TOWN OF LYONS
SOLAR FARM FEASIBILITY STUDY

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A report submitted to the University of Colorado at Denver, Civil Engineering Department in partial fulfillment of the Senior Design course

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Dedication and Acknowledgements

Our team wants to thank Professor Heidi Brothers and Professor Peter Marxhausen, our senior design professors, for their guidance throughout this project. Professor Peter Marxhausen was key in helping us navigate through team dynamics. Professor Heidi Brothers assisted us in understanding the contract with the client and offering professional advice on several aspects of the project.

It is important to acknowledge the University of Colorado at Denver, especially the Civil Engineering Department, for preparing us to have the confidence to represent the school on such an incredible project. We would also like to thank Professor Bruce Janson for assistance with return-on-investment calculations. Suzanne Schuett for assisting with environmental impacts guidance. Jeffery Wood, another UC Denver faculty member out of the architectural program guided us on the public outreach portion of this project.

Our team would like to send a special thanks to Lee Hall, Jim Kerr, Aaron Caplan, and Ben Rodman for their invaluable assistance in obtaining information regarding the Town of Lyons to help us complete this project. A special thanks to Lee Hall and Jim Kerr for being our town experts on the two virtual town halls.

Chris La May, from the Colorado Department of Local Affairs, assisted us in answering our questions regarding this important grant and a major aspect of funding this project.

Thanks again,

The Lyons Team
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May 7\textsuperscript{th}, 2020

Mr. Lee Hall
Lyons, Colorado

Final Feasibility Report and Recommendations
Lyons Solar Farm Feasibility Study
Lyons, Colorado

Greetings Lee Hall, Jim Kerr, Aaron Caplan, and Ben Rodman,

The Lyons Team would like to thank you for the privilege of performing the solar farm feasibility and community outreach as part of our Senior Design project. It is our understanding that you wish to take this information and apply for a Colorado Department of Local Affairs grant to help finance this project. The purpose of our involvement was to compile all the given information, select which sites are feasible, facilitate public outreach, and write the feasibility report for the grants. As part of our investigation, we performed a site visit on February 21\textsuperscript{st}, 2021, and met with Jack’s Solar Farm on February 26\textsuperscript{th}, 2021, to help us better understand the project. We also met with Professors Heidi Brothers and Peter Marxhausen to obtain the background information on this project. This report contains our findings, conclusions, and recommendations.
Project Background

The Town of Lyons contracted with the University of Colorado in Denver to create a feasibility study on a solar farm project responsible for powering 5% of the Town of Lyon’s energy demands with a possibility for expansion in the future. The Town of Lyons is hoping to supplement the cost of the project with funds from a Colorado Department of Local Affairs grant. The purpose of our involvement was to compile all the given information, select which sites are most feasible for the array, facilitate public outreach, and write the feasibility report for the grants. This study will include the optimal locations for solar access of one acre in size to produce 5% of the town’s electrical use, the total cost of the project, a calculation report of return of investment, as well as creating some sort of public outreach to better enhance communication with the townspeople, regarding the solar farm.

Per the Town of Lyons, Colorado Resolution 202-172, one of our team’s project responsibilities includes reviewing several potential locations capable of housing the solar farm and identifying the three most optimal locations for their use. This task will be completed by utilizing the information that Lee Hall supplies us regarding potential solar farm locations already in question, as well as identifying potential locations for review of our own. Each site will be individually graded on criteria including, but not limited to, their environmental impact, distance to phase three power, solar access, access to roadways for construction and maintenance purposes, their ability to potentially house more solar arrays for future demand, viewshed impact, their risk of being damaged by flooding, and potential return on investment.
A portion of preparing the feasibility report includes preparing a rough return on investment for each of the three feasible sites that we choose. This return on investment must include as current information that we as a team are able to attain. The return on investment will be done based upon both a 25- and 30-year lifespan of the solar farm. Cost of investment will be based upon the cost estimation of each site after including funds from the Department of Local Affairs grant and the CollectiveSun investment tax credit that the Town of Lyons plans on utilizing. Included within the return-on-investment calculations will be financing, solar panel annual degradation, 15-year inverter replacement, operation and maintenance costs, insurance, and inflation will be accounted for within some of these costs.

Public input given by the townspeople of Lyon’s is vital in forming a conclusion as to which three sites should be chosen as optimal locations to house the potential solar farm. In order to address the possible concerns, suggestions or any feedback the townspeople may share with us, our team is tasked with providing a transparent public outreach program to the Town of Lyons. This includes drafting information for the town’s website, townoflyons.com, which shall give details about the feasibility study, as well as inform the townspeople on upcoming virtual public outreach sessions, or other social media events. Our team is specifically required to conduct at least two virtual public outreach sessions which shall include giving presentations regarding our findings and any suggestions we may have, as well as having qualified individuals present to respond to any questions, suggestions, or concerns the townspeople may share. Our team is responsible for recording these virtual public outreach sessions to ensure no question, suggestion, or concern is left unanswered.
Our team is responsible for preparing and submitting a formal, written feasibility study. This written study shall contain all information collected during our research, as well as the documented information collected during the public outreach sessions. We are also tasked with conducting a formal and conclusive presentation to our clients, which will reiterate much of the information present on written feasibility study. Lastly, we are to prepare a summary of work to be included in the engineering services contract.

With the compiled information, the project client and townsman, Mr. Lee will present it to The Colorado Department of Local Affairs, in hopes to obtain a federal grant to financially assist with the project.

Whereas, the Town of Lyons has applied for funding from this initiative to help establish a feasibility plan for a solar farm in Lyons, and the Colorado Department of Local Affairs and the University of Colorado at Denver want to support local governments and political subdivisions in Colorado that are facing social and economic consequences as a result of the growth of energy and natural resource industries, and via a memorandum of understanding between the Parties, it is appropriate and beneficial to define these facilities, the intended end goods, and the roles of both the Department of Labor Affairs, University of Colorado at Denver, and Lyons in completing this mission, and while, the cost of this new Solar Farm Feasibility Study is expected to be $5,000.00. Lyons is asked to donate or balance a maximum of $3,000.00 toward the project costs to fund time, mileage, fees, follow-up analysis, and final paper planning.
Purpose of the Work

The Town of Lyons is committed to finding new ways to achieve sustainability by converting to the use of renewal energy, particularly, solar energy. With the help of the University of Colorado at Denver, a feasibility study will be conducted to help build a solar farm in the Town of Lyons. With the goal of having complete, sustainable energy by the year 2050, engineers and governments are actively seeking ways to harness the power of the wind, water, and the sun. A current restriction within the contract between the Town of Lyons and the Municipal Energy Agency of Nebraska, restricts the town from obtaining any more than 5% of its current consumption. However, with goals of making the town carbon neutral in the near future, it is likely the Town of Lyons may need to expand beyond the 5% consumption restriction.

The purpose of this feasibility study is to assist in identifying the three most optimal locations able to house a solar array that will be capable of supplying 5% of the Town of Lyon’s current electrical demand. This task shall be accomplished by identifying and investigating multiple locations around the town that may be suitable for the energy demand requirements, as well as listening to and documenting any questions, feedback, or suggestions that our clients or the townspeople of Lyons may offer to us. Site investigation tasks will include comparing the physical characteristics of the potential array locations. Some physical characteristics we will investigate include topography, geotechnical studies, floodplain analysis and solar access. A rough cost estimate for the potential solar farms will also be provided within the feasibility report and will contain an estimated potential return on investment.
Jurisdictions Having Authority

1. Colorado Department of Local Affairs
   Division of Local Government
   1313 Sherman Street Room 521
   Denver, Colorado 80203
   Office: 303-864-7720
   Fax: 303-353-0751
   cdola.colorado.gov/local-government

2. Municipal Energy Agency of Nebraska
   8377 Glynoaks Drive
   Lincoln, Nebraska 68516
   Office: 800-234-2595
   Office: 402-474-4759
   www.nmppenergy.org/mean

3. Town of Lyons, Board of Trustees
   PO Box 49
   920 McCall Alley
   Lyons, Colorado 80540
   Office: 303-823-6622
   Mon-Fri: 8 a.m.-4:30p.m.
   www.townoflyons.com/183/Board-of-Trustees

4. Town of Lyons, Building Department
   PO Box 49
   432 5th Avenue
   Lyons, Colorado 80540
   Office: 303-823-6622
   Mon-Fri: 8 a.m.-4:30p.m.
   www.townoflyons.com/149/Building-Department

5. Town of Lyons, Parks and Recreation
   PO Box 49
   920 McCall Alley
   Lyons, Colorado 80540
   Office: 303-823-6622
   Mon-Fri: 8 a.m.-4:30p.m.
   www.townoflyons.com/157/Parks-Recreation

6. Town of Lyons, Utilities and Engineering Board
   PO Box 49
   920 McCall Alley
   Lyons, Colorado 80540
   Office: 303-823-6622
   Mon-Fri: 8 a.m.-4:30p.m.
   www.townoflyons.com/203/Utilities-Engineering-Board
Applicable Building Codes

The state of Colorado has no standard state building code. It is the responsibility of local jurisdiction to designate applicable building code as their standard. The Town of Lyons adopted the 2015 International Building Code as the town’s building code standards in August of 2018, requiring all construction conducted after this date to comply with the 2015 International Building Code.

Chapter 2 of the 2015 International Building Code defines a photovoltaic panel system as a “system that incorporates discrete photovoltaic panels, that converts solar radiation into electricity, including rack support systems.”

Code applicable to a photovoltaic panel system (excluding roof panel systems and the Washington State Amendment, Appendix N) found within the 2015 International Building Code include the following:

1607.12.5.3 Photovoltaic panels or modules installed as an independent structure.

3111.1 Photovoltaic panels and modules, General.

Other building code to consider when constructing photovoltaic panels include the necessary geotechnical studies needed prior to panel installation. These codes can be found in the 2015 International Building Code, Section 1803.
**Town of Lyons Background**

The Town of Lyons is a small town within Boulder County, Colorado and is nestled in the foothills of the Rocky Mountains. It is located in between the Rocky Mountain National Park and Boulder. The town has been described by some as the "The Double Gateway to the Rockies", due to its location at the intersection of Highway 36 and Highway 7. Historically the town used to be a quarrying town for sandstone but is now known for its natural beauty and offering the small-town experience to its current residents.

![Figure 2: Town of Lyons Boundaries (Identified by red border)](image)

The current population of the town is 2,228 people with a 38.1% population change since 2000. The median resident age is 41.9 years old which is almost 5 years older than the average age of all Colorado residents. Average annual income in Lyons is around $110,000 which is $30,000 higher than the Colorado state average.
On September 2013, the Town of Lyons got hit with a major water storm, heavy rain resulting in two days and accumulating seventeen inches the local town creek, Saint Vrain Creek was quickly overflown, carrying ten times its normal volume. This resulted in a catastrophic event, making it a one-thousand-year event, with eight people dead and eleven hundred people had to be evacuated. Severe damage was done to the roads, buildings, a major change in landscape.

The storm was so intense, it had the power to completely destroy five river gauges located throughout the rivers in Boulder County. It took about six months for the residents to slowly move back into the Town of Lyons. Many efforts were made to recover from the 2013 flood.
How Solar Farms Work

A solar farm consists of a large area with solar panels typically ground mounted on a tracking system. The tracking system is typically chosen depending on the region and finding the best sun array. Once the energy from the sun is captured, it is inverted and sent to the nearest electrical grid provided by the local electric utility company.

There are two main types of solar panel systems which are fixed tilt and axis tracker panels. A fixed-tilt system typically requires the least amount of maintenance. These types of systems have the most options for foundations with steep slopes or unfavorable geotechnical ground conditions.

![Figure 5: Fixed Versus Single-Axis Tracking (MWH/MW)](image)

Single-axis trackers are the most installed solar panel system today. These are favored as they increase the energy production as much as 15%- 25% compared to fixed-tilt solar panels. The price of single-axis trackers has also been dropping leading to reason the majority of systems are now this type. Multiple-axis trackers are similar to single-axis trackers but are more accurate at following the sun and increasing energy production. These have the most amount of maintenance and come with higher complexity.
Types of foundations include beams, ground screws, helical anchors, concrete ballast, and concrete piers. To install beams a piledriver is used to place the beams at a predetermined depth depending on soil type. The beams can be I-beams, H-beams, or C-channels and can be more expensive than other foundation types. The biggest advantage of this type of foundation is larger load bearing and can accommodate large solar panel systems.

Ground screws are threaded and come to a chisel tip point that is capable of moving small rocks. In extremely rocky soil or bedrock it is possible to drill a starter hole and then use the ground screw to drill to rest of the depth.

Helical anchors are installed by creating a starter hole and using a skid steer with a rotating attachment to turn the helix into the ground. This creates a cone of soil above the helix providing a foundation that is resistant to movement.

Ballasted concrete systems can be used when drilling into the ground can cause contamination or soil type is too dense. They are essentially blocks used to counteract the weight of the solar panel system. These can be made either as cast-in-place or precast concrete.

Concrete piers are typically used for smaller projects and but require move excavation than beams or helical anchors which are pile driven. These are used in corrosive or swampy soils which we will not encounter in Lyons.
Tour of a Working Solar Farm

Our tour to Jack’s Solar Garden was made on Friday, February 26th at 2:00 PM, located on 8102 N 95th Street, Longmont, CO 80504 in Boulder County. Our friendly tour guide was Andy Bingle, a local citizen that resides in the Town of Lyons. Andy was able to tell us a little about the farm’s history. Jack’s Solar Garden is comprised of a twenty-four-acre plot of farmland. The current owner of Jack’s Solar Garden is Byron Kominek, who inherited the farm from his grandfather, Jack Kominek. The farm’s original intent was the cultivation of hay and wheat, but Byron knew he wanted to do something more with his family’s farm. After graduating college, serving in the Peace Corps, then working for the United States Agency for the International Development, Bryon decided to take agriculture to the next level and convert his family’s farm into a solar farm to benefit both his farm and the local community. During this tour of Jack’s Solar Farm, we were accompanied by Lee Hall and Ben Rodman, both residents of the Town of Lyons.

Figure 6: Jack’s Solar Garden
The solar farm contains approximately 3,200 panels which create approximately 1.2 Megawatts, serving power to up to three hundred homes. Jack’s Solar Garden currently has the largest commercially active agrivoltaic system in the United States. Andy explained to us that agrivoltaic is a farming system where the land is used for solar panels but houses vegetation under the solar panel shade versus a traditional setting where the crop grows out in the open. Agrivoltaics can aid in providing income to struggling farmers by selling the captured solar energy to the local utility company. The plan to start planting crops under the solar panels will begin sometime during the summer of 2021.

![Figure 7: Jack's Solar Array](image)

The total cost of installing these panels was approximately $2 million. Andy mentioned one of the benefits of having an agrivoltaic system is that the panels create new drainage patterns, that is, when rain hits the solar panels, the water is captured and dropped wherever the solar panel is tilted, having a consistent place for the water to drop, which in turn feeds the crops. Another advantage is that solar panels can protect the crop from the damaging effects of wind and hail. Rain serves the panels as well, as rainwater is a common method of cleaning the panels surface.
As we toured the solar farm, we observed no fences protecting the solar panels from the public. Andy was then able to inform us of the large pollinator surrounding the panel farm, made with shrubs, bushes and trees. The pollinator not only helps feed birds and bees but is also used as a method of keeping the general public out of the solar farm.

![Figure 8: Jack’s Solar Garden Group Photo](image)

Figure 8: Jack’s Solar Garden Group Photo

Other interesting things the solar garden offers are educational tours and promotions to local artists. In general, Jack’s Solar Garden is a solar farm helping local farmers offering. Creating educational tours to educate the children on energy. The land is used to feed bees and birds with the pollinator and create a garden to grow crop. With the help of their partners, they were able to create their vision and help out the community.
**Analysis Procedures**

Part of our analysis for this solar farm feasibility study includes reviewing each document provided to us by Professor Heidi Brothers and our client representative, Lee Hall. These documents provide information regarding specifics of the various sites in question, including geotechnical and helioscope studies previously conducted. While sifting through all the documents and information that we have been provided with, we will be able to identify areas that require further research.

We plan on visiting the Town of Lyons to tour all eight potential sites that we have been given. This will serve to acclimate our team on each of these sites and further provide us with more information to use within our decision-making process. Seeing firsthand each site’s layout as well as its location within the town will prove to educate us on the potential that each site has. Lyons rests within the foothills and this will introduce varying elevations and land grades at each of these different sites that photos cannot accurately provide context for.

Other analyses that may impact our final decision regarding the appropriate location for installation of the solar panels include floodplain research, site jurisdiction, interference with local flora and/or fauna, solar access, available land, and how the community responds during the outreach phase. To conduct this research our team will reach out to any pertinent organization that may be able to enlighten us on any of these site considerations that we have laid out.
As part of these analyses, we were given access to a solar design software from Aurora Solar. We had hoped to use this software as a tool to accurately design a solar farm at each of the more feasible locations and include preliminary financial information for more than just the three most feasible locations. Aurora Solar’s software will become more of a tool to gauge solar access of our different potential sites as well as each site’s ability to accommodate the required size solar farm with the space available.

Using this criterion, we will be able to eliminate the less feasible locations allowing us to focus on the more favorable locations. Once thorough analysis has been conducted and we have identified the sites we feel are the most adequate for the solar array installation, we can comfortably present to the townspeople of Lyons our suggestions. As public outlook on this project is of the utmost importance; this will serve to affirm the potential sites that we have focused on or make us reconsider the remaining potential sites that we have previously turned from. The public outreach will also provide our team the opportunity to address any concerns or feedback on any of the sites as well as the project as whole.
Site Reviews

A major part of this project was reviewing the eight potential sites and choosing three to concentrate our efforts on. It was necessary to establish initial criteria to narrow down our focus to only three feasible sites.

Figure 9: Yellow Leaders Denote Potential Sites, White Leaders Denote Points of Interest

One important factor in considering the feasibility of each site will be based upon the size and shape of the plot of land at each location. The available land must accommodate the 330 kW solar farm, roughly one acre of land, and also allow for an optimal horizontal solar panel array to maximize the efficiency. When looking at the plot of land for each location we also take into account the construction that could be occurring at each site. This includes the ease of access, disturbances to residents, known soil conditions, and potential lay down sites.
Much of the Town of Lyons has a substantial flood risk being that it is nestled at the confluence of the North and South Saint Vrain Creeks. We were advised by Chris LaMay, Colorado Department of Local Affairs Regional Manager, that any project proposed within a floodway would not be approved for grant funds. It was of the utmost importance that we reference the Federal Emergency Management Agency Flood Map to ascertain any possible flood risks for potential sites and be able to rule them out.

Figure 10: Federal Emergency Management Agency Flood Map of the Town of Lyons
**Eagle Canyon Potential Site**

The Eagle Canyon site is in the southwestern portion of the Town of Lyons and is right off highway 36, this allows for easier construction site access. It is a long slender plot of land that moves in a diagonal line in between two private properties. This site does not lend itself to the long horizontal lines of solar panels that maximize the potential energy gains of the solar farm. The limited land available rules out possible future expansion and may not allow for the necessary space needed to meet the 5% energy demand goal.

![Figure 11: Eagle Canyon Site](image)

To the northeast of this site is a large, exposed rock face that would block the sun until noon in some of the summer months that would likely limit the solar potential of the site to below 90% in some of the summer months. The Town of Lyons also has no record of a geotechnical report on file near this location, making the soil properties an unknown. This could lead to potentially more expensive earthwork given possible bedrock depth and large cobble stone conditions based on known geotechnical properties from other sites (Exhibit 2).
Steamboat-Vasquez Draw Potential Site

The Steamboat-Vasquez site is in the northern part of the Town of Lyons in a small valley. This site extends straight across from north to south in slender path that does not allow for the horizontal layout that maximizes energy potential of solar panels. It is outside of the floodplain per the Federal Emergency Management Agency maps, in the bottoms of the valley is a drainage ditch that could potentially overflow or have a risk of flooding. A potential environmental impact this site has if chosen will be the amount of noise the solar panels may have, and the reactions of the residents living nearby. Not to mention, the viewshed impact it may have to the houses surrounding. Residents may not like the view of having solar panels in front of their properties. Also, construction cost will have a major increase, considering that the land use is not feasible because it is mainly made of boulders or cobbles. The safety standards for having heavy machinery are not safe, considering that the land has a steep slope. The only way to get up to this location is by taking a curvy road, so it is nearly impossible to transport the solar panels to this location. The only advantage this location has is the close proximity to the three-phase power, located northwest of the site.

Figure 12: Steamboat-Vasquez Site
**Tank Hill Potential Site**

This site made the list of potential sites more for how it would help the Town of Lyons in multiple ways. This site sits atop a hill in the middle of a neighborhood. The land available to build a solar farm atop would not meet the energy demands that the Town of Lyons is trying to meet. Upon this site exists a large out of commission water tank, as well as a relay station for the local internet company.

A geotechnical analysis has been conducted at this location which indicated high concentrations of bedrock within the soil. These heavy bedrock conditions may prove difficult to excavate during construction operations which may make this location more costly than worth when considering a long-term return on investment. Local fox dens are within proximity to this site as well, and further research would be necessary to determine how protected these species are and if relocation of their dens would be feasible.
The Town of Lyons would really like this site considered as the water tank has been out of commission for over a decade and the town is paying taxes on this property. The largest challenge would be the need for ground screws or a ballast concrete block system to support the solar panels. The largest problem with the ground screws would be the cost to drill into bedrock. The largest problem with ballasted foundation is that while it is non-ground penetrating the slope of the hill could cause issues with using the weight of the concrete as the primary source for the foundation. There is also the issue of using precast concrete or cast-in-place as the steep hill would require tracked machinery instead of tires and this could add to the already high cost including the demolition of the existing water tank.

As shown in the topographical map above, Tank Hill rises over 40 feet above the surrounding land. This increased elevation poses challenges for construction, primarily by precluding the location of a lay-down area, and by posing a challenge for construction vehicles going up the steep hill. In addition, there is little area available on top of the hill for the construction of the solar panels.
**Longs Peak Drive Potential Site**

This site is at the end of a long steeply graded road and sits behind the backyards of some Lyons’ residents. This makes construction access more difficult as well as likely disturbing residents of this neighborhood the entire timeline of the project. The land beneath this site is all cobbles, as evidenced by the rocky terrain clearly visible on our site visit. This would further complicate any possible earthwork and installation of ground mounts for the solar array.

It was brought to our attention that many deer bed down in this area, which brings up environmental concerns that would require impact studies to fully understand the potential impact of construction a solar farm at this location. Upon our site visit some residents voiced their concerns at this location being one of the potential sites for the Solar Farm. They voiced concerns mentioned above as well as not wanting what is now a beautiful vista to be covered up by a large solar array. This immediate negative public response is cause for concern, as one of our contractual obligations is to perform public outreach and we want to shed the best light possible on this potential project.
Wastewater Treatment Potential Site

This site sits next to the wastewater treatment plant near Bohn Park. The site has been a lay down site for many construction projects within the park and is currently under use for what should be the final project currently planned near the park. The site sits in the floodplain and is on land that was affected by the flood that occurred in 2013. Given that the funding for the project is coming in part from a grant from Department of Local Affairs we were advised against any site that had flood risk by the contact working with Department of Local Affairs, Chris La May.

If this site has been chosen, the solar farm would have the energy requirements of the Wastewater Treatment Plant, this means, a large battery backup used during power outage may be added, thus creating a microgrid. However, we decided this site was not feasible because of the high flood risk.
Bohn Park Parking Lot Potential Site

Using the Bohn Park parking lot as a potential site bears with it the assumption that we would be doubling our solar farm as a covered parking in the park. Between September 11 and 13, 2013, The Town of Lyons experienced heavy rains that caused flash floods in the Bohn Park area, including this parking lot site. A water peak of approximately 8.8 feet in depth was recorded in Saint Vrain Creek. Because this site is within the floodplain, there is always potential for an instance of a flooding around the same magnitude as what was experienced in 2013. Because of these flooding risks, any construction of a solar farm, regardless of if it is elevated on a covered parking lot, still poses the risk of sustaining damage or being destroyed, however minimal.

A geotechnical study was conducted in this location in May 2016 by Shannon & Wilson, INC. The soil survey utilized five borings and three test pits in various locations around Bohn Park. The survey indicated subsurface conditions generally consisting of sand and gravel. Scattered cobbles were inferred from drill action in the borings and were observed within the test pit excavations, as well as concrete rubble. Groundwater was observed in some of the borings at depths of 7.7 and 5.5 feet below existing ground surface. Further geotechnical analysis would need to be conducted if constructing a covered parking/solar farm.
**Southwest Dog Park Potential Site**

This site would take up an acre of the currently existing ten-acre dog park in Bohn Park. This site would have little obstructions and easily meet over 90% of its solar potential. The dog park is city owned so construction could begin with the board’s approval. The major concern of this site is the public’s view on taking some of the dog park, as well as the effects the construction of the solar farm might have on the dog park. This has very little construction access to highways and paved roads to reach the site, additional construction cost will be added to construct an access path. We consider this site feasible because it has a minor flood risk, according to the Federal Emergency Management Agency. Some of the other advantages this location has is the room for expansion in the future if the project is a success. Another attractive point this location has is the fact that there are no homes around this area. The noise of the construction and the noise of the fans located near the solar panels used to cool off when it reaches high temperatures will not be disturbing the residents as much.
One of the only disadvantages we find with this location is the long distance the site has with running the underground power distribution. The underground power distribution is one of the main factors that adds to the cost of this project. The cost difference is expected to affect the return on investment of the project as well. This added cost of running phase-three power from the site will lessen the percentage of the return on investment, but we do not foresee this having a drastic effect on the forecasted payback period of the solar farm.

Figure 20: Southwest Dog Park Site
Bike Park Potential Site

One of the most desirable potential sites of the eight that have been brought to our attention. This site exists in a currently unused corner of the park. The site is large enough to provide the energy demands that the Town of Lyons is looking to meet, as well as easily being over 95% for potential solar energy with its placement. This portion of the park used to be a community garden but has since gone unused. Adding the solar farm here would possibly allow the Town of Lyons to implement agrivoltaics and bring together two sustainable ideas for the town.

This site would require the permission of the farmstead owners, the Carrols, who live just catty-corner to the potential site. This site also does not lend itself to much expansion in the future, if the Town of Lyons is able to supplement more than just 5% of their energy demands with solar energy in the future. A disadvantage, if this location is chosen, is the added construction cost, because the three-phase power is farther than desired.
Available Funding

In 2019 the Colorado Department of Local Affairs launched their Renewable and Clean Energy Challenge in an effort to reach Colorado’s 2040 energy goal of being 100% renewable. Since 2019 the Colorado Department of Local Affairs has awarded grants to over thirty planning projects and renewable implementation projects totaling in over fifteen million dollars. The Department of Local Affairs implements what they call “Local Match” for the awarding of grant funds. This requires applicants to match grant funding on a dollar-for-dollar basis with no cap on required funds, given budgets are reasonable and defensible. The application process for receiving one of the grants requires applicants to work with their respective Department of Local Affairs Regional Manager. The Town of Lyons has been working alongside Chris LaMay to meet this requirement. Applications are rated based upon the Energy/Mineral Impact Assistance Fund Grant program rating criteria (Exhibit 19).

Collective Sun is an organization that aids non-profits and tax-exempt organizations make use of the federal investment tax credit and reduce the bid of any solar installer by 12%. Tax-exempt entities are not able to make use of tax credits, however Collective Sun's proprietary funding is able to utilize the tax credits and transfer these savings over to the tax-exempt organization. There are numerous ways to fund the entire project including donations, reserves, bank loans, and Collective Sun's Proprietary Crowd Lending Campaign. This crowdfunding allows a non-profit organization to take a loan out from CollectiveSun. This loan differs from a conventional loan in that interest rates can vary from 0%-8%.
**Return-on-Investment**

Initial cost estimations on all three feasible sites are based upon quotes received from solar contractors, Namaste Solar and RBI Solar. The quote from Namaste Solar, completed in September of 2020, is for a ground mounted solar farm at the Bike Park location and includes design, labor, earthwork, and materials. The quote from RBI Solar, completed March of 2021, is for a raised carport at the Bohn Park parking lot and includes design, labor, earthwork, materials, and power distribution. The initial quote for the Bike Park location lies only 500 feet away from the Dog Park location and is similar in design, for this reason the quote was used within the cost estimations for both.

The quote for both the Bike Park and Dog Park locations does not include underground power distribution, legal and administration fees, geotechnical report for soil conditions, and special election fees for the rezoning of just the Bike Park location. Following the addition of these costs, both the Department of Local Affairs grant and the Collective Sun investment tax credit have to be accounted for within the cost estimation. Rough Cost estimates for the Bike Park and Dog Park locations are $313,726 and $321,266, respectively (Exhibits 17 and 18).

The quote for the Bohn Park parking lot location does not include legal and administration fees or a geotechnical report. Following the addition of these costs and the inclusion of the Department of Local Affairs grant and the Collective Sun investment tax credit the rough cost estimate for the Bohn Park parking lot carport is $577,120 (Exhibits 17 and 18).
To calculate the return-on-investment; annual energy output, savings, and costs need to be accounted for each year over the projected lifespan of the solar farm. The energy savings were estimated by first applying an annual solar panel degradation rate of 0.5% to get the annual energy production of the solar farm. This energy production was then multiplied by the Municipal Energy Agency of Nebraska’s energy rate, after applying an annual electricity rate escalation of 2.1%. Annual costs for the solar farms include the financing over a 20-year time period at an interest rate of 2.5%, operation and maintenance costs at an inflation rate of 3%, insurance ride at the cost of 0.35% of the system price at a rate of 3% inflation, and a year 15 inverter replacement at the cost of $0.10/watt. Return on investment calculations can be seen on exhibit 17 and final percentages can be seen in figure 22, below.

![Figure 22: Return on Investment Summary](image)

Most notable of these numbers is the negative return on investment of the carport to be constructed. If the Town of Lyons seeks to consider this site further, additional possible revenues from the carport solar array must be considered. Paid parking beneath the carport has been discussed amidst the town staff but no further numbers or pricing have been considered or calculated as part of this report.
Public Outreach

Due to the ongoing pandemic, public outreach was primarily conducted online, rather than in-person. One of the key aspects of this was monthly updates regarding our progress being published in the Redstone Review. The Redstone Review is the monthly newspaper published for the Town of Lyons and surrounding parts of Boulder County.

Before the student team was assigned to the project, Longmont resident Don Moore wrote an article (Exhibit 30) in the Redstone Review about the possibility of a solar farm in the Town of Lyons. Published in the November-December 2020 issue, Don Moore wrote an article, titled “A solar energy project will create renewable energy for Lyons,” that went into detail about the various aspects of the project. In the article, he describes the role that Lee Hall and Jim Kerr, both residents of the Town of Lyons and members of the Utilities and Engineering Board, played in creating the proposal for the solar array. The article also describes the role the student team will play in the project, as well as the overall scope of the project. The main purpose of the article was to inform the residents of the Town of Lyons of the project, as well as to garner excitement for the town investing in green energy.
Later in the semester, as part of the Public Outreach process, Brittany LeMarc wrote two articles for the Redstone Review. The first article (Exhibit 31), published in the March-April edition of the Redstone Review, served primarily to provide an update as to the progress the team had made on the project to that point. The article, titled “Solar energy farm could supply 5% of Lyons’ electricity,” detailed the site visit the team conducted in February, and how that related to the feasibility report. Also included in the article was a summary of the team’s visit to Jack’s Solar Farm in Longmont, Colorado. The article concluded with informing the public about the April 1st Virtual Town Hall.

The second article (Exhibit 32) was written for the April-May edition of the Redstone Review. This article, titled “Town Hall Zoom meeting is held to answer questions on proposed Lyons Solar Farm,” was more focused on discussing the town hall meeting on April 1st. The article, co-authored by Brittany LeMarc and Lee Hall, detailed the first town hall meeting for those residents that were not able to attend. Included in the article were some questions and answers to those questions from the town hall. The article also included the link for the second virtual town hall.

The other method of public outreach, used to inform the public of the town halls, was the Town eblast (Exhibit 33). The eblast is a feature used the Town of Lyons to send notifications to residents about upcoming events in the town. The first two eblasts were sent March 30th and April 1st before the first town hall meeting. The third and fourth eblasts were sent on April 12th and April 15th before the second town hall meeting.
The first virtual town hall (Exhibit 34) with the residents of the Town of Lyons was on Thursday April 1st, at 6:00 pm. In this meeting, the group, along with experts Lee Hall and Jim Kerr, answered questions posed by the public regarding the solar farm project. During this meeting, the public reaction to the project was positive and optimistic. Most of the questions posed during this town hall were regarding the locations of the project, as well as the impact of the project on the surrounding areas. This meeting had 24 total participants, of which 16 were residents of the Town of Lyons. The meeting started with a 15-minute presentation from the group on the project (Exhibit 34), followed by a 40-minute question and answer session. During this time, participants would enter their questions in the chat box on Zoom, and Chandler Kitson would read them out for team members, Lee Hall, and Jim Kerr to answer.

The second town hall (Exhibit 35) occurred on Thursday April 15, also at 5:00 pm. This meeting was the same format as the first town hall and featured a largely different group of residents than the first meeting. During this meeting, the public reaction to the project was positive and inquisitive. A lot of questions were asked during this town hall regarding agrivoltaics and the possibility of future expansions of the solar farm. This meeting had 23 total participants, of which 15 were residents of the Town of Lyons. The meeting started with an updated 15-minute presentation (Exhibit 35) from the group on the project, followed by a 40-minute question and answer session. Our two same town experts answered questions from the town residents.
Feasibility Report

The Town of Lyons is committed in creating better ways for sustainability and to reduce carbon footprint by the year 2050. Therefore, the Town of Lyons has partnered up with the College of Engineering, Design, and Computing of the University of Colorado at Denver to provide a feasibility study for a solar farm. The Town of Lyons reached out to The Department of Labor Affairs in hopes to obtain a grant to help pay the total project cost.

The purpose of the feasibility study (Exhibit 27) is to investigate and identify potential sites that can house a solar farm. These sites must have the ability to capture and maximize sun array, in which will be capable to supply 5% of the town’s current electrical demand. The feasibility report will include the top three sites the student team believes are the most feasible for the project, the advantages and disadvantages will be included for each site. The report will also have a rough cost estimate and return on investment per site, based on data obtained from Namaste Solar and RBI Solar, for each perspective sites. The feasibility report will also contain information on the best approach the student team members took to receive optimal public outreach. We wrote a couple of articles for the local town’s newspaper announcing of the two upcoming town hall meetings, in which we the student body will be conducting, along with two professionals of the town, involved with the project. The first town hall meeting was conducted on April 1st, and the second town hall meeting was done on April 15th. For both meetings it had approximately about the same amount of audience, in which positive feedback was provided. The citizens had a variety of questions, mainly questions in regards of the project cost.
**Recommendations for Future Work**

There remains much work to be done by the Town of Lyons to bring the solar farm into fruition. Our team has compiled some recommendations for the town to take on after our involvement on this project comes to an end. These recommendations include weighing the feasibility scores (Exhibit 18) of the three sites, hiring on an engineer to design the solar farm, and performing a geotechnical study at the site chosen.

The decision to finalize on a single site will require the Town of Lyons to weigh the different factors that have arisen throughout our study. The highest priority factors being cost and the potential rezoning of some of the sites. Costs differences do not vary greatly between the Dog Park and Bike Park sites, but the Parking Lot carport adds a considerable cost that would require the town to consider possible additional revenue options. The potential rezoning of sites pertains to the Bike Park and potentially the Parking Lot locations and would require a special election to be held and voted on by town residents. There exists a risk that the vote could not pass and require the town to default to another of the three sites.

Professional Engineers still need to be hired on and consulted for this project as well. Soil conditions vary greatly within the boundaries of the Town of Lyons and these soil conditions could greatly impact the design and construction of the solar farm. Soil conditions will determine the available options for ground mounts and could increase the difficulty of any earthwork necessary for the construction of the solar array. The solar farm would also require a set of drawings designed and stamped by a professional engineer to finalize requirements for the project and allow for a more accurate cost estimate to occur.
Disclaimer

The assumptions, findings, calculations, and conclusions expressed and described in this report and its exhibits were developed by undergraduate civil engineering students who are not licensed professional engineers. This report was prepared as an academic exercise as partial fulfillment of the Civil Engineering Senior Design course. Pursuant to C.R.S. §12-25, no part of this report should be used for construction without a complete review and written endorsement from an independent, qualified, and licensed engineer who can assume responsible charge of the project and who is willing and able to become the engineer of record for all aspects of the study, calculations, findings, recommendations, and the project in part and in whole.

The client is hereby given permission to copy and share the report as their needs dictate; however, a copy of this disclaimer shall accompany all copies made. By the acceptance of and/or use of this report and the exhibits hereto, the client and all reviewers of the content included herein shall indemnify and hold harmless the University of Colorado; the College of Engineering, Design and Computing; University employees; and the authors of this report from any and all liability, of whatsoever nature, that may result from such review, acceptance, or use.
Conclusion and Summary

The University of Colorado at Denver was contracted by the Town of Lyons to perform a feasibility study on the implementation of a solar farm capable of producing 5% of the town’s energy demands. As part of our obligations within this contract we were to ascertain the three most optimal sites, conduct public outreach, and prepare a rough cost estimate and return on investment. Our search began with eight initial sites that the town already had in question for installing a solar farm. After establishing a set criterion in which to judge these locations, we were able to conclude upon the three most feasible.

Having the three most optimal sites selected allowed our team to conduct public outreach with viable information for the townspeople of Lyons, and the townspeople were able to supply us with important questions and feedback which were used to create overall feasibility scores. Rough cost estimations and return on investments were completed on all three of the most feasible sites to provide additional information to the Town of Lyon’s, which is necessary when comparing the feasibility of the three selected sites.

