camera data collection during the 2019 growing season of potato crops to detect crop threats

- PhD student conducted experiment to determine essential spectral signatures required to detect individual unhealthy plants in a growers field that leverages machine learning of hyperspectral imagery – thus offering the opportunity to reduce inputs for control and mitigation of disease.
- New thermal and hyperspectral data acquired in the first portion of the 2020 growing season, as well as more training/testing with growers on the effectiveness of the satellite-based tool for monitoring emerging crops
- Co-I Delparte launched a new Idaho based spin-off company (I2IGeo) to provide growers with technological innovations and decision support to assist their operations, leveraging the research outcomes from this grant.

Plans for next reporting period:

For the next reporting period, the team will focus on the continued development and testing of UAS platform and sensor combinations for data collection in the 2020 growing season and the first part of the growing season in 2021, again in partnership with growers and crop consultants. Dr. Delparte will also continue to work actively toward commercialization of the most promising technologies from this research through her new Idaho company (I2IGeo).

***Task D) Engaging the present and future workforce in the adoption of new technologies***

*Team members for training (primary):* Karen Humes, Erik Coats, Kevin Feris, and partners at CSI, UI Idaho Falls and professional organizations such as Food Northwest, *Primary team member for drone outreach activities:* Jae Ryu (Idaho Drone League (I-Drone), Founder).

Overall goals:

The overall goals in this task are two-fold: 1) to provide direct support to our stakeholders in the near-term by identifying workforce development needs that universities could plan and implement, together with partners at community colleges and professional organizations (resourced primarily in Yrs 2 and 3) and 2) contribute to longer-term workforce needs by holding outreach events designed to engage the future workforce in STEM activities that will serve the food industry in Idaho in the future, such as drone operations and the analysis of data from sensors onboard drones.

Accomplishments this period:

- Goal 1: Current/near-term workforce development needs
  - Engaged with a stakeholder (IDEQ) that approached us about workforce development needs and added a representative to our Stakeholder Advisory Board
  - Discussion and initial planning for training sessions we could hold in coordination with the rural water treatment association meetings later in Yr 2 and in Yr 3.
  - Due to Covid-19 and the cancellation of the rural water treatment association, some of the outreach planned for the end of Yr 2 had to be postponed to Yr 3.

- Goal 2:
  - Hosted a hands-on education program known as “Idaho Drone League(iDrone)” in the Treasure Valley in Fall 2019 to promote STEM pipelines and skills important to the Idaho food industry in the future.
  - There was a Drone League event planned for June 2020 in Twin Falls, which unfortunately had to be postponed due to Covid-19 closures and restrictions.

Plans for Yr 3:

- Training sessions to be held in conjunction with the Rural Water Treatment Association meeting and similar venues. If travel and in-person meetings continue to be problematic, we will hold virtual training sessions.
- Three Idaho Drone League events will be scheduled in Year 3. These event will include a table highlighting how drones can be used in food production (from Task C of this research). If COVID-19 continues in Yr3, we will adopt a hybrid option (e.g., virtual meeting for drone building/coding/programming + hands-on flight experience outdoor with social distancing and PPE).
- Continue to engage with our Stakeholder Advisory Board and professional organizations such as Food Northwest to identify and implement professional development needs in food, water, energy and waste and how the universities can catalyze and facilitate these.
- Continue to engage with other stakeholders such as the IDEQ on needs and opportunities in professional development on pollution control and management.

***Task E) Project Management/Stakeholder Engagement***

Background: An important element of our project management was to put together and meet regularly with an advisory board comprised of stakeholders in the food production and processing industries, water user groups and state agencies. In Year 1 we formed this advisory and had a very successful 1<sup>st</sup> meeting in person in Boise in early May 2019. As noted in the technical progress reports (earlier sections of this report), the board feedback influenced our research plans in Year 2, as planned. The board agreed to meet in it’s entirety once/yr in person (Apr/May), once/yr via videoconference (Nov/Dec) and have specialized meetings between specific sub-groups of team and advisory board members in between.

*Accomplishments this period:*

- We held a 2<sup>nd</sup> meeting of our full Stakeholder Advisory Board (SAB) on Dec 17, 2019. As planned and discussed at our May meeting, the meeting was held by video, with 4-5 attendees in one conference room in The following SAB members attended and those listed with a (\*) were invited and had hoped to attend but were not able to do so:
  - Jeff Bohlscheid, Senior Principal Scientist, J.R. Simplot Company
  - Shawn Moffitt, Regional Business Manager, Jacobs Engineering (contractor for City of Twin Falls and Chobani water treatment plants)

- Bob Naerebout, Government Affairs and former Exec Director, Idaho Dairyman’s Association and and Megan Satterwhite, Environmental Programs Director, IDA
  - Ben Nydegger, Biosolids Program Manager, City of Boise
  - Sean Vincent, Hydrology Section Manager, Idaho Dept of Water Resources
  - Ben Jarvis, Pollution Prevention Projects Coordinator, Idaho Department of Environmental Quality
  - Brian Olmstead\*, President, Surface Water Appropriators and General Manager, Twin Falls Canal Company
  - Brandon Vining\*, ProGro Consulting
- The primary goal of this second meeting of our SAB was to update the SAB on our previous 6 months activities, particularly those things that had been prioritized or tweaked as a result of their feedback in May, and to gain more insight from them as to how we could make our research as useful to them as possible.
  - PI Karen Humes and Co-I Erik Coats met individually with Ben Jarvis in Oct 2019 to discuss workforce training opportunities that could “piggyback” along with existing IDEQ events and/or professional meetings such as the Idaho Rural Water Association
  - As described in some detail under our “Task A” Technical progress section above, two of our Co-Is (Coats and Feris) have done considerable outreach to the dairy industry in both Idaho and Utah, including presentations at the Utah Dairyman’s Association in July 2019.
  - We also established a cloud file storage space for our project (and shared it with the SAB) in which all presentations and notes from our SAB meetings are stored, along with our progress reports to the SBOE/HERC.
  - PI Humes has begun a new stakeholder relationship with the Association of Idaho Cities
  - In the way of other team management and organization among Co-Is at the multiple institutions, we have continued our monthly team meetings via videoconferencing.
  - We had planned to hold a second SAB meeting in May 2019 but postponed it in the hope that meeting at a later date would allow face-to-face meeting. However, in late June we began preparations to hold another SAB meeting via Zoom in early July.

Plans for YR 3:

- Hold two SAB meetings (Dec 2020 and June 2021)
- Continue to build on existing relationships with Twin Falls wastewater treatment facility, Food Northwest, Chobani, Amalgamated Sugar, J.R. Simplot, Idaho Dairymen’s Association, and Glanbia, and expand to new partners throughout this project
- Continue to hold monthly team meetings to monitor progress and facilitate coordination of all project tasks and stakeholder engagement activities. In coming months these meetings will focus on student presentations of research.

## 2. Summary of budget expenditures for Yr 2 (July 1, 2019 – June 30, 2020)

A detailed expenditure is provided in Section 6 at the end of the report, but the table below summarizes the spending in the major budget categories, relative to the budgeted amounts for Year 2. The expenditure report was run on June 30, 2020, but expenses for the last pay period in June, which ended on June 27, are not yet reflected in the amounts remaining. There are also a few operational expenses that are still working their way through the approval queue and have not yet posted. Our subcontractors final estimated invoices sent on June 15 indicated that all but \$267 of the funds allocated to them would be spent. We anticipate that all of the funds in the budget for UI investigators will be expended after all June expenses clear the system.

	Budget	Expenses Cleared	Remaining*			
Salaries:	\$ 181,768	\$ 179,629	\$ 2,139			
Fringe Benefits:	\$ 25,901	\$ 22,957	\$ 2,944			
Irregular Help:	\$ 53,023	\$ 40,965	\$ 12,057			
Travel:	\$ 10,912	\$ 10,511	\$ 401			
OE:	\$ 65,760	\$ 63,284	\$ 2,477			
Subcontracts:	\$ 287,435	\$ 287,168	\$ 267			
\$5K > Capital:	\$ 18,245	\$ 18,245	\$ -			
\$5K < Capital:	\$ 2,522	\$ 2,522	\$ -			
Trustee/Benefits:	\$ 54,435	\$ 55,533	\$ (1,098)			
Total:	\$ 700,000	\$ 680,813	\$ 19,187			

\*Payroll has not yet cleared for the last pay period in June, as well as a few other expensed amounts in approval queues.

## 3. Demonstration of economic development/impact

- Patents, copyrights, Plant Variety Protection Certificates received or pending

Co-I Dr. Donna Delparte has formed a private company in Idaho called **IZIGeo** and is working to develop a commercialization pathway for her research on this grant related to the use of satellite and drone technology to assist growers in the application of nutrients, herbicides, pesticides and water.

- Private sector engagement

Because every aspect of our work involves considerable private sector engagement, we have noted those engagements in each of our five tasks described in Section 1, particularly under Task E: Project Management/Stakeholder Engagement.

- Jobs created

Several of the research assistant and all of student research assistantship positions described in the next section were newly created in Year 1 of this grant.

#### 4. Numbers of faculty and student participation

In the Yr 2, the numbers of faculty, students and other researchers participating are as follows:

Faculty:	6	(4 UI, 1 BSU, 1 ISU)
Graduate Students:	11	(7 UI, 2 ISU; 2 BSU (both of whom are from groups underrepresented in STEM fields))
Undergrad Students:	5	(UI)
Research Scientists:	2	(1 UI, 1 ISU, both partially supported by this grant)

More details on staffing, by Task:

Task A: Recovery of energy, nutrients, water and bioproducts from waste streams

Coats staffing: 2 PhD students in Environmental Engineering; 2 MS student in Environmental Engineering; 2 undergraduate students in Environmental Engineering; 2 undergraduate students in Environmental Science; 1 research scientist. 4 women, 4 men.

McDonald staffing: 1 PhD student in Environmental Science. 1 woman.

Feris staffing: Current staffing includes 2 male graduate students (both from underrepresented groups in STEM). Both graduate students were previously employed as research technicians on this project, however, by Jan 2020 both transitioned to the MS graduate program in the Biological Sciences with a Spring 2020 start date. Both students will participate in experimental development, data collection, and data analysis. We had originally targeted recruitment of additional undergraduate students (1 or 2) for the second half of year 2 to assist with laboratory and greenhouse scale experiments. However, due to the COVID-19 pandemic we decided to postpone recruitment of additional undergraduate team members. We are planning to recruit additional undergraduate team members in year 3, assuming conditions are favorable for such recruitment.

Task B: Quantifying Water/Energy Linkages

- 2 PhD students (1 in Geography, 1 in Water Resources)

Task C:

- 1 PhD students in Geosciences
- 2 summer Masters students in Geoscience
- 1 research/programming technician

#### 5. Description of future plans for project continuation or expansion

- PI Karen Humes is a Co-Lead on the newly formed CAES Focus Area group in the Energy-Water Nexus arena. Being a CAES Focus Area lead provides some access to CAES resources, including program development funds, to build a team of CAES researchers in pursuit of establishing CAES as a global leader in research, education, and innovation related to the energy-water nexus. Team members of this project are looking forward to leveraging our

current work to pursue future opportunities. The coupling of food, water and energy is exceptionally strong in southern Idaho, from both a national and international standpoint, making a compelling case for other funding sources. Our integrated approach to water, energy and waste is also unique among teams studying the food-energy-water nexus. She and Co-I Erik Coats organized and attended a workshop at CAES in Idaho Falls on Nov 25, 2019 and are now involved in developing proposals.

