UNIVERSITY OF MICHIGAN

Implementing Community Solar

in Chelsea, Michigan

2020

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Executive Summary

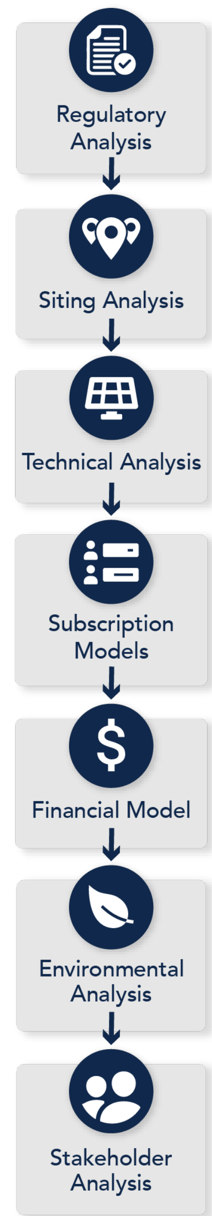
This year-long Dow Sustainability Fellows project assessed the feasibility of implementing community solar in collaboration with the City of Chelsea, Michigan *(see Map 1 Context Map)*. The state of Michigan has a mandated Renewable Portfolio Standard (RPS) of 15% renewable energy generation by 2021 and recently announced a goal for a carbon-neutral economy by 2050.[1,2] The City of Chelsea is exploring new and sustainable ways to contribute to these statewide goals, and the City and its municipal utility (a.k.a. MUNI) want to collaborate to develop a community solar program. Since current Michigan Public Service Commission regulations do not allow investor-owned utilities to develop community solar programs, Chelsea's MUNI is well-situated to implement community solar.

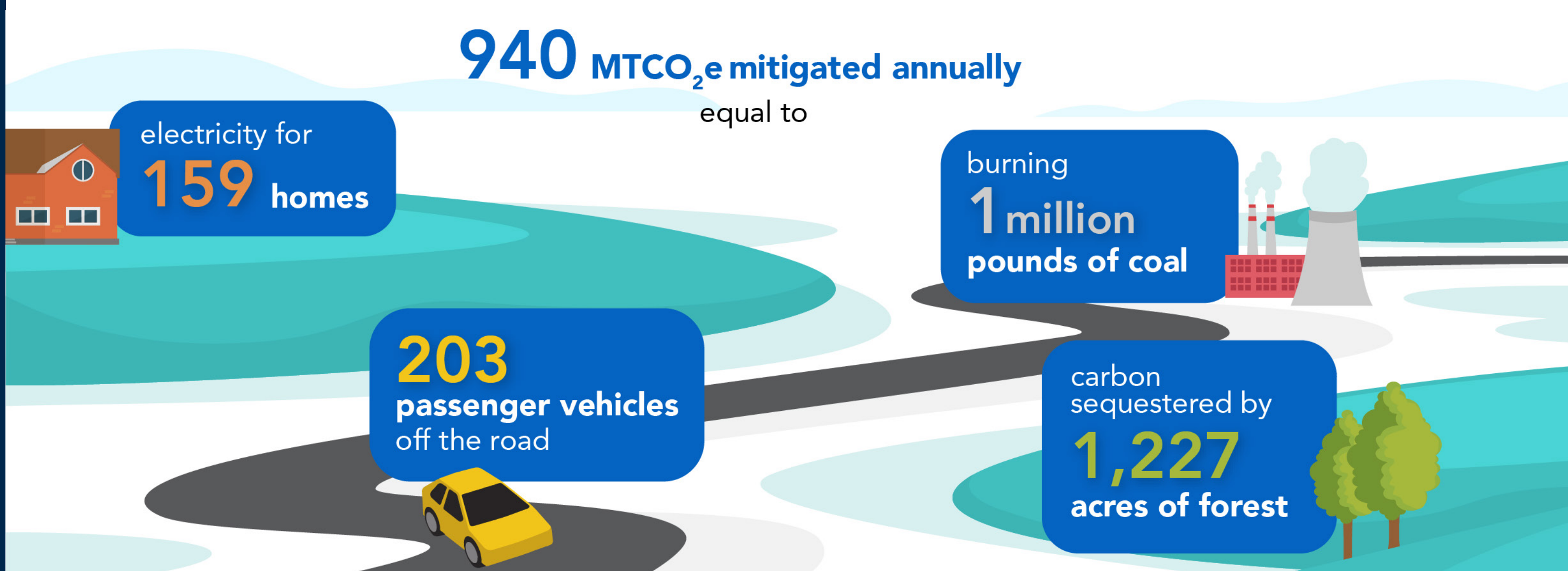
Methods for this work included benchmarking (i.e. a literature and case study review), interviewing project stakeholders, modeling, and analyses *(see Methods and Activities Appendix)*. The team conducted the detailed analyses shown in Figure 1: Project Flow Chart.