In their mission to helping build a more sustainable world, the Town of Lyons is going to use this feasibility study to secure funds from the Colorado Department of Local Affairs. This funding will reduce the cost of the project by half, and greatly reduce the financial burden that the expenses of a solar farm would have on the town. The information that will be contained within the feasibility study report will greatly aid the Town of Lyon’s in deciding upon a single site in which to focus their attention on when applying for grant funds. Knowing the characteristics of each site, the public’s opinion on the locations, and having cost analyses will also create a basis on which to begin their planning and designing of the solar array.
**Exhibit List**

**Site Photography Exhibits**

Exhibit 1: Overall Site Map
Exhibit 2: Eagle Canyon Site Photography
Exhibit 3: Steamboat-Vasquez Draw Photography
Exhibit 4: Tank Hill Site Photography
Exhibit 5: Longs Peak Drive Site Photography
Exhibit 6: Wastewater Treatment Site Photography
Exhibit 7: Bohn Park Parking Lot
Exhibit 8: Southwest Dog Park Site Photography
Exhibit 9: Bike Park Site Photography
Exhibit 10: Jack’s Solar Farm Photography

**Project Exhibits**

Exhibit 11: References
Exhibit 12: University of Colorado Presentation (PowerPoint & DVD)
Exhibit 13: Geotechnical Report on Tank Hill Site
Exhibit 14: Geotechnical Report on Bohn Park
Exhibit 15: USGS and FEMA Data
Exhibit 16: Finances Calculated by Town of Lyons (Cost and Return on Investment)
Exhibit 17: Finances Calculated by Student Team (Cost and Return on Investment)
Exhibit 18: Cost and Site Comparison Charts
Exhibit 19: Department of Local Affairs Grant- Impact Assessment
**Exhibit List (Continued)**

**Solar Contractors Exhibits**

Exhibit 20: Namaste Lyons Overall Report
Exhibit 21: Namaste Summary of Qualifications
Exhibit 22: Namaste Bike Park Site Assessment
Exhibit 23: Namaste Solar Farm Pricing Qualifications for Bohn Park
Exhibit 24: RBI Bohn Park Parking Lot Assessment (Design Criteria, Solar Panels, Helioscope)

**Contract Deliverable Exhibits**

Exhibit 25: Town of Lyons Resolution
Exhibit 26: Town of Lyons- Solar Farm Feasibility Report (Rough draft)
Exhibit 27: Town of Lyons- Solar Farm Feasibility Report (Final Draft)
Exhibit 28: Initial Client Meeting (Agenda & DVD)
Exhibit 29: Final Client Presentation (PowerPoint & DVD)

**Public Outreach Exhibits**

Exhibit 30: Previous Written Redstone Review Article and Letter to the Editor
Exhibit 31: Redstone Review article from March 2021
Exhibit 32: Redstone Review article from April 2021
Exhibit 33: Town of Lyons E-Blasts for Virtual Town Halls
Exhibit 34: Virtual Town Hall on April 1st, 2021 (Participants, Questions, Presentation, DVD)
Exhibit 35: Virtual Town Hall on April 15th, 2021 (Participants, Questions, Presentation, DVD)
Exhibit 36: Select Answers to Virtual Town Hall Questions

**Teamwork Exhibits**

Exhibit 37: Team Journal (Contact Info, Availability, & Task Schedule)
Exhibit 38: Team Meeting Minutes
Exhibit 39: Team Member Resumes
Exhibit 1

Overall Site Map

Contains:

1 Photo of all 8 Potential Sites
Exhibit 1: Overall Site Map

Yellow Location Marker: Potential Site

White Location Marker: Town of Lyons Landmarks
Exhibit 2

Eagle Canyon Site Photography

Contains:

2 Site Photos
Exhibit 2: Eagle Canyon Site Photography

Northeast Bluff
Exhibit 2: Eagle Canyon Site Photography

Southeast Bluff
Exhibit 3
Steamboat-Vasquez Draw Site Photography

Contains:
1 Site Photo
Exhibit 3: Steamboat-Vasquez Draw Photography
Exhibit 4
Tank Hill Site Photography

Contains:
1 Satellite Photo
2 Site Photos
Exhibit 4: Tank Hill Site Photography

Pro: Close interconnect; no flood risk; parcel is otherwise an unusable liability
Cons: System size limited by at least 35%; very rocky soils; steep slopes
Exhibit 5
Longs Peak Drive Site Photography

Contains:
1 Satellite Image
1 Site Photo
Exhibit 5: Longs Peak Drive Site Photography
Exhibit 5: Longs Peak Drive Site Photography
Exhibit 6
Wastewater Treatment Plant Site Photography

Contains:
1 Satellite Photo
2 Site Photos
Exhibit 6: Wastewater Treatment Site Photography

Pros: Most buildable site; close interconnect; low public impact
Cons: High catastrophic flood risk
Exhibit 6: Wastewater Treatment Site Photograph
Exhibit 7
Bohn Park Parking Lot Site Photography

Contains:
1 Satellite Photo
1 Site Photo
Exhibit 7: Bohn Park Parking Lot
Exhibit 8
Southwest Dog Park Site Photography

Contains:
1 Satellite Photo
2 Site Photos
Pros: Very buildable; low proximity to residential areas; zoned Municipal? (not confirmed)
Cons: Significant underground interconnect; potential for public opposition; minor flood risk
Exhibit 9
Bike Park Site Photography

Contains:
3 Site Photos
Exhibit 9: Bike Park Site Photography
Exhibit 9: Bike Park Site Photography
Exhibit 10
Jack’s Solar Garden Photography

Contains:
2 Site Photos
1 Student Team Photo
Exhibit 10: Jack’s Solar Garden Photography
Exhibit 10: Jack’s Solar Garden Photography
Exhibit 10: Jack’s Solar Garden Photography
Exhibit 11

References

Contains:

2 Pages of References
Exhibit 11: References


- *Visit Lyons Colorado*, lyonscolorado.com/, Accessed on April 22, 2021


- “Division of Local Government,” *Department of Local Government*, cdola.colorado.gov/local-government, Accessed on April 15, 2021


Exhibit 12
University of Colorado Presentation (PowerPoint & DVD)

Contains:

7 Pages of PowerPoint Presentation Slides
DVD of Recorded Presentation
Town of Lyons
Solar Farm Feasibility Project

Presentation Brought to you by:
The University of Colorado at Denver Student Team
May 2nd, 2021

AGENDA

- Introductions
- Project Overview
- Potential Sites
- Public Outreach
- Recommendations
Exhibit 12: University of Colorado Presentation (PowerPoint & DVD)

Student Team Members
University of Colorado at Denver
Spring 2021, Senior Design Class

01. Brittany LaMarre
02. Mauricio Chavez
03. Chandler (CU) Kibon
04. Kevin Riker
05. Elvia Martinez
06. Ocelma Abdulah

Project Overview

Purpose of Feasibility Study
- Contract between Lyons & CU Denver
- Lyons path toward sustainability
- 5% MEAN limit
- Secure funds from DOLA grant

Contractual Obligations
- Review through Lyons staff, utility company, & other agencies
- Address issues and incorporate new information into study
- Prepare and conduct public outreach
- Document outreach sessions
- Prepare summary of work
- Feasibility Study
Exhibit 12: University of Colorado Presentation (PowerPoint & DVD)

Potential Sites Overview

Eight Total Sites
- Environmental Impacts
- Construction Concerns
- Solar Access
- Geotechnical Conditions
- Flood Risk Assessment

Southwest Dog Park
0 Bradford Street, Lyons, Colorado

Pros
- Outside of the flood region
- Room for future expansion
- Away from residential area
- Does not require rezoning
- Excellent solar access

Cons
- Uses existing dog park land
- 2000 feet to run underground Power distribution

Source: Google Maps and Title
Actual Photo
Bohn Park - Near Bike Park
199 2nd Ave, Lyons, Colorado

**Pros**
- Currently unused plot of land
- Shorter distance to run underground power distribution, 1625 ft
- Exceptional Solar Access

**Cons**
- Land requires rezoning
- No room for future expansion

---

Bohn Park Parking Lot
199 2nd Ave, Lyons, Colorado

**Pros**
- Add covered parking
- Opportunity to add shade garden park amenity
- 50 ft to run power distribution

**Cons**
- Much higher construction cost
- Close proximity to public
- Low Flood Risk Zone (0.2%-1%)

---

Agrivoltaics
The idea of combining agriculture such as farming or gardening with photovoltaic power such as solar panels.
### Cost Analysis

<table>
<thead>
<tr>
<th>Bohn Park Sites</th>
<th>Southwest Dog Park</th>
<th>Near Bike Park</th>
<th>Parking Lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Quote</td>
<td>$615,700</td>
<td>$615,700</td>
<td>$1,492,000</td>
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<td>Power Distribution</td>
<td>$203,000</td>
<td>$170,000</td>
<td>-</td>
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<tr>
<td>Legal &amp; Admin Fees</td>
<td>$25,000</td>
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<tr>
<td>Geotech Report</td>
<td>$7,000</td>
<td>$7,000</td>
<td>$7,000</td>
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<tr>
<td>Special Election</td>
<td>-</td>
<td>$10,000</td>
<td>-</td>
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<tr>
<td><strong>Sub Total:</strong></td>
<td>$850,700</td>
<td>$827,700</td>
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<tr>
<td>DOLV Grant</td>
<td>-$349,750</td>
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<td>Collective ITC.</td>
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<td>-$102,880</td>
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<td><strong>Total:</strong></td>
<td>$323,266</td>
<td>$345,326</td>
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<tr>
<td>25 Year ROI</td>
<td>10%</td>
<td>12%</td>
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<tr>
<td>30 Year ROI</td>
<td>13%</td>
<td>15%</td>
<td>-5%</td>
</tr>
<tr>
<td>Payback Period</td>
<td>21</td>
<td>21</td>
<td>43</td>
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</tbody>
</table>

### Site Overview

<table>
<thead>
<tr>
<th>Bohn Park</th>
<th>Weight Score of 1.5 Higher Number Indicates Higher Importance</th>
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</thead>
<tbody>
<tr>
<td>Environmental Impact</td>
<td>5  2  3  4</td>
</tr>
<tr>
<td>Distance to Power</td>
<td>1   2  3  5</td>
</tr>
<tr>
<td>Solar Access</td>
<td>5   5  5  5</td>
</tr>
<tr>
<td>Access to Roadways</td>
<td>1   3  4  5</td>
</tr>
<tr>
<td>Ability to Expand &gt;5%</td>
<td>3   5  2  1</td>
</tr>
<tr>
<td>Viewshed Impact</td>
<td>4   1  5  3</td>
</tr>
<tr>
<td>Existing Land Use</td>
<td>3   2  3  4</td>
</tr>
<tr>
<td>Return on Investment</td>
<td>5   4  5  1</td>
</tr>
<tr>
<td>Flood Risk</td>
<td>5   5  5  1</td>
</tr>
<tr>
<td><strong>Feasibility Score:</strong></td>
<td><strong>110</strong> 134 95</td>
</tr>
</tbody>
</table>
Exhibit 12: University of Colorado Presentation (PowerPoint & DVD)

Public Outreach

Redstone Review:
Monthly Local Newspaper
Serving Lyons
- December 2020
- March 2021
- April 2021

Town of Lyons E-Blast:
Bi-Weekly Notification System
- 1st Town Hall
  - March 26th & April 1st
- 2nd Town Hall
  - April 14th & April 15th

Virtual Town Halls:
- April 14th, 2021
- April 15th, 2021

Participants:
- 6 Student Team Members
- 2 Town & Project Experts
- 54 Citizens

Questions:
- Cost & ROI
- Details of Agriculture
- Feasibility of Expansion

Results:
- Mostly Positive Feedback & Opinions
- Main Concern of Existing Park Camp

Recommendations

Engineering Services
- Perform Geotechnical Study
- Acquire Professional Designs
- Environmental Impact Study

Special Election
- Required for Bohn Park Near Bike Path
- Not Required for Southwest Dog Park
- Decision Pending for Bohn Park Parking Lot

Grant Work & Submittal
- DOLA Grant
- Collective Sun ITC
Town of Lyons
Solar Farm Feasibility Project

Presentation Brought to you by:
The University of Colorado at Denver Student Team

Brittany Lattanzio
Mauricio Chavez
Chandler (C.J.) Kotson
Kevin Riker
Elvia Martinez
Desirae Abdoun

College of Engineering, Design and Computing
University of Colorado Denver
Exhibit 12: University of Colorado Presentation (PowerPoint & DVD)

DVD of Recorded Presentation
Exhibit 13
Geotechnical Report on Tank Hill Site

Contains:
26 Pages of Terracon GeoReport
Exhibit 13: Geotechnical Report on Tank Hill Site

Subsurface Exploration and Site Characterization Report
0 Reese Street Future Development
Town of Lyons, Colorado
February 7, 2018
Terracon Project No. 22185004

Prepared for:
Town of Lyons
Lyons, Colorado

Prepared by:
Terracon Consultants, Inc.
1242 Bramwood Place
Longmont, Colorado 80501
February 7, 2018

Town of Lyons
432.5th Avenue
P.O. Box 49
Lyons, Colorado 80540

Attn: Ms. Victoria Simonsen – Town Administrator
P: (303) 823 8622 Ext. 19
E: vsimonsen@townoflyons.com

Re: Subsurface Exploration and Site Characterization Report
0 Reese Street Future Development
Town of Lyons, Colorado
Terracon Project No. 22185004

Ms. Simonsen:

We have completed the Subsurface Exploration and Site Characterization services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P22185004 dated January 24, 2018. This report presents the findings of the subsurface exploration and provides information concerning geotechnical conditions encountered in the test borings and potential site development constraints/concerns; in particular, regarding site excavation.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Garrett Martin, E.I.
Geotechnical Engineer

Eric S. Willis, P.E.
Senior Project Manager/Engineer
Exhibit 13: Geotechnical Report on Tank Hill Site

REPORT TOPICS

REPORT SUMMARY ................................................................................... i
INTRODUCTION .................................................................................... 1
SITE CONDITIONS ................................................................................. 1
PROJECT DESCRIPTION ......................................................................... 2
GEOTECHNICAL CHARACTERIZATION .................................................... 2
PHOTOGRAPHY LOG .............................................................................. 4
GEOTECHNICAL CONSIDERATIONS ....................................................... 5
GENERAL COMMENTS ............................................................................. 6

Note: This report was originally delivered in a web-based format. Orange Bold text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
SITE LOCATION AND EXPLORATION PLANS
EXPLORATION RESULTS (Boring Logs and Laboratory Data)
SUPPORTING INFORMATION (General Notes, Unified Soil Classification System and Description of Rock Properties)

Responsive  ●  Resourceful  ●  Reliable
# REPORT SUMMARY

<table>
<thead>
<tr>
<th>Topic</th>
<th>Overview Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geotechnical Characterization</td>
<td>Subsoils generally consisted of about 1/3 to 3 feet of silty, clayey sand with gravel and silty sand underlain by well-cemented sandstone/siltstone bedrock. No groundwater was observed in the test borings during or shortly after completion of drilling to the depths explored.</td>
</tr>
<tr>
<td>Geotechnical Considerations</td>
<td>Based on our subsurface exploration, we have identified several geotechnical conditions that could impact construction and development of the site. These include, but are not limited to, difficult excavation of bedrock and cut/fill slopes. These conditions are discussed in the Geotechnical Considerations Section of this report.</td>
</tr>
</tbody>
</table>

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.

2. This summary is for convenience only. It should be used in conjunction with the entire report for decision making. The section titled General Comments should be read for an understanding of the limitations of this geotechnical engineering report.
Exhibit 13: Geotechnical Report on Tank Hill Site

Subsurface Exploration and Site Characterization Report
0 Reese Street Future Development
Town of Lyons, Colorado
Terracon Project No. 22185004
February 7, 2018

INTRODUCTION

A subsurface exploration and site characterization report has been completed for the proposed property located at 0 Reese Street in the Town of Lyons, Colorado. Two (2) borings, designated TB-1 and TB-2, were performed to depths of about 3½ to 5 feet below existing ground surface at which point practical auger refusal was encountered. Maps showing the site and boring locations are shown in the Site Location and Exploration Plan sections, respectively. Boring logs and laboratory testing data are included in the Exploration Results section of this report.

The purpose of these services is to characterize the geotechnical conditions encountered in our borings and to provide information relative to:

- subsurface soil and bedrock conditions
- general engineering properties of soil/bedrock
- groundwater conditions
- potential site development constraints/complications

The opinions presented in this report are based upon the results of field and laboratory testing from widely spaced borings, experience with similar soil/bedrock conditions and our understanding of the proposed project.

SITE CONDITIONS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>The project is located at 0 Reese Street in the Town of Lyons, Colorado. The lot encompasses a little under 1 acre. The general location of the project site is 40.2286°N 104.2688°W.</td>
</tr>
<tr>
<td>Existing Improvements/Existing Site Features</td>
<td>The site can be characterized as a relatively large knoll. An existing water tank is located near the northwest corner of the property, while a cluster of satellite dishes and associated equipment shed are located near the center of the project site. In general, the project site is surrounded by single-family residential developments.</td>
</tr>
</tbody>
</table>
Exhibit 13: Geotechnical Report on Tank Hill Site

Subsurface Exploration and Site Characterization Report
0 Reese Street Future Development & Town of Lyons, Colorado
February 7, 2016 & Terracon Project No. 22185004

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Ground Cover</td>
<td>Ground cover on the site consists of barren ground, native grasses/weeds and scattered shrubs.</td>
</tr>
<tr>
<td>Existing Topography</td>
<td>Based on our site visit, the ground surface on the site slopes down in all directions from the approximate center of the site at moderate to comparatively steep slopes. In addition, a difference in elevation of about 4 feet was measured across our boring locations</td>
</tr>
</tbody>
</table>

We also collected photographs at the time of our field exploration program. Photographs were taken from the access road on the east side of the site, and are presented in our Photography Log.

PROJECT DESCRIPTION

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Description</td>
<td>Our understanding is that the project site is being considered as a potential location for future development. The client is requesting subsurface exploration and site characterization services to provide information regarding subsurface conditions to aid in future planning for potential site development, in particular, addressing possible excavation difficulties.</td>
</tr>
<tr>
<td>Grading</td>
<td>Preliminary grading information was not available at the time of this report. However, based on our site visit and discussion with the client, we anticipate significant cuts will likely be required to achieve final grades.</td>
</tr>
</tbody>
</table>

GEOTECHNICAL CHARACTERIZATION

Geology

Bedrock conditions mapped in the vicinity of the site (1) include the Forelle Limestone Member (Pll) and the Lower part (Pil) of the Lykins Formation. Bedrock was encountered in our borings at depths ranging from about ½ to 3 feet below existing ground surface. The Forelle Limestone Member is described as yellowish-brown and yellowish-gray, finely laminated, wavy-bedded limestone, while the Lower part of the Lykins Formation is described as predominantly reddish-brown silty shale and minor limestone. Our subsurface exploration generally confirmed the conditions anticipated from the geologic maps.

Exhibit 13: Geotechnical Report on Tank Hill Site

Subsurface Exploration and Site Characterization Report

d Description and Site Characterization Report
0 Reese Street Future Development ■ Town of Lyons, Colorado
February 7, 2018 ■ Terracon Project No. 22185004

The geologic conditions presented in this section were obtained by locating the subject site on available large-scale geologic maps. Because of the scales involved, precise location of the site can be difficult to determine. In addition, the large-scale geologic maps describe only general trends. Local variations are possible and site specific geology may differ from those described above.

Subsurface Profile

Subsurface conditions at the boring locations can be generalized as follows:

<table>
<thead>
<tr>
<th>Approximate Depth to Bottom of Stratum</th>
<th>Material Encountered</th>
<th>Consistency or Relative Density/Hardness</th>
<th>General Engineering Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>About 4 inches</td>
<td>Vegetative soil layer</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>About 2½ to 3 feet</td>
<td>Silty, clayey sand with gravel and silty sand</td>
<td>Not determined</td>
<td>Judged to have negligible to low swell potential, low plasticity, low difficulty of excavation</td>
</tr>
<tr>
<td>Extended to bottom of borings</td>
<td>Sandstone/siltstone bedrock, well-cemented</td>
<td>Very hard</td>
<td>Judged to have negligible to low swell potential, low plasticity, high difficulty of excavation</td>
</tr>
</tbody>
</table>

Conditions encountered at each boring location are indicated on the individual boring logs shown in the Exploration Results section and are attached to this report. Stratification boundaries on the boring logs represent the approximate location of changes in soil/bedrock types; in situ, the transition between materials may be gradual.

Groundwater Conditions

The boreholes were observed while drilling and after completion for the presence and level of groundwater. The water levels observed in the boreholes can be found on the boring logs in Exploration Results, and are summarized below.

<table>
<thead>
<tr>
<th>Boring Number</th>
<th>Approximate Depth to Groundwater during Drilling (feet)</th>
<th>Approximate Depth to Groundwater after Drilling (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB-1</td>
<td>None encountered</td>
<td>None encountered</td>
</tr>
<tr>
<td>TB-2</td>
<td>None encountered</td>
<td>None encountered</td>
</tr>
</tbody>
</table>

1. Below ground surface
Due to the presence of shallow, well-cemented bedrock, the test borings could only be advanced to depths of about 3½ to 5 feet below the existing ground surface before practical auger refusal was encountered. Consequently, our understanding of the true nature of the groundwater conditions on the site are limited. Zones of perched and/or trapped groundwater could occur at times in the subsurface soils overlying bedrock, on top of the bedrock surface or within permeable fractures in the bedrock materials. The location and amount of perched water is dependent upon several factors, including hydrologic conditions, type of site development, irrigation demands on or adjacent to the site and seasonal and weather conditions.

PHOTOGRAPHY LOG

Photographs were taken from the access road located on the east side of the project site facing west and depict exposed bedrock. See the Exploration Plan for specific location.
Exhibit 13: Geotechnical Report on Tank Hill Site

Subsurface Exploration and Site Characterization Report
0 Reese Street Future Development ■ Town of Lyons, Colorado
February 7, 2018 ■ Terracon Project No. 22165004

GEOTECHNICAL CONSIDERATIONS

We understand the project site is being considered as a potential location for future development. Based on our subsurface exploration, we have identified several geotechnical conditions that could impact construction and development of the site. These include, but are not limited to, difficult excavation of bedrock and cut/fill slopes. These conditions are briefly discussed in the following sections.

Difficult Excavation

Well cemented sandstone/siltstone bedrock is present at shallow depth on this site. In general, penetration resistance measurements taken in the bedrock were 1 inch or less by 50 blows from a 140-pound hammer falling 30 inches. Practical auger refusal was encountered at, or near the boring locations at depths ranging from about ½ to 5 feet below the existing ground surface. Excavation into bedrock is anticipated to be difficult and will be expensive. Excavations will require the use of large ripper, pneumatic hammers or other specialized heavy-duty rock excavation equipment in order to advance excavations. Drilling and blasting will likely be required to advance excavations into the bedrock.

The means and methods for rock excavation should be evaluated and determined by a local excavation contractor who is familiar with subsurface conditions in the area of the project site. Consideration should be given to obtaining a unit price for difficult excavation. Furthermore, we recommend a contingency be provided in the construction budget for difficult excavation.

Cut/Fill Slopes

3H:1V slopes are widely used by state and local government agencies for dry slopes on the order of about 8 to 10 feet in height. However, the use of 3H:1V slopes does not guarantee that slope failures will not occur. At a minimum, some local raveling and/or surface sloughing should be
anticipated on slopes constructed at this angle until vegetation is re-established. Flatter slopes can be considered to reduce raveling, surface sloughing and other stability issues.

Slopes should be revegetated as soon as possible to reduce the potential for erosion problems. Seeded slopes should be protected with erosion mats until the vegetation is established. Surface drainage is critical to performance of slopes and should be designed, constructed and maintained to direct water away from slope faces and to prevent ponding adjacent to the crest or toe of the slope.

If saturated or steeper slopes and/or slopes over about 8 to 10 feet in height are anticipated, or if structures or other surcharge loads will be located within a distance of 1 to 1 ½ times the slope height from the crest of the slope, the slopes should be evaluated for stability on an individual basis. In any event, cut/fill slopes should be evaluated during design level geotechnical investigations.

GENERAL COMMENTS

The opinions presented in this report are based upon the data obtained from widely spaced borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction, weather or time. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be notified. The information presented in this report is intended for planning and feasibility study only. Design level geotechnical exploration(s) will be required on the site in order to design and construct foundations, floor slabs and pavements and to address specific earthwork recommendations.

The scope of services for this report does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third party beneficiaries intended. Any third party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.
Exhibit 13: Geotechnical Report on Tank Hill Site

Subsurface Exploration and Site Characterization Report
6 Reese Street Future Development - Town of Lyons, Colorado
February 7, 2018 - Terracon Project No. 22185004

Site characteristics as provided are for planning purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, we should be contacted to review the changes and either verify or modify our conclusions in writing.
EXPLORATION AND TESTING PROCEDURES

Field Exploration

<table>
<thead>
<tr>
<th>Number of Borings</th>
<th>Boring Depth (feet)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3½ to 5</td>
<td>See Exploration Plan</td>
</tr>
</tbody>
</table>

1. Multiple attempts to complete each soil boring were made within 10 to 15 feet laterally of the boring locations. In all locations/attempts, practical auger refusal was encountered at depths ranging from about ½ to 5 feet below the existing ground surface.

Boring Layout and Elevations: The borings were located in the field by pacing using property boundaries and/or existing site features as a reference. Right angles for locating the borings were estimated. Approximate ground surface elevations at the boring locations for this exploration were obtained by measurements with an engineer’s level and rod from a temporary bench mark (TBM) shown on the Exploration Plan. The latitude and longitude coordinates of the boring locations were obtained by using a recreational-grade GPS device. The accuracy of these coordinates is typically about ±/− 10 feet. The accuracy of boring locations and elevations should only be assumed to the level implied by the methods used.

Subsurface Exploration Procedures: Borings were advanced with a CME-45 truck-mounted drilling rig, utilizing 4-inch diameter solid stem auger. A geotechnical engineer recorded lithologic logs of each boring during the drilling operations. At selected intervals, samples of the subsurface materials were taken by means of driving a standard split-spoon sampler. Bulk samples were also obtained from the test borings. Penetration resistance measurements were obtained by driving the split-spoon into the subsurface materials with a 140-pound hammer falling 30 inches. The penetration resistance value, when properly interpreted, is a useful index in estimating the consistency, relative density, or hardness of the materials encountered.

Groundwater levels were recorded in each boring at the time of site exploration and after the completion of drilling. After the groundwater levels were checked, the borings were backfilled with on-site soils (auger cuttings) prior to leaving the site. Some settlement of the backfill may occur over time and should be repaired as soon as possible.

A CME automatic SPT hammer was used to advance the split-spoon sampler in the borings performed on this site. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between penetration values and soil properties are based on the lower efficiency cathead and rope method. This higher efficiency affects the penetration resistance blow count value by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method. The effect of the automatic hammer’s efficiency has been considered in the interpretation and analysis of the subsurface information for this report.
The penetration test provides a reasonable indication of the in-place density of sandy type materials, but only provides an indication of the relative stiffness of cohesive materials since the blow count in these soils may be affected by the soils moisture content.

**Laboratory Testing**

Samples retrieved during the field exploration were returned to the laboratory for observation by the project geotechnical engineer and were visually classified in general accordance with the Unified Soil Classification System described in the Supporting Information section of this report. Samples of bedrock were classified in accordance with the general notes for Rock Classification.

After sample review by the project engineer, an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials. Following completion of the laboratory testing, the field and visual descriptions were confirmed or modified as necessary, and Logs of Borings were prepared. These logs are presented in the Exploration Results section of this report.

Selected samples were tested for the following physical and/or engineering properties:

- Moisture Content
- Grain Size Distribution
- Atterberg Limits

Laboratory test results are indicated on the boring logs and are presented in depth in the Exploration Results section. The test results are used to develop a geotechnical site characterization and identify potential site development constraints or complications for the project area. Laboratory tests are performed in general accordance with applicable local standards or other accepted standards. Procedural standards noted in this report are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Also shown are estimated Unified Soil Classification Symbols. A brief description of this classification system as well as the General Notes can be found in the Supporting Information section. Classification was by visual-manual procedures. Selected samples were further classified using the results of Atterberg limit and percent fines testing. The Atterberg limit test results are also provided in the Exploration Results section.
SITE LOCATION AND EXPLORATION PLANS
Exhibit 13: Geotechnical Report on Tank Hill Site
Exhibit 13: Geotechnical Report on Tank Hill Site
EXPLORATION RESULTS
Exhibit 13: Geotechnical Report on Tank Hill Site

**BORING LOG NO. TB-1**

**PROJECT:** 0 Reese Street Future Development

**SITE:** 0 Reese Street

**TOWN OF LYONS**

**CLIENT:** Town of Lyons

**LONGMONT, COLORADO**

**LOCATION:**
- Latitude: 40.2665°
- Longitude: -105.2665°
- Approximate Surface Elev: 100.7 (ft)

**ELEVATION:** (ft)

**VEGETATIVE SOIL LAYER:** SAND soil with vegetation

**SANDY CLAY**
- BROWN, FINE GRAINED TO COARSE GRAINED

**SANDY CLAY**
- RED, LIGHT PINK, FINE GRAINED TO MEDIUM GRAINED

**SANDY/SILTSTONE**
- RED, PINK, VERY HARD, WELL-CEMENTED, SLIGHTLY CLAYEY

Practical Auger Refusal at 3.5 Feet

**SUPPORTING INFORMATION:**
- FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS

**NOTES:**
- None encountered after completion of drilling

**TERRACON**

1242 Bramwood Pl
Longmont, CO

**Boring Started:** 01-30-2013
**Boring Completed:** 01-30-2013

**DRL BDG:** 030-46
**CHERs:** UAD
### Exhibit 13: Geotechnical Report on Tank Hill Site

**BORING LOG NO. TB-2**

**PROJECT:** 0 Reese Street Future Development  
**SITE:** 0 Reese Street  
**Town of Lyons, Colorado**  
**CLIENT:** Town of Lyons  
**Lyons, Colorado**

<table>
<thead>
<tr>
<th>DEPTH (Ft)</th>
<th>MATERIAL</th>
<th>SAMPLE TYPE</th>
<th>FIELD TEST RESULTS</th>
<th>SHEAR LOK ELOD OR E-10</th>
<th>REACTION</th>
<th>WATER</th>
<th>RESIST</th>
<th>PERC</th>
<th>HAMMER TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>SANDSTONE/SILTSTONE</td>
<td>red, pink, very hard, well-cemented, slightly clayey</td>
<td>50'0&quot;</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>SILT CLAYEY SAND with GRAVEL (SC-SM) red brown, fine grained to coarse grained</td>
<td></td>
<td>50'3&quot;</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5-1.0</td>
<td>VEGETATIVE SOIL LAYER</td>
<td>SAND soil with vegetation and root penetration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0-1.0</td>
<td>GISS.4.60'</td>
<td>27-20-7</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Practical Auger Refusal at 5 Feet**

**Hammers:**  
- TYPE: Automatic

**Advance Method:**  
- Method: Solid flight auger

**Notes:**
- Water Level Observations: None encountered after completion of drilling

**Environments:**
- Boring started: 01-30-2018
- Boring completed: 01-30-2018
- Drill Rig: OME-46  
- Order: UAO

**Terracon**

1242 Bramwood Pl  
Longmont, CO

Project No: 22188004
Exhibit 13: Geotechnical Report on Tank Hill Site

**Atterberg Limits Results**

*ASTM D4318*

<table>
<thead>
<tr>
<th>Boring ID</th>
<th>Depth</th>
<th>LL</th>
<th>PL</th>
<th>Pi</th>
<th>Fines</th>
<th>USCS</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB-1</td>
<td>3 - 3.5</td>
<td>18</td>
<td>14</td>
<td>4</td>
<td></td>
<td></td>
<td>SANDSTONE/SILTSTONE</td>
</tr>
<tr>
<td>TB-2</td>
<td>0.5 - 3</td>
<td>27</td>
<td>20</td>
<td>7</td>
<td>28</td>
<td>SC-SM</td>
<td>SILTY, CLAYEY SAND with GRAVEL</td>
</tr>
</tbody>
</table>

**Project Details**

PROJECT: 0 Reese Street Future Development

SITE: 0 Reese Street
Town of Lyons, Colorado

1242 Brannwood Pl
Longmont, CO

PROJECT NUMBER: 22185004

CLIENT: Town of Lyons
Lyons, Colorado
Exhibit 13: Geotechnical Report on Tank Hill Site

**GRAIN SIZE DISTRIBUTION**

**ASTM D422 / ASTM C136**

<table>
<thead>
<tr>
<th>U.S. SIEVE OPENING IN INCHES</th>
<th>U.S. SIEVE NUMBERS</th>
<th>HYDROMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>3</td>
<td>1/16</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

**PERCENT FINER BY WEIGHT**

**GRAIN SIZE IN MILLIMETERS**

<table>
<thead>
<tr>
<th>COBBLES</th>
<th>GRAVEL (coarse)</th>
<th>GRAVEL (fine)</th>
<th>SAND (coarse)</th>
<th>SAND (medium)</th>
<th>SAND (fine)</th>
<th>SILT OR CLAY</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Boring ID</th>
<th>Depth</th>
<th>USCS Classification</th>
<th>WC (%)</th>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>Cc</th>
<th>Cu</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB-2</td>
<td>0.5 - 3</td>
<td>SILTY, CLAYEY SAND with GRAVEL (SC-SM)</td>
<td>9</td>
<td>27</td>
<td>20</td>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Boring ID</th>
<th>Depth</th>
<th>D&lt;sub&gt;100&lt;/sub&gt;</th>
<th>D&lt;sub&gt;50&lt;/sub&gt;</th>
<th>D&lt;sub&gt;90&lt;/sub&gt;</th>
<th>D&lt;sub&gt;10&lt;/sub&gt;</th>
<th>%Gravel</th>
<th>%Sand</th>
<th>%Silt</th>
<th>%Fines</th>
<th>%Clay</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB-2</td>
<td>0.5 - 3</td>
<td>19</td>
<td>0.493</td>
<td>0.083</td>
<td>20.0</td>
<td>51.7</td>
<td>28.4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Exhibit 13: Geotechnical Report on Tank Hill Site

SUPPORTING INFORMATION
Exhibit 13: Geotechnical Report on Tank Hill Site
Exhibit 13: Geotechnical Report on Tank Hill Site

### Unified Soil Classification System

#### Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests

**Group Classification**

<table>
<thead>
<tr>
<th>Group Symbol</th>
<th>Group Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW</td>
<td>Well-graded gravel</td>
</tr>
<tr>
<td>GM</td>
<td>Poorly graded gravel</td>
</tr>
<tr>
<td>GC</td>
<td>Clayey gravel</td>
</tr>
<tr>
<td>SP</td>
<td>Poorly graded sand</td>
</tr>
<tr>
<td>SM</td>
<td>Silty sand</td>
</tr>
<tr>
<td>SC</td>
<td>Clayey sand</td>
</tr>
<tr>
<td>OL</td>
<td>Organic clay</td>
</tr>
<tr>
<td>CH</td>
<td>Fat clay</td>
</tr>
<tr>
<td>MH</td>
<td>Elastic Silt</td>
</tr>
<tr>
<td>PT</td>
<td>Peat</td>
</tr>
</tbody>
</table>

**Coarse-Grained Soils: More than 50% retained on No. 200 sieve**

- **Gravels:** More than 50% of coarse fraction retained on No. 4 sieve.
- **Gravels with Fines:** More than 12% fines.
- **Clean Sands:** Less than 5% fines.
- **Sands:** 50% or more of coarse fraction passes No. 4 sieve.
- **Sands with Fines:** More than 12% fines.

**Fine-Grained Soils: 50% or more passes the No. 200 sieve**

- **Sloths and Clays:** Liquid limit less than 50.
- **Silt and Clays:** Liquid limit 50 or more.

**Highly Organic Soils:** Primarily organic matter, dark in color, and organic odor.

---

**For classification of fine-grained soils and fine-grained fraction of coarse-grained soils**

**Equation of "A" line**

Horizontal at Pl=4 to LL=25.5, then Pl=0.73 (LL=20).

**Equation of "U" line**

Vertical at LL=16 to Pl=7, then Pl=0.9 (LL=8).

**CL or OL**

- CL: ML
- OL: ML

**CH or OH**

- CH: OH

**MH or OH**

- MH: OH
DESCRIPTION OF ROCK PROPERTIES

(Based on ASTM C-294)

Sedimentary Rocks

Sedimentary rocks are stratified materials laid down by water or wind. The sediments may be composed of particles or pre-existing rocks derived by mechanical weathering, evaporation or by chemical or organic origin. The sediments are usually indurated by cementation or compaction.

Chert: Very fine-grained siliceous rock composed of micro-crystalline or cryptocrystalline quartz, chalcedony or opal. Chert is various colored, porous to dense, hard and has a conchoidal to splintery fracture.

Claystone: Fine-grained rock composed of or derived by erosion of silts and clays or any rock containing clay. Soft massive and may contain carbonate minerals.

Conglomerate: Rock consisting of a considerable amount of rounded gravel, sand and cobbles with or without interstitial or cementing material. The cementing or interstitial material may be quartz, opal, calcite, dolomite, clay, iron oxides or other materials.

Dolomite: A fine-grained carbonate rock consisting of the mineral dolomite [CaMg(CO₃)₂]. May contain noncarbonate impurities such as quartz, chert, clay minerals, organic matter, gypsum and sulfides. Reacts with hydrochloric acid (HCL).

Limestone: A fine-grained carbonate rock consisting of the mineral calcite (CaCO₃). May contain noncarbonate impurities such as quartz, chert, clay minerals, organic matter, gypsum and sulfides. Reacts with hydrochloric acid (HCL).

Sandstone: Rock consisting of particles of sand with or without interstitial and cementing materials. The cementing or interstitial material may be quartz, opal, calcite, dolomite, clay, iron oxides or other material.

Shale: Fine-grained rock composed of or derived by erosion of silts and clays or any rock containing clay. Shale is hard, pliant, or fissile and may be gray, black, reddish or green and may contain some carbonate minerals (calcareous shale).

Siltstone: Fine grained rock composed of or derived by erosion of silts or rock containing silt. Siltstones consist predominantly of silt sized particles (0.0625 to 0.002 mm in diameter) and are intermediate rocks between claystones and sandstones and may contain carbonate minerals.
Exhibit 14
Geotechnical Report on Bohn Park

Contains:
48 Pages of Shannon & Wilson. INC Geotechnical Report
May 31, 2016

DHM Design
900 South Broadway, Suite 300
Denver, Colorado 80209

Attn: Mr. Mark Wilcox

RE: GEOTEchnical REPORT, BOHN PARK FLOOD RECOVERY PROJECT,
LYONS, COLORADO

We are pleased to submit our geotechnical report for the above-referenced project. The enclosed report summarizes subsurface conditions encountered in a subsurface exploration program, laboratory tests, and geotechnical engineering recommendations for the proposed Bohn Park Flood Recovery Project.