- Team members are also actively writing grants to other agencies for related work, such as the NSF, USDA and NASA. This includes a current effort led by PI Karen Humes and involving Co-I Erik Coats and 6 other UI faculty) for a graduate student training grant to NSF (the NSF Research Training Grant program, or NRT) related to water quality and public health, with emphasis on Idaho (proposal was submitted to NSF in Feb 2020 and is currently pending). This effort includes also stakeholder partners such as IDWR, IDEQ, and the City of Boise Dept of Public Works. The NSF-NRT program is highly competitive and it would be very unusual for the proposal to be funded on the first attempt; however, if not funded, the team is dedicated to strengthening the proposal (particularly the partnerships with stakeholders) and resubmit in Feb 2021.
- PI Karen Humes submitted a proposal to UI Presidential Initiative on Water and Sustainability for seed funding to begin discussions with stakeholders for the possible formation of an Industry-University Cooperative Research Center on topics studied in this IGEM grant. The NSF supports the development of these with a process that involves a planning grant and then a full proposal the following year. The NSF goal for this program is as follows: *“The IUCRC program generates breakthrough research by enabling close and sustained engagement between industry innovators, world-class academic teams and government agencies.”* We would see this as a way to institutionalize and sustain the research and industry relations developed in this grant. If successful in a full proposal, the NSF provides up to 10 yrs of base funding to establish and maintain such a center. We will also discuss this program at our SAB meeting in early July 2020.
- Co-I Erik Coats (and team leader for Task A of this grant) is a Co-I on the recently awarded 5-yr \$10M grant funded by USDA, led by the College of Agriculture and Life Science, that has among its goals the recovery of byproducts from dairy waste. Dr. Coats will ensure that progress made in the IGEM grant will be brought to bear on the USDA grant and vice-versa.

## 6. Expenditure reports

The expenditure reports presented in Appendix B (detailed first, then a summary by category) details the expenditures at the University of Idaho, including the amounts for paid invoices from our two contracting institutions (Idaho State University and Boise State University). Please note that that this report was run on June 30, 2020 and not all expenses from June 2020 have cleared the system, including the last payroll period that ended on June 27, 2020.

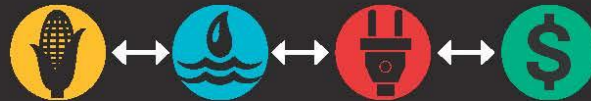
## 7. Commercialization Revenue

None to report yet, but the company I2IGeo (Co-I Delparte as Founder) has been formed.



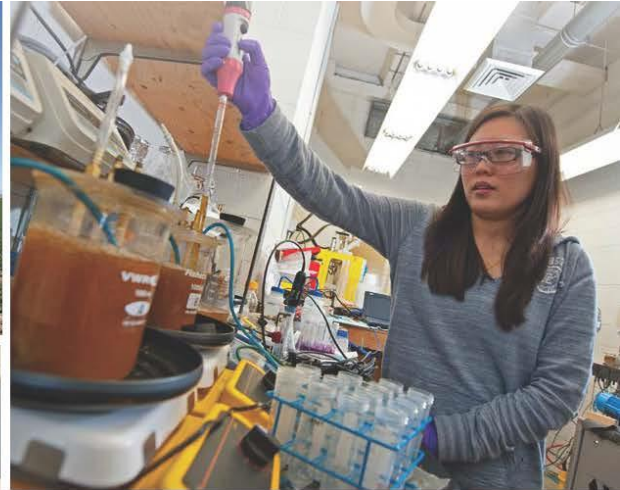
# WATER, ENERGY, and WASTE Management

for FOOD PRODUCTION, PROCESSING, and RESOURCE RECOVERY



**WHO we are:** Consortium of scientists and engineers from University of Idaho, Boise State University, Idaho State University, and Center for Advanced Energy Studies



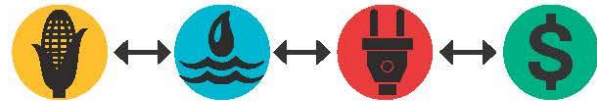


## WHY ARE WE ASKING YOU TO ENGAGE WITH US?

- You are among the leaders in Idaho food production, processing, and associated services such as water and waste treatment
- To gain your perspective and input on issues, challenges, and pathways for your industry
- To better understand both single-user solutions and longer-term visions for applied research on regional solutions, including efficiencies to be gained through collaboration.
- To learn about workforce preparedness gaps and how we can help fill them

## WHAT we are:

- Team conducting applied research funded by Idaho State Board of Education
- Research activities focused on creative solutions in water, energy, and waste management that enhance economic and environmental bottom line for Idaho agro-industry and rural communities.



### TEAM EXPERTISE -

#### FOR DAIRIES AND FOOD PROCESSING:

- Wastewater treatment: operations, energy efficiency, nutrient recovery, and water recycling
- Minimizing management of waste products or any other outputs parasitic to the economic bottom line
- Assisting stakeholders to diversify economic portfolio via resource recovery and retrieval of other value-added products

### TEAM EXPERTISE -

#### FOR CROP PRODUCTION:

- Tools for utilizing satellite and drone data for optimal application of nutrients and water

### TEAM EXPERTISE -

#### FOR ALL STAKEHOLDERS, INCLUDING STATE AND COUNTY/MUNICIPAL PLANNING:

- Quantifying the interconnection of water, energy, and waste streams in southeastern Idaho region
- Useful for planning and identifying synergies/partnerships among stakeholders in the future

**For more information**, please contact Project Director Karen Humes, [khumes@uidaho.edu](mailto:khumes@uidaho.edu) or 208-885-6506.

FWRITEM

University of Idaho  
Itemized Expenditures by Grant Code  
From 01-JUL-2019 To 30-JUN-2020

Grant: SG3587 - ISBOE IGEM FY20 Sustain Food Ind-KH 30-Jun-2020 12:04 PM

-----  
Salaries

E4106 Staff		
Brinkman, Cynthia		16040.32
884.25 hours		
E4108 Summer Salary		
Humes, Karen		17647.20
240.00 hours		
McDonald, Armando		11513.60
160.00 hours		
Ryu, Jae		3711.40
70.00 hours		
E4109 IA/GA Salary		
Abbasi, Maryam		20030.00
1000.00 hours		
Alfaro Salmeron, Glenda		750.00
40.00 hours		
Deyo, Brent		21500.00
860.00 hours		
Mellin, Jason		36410.00
1000.00 hours		
Smoot, Lindsey		8250.00
440.00 hours		
Thompson, Emily		22228.40
1000.00 hours		
Walters, Riveraine		19497.00
780.00 hours		
E4175 Overtime - Covered by FLSA		
Brinkman, Cynthia		74.83
8.25 hours		
		-----
		\$ 177652.75
Temporary/Irregular Help		
E4135 Temporary Student		
Brouillard, Nicolas		2163.00
180.50 hours		
Crites, Willow		2664.75
242.25 hours		
Deyo, Brent		2800.00
112.00 hours		
Ekness, Tayler		474.38
43.75 hours		
Gibson, Joseph		3515.88
326.25 hours		
Guho, Nicholas		23446.32
848.00 hours		
McCormack, Roslyn		595.38
54.75 hours		
McLean, Carly		569.25
51.75 hours		
Shaber, Jonathon		1369.50
124.50 hours		
Smoot, Lindsey		2811.88
258.25 hours		
		-----
		\$ 40410.34

## Fringe Benefits

E4280 Faculty CFR Benefit Expense	10157.50
E4281 Staff CFR Benefit Expense	6526.59
E4282 Student CFR Fringe Expense	5748.64
	-----
	\$ 22432.73

## Travel

E5360 Personal Vehicle - In-State		
20-SEP-19	I2095733	Ryu, Jae H. 5.00
18-OCT-19	I2101059	Humes, Karen S.. 48.09
10-DEC-19	ZT913239	Parking 11112019 10.00
13-DEC-19	I2110710	Ryu, Jae H. 147.69
E5365 Personal Vehicle - Out-of-State		
07-AUG-19	I2087973	Coats, Erik Robert. 42.28
22-OCT-19	I2101614	Coats, Erik Robert. 96.82
22-OCT-19	I2101614	Coats, Erik Robert. 55.00
E5367 Rental Vehicles - In-State		
12-AUG-19	ZT407009	Car Rental Fuel 07202019 60.55
12-AUG-19	ZT407009	Car Rental Fuel 07242019 44.04
12-AUG-19	ZT407009	Car Rental Fuel 07292019 26.72
12-AUG-19	ZT407009	Car Rental Fuel 07302019 37.88
12-AUG-19	I2088874	Ryu, Jae H. 520.99
20-SEP-19	ZT534237	Car Rental Fuel 08102019 27.36
20-SEP-19	ZT534237	Car Rental Fuel 08102019 60.55
20-SEP-19	ZT534237	Car Rental Fuel 08132019 63.74
20-SEP-19	ZT534237	Car Rental Fuel 08142019 27.90
20-SEP-19	ZT534294	Car Rental 09032019 230.06
20-SEP-19	ZT534294	Car Rental Fuel 08302019 64.79
20-SEP-19	ZT534294	Car Rental Fuel 08312019 29.63
20-SEP-19	ZT534294	Car Rental Fuel 09022019 16.02
20-SEP-19	I2095733	Ryu, Jae H. 53.87
20-SEP-19	I2095733	Ryu, Jae H. 604.78
18-OCT-19	I2101059	Humes, Karen S.. 181.16
18-OCT-19	I2101059	Humes, Karen S.. 2.02
10-DEC-19	I2109969	Humes, Karen S.. 252.00
E5380 Airfare - In-State		
18-OCT-19	I2101059	Humes, Karen S.. 58.30
18-OCT-19	I2101059	Humes, Karen S.. 284.50
10-DEC-19	ZT913239	Airfare 11112019 521.51
E5381 Airfare - Out-of-State		
23-JUL-19	I2085705	Coats, Erik Robert. 478.20
23-JUL-19	I2085707	Coats, Erik Robert. 1280.00
08-OCT-19	I2098846	Ryu, Jae H. 125.00
18-DEC-19	I2111627	Ryu, Jae H. 213.10
25-MAR-20	Z1002936	McDonald A- Airfare to GA- GOT CANC 299.40
E5391 Ground Transportation - In-State		
18-OCT-19	I2101059	Humes, Karen S.. 38.00
E5392 Ground Transportation-Out-of-State		
07-AUG-19	I2087973	Coats, Erik Robert. 17.72
22-OCT-19	I2101614	Coats, Erik Robert. 278.80
18-DEC-19	ZT905632	RyuJa 905632 Uber Jae traveled to S 13.95
18-DEC-19	ZT905632	RyuJa 905632 Uber Jae traveled to S 15.26
E5396 Lodging & Per Diem ? In State		
20-SEP-19	I2095776	Ryu, Jae H. 49.00
20-SEP-19	I2095776	Ryu, Jae H. 23.00
20-SEP-19	I2095776	Ryu, Jae H. 49.00
18-OCT-19	I2101059	Humes, Karen S.. 26.00
18-OCT-19	I2101059	Humes, Karen S.. 42.00
18-OCT-19	I2101059	Humes, Karen S.. 42.00
18-OCT-19	I2101059	Humes, Karen S.. 33.00
18-OCT-19	I2101059	Humes, Karen S.. 30.00
18-OCT-19	I2101059	Humes, Karen S.. 164.02
18-OCT-19	I2101059	Humes, Karen S.. 433.07
10-DEC-19	I2109969	Humes, Karen S.. 26.00