The team has several key recommendations including: 1) ensuring a positive Net Present Value (NPV) for the City and subscribers in the **financial model**; 2) engaging a tax equity investor to ensure a positive NPV; 3) designing the system to ensure the highest possible capacity factor; 4) utilizing a subscription model with 25 year subscriptions; 5) **including a low-to-middle-income (LMI) component**; 6) engaging competent counsel to ensure compliance with securities law and consumer protection laws; and 7) engaging deeply with the relevant stakeholders from the stakeholder analysis, especially community members through community outreach. Further detailed recommendations from the models and analyses are provided in Table 2 *(see Reference Appendix)*.

Results and impact (*shown below, see Environmental Analysis Section*) are shared in this final report and in an accompanying database with supplemental materials, including customizable financial models. The results will be presented to the City Council for approval to inform the development and implementation of a community solar project in early 2021. The team also recommends engaging a future Dow Fellowship team to investigate the feasibility of adding additional generation capacity or a storage component to the community solar array.

Figure 1. Project Flowchart





Introduction and Background

The City of Chelsea, Michigan, ("Chelsea" or the "City") strives to meet and exceed Michigan's Renewable Portfolio Standard (RPS) of 15% renewable electricity generation by 2021.[i,3,4] To reach this goal and pursue other sustainability-centric endeavors, local community members were engaged through the Chelsea Sustainability Advisory Commission (CSAC). The Commission's report identified interest in a community-scale decentralized solar installation that would enable community members to access renewable energy to meet their residential load.[5]

Community solar is a model where community members subscribe to a portion of a local solar array and receive credits on their electricity bills for their share of the power produced, ultimately leading to financial savings. This model increases access to renewable energy for community members who might not otherwise be able to install their own personal residential solar system, due to factors such as affordability or renter status. Cumulatively through 2019, over 2,000 MW of community solar have been installed in the U.S., in at least 40 states.[6]

As a municipal utility (a.k.a. MUNI), Chelsea owns its grid. Furthermore, community solar programs within Chelsea's MUNI territory would not be regulated by the Michigan Public Service Commission (MPSC) or require its approval. This unique position enables Chelsea to pursue community solar more freely. CSAC made the following recommendations to the City Council regarding a potential community solar project: the project be member owned and financed, city organized, have an economy of scale, utilize schools, rooftops, and parking lots (or other available land) as siting options, and provide on-bill credits for energy generated from the project.[7] There are several examples of community solar in Michigan that provide benchmarks for best practices. Furthermore, local governments like Chelsea typically have limited resources and capacity, and thus require external support beyond case studies to understand the true potential and feasibility of community solar in their community.

This Dow Fellows Team has worked to provide external support to Chelsea by studying the feasibility of a community solar project in Chelsea. To accomplish this, the team conducted regulatory, siting, technical, low-to-middle-income (LMI) subscription, financial, environmental, and stakeholder analyses. The fellows are motivated by an impact-driven focus and shared passion for enabling further deployment of renewable energy throughout the U.S. while engaging with local communities. With backgrounds in sustainability, engineering, law, business, and public policy, the team brings an interdisciplinary lens to this project. The feasibility study provides a roadmap for Chelsea to integrate community solar into their power generation portfolio in a cost-effective manner. City Manager John Hanifan and Mayor Melissa Johnson represented the City and community while working in collaboration with the Dow team, as well as other experts including a University of Michigan (UM) faculty advisor, Dr. Sarah Mills. The project will be presented to the City Council in early 2021 to inform the development and implementation of a community solar project.

i During this project, Governor Gretchen Whitmer signed Executive Directive 2020-10, which commits Michigan to the goal of economy-wide carbon neutrality by no later than 2050. An interim goal of a 28% reduction below 1999 greenhouse gas emissions levels by 2025 was also set. Therefore, specific RPS targets are subject to change over the duration of the proposed project and will likely increase.

Analyses, Modeling, and Results

Regulatory Analysis[ii]

Net Metering

Michigan's net metering laws and regulations apply to electrical utilities and alternative electric suppliers.[8] Since municipal utilities are not included in the definitions of electrical utility or alternative electric supplier, the net metering laws do not apply to municipal utilities, and Chelsea does not need to design its program to comply with state net metering laws.[9,10]

Securities Law

If care is not taken in designing the community solar contract, regulators at the state and federal level may characterize the contract as a security, which in turn triggers onerous registration and reporting requirements. Consideration must be given to federal securities law enforced by the Securities and Exchange Commission (SEC), as well as state "blue sky" securities laws, to avoid the contract being characterized as a security (*see Securities Law Appendix for further details*). Competent counsel should be engaged to structure the contract in a manner that avoids characterization as a security.