We appreciate the opportunity to be of service to you on this project. If you have any questions or require further information, please contact me at 303-825-3800.

Sincerely,

SHANNON & WILSON, INC.

[Signature]

Gregory R. Fischer, Ph.D., P.E.
Senior Vice President

DAA-KDD-GRF/

Encl: Draft Geotechnical Report
# Exhibit 14: Geotechnical Report on Bohn Park

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1. Vicinity Map
2. Site and Exploration Plan (3 sheets)

APPENDICES

A. Subsurface Explorations
B. Laboratory Test Results
C. Important Information About Your Geotechnical Report
GEOTECHNICAL REPORT
BOHN PARK FLOOD RECOVERY PROJECT
LYONS, COLORADO

1.0 INTRODUCTION
This report presents the results of our subsurface exploration program for the Bohn Park Flood Recovery Project. The report summarizes subsurface explorations and laboratory testing and provides geotechnical engineering recommendations for design of the project.

2.0 SCOPE OF WORK
Our work was completed under our subcontract agreement with DHM Design (DHM), dated March 22, 2016. We completed the following geotechnical tasks for the project:

- Observed, logged, and collected soil samples from eight exploration locations;
- Completed laboratory testing on selected soil samples from the explorations;
- Evaluated geotechnical data and completed analysis for earthwork, pavement subgrade, and foundations to develop conclusions and recommendations for design of the project; and
- Preparation of this report.

3.0 SITE AND PROJECT DESCRIPTION
The site is located at Bohn Park in Lyons, Colorado about a half mile south of downtown Lyons (Figure 1). The topography gently slopes down from south to north toward the creek. Large cobble to boulder size material is common on the surface within about 200 feet of the creek and dissipates to the south. On September 12, 2013, the confluence of the North and South Saint Vrain Creek flooded, overtopping the creek banks and causing damage to many of the Bohn Park facilities including: two pedestrian bridges, utilities (water, sewer, gas and electric), and several Park shelters. In addition, the flooding covered park fields with several feet of flood debris and cobbles.

Proposed construction includes a pedestrian bridge crossing of the South Saint Vrain Creek, public restrooms, picnic shelters, and parking areas. In addition, we understand that the renovation will include a proposed skate park near the southwest corner of the park, two baseball fields and a multiuse field near the central area of the park, tennis courts and a sand volleyball court in the northern area of the park, and various park trails along the Saint Vrain Creek.
4.0 FIELD EXPLORATIONS AND LABORATORY TESTING

Shannon & Wilson conducted a field exploration program on April 12 and 17, 2016 to explore subsurface conditions at the project site. Exploration locations were laid out by DEH prior to our arrival. Five exploratory borings (designated SW-01 through SW-05) were drilled. Boring SW-01, located at the proposed skate park, was drilled to a depth of 19.3 feet. Boring SW-02, located at the proposed equipment shelter for the proposed baseball fields, was drilled to a depth of 19.9 feet. Borings SW-03 and SW-05 were drilled near proposed picnic shelters and boring SW-04 was drilled near the proposed multi-use court and parking lot. Borings SW-03 through SW-05 each encountered shallow drilling refusal at depths of about 6, 5 and 7 feet, respectively, because of the presence of cobbles and boulders in the soil. Due to this shallow drilling refusal, test pits were excavated at the locations of the proposed pedestrian bridge crossing of the South Saint Vrain Creek (test pits TP-07, TP-07A, and TP-08) and at the proposed overlook (located near test pit TP-06). The approximate locations of the borings and test pits are shown on Figure 2.

Appendix A presents a discussion of the drilling, excavating and sampling procedures used in completing the explorations. Appendix A also presents the individual exploration logs and an explanation of the symbols and terminology used.

Geotechnical laboratory tests were completed on selected samples retrieved from the explorations to estimate soil properties. Tests included natural water content, grain size distribution, Atterberg limits, and corrosion. Laboratory results are provided in Appendix B. The natural water content, fines content, and Atterberg limits are also shown on the individual boring logs included in Appendix A.

5.0 REGIONAL GEOLOGY AND SUBSURFACE CONDITIONS

5.1 Regional Geology

Based on a review of a geological map for the Lyons Quadrangle (Braddock et al., 1988), surficial soils within the project site generally consist of Holocene alluvial sandy gravel deposits within the river valley atop a broad anticline/syncline pair. The map indicates that bedrock of the Lyons Sandstone underlies the overburden alluvium and generally consists of orange to pink to pinkish gray quartz sandstone.

Subsurface conditions revealed during the field exploration program were consistent with the geologic maps of the area, as described below, except bedrock was not encountered.
Exhibit 14: Geotechnical Report on Bohn Park

5.2 Subsurface Conditions

The subsurface conditions encountered in the five borings were relatively consistent throughout the site and generally consisted of sand and gravel with varying percentages of silt. Scattered cobbles were inferred from drill action in our borings and observed in our test pits excavations. In test pit TP-07, concrete rubble was also encountered in the excavation. In test pit TP-07A, a loose sandy silt layer was encountered to a depth of approximately 7 feet.

Groundwater was observed in borings SW-01 and SW-02 at depths of 7.7 and 5.5 feet below ground level, respectively. Test pits TP-06 and TP-07A encountered groundwater at a depth of approximately 4.5 feet below ground level. Borings SW-03, SW-04, and SW-05 and test pits TP-07 and TP-08 did not encounter groundwater. Groundwater depths should be considered accurate at the time of our explorations. Groundwater level fluctuations are possible and depend on many factors, including proximity to South Saint Vrain Creek, seasonal variations, and local precipitation.

6.0 GEOTEchnICAL RECOMMendations

Bohn Park improvements will include playgrounds, trails and trailheads, two baseball fields, a sand volleyball court, tennis courts, and restroom/picnic areas. Each of these features will have some earthwork and subgrade preparation to be performed before building the feature.

6.1 Site Trails

Site material for trails should conform to Section 2.2 of the Lyons Colorado Park Standards Booklet (2016).

6.2 Aggregate Surfaced Roads

We understand that two parking lots are proposed at the northeast side of the park at the entrance from 2nd Avenue. The parking lots will consist of an aggregate surfacing with 100 and 92 parking spaces in each lot. An overflow parking lot to the east of 2nd Avenue will have another 150 parking spaces. Access roads from 2nd Avenue will also have aggregate surfacing.

Based on limited number of explorations performed at the site, we anticipate the proposed parking and access road subgrade to be granular composed primarily of a poorly graded sand and gravel with various amounts of silt and clay. Shannon & Wilson was not provided traffic volumes or specific vehicle types, but we understand that the anticipated traffic will be relatively low volumes and consist primarily of light-weight automotive vehicles with occasional park
Exhibit 14: Geotechnical Report on Bohn Park

SHANNON & WILSON, INC.

maintenance vehicles. For our analysis, we assumed design life that corresponds to the frequency of future rehabilitation/resurfacing treatments of the aggregate surfacing (3 to 5 years depending on anticipated traffic volume). For our analysis, we used design procedures outlined in the AASHTO Guide for Design of Pavement Structures (1993) and we assumed an equivalent single axle load (ESAL) of 10,000 for the parking and access roads. The below table summarizes anticipated rutting at the end of the design life for various aggregate surfacing thicknesses.

**TABLE 1**

<table>
<thead>
<tr>
<th>Aggregate Surfaced Road Thickness</th>
<th>Approximate Rutting Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 in.</td>
<td>1-3/4 in.</td>
</tr>
<tr>
<td>7 in.</td>
<td>2-1/2 in.</td>
</tr>
<tr>
<td>8 in.</td>
<td>3-1/4 in.</td>
</tr>
</tbody>
</table>

Aggregate surfaced roads will be subject to routine maintenance to repair, potholes, deep rutting, and a rough riding surface. In our opinion, an efficient way to avoid frequent maintenance of these proposed parking areas and access road is to have a properly graded road with a crowned driving surface, a shoulder area that slopes directly away from the edge of the driving surface, and drainage ditches. Rutting occurs in areas where water collects in the roadway wheel path (after a rain event) and saturates the subgrade. Shedding surface water away from the road reduces the potential and severity of rutting. If regular maintenance is not desired, a more permanent surface treatment (bituminous surface treatment or asphalt surfacing) should be considered.

Potholes in the aggregate surfacing occur from the loss of the fine particulate within the aggregate. The fine particles (material that passes the U.S. number 200 sieve) within a well-graded aggregate surfacing act as a binder that prevents the coarser sand and gravel-sized particles from migrating. The loss of the fine material increases roadway surface raveling and eventually leads to rutting. We understand that RFP documents specify CDOT Class 6 aggregate base course (ABC) for the aggregate surfacing. CDOT specifications allow for the fines content to vary from 3 to 12 percent for Class 6 ABC. In our opinion, a relatively clean (or low fines content) CDOT Class 6 may not have the desired durability for a surface aggregate. Therefore, we recommend the imported CDOT Class 6 (for roadway surfacing) have a minimum fines content of 8 percent.
A common maintenance method (other than importing new aggregate surfacing material and regrading), is applying a dust suppressant product (or dust palliative). Dust suppressants typically work by adhering or binding the surficial aggregate, or increasing the density of the road surface material to reduce the potential for fine migration.

6.3 Pedestrian Bridge

We understand the proposed pedestrian bridge will likely be a single span structure supported on spread footings, but no additional foundation details have been provided to us. Further, due to caving side-slopes during the excavation of our test pits (test pits TP-07, TP-07A, and TP-08), we were unable to excavate below an elevation of 5.328 (a depth of 7 feet) at the proposed south abutment and an elevation of 5.331 feet (a depth of 5 feet) at the north abutment. Test pit TP-07A did encounter loose, sandy silt near the south abutment approximate foundation embedment depth. The total thickness of the loose sandy silt layer is unknown and if this loose layer is thick, could result in long-term movement of the south abutment if used as the bearing stratum. At this time, it is unclear as to the depth of the footings and, therefore, the subgrade soils within the bearing zone. In our opinion, geotechnical borings extending below the proposed foundation depth will be required for the spread footing foundation design, and the pedestrian bridge foundation analysis should be re-evaluated by a geotechnical engineer at that time.

6.4 Restroom/Picnic Shelter Foundations

We understand that the proposed structures will be single story, constructed near existing grade, supported by shallow foundations. A slab on grade will be utilized for the floor of the structure, and foundation loads are anticipated to be relatively light.

Based on the limited subsurface explorations, the anticipated foundation subgrade will consist of granular soil (medium dense to dense, poorly graded sands and gravels with varying silt content). Footings are a suitable foundation option for the proposed structures. We recommend designing the footings for a net allowable bearing capacity of 3,000 pounds per square foot (psf). These pressures can be increased by 33 percent for short-term wind or seismic loads. In addition, we recommend a minimum footing width of 16 inches and an embedment of 30 inches for strip footings supporting the perimeter walls of the proposed structures. Any spread footings supporting columns should also have a minimum width of 2 feet and an embedment of 30 inches.

We anticipate a potential total movement on the order of 1 inch and differential movement on the order of 1/2 inch over a span of 30 feet. Approximately half of the settlement is expected to
occur as the load is applied with the remaining settlement occurring within one year after construction.

Horizontal seismic or wind loads on the structure may be resisted by friction along the base of the foundation and by passive soil resistance against the buried portion of the foundation. Passive soil resistance can be calculated based on an allowable equivalent fluid density of 250 pounds per cubic foot (pcf). This value was reduced by a factor of 2 on ultimate soil strengths to include a factor of safety and to reflect limited lateral deformations (less than one percent of the embedment depth). This value also assumes that groundwater is below the base of the footing and that a horizontal ground surface exists beyond the footing at least two times the depth of embedment in the direction of movement. Passive resistance should be ignored above the frost depth (2.5 feet). Footings cast on properly prepared material (as described in this report) may be designed using an allowable coefficient of base friction of 0.30. This value was reduced by a factor of 1.5 on ultimate soil strength.

We anticipate that the native subgrade soils will provide adequate support for slabs on grade, but we recommend that the upper 8 inches of native subgrade be scarified, screened for oversized material (boulder or cobbles greater than 6 inches in diameter), and recompacted. For structural design of the floor slabs, we recommend that a coefficient of subgrade reaction of 25 pounds per cubic inch (pci) be used for slabs founded on properly prepared subgrade. In addition, we recommend slab on grade floors be supported by at least 6 inches of granular subbase to act as a capillary break and provide additional support. The subbase should consist of clean crushed non-porous rock or crushed gravel. The maximum particle size should be 1-1/2 inches with no more than 2 percent passing the No. 4 sieve. The subbase should be compacted to a dense and unyielding condition and to at least 95 percent of the Modified Proctor maximum dry density in accordance with ASTM D 1557. We estimate slab movement (differential with respect to the footings) will be on the order of 1/2 inch or less.

The following details are recommended for slabs on grade:

- To reduce the effects of differential movement, slabs on grade should be separated from bearing walls and columns with expansion joints that allow unrestrained vertical movement. Further, slabs on grade should be reinforced and placed after dead loads have been placed on the foundation.
- Frequent control joints should be used to reduce damage due to shrinkage cracking.
- Slabs should be isolated from slab projections. At the discretion and judgment of the designer, slabs may be lightly tied to foundations at entries to prevent a lip from
forming as a result of slab movement. This should be limited to the minimum required. Where slabs are tied to walls, a control joint about 3 to 5 feet from the edge of the slab is suggested to allow the slab to hinge if movement occurs. Exterior slabs should be similarly isolated from foundation components.

- Utilities penetrating or supported by the slab should be isolated from the slab.
- Interior partitions resting on floor slabs should be provided with slip joints so that if the slab moves, the movement will not be transmitted to the upper structure. Slip joints should allow at least 2 inches of vertical movement (void space at the top or bottom of the wall). If top voiding is used, then a sliding joint should be provided at the intersection of partition walls with exterior walls to allow for differential movement.
- Load bearing partition walls should not be supported on thickened slabs. Instead, such walls should be supported on a grade beam or footing.

6.5 Corrosivity and Sulfates

The soil and bedrock materials in the Colorado Front Range area can be corrosive to substructure elements. To assist in estimating the corrosion potential at the site, samples of the overburden soils were tested for pH, resistivity, and water-soluble sulfates and chlorides. The results are presented in Table B-1 in Appendix B.

The resistivity measured in the samples were 7,200 and 14,000 ohm-cm. Roberge (2012) provides corrosivity ratings based on soil resistivity, as summarized in Table 2 below. The resistivity values measured in the samples indicate moderately corrosive to mildly corrosive subsurface conditions.

<table>
<thead>
<tr>
<th>Soil Resistivity (ohm-cm)</th>
<th>Corrosivity Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 20,000</td>
<td>Essentially noncorrosive</td>
</tr>
<tr>
<td>10,000 – 20,000</td>
<td>Mildly corrosive</td>
</tr>
<tr>
<td>5,000 – 10,000</td>
<td>Moderately corrosive</td>
</tr>
<tr>
<td>3,000 – 5,000</td>
<td>Corrosive</td>
</tr>
<tr>
<td>1,000 – 3,000</td>
<td>Highly corrosive</td>
</tr>
<tr>
<td>&lt; 1,000</td>
<td>Extremely corrosive</td>
</tr>
</tbody>
</table>

The concentration of water soluble sulfates measured in the samples from the site were 0.02 and 0.01 percent by weight. Classification as defined by the American Concrete Institute in ACI-318-14 (2014) (summarized in Table 3) suggests a negligible degree of sulfate attack on concrete exposed to site soils.
TABLE 3
ACI SULFATE EXPOSURE CRITERIA

<table>
<thead>
<tr>
<th>Water Soluble Sulfate in Soil (Percent by Weight)</th>
<th>Sulfate Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.10</td>
<td>Negligible (S0)</td>
</tr>
<tr>
<td>0.10 – &lt; 0.20</td>
<td>Moderate (S1)</td>
</tr>
<tr>
<td>0.20 – 2.00</td>
<td>Severe (S2)</td>
</tr>
<tr>
<td>&gt; 2.00</td>
<td>Very Severe (S3)</td>
</tr>
</tbody>
</table>

The test results provided in our report are to assist in the selection of pipe materials, concrete type or other features that should consider the subsurface conditions with respect to corrosion. If more evaluation is required, we recommend that a specialist in corrosion resistance design review the results included in Table B-1 to determine actual construction materials and methods based on the test results.

6.6 Seismic Ground Motion Design Parameters

Colorado is comprised of areas of very low to moderate potential for damaging earthquakes. Unfortunately, it is not possible to accurately estimate the timing or location of future major earthquakes, because the occurrence of major earthquakes is relatively infrequent and the historical earthquake record in Colorado is short (about 150 years). Based on a geologic map by the U.S. Geological Survey (2016a), the nearest fault to the proposed project is the Holocene to late Pleistocene Williams Fork Mountains Fault, located approximately 50 miles to the southwest. Based on this distance, it is our opinion that the risk of fault rupture is low at the site.

Our geotechnical borings at the site did not provide sufficient penetration to determine the site classification in accordance with IBC design guidelines, but based on our experience and our understanding of the site geology, we recommend assuming a Site Class D for the site. Ground motion parameters provided in the below table were determined for the project site using the USGS Seismic Design Map Web Application (2016b) with the 2012 International Building Code (IBC) design criteria.
Exhibit 14: Geotechnical Report on Bohn Park

TABLE 4
SEISMIC DESIGN GROUND MOTION PARAMETERS

<table>
<thead>
<tr>
<th>Ground Motion Parameters</th>
<th>Value (2012 IBC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Class</td>
<td>D</td>
</tr>
<tr>
<td>$S_x$</td>
<td>0.200 g</td>
</tr>
<tr>
<td>$S_1$</td>
<td>0.061 g</td>
</tr>
<tr>
<td>$F_x$</td>
<td>1.6</td>
</tr>
<tr>
<td>$F_1$</td>
<td>2.4</td>
</tr>
<tr>
<td>$S_{max} \times S_{min}$</td>
<td>0.320 g</td>
</tr>
<tr>
<td>$S_{min} \times S_{max}$</td>
<td>0.146 g</td>
</tr>
<tr>
<td>$S_{path} (2/3 \times S_{max})$</td>
<td>0.214 g</td>
</tr>
<tr>
<td>$S_{path} (2/3 \times S_{min})$</td>
<td>0.087 g</td>
</tr>
</tbody>
</table>

7.0 CONSTRUCTION CONSIDERATIONS

The applicability of the design parameters is contingent on good construction practice. Poor construction techniques may alter conditions from those upon which our recommendations are based, and therefore result in poor performance. Our analyses assumed that this project will be constructed according to Lyons Colorado Park Standards Booklet (2016) and the Town of Lyons Manual of Design Criteria & Standard Specifications for the Construction of Public Improvements (2002). The following sections provide additional construction considerations for this project.

7.1 Site Preparation

Prior to site grading, brush and other vegetation should be cleared from all areas to be graded. Any existing surficial topsoil and any soil containing organics should be stripped and removed from all areas. The depth of this removal is anticipated to vary, but generally be relatively thin. Topsoil and organic-rich soils are not considered suitable for reuse as fill and should be removed from the site. Care should be taken to avoid disturbing subgrade soils and supporting soils that will remain in place, as they can rut and pump under repeated construction traffic. The final subgrade surface should be sloped to promote positive drainage.

7.2 Subgrade Preparation and Proof Roll

Proper subgrade preparation is required for adequate foundation and pavement performance. Excavations for foundations should be observed by a geotechnical engineering representative familiar with the subsurface conditions to evaluate the adequacy of the bearing stratum and
check that the subsurface conditions at and below the bearing elevations are suitable for the design values presented in this report. Subgrade excavations should be cleaned of all fill, debris, or loose material prior to concrete placement and should be kept free of water at all times. We recommend that the foundation subgrade be proof rolled (where feasible) or probed to identify soft or loose zones.

Proof rolls should be conducted using a fully-loaded, tandem-axle dump truck or equivalent. Any areas that are delineated to be soft, loose, or yielding during proof rolling should be removed and reconditioned, or replaced with granular fill.

7.3 Fill Placement and Compaction

All fill should consist of either on-site or other granular material with less than 30 percent fines (material passing the U.S. Standard No. 200 sieve). The onsite soils can be re-used as fill provided the soil does not contain organic or any deleterious material, or if silt or clay soils are encountered. In addition, we recommend screening the onsite material to remove oversized material (material larger than 6 inches). The onsite material was observed to contain numerous cobbles and reusing this material can be difficult to compact.

Fill materials should be placed in horizontal lifts, with the loose lift thickness not to exceed 10 inches for heavy equipment compactors and 6 inches for hand-operated compactors. Thinner lifts may be required, depending on the size of the contractor's equipment. Fill should be compacted to at least 95 percent of its modified Proctor maximum dry density (ASTM D 1557), within 2 percent of the optimum moisture content, and to a dense and nonyielding condition. If the oversized material fraction (material larger than 3/4 inch) exceeds 30 percent, then the compaction criteria determined from ASTM D 1557 is not valid. For these fill soils, we recommend that the fill placement be monitored on a full-time basis to observe and document the compaction process.

8.0 PLAN REVIEW AND CONSTRUCTION OBSERVATION SERVICES

We recommend that we be retained to review the geotechnical aspects of the plans and specifications before construction begins to confirm that they are in accordance with our recommendations.

Due to the relatively shallow explorations at the proposed structures, the geotechnical design recommendations included herein were developed from a limited number of explorations and tests. Geotechnical recommendations may need to be adjusted in the field based on conditions...
encountered during construction. Therefore, we recommend that a construction observation and monitoring program be implemented for the project and that Shannon & Wilson be retained to monitor the geotechnical aspects of construction, particularly earthwork activities. This monitoring would allow us to confirm that conditions encountered are consistent with those indicated by the explorations. A site representative will also be able to quickly provide changes to recommendations in the event that conditions revealed during construction are different from those anticipated.

9.0 LIMITATIONS

The analyses, conclusions, and recommendations presented in this report are based on our understanding of the project and a limited number and limited depth of subsurface explorations and laboratory test results. We assume that these explorations are representative of the subsurface conditions beneath the site; that is, the subsurface conditions everywhere are not significantly different from those disclosed by the explorations.

This report was prepared for the exclusive use of DHM and the City of Lyons for the Bohn Park Flood Recovery Project. It should be made available to prospective contractors and/or the Contractor for information on factual data only, and not as warranty of subsurface conditions.

Within the limitations of scope, schedule and budget, the analyses, conclusions and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical and geological principles and practice in this area at the time this report was prepared. We make no other warranty, either express or implied.

Unanticipated soil conditions are commonly encountered and cannot be fully determined by a limited boring and testing program. Such unexpected conditions frequently require that additional expenditures be made to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

The scope of our services did not include an evaluation regarding the presence or absence of hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. If such contamination exists, it would not be possible to determine it within this limited scope of work.
Shannon & Wilson has prepared Appendix C, "Important Information About Your Geotechnical Report," to assist you and others in understanding the use and limitations of our reports.

David Asunskis, P.E.
Geotechnical Engineer

Gregory R. Fischer, Ph.D., P.E.
Senior Vice President

DAA:GFR/Imr
10.0 REFERENCES

American Concrete Institute (ACI), 2014, Building Code Requirements for Structural Concrete and Commentary, Farmington Hills, Michigan, ACI 318-14.


Lyons, Colorado, 2016, Park Standards Booklet.


Exhibit 14: Geotechnical Report on Bohn Park

NOTE
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Exhibit 14: Geotechnical Report on Bohn Park

Legend:
- SW-01: Boring Designation and Approximate Location
- TP-06: Test Pit Designation and Approximate Location

Notes:
1. Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth™ Mapping Service.
2. Boring/test pit locations approximated using consumer grade GPS.

Site and Exploration Plan
Bohn Park
Flood Recovery Project
Lyons, Colorado

May 2016
23-1-01530-001

Scale in Feet

0 250 500
Exhibit 14: Geotechnical Report on Bohn Park
Exhibit 14: Geotechnical Report on Bohn Park

LEGEND

SW-01 Boring Designation and Approximate Location

NOTE
Map adapted the DHM Design proposed Bohn Park layout provided to Shannon & Wilson on May 5, 2016

SITE AND EXPLORATION PLAN

Bohn Park
Flood Recovery Project
Lyons, Colorado

May 2016
23-1-01530-001

SHANNON & WILSON, INC
FIG. 2
Sheet 3 of 3
APPENDIX A
SUBSURFACE EXPLORATIONS
APPENDIX A

SUBSURFACE EXPLORATIONS

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</tr>
</tbody>
</table>

Exhibit 14: Geotechnical Report on Bohn Park
APPENDIX A
SUBSURFACE EXPLORATIONS

A.1 INTRODUCTION

The field exploration program for the Bohn Park Flood Recovery project was conducted on April 12 and 17, 2016 and consisted of drilling five geotechnical borings (designated SW-01 through SW-05) and excavating four test pits (designated TP-06, TP-07, TP-07A, and TP-08). A representative from Shannon & Wilson observed the drilling, excavating and sampling operations; retrieved representative samples for laboratory testing; and prepared descriptive field logs of the explorations. The methods used to conduct the field exploration program are described below.

A.2 SUBSURFACE EXPLORATIONS

The borings and test pits were coordinated (including subcontractor coordination and utility locates) and observed by our field representative. Individual boring logs are presented on Figures A-2 through A-6 and test pit logs are Figure A-7 through A-10. These exploration logs represent our interpretation of the subsurface conditions encountered at the time of drilling/excavating and the results of laboratory testing. The location of each exploration (Figure 2) was approximated using recreational grade GPS unit. The approximate exploration elevations were estimated for electronic site topography files provided by DHM.

A.2.1 Geotechnical Drilling

The borings were drilled by Vine Laboratories of Denver, Colorado, under subcontract to Shannon & Wilson, using a truck-mounted CME 75 drill rig. The borings were advanced with 8-inch hollow-stem auger drilling techniques to a depth of 19.3 and 19.9 feet below ground surface in borings SW-01 and SW-02, respectively. Shallow auger drilling refusal was encountered in borings SW-03 through SW-05 and only penetrated to a depth of 6.3, 4.8, and 7.0 feet below ground surface, respectively. Refusal was presumably from buried cobbles or boulder size material located below our boring location. After the completion of drilling, our field representative estimated the groundwater depth using visual observation of the water column and a weighted measuring tape. Following the groundwater measurement the borings were backfilled with drill cuttings.
A.2.2 Test Pits

The test pits were excavated using a John Deere 310SJ rubber tire backhoe operated by the Town of Lyons. Test pit excavation was completed to a depth of 3 feet where the subgrade was probed with a 3/8-inch diameter rebar. Excavation was then continued up to a depth of 5 to 7 feet. The soil was classified using the system described below. Excavation was halted between depths of 5 and 7 feet due to collapsing side slopes during excavation. On completion, the test pits were backfilled with excavated spoils and tamped with the bucket of the backhoe in approximately 3 foot-thick lifts.

A.2.3 Soil Classification System

The Shannon & Wilson representative collected soil samples and prepared a field log of each exploration. Soil classifications were based on ASTM International (ASTM) Designation: D 2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), and ASTM Designation: D 2488, Standard Practice for Description and Identification of Soils (Visual Manual Procedure). The system is referred to as the Unified Soil Classification System and is summarized on Figure A-1.

A.2.4 Standard Penetration Test (SPT)

Disturbed samples were obtained in the borings in general accordance with ASTM Designation: D 1586, Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils. The SPT consists of driving a 2-inch outside diameter (O.D.), 1 375-inch inside diameter (I.D.) split-spoon sampler a distance of 18 inches with a 140-pound hammer free-falling a distance of 30 inches. An automatic hammer system was used to advance the samplers. During sampling, the Shannon & Wilson field representative recorded the number of blows for each 6-inch increment of penetration and summed the blow counts for the last two 6-inch increments. This sum is recorded as the penetration resistance number, or N-value. If high penetration resistance prevented driving the total length of the sampler, the Shannon & Wilson field representative recorded the partial penetration depth and blow count. The N-values provide a means for evaluating the relative density or compactness of cohesionless (granular) soils and consistence or stiffness of cohesive (fine-grained) soils (see Figure A-1). The N-values are shown on the individual boring logs. Representative portions of the split-spoon sample obtained in conjunction with the SPT were placed in a screw-top plastic jar and transported to our laboratory.
A.2.5 Bulk Samples

Bulk soil samples were obtained by collecting the drill cuttings of select borings and test pit excavations. Approximately 30 to 40 pounds of cuttings were placed in a plastic bag and transported to our laboratory for further analysis and testing.
Exhibit 14: Geotechnical Report on Bohn Park

Shannon & Wilson, Inc. (S&W) uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2487) and laboratory testing procedures (ASTM D2487), if performed.

**S&W INORGANIC SOIL CONSTITUENT DEFINITIONS**

<table>
<thead>
<tr>
<th>CONSTITUENT</th>
<th>FINE-GRAINED SOILS (95% or more fines)</th>
<th>COARSE-GRAINED SOILS (less than 50% fines)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major</td>
<td>Silt, Lean Clay, Elastic Silt, or Fat Clay</td>
<td>Sand or Gravel*</td>
</tr>
<tr>
<td></td>
<td>30% or more coarse-grained: Sandy or Gravely</td>
<td>More than 12% fine-grained: Silty or Clayey*</td>
</tr>
<tr>
<td></td>
<td>15% to 30% coarse-grained: Sandy or Gravely with Sand or Gravel*</td>
<td>5% to 12% fine-grained: Silty or Clayey with Gravel*</td>
</tr>
<tr>
<td>Minor</td>
<td>30% or more coarse-grained and lesser coarse-grained constituent is 15% or more: Sandy or Gravely with Sand or Gravel*</td>
<td>15% or more of a second coarse-grained constituent: Sandy or Gravely with Gravel*</td>
</tr>
</tbody>
</table>

*All percentages are by weight of total specimen passing a 3-inch sieve.
*The order of terms is: Modifying Major with Minor.
*Determined based on behavior.
*Determined based on which constituent comprises a larger percentage.
*Whichever is the lesser constituent.

**MOISTURE CONTENT TERMS**

<table>
<thead>
<tr>
<th>Moisture Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Absence of moisture, dusty, dry to the touch</td>
</tr>
<tr>
<td>Moist</td>
<td>Damp but no visible water</td>
</tr>
<tr>
<td>Wet</td>
<td>Visible free water, from below water table</td>
</tr>
</tbody>
</table>

**STANDARD PENETRATION TEST (SPT) SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Hammer:</th>
<th>140 pounds with a 30-inch free fall. Drop on 8- to 10-inch-diam. cachet 2-1/4 rope turns, &gt; 100 rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOTE:</td>
<td>If automatic hammers are used, blow counts shown on boring logs should be adjusted to account for efficiency of hammer.</td>
</tr>
<tr>
<td>Sampler:</td>
<td>10 to 30 inches long Show I.D. = 1.375 Inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches</td>
</tr>
<tr>
<td>N-Value:</td>
<td>Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches</td>
</tr>
<tr>
<td>NOTE:</td>
<td>Penetration resistances (N-values) shown on boring logs are not recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors</td>
</tr>
</tbody>
</table>

**PARTICLE SIZE DEFINITIONS**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>SIEVE NUMBER AND/OR APPROXIMATE SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FINES</td>
<td>&lt; #200 (0.075 mm = 0.003 in.)</td>
</tr>
<tr>
<td>SAND</td>
<td>#200 to #40 (0.075 to 0.167 mm = 0.003 to 0.02 in.)</td>
</tr>
<tr>
<td></td>
<td>#40 to #10 (0.167 to 0.4 mm = 0.007 to 0.02 in.)</td>
</tr>
<tr>
<td></td>
<td>#10 to #4 (0.02 to 0.167 mm = 0.007 to 0.06 in.)</td>
</tr>
<tr>
<td></td>
<td>#4 to #1 (0.167 to 1.778 mm = 0.007 to 0.06 in.)</td>
</tr>
<tr>
<td>GRAVEL</td>
<td>#4 to 3/4 in. (4.75 to 19 mm = 0.187 to 0.75 in.)</td>
</tr>
<tr>
<td></td>
<td>3/4 to 3 in. (19 to 76 mm)</td>
</tr>
<tr>
<td>COBBLES</td>
<td>3 to 12 in. (76 to 305 mm)</td>
</tr>
<tr>
<td>BOULDER</td>
<td>&gt; 12 in. (305 mm)</td>
</tr>
</tbody>
</table>

**RELATIVE DENSITY / CONSISTENCY**

<table>
<thead>
<tr>
<th>CONCENTIONLESS SOILS</th>
<th>COHESIVE SOILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>N, SPT</td>
<td>RELATIVE BLOW</td>
</tr>
<tr>
<td>&lt; 4</td>
<td>Very loose</td>
</tr>
<tr>
<td>4 - 10</td>
<td>Loose</td>
</tr>
<tr>
<td>10 - 30</td>
<td>Medium dense</td>
</tr>
<tr>
<td>30 - 50</td>
<td>Dense</td>
</tr>
<tr>
<td>&gt; 50</td>
<td>Very dense</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WELL AND BACKFILL SYMBOLS**

- Bentonite
- Cement Grout
- Surface Cement
- Seal
- Bentonite Grout
- Asphalt or Cap
- Bentonite Chips
- Slough
- Silica Sand
- Inclinometer or Non-perforated Casing
- Perforated or Screened Casing
- Vibrating Wire
- Piezometer

**PERCENTAGES TERMS**

<table>
<thead>
<tr>
<th>Trace</th>
<th>&lt; 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Few</td>
<td>5 to 10%</td>
</tr>
<tr>
<td>Little</td>
<td>15 to 25%</td>
</tr>
<tr>
<td>Some</td>
<td>30 to 45%</td>
</tr>
<tr>
<td>Mostly</td>
<td>50 to 100%</td>
</tr>
</tbody>
</table>

Gravel, sand, and fines estimated by mass. Other constituents, such as organic, cobbles, and boulders, estimated by volume.


Bohn Park
Flood Recovery Project
Lyons, Colorado

**SOIL DESCRIPTION AND LOG KEY**

May 2016

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants
FIG. A-1
Exhibit 14: Geotechnical Report on Bohn Park

<table>
<thead>
<tr>
<th>UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)</th>
<th>MAJOR DIVISIONS</th>
<th>GEOGRAPHIC SYMBOL</th>
<th>TYPICAL IDENTIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)</td>
<td>Gravels (more than 50% of coarse fraction retained on No. 4 sieve)</td>
<td>GW</td>
<td>Well-Graded Gravel; Well-Graded Gravel with Sand</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GP</td>
<td>Poorly Graded Gravel; Poorly Graded Gravel with Sand</td>
</tr>
<tr>
<td></td>
<td>Silty or Clayey Gravel (more than 12% fines)</td>
<td>OM</td>
<td>Silty Gravel; Silty Gravel with Sand</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OC</td>
<td>Clayey Gravel; Clayey Gravel with Sand</td>
</tr>
<tr>
<td></td>
<td>Sand (less than 5% fines)</td>
<td>SW</td>
<td>Well-Graded Sand; Well-Graded Sand with Gravel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SP</td>
<td>Poorly Graded Sand; Poorly Graded Sand with Gravel</td>
</tr>
<tr>
<td></td>
<td>Silty or Clayey Sand (more than 12% fines)</td>
<td>SM</td>
<td>Silty Sand; Silty Sand with Gravel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SC</td>
<td>Clayey Sand; Clayey Sand with Gravel</td>
</tr>
<tr>
<td></td>
<td>Silt and Clays (liquid limit less than 50)</td>
<td>Inorganic</td>
<td>ML</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CL</td>
<td>Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organic</td>
<td>CL</td>
</tr>
<tr>
<td></td>
<td>Silt and Clays (liquid limit 50 or more)</td>
<td>Inorganic</td>
<td>MH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH</td>
<td>Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organic</td>
<td>OH</td>
</tr>
<tr>
<td></td>
<td>Highly Organic Soils</td>
<td>Primarily organic matter, dark in color, and organic odor</td>
<td>PT</td>
</tr>
</tbody>
</table>

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.095 mm = 0.003 in.

NOTES

1. Dual symbols (symbols separated by a hyphen, i.e., SP-SM, Sand with Sil) are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index value plots in the CL-ML area of the plasticity chart. Graphics shown on the logs for these soil types are combinations of the two graphic symbols (e.g., SP and SM).

2. Borderline symbols (symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Sil to Silty Sand) indicate that the soil properties are close to the defining boundary between two groups.

BOHN PARK
Flood Recovery Project
Lyons, Colorado

SOIL DESCRIPTION
AND LOG KEY

May 2016 23-1-01530-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants FIG. A-1
Sheet 2 of 3
Exhibit 14: Geotechnical Report on Bohn Park

**GRADATION TERMS**
Poorly Graded
- Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
- Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

**CEMENTATION TERMS**
- Weak: Crumbles or breaks with handling or slight finger pressure.
- Moderate: Crumbles or breaks with considerable finger pressure.
- Strong: Will not crumble or break with finger pressure.

**PLASTICITY**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>VISUAL- MANUAL CRITERIA</th>
<th>APPROX. PLASTICITY INDEX RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonplastic</td>
<td>A 1/8-in. thread cannot be rolled at any water content.</td>
<td>&lt; 4</td>
</tr>
<tr>
<td>Low</td>
<td>A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.</td>
<td>4 to 10</td>
</tr>
<tr>
<td>Medium</td>
<td>A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rolled after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.</td>
<td>10 to 20</td>
</tr>
<tr>
<td>High</td>
<td>It is possible to roll a thread and knead it to reach the plastic limit. A thread can be kneaded several times after reaching the plastic limit.</td>
<td>&gt; 20</td>
</tr>
</tbody>
</table>

**ADDITIONAL TERMS**
- Motiled: Irregular patches of different colors.
- Bioturbation: Soil disturbance or mixing by plants or animals.
- Diamicrite: Noncoherent sediment; sand and gravel in alluvial and clay matrix.
- Overburden: Material brought to surface by drilling.
- Slough: Material that caved from sides of borehole.
- Sheared: Disturbed texture, mix of strengths.

**PARTICLE ANGLULARITY AND SHAPE TERMS**
- Angular: Sharp edges and unpolished planar surfaces.
- Subangular: Similar to angular, but with rounded edges.
- Subrounded: Nearly planar sides with well-rounded edges.
- Rounded: Smoothly curved sides with no edges.
- Flattened: Length/width ratio > 3.