10-DEC-19	I2109969	Humes, Karen S..	49.00
10-DEC-19	ZT913239	Hotel - Lodging 11132019	185.00
10-DEC-19	ZT913239	Hotel - Lodging 11142019	178.71
13-DEC-19	I2110710	Ryu, Jae H.	49.00
E5397 Lodging & Per Diem ?		Out of State	
22-JUL-19	F0168715	GRT226540-CIVIL&ENV ENGINEERIN	-1526.56
23-JUL-19	I2085705	Coats, Erik Robert.	147.96
24-JUL-19	ZT335285	Hotel - Lodging 07032019	2289.84
07-AUG-19	I2087973	Coats, Erik Robert.	56.00
07-AUG-19	I2087973	Coats, Erik Robert.	43.00
08-OCT-19	ZT599870	Hotel - Lodging 08142019	76.61
08-OCT-19	I2098846	Ryu, Jae H.	50.00
08-OCT-19	I2098846	Ryu, Jae H.	38.00
08-OCT-19	I2098846	Ryu, Jae H.	37.05
22-OCT-19	I2101614	Coats, Erik Robert.	76.00
22-OCT-19	I2101614	Coats, Erik Robert.	76.00
22-OCT-19	I2101614	Coats, Erik Robert.	76.00
22-OCT-19	I2101614	Coats, Erik Robert.	76.00
22-OCT-19	I2101614	Coats, Erik Robert.	76.00
18-DEC-19	I2111627	Ryu, Jae H.	33.00
18-DEC-19	I2111627	Ryu, Jae H.	56.00
18-DEC-19	I2111627	Ryu, Jae H.	56.00
18-DEC-19	I2111627	Ryu, Jae H.	56.00
18-DEC-19	I2111627	Ryu, Jae H.	568.54
18-DEC-19	I2111627	Ryu, Jae H.	56.00
25-MAR-20	Z1002936	McDonald A, hotel in GA for Swanapa	381.66
		-----	
		\$	10510.58

## Operating Expenses

E5045 Photocopy Service			
03-FEB-20	J1263308	DS; UIB copier charge Jan 2020	0.06
02-MAR-20	J1265005	DS; UIB copier charge Feb 2020	0.18
E5049 Journal Publication Costs			
25-SEP-19	ZT574740	Professional Services 09042019	25.00
E5070 Conference/Registration Fees			
24-JUL-19	ZT335285	Conference Registration 07012019	615.00
24-JUL-19	ZT335285	Conference Registration 07092019	-570.00
24-JUL-19	ZT335285	Conference Registration 07092019	725.00
24-JUL-19	ZT335285	Conference Registration 07092019	570.00
26-SEP-19	ZT568130	Memberships / Subscriptions / Regis	180.00
01-NOV-19	ZT748634	Memberships / Subscriptions / Regis	-725.00
18-DEC-19	I2111627	Ryu, Jae H.	630.00
11-FEB-20	Z1000753	AAG 2020 conference registration fo	175.00
25-MAR-20	Z1002876	RyuJa 367212 Registration Grant res	5.00
07-APR-20	Z1003527	McDonald A-FPS International Confer	415.00
09-APR-20	Z1003603	2020 AAG conference cancellation fo	-175.00
E5210 R&M Svcs - Work Orders			
26-MAR-20	I2126584	Oppenheimer Development Corporation	195.97
21-APR-20	J1267705	ef/CT from 826742 to 826867	-195.97
E5307 Analytical Services			
02-OCT-19	J1252563	MJ/GRC 1811977_Forney	860.00
16-DEC-19	J1260582	bf ASL Invoice EOCT19-003	46.00
E5320 Software/Applications - Individual			
27-AUG-19	ZT406541	Supplies 07272019	129.00
26-JUN-20	I2138310	Oregon Education Technology Consort	107.88
30-JUN-20	B1835767	Oregon Education Technology Consort	0.00
E5330 Software/Applications - College/Dep			
24-JUL-19	I2086054	Ryu, Jae H.	799.00
14-AUG-19	ZT401299	Supplies 07032019	19.15
14-AUG-19	ZT401299	Supplies 07172019	15.99
12-SEP-19	ZT511342	Supplies 08032019	19.99
12-SEP-19	ZT514946	Supplies 08272019	129.00
01-APR-20	Z1003304	RyuJa 400924 Amazon Grant research	31.71
29-MAY-20	Z1005499	RyuJa 746498 Verizon Data storage s	166.90

E5410 Office and Administrative Supplies			
04-DEC-19	ZT859061	Supplies 11122019	88.34
17-JAN-20	ZT159595	Charge for tonor cartridge. Linda M	120.64
E5430 Consumable Water			
08-AUG-19	I2088020	Culligan Water Conditioning	29.95
E5465 Gasoline			
14-AUG-19	ZT401299	University Vehicle Expenses 0701201	42.34
14-AUG-19	ZT401299	University Vehicle Expenses 0715201	40.31
E5560 Technology - Supplies			
09-AUG-19	I2088550	Ryu, Jae H.	476.96
04-SEP-19	ZT498840	Supplies 08122019	62.99
30-OCT-19	ZT730095	Supplies 10152019	33.99
18-FEB-20	Z1001008	Charge for power cord for SC 200 Co	12.14
E5710 Tools			
14-AUG-19	ZT401299	Supplies 07042019	107.25
14-AUG-19	ZT401299	Supplies 07112019	38.03
E5724 Research Supplies			
18-JUL-19	ZT303097	Supplies 07032019	1613.10
18-JUL-19	ZT303097	Supplies 07052019	11.94
18-JUL-19	ZT303097	Supplies 07062019	98.17
18-JUL-19	ZT303097	Supplies 07072019	11.74
18-JUL-19	ZT303097	Supplies 07092019	396.00
18-JUL-19	ZT303097	Supplies 07092019	18.00
18-JUL-19	ZT303097	Supplies 07102019	166.30
18-JUL-19	ZT303097	Supplies 07112019	91.62
23-JUL-19	I2085701	Ryu, Jae H.	271.08
02-AUG-19	ZT335026	Supplies 07032019	420.44
02-AUG-19	ZT335026	Supplies 07102019	1704.66
02-AUG-19	ZT335026	Supplies 07102019	69.54
02-AUG-19	ZT335026	Supplies 07122019	75.80
02-AUG-19	ZT335026	Supplies 07132019	52.28
02-AUG-19	ZT335026	Supplies 07162019	169.80
02-AUG-19	ZT335026	Supplies 07162019	30.26
02-AUG-19	ZT335026	Supplies 07172019	13.75
02-AUG-19	ZT335026	Supplies 07222019	29.98
02-AUG-19	ZT335026	Supplies 07242019	320.62
02-AUG-19	ZT335026	Supplies 07242019	327.90
02-AUG-19	ZT335026	Supplies 07252019	701.46
07-AUG-19	ZT381455	Agriculture and Medical Supplies 07	18.08
14-AUG-19	ZT401299	Supplies 06262019	5.99
14-AUG-19	ZT401299	Supplies 06272019	94.80
14-AUG-19	ZT401299	Supplies 07022019	92.91
14-AUG-19	ZT401299	Supplies 07022019	9.24
14-AUG-19	ZT401299	Supplies 07082019	39.94
14-AUG-19	ZT401299	Supplies 07112019	189.74
14-AUG-19	ZT401299	Supplies 07142019	217.28
14-AUG-19	ZT401299	Supplies 07192019	156.86
15-AUG-19	ZT402367	Supplies 07192019	61.57
15-AUG-19	ZT402367	Supplies 07272019	69.54
15-AUG-19	ZT402367	Supplies 07272019	48.02
15-AUG-19	ZT402367	Supplies 08012019	185.84
15-AUG-19	ZT402367	Supplies 08012019	53.10
15-AUG-19	ZT402367	Supplies 08022019	-53.10
15-AUG-19	ZT402367	Supplies 08052019	28.45
15-AUG-19	ZT402367	Supplies 08062019	13.94
15-AUG-19	ZT402367	Supplies 08072019	32.44
15-AUG-19	ZT402367	Supplies 08082019	13.98
15-AUG-19	ZT402367	Supplies 08082019	250.82
15-AUG-19	ZT402367	Supplies 08082019	334.67
27-AUG-19	ZT406541	Supplies 07292019	7.41
27-AUG-19	ZT406541	Supplies 07292019	28.93
04-SEP-19	ZT498840	Agriculture and Medical Supplies 08	36.10
04-SEP-19	ZT498840	Supplies 08072019	9.65
12-SEP-19	ZT511342	Supplies 08032019	4.55
12-SEP-19	ZT511342	Supplies 08032019	217.94

12-SEP-19	ZT511342	Supplies 08052019	5.29
12-SEP-19	ZT470567	Supplies 08102019	113.20
12-SEP-19	ZT470567	Supplies 08132019	197.90
12-SEP-19	ZT470567	Supplies 08132019	79.82
12-SEP-19	ZT470567	Supplies 08142019	65.08
12-SEP-19	ZT470567	Supplies 08142019	54.04
12-SEP-19	ZT470567	Supplies 08152019	149.99
12-SEP-19	ZT470567	Supplies 08162019	32.26
12-SEP-19	ZT470567	Supplies 08172019	1046.30
12-SEP-19	ZT470567	Supplies 08182019	1700.00
12-SEP-19	ZT470567	Supplies 08182019	82.51
12-SEP-19	ZT470567	Supplies 08212019	38.35
12-SEP-19	ZT470567	Supplies 08212019	55.97
12-SEP-19	ZT470567	Supplies 08222019	216.16
12-SEP-19	ZT470567	Supplies 08272019	188.66
12-SEP-19	ZT514946	Supplies 08202019	89.90
12-SEP-19	ZT514946	Supplies 08222019	229.00
12-SEP-19	ZT514946	Supplies 08262019	241.38
18-SEP-19	ZT536932	Supplies 09032019	487.72
18-SEP-19	ZT536932	Supplies 09042019	182.70
18-SEP-19	ZT536932	Supplies 09052019	456.23
25-SEP-19	ZT574740	Supplies 09032019	88.77
25-SEP-19	ZT574740	Supplies 09082019	81.80
25-SEP-19	ZT574740	Supplies 09092019	62.95
25-SEP-19	ZT574740	Supplies 09102019	51.94
25-SEP-19	ZT574740	Supplies 09102019	28.39
25-SEP-19	ZT574740	Supplies 09102019	49.69
25-SEP-19	ZT574740	Supplies 09112019	211.89
25-SEP-19	ZT574740	Supplies 09132019	102.25
01-OCT-19	I2097494	Ryu, Jae H.	3120.00
07-OCT-19	I2098295	Culligan Water Conditioning	29.95
07-OCT-19	ZT582328	Supplies 09092019	75.00
07-OCT-19	ZT582328	Supplies 09092019	1.42
07-OCT-19	ZT582328	Supplies 09092019	4.50
07-OCT-19	ZT582328	Supplies 09092019	28.26
07-OCT-19	ZT582328	Supplies 09112019	166.30
07-OCT-19	ZT582328	Supplies 09122019	157.46
07-OCT-19	ZT582328	Supplies 09132019	21.60
07-OCT-19	ZT582328	Supplies 09132019	81.64
07-OCT-19	ZT582328	Supplies 09132019	66.68
07-OCT-19	ZT582328	Supplies 09202019	173.07
07-OCT-19	ZT582328	Supplies 09212019	75.80
09-OCT-19	ZT631422	Supplies 09212019	3244.50
09-OCT-19	ZT631422	Supplies 09242019	283.86
09-OCT-19	ZT631422	Supplies 09272019	2154.25
09-OCT-19	ZT631422	Supplies 09272019	-3244.50
09-OCT-19	ZT631422	Supplies 10012019	17.40
09-OCT-19	ZT631422	Supplies 10022019	396.00
25-OCT-19	ZT638339	Agriculture and Medical Supplies 09	18.50
25-OCT-19	ZT638339	Supplies 09192019	56.82
25-OCT-19	ZT638339	Supplies 09232019	7.40
25-OCT-19	ZT638339	Supplies 09232019	4.79
01-NOV-19	ZT748634	Supplies 10082019	446.27
01-NOV-19	ZT748634	Supplies 10182019	377.25
01-NOV-19	ZT748634	Supplies 10222019	266.80
06-NOV-19	I2103978	Culligan Water Conditioning	29.95
18-NOV-19	ZT811408	Supplies 10282019	70.56
18-NOV-19	ZT811408	Supplies 10292019	41.98
18-NOV-19	ZT811408	Supplies 10302019	147.50
18-NOV-19	ZT811408	Supplies 11012019	187.34
04-DEC-19	ZT900954	Supplies 11042019	8.99
04-DEC-19	ZT900954	Supplies 11072019	6.63
04-DEC-19	ZT900954	Supplies 11132019	461.22
04-DEC-19	ZT900954	Supplies 11152019	137.09
04-DEC-19	ZT900954	Supplies 11152019	1096.36

