Anna Burton
Alluvial Solutions
Oregon State University
Corvallis, OR, 97330

December 6, 2019

Dr. Linda Hardison, Dr. Gerrad Jones
Oregon State University
Corvallis, OR, 97330

Greetings Dr. Hardison and Dr. Jones,

Our team is excited to wrap up the first phase of the project as we approach the end of the year. The past months have brought the team great opportunity to dive into research and development of our project design. We have been diligently working to ensure our work is of the highest quality, both for our client and for the future of the Lamprey Creek site.

As we have approached the final phases of research and planning, the team has agreed on a few pivotal decisions to better guide the project and ensure the client's goals are satisfied. We have chosen to take a step back from applying livestock management as a strategy for our engineering design. Due to the intricate nature of livestock grazing and its effects on the landscape, we feel this is outside of our areas of competence and would be better handled between the livestock manager and the client.

We will be focused on delivering an engineered solution to satisfy the client's goals of reestablishing native plant species in a restored Lamprey Creek wetland system. Our technical report will be focused on summarizing our research regarding alternative technologies for achieving this main goal.

As the team looks to the new year and the next phase of the project, we are immensely excited for continued progress. Attached, you will find a memo detailing the final summary of the project at this stage. We would like to wish you a happy holiday season and a wonderful new year!

Cheers,

Anna Burton

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Project Lead

MEMORANDUM

To: Dr. Linda Hardison, Dr. Gerrad Jones
From: Anna Burton
Subject: Final technical report, project goals, and end of first project phase
Date: December 6, 2019
CC: Brooke Bennett *(Communications Lead)*, Derec Chumley *(Organizational Lead)*, Dr. John Selker

Progress Update:
Alluvial Solutions will no longer be including livestock grazing as an engineering strategy for achieving the project's main goal. This decision was founded on an identified lack of quantifiable control, and the inability to provide verified expected outcomes. The team could no longer justify including this as a key component of the project's engineering strategy as there was little quantifiable, scientific evidence for the benefits or results of livestock grazing to control non-native species. After a thorough literature review and research into case studies, research papers, and journals, it appears that experimental results are repeatedly anecdotal and site-specific.

Control of grazing will be allocated to the livestock manager, and the final project design will ensure that the wetland habitats are appropriately protected from livestock presence. The cattle will be included within the project framework as an environmental concern and technical constraint. We hope this will allow for continued multi-functionality of the landscape, and a balance between grazing on upland areas and restoration efforts within wetland areas.

The team has strategically reevaluated the project goal and determined that the sub-goals will now be increasing native wetland species habitat area (measurable by number of acres created), and improving the flood capacity of the landscape (measureable by percent increase in water storage). We identified selection of wetland species and planting methods as our alternatives for engineering strategies. We created multiple plant matrices to identify species endemic to the Willamette Valley, then the species were compared based on characteristics, identified habitat distribution, and availability to purchase. The project site was delineated into zones based on soil qualities, hydric rating and water statistics, and land cover. The combination of the plant matrices and project zones can inform the team's decisions on wetland species planting strategies. Appropriate planting methods will be applied based on research of various technologies and their suitability to the project site.

The team would like to focus on engineered structures (weirs) to control the hydrologic behavior of the landscape, as it has become evident this is an optimal strategy for reaching quantitative outcomes. We predict we will be able to select weir elevations based on Lamprey Creek baseflow and stormflow levels. Furthermore, we anticipate that we can analyze the topographical site survey completed by Ken Elbert, PE, to map flooded zones and ponding at various flow levels. This should allow us to calculate factors such as flood capacity, flood duration, and water storage. This control and knowledge of hydrological outcomes is crucial for creating new wetland habitat and ensuring the wetland species will have adequate conditions. Alluvial Solutions is confident that this is an improved perspective for the project and expects this to provide a more quality project design with clear and measurable engineering outcomes.

Earlier this week, project members presented a final overview of the Lamprey Creek project, identified engineering goals, and a review of alternative strategies. The audience included Dr. Gerrad Jones, Dr. John Selker, and engineering colleagues. The presentation was a productive opportunity for the team to summarize progress and outline the finalized project plan. The reevaluation of the project goals and scope will be incorporated into the final technical report to ensure clear, quantified communication of our most current design.

Ethical Considerations:
As mentioned above, the cattle will be incorporated within the framework of environmental concerns. This is a main ethical subject for the project as lack of consideration for nitrogen loading may threaten ecosystem health. Alluvial Solutions will assess the estimated magnitude of nitrogen loading to properly judge whether this concern must be accounted for in the final design. Runoff from the landscape will enter sensitive aquatic and riparian areas where excess nitrogen may cause adverse effects. Furthermore, the project team has identified meeting EPA standards is an appropriate benchmark for gauging aquatic nitrogen loading from storm runoff.

Beyond cattle presence and nitrogen loading, we are also weighing the impact of our designed water control structures on fish passage. The team is concerned about weirs (or comparable structures) potentially acting as a fish passage barrier; if the stream is fish bearing, this would severely impede the project design as the construction would no longer meet regulatory standards or restoration goals. Further research is needed into what aquatic species are present in Lamprey Creek, and the potential impacts a weir may have on them.

Finally, safety concerns are a prioritized ethical topic the team is weighing in our design. Our design cannot pose a risk to or increase flooding on nearby roadways (Walnut, Harrison). This would damage infrastructure, impede travel, and incur significant costs to the City of Corvallis. We also must take cattle presence into consideration as a safety concern by ensuring the design protects both the sensitive native

species from the cattle, and the cattle from encountering unsafe landscape features (i.e. steep slopes and incised channels).

Commitments for the Next Two Weeks:

The final technical report will be delivered by December 9, 2019. The report deadline was shifted to accomodate for completion of all associated deliverables. The team will ensure the report is completed to a quality standard, and will provide a substantive starting point for the next phase of the project. We would like to obtain the site survey results from Ken Elbert, PE, as soon as possible as this will be crucial for developing our hydrologic and hydraulic models. Our outlook for next steps includes analyzing elevations and topography on the landscape to outline flood zones and engineering ponding areas. We will also be modeling in HEC-HMS and HEC-RAS to understand channel morphology and effects of various urban runoff demands. These tasks are expected to provide a productive start to the next phase of project design.

Needs from Client:

Dr. Linda Hardison is welcomed to contact us at any time if there are any pertinent questions, concerns, or feedback. It is our highest priority to ensure the client is satisfied with the project progress and current trajectory. We expect Dr. Gerrad Jones may be approached for technical review of the report and for engineering content critique. We will be in continued communication with Dr. Hardison to relay project updates, and request contact with Ken Elbert, PE, for the site survey data. Continuing in line with the previous memorandum, we would like to request that Dr. Hardison keep Alluvial Solutions up to date with species concerns, information or data on wetland species, or any other relevant material. The team greatly values the insight and specialized information Dr. Hardison provides for the project.