**ACRONYMS AND ABBREVIATIONS**
- AFD: At Time of Drilling
- Diam: Diameter
- Elev: Elevation
- ft: Feet
- FeO: Iron Oxide
- gal: Gallons
- Helix: Horizontal
- HSA: Hollow Stem Auger
- I.D: Inside Diameter
- in: Inches
- lbs: Pounds
- MgO: Magnesium Oxide
- min: Millimeter
- MnO: Manganese Oxide
- NA: Not Applicable or Not Available
- NP: Nonplastic
- O.D: Outside Diameter
- OW: Observation Well
-pcf: Pounds per Cubic Foot
- PiD: Photo-Ionization Detector
- PMT: Pressuremeter Test
- ppm: Parts per Million
- psi: Pounds per Square Inch
- PVC: Polyvinyl Chloride
- rpm: Rotations per Minute
- SPT: Standard Penetration Test
- USCS: Unified Soil Classification System
- UCS: Unconfined Compressive Strength
- VWP: Vibrating Wire Piezometer
- Vert: Vertical
- WCH: Weight of Hammer
- WOR: Weight of Rock
- Wt: Weight

**STRUCTURE TERMS**
- Interbedded: Alternating layers of varying material or color with layers at least 1/4-inch thick; singular bed.
- Laminated: Alternating layers of varying material or color with layers less than 1/4-inch thick; singular laminations.
- Flattened: Breaks along definite planes or fractures with little resistance.
- Slickenied: Fracture planes appear polished or glossy; sometimes slick-slated.
- Blocky: Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
- Lensed: Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
- Homogeneous: Same color and appearance throughout.

**SOIL DESCRIPTION AND LOG KEY**

<table>
<thead>
<tr>
<th>Bohn Park Flood Recovery Project</th>
<th>Lyons, Colorado</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2016 23-1-01530-001</td>
<td>SHANNON &amp; WILSON, INC. Geotechnical and Environmental Consultants FIG. A-1</td>
</tr>
</tbody>
</table>

Exhibit 14: Geotechnical Report on Bohn Park

<table>
<thead>
<tr>
<th>Total Depth</th>
<th>19.3 ft</th>
<th>Latitude: ~40.21691°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Elevation</td>
<td>~533 ft</td>
<td>Longitude: ~105.28338°</td>
</tr>
</tbody>
</table>

Drilling Method: Hollow-Stem Auger  
Drill Company: Veen Laboratories  
Rod Type: AWU  
Drill Rig Equipment: CME 75 Truck Mount  
Hammer Type: Automatic

### Soil Description

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicate approximate boundaries between soil types, and the transition may be gradual.

- **Red-brown, Silty Sand with Gravel (SM): moist. Alluvium.**

Very dense, tan to red-brown, Poorly Graded Gravel with Silt and Sand (SP-OM) to Poorly Graded Sand with Silt and Gravel (SP-SM), moist to wet; cobbles inferred from drill action. Alluvium.

**Bottom of Boring**  
Completed on 04/12/2016

#### Penetration Resistance (lb/ft)

- **Hammer Wt & Drop:** 140 lb / 30 inches

---

**Legend**

- *: Sample Not Recovered
- #: Standard Penetration Test
- **: Ground Water Level ATD
- ◆: % Fines (<0.075mm)
- ◇: % Water Content

**Not**

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent approximate boundaries between soil types, and the transition may be gradual.
3. The information in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual manual classification and selected lab testing.
Exhibit 14: Geotechnical Report on Bohn Park

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transition may be gradual.

Medium dense, red-brown, Clayey Sand (SQ); moist, trace to few gravel. Alluvium.

Medium dense to very dense, brown to red-brown, Poorly Graded Gravel with Silt and Sand (SP-GM) to Silty Gravel with Sand (GM) to Poorly Graded Sand with Silt and Gravel (SP-SM); moist to wet, cobbles inferred from drill action. Alluvium.

BOTTOM OF BORING
COMPLETED ON 04/12/2016

LEGEND

- Sample Not Recovered
- Ground Water Level (GW)
- Standard Penetration Test
- % Fines (<0.075mm)
- % Water Content
- Plastic Limit
- Liquid Limit
- Natural Water Content

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the data specified and may vary.
5. USCS designation is based on visual manual classification and selected lab testing.

LOG OF BORING SW-02

Bohn Park
Flood Recovery Project
Lyons, Colorado

May 2016 23-1-01530-001

SHANNON & WILSON, INC. Geotechnical and Environmental Consultants FIG. A-3

REV 3
Exhibit 14: Geotechnical Report on Bohn Park

**SOIL DESCRIPTION**

- Very dense, tan to brown. Poorly Graded Gravel with Silt and Sand (GP-GM), dry to moist; cobbles and boulders inferred from drill action. Alluvium.

- Auger drilling refusal at 6.3 feet.

**BOTTOM OF BORING COMPLETED ON 04/12/2016**
Exhibit 14: Geotechnical Report on Bohn Park

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Very dense, tan to brown, Poorly Graded Gravel with Silt and Sand (GP-GM) to Silty Gravel with Sand (SM) to Silty Sand with Gravel (SM); mottled, cobblestones and boulders inferred from drill action. Alluvium.

- Auger drilling refusal at 4.8 feet.

BOTTOM OF BORING COMPLETED ON 04/12/2016

LEGEND

- Sample Not Recovered
- Grab Sample
- Standard Penetration Test

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCIS designation is based on visual manual classification and selective lab testing.

LOG OF BORING SW-04

May 2016
23-1-01530-001
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants
FIG. A-5

REV 3
Exhibit 14: Geotechnical Report on Bohn Park

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Depth, ft.</th>
<th>Soil Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1</td>
<td>15</td>
<td>Medium dense to very dense, tan to red-brown, Poorly Graded Gravel with Silt and Sand (GP-GM) to Poorly Graded Sand with Silt and Gravel (SP-SM); moist, cobbles and boulders inferred from drill action. Alluvium.</td>
</tr>
<tr>
<td>5-2</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5-3</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>3-1</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>3-2</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>3-3</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>BOTTOM OF BORING COMPLETED ON 04/12/2016</td>
<td></td>
</tr>
</tbody>
</table>

**Penetration Resistance (lb/ft)**
- Auger drilling refusal at 7 feet.
- Hammer Wt & Drop: 140 lbs / 30 inches

**Legend**
- * Sample Not Recovered
- l Standard Penetration Test

**Notes**
1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCIS designation is based on visual manual classification and selected tab testing.
Exhibit 14: Geotechnical Report on Bohn Park

LOG OF TEST PIT TP-06

SOIL DESCRIPTION

1. Loose, yellow-brown, Poorly Graded Sand with Gravel (SP); moist, few roots.
2. Medium dense to dense, brown, Clayey Sand with Gravel and Cobble (SC), moist.
3. Medium dense to dense, yellow-brown, Poorly Graded Sand with Gravel and Cobble (SP), moist to wet.

- Excavation was terminated due to eroding side slopes.
**Exhibit 14: Geotechnical Report on Bohn Park**

<table>
<thead>
<tr>
<th>SOIL DESCRIPTION</th>
<th>Ground Water Content</th>
<th>Samples</th>
<th>Depth, FT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dense to very dense, red-brown, Flooding Gravel with Sand and Gravel (57); nuclei of till, scattered boulders, fill.</td>
<td>2.6</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.2</td>
</tr>
</tbody>
</table>

- Excavation was terminated due to eroding side slopes.

---

**LOG OF TEST PIT TP-07**

**JOB NO:** 23-1-01540.001  **EXCAVATION DATE:** 5-17-2016

**PROJECT:** Bohn Park, Flood Recovery Project, Lyons, Colorado

**Sketch of West Pit Side**

Elevation: 5,337 feet

Horizontal Distance in Feet
Exhibit 14: Geotechnical Report on Bohn Park

<table>
<thead>
<tr>
<th>Soil Description</th>
<th>Ground Water Content</th>
<th>Samples Depth, Ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Medium dense to very dense, red brown, Poorly Graded Sand w/ Gravel and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cobble (GP), moist; scattered boulders.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Medium dense to very dense, red brown, Poorly Graded Gravel w/ Sand and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cobble (GP), moist; scattered boulders.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Loose, dark gray, Sandy Silt (ML), wet, scattered roots.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Excavation was terminated due to caving side slopes.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Exhibit 14: Geotechnical Report on Bohn Park

LOG OF TEST PIT TP-08

1. Topsoil and roots.
2. Medium dense to dense, red-brown, Poorly Graded Gravel with Sand, Silt and Cobbles (GP-GM); moist; trace of silt.
   - Excavation was terminated due to caving side slopes.
APPENDIX B
LABORATORY TEST RESULTS
APPENDIX B

LABORATORY TEST RESULTS

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<td>Water Content</td>
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<td>B.2.2</td>
<td>Grain Size Analysis</td>
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<td>B.2.3</td>
<td>Atterberg Limits</td>
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<td>B.2.4</td>
<td>Corrosion</td>
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TABLE

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<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>B-1</td>
<td>Summary of Laboratory Test Results by Boring (1 sheet)</td>
</tr>
</tbody>
</table>

FIGURES

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td>B-1</td>
<td>Grain Size Distribution</td>
</tr>
<tr>
<td>B-2</td>
<td>Plasticity Chart</td>
</tr>
</tbody>
</table>
APPENDIX B

LABORATORY TEST RESULTS

B.1 INTRODUCTION

Laboratory tests were completed on soil samples retrieved from the borings in general accordance with ASTM, AASHTO, and CDOT testing methods. The laboratory testing program was performed to classify the materials into similar geologic groups and provide data that can be used for design of the project. The geotechnical laboratory testing was performed at our laboratory. The testing program included index tests and a summary of the laboratory test results is presented in Table B-1. The following sections describe the laboratory testing procedures.

B.2 GEOTECHNICAL TESTING

B.2.1 Water Content

Water content was determined for selected samples in general accordance with ASTM Designation: D 2216, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass. To perform this test, a sample was weighed before and after oven-drying and the water content was calculated. Water content determinations are shown graphically on the boring logs and are also summarized in Table B-1.

B.2.2 Grain Size Analysis

The grain size distribution of selected samples was determined in general accordance with ASTM Designation: D 6913, Standard Test Method for Particle-Size Distribution of Soils Using Sieve Analysis. Results of these analyses are presented as grain size distribution curves in Figure B-1 and summarized in Table B-1. Select samples were also tested for the percentage of material passing the No. 200 sieve in general accordance with ASTM Designation: D 1140, Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75-μm) Sieve. The percent fines (silt- and clay-sized particles passing the No. 200 sieve) are shown graphically in the boring logs in Appendix A and are also summarized in Table B-1.

B.2.3 Atterberg Limits

Soil plasticity was determined by performing Atterberg limits tests on selected fine-grained samples. The tests were completed in general accordance with ASTM Designation: D...
4318. Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. The Atterberg limits include liquid limit (LL), plastic limit (PL), and plasticity index (PI equals LL minus PL) and are generally used to assist in classification of soils, to indicate soil consistency (when compared to natural water content), and to provide correlation to soil properties. The results of the Atterberg limits tests are shown graphically shown on Figure B-2 and are summarized in Table B-1.

B.2.4 Corrosion

Corrosion testing of select samples was performed for pH, resistivity, sulfate content, and chloride content. Testing for pH and resistivity were done in general accordance with AASHTO T 289, Standard Method of Test for Determining pH of Soil for Use in Corrosion Testing. Sulfate content testing was done in accordance with CDOT laboratory procedure CP-L 2103, Sulfate Ion Content in Soil. Chloride content was done in accordance with CDOT CP-L 2104, Determining Water-Soluble Chloride Content in Soil. Test results for sulfate and chloride content are given in units of percent by weight. The test results are summarized in Table B-1.
**Exhibit 14: Geotechnical Report on Bohn Park**

**TABLE B-1**

<table>
<thead>
<tr>
<th>SAMPLE DATA</th>
<th>Depth (feet)</th>
<th>USCS Symbol</th>
<th>Natural Water Content</th>
<th>GRAIN-SIZE ANALYSES</th>
<th>ATTERBERG LIMITS</th>
<th>CORROSION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Top Bottom</td>
<td></td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td>cm (%) (%)</td>
</tr>
<tr>
<td><strong>Boring</strong></td>
<td><strong>Sample</strong></td>
<td><strong>Top</strong></td>
<td><strong>Bottom</strong></td>
<td><strong>Gravel</strong></td>
<td><strong>Sand</strong></td>
<td><strong>Fines</strong></td>
</tr>
<tr>
<td>SW-01</td>
<td>S-1</td>
<td>2.5</td>
<td>3.4</td>
<td>0.5</td>
<td>5.5 7.200</td>
<td>0.02 0.02</td>
</tr>
<tr>
<td></td>
<td>S-2</td>
<td>4.0</td>
<td>5.5</td>
<td>1.4</td>
<td>56 37</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>S-3</td>
<td>7.0</td>
<td>8.5</td>
<td>5.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW-02</td>
<td>S-1a</td>
<td>2.5</td>
<td>3.1</td>
<td>9.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S-1b</td>
<td>3.1</td>
<td>4.0</td>
<td>8.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S-2</td>
<td>4.0</td>
<td>5.5</td>
<td>7.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S-3</td>
<td>7.0</td>
<td>8.5</td>
<td>GM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G-1</td>
<td>0.5</td>
<td>3.1</td>
<td>SC</td>
<td>19.1 34</td>
<td>26 18 8</td>
</tr>
<tr>
<td>SW-03</td>
<td>S-1</td>
<td>2.5</td>
<td>3.5</td>
<td>2.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S-2</td>
<td>4.0</td>
<td>5.5</td>
<td>1.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S-3</td>
<td>5.5</td>
<td>6.3</td>
<td>2.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW-04</td>
<td>S-1</td>
<td>2.5</td>
<td>4.0</td>
<td>1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S-2</td>
<td>4.0</td>
<td>4.8</td>
<td>4.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G-1</td>
<td>0.0</td>
<td>4.8</td>
<td>SM</td>
<td>6.4 25 61 14</td>
<td>NP NP NP</td>
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<tr>
<td>TP-06</td>
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<td></td>
<td>9.0</td>
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<td></td>
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<td>4.0</td>
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<td></td>
<td>S-2</td>
<td>3.0</td>
<td></td>
<td>GP</td>
<td>5.5 61 38 1</td>
<td></td>
</tr>
<tr>
<td>TP-07A</td>
<td>S-1</td>
<td>2.0</td>
<td></td>
<td>3.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S-2</td>
<td>5.0</td>
<td></td>
<td>ML</td>
<td>44.3 0 42 25 33 24 9</td>
<td>3.2 14.000 0.01 0.005</td>
</tr>
<tr>
<td>TP-08</td>
<td>S-1</td>
<td>2.0</td>
<td></td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S-2</td>
<td>3.5</td>
<td></td>
<td>GP GM</td>
<td>6.4 54 41 5</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Refer to Appendix A, Figure A-1 for definitions.
2. Gravel defined as particles larger than the No. 4 sieve size, Sand as particles between the No. 4 and No. 200 sieve sizes, and Fines as particles passing the No. 200 sieve.
Exhibit 14: Geotechnical Report on Bohn Park
Exhibit 14: Geotechnical Report on Bohn Park

LEGEND

CL: Low plasticity inorganic clays, sandy and silty clays

CH: High plasticity, inorganic clays

ML or OL: Inorganic and organic silts and clayey silts of low plasticity

MH or OH: Inorganic and organic silts and clayey silts of high plasticity

CL-ML: Silty clays and clayey silts

<table>
<thead>
<tr>
<th>SAMPLE ID</th>
<th>DEPTH (ft)</th>
<th>VSCCS NUMBER</th>
<th>BSELI</th>
<th>CLASSIFICATION</th>
<th>LL</th>
<th>PI</th>
<th>ML</th>
<th>W/C</th>
<th>PASS 20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHK-02, B1a</td>
<td>2.8</td>
<td>5C</td>
<td>Clayey sand</td>
<td>26</td>
<td>18</td>
<td>6</td>
<td>19.1</td>
<td>33.9</td>
<td></td>
</tr>
<tr>
<td>SHK-04, C1a</td>
<td>2.4</td>
<td>5N</td>
<td>Silty sand with Gravel</td>
<td>46</td>
<td>60</td>
<td>8</td>
<td>19.4</td>
<td>10.2</td>
<td></td>
</tr>
<tr>
<td>TP-07A, B3</td>
<td>4.0</td>
<td>5L</td>
<td>Silt</td>
<td>56</td>
<td>60</td>
<td>0</td>
<td>44.5</td>
<td>54.0</td>
<td></td>
</tr>
</tbody>
</table>

Bohn Park
Flood Recovery Project
Lyons, Colorado

PLASTICITY CHART

May 2016

SHANNON & WILSON, INC.
FIG. B-2
APPENDIX C

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL REPORT
IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT’S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.
A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties, rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the

ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland
Exhibit 15
USGS and FEMA Data

Contains:
1 Page FEMA Map
5 Pages of USGS Maps
Exhibit 15: USGS and FEMA Data
Exhibit 15: USGS and FEMA Data
Exhibit 15: USGS and FEMA Data
Exhibit 15: USGS and FEMA Data
Exhibit 15: USGS and FEMA Data
Exhibit 15: USGS and FEMA Data
Exhibit 16
Finances Calculated by Town of Lyons (Cost and Return on Investment)

Contains:
1 Details Page
1 Calculations Spreadsheet
Solar Farm Cost Analysis Notes

- See spreadsheet for cost analysis what-if.
- Top issues include what to use for
  - Energy Charge Rate - MEAN wind rate or base rate? Leaning is to use wind rate.
  - Annual Electricity Price Escalation
    - Namaste escalation rate is considered too high.
      - 7.1 Inflation and discount rate page 55 - Assumes 2 percent annual inflation rate
      - 7.5.3 New solar resources page 63 - Assumes flat solar prices after near term increase due to reduction of investment tax credits (ITC) from 30 to 10 percent by 2024. Note that the ITC was extended a couple years in Dec 2020. https://www.solarpowerworldonline.com/2020/12/solar-investment-tax-credit-extended-at-26-for-two-additional-years/
    - Note MEAN energy rates have been flat (zero percent) over the last six years
- See slide 19 of briefing "MEAN Finance Committee MEAN Risk Oversight Committee Joint Meeting December 9, 2020" - https://d1xq11ehxn61z.cloudfront.net/d966-36667767-20201209PresentationFinanceandRiskOversight.pdf?versionId=ogFhT7Fa6dEf6_LQdrKSDqZQZ3tMDnq
  - Other long term inflation rate forecasts
    - 2.2 percent (CBO) consumer price index - https://www.cbo.gov/publication/56465
- Financing Rate and Years
  - Lyons may be able to use a tax free municipal bond
  - May also decide to pay full amount up front since Electric utility fund presently has sufficient balance and the expected TAP fees from the Summit housing project could significantly add to the balance.
- DOLA Grant - expected to cover half the cost.
- Investment Tax Credit savings - For a 5-minute introduction, here is a How CollectiveSun Works video. https://www.youtube.com/watch?v=KvG6DVOAoV4
Exhibit 16: Finances Calculated by Town of Lyons (Cost and Return on Investment)

---

### Lyons Solar Farm Cost Analysis

<table>
<thead>
<tr>
<th>Year</th>
<th>Energy Rate</th>
<th>Energy Sold</th>
<th>Cum Energy</th>
<th>Energy Savings/Financing</th>
<th>O&amp;M</th>
<th>Insurance</th>
<th>Inverter/Array Net Savings</th>
<th>Cumulative Cost</th>
<th>Cum Cost/KWH</th>
<th>Cost/KWH Energy Rate</th>
</tr>
</thead>
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<td>2022</td>
<td>0.045000</td>
<td>567,105</td>
<td>1,137,700</td>
<td>$24,550</td>
<td>0</td>
<td>-2,195</td>
<td>-2,195</td>
<td>$2,371</td>
<td>$5,941</td>
<td>$-455.543</td>
</tr>
<tr>
<td>2023</td>
<td>0.049667</td>
<td>566,284</td>
<td>1,136,399</td>
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<td>$-455.543</td>
</tr>
<tr>
<td>2024</td>
<td>0.054470</td>
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<td>1,138,342</td>
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<td>$5,941</td>
<td>$-455.543</td>
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<tr>
<td>2025</td>
<td>0.059445</td>
<td>567,105</td>
<td>1,137,700</td>
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<td>0.064540</td>
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<td>$5,941</td>
<td>$-455.543</td>
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<tr>
<td>2027</td>
<td>0.069756</td>
<td>568,324</td>
<td>1,139,064</td>
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<td>-2,195</td>
<td>$2,371</td>
<td>$5,941</td>
<td>$-455.543</td>
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<tr>
<td>2028</td>
<td>0.075090</td>
<td>569,080</td>
<td>1,140,064</td>
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<td>0.080560</td>
<td>569,957</td>
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<td>2030</td>
<td>0.086160</td>
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<td>-2,195</td>
<td>$2,371</td>
<td>$5,941</td>
<td>$-455.543</td>
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</table>

Total: $812,857
Exhibit 17
Finances Calculated by Student Team (Cost and Return on Investment)

Contains:
4 Pages Total
1 Page on Bohn Park- Near Bike Path
1 Page on Southwest Dog Park
1 Page on Bohn Park Parking Lot
1 Page Chart Return on Investment Summary
Exhibit 17: Finances Calculated by Student Team (Cost and Return on Investment)

Bohn Park- near Bike Park Finances
Exhibit 17: Finances Calculated by Student Team (Cost and Return on Investment)

Southwest Dog Park Finances
Exhibit 17: Finances Calculated by Student Team (Cost and Return on Investment)

Bohn Park Parking Lot Finances
Exhibit 17: Finances Calculated by Student Team (Cost and Return on Investment)

<table>
<thead>
<tr>
<th>Project</th>
<th>Project Cost</th>
<th>25 Year Lifespan</th>
<th>30 Year Lifespan</th>
<th>Payback Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bike Park</td>
<td>$313,726.00</td>
<td>21%</td>
<td>64%</td>
<td>23.4 years</td>
</tr>
<tr>
<td>Dog Park</td>
<td>$321,266.00</td>
<td>17%</td>
<td>59%</td>
<td>23.9 years</td>
</tr>
</tbody>
</table>
| Carport  | $577,120.00  | -77%             | -60%             | >30 years      

Return on Investment Comparison Chart
Exhibit 18
Cost and Site Comparison Charts

Contains:
2 Charts Total
1 Page Chart of Site Overview Comparison
1 Page Chart of Cost Analysis Comparison
### Site Overview Comparison Chart

**Bohn Park**

<table>
<thead>
<tr>
<th>Site Overview</th>
<th>Weight Score of 1-5</th>
<th>Southwest Dog Park</th>
<th>Near Bike Park</th>
<th>Parking Lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Impact</td>
<td>5</td>
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<td>3</td>
<td>4</td>
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<tr>
<td>Distance to Power</td>
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<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Solar Access</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Access to Roadways</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Ability to Expand &gt;5%</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Viewshed Impact</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Existing Land Use</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Return on Investment</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Flood Risk</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
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**Feasibility Score:**

- Southwest Dog Park: 110
- Near Bike Park: 134
- Parking Lot: 95
## Exhibit 18: Cost and Site Comparison Charts

<table>
<thead>
<tr>
<th></th>
<th>Southwest Dog Park</th>
<th>Near Bike Park</th>
<th>Parking Lot</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bohn Park Sites</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar Quote</td>
<td>$615,700</td>
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<td>$1,492,000</td>
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<td>Power Distribution</td>
<td>$203,000</td>
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<td>Legal &amp; Admin Fees</td>
<td>$15,000</td>
<td>$15,000</td>
<td>$15,000</td>
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<tr>
<td>Geotech Report</td>
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<td>$7,000</td>
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<tr>
<td>Special Election</td>
<td>-</td>
<td>$10,000</td>
<td>-</td>
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<tr>
<td><strong>Sub Total:</strong></td>
<td>$840,700</td>
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<td>DOLA Grant</td>
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<td>Collective ITC</td>
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<tr>
<td><strong>Total:</strong></td>
<td>$321,266</td>
<td>$313,726</td>
<td>$577,120</td>
</tr>
<tr>
<td>25 Year ROI</td>
<td>17%</td>
<td>21%</td>
<td>N/A</td>
</tr>
<tr>
<td>30 Year ROI</td>
<td>59%</td>
<td>64%</td>
<td>N/A</td>
</tr>
<tr>
<td>Payback Period (Years):</td>
<td>23.9</td>
<td>23.4</td>
<td>&gt;30</td>
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Cost Analysis Comparison Chart
Exhibit 19
Department of Local Affairs Grant- Impact Assessment

Contains:
1 Page Chart on Scoring Criteria
Exhibit 19: Department of Local Affairs Grant- Impact Assessment

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Committee or Pre-score (pts. avail.)</th>
<th>Description</th>
</tr>
</thead>
</table>
| Demonstration of Need            | Committee Scored 1-20                                                  | • Problem, opportunity or challenge is clearly identified  
• A quantifiable need is well described and documented  
• Urgency and severity of need may increase the score  
• Health and safety projects may increase score  
• Project is a mandatory priority that must be completed |
| Priority, Community Goal, Outcome| Committee Scored 1-10                                                  | • The project is identified in comprehensive or other plan  
• Project is the local priority  
• Completing the project solves the problem  
• Expected outcomes are identified |
| Local Effort                     | Pre-scored 1-5                                                         | • Cash match is worth a potential 5 points: (50% match required, unless financial circumstance warrants reduction)  
% are rounded to nearest whole number  
  o Less than 25% match, 1 point  
  o 25% - 35% match, 2 points  
  o 36% - 49% match, 3 points  
  o 50% - 74% match, 4 points  
  o 75% or higher match, 5 points |
| Readiness                        | Pre-scored 1-10                                                        | • Cash match is appropriate given unrestricted fund balance  
• In-kind match is appropriate leverage given the low unrestricted fund balance  
• Attempted/succeeded to raise rates, fees or voter initiative to raise revenues  
• Have made every effort to contribute as much to the project as possible  
• Rates are higher than statewide average  
• Exhausted all matching partner options (when applicable)  
• Has been deferred due to lack of funding |
| Resiliency Criteria              | Committee Scored 1-15                                                  | • Project incorporates long-term resiliency measures into planning, development and planned implementation of the project |
| Energy/Mineral Impact            | Pre-Scored 1-10                                                        | • Pre-scored using industry impact metrics  
• Project directly addresses or mitigates industry impacts (current or historic)  
• Project diversifies economy or prepares for post industry economy |

Maximum Possible Score = 100  
TOTAL SCORE =

* Note: Committee for Tier I applications: DOLA Regional and Program Staff  
Committee for Tier II applications: Energy and Mineral Impact Assistance Advisory Committee
Exhibit 20
Namaste Lyons Overall Report

Contains:
12 Pages of Report
Exhibit 20: Namaste Lyons Overall Report

Town of Lyons Solar Farm
Concept, Presentation & Proposal

Prepared for:
Town of Lyons Utilities and Engineering Board
303-623-5515
Cell: 303-881-1110
leehall@leehall.com

Prepared by:
John Shaw
En Commercial Solar Project
Developer
John.Shaw@NamasteSolar.com
303-447-0300 x219

Why Solar?
Additional Benefits

- Expense → Asset
- Differentiate your community
- Environmental:
  - Significant reduction in CO₂ emissions

“The solar looks great. We have noticed that many of our tenants are proud to work in a building that is solar powered and have included it in their monthly newsletters. Pretty exciting stuff.”

– Aaryn Manning, Westbrook Development Partners
Exhibit 20: Namaste Lyons Overall Report

Why Namasté Solar?  
*Expertise & Experience*

- Founded in 2005
- Over 110,000 kW & 8,000 systems
- Co-Owners self-perform all work for roof systems

- One of the longest-standing solar contractors in Colorado
- Designed, permitted, and installed (110MW, 8k systems)
- Across 40 jurisdictions and 6 states
- 170 employees, about 80 of whom are Co-Owners
- 4 Master Electricians
- 15 Journeymen
- 40 NABCEP certified PV professionals

Why Namasté Solar?  
*Quality & Service*

- Employee-owners are vested in the long-term success of your project
- In-house design, independently verified and ‘Stamped’ by 3rd party engineers
- Local Construction, Project Management, Service, and O&M teams
  - (2-yrs. O&M included)

- **Benefit**: a turnkey solution that maximizes return on your investment
Why Namasté Solar?

**Honesty & Integrity**

- Non-commissioned sales team dedicated to finding good-fit customers & projects
- **Safety First**: We do not take shortcuts to save a buck
  - 0.78 Experience Modification Rate (EMR)
  - **Benefit**: Trust, confidence, and peace of mind in your system design, installation, and performance

---

Why Namasté Solar?

**Positive Impact**

- Certified B-Corp. & CO Public Benefit Corporation
- Community Giving & Volunteering
  - 10% of Net Income
  - 20-hrs VTO/pp/yr.
- Triple Bottom Line Business Theory
  - Social, Environmental & Profit on equal footing
- Employee-ownership business model helps our community thrive
  - **Benefit**: Your investment supports business as a force for good in OUR community
Major Equipment Procurement Strategy: Amicus Solar

Namaste Solar is a founding member of the Amicus Solar Cooperative. Amicus is responsible for vetting vendor technology and bankability and negotiating pooled procurement agreements, supply reliability, terms and preferred service and technical support status with Tier 1 suppliers. Building genuine win-win partnerships with our suppliers is a cornerstone of the Amicus business philosophy. To ensure members are working only with top-quality suppliers, each one must be approved by the Vendor Selection Committee, which includes passing both a stringent initial evaluation as well as ongoing assessments.

Other benefits of membership include shared knowledge, resources, and support on the following:
- Safety – Policies & Practices
- Installation Operations – best practices
- IT tools for business optimization
- Preparing for upcoming policy changes
- Risk management
- Procurement best practices
- Project Management

Why Namaste Solar?

JASON SHARPE // CO-OWNER
CEO
Jason is a solar industry veteran with over fifteen years of experience designing systems in the solar PV industry. From the hybrid solar electric vehicle he designed as a college junior project in 1994 to multi-megawatt grid-connected commercial systems, his expertise spans a broad range of solar applications. He has published articles in Solar Pro Magazine, and given numerous technical presentations to a wide variety of audiences including solar conferences, the International Code Council (ICC), and various electrical engineering firms. He has served on technical advisory boards for the DOE, NREL, Colorado’s Governor’s Energy Office, and local inspector groups. Jason is a Colorado Master Electrician and NABCEP Certified Solar PV Installation Professional. Jason holds an Electrical Engineering degree from the University of Vermont.

JON WEDEL // CO-OWNER
Senior Director of Commercial Services
Jon Wedel is an nineteen-year electrical industry veteran with thirteen years in the PV industry. Joining Namaste Solar in early 2010, Jon now leads our Commercial Services Department including Commercial Sales, Project Development, and Operations in Colorado, the Southwest, and the Northeast. Jon is a Colorado State Licensed Master Electrician, RME for our California C-10 license, and qualifier for our Nevada C.2 license. Jon also served as a former Namaste Solar Board Director with four years of service, three as our Board Chair.
Exhibit 20: Namaste Lyons Overall Report

Why Namaste Solar?

RYAN WALKER
Regional Operations Manager, Colorado
Ryan came to Namaste Solar in 2016 from the commercial construction industry, where he has over twelve years of onsite experience managing all phases of multimillion-dollar construction projects for a variety of clients. Ryan’s specialties include: start-to-finish new facility construction; large-scale renovations; bidding estimating, and proposals; site safety and OSHA compliance; contract administration of multiple delivery systems; budgeting and cost controls; site planning and scheduling; subcontractor and crew management; interface conflict resolution; and change negotiation and management. Ryan holds a BS in Civil engineering from Virginia Tech.

ELIOT ABEL
Commercial Sales Director
Eliot has over 12 years of experience in the renewable energy industry, having worked in business development roles at a UK-based solar startup, GE’s global Renewable Energy business, and San Diego-based Renovate America. Eliot currently leads Namaste Solar’s commercial sales team, working with strategic partners to develop C&I and EPs projects in target markets throughout the U.S. Prior to joining Namaste Solar, Eliot was the Founder and Principal of Abel Clean Energy Advisors, a consulting firm that helps commercial property owners and developers utilize innovative financing to implement renewable energy and energy efficiency solutions that increase value, reduce operating costs, and enhance the sustainability of their properties. Eliot holds a BA from Stanford University and an MBA from the Yale School of Management.

Our Customers

IBM
LOCKHEED MARTIN
Conscience Bay Company
REAL Capital Solutions
WESTBROOK Development Partners
Aurora Higher Education Center
UNICO Properties

Transforming Energy. Transforming Business.™
**Summary of Variables Used in Proforma:**

<table>
<thead>
<tr>
<th>Variables &amp; Assumptions</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Total Cost</td>
<td>$615,700</td>
</tr>
<tr>
<td>System wattage (kW;DC)</td>
<td>331.60</td>
</tr>
<tr>
<td>Estimated year-1 solar production (kWh)</td>
<td>570,000</td>
</tr>
<tr>
<td>Net effective value of energy/kWh (MEAN Wind Pool rate till 03/2021)</td>
<td>$0.043</td>
</tr>
<tr>
<td>Annual electricity price escalation rate (per EUA.gov)</td>
<td>3.42%</td>
</tr>
<tr>
<td>Solar panel annual rate of degradation</td>
<td>0.50%</td>
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<td>Assumes county waiver on Biz Personal Prop Tax</td>
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</tr>
<tr>
<td>Estimated insurance rider (as a % system price)</td>
<td>0.35%</td>
</tr>
<tr>
<td>Estimated price/watt for Inverter replacement (year-15)</td>
<td>$0.10</td>
</tr>
</tbody>
</table>

**Site Summary:**

- 331.6 kW Ground-Mounted Fixed-Tilt Solar System
- 570MWh Yr. 1 production
  - (MEAN max = 572MWh)
- Assumes 480VAC Interconnection
  - 13.2kVA transformer by Lyons Utilities needed on site

**Simple Economic Summary**

<p>| | |</p>
<table>
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<th></th>
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<tbody>
<tr>
<td>Initial Investment</td>
<td>$615,700</td>
</tr>
<tr>
<td>Utility Savings (OpEx)</td>
<td>$1,147,903</td>
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<tr>
<td>Net Return</td>
<td>$532,203</td>
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**Key Metrics & Benefits over 30-yr. "Estimated Useful Life"**

- **Note:** Cash flow model DOES NOT include property value increase or possible reduction in measured demand

  - Simple ROI: 86%
  - IRR: 2.23%
  - Breakeven: 23
Exhibit 20: Namaste Lyons Overall Report

Unlevered 25-yr. Cash-flow

<table>
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<tr>
<th></th>
<th></th>
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<td>($819,700)</td>
<td>$779,719</td>
<td>$701,715</td>
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Simple Economic Summary with DOLA Grant at 50%:

- Initial Investment: $397,850
- DOLA Grant: $385,700
- Utility Savings (OpEx): $819,700
- Total Benefits: $1,147,903
- Net Return: $840,053

Key Metrics & Benefits over 30-yr. ‘Estimated Useful Life’

- Simple ROI: -136%
- IRR: 7.26%
- Break-even: 13 years
- NPV ($6% Discount Rate): $48,600
## Unlevered 25-yr. Cash-flow, 50% DOLA Grant:

### Annual Project Cash Flows, Returns & Other Metrics

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### Annual Environmental Benefits:

Solar Production of 570 MWh would be responsible for:

- **302-Ton reduction in CO2 emitted by MEAN ANNUALLY**
- **32-Ton reduction in coal burned by MEAN ANNUALLY**

[Image of CO2 impact and coal train]
Exhibit 20: Namaste Lyons Overall Report

Alternative Perspectives on a Solar Investment

- Uses otherwise sunk utility expense capital to fund an asset that reduces expenses
- A solar asset increases NOI and therefore increases the value of the property
- There is no return on monies paid to MEAN
- We help you market your solar asset by providing a full media toolkit

Namaste Solar Customer Marketing Toolkit

Use this marketing toolkit to share the news about your new solar installation with your internal and external audiences. Each item in the toolkit is described below with some helpful tips on how to put this resource to use.

- **Pop-up Banner**: The pop-up banner highlights the details of your new solar installation.
- **Photos & Video**: We hire a drone photographer to capture photos and video of your system.
- **Press Release**: Share the news that you went solar and gain valuable local press.
- **Infographic**: Easily share info about your solar array and its environmental benefits.
- **Social Posts**: Suggested copy to use on your social media channels to share your solar news.

**Helpful Tips**

- **Pop-up Banner**: Place the banner in your office entryway or another public space for employees and visitors to see.
- **Photos & Video**: Use these in social media posts, company newsletters, internal emails, and in video displays to showcase your solar array.
- **Press Release**: Share this release with local reporters and those who write about your industry to gain coverage for your business.
- **Infographic**: Share this infographic with a company-wide email, post it to social media, and print it out to hang on the office fridge.
- **Social Posts**: Copy and paste these posts as easy copy for your social media channels or use them as inspiration for customized posts.
"When we decided to pursue a solar system installation, we selected Namasté Solar based on the merits of their experience, passion, and dedication to a high level of customer service and quality work, as well as a demonstrated commitment to holistic business practices that benefit all project stakeholders."

New Belgium Brewing Company

"This project demonstrates a creative way to replace and keep a renewable energy resource local while providing benefits to the City beyond energy generation. This facility will help Loveland Water and Power exceed its renewable energy requirements from the State, delay future capital expenditures, and can even be used for solar education in the community."

Gretchen Stanford / City of Loveland Foothills Solar project
“Namaste Solar pioneered the integration of PV into the Denver Public School system. The project included installations on 16 schools and required a complex logistical strategy due to unique electrical services, structural engineering requirements, and school schedules. DPS found the Namaste Solar team to be highly professional, knowledgeable, extremely collaborative, and eager to work with our team.”

Jim Faes / Denver Public Schools
Exhibit 21
Namaste Summary of Qualifications

Contains:
16 Pages of Qualifications
2020
Statement of Qualifications
Transforming Energy / Transforming Business™

namastesolar.com • 303.447.0300
About Namasté Solar

Namasté Solar is a recognized expert in solar PV technology, providing forward-thinking and client-centered solar energy solutions. As an employee-owned company founded in 2005, our nationally recognized staff provides years of comprehensive experience and a commitment to value engineering. Our design engineers have completed projects in utility districts across the country and can navigate your project from initial planning through financing, permitting, interconnection, construction and final commissioning.