04-DEC-19	ZT900954	Supplies 11162019	91.62
06-DEC-19	I2109475	Culligan Water Conditioning	29.95
09-DEC-19	J1260116	KRE-H; Phys Mchn shp wrk A McDonald	87.79
11-DEC-19	ZT907694	Supplies 11032019	77.15
11-DEC-19	ZT907694	Supplies 11112019	178.17
18-DEC-19	ZT030436	McDonald A purchased o-rings and co	12.88
18-DEC-19	ZT030436	McDonald, A purchased research supp	40.32
18-DEC-19	ZT852583	McDonald A purchased lab supplies.	24.92
18-DEC-19	ZT852583	McDonald A purchased lab supplies:	13.60
18-DEC-19	ZT852583	McDonald A purchased lab supplies:	6.78
18-DEC-19	ZT852583	McDonald Armando purchased CHECK IN	254.41
18-DEC-19	ZT852583	McDonald purchased instrument pans	230.00
18-DEC-19	ZT987942	Charge for aluminum dish fluted 144	101.50
18-DEC-19	ZT987942	Charge for high pressure and specia	54.60
18-DEC-19	ZT987942	Charge for new digital ORP sensor,	1123.63
20-DEC-19	ZT923142	USB drives for data backup on the S	65.97
03-JAN-20	ZT080545	Charge for Tryptic Soy Broth 25 Gal	44.87
10-JAN-20	I2113862	Culligan Water Conditioning	29.95
15-JAN-20	J1262127	KRE-H; Phys Mchn Shp: evap dishes	225.72
17-JAN-20	ZT000328	RyuJa 000328 Amazon Grant research	181.14
17-JAN-20	ZT000328	RyuJa 000328 Amazon Grant research	74.18
17-JAN-20	ZT000328	RyuJa 000328 Amazon Grant research	102.56
17-JAN-20	ZT000328	RyuJa 000328 Amazon Grant research	158.99
17-JAN-20	ZT104789	McDonald A purchased sleeve for res	105.44
17-JAN-20	ZT104789	McDonald A purchased Dimethyl carbo	157.51
17-JAN-20	ZT104789	McDonald A purchased flow restricto	18.94
17-JAN-20	ZT104789	McDonald, A purchased a spooler for	28.65
17-JAN-20	ZT159595	Charge for chemicals for research 1	57.42
17-JAN-20	ZT159595	Charge for cylinders, specialty gas	47.40
17-JAN-20	ZT159595	Charge for new (used) controller fo	135.40
24-JAN-20	ZT225464	McDonald A purchased BETAINE, ANHYD	90.07
24-JAN-20	ZT225464	McDonald A purchased CENT BOTTLE 25	204.69
05-FEB-20	I2118261	Culligan Water Conditioning	29.95
05-FEB-20	Z1000337	Charge for a new HACH controller fo	599.99
05-FEB-20	Z1000337	Charge for fuses for lab pumps used	7.79
06-FEB-20	Z1000416	RyuJa 182074 Amazon Grant research	13.08
06-FEB-20	Z1000416	RyuJa 182074 Amazon Grant research	161.38
06-FEB-20	Z1000416	RyuJa 182074 Amazon Grant research	242.74
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	60.16
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	103.68
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	244.55
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	51.77
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	11.65
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	9.57
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	117.25
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	9.56
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	84.59
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	-44.51
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	192.95
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	5.67
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	10.39
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	21.73
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	93.21
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	25.43
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	9.53
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	23.58
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	76.30
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	-242.74
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	119.44
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	50.31
10-FEB-20	Z1000606	RyuJa 231435 Amazon Grant research	18.95
10-FEB-20	Z1000606	RyuJa 231435 Home Depot Grant rese	157.57
10-FEB-20	Z1000606	RyuJa 231435 Home Depot Grant rese	43.82
10-FEB-20	Z1000606	RyuJa 231435 Paypal Grant research	217.56
18-FEB-20	Z1000988	Armando: 25mL autoclave reactors fo	70.00



18-FEB-20	Z1000988	McDonald: Fuses for lab instruments	6.49
18-FEB-20	Z1001008	Charge for PC primers to evaluate b	36.38
18-FEB-20	Z1001008	Charge for cylinders, specialty gas	461.23
18-FEB-20	Z1001008	Charge for new syringes for Erik's	964.58
18-FEB-20	Z1001008	Charge for nitrile exam gloves, pip	1498.11
18-FEB-20	Z1001008	Charge for reagent set ammonia and	1759.50
18-FEB-20	I2120138	McDonald, Armando Gabriel.	9.90
02-MAR-20	B1825956	McDonald, Armando G.	-9.90
04-MAR-20	I2123028	Ryu, Jae H.	1796.52
05-MAR-20	Z1001838	Charge for new caps for ammonia/nit	1733.49
05-MAR-20	Z1001838	Charge for pipette tips used to pro	82.80
05-MAR-20	Z1001838	Charge for silicone treadmill belt	12.25
12-MAR-20	Z1002318	Charge for 96 well plates for qPCR	455.44
12-MAR-20	Z1002318	Charge for adhesive qPCR film, alum	229.81
12-MAR-20	Z1002318	Charge for connective wire, groundi	16.76
12-MAR-20	Z1002318	Charge for cylinders, specialty gas	195.63
18-MAR-20	Z1002545	McDonald A, Chemical Resistant O-ri	22.85
18-MAR-20	Z1002545	McDonald A, pump head for research	96.27
18-MAR-20	Z1002545	McDonald, A- vacuum pump for lab an	649.00
18-MAR-20	Z1002545	McDonald: PTFE STIRRER ANCHOR 500L	58.58
18-MAR-20	Z1002571	McDonald: STANDARD TRNS PIPETS 5ML	13.53
18-MAR-20	Z1002571	McDonald: VIAL SCINT 20ML GLASS 500	230.27
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	17.16
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	144.06
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	227.88
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	37.48
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	185.46
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	22.03
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	232.27
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	8.22
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	21.19
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	25.42
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	10.59
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	164.79
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	211.99
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	8.94
25-MAR-20	Z1002876	RyuJa 367212 Amazon Grant research	8.94
25-MAR-20	Z1002876	RyuJa 367212 Facebook Grant researc	23.82
25-MAR-20	Z1002876	RyuJa 367212 Home Depot Grant resea	36.72
25-MAR-20	Z1002876	RyuJa 367212 USAQUADCOPT EBAY Grant	73.62
25-MAR-20	I2126495	Ryu, Jae H.	697.94
01-APR-20	Z1003304	RyuJa 400924 Amazon Grant research	77.73
01-APR-20	Z1003304	RyuJa 400924 Amazon Grant research	55.07
01-APR-20	Z1003304	RyuJa 400924 Amazon Grant research	124.00
01-APR-20	Z1003304	RyuJa 400924 Amazon Grant research	20.13
01-APR-20	Z1003304	RyuJa 400924 Amazon Grant research	234.95
01-APR-20	Z1003304	RyuJa 400924 Amazon Grant research	26.81
01-APR-20	Z1003304	RyuJa 400924 Home Depot Grant resea	73.80
01-APR-20	Z1003304	RyuJa 400924 Paypal Grant research	140.00
01-APR-20	Z1003304	RyuJa 400924 Paypal Grant research	168.32
01-APR-20	Z1003304	RyuJa 400924 Paypal Grant research	100.00
01-APR-20	Z1003357	RyuJa 514304 Amazon Grant research	8.25
01-APR-20	Z1003357	RyuJa 514304 Amazon Grant research	16.78
01-APR-20	Z1003357	RyuJa 514304 Amazon Grant research	17.96
01-APR-20	Z1003357	RyuJa 514304 Amazon Grant research	44.86
01-APR-20	Z1003357	RyuJa 514304 Amazon Grant research	57.91
01-APR-20	Z1003357	RyuJa 514304 Home Depot Grant resea	131.24
01-APR-20	Z1003357	RyuJa 514304 Home Depot Grant resea	139.85
01-APR-20	Z1003357	RyuJa 514304 Home Depot Grant resea	74.79
01-APR-20	Z1003357	RyuJa 514304 Paypal Grant research	226.80
01-APR-20	Z1003357	RyuJa 514304 Verizon Grant research	166.85
07-APR-20	Z1003527	McDonald A- 3V power supply for re	6.35
07-APR-20	Z1003527	McDonald A- LCD display for researc	6.39
07-APR-20	Z1003527	McDonald A- Mini reflector bulb gua	7.07
07-APR-20	Z1003527	McDonald A- PTFE stirrer anchor for	54.13