We believe in quality engineering, uncompromising integrity and unparalleled performance, all of which are at the core of our work ethic. This culture has made Namasté Solar one of the most experienced EPC and solar PV integrators in the United States. We are an employee owned cooperative, well-versed in the intricacies of project implementation and the importance of working hand-in-hand with all project stakeholders.

Our commercial projects include a wide range of rooftops, solar carports and ground mounted systems, including one of the largest rooftop arrays in the state of Colorado – a 2.3 MW system at the National Renewable Energy Laboratory. Our other projects include a 2 MW single axis tracker for Ecoplexus in Sterling, Colorado, a 2.3 MW fixed tilt ground mounted array for Clarkson Solar in Potsdam, New York and a 1.5 MW fixed tilt ground mounted array for Kenyon Energy in Williamson, New York.

Namasté Solar provides a broad range of operations and maintenance (O&M) services, supported by a team experienced in operations and asset management. Our O&M technicians have detailed knowledge of PV in commercial environments, are recognized by the North American Board of Certified Energy Practitioners as Certified PV Installation Professionals, have OSHA and NFPA 70E certifications, are trained and certified on a wide variety of inverter maintenance requirements, and have training in all aspects of photovoltaic technology, including technical design, project management, installation, system monitoring (DAS), and related technologies.

Namasté Solar is most widely recognized for its exceptional design/build services, conscientious business practices, and commitment to community philanthropy.

Relevant Certifications

- 30 NABCEP (North American Board of Certified Energy Practitioners)
- Solar PV Installation and Sales Professionals
- 3 On-staff Master Electricians
- 11 On-staff Journeymen Electricians


CA License #: 1010955
RI License #: 42369
NV License #: 84793
Exhibit 21: Namaste Summary of Qualifications

Mission Statement
We work to propagate the responsible use of solar energy, pioneer conscientious business practices, and create holistic wealth for ourselves and the community.

What Makes Us Unique

Employee-owned cooperative
Our intention is to share the experience of small business ownership; not just rewards, but also risks and responsibilities. Of our 165 employees, more than 75% are Co-Owners and candidates for co-ownership.

Democratically managed
Co-Owners participate in decision making on a one-person, one-vote basis.

Egalitarian compensation structure
Our sales teams do not work on commission. We also maintain a 6-to-1 pay ratio of highest-to-lowest total pay per employee.

Holistic profit measurement
We don’t just measure profit in terms of dollars and cents, but also in terms of customer satisfaction, employee morale, involvement in the community, impact on the environment, and how well we practice what we preach.

Certified Benefit Corporation (B Corp)
B Corps are accelerating the global culture shift to redefine success in business and build a more inclusive and sustainable economy.

Our Approach
We believe in transforming energy and transforming business through pioneering conscientious business practices, providing best-in-class customer experience, and complete turn-key solutions. A pillar of Namasté Solar’s unique, values-based business model is employee ownership. We currently have over 60 co-owners, including installers, project managers, salespeople and executives that each have an equal ownership share in the company. We firmly believe that this business model translates to better designs, installations and customer experiences. As co-owners of the company, we all bring an ownership mentality to everything we do, as well as a level of personal accountability that our clients find refreshing in the world of contracting.

As a Certified B Corporation, Namasté Solar must meet rigorous standards of social and environmental performance, accountability, and transparency. Unlike traditional corporations, B Corporations are legally required to consider the impact of their decisions on their employees, suppliers, communities, consumers and environment.
Exhibit 21: Namaste Summary of Qualifications

Services

Commercial & Industrial Properties
We design and install commercial solar energy solutions that help property owners lock in low energy costs, reduce operating expenses and boost asset value. Namaste Solar has designed and installed over 6,000 solar energy systems totaling over 84 MW of electricity for C&I customers. Our solar energy experts handle every detail from design to permitting to installation.

Utility-Scale Solar EPC Services
We provide expert solar engineering-design, procurement and construction services for building commercial rooftop and utility-scale solar projects on time and on budget. Recognized nationally for professionalism and top-quality workmanship, we’ve built a variety of solar projects including rooftop arrays, solar canopies, ground-mounted arrays, and single-axis trackers.

Design and Consulting Services
We provide the commercial and utility-scale solar consulting services that help you navigate the complexities of project siting, design, and construction. Trusted nationally by commercial developers and new home builders, our design & consulting teams deliver the expert technical support needed to successfully navigate the complexities of project economics, siting, planning, design, permitting, and construction.

Operations and Maintenance
We provide services for over 95 MW of solar across 150 sites, our service system portfolio includes projects ranging from 10kW to 5MW. Whether you need a one-time system inspection or ongoing service, Namaste Solar offers customizable plans designed for your PV system needs.

Project Development
We provide full service development services from conception to completion. Our commercial, industrial and utility scale project development services help businesses, utilities, and municipalities realize the benefits of solar energy.
Commercial Design & Installation

Namaste Solar provides construction-ready, engineered project designs and installation services for commercial and industrial energy customers. Our thorough designs include detailed documentation including array layout, structural engineering, engineered electrical plans, monitoring design, production models of the system's estimated performance, and financial models. Namaste Solar employs top-notch designers, project managers, and installation crews to ensure high quality workmanship on the ground. Through our longstanding relationships with top solar manufacturers, we obtain high quality raw material and competitive pricing for the equipment.

We are nationally recognized experts in developing, designing, and building commercial solar projects. Namaste Solar's customer focused mind set guarantees each project is custom designed to best meet the needs of each customer. Our non-commissioned sales staff ensure that solar is the right decision for commercial customers and guarantees the highest level of quality materials and customer service.

Services
- Electrical design
- Permitting
- PVSyst production reports
- Project estimation
- Interconnection design
- Equipment procurement
- Economic analysis
- Project management
- Installation
- Construction
- Performance testing
- Customer education

NEW BELGIUM BREWING COMPANY
Fort Collins, Colorado

System Size: 300 kW
System Type: Rooftop

Namaste Solar was selected by Ft. Collins, Colorado-based New Belgium Brewing Company to develop and analyze multiple solar PV system design configurations, including a carport, roof mounted, and fixed-and tracking-groundmount systems. The focus of the project was integrating the solar PV system with the client's preexisting co-generation and the utility grid. The scope of work required Namaste Solar to provide complete system design and project planning: a detailed interconnection plan, soils analysis, structural and electrical engineering reviews, power production modeling, utility compliance, and financial analysis.

“We selected Namaste Solar based on the merits of their experience, passion, and dedication to a high level of customer service and quality work as well as demonstrated commitment to holistic business practices that benefit all project stakeholders.”

New Belgium Brewing Company
Exhibit 21: Namaste Summary of Qualifications

Engineering, Procurement, Construction (EPC)

We custom design projects to meet applicable codes, production goals, aesthetic requirements, and budget constraints with a focus on avoiding change orders and mitigating risk. Our long-term relationships with industry leading equipment manufacturers along with our membership in the Amicus Solar Cooperative allow us to procure high-quality equipment at a competitive price. The Namasté Solar construction team has implemented over 84 MW in solar projects nationwide. We are known for our high-quality workmanship, commitment to site safety, and have a proven track record of delivering projects on time and on budget.

Services
- Design and engineering
- Coordination with electric utility
- Building permits
- Procurement
- Civil construction
- Drainage and erosion control
- Mechanical installation
- Electrical interconnection
- System commissioning
- Monitoring services

CITY OF LOVELAND
Loveland, Colorado

System Size: 3.5 MW
System Type: Single-axis tracker

The Foothills Solar and Substation project is the first electric generating facility in the United States to receive approval through the Federal Emergency Management Administration’s (FEMA) Alternate Project process. The array replaced the idyllic hydroelectric facility, which was damaged during a major flood event in September of 2013. Namasté Solar designed and constructed the 3.5 MW single-axis tracker ground-mounted array, located in the City of Loveland.

We’ve completed projects in utility districts across the US. Our proven track record means we can navigate your project from initial planning through financing, permitting, interconnection, construction and final commissioning. Safely, professionally, on-time, and on budget.

Exhibit 21: Namaste Summary of Qualifications

Design & Consulting

Namasté Solar provides a variety of commercial and utility scale solar consulting services. With 14 years of experience in the solar industry, our consulting team provides industry-recognized design and consulting services, including technical support navigating the complexities of project economics, siting, planning, design, permitting, and construction. Our goal is to provide the highest quality services to PV project stakeholders including project owners, developers, capital providers and investors to identify and quantify project risk and assist in ensuring overall project success.

We are focused on comprehensive PV project evaluation for projects ranging from 50 kW to over 10 MW. Namaste Solar’s quality and collaborative approach makes us one of the leaders in the US solar PV industry.

Services

- Solar feasibility studies
- Development of project budgets
- Preliminary system design
- Power density and production modeling
- RFP-level design
- Construction-level drawings

- Financial modeling
- Review of available local, state, and federal incentives
- Pre-purchase system design reviews and inspections of existing assets

CES COMMUNITY SOLAR GARDENS
10 sites across Colorado

System Size: 20 MW
System Type: Single-axis tracker

Namasté Solar worked with Community Energy Solar to design their portfolio of community solar gardens across the Front Range and San Luis Valley in Colorado. Namasté Solar developed innovative solutions to site specific challenges to deliver a high-performing solar plant for CES off-takers. CES is a top solar developer that builds utility-scale projects across the United States, creating economic and environmental value for its stakeholders.
Exhibit 21: Namaste Summary of Qualifications

Operations & Maintenance

Namasté Solar’s team of highly qualified field electricians and service staff are currently contracted to provide O&M services for over 90MW of solar across 140 sites, 40 customers, and six states. In our seven years of O&M experience we have serviced systems ranging from 10 kW to 5 MW, and we provide industry leading service levels across this range of projects.

Our Colorado based technician team consists of five journeyman electricians, four apprentice electricians, and a full-time performance analyst. With a broad geographic distribution of sites, our team is proficient at sourcing local subcontracted labor to support our remote sites, ensuring resource redundancy, quick response times, and partnerships for additional services such as module washing and vegetation management.

Services

- Preventative maintenance service
- Original equipment manufacturer (OEM) warranty support
- Corrective and reactive maintenance
- System deinstallation and reinstallation

- Guaranteed response times to system outages
- Monitoring and reporting services
- Vegetation management and solar panel washing

SOUTHERN UTE
Ignacio, Colorado

System Size: 1.3 MW
System Type: Single-axis tracker

Namasté Solar’s combination of quality design, installation, and O&M services have allowed this system to operate with over 99.5% availability since its installation in 2017. The Oxford Solar Project is located on the Southern Ute Indian Reservation in Ignacio, Colorado. This ground-mounted system will produce enough energy to offset approximately 15% of 10 tribal buildings’ electricity consumption, helping to reduce the Tribe’s operating costs.
Project Development

We provide integrated industrial and utility-scale solar development services, navigating the complexities of project siting, planning, permitting, and construction. Namaste Solar develops projects from the ground up by first identifying the building or landowner and then collaborating with engineers, archaeologists, biologists, land abutters, and municipal representatives to obtain the Certificate of Public Good and green light the project. Namaste Solar provides a full-service solution to solar project development throughout the lifecycle of the project. From identifying opportunities to securing power purchase agreements, Namaste Solar develops on-time and on-budget solar projects that provide attractive financial returns.

Services
- Land siting and environmental assessment
- Power production modeling
- Financial engineering
- Engineering and design
- Utility and regulatory compliance and permitting
- Construction and commissioning
- Quality assurance and control
- Operations and maintenance

KILLINGTON SKI RESORT
Multiple locations, Vermont

System Size: 1.8 MW
System Type: Ground-mounted

Four projects in a joint portfolio were developed to provide clean, solar energy to Killington Ski Resort, one of Vermont’s largest ski resorts. Namaste Solar was hired to develop the project from the ground-up by identifying landowners, and collaborating with engineers, archaeologists, biologists, land abutters, and municipal representatives to obtain the Certificate of Public Good and green light the project. Namaste Solar also played the role of the EPC and holds the O&M contract to maintain the system.

We’ve completed projects in utility districts across the U.S. Our proven track record means we can navigate your project from initial planning through financing, permitting, interconnection, construction and final commissioning. Safely, professionally, on-time, and on budget.
Exhibit 21: Namaste Summary of Qualifications

Project Experience

MARTIN/MARTIN
Lakewood, Colorado
System Size: 440 kW
System Type: Rooftop
The system is composed of 1,296 solar modules and produces approximately 644,900 kWh of solar electricity each year. They also took advantage of Xcel's Secondary Photovoltaic Time-of-Use Service, which is beneficial to customers who decide to go solar.

MILLER INTERNATIONAL
Denver, Colorado
System Size: 500 kW
System Type: Rooftop
Miller International's solar electric system consists of 1,526 high-efficiency solar panels, providing over 80% of their electricity needs. Miller International is preventing 1,458,438 pounds of carbon dioxide emissions annually, the equivalent of not driving 1,595,263 vehicle miles each year, or planting 56,094 trees.
Project Experience

NATIONAL RENEWABLE ENERGY LAB
Golden, Colorado

System Size: 2.3 MW
System Type: Rooftop & Carport

This project consisted of three arrays installed at three locations. Throughout the installations, Namaste Solar received 28 superior safety ratings for safety performance while on the job. NREL is the U.S. primary laboratory for renewable energy and energy efficiency research and development.

REGIS JESUIT HIGH SCHOOL
Aurora, Colorado

System Size: 495 kW
System Type: Rooftop

Namaste Solar partnered with Unico Properties, LLC to install the system, which is composed of 1,458 solar modules on multiple roof surfaces. The ballasted array will generate close to 750,000 kWh of solar electricity in the first year of operation, offsetting nearly 40% of the school’s electricity needs.
Project Experience

STOWE ELECTRIC DEPARTMENT
Stowe, Vermont

System Size: 1.3 MW
System Type: Ground-mounted

This project is on a reclaimed portion of a municipal gravel pit. Encore Renewable Energy, the Vermont Economic Development Authority, and the Stowe Electric Department achieved project financing under the US Treasury Department’s Clean Renewable Energy Bonds program.

RUTLAND COMMUNITY SOLAR
Rutland, Massachusetts

System Size: 1.3 MW
System Type: Ground-mounted

This project provides clean, renewable, and affordable energy for customers ranging from small businesses to homeowners. As the EPC partner, Namasté Solar worked with the developer to value-engineer the system and complement the existing farmland, and also holds the O&M contract.
Project Experience

COLORADO STATE UNIVERSITY
Fort Collins, Colorado

System Size: 1.2 MW
System Type: Rooftop
Namaste Solar performed a feasibility assessment for the entire campus to determine the ideal locations for solar PV systems. Namaste Solar completed the project ahead of schedule and with only minor impacts to the students and staff. The duration from contract award to project completion was approximately 10 months.

REAL CAPITAL SOLUTIONS
Denver, Colorado

System Size: 2.3 MW
System Type: Rooftop & Carport
Namaste Solar partnered with Real Capital Solutions (RCS), a Colorado-based commercial real estate company, to construct carport and rooftop solar arrays at six locations in the Denver metro area. The project totaled 2.3 MW across all six sites.
Exhibit 21: Namaste Summary of Qualifications

Commercial Project Team

JASON SHARPE // CO-OWNER
CEO
Jason is a solar industry veteran with over 15 years experience designing systems in the solar PV industry. From the hybrid solar electric vehicle he designed as a college senior project in 1994, to multi-megawatt grid-interactive commercial systems; his expertise spans a broad range of solar applications. He has published articles in Solar Pro Magazine, and given numerous technical presentations to a wide variety of audiences including solar conferences, the International Code Council (ICC) and various electrical engineering firms. He has served on technical advisory boards for the DOE, NREL, Colorado’s Governors Energy Office, and local inspector groups. Certifications include: Colorado Master Electrician license, NABCEP Certified Solar PV Installer. Jason holds an Electrical Engineering degree from the University of Vermont.

ELIOT ABEL
Commercial Sales Director
Eliot has over 12 years of experience in the renewable energy industry, having worked in business development roles at a UK-based solar startup, GE’s global Renewable Energy business, and San Diego-based Renovate America. Eliot currently leads Namaste Solar’s commercial sales team, working with strategic partners to develop C&I and EPC projects in target markets throughout the U.S. Prior to joining Namaste Solar, Eliot was the Founder and Principal of Abel Clean Energy Advisors, a consulting firm that helps commercial property owners and developers utilize innovative financing to implement renewable energy and energy efficiency solutions that increase value, reduce operating costs, and enhance the sustainability of their properties. Eliot holds a BA from Stanford University and an MBA from the Yale School of Management.

JON WEDEL // CO-OWNER
Senior Director of Commercial Services
Jon Wedel is an nineteen-year electrical industry veteran with thirteen years in the PV industry. Joining Namaste Solar in early 2010, Jon now leads our Commercial Services Department including Commercial Sales, Project Development, and Operations in Colorado, the Southwest, and the Northeast. Jon is a Colorado State Licensed Master Electrician, RME for our California C-10 license, qualifier for our Nevada C-2 license. Jon also served as a former Namaste Solar Board Director with four years of service, three as our Board Chair.
Commercial Project Team

JONATHAN ERNST // CO-OWNER
Commercial PV System Designer
Jon brings to Namasté Solar his experience as an electrical engineer and his commitment to the use of renewable energy. After graduating in 1991 with a degree in electrical engineering, he worked in California's Silicon Valley, serving in both engineering design and management roles. During this time, Jon was given the opportunity to work for a year in Japan, where he developed a keen interest in the uses of solar energy. In 2004, after gaining additional experience as a reliability engineer, he turned his energies toward issues of sustainability, working first on straw-bale construction and then focusing on PV design and installation. Jon has worked with Namasté Solar since 2006, and is certified in solar PV installation by NABCEP and COSEIA, with extensive experience in both AutoCAD and PVSyst.

STEPHEN KANE // CO-OWNER
Consulting Services Manager
Stephen is a veteran of the solar industry and of Namasté Solar. He joined the company as one of the first Co-Owners in 2005, followed other pursuits in 2012, and returned to Namasté Solar in 2015. He started one of the first dedicated Service and O&M Departments in the solar PV industry at Namasté Solar in 2007, and currently holds the title of Consulting Services Manager. Stephen's varied and extensive solar PV experience leads him to advise on all aspects of solar design, installation, and O&M. He has experience from the IT and software industry that are critical to working with our DAS/SCADA and monitoring systems. One of his best talents is bridging the gap between technical and non-technical audiences.
Exhibit 21: Namaste Summary of Qualifications

Awards & Highlights

2019
- Best for the World: Best for Workers; Environment – B Corporation
- Best Solar Systems – Boulder Weekly
- Partner of the Year – Denver Public Schools, CareerLaunch
- Best for Colorado – The Alliance Center
- Building Performance – U.S. Green Building Council Colorado
- Best Places to Work, Top 100 – Outside Magazine

2018
- Top Solar Contractor – Solar Power World
- Best Solar Systems – Boulder Weekly
- Inc. 5000: Fastest-Growing Private Companies – Inc. Magazine
- Best Workplaces – Inc. Magazine
- Partner of the Year – Denver Public Schools, CareerLaunch
- Best for the World: Best for Workers; Environment – B Corporation
- Best Places to Work, Top 100 – Outside Magazine

2017
- Top Solar Contractor – Solar Power World
- Best for the World: Best for Workers – B Corporation
- Best Places to Work – Outside Magazine
- Best Solar Systems – Boulder Weekly
- Top Safety Award – Lennar

2016
- Best Solar Energy Provider – Daily Camera
- Best for the World: Best for Workers – B Corporation
- Best Places to Work – Outside Magazine

2015
- Best for the World: Best for Workers – B Corporation
- Best Places to Work – Outside Magazine
- Solar Power World Top Contractors

2014
- Most Democratic Workplaces – WorldBlu
- Best Places to Work – Outside Magazine
- Best Solar Energy Provider – Daily Camera
- Best for the World: Overall Impact; Environment Impact; Worker
Exhibit 22

Namaste Bike Park Site Assessment

Contains:

3 Pages of Site Assessment
Exhibit 22: Namaste Bike Park Site Assessment
Exhibit 22: Namaste Bike Park Site Assessment
Exhibit 22: Namaste Bike Park Site Assessment
Exhibit 23
Namaste Solar Farm Pricing Qualifications for Bohn Park

Contains:
2 Pages of Design Criteria
Namaste Solar - Town of Lyons, Bohn Park Solar

Assumptions

- Single mobilization
- Access to site will be granted 10 hours per day and 6 days per week during normal business hours including material deliveries
- Parking for Namaste Solar staff and subcontractors will be provided within reasonable distance
- Tools and equipment can be staged on-site
- There is enough room for safely operating and staging hoisting operations, as applicable
- Project is approved by the respective Owner’s or Building Owner’s Association
- Pricing is based on the layouts provided and alternative designs may incur additional cost
- Utility will approve the proposed interconnection approach
- System can be designed to meet the currently adopted National Electrical Code (NEC) code, as well as any codes and requirements of the Local Authority Having Jurisdiction (HAHJ)
- Electrical service is 480V 3-phase and interconnection is made at utility transformer secondary side
- Electrical equipment (inverters/panelboard/CT cabinet) installed on equipment piers, no concrete pad
- Carports/Ground Mounts with boring or trenching scope: Rock-free subsoil conditions

Inclusions

- Procurement and installation of equipment proposed (low voltage equipment)
- Building permit and plan review fees
- Best management practices to reduce storm water pollution and provide erosion control budget $15,000
- Structural and electrical engineering stamped by a professional engineer licensed in state
- Utility interconnection study fee if applicable
- ALSO Energy Data Acquisition System (DAS) - 5-year cellular data plan, Production Monitoring: true, Consumption Monitoring: true
- 480V 3-phase service/Supply Side Point of Interconnection (external) (Qty: 1)
- 2-Year standard Operations & Maintenance plan (O&M)
- Payment and/or Performance Bond
- Spare Modules (Qty: 7)

Exclusions

- Cost associated with facility or service upgrades, utility-required system upgrades
- Cost associated with the procurement and installation of Medium Voltage equipment
- Certified Payroll and/or prevailing wage rates
- Buy American Act/Buy America Act/FM Global compliance
- Backup power generation
- Painting or powder coating
- Re-certification of switchgear (Supply Side Interconnection)
Exhibit 23: Namaste Solar Farm Pricing Qualifications for Bohn Park

- New tariffs on equipment imposed by the federal government
- Pile refusals exceeding the following limits, for Labor $1,625, and for Materials $1,725
- Underground electrical work inside the fenced-in perimeter
- Trenching or directional boring outside the fenced-in perimeter
- Landscape rehabilitation beyond proposed budget of $4,000 for drill-seeding native grass-mix
- Irrigation (permanent or temporary) to promote vegetation growth
- Bonding
- Access road
- Grounding transformer

Production Estimate

- Any production estimate provided does not consider the shade impact of surrounding obstructions or vegetation unless specifically required or requested.
- Actual production is dependent on environmental conditions
- Informational note: Parameter inputs for production modeling, such as the specific meteorological data set and monthly soiling (dust & snow) loss percentages, must be substantially similar if production reports from competing proposals are to be reliably compared.

Warranties

- Namaste Solar warranty: 2-year workmanship
- 3rd party warranties: Per Manufacturer
- Inverter warranty: Standard

Condition

- Bid is subject to mutually agreeable contract terms being reached
- PV Module cost at time of this quote: $0.365/W
- Bid validity period is 15 days
Exhibit 24

RBI Bohn Park Parking Lot Assessment

(Design Criteria, Solar Panels, Helioscope)

Contains:

2 Pages of RBI Solar Truss Design

2 Pages of RBI Suggested Solar Panels

2 Pages Helioscope of RBI Design
Truss Canopy Solution | CP-Truss

When EPCs and project developers across the USA need dependable, low-maintenance solar carports or canopies, they turn to RBI Solar. Our variety of structure models, layouts, foundations, and add-ons offer many possibilities to design and engineer the solar canopy that fits the needs of your budget and aesthetic preferences. With over 100 carports constructed in the last 5 years, our team has the experience to deliver a robust carport solution for your business, institution, or community.

Cost-Effective Benefits

- Maximize parking lot functionality
- Single-source solution for canopy structure design and construction
- No on-site welds for faster install
- Multiple manufacturing facilities
- In-house engineering team licensed in all 50 states
- Pre-construction design and support resources available
- Water management available
- Multiple foundation options

www.rbisolar.com
Exhibit 24: RBI Bohn Park Parking Lot Assessment (Design Criteria, Solar Panels, Helioscope)

RBI Suggested Solar Panels (Page 1 of 2)
Exhibit 24: RBI Bohn Park Parking Lot Assessment (Design Criteria, Solar Panels, Helioscope)

## ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
<th>Power rating (front)</th>
<th>Power rating (back)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>400 Wp</td>
<td>405 Wp</td>
</tr>
<tr>
<td><strong>Testing Condition</strong></td>
<td>Print</td>
<td>Print</td>
</tr>
<tr>
<td><strong>STC rated output (P_{AC} / W)</strong></td>
<td>400</td>
<td>285</td>
</tr>
<tr>
<td><strong>Rated voltage (V_{AC}) at STC</strong></td>
<td>49.67</td>
<td>49.83</td>
</tr>
<tr>
<td><strong>Rated current (I_{AC}) at STC</strong></td>
<td>9.94</td>
<td>9.91</td>
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<tr>
<td><strong>Open circuit voltage (V_{OC}) at STC</strong></td>
<td>45.24</td>
<td>45.62</td>
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<tr>
<td><strong>Short circuit current (I_{SC}) at STC</strong></td>
<td>10.30</td>
<td>7.22</td>
</tr>
<tr>
<td><strong>Module efficiency</strong></td>
<td>13.4%</td>
<td>13.7%</td>
</tr>
<tr>
<td><strong>Temperature coefficient (P_{T})</strong></td>
<td>-0.38%°C</td>
<td>-0.38%°C</td>
</tr>
<tr>
<td><strong>Temperature coefficient (I_{ph})</strong></td>
<td>-0.04%°C</td>
<td>-0.04%°C</td>
</tr>
<tr>
<td><strong>Nominal module operating</strong></td>
<td>44°C</td>
<td>44°C</td>
</tr>
<tr>
<td><strong>Maximum system voltage (IEC/UL)</strong></td>
<td>1800Vdc</td>
<td>1800Vdc</td>
</tr>
<tr>
<td><strong>Number of series</strong></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Junction box IP rating</strong></td>
<td>IP 68</td>
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</tr>
<tr>
<td><strong>Maximum series fuse rating</strong></td>
<td>20 A</td>
<td>20 A</td>
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</tbody>
</table>

<table>
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<tr>
<th></th>
<th>Power rating (front)</th>
<th>Power rating (back)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical specifications (Integrated power)</strong></td>
<td>Print</td>
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<td><strong>P_{in} (V_{in})</strong></td>
<td>43.1 V</td>
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<tr>
<td><strong>P_{in} (V_{max})</strong></td>
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<td>45.00 V</td>
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<tr>
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## MECHANICAL SPECIFICATIONS

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<th>2038 x 1010 x 30 mm</th>
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<tbody>
<tr>
<td><strong>Frame technology</strong></td>
<td>Aluminum silver anodized</td>
</tr>
<tr>
<td><strong>Glass thickness</strong></td>
<td>2.0 mm</td>
</tr>
<tr>
<td><strong>Cable length (IEC/UL)</strong></td>
<td>Portrait: 350 mm</td>
</tr>
<tr>
<td><strong>Cable diameter (IEC/UL)</strong></td>
<td>4 mm - 12 AWG</td>
</tr>
<tr>
<td><strong>Maximum mechanical test load</strong></td>
<td>5400 Pa (front) / 2400 Pa (back)</td>
</tr>
<tr>
<td><strong>Connector type (IEC/UL)</strong></td>
<td>MC4 compatible</td>
</tr>
</tbody>
</table>

## PACKING SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
<th>Weight (module only)</th>
<th>Weight of packing unit (for 40'H2 container)</th>
<th>Number of modules per 40'H2 container</th>
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</thead>
<tbody>
<tr>
<td><strong>Reference</strong></td>
<td>28.3 kg</td>
<td>904 kg</td>
<td>702 pcs</td>
</tr>
<tr>
<td><strong>Packaging unit</strong></td>
<td>38 pcs / box</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RBI Suggested Solar Panels (Page 2 of 2)
Helioscope of RBI Design (Page 1 of 2)
Helioscope of RBI Design (Page 2 of 2)
Exhibit 25

Town of Lyons Resolution

Contains:

7 pages of Contract

Between town of Lyons and University of Colorado at Denver
TOWN OF LYONS, COLORADO
RESOLUTION 2020-172

A RESOLUTION OF THE TOWN OF LYONS, COLORADO
APPROVING AN MEMORANDUM OF UNDERSTANDING BETWEEN
THE COLORADO DEPARTMENT OF LOCAL AFFAIRS,
THE UNIVERSITY OF COLORADO DENVER, AND THE TOWN OF LYONS

WHEREAS, the Colorado Department of Local Affairs ("DOLA"), has contracted
with the University of Colorado Denver Colorado Center for Community Development
("CU Denver") to provide technical assistance in a 64-county area of Colorado; and

WHEREAS, the Town of Lyons ("Lyons") has requested assistance through this
program to assist in the development of a feasibility study for a solar farm in Lyons; and

WHEREAS, the DOLA and CU Denver desire to assist local governments and
political subdivisions of the State that are experiencing social and economic impacts
resulting from the development of energy/mineral resource industries in Colorado; and

WHEREAS, it is necessary and desirable to specify these services, the desired
end products, and the responsibilities of both the DOLA, CU Denver, and Lyons
(collectively, "the Parties") in completing this project through a memorandum of
understanding ("MOU") between the Parties; and

WHEREAS, it is estimated that work on this proposed Solar Farm Feasibility
Study is $5,000.00; and

WHEREAS, Lyons is requested to contribute or match a not to exceed amount of
$3,000.00 of the project costs to cover the time, travel, expenses, follow-up review and
preparation of the final documents; and

WHEREAS, the Board of Trustees desires to approve the MOU.

NOW THEREFORE, BE IT RESOLVED BY THE BOARD OF TRUSTEES OF THE
TOWN OF LYONS, COLORADO, THAT:

Section 1. The above recitals are hereby incorporated by reference.

Section 2. The Board of Trustees of the Town of Lyons does hereby declare
their support of the MOU between DOLA, CU Denver, and Lyons.

Section 3. Town Staff is hereby authorized to sign the attached MOU for the
Solar Feasibility Study.

Section 4. This Resolution shall take effect immediately upon adoption.
ADOPTED THIS 2ND DAY OF NOVEMBER 2020.

TOWN OF LYONS

Mark Browning
Nicholas Angelo, Mayor
Mark Browning, Mayor Pro Tem

ATTEST:

M. Vasquez, CMC
Town Clerk
MEMORANDUM OF UNDERSTANDING
Between
Colorado Department of Local Affairs – University of Colorado Denver, Colorado Center for Community Development
And
Lyons, Colorado

WHEREAS, the Colorado Department of Local Affairs, hereinafter DOLA, has contracted with the University of Colorado Denver Colorado Center for Community Development, hereinafter CU Denver, to provide technical assistance in a 64 county area of Colorado, and

WHEREAS, the Town of Lyons hereinafter Lyons (432 5th Ave, PO Box 49, Lyons, CO 80540), has requested assistance through this program to assist in the development of a feasibility study for a Solar Farm in Lyons, and

WHEREAS, the DOLA and CU Denver desire to assist local governments and political subdivisions of the State that are experiencing social and economic impacts resulting from the development of energy/mineral resource industries in Colorado, and,

WHEREAS, it is necessary and desirable to specify these services, the desired end products, and the responsibilities of both the DOLA, CU Denver, and Lyons in completing this project,

NOW, THEREFORE, it is hereby agreed that:

I. SCOPE OF WORK

CU Denver shall provide the services to Lyons as detailed in Attachment A-Scope of Services Dated 5 October 2020

II. COST ESTIMATE

Work will be billed to the Lyons at completion of the final work task. It is estimated that work on this project will be $5000 and the Lyons is requested to contribute or match a not to exceed amount of $3000 of the project costs to cover the time, travel, expenses, follow-up review and preparation of the final documents.

III. PAYMENTS

CU Denver shall submit an invoice to Town of Lyons upon completion of services for the Lyons contribution of $3000. Invoices will be sent to the following:

Town of Lyons
Attn: Aaron Caplan – Director of Utilities & Engineering
P O Box 49
Lyons, CO 80540
303-823-6822 ext. 42
acaplan@townoflyons.com

Payments, identifying a CU Denver invoice number, will be sent within 30 days of invoice to:

University of Colorado Denver
ATTN: Michelle Haynes

---

Town of Lyons Solar Farm Project 3 of 3 19/5/2020
IV. Department and Community Responsibilities

CU Denver will provide the personnel and administrative oversight to accomplish the objectives as described. Student Employees of CU Denver may do some necessary research, plans, and prepare documents in accordance with the scope of work. Supervision of the students and their work tasks rests with Heidi Brothers, Assistant Professor and Jeffrey Wood, Community Development Specialist for CU Denver. Chris LaMay, Regional Manager will monitor the Project on behalf of DOLA.

V. Period of Performance

This agreement will be deemed valid by the authorized signatures and it is anticipated that work can begin when fully executed and completed by 12/01/2021.

VI. Changes and Termination

The CU Denver Technical Assistance Program, the Colorado Department of Local Affairs, or the Lyons may, from time to time require changes in the Scope of Services of this agreement. In the event changes are required they must be made with the agreement of all parties. Either party may terminate this agreement by giving written notice of such termination and specifying the effective date thereof, at least thirty (30) days before the proposed date of termination.

VII. Agreement

For: Town of Lyons

[Signature and Date]

Title: Mayor

For: Department of Local Affairs

[Signature and Date Chris La May]

Title: Regional Manager
Exhibit 25: Town of Lyons Resolution

For: University of Colorado Denver

Heidi Brothers 11 Oct 2020 Title: CU Denver Civil Engineering Dept
Signature and Date Heidi Brothers

Jody Beck 10/11/20 Title: University Technical Assistance Program
Signature and Date Jody Beck

Jeffery Wood 10/11/20 Title: University Technical Assistance Program
Signature and Date Jeffery Wood

Signature and Date Title: Assistant Dean of Finance and Administration
Attachment A

Scope of Services for a Feasibility Study for a Solar Farm in Town of Lyons

5 October 2020

The College of Engineering, Design and Computing of the University of Colorado Denver (CU Denver) has been hired to provide a feasibility study for a solar farm in the Town of Lyons. This effort is made possible through the University Technical Assistance (UTA) Program at the Colorado Center for Community Development, CU Denver, through a grant from the Department of Local Affairs (DOLA).

DOLA Regional Manager Chris La May.

Project tasks:
1. Generate preliminary feasibility study for solar farm – approximately 5 pages
   a. Identify at least 3 most optimal sites
   b. Use information from Lee Hall on site, utilities, size and cost of solar farm
   c. Rough ROI with current information
   d. Timeline for entire project
2. Review through Town of Lyons staff, utility company, other agencies
   a. Provide one informational presentation
3. Address issues, incorporate comments and new information into feasibility study
   a. Submit for Town of Lyons approval before public outreach
4. Prepare for and conduct public outreach
   a. Draft information for Town website
   b. Mailings, Emails, Newspaper, Social Media, etc.
   c. Conduct 2 virtual public outreach sessions
      i. Presentations
      ii. Q&A, record sessions
5. Document outreach sessions, investigate issues
6. Finalize draft feasibility study including information from public outreach
   a. Review of study by Town
   b. One presentation on study
7. Prepare summary of work to be included in Engineering Services contract
8. Submit final feasibility study

Timeline:

We assume that work on this feasibility study can start in Dec 2020. Prior to that the Town of Lyons must accept this scope of services and the associated MOU must be executed. We propose submitting the preliminary feasibility study the end of Jan 2021, public outreach in Mar 2021, draft feasibility study in May with a final submittal in July 2021.

This timeline assumes availability, support and responsiveness from various members of the Town of Lyons, related stakeholders and other interested parties. Due to the unpredictability of student schedules, stakeholder timeliness, weather, public outreach schedule, etc., the MOU will reflect a duration of one year to complete the project.
Budget:
An invoice will be sent to the Town of Lyons at the completion of the final work task. It is estimated that work on this feasibility study will require $5000.

<table>
<thead>
<tr>
<th>Projected Total Project Cost</th>
<th>$5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOLA match (40%)</td>
<td>$2000</td>
</tr>
<tr>
<td>Town of Lyons (60%)</td>
<td>$3000</td>
</tr>
</tbody>
</table>
Exhibit 26

Town of Lyons- Solar Farm Feasibility Report (Rough Draft)

Contains:

5 Pages of Rough Draft
Town of Lyons
Solar Farm Feasibility Study
Draft #1

Team Members:
Brittany LeMarc
Omnis Abdoun
Mauricio Chavez
Elvia Martinez
Kevin Riker

College of Engineering, Design and Computing
UNIVERSITY OF COLORADO DENVER
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Section 1: Executive Summary
The Town of Lyons is conducting study with the help of the University of Colorado Denver in order to determine the feasibility of installing a solar farm, projected to be about one acre in size and produce about 5% (is it possible to go beyond 5%, contractually?) of Lyon’s electrical needs. This study intends to identify the best locations capable of housing the solar array, develop a thorough financial scenario, and conduct an outreach program ensuring optimal satisfaction with the residents of the Town of Lyons, Colorado.

Section 2: Town of Lyons Solar Farm
More detailed description of the solar farm goes here when we know more specifics.

Section 3: Public Outreach Strategy
There are several locations up for consideration for installation of the solar farm. Each location would affect the townspeople in different ways, rather it be potential destruction of a local dog park(?), or an obstructive view from a communities’ homes. What is the most effective way of gathering information from the townspeople to determine where they’d most prefer the solar farm be installed, if it turns out there is more than one option available to them? We would assume if more options are available to the public that would not largely impact the overall cost of the project, the public should be able to weigh in their opinion of where the location of the solar farm should be.

Since the publication of the article, A solar energy project will create renewable energy for Lyons, by Don Moore of the Redstone Review (article 9), has there been any feedback from the community with regards to their choice of the location? What public outreach, aside from this article, has been made so far? Has there been any negative feedback from the community? How often should public outreach continue going forward?

Section 4: Company Competition
There are many different companies that provide the services need done both before the installation of the solar farm, and during construction of the solar farm. What options are available to us to determine factors such as Geotech studies, site surveys, water table examinations, etc.? Are we bound to Namaste for providing us with the solar farm or are there other, more viable options that would offer us different advice or different solutions? What is the best method to finding these other options, and how expensive is it to simply obtain estimates from them? What other companies are expected to bid on this project? Is there currently a list of contractors that we need to follow for information regarding proper pricing?
Section 5: Site Analysis

Tank Hill Location
This site has close interconnect, no flood risk. Parcel is an unusable liability. However, system size is limited by at least 35%. Geotech analysis shows the soils are very rocky, making excavation more difficult and costly. This particular site has very steep slopes making for difficult constructability.

Southwest Dog Park Location
This is the only location where a helioscope analysis has been conducted. The site is very buildable, with low proximity to residential areas. However, there is a minor potential for flood risk, potential for public opposition, and significant underground interconnect problems. No Geotech analysis has been conducted at this location.

Longs Peak Location
Power lines may pose a challenge in the construction phase. Local community may not like how close the array is to their homes. No Geotech analysis has been conducted at this location. No Helioscope analysis has been conducted at this location.

Wastewater Treatment Plant Location
This is the most buildable site with close interconnect conditions and has low public impact. However, the risk for catastrophic flood damage is at a high risk.

Section 6: Technological Considerations

There was a previous geotechnical survey conducted by Terracon Consultants Inc. at the 0 Reese Street, Lyons, CO location (Tank Hill location) that confirmed that the site would be costly to excavate due to bedrock conditions. This study was conducted using only two bore holes. Is it a common practice to utilize soil taken from only two bore holes in an area of this size? Does this study restrict us to this location because of financial reasons or is it within the city budget to conduct other Geotech studies at other locations as well? Does this study automatically disqualify the Tank Hill location due to these soil conditions?

If the city still has Geotech reports from previous projects conducted in the locations to be considered for the solar farm (e.g., buildings, road construction, etc.), would it be possible to review these reports and use them in lieu of paying for further studies, or is the city legally obligated to have new reports conducted before each new construction activity?

Our team reviewed a helioscope report provided by Namaste conducted at 199 2nd Ave., Lyons, CO, just north of the ‘dog park’ location. This helioscope was performed September of 2020, almost two years after the Geotech study performed at the Tank Hill location (February 2018). Does this mean that the location at Tank Hill has been ruled out as an option for the solar farm, or is it still up in the air?
Section 7: Financial Projections
In a letter from Mr. Lee Hall to the editor of the Redstone Review (article 10), there was an estimate given regarding the total cost of the system and the projected year the return on investment would be met. Specifically, one statement claimed the total system cost would be estimated about $750,000 with a return on investment at about 13 years based on current and projected electric rates. Our team was not provided with the reports giving these specific estimates and definitely want to review them as well. Is there any possibility we could receive these reports, or were they given on non-official basis? Were these estimates provided by Namaste or a different source?

What additional information should we consider when developing an ROI (e.g., population/economic growth over time)? Does the city require a projected ROI be made within a certain amount of time (no less than x number of years)?

Section 8: Findings and Recommendations
Once a number of these questions are answered, our findings and recommendations on the continuation of the study goes here. According to the Redstone Review article (article 9), the feasibility study will continue on through July 2021.

Section 9: Conclusion
A formal wrap up of the feasibility study.
Exhibit 27
Town of Lyons- Solar Farm Feasibility Report (Second Draft)

Contains:
9 Pages of Final Draft
TOWN OF LYONS
SOLAR FARM FEASIBILITY STUDY

Team Members:
Brittany LeMarc
Oumma Abidoun
Mauricio Chavez
Elvira Martinez
Kevin Riker

Submitted May 7th, 2021

College of Engineering, Design and Computing
UNIVERSITY OF COLORADO DENVER
Exhibit 27: Town of Lyons- Solar Farm Feasibility Report (Second Draft)

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Section 1: Executive Summary

The University of Colorado at Denver has been contracted through the Colorado Department of Local Affairs to provide a feasibility study for a solar farm in the Town of Lyons. The University of Colorado at Denver assigned civil engineering students, as part of the capstone project, to determine the feasibility of installing a solar farm which is projected to be about one acre in size and produce 5% of Lyon’s power demands. This study intends to identify the three best locations capable of housing a solar array, develop a rough cost analysis and return on investment, and conduct a public outreach program ensuring optimal satisfaction with the residents of the Town of Lyons, Colorado. Conducting a feasible study will help the Town of Lyons receive a grant from the Colorado Department of Local Affairs, which will help pay half of the total project cost.

Section 2: Site Analysis

The team was able to tour the Town of Lyons and visit the eight sites potentially capable of housing a solar farm, which some of the townspeople already had in question. These locations include Eagle Canyon, Steamboat-Vazquez Draw, Tank Hill, Long Peak Drive, the Wastewater Treatment Facility, Bohn Park (Dog Park), Bohn Park (Parking Lot), and Bohn Park (Bike Park). Using the data collected on these sites, the team was able to narrow down to the most feasible locations to house a solar farm. It was concluded that the Bohn Park (Dog Park), Bohn Park (Parking Lot), and Bohn Park (Bike Park) sites were the optimal locations for a solar farm project. The following paragraphs will go into further detail regarding the student team’s findings at these three recommended locations.
Bohn Park (Dog Park)

The Bohn Park (Dog Park) location sits on a 10-acre plot of land and is located southwest of Bohn Park. A helioscope analysis was conducted by Namaste Solar in September 2020. After reviewing the helioscope report and visiting this location, the student team determined this site was very buildable with a low proximity to residential areas, room for expansion in the future, minimal obstructions, and can easily meet over 90% of its solar potential. The dog park is owned by the Town of Lyons, so construction could begin with the board’s approval. However, there is a minor potential for flood risk, a possibility for opposition due to the public’s view on repurposing the finite land from the dog park, and significant underground interconnect distribution problems which will add construction cost. This location does not serve easy access to roadways and highways, therefore conducting construction in this location will be a challenging task. No current geotechnical analysis has been conducted at this location.

Bohn Park (Parking Lot)

Using the Bohn Park parking lot as a potential site bears with it the assumption that doubling the solar farm as a covered parking lot for Bohn Park. In September 2013, the Town of Lyons experienced a 1000-year flood, which completely flooded out the Bohn Park area, including this parking lot site. The water level rose to ten times its normal height in Saint Vrain Creek. The possibility that another flood could occur is always present therefore, because of these flood risks, any construction of a solar farm, even if it is elevated atop a covered parking lot, still poses the risk of sustaining damage, or being destroyed by flooding at this location.

A geotechnical study was conducted close to this location in May 2016 by Shannon & Wilson, INC. The soil survey utilized five borings and three test pits in various locations around Bohn
Park. The survey indicated subsurface conditions consisting of sand and gravel. Scattered cobbles were inferred from drill action in the borings and were observed within the test pit excavations, as well as concrete rubble. Groundwater was observed in some of the borings at depths of 7.7 and 5.5 feet below existing ground surface. Further geotechnical analysis would need to be conducted if constructing a covered parking lot/solar farm.

Bohn Park (Bike Park)

The Bohn Park (Bike Park) site is located just on the west corner of Bohn Park. It is large enough to provide the energy demands that the Town of Lyons is looking to meet, as well as being over 90-95% for potential solar energy with its placement. This portion of the park used to be a community garden but has since gone unused. Adding the solar farm here would potentially allow the Town of Lyons to implement agrivoltaics and bring together two sustainable projects for the town. This site would require the permission of the farmstead owners, the Carrolls, who live just catty-corner to the potential site before any construction. This site does not lend itself to much expansion, however. If the Town of Lyons is ever able to supplement more than 5% of the energy demands with solar energy in the future, this location may not have enough land capable of housing additional arrays. Another disadvantage, if this location is chosen, is the added construction cost due to the three-phase interconnection power distance from site.

Section 3: Return on Investment (ROI)

Cost estimations on all three feasible sites are based upon quotes received from solar contractors, Namaste Solar, and RBI Solar. The quote from Namaste Solar, completed in September of 2020, is for a ground mounted solar farm at the Bike Park location and includes design, labor, earthwork, materials, and two years operation and maintenance. The initial quote for the Bike
Park location lies only 500 feet away from the Dog Park location and is similar in design; for this reason the quote was used within the cost estimations for this location as well. The quote from RBI Solar, completed March of 2021, is for a raised carport at the Bohn Park parking lot and includes design, labor, earthwork, materials, five years operation and maintenance, and power distribution.

The quote for both the Bike Park and Dog Park locations does not include underground power distribution, legal and administration fees, geotechnical report for soil conditions, and special election fees for the rezoning of just the Bike Park location. Following the addition of these costs, both the Department of Local Affairs grant, and the Collective Sun investment tax credit must be accounted for within the cost estimation. Rough Cost estimates for the Bike Park and Dog Park locations are $313,726 and $321,266.

The quote for the Bohn Park parking lot location does not include legal and administration fees or a geotechnical report. Following the addition of these costs and the inclusion of the Department of Local Affairs grant and the Collective Sun investment tax credit the rough cost estimate for the Bohn Park parking lot carport is $577,120.

To calculate the return-on-investment; annual energy output, savings, and costs need to be accounted for each year over the projected lifespan of the solar farm. The energy savings were estimated by first applying an annual solar panel degradation rate of 0.5% to get the annual energy production of the solar farm. This energy production was then multiplied by the Municipal Energy Agency of Nebraska's energy rate, after applying an annual electricity rate escalation of 2.1%. Annual costs for the solar farms include the financing over a 20-year period at an interest rate of 2.5%, operation and maintenance costs at an inflation rate of 3%, insurance...
ride at the cost of 0.35% of the system price at a rate of 3% inflation, and a year 15 inverter replacement at the cost of $0.10/watt. Following these calculations, the 25-year return on investment for the Bike Park, Dog Park, and Parking Lot locations are respectively 21%, 17%, and -77%. The 30-year return on investment for the Bike Park, Dog Park, and Parking Lot locations are respectively 64%, 59%, and -60%.

**Section 4: Public Outreach**

Public outreach was done primarily online, due to the ongoing pandemic. We had several tactics to reach out to the public to announce the idea of having a solar farm in the Town of Lyons. Those tactics include, writing two articles for the Redstone Review summarizing the progress being made by the student team in selecting potential sites. The first article focused on providing an update on the project and was featured in the March-April edition of the Redstone Review. The second article focused on the potential site overview and cost analysis with a return on investment done for each site. This article was published in the April-May edition of the Redstone Review.

The Town of Lyons has a feature called the eBlast, which sends a notification to residents about upcoming events in the town. The student team utilized this to inform the town residents of both town hall meetings. The first eBlast was sent out in March 2021, prior to the first town hall. The second eBlast was sent out in April 2021, prior to the second town hall.

The first virtual town hall with the residents of the Town of Lyons was conducted on Thursday, April 1, 2021, at 6:00 pm. In this meeting, the student team members, along with experts Lee Hall and Jim Kerr, answered questions posed by the public regarding the solar farm project.
During this meeting, the town’s people provided positive feedback and were looking forward for the project. Most of the questions posed during this town hall were regarding the locations of the project, as well as the impact of the project on the surrounding areas.

The second town hall was conducted on Thursday April 15, also at 5:00 pm. This meeting was the same format as the first town hall and featured a different group of residents than the first meeting. During this meeting, the town’s people seemed optimistic and provided positive reactions. A lot of questions were asked during this town hall regarding agrivoltaics and the possibility of future expansions of the solar farm.

Section 5: Conclusion

The University of Colorado at Denver has been contracted by the Department of Local Affairs to conduct a feasibility study for the Town of Lyons on the implementation of a solar farm capable of producing 5% of the town’s energy demands. As part of the contract, the three most optimal sites was selected, a public outreach was conducted, and a rough cost estimate and return on investment was prepared. The search began with the eight initial sites that the Town of Lyons had already considered as being potentially feasible. After establishing a set criterion in which to judge these locations, it was possible to conclude upon the three most feasible sites.

Having the most optimal sites selected allowed the team to conduct public outreach with viable information that the residents of Lyons could question, critique, and provide feedback with. Rough cost estimations and return on investments were completed on all three of the most feasible sites to provide further information to the Town of Lyon’s to better compare the feasibility of all selected locations.
In the mission of building a more sustainable world, the Town of Lyons is going to use this feasibility study to secure funds from the Colorado Department of Local Affairs. This funding will reduce the cost of the project by half while also reducing the financial burden that the construction of an array would bear on the town. The information that will be contained within this feasibility study report will aid the Town of Lyon’s in deciding upon a single site in which to focus the attention on when applying for grant funds. Knowing the characteristics of each site, the public’s opinion on the locations, and having cost analysis will also create a basis on which to begin the planning and designing of the solar farm.
Exhibit 28
Initial Client Meeting

Contains:
1 Page Agenda
DVD of Recorded Meeting on February 5th, 2021
Initial Meeting Agenda

Client & Faculty Attendees:  
Lee Hall  
Heidi Brothers  
Jeffery Wood  
Chris La May

Student Attendees:  
Brittany LeMaro  
Mauricio Chavez  
Kevin Riker  
Elvia Martinez  
Chandler Kitson  
Ommi Abdoun

I. Introductions  
Quick introductions to help establish proper communication channels for assistance during this semester long project.

II. Expectations  
The Lyons student team has reviewed the initial documents and would like to hear from the client what their main expectations and goals are for us to complete.

III. Sites  
Overview and Questions related to the sites available.
   a) How many sites are available?
   b) Can we visit the sites? Is this possible with Covid-19 restrictions? Is it necessary?
   c) Are there additional Geotechnical Reports relating to each site?

IV. Schedule  
We have prepared a rough draft of a timeline to get us to the end completion goal in May 2021. We would like to review and see if these dates are workable for all parties involved.

V. Rough Draft of Feasibility Report  
We have prepared a rough draft of the Feasibility Report. This draft is mostly compiling the info we have currently and setting up the general outline. This will be updated continually throughout the project.

VI. Future Meetings  
Expectations of future client meetings: the frequency, in-person versus zoom, and attendees.

VII. Questions  
Any additional questions not covered in the previous discussion sections.

***Minutes will be recorded, and a follow-up email will contain that information.
Exhibit 28: Initial Client Meeting (Agenda & DVD)

DVD of Recorded Meeting on February 5th, 2021
Exhibit 29
Final Client Presentation

Contains:
PowerPoint Presentation
DVD of Recorded Meeting on May 7th, 2021
Town of Lyons
Solar Farm Feasibility Project

Presentation Brought to you by:
The University of Colorado at Denver Student Team
May 7th, 2021

AGENDA

1. Introductions
2. Project Schedule
3. Potential Sites Overview
4. Design & Cost Analysis
5. Public Outreach
6. Recommendations
Student Team Members
University of Colorado at Denver
Spring 2021, Senior Design Class

01. Brittany Lenters
02. Mariacruz Chavez
03. Chandler (Eli) Kibben
04. Kevin Baker
05. Liwa Martinez
06. Oumima Abdeou

Project Schedule

January
- Reviewed Provided Documents
- Developed Contract Obligations Into Workable Plans
- Initial Client Meeting

February
- Town of Lyon’s Visit
- Jake’s Solar Farm Tour
- Reached Out to Other Agencies
- First Draft Feasibility Study

March
- Groundwork for Public Outreach
- Established 3 most Feasible Sites
- Assigned Feasibility Sources
- Public Outreach
- ROI and Cost Estimates
- Draft of Feasibility Study

April
- Final Feasibility Study
Exhibit 29: Final Client Presentation (Presentation & DVD)

Potential Sites Overview
Eight Total Locations

Main Factors
- Solar Access & Panels
- Construction Concerns
- Environmental Impacts
- Geotechnical Conditions
- Flood Data

Main Factors

Solar Access
- Potential Obstructions
- Annual Solar Angle
- PV Panel Spacing
- Axis-Tilt vs. Fixed-Tilt
- Potential Energy Output

Construction Concerns
- Cost & ROI
- Distance to Power
- Access to Roadways
- Disturbance to Public
- Topography of Sites

Environmental Impacts
- Existing Land Use
- Viewshed Impact
- Noise
- Storm Water Drainage
- Flora & Fauna
Exhibit 29: Final Client Presentation (Presentation & DVD)

Main Factors

Geotechnical

- Geotechnical analysis was performed at only two of our eight proposed solar farm locations.
- Soil conditions range from very feasible excavation conditions around the Bohm Park area (top) to very difficult conditions at the Tank Hill location (bottom).
- Shallow bedrock conditions may increase time/cost of excavation at some proposed locations.
- We recommend further geotechnical evaluation take place before any new excavation.

Main Factors

Flood Data

Town of Lyons
1000 Year Flood
September 2013

FEMA
Federal Emergency Management Agency

Data Gathered
- Identify Flood Hazards
- Risk Mapping
- Hydrologic Analysis
- Assessment & Planning

Map Details
- Special Flood Hazard Areas
- Regulatory Floodway
- 0.2% - 1.0% Flood Zones
Exhibit 29: Final Client Presentation (Presentation & DVD)

Southwest Dog Park
0 Bradford Street, Lyons, Colorado

Pros
- Outside of the flood region
- Room for future expansion
- Away from residential area
- Does not require rezoning
- Excellent solar access

Cons
- Uses existing dog park land
- Longest distance to run underground power distribution

Bohn Park - Near Bike Park
199 2nd Ave, Lyons, Colorado

Pros
- Currently unused plot of land
- Shorter distance to access phase 3 power
- Exceptional solar access

Cons
- Land requires rezoning
- No room for future expansion
- Limited road access
Bohn Park Parking Lot
199 2nd Ave., Lyons, Colorado

Pros
- Add covered parking
- Opportunity to add agrivoltaic shade garden
- Only 500 ft to access phase 3 power

Cons
- Added cost of carport construction
- Close proximity to public
- Low risk flood zone (0.2%)

Site Overview

<table>
<thead>
<tr>
<th>Site</th>
<th>Weight</th>
<th>Southwest Dog Park</th>
<th>Near Bike Park</th>
<th>Parking Lot</th>
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<tbody>
<tr>
<td>Bohn Park</td>
<td></td>
<td>Higher Number Indicates Higher Importance</td>
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<tr>
<td>Environmental Impact</td>
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<tr>
<td>Access to Roadways</td>
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<td>5</td>
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<td>Ability to Expand &gt;5%</td>
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<td>Return on Investment</td>
<td>5</td>
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<td>Flood Risk</td>
<td>5</td>
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<td>5</td>
<td>1</td>
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</table>

Feasibility Score: 110 134 95
Solar Panel Design Recommendations

- Two types of solar panel racking systems in question: Fixed-till and axis tracking.
- Fixed-till systems positions the panels at a position "fixed" in place, limiting sun exposure time. Less expensive.
- Axis tracking systems adjusts the panels to "track" the sun, allowing for more exposure. More expensive.
- We recommend a fixed-till system, as the exposure difference is negligible when considering cost.

Namaste Solar Design Summary
Bohn Park – Near Bike Park

Design from September 2020

Details
- >95% Solar Access.
- ~1 Acre of Land.
- Underground Power Distribution 1825 ft/2525 ft.
- 799 415W PV Panels
- System Nameplate 331.5 kW
- 570 MWh Annually
- Driven by Beams
Exhibit 29: Final Client Presentation (Presentation & DVD)

RBI Solar Design Summary
Bohn Park – Near Bike Park

Design from March 2021

Details
- >95% Solar Access
- Underground Power Distribution 50-100 ft
- 1050 400W PV Panels
- System Nameplate 430.5 kW
- 580.3 MWh Annually
- Steel Columns 6-8 ft high
- Concrete Footings

Site Inspiration Bohn Park Parking Lot

Community Garden
Existing park amenity that was destroyed in the 2013 floods.
Idea of rebuilding this to increase town approval of solar array in Bohn Park.

Jack's Solar Garden
Longmont based family farm that has introduced the concept of agrivoltaics into a local community.
Our tour provided us with the inspiration for creating a shade garden.

Agrivoltaics
The idea of combining agriculture such as farming or gardening with photovoltaics power such as solar panels.
Exhibit 29: Final Client Presentation (Presentation & DVD)

Cost Analysis

<table>
<thead>
<tr>
<th></th>
<th>Southwest Dog Park</th>
<th>Near Bike Park</th>
<th>Parking Lot</th>
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<td>Collective ITC</td>
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<td>-$179,880</td>
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<td><strong>$311,726</strong></td>
<td><strong>$517,126</strong></td>
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</tbody>
</table>

25 Year ROI: 17% 21% N/A
30 Year ROI: 59% 64% N/A
Payback Period (Years): 23.9 23.4 >30

Public Outreach

**Redstone Review:**
- Monthly Local Newspaper Serving Lyons
  - December 2023
  - March 2021
  - April 2022

**Town of Lyons E-Blast:**
- Bi-Weekly Notification System
  - 1st Town Hall
    - March 10th & April 1st
  - 2nd Town Hall
    - April 10th & April 10th
Public Outreach: Virtual Town Halls

April 1st, 2021

- Participants: 24 Total Participants
  - 9 Group Members
  - 2 Town Project Experts
  - 16 Citizens

- Time Frame: Presentation: 60 Mins

Questions
- “What is the total cost of the project?” - Laurie Harper
- “Do you think a PV farm in Lyons could help with bringing in new future businesses?” - Paul Dryer
- “Where is the best point to access the grid?” - Kim

April 15th, 2021

- Participants: 23 Total Participants
  - 9 Group Members
  - 2 Town Project Experts
  - 15 Citizens

- Time Frame: Presentation: 15 Mins

Questions
- “Is energy storage considered in this plan?” - Jane Albo
- “What is the target size of the plant?” - Ben Thomas
- “Would it be feasible to get 7% by installing this amount of solar on rooftops around town by offering homeowners a subsidy?” - Rick DiSalvo

Recommendations

Engineering Services
- Perform Geotechnical Study
- Acquire Professional Designs
- Environmental Impact Study

Special Election
- Required for Bohn Park - Near Bike Path
- Not Required for Southwest Dog Park
- Decision Pending for Bohn Park Parking Lot

Grant Work & Submittal
- DOLA Grant
- Collective Sun ITCA
Exhibit 29: Final Client Presentation (Presentation & DVD)

Project Files

Feasibility Report
- 7 Pages

Senior Design Report
- 347 Pages

Exhibit Files
- 39 Exhibits

Cost & ROI
- 3 Site Breakdowns

Thanks For the Opportunity.
Any Questions, Concerns, or Feedback?

Brittany LeMarch
Mauricio Chavez
Chandler (CI) Kitson
Kevin Riker
Elvia Martinez
Ommima Abdoun

College of Engineering, Design and Computing
UNIVERSITY OF COLORADO DENVER
Exhibit 29: Final Client Presentation (Presentation & DVD)

DVD of Recorded Meeting on May 7th, 2021
Exhibit 30
Previous Written Redstone Review Article and Letter to the Editor

Contains:
5 Photos Total
1 Photo of Full November/December Article
4 Cropped Photos – 1 Photo per Article Column

Follow-up Letter to the Editor (2 Pages)
A solar energy project will create renewable energy for Lyons

By Don Moore

LYONS – If all goes as planned, soon Lyons will have an array of solar panels on a plot about one acre in size. The inexpensive renewable energy provided by the sun through the array will amount to a projected 5 percent of the entire electrical needs of the town.

The project is the brainchild of Lyons resident, Lee Hall, who together with Jim Kerr, former Board of Trustees member and current chair of the Lyons Utilities and Engineering Board (UREB), spearheaded the creation of the solar farm. Hall is also a member of the URB board. Hall and Kerr (who had a career in systems engineering before retirement) have been working closely with Aaron Clapham, Director of Utilities for the Town of Lyons, to move the project forward.

Asked how he became involved, Hall replied, "I had the good fortune to live in a cutting-edge solar dorm in high school in the early 1980s. It was the most comfortable dorm on campus – even during the coldest and hottest periods of the year." He was a convert to solar energy, became a student of it, and in 2019 had his home installed with solar electric generation. Neither Hall nor Kerr is being paid for his services.

At a recent meeting, the Lyons Town Board of Trustees authorized the town to commit up to $3,000 to pay for a solar farm feasibility study to be performed by University of Colorado at Denver. The study will cost $5,000 in total and the remaining $2,000 is to be paid by a grant from the Colorado Department of Local Affairs (DOLA). As part of its responsibilities, DOLA distributes such grants to municipalities for this purpose. CU Denver has a history of producing these studies and has worked extensively with DOLA on other similar projects.

"The study will identify the best sites to house the array, create a financial scenario, and perform community outreach to inform and listen to Lyons’ residents about the nature of the project," said Kerr. He went on to explain that no money for site acquisition will be necessary, as the intent is to build the farm on property currently owned by the town. The factors in site selection include distance to the grid, availability of utilities, and soils condition.

The town currently gets its electricity from the Municipal Energy Agency of Nebraska (MEAN), a cooperative of about 15 municipalities in Colorado, Nebraska, Iowa, and Wyoming. MEAN is the not-for-profit wholesale electricity supply organization of Nebraska Municipal Power Pool energy. About 7 percent of the energy MEAN supplies to the town comes from renewable sources.

According to the contract with MEAN, Lyons is allowed to produce up to 5 percent of its total electricity needs from solar energy," Hall said. "In addition to that limitation, the town is reaching the limit of individual users creating individual solar installations. New individual solar installations will be allowed, but the subsidy will go away.

For the project to succeed, it is necessary to have solar generation and, after providing for all their electrical power needs, there have been selling the excess energy back to the town. That cost ends up being paid by non-users residing in a suburb for men who have their own solar installations. One of the purposes of this new array as Hall mentioned is to end that subsidy.

"Solar arrays will be way ahead of rooftop installations which are the most uneconomic ways to do it. Arrays are cost effective and the way of the future," Kerr said.

According to Hall, Preliminary financial projections show total costs will be paid for out of user fees in a 10-15-year timeframe. The cost for maintenance will be extraordinarily little, resulting in a total life expectancy for the solar farm projected to be 30 to 40 years. As noted above, one of the requirements of the feasibility study is to create a more precise financial scenario. The timeframe for the feasibility study to be conducted is December 2020 to July 2021.

Don Moore is a retired lawyer and the author of Love is a Verb: Healing Yourself Love, Guilt and Compassion. He lives in Longmont with his wife Joanne.

Redstone Review Article Written for November/December Issue

Article written by Don Moore
A solar energy project

By Don Moore
Redstone Review

LYONS – If all goes as planned, soon Lyons will have an array of solar panels on a plot about one acre in size. The inexpensive renewable energy provided by the sun through the array will amount to a projected 5 percent of the entire electrical needs of the town.

The project is the brainchild of Lyons resident, Lee Hall, who together with Jim Kerr, former Board of Trustees member and current chair of the Lyons Utilities and Engineering Board (UEB), spearheaded the creation of the solar farm. Hall is also a member of the UEB board. Hall and Kerr (who had a career in systems engineering before retirement) have been working closely with Aaron Caplan, Director of Utilities for the Town of Lyons, to move the project forward.

Asked how he became involved, Hall replied, “I had the good fortune to live in a cutting-edge solar dorm in high school in the early 1980s. It was the most comfortable dorm on campus – even during the coldest and hottest periods of the year.” He was a convert to solar energy, became a student of it, and in 2019 had his home installed with solar electric generation. Neither Hall nor Kerr is being paid for his services.

At a recent meeting, the Lyons Town Board of Trustees authorized the town to commit up to $3,000 to pay for a solar farm feasibility study to be performed by Uni-
Lyons resident, Lee Hall, left, together with Engineering Board, are working on the creation of a project that will create 5 percent of the town’s electrical needs.

The study will cost $5,000 in total and the remaining $2,000 is to be paid by a grant from the Colorado Department of Local Affairs (DOLA). As a part of its responsibilities, DOLA distributes such grants to municipalities for this purpose. CU Denver has a history of producing these studies and has worked extensively with DOLA on other similar projects.

“The study will identify the best sites to house the array, create a financial scenario, and perform community outreach to inform and listen to Lyons’ residents about the nature of the project,” said Kerr. He went on to explain that no
money for site acquisition will be necessary, as the intent is to build the farm on property currently owned by the town. The factors in site selection include distance to the grid, availability of utilities, and soils condition.

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“According to the contract with MEAN Lyons is allowed to produce up to 5 percent of its total electricity needs from solar energy,” Hall said. “In addition to that limitation, the town is reaching the limit of individual users creating individual solar installations. New individual solar installations will be allowed, but the subsidy will go away.”

Over the past many years many town users have built solar generation and after providing for all their electrical power needs, they have been selling the excess energy back to the town. That cost ends up being paid by non-users resulting in a subsidy for users who have their own solar installations. One of the purposes of this new array as Hall mentioned is to end that subsidy.

“Solar arrays will be way ahead of rooftop installations which are the most uneconomic way to do it. Arrays are cost effective and the way of the future,” Kerr said.

According to Hall, Preliminary financial projections show total costs will be paid for out of user fees in a 10-to-15-year timeframe. The costs for maintenance will be extraordinarily little, resulting in a total life expectancy for the solar farm projected to be 30 to 40 years. As noted above, one of the requirements of the feasibility study is to create a more precise financial scenario. The timeframe for the feasibility study to be conducted is December 2020 to July 2021.

Don Moore is a retired lawyer and the author of Love is a Verb: Healing Yourself through Love, Gratitude and Compassion. He lives in Longmont with his wife Joanne.
Letter to the Editor of the Redstone Review

I wish to thank Don Moore for his *A Solar Energy Project Will Create Renewable Energy for Lyons* article published in the November/December issue of the Redstone Review. Informing the people of Lyons about this exciting proposed project is one of the most important components of the development plan.

I would like to supplement Don’s article with some additional points, as well as new information that was received after his article went to press.

Perhaps the most exciting thing about the concept is that the solar farm has real potential to actually reduce the cost of electricity for all of Lyons’ residential and commercial rate-payers in the long run. The total cost of the system is currently estimated at about $750,000. One estimate predicts that it would be fully paid for by year 13 based on current and projected electric rates*, a DOLA grant of more than $300,000 and other smaller factors. During the subsequent 20 years, that estimate predicts that the system could save Lyons about $500,000. That avoided cost would help the Town of Lyons reduce its consumers’ rates or, at least, reduce their increase over time. And the system could continue producing power for our children and their children—well beyond 2050.

* Note: if the wholesale energy rates that Lyons pays don’t increase as much as that estimate assumes, the break-even period would be longer.

Beyond cost savings, this project can have many other benefits. It can lower our carbon footprint. It can increase the local resilience of our little municipal power grid. It can be a tangible, visible reminder that we, as a community, have been pro-active, progressive and responsible with our energy usage. What better endeavor can there be—when serving our own self-interests would also benefit future generations and the world as a whole?

The time is right for this project to succeed. The will of the town’s leadership and constituents alike are aligned for this kind of progress. Colorado’s leadership is similarly aligned. Solar is now the cheapest form of new electricity generation. Our wholesale electricity supplier (MEAN) does not currently have the ability to increase Lyons’ percentage of solar or renewable energy. And building a single 350KW solar farm is much less expensive per watt than building 5KW rooftop systems.

Furthermore, the justifiability of residential rooftop solar installations has greatly diminished. The town’s high penetration of residential systems is placing an increased cost burden onto those rate-payers who do not have solar generation. Those rate-payers effectively subsidize the average (5KW)
system to the tune of about $7000 over a 20 year period. That is one the reasons that Lyons is currently moving away from 1-to-1 net metering.

I should also clarify that this project is still in the early stages of planning – as evidenced by that fact that a formal feasibility study has not yet been done. However, all significant considerations thus far indicate that Lyons might have its very own solar farm soon!

Thank you for reading.

Lee Hall, Member of the Town of Lyons Utilities & Engineering Board
Exhibit 31
Redstone Review article from March 2021

Contains:
4 Photos Total
1 Photo of Full March/April Article
3 Cropped Photos – 1 Photo per Article Column
Solar energy farm could supply five percent of Lyons’ electricity

By Brittany LeMarc

DENVER – The Town of Lyons has partnered with the University of Colorado at Denver to create a solar farm feasibility study. The intent of the feasibility study is to make suggestions about how to incorporate a solar farm and request town input on the students’ ideas.

The objective of the solar farm is to supply five percent of the entire electrical needs of the town of Lyons. The team of students has been tasked with reviewing potential plots of land, assessing the cost of construction, public outreach, and helping draft the report for a state grant to build the solar farm. The grant would come from the Colorado Department of Local Affairs (DOLA), and their purpose is to help municipalities create new projects just like this one.

The students at the University of Colorado at Denver have the help of local Lyons residents and town employees. Lee Hall and Jim Kerr of the Lyons Utilities and Engineering Board (UEB) are essential parts of the team assisting the students, as well as town staff Ben Rodman, the town of Lyons Sustainability Coordinator, and Aaron Caplan, Director of Utilities and Engineering. The student group consists of Brittany LeMarc (myself), Kevin Riker, Mauricio Chavez, Elvia Martinez, Chandler Kitson, and Onima Abdon. All six student members will be graduating in May 2021 with Bachelor of Science in Civil Engineering degrees.

Our first step in this feasibility study is to assess the properties that the town of Lyons currently owns. We reviewed eight plots of land and have narrowed our focus down to two plots located in beautiful Bohn Park. The other six plots of land look less feasible due to environmental impacts such as animal habitats, construction access or noise, flood risk and/or cost. While on our tour, Lee Hall explained to us the impact of the 2013 floods and photovoltaic power such as solar panels. This technology is at the forefront of green energy and can help provide an inexpensive renewable energy and food source.

We toured an agrivoltaic project in Longmont, Jack’s Solar Garden, with the purpose of learning about the fundamentals to bring this cutting-edge idea to Lyons. Our tour guide Andy Bingle, a Lyons resident and the Education Director of the Colorado AgriVoltaic Learning Center (CALC), stated, “An agrivoltaic solar array not only brings pollinators to the installation but also attracts the attention of people, one of the most important ingredients in an agrivoltaic array. The site can become a living laboratory for local students as they study plant growth, soil health, and solar production while developing the skills they need to be the sustainability leaders of the future.”

The Colorado AgriVoltaic Learning Center is a Longmont-based nonprofit project under the larger organization called the Colorado Nonprofit Development Center that inspires sustainability leaders by connecting students and community members to clean energy, local food, and responsible land use through experiential agrivoltaic farm tours and events. The opportunity exists to pair students from Lyons Middle/Senior High School with CALC to teach the importance of sustainability and encourage students to explore science, technology, engineering, and math (STEM) programs in college.

This project is still in the early developmental phase, and as students, we are working through all the challenges that arise with help from professionals, our professors, and Lyons staff. The next step of the feasibility study is to share our suggestions about how to incorporate the solar farm and request town input on our ideas. We will be hosting a virtual town hall on Thursday, April 1, 2021, from 6 p.m. to 7 p.m., with the purpose of receiving feedback from the residents of Lyons. This town hall will be conducted via the following zoom link, https://us02web.zoom.us/j/84556406300. A short presentation will be given detailing the feasibility of each site reviewed and the pros and cons of agrivoltaics.

We look forward to speaking with the residents of Lyons about the potential sites, the overall solar project, and the possibility of future amenities being added to Bohn Park.

Brittany LeMarc is a student at U.C. Denver and will receive her B.S. Degree in Civil Engineering and a Construction Management Minor in May, 2021.
Exhibit 31: Redstone Review Article from March 2021

Solar energy farm coup

By Brittany LeMarc
Redstone Review

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This group of CU Denver students will work with the Town of Lyons. (Right, top to bottom) Mauricio Chavez, Brittany LeMarc, Kevin Chen. All six will be graduating in May 2021 with Bachelor of Science degrees in engineering.

and helping draft the report for a state grant to build the solar farm. The grant would come from the Colorado Department of Local Affairs (DOLA), and their purpose is to help municipalities create new projects just like this one.

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Our idea to combine the solar panels with a returning park amenity, the community garden, was born. The possibility of adding new park amenities opens the door for Lyons to become one of the first public parks in the nation with an agrivoltaics project. Agrivoltaics is the idea of combining agriculture such as farming or gardening with
of Lyons’ electricity

photovoltaic power such as solar panels. This technology is at the forefront of green energy and can help provide an inexpensive renewable energy and food source.

We toured an agrivoltaic project in Longmont, Jack’s Solar Garden, with the purpose of learning about the fundamentals to bring this cutting-edge idea to Lyons. Our tour guide Andy Bingle, a Lyons resident and the Education Director of the Colorado Agrivoltaic Learning Center (CALC), stated, “An agrivoltaic solar array not only brings pollinators to the installation but also attracts the attention of people, one of the most important ingredients in an agrivoltaic array. The site can become a living laboratory for local students as they study plant growth, soil health, and solar production while developing the skills they need to be the sustainability leaders of the future.”

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Exhibit 32
Redstone Review article from April 2021

Contains:
4 Photos Total
1 Full Photo of News Article
3 Cropped Photos – 1 Photo per Article Column
Town Hall Zoom meeting is held to answer questions on proposed Lyons Solar Farm

By Brittany LeMarc and Lee Hall
Redstone Review

LYONS – The first Lyons Solar Farm virtual town hall was held on Thursday April 1. There were 24 attendees including a good turnout from the residents of Lyons.

The Zoom meeting was hosted by the University of Colorado Denver Solar Farm Feasibility Study team, which provided a short presentation detailing the project. The U.C. Denver team is Mauricio Chavez, Brittany LeMarc (me), Kevin Riker, Chandler Kinson, Elvira Martinez and Omima Abdou. All six will be graduating in May with Bachelor of Science in Civil Engineering degrees. The Town of Lyons has partnered with the student team and the Lyons Utilities and Engineering Board (UEB) to create a solar farm viability study. The objective of the solar farm is to supply five percent of the of the electrical needs of the town or Lyons.

The presentation covered general knowledge of how a solar farm works, an overview of all the sites considered while concentrating on the four most feasible options, and a brief summary of agrihoods. A large portion of the meeting was dedicated to collecting feedback and answering questions.

The power point presentation from the meeting is available at tinyurl.com/3bweqf. Here is a partial list of questions and paraphrased answers from the meeting:

Question 1: Can you explain why the parking lot would be the best location for agrihoods, and not the bike park or dog park locations?
Answer: Public vehicle access is not available at the bike park or dog park locations.