07-APR-20	Z1003527	McDonald A- bread board for resear	5.99
07-APR-20	Z1003527	McDonald A- breadboard jumper cable	7.99
07-APR-20	Z1003527	McDonald A- clamp assembly for rese	68.00
07-APR-20	Z1003527	McDonald A- hands on primer-monitor	15.99
07-APR-20	Z1003527	McDonald A- lab supplies for resear	43.35
07-APR-20	Z1003527	McDonald A- pi4 touchscreen for res	19.99
07-APR-20	Z1003527	McDonald A- sensor board for resear	6.99
07-APR-20	Z1003527	McDonald A- sensor for research	6.48
07-APR-20	Z1003527	McDonald A- soil sensor for researc	14.87
07-APR-20	Z1003527	McDonald, A- CO2 gas sensors for re	296.59
07-APR-20	Z1003527	McDonald, A- Mega v-3 shield for la	27.00
07-APR-20	Z1003527	McDonald, A- clamps for lab researc	35.51
07-APR-20	Z1003527	McDonald, A- cuvette for research	34.50
07-APR-20	Z1003527	McDonald, A- data logging equipment	23.97
07-APR-20	Z1003527	McDonald, A- data logging equipment	11.99
07-APR-20	Z1003527	McDonald, A- data logging equipment	70.26
07-APR-20	Z1003527	McDonald, A- data logging for resea	7.50
07-APR-20	Z1003527	McDonald, A- electric motor replace	16.67
07-APR-20	Z1003527	McDonald, A- pellet die for researc	319.12
07-APR-20	Z1003527	McDonald, A- replacement GC column	602.37
07-APR-20	Z1003527	McDonald, A-replacement motor resea	7.77
10-APR-20	I2128570	Culligan Water Conditioning	29.95
14-APR-20	Z1003781	Charge for cylinders, specialty gas	57.00
14-APR-20	Z1003781	Charge for pack of 1000 filters, re	880.16
14-APR-20	Z1003781	Charge for reagents to test for nit	1002.52
14-APR-20	Z1003781	Charge for reagents to test for nit	136.84
06-MAY-20	Z1004558	McDonald A- Masks for research.	36.98
06-MAY-20	Z1004558	McDonald A- digital thermometer for	12.98
06-MAY-20	Z1004558	McDonald A- refund for 4 CO2 sensor	-296.59
06-MAY-20	Z1004558	McDonald A- research supplies	29.15
19-MAY-20	Z1004937	Charge for purchase of PCR test pla	116.55
29-MAY-20	Z1005467	RyuJa 689859 Amazon Grant research	149.68
29-MAY-20	Z1005467	RyuJa 689859 Amazon Grant research	7.41
29-MAY-20	Z1005467	RyuJa 689859 Amazon Grant research	190.79
29-MAY-20	Z1005467	RyuJa 689859 Amazon Grant research	19.15
29-MAY-20	Z1005467	RyuJa 689859 Amazon Grant research	14.98
29-MAY-20	Z1005467	RyuJa 689859 Amazon Grant research	14.51
29-MAY-20	Z1005467	RyuJa 689859 Amazon Grant research	37.49
29-MAY-20	Z1005467	RyuJa 689859 Amazon Grant research	10.06
29-MAY-20	Z1005467	RyuJa 689859 Amazon Grant research	203.06
29-MAY-20	Z1005467	RyuJa 689859 Amazon Grant research	158.87
29-MAY-20	Z1005467	RyuJa 689859 Amazon Grant research	46.50
29-MAY-20	Z1005467	RyuJa 689859 Home Depot Grant resea	49.21
29-MAY-20	Z1005467	RyuJa 689859 Office Depot Grant res	43.66
29-MAY-20	Z1005475	RyuJa 764722 Amazon Batteries neede	20.99
29-MAY-20	Z1005475	RyuJa 764722 Staples Storage boxes	62.97
29-MAY-20	Z1005499	RyuJa 746498 Amazon Batteries and r	95.96
29-MAY-20	Z1005499	RyuJa 746498 Amazon Brushless motor	33.89
29-MAY-20	Z1005499	RyuJa 746498 Amazon Electronic spee	156.66
29-MAY-20	Z1005499	RyuJa 746498 Amazon Metal dispenser	44.99
29-MAY-20	Z1005499	RyuJa 746498 Amazon Metal sealer to	27.99
29-MAY-20	Z1005499	RyuJa 746498 Amazon Plastic bags ne	52.00
29-MAY-20	Z1005499	RyuJa 746498 Amazon Plastic bags ne	35.99
29-MAY-20	Z1005499	RyuJa 746498 Amazon Plastic bags th	29.99
29-MAY-20	Z1005499	RyuJa 746498 Amazon Raspberry pi he	5.99
29-MAY-20	Z1005499	RyuJa 746498 Amazon Small boxes tha	23.71
29-MAY-20	Z1005499	RyuJa 746498 Amazon Zip ties that a	4.39
29-MAY-20	Z1005499	RyuJa 746498 Staples File storage a	101.93
29-MAY-20	Z1005531	RyuJa 680904 Amazon Grant research	30.89
29-MAY-20	Z1005531	RyuJa 680904 Amazon Grant research	7.41
29-MAY-20	Z1005531	RyuJa 680904 Amazon Grant research	84.53
29-MAY-20	Z1005531	RyuJa 680904 Amazon Grant research	138.43
29-MAY-20	Z1005531	RyuJa 680904 Home Depot Grant resea	46.94
29-MAY-20	I2134640	Ryu, Jae H.	254.99
03-JUN-20	Z1005709	McDonald A- 2 angle plate 2" webbed	37.04

03-JUN-20	Z1005709	McDonald A- 4 CO2 sensors for resea	279.80
03-JUN-20	Z1005709	McDonald A- gloves for research lab	54.76
03-JUN-20	Z1005709	McDonald A- lab supplies for resear	15.97
03-JUN-20	Z1005709	McDonald A- lab supplies for resear	7.95
03-JUN-20	Z1005709	McDonald A- masks for lab research	119.96
03-JUN-20	Z1005709	McDonald A- stand for research.	114.80
03-JUN-20	Z1005709	McDonald A- supplies for research	98.58
03-JUN-20	Z1005722	Charge for 250 pk small nitrile exa	334.46
03-JUN-20	Z1005722	Charge for Great Stuff hornet spray	24.97
03-JUN-20	Z1005722	Charge for for purchase of material	1470.70
03-JUN-20	Z1005722	Charge for grease gun, grease hose,	33.47
03-JUN-20	Z1005722	Charge for plastic welding kit, res	74.19
03-JUN-20	Z1005722	Charge for purchase of new peristal	220.50
09-JUN-20	Z1006053	Charge for BASE PAIR 50 NMOL SCALE,	48.56
09-JUN-20	Z1006053	Charge for nitrile exam gloves, res	167.23
18-JUN-20	J1271165	ef/CT from 826742 to 826744	-400.98
29-JUN-20	Z1007007	Surge Protector with extension cord	50.38
29-JUN-20	I2138724	Humes, Karen S..	43.67
E5741 Med Lab & Tech Supplies			
08-JUL-19	U0132495	Chemstores/Alfaro	16.51
10-JUL-19	U0132527	Chemstores/Guho	3.04
10-JUL-19	U0132530	Chemstores/Guho	8.65
24-JUL-19	U0132644	Chemstores/Abbasi	8.18
25-JUL-19	U0132646	Chemstores/Abbasi	30.02
25-JUL-19	U0132647	Chemstores/Abbasi	21.53
26-JUL-19	U0132658	Chemstores/Abbasi	134.58
26-JUL-19	U0132659	Chemstores/Dikshyapokhrel	61.69
07-AUG-19	U0132748	Chemstores/Alfaro	72.00
08-AUG-19	U0132758	Chemstores/McDonald	10.89
13-AUG-19	U0132773	Chemstores/Abbasi	9.91
14-AUG-19	U0132781	Chemstores/Pokhrel	8.18
23-AUG-19	U0132870	Chemstores/Abbasi	214.26
26-AUG-19	U0132881	Chemstores/Pokhrel	9.91
26-AUG-19	U0132882	Chemstores/Pokhrel	29.72
27-AUG-19	U0132894	Chemstores/Abbasi	39.63
29-AUG-19	U0132924	Chemstores/Abbissa	80.97
29-AUG-19	U0132925	Chemstores/Abbisa	61.47
29-AUG-19	U0132926	Chemstores/ReturnU132924	-61.70
03-SEP-19	U0132965	Chemstores/Pokhrel	61.47
04-SEP-19	ZT498840	Agriculture and Medical Supplies 08	47.17
04-SEP-19	ZT498840	Agriculture and Medical Supplies 08	43.99
04-SEP-19	ZT498840	Agriculture and Medical Supplies 08	213.00
04-SEP-19	ZT498840	Agriculture and Medical Supplies 08	9.90
04-SEP-19	ZT498840	Agriculture and Medical Supplies 08	30.04
06-SEP-19	U0133005	Chemstores/Abbasi	91.48
11-SEP-19	U0133072	Chemstores/Abbasi	34.02
13-SEP-19	U0133135	Chemstores/McDonald	23.13
17-SEP-19	U0133169	Chemstores/Abbasi	87.88
17-SEP-19	U0133186	Chemstores/Abbasi	44.84
19-SEP-19	U0133228	Chemstores/Abbasi	72.56
23-SEP-19	U0133262	Chemstores/Guho	9.91
24-SEP-19	U0133284	Chemstores/Guho	25.56
25-SEP-19	U0133296	Chemstores/Abbasi	38.16
02-OCT-19	U0133354	Chemstores/Brower	43.50
03-OCT-19	U0133365	Chemstores/Pokhrel	72.35
22-OCT-19	U0133570	Chemstores/Pokhrell	23.33
25-OCT-19	ZT638339	Agriculture and Medical Supplies 09	299.99
25-OCT-19	ZT638339	Agriculture and Medical Supplies 09	178.08
25-OCT-19	ZT638339	Agriculture and Medical Supplies 09	17.65
25-OCT-19	ZT638339	Agriculture and Medical Supplies 09	105.69
25-OCT-19	ZT638339	Agriculture and Medical Supplies 09	226.85
25-OCT-19	ZT638339	Agriculture and Medical Supplies 09	21.98
04-NOV-19	U0133705	Chemstores/Abbasi	23.73
21-NOV-19	U0133885	Chemstores/Pokhrel	30.00
20-DEC-19	U0134294	Chemstores/Alfaro	19.68

06-JAN-20	U0134306	Chemstores/Abbasi	47.03
14-JAN-20	U0134369	Chemstores/Abbasi	19.53
21-JAN-20	U0134419	Chemstores/Abbasi	30.00
24-JAN-20	U0134463	Chemstores/Abbasi	53.97
27-JAN-20	U0134467	Chemstores/Abbasi	30.00
30-JAN-20	U0134555	Chemstores/Return-U134463	-53.97
10-FEB-20	U0134652	Chemstores/Alfaro	2.00
14-FEB-20	U0134749	Chemstores/McDonald	44.18
28-FEB-20	U0134883	Chemstores/Abbasi	19.45
02-MAR-20	U0134893	Chemstores/Abbasi	19.39
03-MAR-20	U0134905	Chemstores/Guho	47.82
04-MAR-20	U0134948	Chemstores/McDonald	31.77
05-MAR-20	I2123057	Qiagen Inc.	1216.35
05-MAR-20	U0134967	Chemstores/Abbasi	82.37
05-MAR-20	U0134980	Chemstores/Guho	-36.09
05-MAR-20	U0134982	Chemstores/Guho	75.44
09-MAR-20	U0134996	Chemstores/Abbissa	36.41
09-MAR-20	U0135008	Chemstores/Abbissa	16.03
13-MAR-20	U0135054	Chemstores/Abbissa	29.12
18-MAR-20	U0135104	Chemstores/Abbissa	9.73
25-MAR-20	U0135167	Chemstores/Abbissa	117.43
25-MAR-20	U0135175	Chemstores/Abbasi	143.66
29-MAY-20	U0135346	Chemstores/Abbisa	58.21
05-JUN-20	U0135394	Chemstores/Pokhrel	60.51
25-JUN-20	U0135503	Chemstores/Crites	2.00
E5747 Safety Supplies			
25-SEP-19	ZT574740	Supplies 09022019	21.18
E5910 Rent - Machinery & Equip			
28-AUG-19	I2091615	Culligan Water Conditioning	29.95
07-MAY-20	I2131585	Culligan Water Conditioning	29.95
E5940 Other Rentals and Leases			
20-AUG-19	I2090470	Boise State University	337.50
E5992 Promotion			
02-DEC-19	J1259868	Bkstr;TABLECLOTH CALS	188.00
			-----
			\$ 65745.64