Question 2: How many acres of the 10-acre dog park would be needed?
Answer: Approximately one acre of land would be needed.

Question 3: How will the solar installation be paid for?
Answer: Residential and commercial rate payers will pay for the system just by paying their electric bills as they do normally. No rate change is planned while the system pays for itself – which is expected to take about 20 years. The system would be warranted for 25 years, but could produce nearly free energy for the remainder of its 40- to 50-year life cycle. That low-cost energy could save Lyons’ rate payers hundreds of thousands of dollars in the long run.

Question 4: What are the pros and cons of siting the solar farm within town limits versus somewhere else?
Answer: The pros of siting it outside of town limits include not consuming open space – of which Lyons has a very finite amount. The cons include increased costs. The costs of leasing or purchasing land along with the legal agreements and transmission costs would likely preclude the financial viability of the project.

Question 5: Will town residents need to vote to change the use of some of the proposed areas?
Answer: Yes for the site in Bohin Park, which is zoned Parks and Open Space (POS). No for the dog park, which is zoned Municipal Facilities and Services (note: some zoning maps incorrectly show it as POS). While the risk of a “no” vote is real, the cost of using the dog park location is high – both financially and in terms of impact on contiguous tracts of open space.

The next town hall will be on Thursday, April 15, 2021 from 6 p.m. to 7 p.m. The Zoom link is underenvz.zoom.us/j/91290811881. All Lyons community members are encouraged to attend. The more perspectives, questions and concerns that are shared, the better the project can be planned and designed to suit the whole community.

The feasibility study team plans to cover the same information as the first presentation to ensure that any citizens that missed the opportunity of attending can have all their questions and comments addressed. They will also be adding information on rough cost estimates for the three main sites, which are located within Bohin Park and the dog park.

Brittany LeMarc is a student at U.C. Denver and will receive her B.S. Degree in Civil Engineering and a Construction Management minor in May 2021.
Lee Hall is a member of the UEB, works with the U.C. Denver student team and a local computer technician who handles many of our computer disasters and deadline challenges.
Town Hall Zoom meeting questions on proposed solar farm

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t is held to answer Lyons Solar Farm

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Exhibit 32: Redstone Review article from April 2021

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Lee Hall is a member of the UEB, works with the U.C. Denver student team and a local computer technician who handles many of our computer disasters and deadline challenges.

Lyons to create a solar farm feasibility study. They are (left to right) Riker, Chandler Kitson, Elvia Martinez, and Omima Ab-Science in Civil Engineering degrees.
Exhibit 33

Town of Lyons E-Blast for Virtual Town Halls

Contains E-Blast from Dates:

March 30th, 2021 at 9:08 AM

April 1st, 2021 at 4:15 PM

April 14th, 2021 at 5:33 PM

April 15th, 2021 at 11:32 AM
Exhibit 33: Town of Lyons E-Blast for Virtual Town Halls

Above Photo: E-Blast from March 30th, 2021 at 9:08 AM
Below Photo: E-Blast from April 1st, 2021 at 4:15 PM
Exhibit 33: Town of Lyons E-Blast for Virtual Town Halls

Above Photo: E-Blast from April 14th, 2021 at 5:33 PM
Below Photo: E-Blast from April 15th, 2021 at 11:32 AM
Exhibit 34
Virtual Town Hall on April 1st, 2021

Contains:
1 Page of Participants and Questions Asked
7 Pages of PowerPoint Presentation Slides
DVD of Recorded Town Hall
First Lyons Town Hall

Presentation Time: 6:05PM

Participants at start: 24 (Mauricio Chavez, Brittany LeMarc, Andy Bingle, Ben Duhl, Ben Rodman, Bill Kitson, CJ Kitson, Dave Hatchimonji, Dawn, Dayton Jones, DK, Don, Jim Kerr, Kara Baumann, Kevin Riker, Kim, Lee Hall, Linda, Paul Dreyer, Stephen Kane, Victoria, Omima Abdeou, Laurie Harper, Elvia Martinez)

Questions:

1. Andy (6:15) - Can you explain why the parking lot would be the best location for agrivoltaics, and not the Bohn or Dog Park locations?
2. Victoria (6:15) - How many acres of the 10-acre dog park would be needed?
3. Laurie Harper (6:15) - How will the solar installation, etc. be paid for?
4. Kim (6:16) - Can you show the Bohn example for everyone again, so we can see it?
5. Paul Dreyer (6:22) - Has this been discussed with the Board of Trustees at all yet?
6. Paul Dreyer (6:22) - If we wanted to get 10% of our power from PV farm, would that mean adding twice as many panels or can you get economies of scale in some way as the farm gets bigger?
7. Dave Hatchimonji (6:23) - What are the pros and cons of siting the CSG in town versus somewhere else that is in MEAN territory?
8. Kim (6:27) - Will the residents need to vote to change the use of some of the proposed areas? E.g., Dog Park, SW Bohn Park, Bohn Parking lot? (And could the host show those sites again?)
9. Laurie Harper (6:29) - What is the total cost of the project?
10. Laurie Harper (6:29) - Who will actually benefit from 5% 'NO/low cost' Power?
11. Andy Bingle (6:31) - How is the April 15th Town Hall going to be different than this one?
12. Dave Hatchimonji (6:33) - Have you evaluated other financing tools besides the outright purchase. E.g., lease, PPA that may include maintenance costs?
13. Ben Rodman (6:34) - what is PPA? (Dave Hatchimonji responded “power purchase agreement.”)
14. Ben Rodman (6:36) - Is there an estimate available for the additional cost to build a typical PV array vs agrivoltaics?
15. Laurie Harper (6:36) - If the panels were located in Bohn Park, WHERE are we talking? In existing west lot? Or adjacent to waste water treatment plant?
16. Kim (6:36) - Do any of you know of other similar sized communities in Colorado that have undertaken a similar size/scope of project?
17. Paul Dreyer (6:37) - OPINION QUESTION: Do you think a PV farm in Lyons could help with bringing in new future businesses?
18. Aimee Kane (6:48) - I wonder if we can do 2 of the sites - if we have discounts from 3rd party ownership and grants? The same costs as a full 5% offset of our town’s consumption? Just a thought. Right now, I’m leaning towards the SW dog park + Bohn Park Parking lot (agrivoltaics). Could we get some information on this possibility for the next presentation?
19. Don (6:48) - Where is the best point to access the grid?

Feedback/Suggestions:

1. If someone asks a question about a specific site during the Q&A section, make that slide visible in the zoom meeting for everyone to reference.
Exhibit 34: Virtual Town Hall on April 1st, 2021 (Participants, Questions, Presentation, DVD)

Town of Lyons
Solar Farm Feasibility Project

Presentation Brought to you by:
The University of Colorado at Denver Student Team

AGENDA

- Rules for Virtual Town Hall
- Introductions
- Presentation
- Feedback & Public Input
Rules for Feedback & Input

01. Please keep all microphones muted during the town hall.
02. Type all questions, feedback or input into the zoom chat box.
03. Be sure to include your name at the beginning of each question or comment.
04. We will try our best to address feedback. Each response will be kept to around 2 minutes.
05. All feedback will be logged for record as we continue to work on this project.

Student Team Members
University of Colorado at Denver
Spring 2021: Senior Design Class

01. Brittany Lattanz
02. Mauricio Chavez
03. Chandler (C.J.) Kelson
04. Kevin Nekar
05. Eliza Martinez
06. Ominika Abbeau
Exhibit 34: Virtual Town Hall on April 1st, 2021 (Participants, Questions, Presentation, DVD)

Project Experts

Lee Hall
Town of Lyons Staff
Volunteer on the Utility & Engineering Board

Jim Kerr
Town of Lyons Resident
Volunteer on the Utility & Engineering Board

Solar Overview

HOW DOES COMMUNITY SOLAR WORK?

SOURCE → DELIVERY → CUSTOMER
Exhibit 34: Virtual Town Hall on April 1st, 2021 (Participants, Questions, Presentation, DVD)

Potential Sites Overview

Eight Total Sites
- Environmental impacts
- Construction cost
- Flood risk
- Solar studies
- Geotechnical concerns

Tank Hill Location
© Reese Street, Lyons, Colorado

Site Considerations
- Added cost of removing the water tank.
- Location and soil properties would increase cost of construction.
- Would accommodate only half of the solar panels necessary to meet energy goal.
- Possible fox den impacts
Exhibit 34: Virtual Town Hall on April 1st, 2021 (Participants, Questions, Presentation, DVD)

Southwest Dog Park
6 Bradford St, Lyons, Colorado

Site Considerations
- > 95% solar access
- Outside of the flood region
- Would only take up a small section of dog park.
- Room for potential future expansion

Bohn Park - Near Bike Area
199 2nd Ave, Lyons, Colorado

Site Considerations
- > 95% solar access
- Currently an unused and secluded parcel of land
- Outside of the flood region
- No room for future potential expansion
Bohn Park Parking Lot
199 2nd Ave., Lyons, Colorado

Site Considerations
- Would add covered parking to the park
- Could present opportunity to add shade garden park amenity
- Added cost of carport construction
- Lower cost to access phase 3 power
- Lies within 0.2% chance flood region

Agrivoltaics

Overview
- Idea of combining agriculture such as farming or gardening with photovoltaic power such as solar panels
- Making dual use of same land
- Construction cost increases
Thanks

From the University of Colorado at Denver Student Team

We Plan to Host a Follow-up Virtual Town Hall on
Thursday, April 15th, 2021
6:00 PM – 7:00 PM

The Zoom Link:
https://ucdenver.zoom.us/j/91290801881

Rules for Feedback & Input

01. Please keep all microphones muted during the town hall.
02. Type all questions, feedback or input into the zoom chat box.
03. Be sure to include your name at the beginning of each question or comment.
04. We will try our best to address feedback. Each response will be kept to around 2 minutes.
05. All feedback will be logged for record as we continue to work on this project.
Exhibit 34: Virtual Town Hall on April 1st, 2021 (Participants, Questions, Presentation, DVD)

DVD of Virtual Town Hall held on April 1st, 2021
Exhibit 35
Virtual Town Hall on April 15th, 2021

Contains:
3 Pages of Participants and Questions Asked
8 Pages of PowerPoint Presentation Slides
DVD of Recorded Town Hall
Second Lyons Town Hall

Presentation Time: 6:05-6:55PM
April 15, 2021

Participants at Start: 23 (Brittany LeMarc, CJ Kitson, Mauricio Chavez, Kevin Riker, Omima Abdoun, Elvia Martinez, Ben Rodman, Lee Hall, Jim Kerr, Arron Caplin, Rhonda Vandenbos, Kara Bouman, Jane Allo, Ben Thomas, Kate Kerr, Diane, Bonnie Disalvo, Kim M, Brent, Julie Boyle, Richard Bennett, Andy Bingle, Don)

Questions:
1. Question: (Julie Boyle) The bike park area is not unused.
2. Question: (Ben Thomas) We will be able to acquire 332 kW in 1 acre?
3. Question: (Jane Allo) Is energy storage considered in this plan?
4. Question: (Ben Thomas) what is the target size of the plant?
5. Question: (Ben Thomas) was there any consideration of residents being able to fund solar rather than roof install?
6. Question: (Julie Boyle) If agrovoltaic project is considered, what consideration has been given to transportation of tools to, and tools and harvest from, site? I would suggest that garden carts be given consideration:
7. Question: (Jane Allo) Would the Town of Lyons be interested in looking at a beta system from ElektrikGreen, elektrikgreen.com?
8. Question: (Dave) what were the pros and cons of the Public Works location east of town on 56?
9. Question: (Jane Allo) What would peak shaving be worth monetarily to the town of Lyons?
10. Question: (Rick DiSalvo) Would it be feasible to get 5% by installing this amount of solar on rooftops around town by offering homeowners a subsidy?
11. Question: (Ben Rodman) Can you briefly discuss the reasons the wastewater plant site is not in the running, especially if the power may be used to power that plant during an outage?
12. Question: (Ben Rodman) It is in flood way, which is a higher risk than flood plain.
13. Question: (Jane Alto) I understand your concern with battery prices, have you considered other means of storage? I am talking about a different type of energy storage, please take a few minutes to look at the ElektrikGreen website. ElektrikGreen is a Lyons based company bringing greener, safer energy storage to the United States.
14. Question: (Julie Boyle) Aaron sent an email today discussing the load on transformers of increased e-vehicle usage. The article he sent discussed the value of rooftop solar for removing some of that load from major transformers.
15. Question: (Ben Thomas) Was there any discussion about off peak rates to shift load and reduce peak?
16. Question: (Don) Does the 10% limit include individual residential or commercial installations?
17. Question: (Dave) a couple of the sites may require a vote of the residents. Can you build in an option B in case the preferred site is voted down? Don't want to lose this opportunity to leverage outside funding.
18. Question: (Jane Alto) Would that 5% limitation still be a limitation if the town of Lyons be able to install storage?
19. Question: (Don) what is the source of MEAN's power?
20. Question: (Bonnie Disalvo) Rick Have you talked with Jim Carroll and Kathy Carroll who live just south of the preferred location?
21. Question: (Diane) What is DOLA?
22. Question: (Facebook Group) More potential encroachment on parks/rec space?
Feedback/Comments:

1. Julie Boyle suggested that the bike park area is not unused, referring to our misspoken comment.

2. Brent Moellenberg: I really like the idea of combining the solar mounts with shade for cars at Bohn Park. Gives dual purpose.


4. Jane Alto: I really like the idea of the Dog Park since there is room to grow.

5. Aaron Caplin: Just wanted to say thank you to the CU group for your work on this.
   Hopefully it is beneficial for all of you to help understand what is involved in public projects and the multiple aspects that need to be considered. It takes patience and persistence to keep working towards a goal that involves multiple perspectives.

6. I support the solar farm, but I also support gathering data extensively, via the new meters, before we make other decisions about the whole energy scenario. (Jim Kerr) We need a year's worth of data (cite Fort Collins). We will move toward time of rate, rate structure, which is the direction that it is going. It doesn't favor rooftop because solar production doesn't coincide with peak usage.
Exhibit 35: Virtual Town Hall on April 15th, 2021 (Participants, Questions, Presentation, DVD)

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05. All feedback will be logged for record as we continue to work on this project.

Student Team Members
University of Colorado at Denver
Spring 2021: Senior Design Class

01. Brittany Lathane
02. Mauricio Chavez
03. Chandler (E.J.) Kilton
04. Kevin Wilcox
05. Ilona Martine
06. Olima Abdoum
Project Experts
Town of Lyons Staff and Volunteers

Lee Hall
Town of Lyons Resident
Volunteer on the Utility & Engineering Board

Jim Kerr
Town of Lyons Resident
Volunteer on the Utility & Engineering Board

Solar Overview

How does community solar work?

Source → Delivery → Customer
Exhibit 35: Virtual Town Hall on April 15th, 2021 (Participants, Questions, Presentation, DVD)

Potential Sites Overview

- Environmental impacts
- Construction cost
- Flood risk
- Solar studies
- Geotechnical concerns

Tank Hill Location
© Reese Street, Lyons, Colorado

Site Considerations
- Added cost of removing the water tank.
- Location and soil properties would increase cost of construction.
- Would accommodate only half of the solar panels necessary to meet energy goal.
- Possible fox den impacts
Southwest Dog Park
6 Bradford Stree, Lyons, Colorado

Site Considerations
- > 90% solar access
- Outside of the flood region
- Would only take up a small section of dog park.
- Room for potential future expansion

Bohn Park - Near Bike Area
199 2nd Ave, Lyons, Colorado

Site Considerations
- > 90% solar access
- Currently an unused and secluded parcel of land
- Outside of the flood region
- No room for future potential expansion
Exhibit 35: Virtual Town Hall on April 15th, 2021 (Participants, Questions, Presentation, DVD)

Bohn Park Parking Lot
199 2nd Ave., Lyons, Colorado

Site Considerations
- Would add covered parking to the park
- Could present opportunity to add shade garden park amenity
- Added cost of carport construction
- Lower cost to access phase-3 power
- Lies within 0.2% chance flood region

Agrivoltaics

Overview
- Idea of combining agriculture such as farming or gardening with photovoltaic power such as solar panels
- Making dual use of same land
- Construction cost increases
Exhibit 35: Virtual Town Hall on April 15th, 2021 (Participants, Questions, Presentation, DVD)

**Finances**

**Rough Cost Estimate**
- Design
- Labor
- PV Panels and Components
- Ground Mounts/Carport
- Geotechnical Report
- Earthwork
- Underground Power Distribution
- Special Election
- Legal & Administration Fees
- 50% of cost covered by DOLA grant
- 12% of cost by Collective Sun ITC

**Return on Investment (ROI)**
- Operation & Maintenance Cost
- Solar Panel Degradation
- Electricity Rate Escalation
- Insurance
- Loan Interest
- Life Span
- Salvage

**Site Overview**

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13 14 7
Thanks
From the University of Colorado at Denver Student Team

Brittany LeMare
Mauricio Chavez
Chandler (CJ) Kilson
Kevin Riker
Elvia Martinez
Omima Abdulnour

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Exhibit 35: Virtual Town Hall on April 15th, 2021 (Participants, Questions, Presentation, DVD)

DVD of Virtual Town Hall held on April 15th, 2021
Exhibit 36
Select Answers to Virtual Town Hall Questions

Contains:
Top 22 questions and answers.
Select Answers to Virtual Town Hall Questions

1. Question: (Julie Boyle) The bike park area is not unused.
   a. Answer: (Aaron Caplin) This would be South West of the current Bike Park between the Bike Park and the House that is there, the Caroll’s property.
2. Question: (Ben Thomas) We will be able to acquire 332 kW in 1 acre?
   a. Answer: (Lee Hall) 1 to 1 and a half most likely.
3. Question: (Jane Allo) Is energy storage considered in this plan?
   a. Answer: (Lee Hall) It is something we want very badly, something of huge importance in usability and value in energy, but also for the resiliency it could add to our own grid in Lyon’s. Unfortunately, at this time, storage is beyond financial capability. (Jim Kerr) We could potentially match storage and use that storage for an outage to keep wastewater treatment plan going. (Lee Hall) The storage could be used to increase our peak usage.
4. Question: (Ben Thomas) what is the target size of the plant?
   a. Answer: (Lee Hall) 332 kW
5. Question: (Ben Thomas) was there any consideration of residents being able to fund solar rather than roof install?
   a. Answer: (Jim Kerr) Utility size installations are more cost effective than rooftop solar. Solar is more economical. We don’t have to subsidize electric rates. In the long run, it’ll be a cost positive.
6. Question: (Julie Boyle) If agrovoltaic project is considered, what consideration has been given to transportation of tools to, and tools and harvest from, site? I would suggest that garden carts be given consideration:
   a. Answer: (Brittany) We could be able to park your car and bring what you need to the shade garden. This is the most expensive option and lies in the floodway region. (Lee Hall) As far as agrovoltaics is concerned, per a meeting with parks and rec, a community garden in the bike/dog park is strictly not going to happen due to public vehicular access.
Exhibit 36: Select Answers to Virtual Town Hall Questions

7. Question: (Jane Allo) Would the Town of Lyons be interested in looking at a beta system from ElektrikGreen, elektrikgreen.com?
   a. Answer: (Kevin Riker) Putting in storage is not financially feasible at the moment, however I'm sure it will be put into consideration in the future.

8. Question: (Dave) what were the pros and cons of the Public Works location east of town on 66?
   a. Answer: (Kevin) The public works location isn't a potential site location. (Lee Hall) Sold to private interest/consumed by public works building and facility.

9. Question: (Jane Allo) What would peak shaving be worth monetarily to the town of Lyons?
   a. Answer: (Jim Kerr) We haven't been looking at shaving cost at this point in time. It will be considered in the future. (Lee Hall) Cost curve is too high, pushed out of fiscal responsibility. (Jim Kerr) Battery prices will come down in the future making it a better time to look at it.

10. Question: (Rick DiSalvo) Would it be feasible to get 5% by installing this amount of solar on rooftops around town by offering homeowners a subsidy?
    a. Answer: (Brittany) It doesn't make sense to have personal 1 to 1 meters. We are trying to use land that is already owned by the town of Lyons.

11. Question: (Ben Rodman) Can you briefly discuss the reasons the wastewater plant site is not in the running, especially if the power may be used to power that plant during an outage?
    a. Answer: (Kevin Riker) Flood risk makes it impossible.

12. Question: (Ben Rodman) It is in flood way, which is a higher risk than flood plain.
    a. Answer: (Kevin) Yes, it is in a flood way and flood plain.

13. Question: (Jane Alto) I understand your concern with battery prices, have you considered other means of storage? I am talking about a different type of energy storage, please take a few minutes to look at the ElektrikGreen website. ElektrikGreen is a Lyons based company bringing greener, safer energy storage to the United States.
    a. Answer: (Jim Kerr) No, at this time we haven't looked at others. If you know of any let us know.
14. Question: (Julie Boyle) Aaron sent an email today discussing the load on transformers of increased e-vehicle usage. The article he sent discussed the value of rooftop solar for removing some of that load from major transformers.
   a. Answer: (Lee Hall)

15. Question: (Ben Thomas) Was there any discussion about off peak rates to shift load and reduce peak?
   a. Answer: (Jim Kerr) Our plan is to move the town use rates in the future. We are installing smart meters which allow us to do that. We view solar farm as separate from that and not dependent on time of use pricing.

16. Question: (Don) Does the 10% limit include individual residential or commercial installations?
   a. Answer: (Brittany) It’s 5%. Lyons have contract with MEAN. They can only have 5% as of now. There is room to expand but no timetable, so at the moment we are only able to use 5%. (Lee Hall) 5% limit is on town of Lyons as a municipality.

17. Question: (Dave) a couple of the sites may require a vote of the residents. Can you build in an option B in case the preferred site is voted down? Don’t want to lose this opportunity to leverage outside funding.
   a. Answer: (Lee Hall) One of the biggest challenges facing this project is where does it get sited? Bohn Park? The easier route is to go with the dog park because it is owned municipal. It is zoned for things just like this (solar farm). We value the open space in the dog park/considering cost to bringing power out there (cheaper than though). We might have dog park as contingency plan.

18. Question: (Jane Allo) Would that 5% limitation still be a limitation if the town of Lyons be able to install storage?
   a. Answer: (Jim Kerr) Yes, storage does not affect 5% (Lee Hall) It’s conceivable as storage gets considered by MEAN. There is a possibility engineers might be able to take that storage into consideration when considering the 5% limitation, though years down the road.

19. Question: (Don) what is the source of MEAN’s power?
   a. Answer: (Jim Kerr) 50% coal, other percentages include nuclear, hydroelectric wind power.
20. Question: (Bonnie Disalvo) Rick Have you talked with Jim Carroll and Kathy Carroll who live just south of the preferred location?
   a. Answer: (Brittany) They are in support of establishing this solar farm and insuring land next to them goes into good use. (Lee Hall) There is a memorandum of agreement which limits what happens in that portion of Bohn park, which is why I went to the Carrolls and discussed the overall vision of the sites (bike park/dog park). At that time, they expressed quite clearly that they had a preference for the bike park location.

21. Question: (Diane) What is DOLA?
   a. Answer: (Ben Rodman) Department of Local Affairs

22. Question: (Facebook Group) More potential encroachment on parks/rec space?
   a. Answer: (Lee Hall) People of Lyon's value what open space we have in town. It is finite. It is something that needs to be discussed very seriously. Most of the people I've spoken with about this (solar project) is overwhelmingly positive and supportive. Do it smart, do it the best way, but do it. I thank these people for their consent and concerns. We want to hear more from everyone, and needs to be a community discussion, especially if we are going to expend even one acre of our precious space.
Exhibit 37
Team Journal

Contains:
Contact Info
Availability
Task Schedule
### Exhibit 37: Team Journal (Contact Info, Availability, & Task Schedule)

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peter Marxhausen</td>
<td><a href="mailto:peter.marxhausen@ucdenver.edu">peter.marxhausen@ucdenver.edu</a></td>
<td>Cell: 720-618-6473</td>
</tr>
<tr>
<td>Heidi Brothers</td>
<td><a href="mailto:heidi.brothers@ucdenver.edu">heidi.brothers@ucdenver.edu</a></td>
<td>Home: 303-471-2872</td>
</tr>
<tr>
<td>Lee Hall</td>
<td><a href="mailto:leehall@leehall.com">leehall@leehall.com</a></td>
<td>Work: 720-789-7198</td>
</tr>
<tr>
<td>Jim Kerr</td>
<td><a href="mailto:kerrjamesf@gmail.com">kerrjamesf@gmail.com</a></td>
<td>Cell: 719-640-1212</td>
</tr>
<tr>
<td>Ben Rodman</td>
<td><a href="mailto:brodman@townoflyons.com">brodman@townoflyons.com</a></td>
<td>Cell: 303-888-1110</td>
</tr>
<tr>
<td>Aaron Caplan</td>
<td><a href="mailto:acaplan@townoflyons.com">acaplan@townoflyons.com</a></td>
<td></td>
</tr>
<tr>
<td>Chris La May</td>
<td><a href="mailto:chris.la.may@state.co.us">chris.la.may@state.co.us</a></td>
<td></td>
</tr>
<tr>
<td>Jeffrey Wood</td>
<td><a href="mailto:jeffrey.wood@ucdenver.edu">jeffrey.wood@ucdenver.edu</a></td>
<td></td>
</tr>
<tr>
<td>Jody Beck</td>
<td><a href="mailto:jody.beck@ucdenver.edu">jody.beck@ucdenver.edu</a></td>
<td></td>
</tr>
<tr>
<td>Brittany LeMarc</td>
<td><a href="mailto:brittany.lemarc@ucdenver.edu">brittany.lemarc@ucdenver.edu</a></td>
<td>303-435-6449</td>
</tr>
<tr>
<td>Kevin Riker</td>
<td><a href="mailto:kevin.riker@ucdenver.edu">kevin.riker@ucdenver.edu</a></td>
<td>720-879-8493</td>
</tr>
<tr>
<td>Mauricio Chavez</td>
<td><a href="mailto:mauricio.a.chavez@ucdenver.edu">mauricio.a.chavez@ucdenver.edu</a></td>
<td>615-319-1688</td>
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<tr>
<td>Elvia Martinez</td>
<td><a href="mailto:elvia.martinez@ucdenver.edu">elvia.martinez@ucdenver.edu</a></td>
<td>720-220-2953</td>
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<td>Omima Abdoun</td>
<td><a href="mailto:omima.abdoun@ucdenver.edu">omima.abdoun@ucdenver.edu</a></td>
<td>720-427-6477</td>
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<tr>
<td>CJ Kitson</td>
<td><a href="mailto:chandler.kitson@ucdenver.edu">chandler.kitson@ucdenver.edu</a></td>
<td>567-686-5022</td>
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<table>
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<th>Name</th>
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<tr>
<td>Peter Marxhausen</td>
<td>Senior Design Professor</td>
</tr>
<tr>
<td>Heidi Brothers</td>
<td>Lyons Group Contact Professor</td>
</tr>
<tr>
<td>Lee Hall</td>
<td>Point of Contact for Lyons Solar Farm</td>
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<tr>
<td>Jim Kerr</td>
<td>Town of Lyons- Chair of Utilities &amp; Engineering Board</td>
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<td>Ben Rodman</td>
<td>Town of Lyons Staff Member- Sustainability Coordinator</td>
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<td>Aaron Caplan</td>
<td>Town of Lyons Staff Member- Director of Utilities &amp; Engineering</td>
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<tr>
<td>Chris La May</td>
<td>Contact with DOLA who has approved this project and submittials will go to him</td>
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<td>Jeffrey Wood</td>
<td>Public Outreach/ Arch Program with CAP/Started the project before Lee Hall took over</td>
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<tr>
<td>Jody Beck</td>
<td>Arch with CAP at UC Denver</td>
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<td>Brittany LeMarc</td>
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Exhibit 37: Team Journal (Contact Info, Availability, & Task Schedule)

### Monday

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<td>1</td>
<td>01/17/21</td>
<td>01/23/21</td>
<td>Get Familiar with the Project and files</td>
</tr>
<tr>
<td>2</td>
<td>01/24/21</td>
<td>01/30/21</td>
<td>Contact Heidi Brothers to help start project</td>
</tr>
<tr>
<td>3</td>
<td>01/31/21</td>
<td>02/06/21</td>
<td>Start Organizing Files and Create Teams Group</td>
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<tr>
<td>4</td>
<td>02/07/21</td>
<td>02/13/21</td>
<td>First Draft of Feasibility Report</td>
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<tr>
<td>5</td>
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<td>Come up with 5 questions about the project</td>
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<td>6</td>
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<td>Initial Client Meeting</td>
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<td>7</td>
<td>02/14/21</td>
<td>02/20/21</td>
<td>Look at Alternative Solar Companies</td>
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<tr>
<td>8</td>
<td>02/21/21</td>
<td>02/27/21</td>
<td>Use USGS to get topograph data for each site</td>
</tr>
<tr>
<td>9</td>
<td>02/21/21</td>
<td>02/27/21</td>
<td>Establishing Official Schedule for Project</td>
</tr>
<tr>
<td>10</td>
<td>02/21/21</td>
<td>02/27/21</td>
<td>Contact Jody Beck &amp; Jeff Wood about public outreach</td>
</tr>
<tr>
<td>11</td>
<td>02/21/21</td>
<td>02/27/21</td>
<td>Learn about Contract with MEAN</td>
</tr>
<tr>
<td>12</td>
<td>02/21/21</td>
<td>02/27/21</td>
<td>Reach Out to Aurora Solar to use their software</td>
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<tr>
<td>13</td>
<td>02/21/21</td>
<td>02/27/21</td>
<td>Flood &amp; Water Research</td>
</tr>
<tr>
<td>14</td>
<td>02/21/21</td>
<td>02/27/21</td>
<td>Visiting town of Lyons all 8 sites</td>
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<td>15</td>
<td>02/21/21</td>
<td>02/27/21</td>
<td>Visiting Jack's Solar Farm in Longmont</td>
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<tr>
<td>16</td>
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<td>02/27/21</td>
<td>Narrow down site options and prioritize</td>
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<tr>
<td>17</td>
<td>02/21/21</td>
<td>02/27/21</td>
<td>Skeleton Report</td>
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<td>Research for Environmental impacts</td>
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<td>19</td>
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<td>37</td>
<td>02/21/21</td>
<td>02/27/21</td>
<td>Write Redstone Review Article</td>
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<td>38</td>
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<td>Research for Environmental impacts</td>
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<td>43</td>
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<td>Research for Environmental impacts</td>
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<td>02/27/21</td>
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<td>50</td>
<td>02/21/21</td>
<td>02/27/21</td>
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</tr>
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</table>
Exhibit 38
Team Meeting Minutes

Contains these following dates:

January
24th, 26th, and 31st

February
5th, 7th, 9th, 14th, 18th, 24th, and 28th

March
4th, 7th, 14th, 21st, 25th, and 28th

April
5th, 11th, 25th, 29th, and 30th

May
2nd, 6th, and 7th
Exhibit 38: Team Meeting Minutes

City of Lyons Solar Farm Feasibility Study Meeting Minutes

<table>
<thead>
<tr>
<th>Meeting Date and Time</th>
<th>24-Jan-2021, 12:00PM</th>
<th>Meeting Location</th>
<th>Teams</th>
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<tr>
<td>Meeting Organizer</td>
<td>Brittany LeMarc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting Duration</td>
<td>12:00-1:30 PM</td>
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</table>

<table>
<thead>
<tr>
<th>Attendees</th>
<th>Apologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Brittany LeMarc</td>
<td></td>
</tr>
<tr>
<td>2. Omima Abdoun</td>
<td></td>
</tr>
<tr>
<td>3. Mauricio Chavez</td>
<td></td>
</tr>
<tr>
<td>4. CJ Kitson</td>
<td></td>
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<tr>
<td>5. Elvia Martinez</td>
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<tr>
<td>6. Kevin Riker</td>
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</tr>
<tr>
<td>7. Heidi Brothers (briefly)</td>
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<tr>
<td>N/A</td>
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</table>

**Brief Description/Agenda**

As this was our teams first official meeting, our goal was to get everybody on the same page as far as what we think we know we’re doing, defining any questions we might have regarding the project/files sent to us, and determining what schedules might look like for our team moving forward. We had intended to collaborate with Dr. Heidi Brothers, but in our miscommunication she left the meeting prematurely. Brittany is working to reschedule with her.

**Summary of the Discussion**

Items discussed include questions regarding the limitations we might run into during our project, other companies/products we may want to research, etc. (See ‘Questions’ tab for 01/24). Our goal of getting a better understanding of our project was not accomplished, as Dr. Heidi Brothers was unable to attend most of this meeting, however, our team leader, Brittany, is working on rescheduling a meeting with her. Our team also devised a schedule that shows each others availability to meet in the future, for site visits, meetings with clients, etc.

**Conclusion**

The meeting concluded with all team members agreeing to continue to look into the files we received via Dropbox for better understanding of our scope, and to accumulate any questions we may have for Lee Hill once our meeting with him is scheduled. We concluded that our next steps involve meeting with Dr. Brothers, then meeting with Mr. Hill, then figuring out where to go from there. We suspect future meetings will be much more organized, but our first meeting was still a partial success.
City of Lyons Solar Farm Feasibility Study Meeting Minutes

<table>
<thead>
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<td>Meeting Duration</td>
<td>9:30-10:30 AM</td>
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<table>
<thead>
<tr>
<th>Attendees</th>
<th>Apologies</th>
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</thead>
<tbody>
<tr>
<td>1. Brittany LeMarc</td>
<td>N/A</td>
</tr>
<tr>
<td>2. Heidi Brothers</td>
<td>Meeting was intentionally kept small</td>
</tr>
<tr>
<td>3. Mauricio Chavez</td>
<td></td>
</tr>
<tr>
<td>4. Kevin Riker</td>
<td></td>
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</table>

**Brief Description/Agenda**

This is the first official meeting with Heidi Brothers, the professor attached to our Senior Design Project. We hope to get a general outline and figure out the parameters in which we are able to work within for the Lyons Solar Farm project.

**Summary of the Discussion**

We started the meeting by presenting what we have done so far as organization, schedule, meeting minutes, etc. to Heidi. We started asking technical questions (are there three or four sites, geotech reports, etc.) which should be directed to Lee. Questions Heidi suggested we ask Lee, specifically, include what ROI do we need specifically? what might other solar companies suggest? could we potentially gather geotech studies from previous construction operations (dog park, housing construction)? Dr. Heidi also suggested that she wanted to review any prelim reports before we submit them to the city.

**Conclusion**

In conclusion, this is a feasibility study, exclusively. We are not expected to design. We are expected to generate a cohesive report that the town receives in order to apply for the grant needed to continue this project. This includes identifying every issue we can possibly find, collectively, and summarizing it on our final report. We are identifying problems, not solving them. Dr. Heidi concluded by suggesting we should get responses from solar companies other than Namaste, as it provides more options for townspeople to review.
City of Lyons Solar Farm Feasibility Study Meeting Minutes

<table>
<thead>
<tr>
<th>Meeting Date and Time</th>
<th>Meeting Location</th>
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<table>
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</thead>
<tbody>
<tr>
<td>Brittany Lemarc</td>
<td>Omima Abdoun</td>
</tr>
<tr>
<td>Mauricio Chavez</td>
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<tr>
<td>CJ Kitson</td>
<td></td>
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<tr>
<td>Elvia Martinez</td>
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<tr>
<td>Kevin Riker</td>
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</table>

**Brief Description/Agenda**

The Agenda of this meeting was to discuss our meeting with Heidi regarding the overall scope and future plans of this project, plan our first meeting with client and go over the agenda.

**Summary of the Discussion**

Brittany started the meeting by mentioning emailing the client today to setup our first meeting. We also discussed the agenda we plan on going over on the first meeting with our client. Elvia volunteered to do additional research into other solar installation companies. Brittany raised the question if the solar panels can be elevated. CJ volunteered to look into surveying companies/USGS map options for elevation/gradation. Brittany is planning to reach out to Omima about finding methods of outreach the community of Lyons.

**Conclusion**

This meeting was intended to discuss our plan for tackling the first meeting with our client. We discussed our agenda and are prepared for our first meeting. We also assigned a few tasks to accomplish to better prepare us for the meeting such as company and community outreach research.
Exhibit 38: Team Meeting Minutes

<table>
<thead>
<tr>
<th>City of Lyons Solar Farm Feasibility Study Meeting Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meeting Date and Time</strong></td>
</tr>
<tr>
<td><strong>Meeting Organizer</strong></td>
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</table>

<table>
<thead>
<tr>
<th>Attendees</th>
<th>Apologies</th>
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<tbody>
<tr>
<td>Brittany Lemarc</td>
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<tr>
<td>Mauricio Chavez</td>
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<td>CJ Kitson</td>
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<td>Elvia Martinez</td>
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<td>Kevin Riker</td>
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<tr>
<td>Omima Abdoun</td>
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<tr>
<td>Heidi Brothers</td>
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<tr>
<td>Ben Rodman</td>
<td></td>
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<tr>
<td>Lee Hall</td>
<td></td>
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<tr>
<td>Jim Kerr</td>
<td></td>
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<tr>
<td>Jeff Wood</td>
<td></td>
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<tr>
<td>Chris La May</td>
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<td>Aaron Caplin</td>
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</table>

**Brief Description/Agenda**

This is our initial meeting with our clients. We plan on going over our agenda which includes introductions, questions we have regarding expectations, site possibilities, schedule/changes, and our rough draft feasibility report.

***This meeting’s minutes are continued on the next page.***
### Summary of the Discussion

After brief introductions, the meeting continued based on items to be discussed in the agenda. **EXPECTATIONS:** Ben Rodman offered to be POC regarding questions involving public outreach. DOLA requires proof of public outreach for grant. The Redstone Review may be a potential source for outreach (monthly periodical). Our team needs to be very forward with the public regarding all facets of the project, particularly site selection. **SITES:** approx. 10-15% of the dog park could go toward solar farm. Tank Hill is less feasible due to rocky soil conditions. Wastewater treatment facility is less feasible due to flooding (DOLA may not approve). Top sites include dog park, bike path, Long's Peak drive locations. There is a potential for elevated, 'shade supplying' panels which our team will further look into, as well as other potential site locations. A local golden eagle habitat might prove a challenge if within half-mile radius of potential sites. Lee Hall says to contact him regarding questions involving restraints due to wildlife. Our team is planning on touring Jack's Solar Farm (south of Longmont) with clients on a date TBD. **SCHEDULE:** Our schedule will likely be revised at our next schedule team meeting (Feb 27). **FIRST DRAFT:** Several questions posed on our first rough draft were answered. We will not exceed 5% per MEAN’s expectations. Jim Kerr will be sending us averages from MEAN’s 2020 report. There has not been much feedback from the community with the exception of the article written by Redstone Review. All feedback has been positive thus far, but much more data will be needed moving forward. As far as solar supplying companies, Namaste is not our only option. IPower Alliance may be an option as well. It may be difficult obtaining estimates as this might be a charged service. Elvia volunteered to research other viable options as far as potential companies are concerned.

### Conclusion

The meeting concluded with suggestions given about the "Executive Summary" portion of the report. Suggestions included fitting in Lyon’s future goals regarding sustainability, reducing carbon footprint (~60% non-carbon sources by 2035). It was also suggested that we adjust our language in some areas (e.g. ‘Town’ of Lyon’s, not ‘City’, of Lyons; Don’t use ‘destruction’ of dog park, use ‘relocation,’ or don’t bring it up if not necessary). Overall, this meeting was highly instructive and will provide our team a number of objectives to capitalize on moving into our weekly scheduled meeting. Brittany also instructed our team to provide additional questions we might have coming into the next meeting. We will attempt to get a meeting going at Jack’s Solar ASAP.
City of Lyons Solar Farm Feasibility Study Meeting Minutes

Meeting Date and Time: 2/7/2021, 12:00PM
Meeting Location: Teams
Meeting Duration: 12:00-12:30PM

Attendees
Brittany Lemarc
Mauricio Chavez
CJ Kitson
Elvira Martinez
Omima Abdoun

Apologies
Kevin Riker

Brief Description/Agenda
This is our first team meeting following the Feb-5 meeting with the clients. We intend to go over scope and individual responsibilities.

Summary of the Discussion
Our team discussed making a plan to visit the potential sites in person before we attend a tour at Jack's Solar Farm this coming Friday, Feb-12. We further discussed the possibility for an elevated farm on top of the Bohn parking lot. Omima volunteered to do research into the water patterns at South Saint Vrain Creek by the Bohn parking lot.

Conclusion
Omima intends to research into the creek by Bohn Park. Elvia intends to contact CO Parks and Wildlife. Brittany is going to contact Lee Hill in regards to getting a field trip setup to tour Jack's Solar Farm.
## City of Lyons Solar Farm Feasibility Study Meeting Minutes

<table>
<thead>
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### Attendees
Brittany Lemarc  
Mauricio Chavez  
CJ Kitson  
Elvia Martinez  
Kevin Riker  
Omima Abdoun

### Apologies
N/A

### Brief Description/Agenda
This was just a quick meeting following class to catch everyone up, go over the items some team members have researched, etc.

### Summary of the Discussion
Kevin started off by discussing the software program that could potentially help with the financial aspect of this project. Elvia is still working on a way to contact Fish and Wildlife, which will be complicated because there is nobody specific we can contact; they contact us. Omima is continuing finding research on gauge readings and flooding information regarding St. Vrain Creek. Elvia and Mauricio are going to work on the "skeleton report" that's due Feb 23. Chandler is continuing to work on the USGS grading/elevation information for our potential sites. Brittany is planning to send an email regarding visiting Jack's Solar Farm within the week.

### Conclusion
This meeting was intended to catch everyone up briefly on where they're at on the project. New duties were assigned as well. Very beneficial meeting, and we feel the team is on a good track.
Exhibit 38: Team Meeting Minutes

City of Lyons Solar Farm Feasibility Study Meeting Minutes

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Attendees

- Brittany Lemarc
- Mauricio Chavez
- CJ Kitson
- Elvia Martinez
- Omima Abdoun

Apologies

- Kevin Riker

Brief Description/Agenda

Today we plan on going over the required project report format (Course Syllabus & Handbook, pages 7-11).

Summary of the Discussion

The bulk of this meeting included questions we have regarding the report format and going over the skeleton report that Brittany has already put together. Questions include: How do we start page numbering on the appropriate page? How are the margins going to be set up? etc. Elvia said she will work on cover pages. Mauricio said he will adjust Exhibits. CJ will head the public outreach section of the report. Kevin and Elvia will head the Return on Investment section of the report. Elvia suggests we come up with ideas for public outreach by next meeting. Additional tasks were assigned during this meeting and can be reviewed in teams file "00-Senior Design Report.docx":
Project Background (Brittany), Purpose of the Work (Elvia), Jurisdictions Having Authority (Kevin), Applicable Building Codes (Mauricio), Analysis Procedures (All), Water Summary (Omima).

Conclusion

We intend to stay late after class (Tuesday, February 16) to ask Professor Marxhausen any questions regarding the report formatting. Our team will also be meeting Thursdays at 5:00PM from now on.
# City of Lyons Solar Farm Feasibility Study Meeting Minutes

<table>
<thead>
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## Attendees
- Brittany Lemarc
- Mauricio Chavez
- CJ Kitson
- Elvia Martinez
- Kevin Riker

## Apologies
- Omima Abdoun

## Brief Description/Agenda
Today we are going over field trip info and what was asked to professor Markhausen during class.

## Summary of the Discussion
We are currently planned to meet at Bohn Park at noon, 12:00PM, Sunday the 21st to take pictures of the potential sites. We are also planning to tour Jack's Solar Farm 2:00PM, Friday the 26th. If you have not done so, please pay the 5$ fee via the link Brittany sent over email. We are each getting tasked with a site we will individual research. Tank Hill-Mauricio; Long's Drive-Brittany; Bohn Park Parking lot-Omima; Dog Park-Kevin; Water Treatment Plant-Elvia; Bike Path-CJ.

## Conclusion
We are each tasked to review the sites we have been assigned individually before the field trip noon, 12:00PM, Sunday the 21st. Make sure you pay the 5$ fee by Wednesday the 24th.
Exhibit 38: Team Meeting Minutes

City of Lyons Solar Farm Feasibility Study Meeting Minutes

Meeting Date and Time  2/24/2021, 5:00PM
Meeting Organizer  Brittany Lemarc
Meeting Location  Teams
Meeting Duration  8:00-8:35PM

Attendees
Brittany Lemarc
Mauricio Chavez
CJ Kitson
Elvia Martinez
Kevin Riker
Omima Abdoun

Apologies
N/A

Brief Description/Agenda
Our goal is to divy up some of the duties moving forward after the skeleton report was turned in/discuss our field trip to Jack’s solar farm which will take place Friday, February 26.

Summary of the Discussion
Aurora Solar got back with Kevin and said they would do a workup on the bike path site. He has a zoom meeting scheduled on Wednesday to go over what can be expected. Our team is starting to blacklist a few of the sites and hone in on the most feasible sites (bike path & dog park). Brittany plans to add more info on "Purpose of Work." Mauricio will be working on the Jurisdiction section of the report. Brittany is going to work with CJ with public outreach. Mauricio will find out rainwater collection laws pertaining to the Lyons while looking up building code rules.

Conclusion
We finished the meeting by relaying our weekly/monthly goals we plan on getting done.
City of Lyons Solar Farm Feasibility Study Meeting Minutes

Meeting Date and Time  2/28/2021, 12:30PM
Meeting Location
Meeting Organizer  Brittany Lemarc
Meeting Duration  12:30-12:50PM
Teams

<table>
<thead>
<tr>
<th>Attendees</th>
<th>Apologies</th>
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<tr>
<td>Brittany Lemarc</td>
<td>Omima Abdoun</td>
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<td>Mauricio Chavez</td>
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Brief Description/Agenda
This is our first meeting following our tour of Jack's solar farm, so we intend to go over some of the information we found useful during our visit. We also just received feedback on our skeleton report from Professor Marxhausen, so we will go over that information as well, as well as checking up on the status of everyone's responsibilities. We are also going over Ben Rodman's recent email regarding the potential 4 month delay dealing with rezoning complications.

Summary of the Discussion
We are planning on moving away from the bike park location due to the 4 month hold on rezoning and focusing more on the southwest dogpark location and perhaps another. Brittany and CJ are going to discuss outreach program details with Ben Rodman.

Conclusion
We will continue working on individual responsibilities through the week and wait to hear more regarding the zoning complications, and how we will plan to move forward after that.
# City of Lyons Solar Farm Feasibility Study Meeting Minutes

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<tr>
<th>Meeting Date and Time</th>
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<td>3/04/2021, 5:00PM</td>
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**Meeting Organizer**: Brittany Lemarc  
**Meeting Duration**: 5:00-5:30PM

### Attendees
- Brittany Lemarc  
- Mauricio Chavez  
- CJ Kitson  
- Elvia Martinez  
- Kevin Riker  

### Apologies
- Omima Abdoun

### Brief Description/Agenda
This is a general meeting which intends to review how each of us have progressed through the week/what we intend to do before our Sunday meeting.

### Summary of the Discussion
Elvia is planning to reach out to Jeffrey Wood regarding DOLA info. CJ contacted Redstone Review and our team is planning on writing an article by Saturday/Sunday, which will go to Lee Hall, Rodman, on Monday. CJ will work with Jody Bech with virtual town hall. Kevin has access to estimation software from his company. He is limited to elevation of panels/foundation info. We will have to do a rough estimate for geotech info. CJ will research single vs fixed axis (multiple is out of question/too pricey) tilt panels.

### Conclusion
We will continue to keep track with our responsibilities, start working on the rough draft due soon, and begin a draft for the upcoming presentation. Brittany will begin drafting up the article for the Redstone Review.
City of Lyons Solar Farm Feasibility Study Meeting Minutes

Meeting Date and Time: 3/07/2021, 12:00PM
Meeting Location: N/A
Meeting Duration: 12:00-12:20PM
Teams: N/A

Attendees
Brittany Lemarc
Mauricio Chavez
CJ Kitson
Elvia Martinez
Kevin Riker
Ornima Abdoun

Brief Description/Agenda
This is a general meeting which intends to review how each of us have progressed through the week/what we intend to do before we start the new week.

Summary of the Discussion
Brittany is drafting the Redstone article today so they have time to respond by tomorrow. She is also planning to email Jeffrey Wood regarding DOLA info. We are going to make the draft presentation which is due by the 30th. We reviewed what Brittany has written so far in the article and she’s planning on sending it out for review.

Conclusion
We will continue to work on our individual portions of the project and try to get them into the report this week before we start building/practicing the presentation draft.
# City of Lyons Solar Farm Feasibility Study Meeting Minutes

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<th>Meeting Date and Time</th>
<th>3/14/2021, 12:00PM</th>
<th>Meeting Location</th>
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<td>Meeting Organizer</td>
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<td>Omima Abdoun</td>
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## Brief Description/Agenda
This is a general meeting which intends to review how each of us have progressed through the week/what we intend to do before we start the new week.

## Summary of the Discussion
We discussed meeting with Heidi regarding the confusion concerned with the site conflicts the people of Lyons are having. Lyons will find out how much it'll cost for phase 3 power. We plan on setting up a meeting with the clients on 1 April (not confirmed) before the initial first virtual town hall. Kevin is working on designs this week. CJ is creating bullets on the paper. Mauricio will work on building codes. Elvia emailed State Wildlife and they are charging her $33 for info. She will be emailing Federal Wildlife as well. Jeff Wood said they're hiring a writer for the DOLA grant.

## Conclusion
We are not completely sure where to go as far as the multiple clients differing opinions are considered. Do we need a special election?
City of Lyons Solar Farm Feasibility Study Meeting Minutes

Meeting Date and Time  |  3/21/2021, 2:00PM  |  Meeting Location  |  Zoom
---|---|---|---
Meeting Organizer  |  Brittany Lemarc  |  Meeting Duration  |  2:00-2:45PM

Attendees
Brittany Lemarc  
Mauricio Chavez  
CJ Kitson  
Elvia Martinez  
Omima Abdoun  
Kevin Riker  
Heidi Brothers

Apologies
N/A

Brief Description/Agenda
The agenda for this meeting is to discuss some of the hangups we have with Heidi Brothers, as well as some methods we could potentially use to create estimates for our sites.

Summary of the Discussion
We addressed our biggest concern regarding conflicting "politics" occurring with our clients. So far we have been focusing on two properties per the advice of Lee Hall, but we have been made aware by Jim Kerr that we need to have estimates for all eight sites by the end of May. Heidi Brothers referenced the contract regarding this project. We are required to conduct a feasibility report on at least 3 sites per the contract. We are required to record the information, we are only gathering input from the public and documenting/compiling it for the town to input in the feasibility study. We are reminded to give rough ROI's, estimates, etc. Not too detailed. This includes environmental impact information.

Conclusion
Kevin and Elvia are going to work on the rough estimate/ROI throughout the week. CJ is going to work on a disclaimer for the virtual town hall. We gathered a lot of useful information from Heidi and will implement this going forward, particularly researching virtual public engagement online. Brittany will get the powerpoint done by Thursday. She will work with the clients to choose a date for a second town hall. We plan to meet next Thursday at 5PM, then Sunday at 3PM.
## City of Lyons Solar Farm Feasibility Study Meeting Minutes

<table>
<thead>
<tr>
<th>Meeting Date and Time</th>
<th>3/25/2021, 2:00PM</th>
<th>Meeting Location</th>
<th>Teams</th>
<th>Meeting Duration</th>
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<tr>
<td>Meeting Organizer</td>
<td>Brittany Lemarc</td>
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### Attendees
- Brittany Lemarc
- Mauricio Chavez
- CJ Kitson
- Elvia Martinez
- Omima Abdoun
- Kevin Riker

### Apologies
- N/A

### Brief Description/Agenda
The intention of this meeting is to briefly go over what we might expect for the town hall meeting coming up. We will go over the powerpoint presentation and some of the responsibilities we have during the presentation. We are presenting on April 8.

### Summary of the Discussion
Kevin designed the three arrays at locations Bohn Park, Dog Park, and Tank Hill (MEAN is not in the program's financial portion). Kevin will be going over the three locations, Bohn park, Dog park, Tank Hill in slides 6, 7, and 8 during the presentation. Brittany went over the powerpoint she put together for the town hall presentation. Mauricio will be responsible for taking notes/documenting all questions and feedback acquired during the town hall. CJ is responsible for disclaimers and slide 9.

### Conclusion
We are practicing going over the powerpoint on Sunday. We are required to come up with a sentence or two for introductions. Our next meeting will be at 3PM, Sunday 28.
# City of Lyons Solar Farm Feasibility Study Meeting Minutes

**Meeting Date and Time:**
3/28/2021, 3:00PM

**Meeting Location:**
Teams

**Meeting Organizer:**
Brittany Lemarc

**Meeting Duration:**
3:00-4:15PM

### Attendees
Brittany Lemarc  
Mauricio Chavez  
CJ Kitson  
Elvia Martinez  
Kevin Riker

### Apologies
Ommia Abdoun

### Brief Description/Agenda
The agenda for this meeting is to rehearse for the upcoming town hall. We will go over our individual responsibilities and perform a trial run based on how we expect the town hall will pan out. We will also work on the Powerpoint together as a group.

### Summary of the Discussion
Jim Kerr suggests we include the south Bohn Park parking lot that is in the floodplain into our list of proposed sites. It is most likely considered unfeasible as the total predicted cost is 1.5M. Brittany will make another slide to include this information before the town hall. Elvia will go over how solar farms work during the town hall meeting. We added to the powerpoint brittany put together to include additional site info. We went over some of the bullets listed in our individual syllabus, specifically what is expected of us like ROI and the public outreach presentations which were supposed to have been conducted in March. In conclusion of this meeting, we went over our presentation, slide by slide, as if we were doing the town hall live.

### Conclusion
We are waiting for info on when we should conduct our second town hall presentation. We went over our slides and added information to them in preparation for our first town hall meeting. We went over our project tasks listed in our syllabus. We are skeptical about some of the bullets listed in our project tasks, including the two march public outreach presentations which was unfeasible given our restricted timeline. We are planning on meeting a little early at 5PM, Thursday, April 1, to go over our slides again before the Town Hall begins.
City of Lyons Solar Farm Feasibility Study Meeting Minutes

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<th>Meeting Date and Time</th>
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<td>4/05/2021, 2:00PM</td>
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<td>Meeting Duration</td>
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**Attendees**
- Brittany Lemarc
- Heidi Brothers
- CJ Kitson
- Kevin Riker
- Omima Abdoun

**Apologies**
- Elvia Martinez
- Mauricio Chavez

**Brief Description/Airge**
The intentions of this meeting is to touch base with Dr Brothers and have her asses are current position as well as what direction we need to head in as a team.

**Summary of the Discussion**
Brittany informed Dr. Brothers on how the first town hall meeting went. Heidi went over the contract and the scope of work with us. Stating that we need to come up with deadlines for our remaining deliverables. Asked for one of us to contact Chris LaMay and get an example format for the DOLA grant application. As well as the Engineering Services Contract, so that we can come up with a list of remaining tasks that an Engineer will have to accomplish for the project. Heidi discussed the need for a order of magnitude cost estimate and how that would be beneficial to have completed before the next town hall.

**Conclusion**
Brittany had stated Elvia is already on the task of reaching out to Chris LaMay. Next meeting we are going to discuss deadlines for our remaining deliverables. Kevin is going to meet with Heidi later this week to discuss the Order of Magnitude Cost Estimates and the ROI.

---

***This date consisted of two meetings. The second meetings minutes will be on the following page.***
# City of Lyons Solar Farm Feasibility Study Meeting Minutes

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<th>Meeting Date and Time</th>
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<td>Meeting Location</td>
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## Brief Description/Agenda

This meeting is to determine the remaining direction for our team. Come up with deadlines on the remaining deliverables. As well as working on and practicing the class presentation due on 4/8.

## Summary of the Discussion

Elvia is going to call Chris Lemay with regards to the DOLA grant application outline/format and services contract. Kevin is meeting with Heidi Brothers on Wednesday in regards to ROI/cost estimate information. We edited our existing slides for the client presentation. Everyone was assigned their respective slides for the presentation. For any questions about which slides you are presenting, message Brittany. Our names are attached to our slides via a note Brittany added. We worked on our schedule.

## Conclusion

15 minutes before Thursday's presentation we are going to do a quick practice run. Everyone is expected to complete their slides and report back to Brittany about how long their slides will take by Wednesday.
City of Lyons Solar Farm Feasibility Study Meeting Minutes

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<td>4/11/2021, 12:00PM</td>
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Meeting Organizer: Brittany Lemarc
Meeting Duration: 12:00-12:50PM

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<td>Elvira Martinez</td>
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<td>Heidi Brothers</td>
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Brief Description/Agenda

Today's agenda includes going over the client presentation we did during the class presentation, and how we can improve it before the actual client presentation. We also plan on going over the details for our upcoming and second virtual town hall with the town of Lyons.

Summary of the Discussion

The presentation will be almost identical, with an additional slide on the cost estimate. If we don't have final numbers, Kevin will talk about the factors that kept the estimate from being fully conducted. We need to make sure that the new slide is up so that all the clients can review it. Brittany said that Kevin needs to complete this slide by Thursday. We reviewed the email Elvia sent regarding sample template contracts by DOLA. We need to put together in our final presentation and in the report a rough draft of a schedule for our project. This schedule will show potential funding, grant submittal in August, when design money from DOLA can come out, installation (See Chris Lemay). This project will utilize Design-Build for this project. DOLA will hire one Contractor hired by DOLA to do both the design and construction. This increases speed of project and quality.

Conclusion

We created a finances slide for the town hall slide show. We also went over the slide (titled site overview) ranking the sites using numbers 1-3, and added an environmental impact category. We will be presenting with the same format as the first town hall meeting. We just need to create the client schedule for the client report. We will have our paper completed by April 24. We are meeting 5PM Thursday, 15 to go over the town hall before it actually begins.
# City of Lyons Solar Farm Feasibility Study Meeting Minutes

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<tr>
<th>Meeting Date and Time</th>
<th>4/25/2021, 12:00PM</th>
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## Brief Description/Agenda
The purpose of this meeting is to go over the 5 minute presentation we are presenting to the school. We are going to condense the original client presentation to meet the 5 minute timeframe and assign slides.

## Summary of the Discussion
For this meeting we were able to cut slides while getting rough ideas of how long we should be talking individually for the 5 minute presentation. We also went over what we need to accomplish on the feasibility report before we have to turn it in.

## Conclusion
We are going to rehearse and record our presentation in one week as well as put finishing touches on the feasibility report. We will review the report together before we turn it into the learning center.
City of Lyons Solar Farm Feasibility Study Meeting Minutes

Meeting Date and Time: 4/29/2021, 5:00PM
Meeting Location: N/A
Meeting Organizer: Brittany Lemarc
Meeting Duration: 5:00-7:30PM

Attendees
Brittany Lemarc
Mauricio Chavez
CJ Kitson
Elvia Martinez
Omima Abdoun
Kevin Riker

Apologies
N/A

Brief Description/Agenda
The purpose for today's agenda is to go over our feasibility design report before we turn it into the writing center tomorrow. We expect this particular meeting will take much more time than usual as we put the final touches into the report.

Summary of the Discussion
As predicted, we spent a majority of this meeting going over each section of the report with scrutiny before we submit it to the writing center. Several sections were remodeled and many exhibits were added.

Conclusion
Our next meeting will be held this coming Sunday, April 29. We will be recording our presentation to submit to the school. Some of us will also be attending the meeting with the writing center to go over what needs to be changed on our feasibility report.
Exhibit 38: Team Meeting Minutes

City of Lyons Solar Farm Feasibility Study Meeting Minutes

<table>
<thead>
<tr>
<th>Meeting Date and Time</th>
<th>Meeting Location</th>
<th>Writing Center</th>
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<td>4/30/2021, 2:00PM</td>
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<td>Meeting Duration</td>
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<td>Kevin Riker</td>
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<td>Darryl Ellison (writing center)</td>
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Brief Description/Agenda

The agenda for today’s meeting is to review our feasibility report draft with the writing center. We plan on getting together for a few days this week to work on the final report as a team using the information given to us by the writing center.

Summary of the Discussion

The percent sign depends on the citation we use. Use what looks best and be consistent. Pick a citation method we feel most comfortable and be consistent. Regarding the exhibits, use best practice common sense approach. Keep consistency. Maybe use an appendix for exhibits. Conclusions have one or two “retrospective component (look back)” (summarizing what we’ve accomplished, reiterate what the reader’s already gotten. more complicated than proposal, most fully developed.) Conclusions may have a prospective conclusion which “looks out” into future implications of the program. “What hasn’t been done, what needs to be done?” Where others may start. As far as repetition, our reader may not expected to read our document front to back, which makes repetition beneficial. If we are saying the same thing. We went over the format for our conclusion. Link the sites with the challenges they face after this report is finished (special election, etc.).

Conclusion

We have a good starting point for our conclusion, and we were able to get information cleared up regarding how to site our sources and how we should implement % vs “percent”. Overall, we learned to be consistent with whichever method we choose to implement.
City of Lyons Solar Farm Feasibility Study Meeting Minutes

Meeting Date and Time: 5/02/2021, 2:00PM
Meeting Location: Zoom
Meeting Duration: 12:00-5:50PM

Attendees:
Brittany Lemarc
Mauricio Chavez
CJ Kitson
Elvia Martinez
Omima Abdoun
Kevin Riker
Heidi Brothers

Apologies: N/A

Brief Description/Agenda:
Today we are meeting with Heidi Brothers to go over what we have to do left. We also plan on spending awhile editing our feasibility report, final report, and client presentations.

Summary of the Discussion:
We spoke with Heidi Brothers and went over our current schedule and what we have to do by what times. We also spent the rest of the evening going over what we can fix and edit within the feasibility report, final report, and client presentation.

Conclusion:
We plan on meeting May, 6 to continue revising our reports and go over our client presentation before we meet with them Friday, May 7 at 11AM.
## City of Lyons Solar Farm Feasibility Study Meeting Minutes

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<th>Meeting Date and Time</th>
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<td>5/06/2021, 2:00PM</td>
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<th>Meeting Organizer</th>
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<tr>
<td>Brittany Lemarc</td>
<td>5:00-8:00PM</td>
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#### Attendees
- Brittany Lemarc
- Mauricio Chavez
- CJ Kitson
- Elvia Martinez
- Omima Abdoun
- Kevin Riker

#### Apologies
- N/A

## Brief Description/Agenda
Tonight we are finalizing our reports and presentation. We intend to go over our presentation at least once before our presentation tomorrow, May 7 at 11:00AM.

## Summary of the Discussion
We did what we intended to do. We finalized our reports and were able to go over our client presentation once before finishing the meeting. We also revised the slides and reports per Heidi Brothers requests.

## Conclusion
Our final client presentation is tomorrow, May 7 at 11:00AM.
City of Lyons Solar Farm Feasibility Study Meeting Minutes

Meeting Date and Time: 5/07/2021, 11:00AM
Meeting Location: N/A
Meeting Organizer: Brittany Lemarc
Meeting Duration: 11:00-11:50AM

Attendees
Brittany Lemarc
Mauricio Chavez
CJ Kitson
Elvia Martinez
Omima Abdu
Kevin Riker
Lee Hall
Ben Rodman
Jim Kerr
Jeffrey Wood
Heidi Brothers
Aaron Caplin
Peter Marxhausen

Apologies: N/A

Brief Description/Agenda
Today we give our clients the final presentation before concluding this semester. We will present and conduct a Q&A session where we will attempt to answer any questions and comment on any feedback we receive.

Summary of the Discussion
We completed our final presentation to our clients. There were some compliments and some feedback. Some comments by Lee Hall: "Aaron Caplin will be able to write the DOLGA Grant. There is absolutely no issues constructing in any of the three feasible sites. Carport has a substantial cost is more than 100 ft to the nearest interconnect point which could cost anywhere from 70-100 thousand dollars. Carport is beyond financial feasibility when considering other sites. Cost is the most important aspect when considering this project." Lee Hall went over the cost analysis with us. Jeffrey Wood would like us to share our experiences on this project and give any feedback we can about it. Jim Kerr shared his thanks and compliments. He asked what form is the report going to come in (written?). He was also interested in our recommendation in doing the design of the solar farm. He was thinking we would put an RFP out and use contractors incorporated design.

Conclusion
Heidi Brothers concluded the presentation by thanking the town of Lyons and reminding them that Brittany will be continuing the project through the upcoming semester. We received positive feedback from our clients with some feedback about our report. Our next plan is to send out all necessary files to the people they need to go to. Heidi also wants us to put the word "Draft" in the feasibility title. She also wants Kevin to work on hammering out a few minor details in the cost excel spreadsheet including any comments Lee Hall made.
Exhibit 39

Team Member Resumes

Contains Resumes From:

Brittany LeMarc
Mauricio Chavez
Elvia Martinez
Chandler Kitson
Omima Abdoun
Kevin Riker
Brittany Lemarc
Edgewater, Colorado • (303) 435-6449
brittany.lemarc@ucdenver.edu • linkedin.com/in/brittanylemarc/

Upcoming graduate of an ABET accredited University with a B.S. Civil Engineering degree and a Minor in Construction Management. Backed by a successful leadership role on the UC Denver ASCE Student Chapter and knowledge of engineering principles, theories, and standards.

**EDUCATION**

**MAY 2021**
**B.S. CIVIL ENGINEERING, UNIVERSITY OF COLORADO AT DENVER**
Minor in Construction Management & Continuing Education into Master’s Degree
3.1 GPA

**DECEMBER 2009**
**A.A. BROADCAST JOURNALISM, ST. LOUIS COMMUNITY COLLEGE**

**SKILLS**

- Highly Organized Projects
- Strong Communication Skills
- Familiar with Microsoft & Bluebeam
- Fast Learner & Team Player
- Used AutoCAD for 3 years
- Used Revit for 2 years

**EXPERIENCE**

**JANUARY 2021 – PRESENT**
**LYONS SOLAR FARM FEASIBILITY STUDY, SENIOR DESIGN PROJECT**
I am the team leader to a six-member group. We worked to create a feasibility study on a solar farm considering cost, geotechnical concerns, environmental impacts, and public opinion. I have written and had published local newspaper articles on the engineering aspects and overall project design, as well as held two virtual town halls.

**JANUARY 2019 – MAY 2019**
**ROADWAY EXPANSION & INTERSECTION, HIGHWAY DESIGN PROJECT**
I was the team leader on a five-member group tasked with designing a road expansion and intersection in Denver, Colorado. We used MicroStation and AutoCAD to complete the designs.

**ACTIVITIES**
University of Colorado at Denver ASCE Student Chapter Officer for over one year. I created and maintained the chapter’s LinkedIn, Facebook, Instagram, and Twitter accounts. I helped to organize student events, seminars, and continuing education opportunities, as well as organizing the chapters documents and creating an online database for files. Also, I created the student chapter logo using ASCE and UC Denver brand standards.
Mauricio Chavez
3317 Syracuse Street, Apartment 102, Denver, Colorado, 80238
(615) 319-1688
riciochavez4@yahoo.com

SUMMARY
Incisive, self-driven former military maintenance professional with eight years of military and civilian work experience in demanding work environments. Proven leader and mentor, having managed both small and large teams through challenging tasks, currently seeking a position in the construction management industry.

• Problem Solver
• Experienced Team Leader
• Trainer and Mentor

EDUCATION
• University of Colorado Denver, Denver, Colorado
  Aug 2016-Present
  • B.S. Civil Engineering, Minor in Construction Management: Final Semester
• Red Rocks Community College, Lakewood, Colorado
  Aug 2017-Aug 2018
• Vandenberg Air Force Base, Lompoc, California
  Oct 2012-Apr 2013
  • Missile and Space Facilities Apprentice Technical School Graduate


Software Skills: AutoCAD, Microsoft Office, Primavera, ProjectLibre, Python, RISA, RSMEANS.

WORK EXPERIENCE

• United States Air Force
  Aug 2011-Aug 2017
  Hardened Intersite Cable System Team Chief, FE Warren AFB, WY
  Aug 2014-Aug 2017
  • Oversaw 1.5K-ft Air Force hardened missile cable realignment resulting in a $34 million Cabela’s build project on schedule.
  • Led 49 cable air dryer periodic maintenance inspections alleviating $1.8 million in damages to critical Air Force hardened missile cable.
  • Supervised maintenance, inspections and testing procedures on Air Force Minuteman III nuclear weapon system hardened missile communication cable spanning 9,600 square-miles in a tri-state area.

Hardened Intersite Cable System Technician, FE Warren AFB, WY
Apr 2013-Mar 2014
  • Managed department HAZMAT program during EPA inspection resulting in zero deficiencies.
  • Custodian for 87 precision measurement equipment items including ohmmeters, multimeters, torque wrenches, and pressure gauges.
  • Responsible for maintaining and repairing 9,600 square-miles of Minuteman III communication cable in a tri-state area.
Elvia Martinez
7959 Pecos Street
Denver, CO 80221
cell phone 720-220-2953
elvia.martinez@ucdenver.edu

Field Engineer Intern June 2019 to current
Kiewit – Denver, CO

- Quality control coordinator at the asphalt plant. Formulate and maintain quality control objectives to ensure product reliability.
- Estimate costs of specific project.
- Gather and study proposals, blueprints, specifications, and related documents of specific project.
- Compute cost of labor, materials, and time requirements on specific project.
- Create timecards and workplans, communicate with Foreman and Superintendent, and create a safety culture.
- Plan and organize project, order material, and create Material Received Reports.
- Complete Pre-Pour Concrete Checklist.
- Manage concrete ordering for all disciplines in the project and pay out concrete bills.
- Keep track of all concrete and rebar invoices. Pay all payforms

Experienced Supervisor March 2005 to June 2019
Safeway – Denver, CO

- Provide customer service with in the scope of the position and within company policy.
- Trains, observes, and coaches all employees to ensure the highest standards of superior customer service are being met.
- Supervises store employees in the presence or absence of store manager.
- Assists in maintaining a clean and safe work environment within the store.
- Bookkeeping duties and complete all accounting procedures. Finalize inventory, carry forward, return to main Veri-Balance tab to create automatic flow to FSM.

Education

- Bachelors of Science: Civil Engineering, graduating in Spring 2021 - University of Colorado at Denver – Denver, CO, US
Exhibit 39: Team Member Resumes

Chandler J Kitson  
567.686.5022  
Chandler.Kitson@ucdenver.edu

Objective: Seeking Civil Engineering internship

Education
University of Colorado Denver (UCD)  
Pursuing Bachelors of Science, Civil Engineering  
Expected completion: May 2021

Skills:
- AutoCAD
- ArcGIS
- MATLAB
- Revit
- Synchro
- Microsoft Office

Relevant Courses
- AutoCAD
- Transportation Engineering
- Mechanics of Materials
- Engineering Surveying
- Environmental Engineering
- GIS
- Fluid Mechanics
- MATLAB

Profile
- Developed team building skills through 3 years of leadership experience in high school.
- Developed leadership skills through being section leader in marching band my Senior Year.
- 3 years in Cleveland Youth Wind Symphony (audition-based group at the Cleveland Institute of Music) playing trombone.
- Tutored students in math, science, and language arts.
- Created railfan YouTube channel to post railfan videos I shot. Video of the first run of Big Boy, from May of 2019, has close to 20,000 views.

Work Experience
- King Soopers South Park  
  All-Purpose Clerk, Courtesy Clerk  
  Summer 2019 – Summer 2020
  Work check stand, self-checkout, carts, and more; Consistently in top 5 of checkers at the store
- Chick-fil-A Aspen Grove  
  Team member  
  Spring – Fall 2018
  Worked front counter, drive thru headset, window, bagging, and closing
- City of Beachwood  
  Intern  
  May 2017
  Shadowed Building Department employees on construction sites; Learned important aspects of city codes, worksite safety, and project compliance.
- Rob Portman for Senate  
  Intern  
  Spring – Fall 2016
  Made phone calls and knocked on doors; Named top intern in Cleveland Office

Professional Organizations and Other Honors
- Ecology Club  
  Vice President and Chair of Recycling Operations  
  Fall 2013 – Spring 2017
- University of Colorado Denver  
  Dean’s List  
  Fall Semester 2017
- University of Colorado Denver  
  Catalyst Leadership Experience  
  January 2018
- American Society of Civil Engineers  
  Student Chapter; Attended 2018 National Convention  
  Fall 2018 – present
- University of Colorado Denver  
  Steel Bridge Team Member  
  Spring Semester 2019
Omima Abdoun
Denver, CO 80201
720-427-6477
Omimaala@gmail.com
LinkedIn.com/in/omima-abdoun

CIVIL ENGINEER

PROFILE
Graduating Senior majoring in Civil Engineering at the University of Colorado, Denver. Track record includes extensive experience working in engineering design and construction firm. Known for reliability, engineering knowledge and professionalism. Seeking a full-time Civil position in Civil Engineering.

EDUCATION & CREDENTIALS
Elnaser Technical College – Khartoum, Sudan
Diploma, Civil Engineering

Community College of Denver – Denver, CO
Associate of Science, Civil Engineering

University of Colorado Denver – Denver, CO
Bachelor of Science, Civil Engineering - expected graduation May 2021

SKILLS
Relationship Building Management Organization Microsoft 365 Google Workspace
Slack Zoom MS Teams AutoCAD Python MATLAB

NOTABLE COURSES
Highway Design Surveying Structural Analysis Fluid Dynamics
Structural Steel Design Foundation Design Engineering Contracts
Geotechnical Engineering Hydrosystems Engineering Foundations of Engineering Design Innovation
Environmental Engineering Engineering Contracts Statistics

PROJECTS
Senior Design Project: Town of Lyons – Solar Farm Feasibility Study

EXPERIENCE
Community College of Aurora – Aurora, CO Work-Study Program Jan 2012 to May 2013

• Supported non-native English-speaking students with questions related to online learning-management system and course content
• Supervised and assisted students with data entry on student survey projects
• Identified and corrected errors in FSI Department’s practice website

Aloum Contracting – Khartoum, Sudan Owner Jan 1998 to Mar 2009

• Managed and directed the construction, operations at project sites including hiring and oversight of subcontractors
• Worked closely with architects on the design and engineering for construction projects
• Conducted hands-on inspections of land surveys, construction progress and other details necessary to pass municipal inspections in addition to periodic maintenance
Exhibit 39: Team Member Resumes

Kevin Riker
5995 E Iliff Ave #120, Denver, CO 80222 720.879.8493 kevin.m.riker@gmail.com

Education
BS Civil Engineering | July 2021 | University of Colorado Denver
• Major: Civil Engineering
• Minor: Construction Management
• GPA: 3.657
• Related Coursework: CAD, REVIT and Civil 3D, Land Surveying, Project Management Systems, Construction Materials & Methods, Reinforced Concrete, Structural Steel.

Skills & Abilities
Skills: Planswift, RS Means, ProjectLibre, AutoCAD, REVIT, and Civil 3D: Modeling structures in 2D and 3D space based on specific parameters

Leadership
• Experience in leading jobs and training personnel on aircraft maintenance tasks while in the US Air Force. Jobs including but not limited to: engine install and removal, landing gear rebuild, flight control assemblies, and daily maintenance tasks.
• Self-directed in previous job as a Registered Polysomnographic Technician with astute judgment skills. High level of personal accountability. Training new personnel to meet their on the job training requirements for credential testing.

Experience
Design and Construction Office Intern | UC Health/CU Denver | Jan 2020-May 2020
• Inspected ongoing projects to ensure they met Infection Control Risk Assessment (ICRA) and Interim Life Safety Measures (ILSM) standards.
• Created, managed, and populated spreadsheets to track and report data.
• Developed ability to identify specific features on construction documents.
• Compared bid proposals from General Contractors

Freight Employee | Home Depot | May 2020-Current
• Able to distinguish common building materials based on different specifications.
• Directed customers to common materials and tools needed for home projects.
• Prioritized safety around ever-present heavy machinery.

Tactical Aircraft Maintainer | United States Air Force | Nov 2012-Dec 2016
• Cultivated problem solving skills while troubleshooting maintenance issues in high tempo situations while deployed where limited required tools and equipment were available.
• Capable of learning technical skills capable of meeting Air Force standards to identify issues with keen attention to detail.
• Able to identify and prioritize tasks over a 12-hour shift.

Registered Polysomnographic Technician | Mountain Sleep Diagnostics | Dec 2016-Jan 2020
• Working without direct supervision under ever changing circumstances to diagnose and treat sleeping conditions.