## Subawards

ES001 Subaward 1 Expenses			
28-OCT-19	I2102349	Boise State University	27940.93
30-JAN-20	I2117336	Boise State University	25033.25
26-JUN-20	I2138244	Boise State University	33735.28
26-JUN-20	I2138245	Boise State University	31824.18
ES002 Subaward 2 Expenses			
01-MAY-20	I2130988	Idaho State University	35436.26
19-JUN-20	I2137457	Idaho State University	133198.43
			-----
			\$ 287168.33

## Small Equipment (&lt;\$5K)

E7830 <5K Computer Equipment Other			
16-JUL-19	I2084671	Ryu, Jae H.	1324.98
E7995 <5K Communication Equipment			
06-NOV-19	I2104173	Ryu, Jae H.	1196.74
			-----
			\$ 2521.72

## Capital Equipment (&gt;=\$5K)

E6850 >5K Medical/Surgery/Lab Equipment			
09-JUN-20	I2135871	Spectra Vista Corporation	18215.00
18-JUN-20	B1835155	Spectra Vista Corporation	0.00
			-----
			\$ 18215.00

## Tuition Remission and Training

## E7140 Tuition and Fees - Grad Assistants

16-AUG-19	J1251999	G1GB for 171-55579	786.00
16-AUG-19	J1251999	SHI1 for 171-55579	951.00
16-AUG-19	J1251999	T1GB for 171-55579	4152.00
21-AUG-19	J1252645	G1GB for V00665494	786.00
21-AUG-19	J1252645	GP01 for V00665494	48.50
21-AUG-19	J1252645	SHI1 for V00665494	951.00
21-AUG-19	J1252645	T1GB for V00665494	4152.00
21-AUG-19	J1252645	VVSF for V00665494	100.00
22-AUG-19	J1252827	G1GD for 142-24168	786.00
22-AUG-19	J1252827	SHI1 for 142-24168	951.00
22-AUG-19	J1252827	T1GD for 142-24168	4152.00
03-SEP-19	J1253572	G1GA for 941-68901	596.00
03-SEP-19	J1253572	G1GB for 051-04535	786.00
03-SEP-19	J1253572	T1GB for 051-04535	4152.00
22-OCT-19	J1257016	AN01 for 051-04535	105.00
02-JAN-20	J1261084	G2GB for 171-55579	786.00
02-JAN-20	J1261084	SHI2 for 171-55579	951.00
02-JAN-20	J1261084	T2GB for 171-55579	4152.00
16-JAN-20	J1262236	G2GD for 142-24168	786.00
16-JAN-20	J1262236	SHI2 for 142-24168	951.00
16-JAN-20	J1262236	T2GD for 142-24168	4152.00
22-JAN-20	J1262441	G2GB for V00665494	786.00
22-JAN-20	J1262441	SHI2 for V00665494	951.00
22-JAN-20	J1262441	T2GB for V00665494	4152.00
22-JAN-20	J1262441	VVSF for V00665494	100.00
22-JAN-20	J1262488	G2GA for 151-29182	786.00
22-JAN-20	J1262488	G2GB for 051-04535	786.00
22-JAN-20	J1262488	G2HA for 041-97395	87.00
22-JAN-20	J1262488	T2GA for 151-29182	4152.00
22-JAN-20	J1262488	T2GA for 941-68901	596.00
22-JAN-20	J1262488	T2GB for 051-04535	4152.00
22-JAN-20	J1262488	T2HA for 041-97395	462.00
01-JUN-20	J1269697	G3HD for 171-55579	174.00
01-JUN-20	J1269697	MPX3 for 171-55579	70.00
01-JUN-20	J1269697	T3HD for 171-55579	924.00
02-JUN-20	J1269878	G3HA for 151-29182	87.00
02-JUN-20	J1269878	G3HA for 941-68901	87.00
02-JUN-20	J1269878	G3HB for 051-04535	87.00
02-JUN-20	J1269878	T3HA for 151-29182	462.00
02-JUN-20	J1269878	T3HA for 941-68901	462.00
02-JUN-20	J1269878	T3HB for 051-04535	462.00
17-JUN-20	J1271019	G3HB for V00665494	87.00
17-JUN-20	J1271019	T3HB for V00665494	462.00
24-JUN-20	J1271442	G3HB for 161-44626	87.00
24-JUN-20	J1271442	T3HB for 161-44626	462.00

-----  
\$ 56155.50

Total Expenses

-----  
\$ 680812.59



**Idaho State  
University**

## ESTIMATED FINAL INVOICE

For information regarding this invoice contact:

Aaron Tolman  
208-282-3056

Renee Jensen-Hasfurther  
Financial Contact  
University of Idaho  
875 Perimeter Drive, MS 3021  
Moscow, ID 83844

Date Prepared: 06/12/2020  
Contract: SG-3587-SB-877869  
**Purchase Order:**  
**Invoice No.: RGE02R-08 Revised**  
Reference invoice number on the  
payment

**PERIOD COVERED: 12/01/2019 - 06/30/2020**

<b>SUBAWARD</b>	<b>BUDGET</b>	<b>CURRENT EXPENSES</b>	<b>CUMULATIVE EXPENSES</b>	<b>(Over)/Under BUDGET</b>
Salary	\$81,365.09	<b>\$61,928.69</b>	\$81,365.09	\$0.00
Fringe Benefits	\$18,858.82	<b>12,615.85</b>	\$18,858.82	0.00
Material and Supplies	\$10,500.00	<b>1,701.92</b>	\$10,477.69	22.31
Equipment	\$51,500.23	<b>51,500.23</b>	\$51,500.23	0.00
Travel	\$3,932.86	<b>2,951.74</b>	\$3,932.86	0.00
Consultant Services	\$2,500.00	<b>2,500.00</b>	\$2,500.00	0.00
<b>Totals</b>	\$168,657.00	<b>\$133,198.43</b>	\$168,634.69	\$22.31

Cumulative Amount Received: \$35,436.26  
Billed-Not Received\*: 0.00  
Current Expenses \$133,198.43  
Credit Applied: (\$231.54)

**Total Due This Period \$132,966.89**

### PLEASE NOTE

The Total Now Due represents the current billing amount and any prior billings that have not yet been received as of the invoice date. If you have already sent payment for an invoice listed as billed-not received, please remit the CURRENT expense amount rather than the cumulative total. THANK YOU!

*Lisa Wood*

Lisa Wood, Director, Grants & Contracts Accounting

"I certify that the above bill is correct and just, that the amounts claimed represent fair charges against this subcontract."

Please make remittances payable to Idaho State University and remit to:  
921 South 8th Avenue, Stop 8219  
Pocatello, ID 83209-8219

Grants & Contract Accounting

921 South 8th Ave., Stop 8046 | Pocatello, ID 83209-8046 | (208) 282-2592 | isu.edu/research

**BSU Account Analysis Report**

From Period: 1-10

To Period: 12-20

Report Date: 6/26/20 10:57 AM

NATURAL_ACCOUNTZ	NATURAL_ACCOUNT_DESC	PROJECT	NET_AMOUNT	ACCTNG_DATE	GL_BATCH_NAME	SUBLEDGER_JE_LINE_DESC
01 - Salary	Employees - Temporary	2000001188	3,200.00	7/26/2019	PPD_6/30/2019_7/13/2019 Payroll A 1472339	Journal Import Created
01 - Salary	Employees - Temporary	2000001188	3,200.00	8/9/2019	PPD_7/14/2019_7/27/2019 Payroll A 1490202	Journal Import Created
01 - Salary	Employees - Temporary	2000001188	3,200.00	8/23/2019	PPD_7/28/2019_8/10/2019 Payroll A 1522239	Journal Import Created
01 - Salary	Employees - Temporary	2000001188	3,200.00	9/6/2019	PPD_8/11/2019_8/24/2019 Payroll A 1547259	Journal Import Created
01 - Salary	Employees - Temporary	2000001188	3,200.00	9/20/2019	PPD_8/25/2019_9/7/2019 Payroll A 1573798	Journal Import Created
01 - Salary	Employees - Temporary	2000001188	1,600.00	10/4/2019	PPD_9/8/2019_9/21/2019 Payroll A 1597100	Journal Import Created
01 - Salary	Employees - Temporary	2000001188	1,600.00	10/18/2019	PPD_9/22/2019_10/5/2019 Payroll A 1617565	Journal Import Created
01 - Salary	Employees - Temporary	2000001188	2,355.60	11/1/2019	PPD_10/6/2019_10/19/2019 Payroll A 1640511	Journal Import Created
01 - Salary	Employees - Temporary	2000001188	3,111.20	11/15/2019	PPD_10/20/2019_11/2/2019 Payroll A 1663033	Journal Import Created
01 - Salary	Employees - Temporary	2000001188	3,111.20	11/29/2019	PPD_11/3/2019_11/16/2019 Payroll A 1686655	Journal Import Created
01 - Salary	Employees - Temporary	2000001188	3,056.00	12/13/2019	PPD_11/17/2019_11/30/2019 Payroll A 1713887	Journal Import Created
01 - Salary	Employees - Temporary	2000001188	3,056.00	12/27/2019	PPD_12/1/2019_12/14/2019 Payroll A 1728919	Journal Import Created
01 - Salary	Employees - Temporary	2000001188	3,056.00	1/10/2020	PPD_12/15/2019_12/28/2019 Payroll A 1749771	Journal Import Created
01 - Salary	Employees - Temporary	2000001188	3,056.00	1/24/2020	PPD_12/29/2019_1/11/2020 Payroll A 1771883	Journal Import Created
01 - Salary	Summer Salary	2000001188	5,541.50	6/12/2020	PPD_5/17/2020_5/30/2020 Payroll A 2007658	Journal Import Created
01 - Salary	Summer Salary	2000001188	5,541.50	6/26/2020	PPD_5/31/2020_6/13/2020 Payroll A 2033051	Journal Import Created
01 - Salary	Students	2000001188	1,846.40	2/7/2020	PPD_1/12/2020_1/25/2020 Payroll A 1791738	Journal Import Created
01 - Salary	Students	2000001188	1,846.40	2/21/2020	PPD_1/26/2020_2/8/2020 Payroll A 1813384	Journal Import Created
01 - Salary	Students	2000001188	1,846.40	3/6/2020	PPD_2/9/2020_2/22/2020 Payroll A 1842597	Journal Import Created
01 - Salary	Students	2000001188	1,846.40	3/20/2020	PPD_2/23/2020_3/7/2020 Payroll A 1865872	Journal Import Created
01 - Salary	Students	2000001188	1,846.40	4/3/2020	PPD_3/8/2020_3/21/2020 Payroll A 1889401	Journal Import Created
01 - Salary	Students	2000001188	1,846.40	4/17/2020	PPD_3/22/2020_4/4/2020 Payroll A 1912741	Journal Import Created
01 - Salary	Students	2000001188	1,846.40	5/1/2020	PPD_4/5/2020_4/18/2020 Payroll A 1936587	Journal Import Created
01 - Salary	Students	2000001188	1,846.40	5/15/2020	PPD_4/19/2020_5/2/2020 Payroll A 1957265	Journal Import Created
01 - Salary	Students	2000001188	1,846.40	5/29/2020	PPD_5/3/2020_5/16/2020 Payroll A 1982147	Journal Import Created
01 - Salary	Students	2000001188	1,846.40	6/12/2020	PPD_5/17/2020_5/30/2020 Payroll A 2007658	Journal Import Created
01 - Salary	Students	2000001188	1,846.40	6/26/2020	PPD_5/31/2020_6/13/2020 Payroll A 2033051	Journal Import Created
		<b>Total Salary:</b>	<b>\$ 71,395.40</b>			
02 - Fringe	Group Insurance - Life	2000001188	25.23	8/9/2019	PPD_7/14/2019_7/27/2019 Payroll A 1490202	Journal Import Created
02 - Fringe	Group Insurance - Life	2000001188	25.23	9/6/2019	PPD_8/11/2019_8/24/2019 Payroll A 1547259	Journal Import Created
02 - Fringe	Group Insurance - Life	2000001188	25.23	10/4/2019	PPD_9/8/2019_9/21/2019 Payroll A 1597100	Journal Import Created
02 - Fringe	Group Insurance - Life	2000001188	25.23	11/1/2019	PPD_10/6/2019_10/19/2019 Payroll A 1640511	Journal Import Created
02 - Fringe	Group Insurance - Life	2000001188	25.23	12/13/2019	PPD_11/17/2019_11/30/2019 Payroll A 1713887	Journal Import Created
02 - Fringe	Group Insurance - Life	2000001188	25.23	1/10/2020	PPD_12/15/2019_12/28/2019 Payroll A 1749771	Journal Import Created
02 - Fringe	Group Insurance - Life	2000001188	35.49	6/12/2020	PPD_5/17/2020_5/30/2020 Payroll A 2007658	Journal Import Created
02 - Fringe	Group Insurance - Med & D	2000001188	970.84	7/26/2019	PPD_6/30/2019_7/13/2019 Payroll A 1472339	Journal Import Created
02 - Fringe	Group Insurance - Med & D	2000001188	970.84	8/23/2019	PPD_7/28/2019_8/10/2019 Payroll A 1522239	Journal Import Created
02 - Fringe	Group Insurance - Med & D	2000001188	970.84	9/20/2019	PPD_8/25/2019_9/7/2019 Payroll A 1573798	Journal Import Created
02 - Fringe	Group Insurance - Med & D	2000001188	970.84	10/18/2019	PPD_9/22/2019_10/5/2019 Payroll A 1617565	Journal Import Created
02 - Fringe	Group Insurance - Med & D	2000001188	970.84	11/15/2019	PPD_10/20/2019_11/2/2019 Payroll A 1663033	Journal Import Created
02 - Fringe	Group Insurance - Med & D	2000001188	970.84	12/27/2019	PPD_12/1/2019_12/14/2019 Payroll A 1728919	Journal Import Created
02 - Fringe	Group Insurance - Med & D	2000001188	970.84	1/24/2020	PPD_12/29/2019_1/11/2020 Payroll A 1771883	Journal Import Created
02 - Fringe	Group Insurance - Med & D	2000001188	286.83	6/12/2020	PPD_5/17/2020_5/30/2020 Payroll A 2007658	Journal Import Created
02 - Fringe	Group Insurance - Med & D	2000001188	286.83	6/26/2020	PPD_5/31/2020_6/13/2020 Payroll A 2033051	Journal Import Created
02 - Fringe	Group Ins - Medical Grad	2000001188	1,967.00	2/21/2020	PPD_1/26/2020_2/8/2020 Payroll A 1813384	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	76.04	7/26/2019	PPD_6/30/2019_7/13/2019 Payroll A 1472339	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	76.04	8/9/2019	PPD_7/14/2019_7/27/2019 Payroll A 1490202	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	76.04	8/23/2019	PPD_7/28/2019_8/10/2019 Payroll A 1522239	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	76.04	9/6/2019	PPD_8/11/2019_8/24/2019 Payroll A 1547259	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	76.04	9/20/2019	PPD_8/25/2019_9/7/2019 Payroll A 1573798	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	7.49	10/4/2019	PPD_9/8/2019_9/21/2019 Payroll A 1597100	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	7.49	10/18/2019	PPD_9/22/2019_10/5/2019 Payroll A 1617565	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	39.86	11/1/2019	PPD_10/6/2019_10/19/2019 Payroll A 1640511	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	72.23	11/15/2019	PPD_10/20/2019_11/2/2019 Payroll A 1663033	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	72.23	11/29/2019	PPD_11/3/2019_11/16/2019 Payroll A 1686655	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	69.87	12/13/2019	PPD_11/17/2019_11/30/2019 Payroll A 1713887	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	69.87	12/27/2019	PPD_12/1/2019_12/14/2019 Payroll A 1728919	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	69.86	1/10/2020	PPD_12/15/2019_12/28/2019 Payroll A 1749771	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	69.87	1/24/2020	PPD_12/29/2019_1/11/2020 Payroll A 1771883	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	8.64	2/7/2020	PPD_1/12/2020_1/25/2020 Payroll A 1791738	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	8.64	2/21/2020	PPD_1/26/2020_2/8/2020 Payroll A 1813384	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	8.64	3/6/2020	PPD_2/9/2020_2/22/2020 Payroll A 1842597	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	8.64	3/20/2020	PPD_2/23/2020_3/7/2020 Payroll A 1865872	Journal Import Created
02 - Fringe	Worker's Compensation	2000001188	8.64	4/3/2020	PPD_3/8/2020_3/21/2020 Payroll A 1889401	Journal Import Created





02 - Fringe	Social Security/Medicare	2000001188	233.78		1/10/2020	PPD 12/15/2019 12/28/2019 Payroll A 17497	Journal Import Created
02 - Fringe	Social Security/Medicare	2000001188	233.78		1/24/2020	PPD 12/29/2019 1/11/2020 Payroll A 177188	Journal Import Created
02 - Fringe	Social Security/Medicare	2000001188	558.31		6/12/2020	PPD 5/17/2020 5/30/2020 Payroll A 2007658	Journal Import Created
02 - Fringe	Social Security/Medicare	2000001188	558.30		6/26/2020	PPD 5/31/2020 6/13/2020 Payroll A 2033051	Journal Import Created
		<b>Total Fringe:</b>	<b>\$ 1,859.54</b>				
03 - Other Expense	Express Mail/Messenger	2000001188	29.06		8/30/2019	Payables A 1562916000006 1562930 Y	FEDEX 33191787~Shipping Waste water samples for research project~~TXN00486075 FEDEX 33191787~Shipping Waste water samples for research project~~TXN00486075
03 - Other Expense	Building Services	2000001188	1,339.55		3/31/2020	Payables A 1893303000001 1893308 Y	FM-243404 2/26/2020 RM 083-101 - ELECT: Please provide a quote to add a 220V outlet in the head house - Shay Gillette FM-243404 2/26/2020 RM 083-101 - ELECT: Pleas
03 - Other Expense	Medical & Laboratory Supp	2000001188	23.17		7/31/2019	Payables A 1505471000005 1505483 Y	TFS FISHERSCI ECOM HUS~algae testing supplies for project~~TXN00483147 TFS FISHERSCI ECOM HUS~algae testing supplies for project~~TXN00483147
03 - Other Expense	Medical & Laboratory Supp	2000001188	56.13		7/31/2019	Payables A 1505471000004 1505479 Y	TFS FISHERSCI ECOM HUS~algae testing supplies for project~~TXN00484009 TFS FISHERSCI ECOM HUS~algae testing supplies for project~~TXN00484009
03 - Other Expense	Medical & Laboratory Supp	2000001188	217.08		7/31/2019	Payables A 1505471000006 1505486 Y	VWR INTERNATIONAL INC~vials for algae TOC analysis~~TXN00480020 VWR INTERNATIONAL INC~vials for algae TOC analysis~~TXN00480020
03 - Other Expense	Medical & Laboratory Supp	2000001188	207.84		8/30/2019	Payables A 1562916000003 1562925 Y	FRED-MEYER #0613~water storage containers~~TXN00489551 FRED-MEYER #0613~water storage containers~~TXN00489551
03 - Other Expense	Medical & Laboratory Supp	2000001188	97.82		8/30/2019	Payables A 1562916000003 1562925 Y	THE HOME DEPOT 1806~secondary containment for water storage~~TXN00491220 THE HOME DEPOT 1806~secondary containment for water storage~~TXN00491220
03 - Other Expense	Medical & Laboratory Supp	2000001188	51.96		8/30/2019	Payables A 1562916000003 1562925 Y	FRED-MEYER #0449~water storage containers~~TXN00489591 FRED-MEYER #0449~water storage containers~~TXN00489591
03 - Other Expense	Medical & Laboratory Supp	2000001188	41.89		8/30/2019	Payables A 1562916000003 1562925 Y	THE HOME DEPOT #1806~materials for water sample collection~~TXN00489917 THE HOME DEPOT #1806~materials for water sample collection~~TXN00489917
03 - Other Expense	Medical & Laboratory Supp	2000001188	3,161.18		8/30/2019	Payables A 1562916000003 1562925 Y	HACH COMPANY~probes for production of effluent for algae experiments~~TXN00485209 HACH COMPANY~probes for production of effluent for algae experiments~~TXN0
03 - Other Expense	Medical & Laboratory Supp	2000001188	75.92		8/30/2019	Payables A 1562916000003 1562925 Y	THE HOME DEPOT #1806~water storage containers~~TXN00491554 THE HOME DEPOT #1806~water storage containers~~TXN00491554
03 - Other Expense	Medical & Laboratory Supp	2000001188	190.44		9/1/2019	Payables A 1589162000001 1589163 Y	CORR009262 - HACH COMPANY~supplies for algae cultivation~~TXN00488820 CORR009262 - HACH COMPANY~supplies for algae cultivation~~TXN00488820
03 - Other Expense	Medical & Laboratory Supp	2000001188	23.94		9/1/2019	Payables A 1589162000001 1589163 Y	CORR009263 - OFFICESUPPLY.COM~supplies for algae cultivation~~TXN00487165 CORR009263 - OFFICESUPPLY.COM~supplies for algae cultivation~~TXN00487165
03 - Other Expense	Medical & Laboratory Supp	2000001188	51.96		9/30/2019	Payables A 1609056000002 1609061 Y	FRED-MEYER #0613~water storage containers for wastewater~~TXN00492762 FRED-MEYER #0613~water storage containers for wastewater~~TXN00492762
03 - Other Expense	Medical & Laboratory Supp	2000001188	-35.98		9/30/2019	Payables A 1609056000002 1609061 Y	DICKS SPORTING GOODS1202~return of unused water containers~~TXN00500063 DICKS SPORTING GOODS1202~return of unused water containers~~TXN00500063
03 - Other Expense	Medical & Laboratory Supp	2000001188	71.46		9/30/2019	Payables A 1609056000002 1609061 Y	VWR INTERNATIONAL INC~supplies for algae TOC analysis~~TXN00498288 VWR INTERNATIONAL INC~supplies for algae TOC analysis~~TXN00498288
03 - Other Expense	Medical & Laboratory Supp	2000001188	219.03		9/30/2019	Payables A 1609056000002 1609061 Y	TFS FISHERSCI ECOM HUS~algae cultivation supplies~~TXN00495199 TFS FISHERSCI ECOM HUS~algae cultivation supplies~~TXN00495199
03 - Other Expense	Medical & Laboratory Supp	2000001188	619.34		9/30/2019	Payables A 1609056000002 1609061 Y	TFS FISHERSCI ECOM HUS~supplies for NH4+ measurements~~TXN00493996 TFS FISHERSCI ECOM HUS~supplies for NH4+ measurements~~TXN00493996
03 - Other Expense	Medical & Laboratory Supp	2000001188	209.33		11/29/2019	Payables A 1712893000005 1712901 Y	TFS FISHERSCI ECOM HUS~ammonia measurement kits~~TXN00512742 TFS FISHERSCI ECOM HUS~ammonia measurement kits~~TXN00512742
03 - Other Expense	Medical & Laboratory Supp	2000001188	257.28		11/29/2019	Payables A 1712893000005 1712901 Y	HACH COMPANY~nutrient measurement chemicals~~TXN00516000 HACH COMPANY~nutrient measurement chemicals~~TXN00516000
03 - Other Expense	Medical & Laboratory Supp	2000001188	580.66		12/31/2019	Payables A 1755230000003 1755260 Y	TFS FISHERSCI ECOM HUS~filters for algae analyses~~TXN00518845 TFS FISHERSCI ECOM HUS~filters for algae analyses~~TXN00518845
03 - Other Expense	Medical & Laboratory Supp	2000001188	71.37		1/31/2020	Payables A 1802127000003 1802132 Y	TFS FISHERSCI ECOM HUS~algae cultivation testing materials~~TXN00522955 TFS FISHERSCI ECOM HUS~algae cultivation testing materials~~TXN00522955
03 - Other Expense	Medical & Laboratory Supp	2000001188	79.72		1/31/2020	Payables A 1802127000003 1802132 Y	TFS FISHERSCI ECOM HUS~algae cultivation testing materials~~TXN00522941 TFS FISHERSCI ECOM HUS~algae cultivation testing materials~~TXN00522941
03 - Other Expense	Medical & Laboratory Supp	2000001188	71.25		1/31/2020	Payables A 1802127000003 1802132 Y	TFS FISHERSCI ECOM HUS~algae cultivation testing materials~~TXN00526671 TFS FISHERSCI ECOM HUS~algae cultivation testing materials~~TXN00526671
03 - Other Expense	Medical & Laboratory Supp	2000001188	180.00		2/29/2020	Payables A 1855059000008 1855092 Y	BOISE COLD STORAGECOMPANY~storage of cultivation media for algae~~TXN00532605 BOISE COLD STORAGECOMPANY~storage of cultivation media for algae~~TXN00532
03 - Other Expense	Medical & Laboratory Supp	2000001188	962.66		2/29/2020	Payables A 1855059000008 1855092 Y	TFS FISHERSCI ECOM HUS~Algae cultivation and testing supplies~~TXN00537467 TFS FISHERSCI ECOM HUS~Algae cultivation and testing supplies~~TXN00537467
03 - Other Expense	Medical & Laboratory Supp	2000001188	313.23		2/29/2020	Payables A 1855059000008 1855092 Y	HACH COMPANY~Algae cultivation and testing supplies~~TXN00537564 HACH COMPANY~Algae cultivation and testing supplies~~TXN00537564
03 - Other Expense	Medical & Laboratory Supp	2000001188	39.27		2/29/2020	Payables A 1855059000009 1855094 Y	MARINE DEPOT~Algae cultivation and testing supplies~~TXN00534357 MARINE DEPOT~Algae cultivation and testing supplies~~TXN00534357
03 - Other Expense	Medical & Laboratory Supp	2000001188	49.15		2/29/2020	Payables A 1855059000009 1855094 Y	TFS FISHERSCI ECOM HUS~Algae cultivation and testing supplies~~TXN00537465 TFS FISHERSCI ECOM HUS~Algae cultivation and testing supplies~~TXN00537465
03 - Other Expense	Medical & Laboratory Supp	2000001188	438.28		3/31/2020	Payables A 1903946000006 1903960 Y	HACH COMPANY~materials for algae cultivation and analysis~~TXN00543625 HACH COMPANY~materials for algae cultivation and analysis~~TXN00543625
03 - Other Expense	Medical & Laboratory Supp	2000001188	56.13		3/31/2020	Payables A 1903946000006 1903960 Y	TFS FISHERSCI ECOM HUS~algae cultivation and testing supplies and storage~~TXN00537870 TFS FISHERSCI ECOM HUS~algae cultivation and testing supplies and storage~~
03 - Other Expense	Medical & Laboratory Supp	2000001188	501.23		3/31/2020	Payables A 1903946000005 1903959 Y	TFS FISHERSCI ECOM HUS~algae cultivation and testing supplies and storage~~TXN00538362 TFS FISHERSCI ECOM HUS~algae cultivation and testing supplies and storage~~
03 - Other Expense	Medical & Laboratory Supp	2000001188	605.65		3/31/2020	Payables A 1903946000006 1903960 Y	TFS FISHERSCI ECOM HUS~materials for algae cultivation and analysis~~TXN00544079 TFS FISHERSCI ECOM HUS~materials for algae cultivation and analysis~~TXN00544079
03 - Other Expense	Medical & Laboratory Supp	2000001188	45.00		3/31/2020	Payables A 1903946000006 1903960 Y	BOISE COLD STORAGECOMPANY~materials for algae cultivation and analysis~~TXN00540021 BOISE COLD STORAGECOMPANY~materials for algae cultivation and analysis~~
03 - Other Expense	Medical & Laboratory Supp	2000001188	1,081.15		5/29/2020	Payables A 2006128000002 2006131 Y	TFS FISHERSCI ECOM HUS~algae cultivation and testing supplies~~TXN00549163 TFS FISHERSCI ECOM HUS~algae cultivation and testing supplies~~TXN00549163
03 - Other Expense	Medical & Laboratory Supp	2000001188	90.60		5/29/2020	Payables A 2006128000002 2006131 Y	TFS FISHERSCI ECOM HUS~algae cultivation supplies~~TXN00549010 TFS FISHERSCI ECOM HUS~algae cultivation supplies~~TXN00549010
03 - Other Expense	Storage Space Rental	2000001188	55.00		9/30/2019	Payables A 1609056000001 1609060 2 Y	BOISE COLD STORAGECOMPANY~cold storage for H2O in Feris research~~TXN00494028 BOISE COLD STORAGECOMPANY~cold storage for H2O in Feris research~~TXN00494
03 - Other Expense	Storage Space Rental	2000001188	45.00		11/29/2019	Payables A 1712893000005 1712901 Y	BOISE COLD STORAGECOMPANY~frozen water storage~~TXN00512002 BOISE COLD STORAGECOMPANY~frozen water storage~~TXN00512002
03 - Other Expense	Storage Space Rental	2000001188	45.00		11/29/2019	Payables A 1712893000005 1712901 Y	BOISE COLD STORAGECOMPANY~frozen water storage~~TXN00512021 BOISE COLD STORAGECOMPANY~frozen water storage~~TXN00512021
03 - Other Expense	Academic Fees Pd By Dept/	2000001188	4,823.00		3/1/2020	Payables A 1871351000001 1871356 Y	CORR015336 - 114063379 Ayala,Edgardo Spring 2020 Graduate Assistant CORR015336 - 114063379 Ayala,Edgardo Spring 2020 Graduate Assistant
03 - Other Expense	Academic Fees Pd By Dept/	2000001188	4,823.00		3/1/2020	Payables A 1871351000001 1871356 Y	CORR015337 - 113077552 Torres,Alejandro Spring 2020 Graduate Assistant CORR015337 - 113077552 Torres,Alejandro Spring 2020 Graduate Assistant
		<b>Total Other Expense:</b>	<b>\$ 21,864.75</b>				
04 - Travel	Rental Vehicles-In State	2000001188	24.10		8/30/2019	Payables A 1562916000004 1562926 Y	CHEVRON 0095274~Rental fuel for E.Ayala to Moscow,ID to pick up research samples~TA#49273~TXN00490372 CHEVRON 0095274~Rental fuel for E.Ayala to Moscow,ID to
04 - Travel	Rental Vehicles-In State	2000001188	21.49		8/30/2019	Payables A 1562916000005 1562929 Y	CHEVRON 0095274~Rental fuel for E.Ayala to Moscow,ID to pick up research samples~TA#49273~TXN00490452 CHEVRON 0095274~Rental fuel for E.Ayala to Moscow,ID to
04 - Travel	Rental Vehicles-In State	2000001188	276.99		8/30/2019	Payables A 1562916000005 1562929 Y	ENTERPRISE RENT-A-CAR~Rental truck to pick up water for Feris lab~49273/49275~TXN00490757 ENTERPRISE RENT-A-CAR~Rental truck to pick up water for Feris lab~4927
04 - Travel	Rental Vehicles-In State	2000001188	46.96		8/30/2019	Payables A 1564130000001 1564144 Y	STINKER # 38~Rental fuel for E.Ayala to Moscow,ID to pick up research samples~TA#49273~TXN00490271 STINKER # 38~Rental fuel for E.Ayala to Moscow,ID to pick up res
04 - Travel	Rental Vehicles-In State	2000001188	32.30		8/30/2019	Payables A 1564130000001 1564144 Y	CHEVRON 0095274~Rental fuel for E.Ayala to Moscow,ID to pick up research samples~TA#49273~TXN00489867 CHEVRON 0095274~Rental fuel for E.Ayala to Moscow,ID to
04 - Travel	Commercial Airfare-Out Of	2000001188	442.10		7/31/2019	Payables A 1505471000005 1505483 Y	DELTA AIR 0067379000717~airfare in SLC to meet with Idaho and Utah dairymen~~TXN00480866 DELTA AIR 0067379000717~airfare in SLC to meet with Idaho and Utah
04 - Travel	Subsistence & Lodging-In	2000001188	93.10		9/1/2019	Payables A 1572382000001 1572384 Y	Per diem for two days in Moscow, ID retrieving water samples from Univ of ID Per diem for two days in Moscow, ID retrieving water samples from Univ of ID
04 - Travel	Subsistence & Lodging-In	2000001188	93.10		9/12/2019	Payables A 1583473000001 1583478 Y	Per diem reimbursement for Alex Torres in Moscow, ID in Aug to retrieve water samples Per diem reimbursement for Alex Torres in Moscow, ID in Aug to retrieve water san
04 - Travel	Subsistence & Lodging-Out	2000001188	149.18		7/31/2019	Payables A 1505471000005 1505483 Y	EXPEDIA 7451936748711~lodging in SLC to meet with Idaho and Utah dairymen~44643~TXN00480616 EXPEDIA 7451936748711~lodging in SLC to meet with Idaho and Uta
04 - Travel	Subsistence & Lodging-Out	2000001188	97.19		8/30/2019	Payables A 1564130000001 1564144 Y	MOTEL 6 MOSCOW ID~Lodging for Feris lab to pick up water for project~49273/49275~TXN00490119 MOTEL 6 MOSCOW ID~Lodging for Feris lab to pick up water for proje
		<b>Total Travel:</b>	<b>\$ 1,276.51</b>				