Consumer Protection Law

Chelsea should also carefully consider Michigan's consumer protection laws when preparing advertising materials and other transaction documents.[11] For instance, failing to reveal a material fact to the consumer or representing that goods or services have benefits that they do not actually have are violations of the consumer protection laws.[12] Given the complicated nature of community solar arrangements, it is critically important to ensure that all marketing materials accurately characterize the arrangement.[13] Importantly, if Chelsea retained title to the renewable energy certificates (RECs) or monetized the RECs, it would be important to explain that the subscriber would not have rights to any of the renewable attributes related to the project. Competent counsel should be engaged to ensure that marketing materials do not present undue risk under Michigan's consumer protection laws.

Siting Analysis

Proposed Sites, Criteria, and Zoning

John Hanifan, Chelsea's City Manager, proposed 11 city-owned sites for community solar that are all front of the meter (FTM).[14] Multiple sites were adjacent to one another, so these were assessed individually and in groups to increase the potential suitable project area. A siting analysis was conducted to determine the best suited project site(s) through identifying criteria, conducting research, and performing analyses using Geographic Information Systems (GIS) (*see Tables 4 and 5 - Siting Tables 1 and 2*). Criteria were selected based on guidance from the City and National Renewable Energy Lab (NREL).[15] Criteria for interconnection points as well as land use and building permits were not considered given that the City owns the sites and manages the utility. John noted that interconnection with the grid should not be an issue within the City, although City staff will ensure this after completing a distribution capacity analysis for final sites.[16] The project also does not require permits and will not conflict with existing zoning because developing Public Works facilities on City-owned land is an allowed "Public Use." [17,18]

Geographic Information System (GIS) Analysis

Esri ArcGIS was used to map all sites, identify groups, visualize site features (buildings, structures, and vegetation) using satellite im-

ii None of the analysis contained in this section constitutes legal advice, and competent counsel should be engaged if the City decides to proceed with the project.

agery, and conduct a slope analysis to identify suitable areas with less than 5% slope as recommended by the NREL[19] (*see Figure 2 for degree to percent slope conversion; see Maps Appendix*). Slope was calculated from a 1-meter Digital Elevation Model (DEM) using the ArcToolbox Slope Function.[20] Slope maps identify areas of suitable and non-suitable slope as either a binary (<5% and >5%) or a range (0-5% and >5%) to show more detail (*see Maps 2-3*). Maps of wetlands and waterways were produced using online mapping tools to identify and avoid potential issues with flooding, drainage, and erosion (*see Maps 4-7*).[21,22] Soil composition was mapped to determine areas with bedrock, sandy soils, and corrosive soils that impact construction and maintenance, including where posts can be located and where additional protection measures may be required (*see Maps 8-9*).[23] The GIS analyses, satellite imagery (*see Maps 10-11*), and associated maps determined the most influential criteria to identify suitable sites (*see Table 5 - Siting Table 2: Most Influential Criteria*).

Using Influential Criteria to Identify Suitable Sites

The most influential criteria for determining suitability were area, potential water issues, and site features such as buildings, structures, and vegetation. Estimates range between four to ten acres required for every 1 MW of generating capacity.[24,25] Eight acres is preferred because site characteristics or features may reduce available area and additional equipment may be required (*see Technical Analysis: Area Considerations Section for more details*). Many sites were eliminated because they are in a floodplain, wetland, or adjacent to a river or stream designated by FEMA as a floodway (*see Maps 4-7*).[26,27,28] Shadows cast by buildings or structures may interfere with energy production *(see Shade Analysis Appendix)*. From the shade analysis, we recommend a setback between the solar array and adjacent buildings, structures, or trees that is at least the length of the object's height to avoid impacting solar production. It is important to note that in the siting area recommendation, there are no immediate objects that would cast shade on the solar array. Dense vegetation was also avoided due to labor costs and carbon emissions associated with removal, which further reduced the available area *(see Maps 10-11)*.[29]

Recommended Sites

Gathering information and identifying the most influential siting criteria early on using GIS analyses narrowed down the potential sites to two: the Water Treatment Plant (WTP) and the Wastewater Treatment Plant (WWTP) *(see Table 5)*. Both sites have minimal structures and vegetation, apart from two buildings and fencing on the WTP (based on updated satellite imagery) that may reduce available development space by approximately four acres if construction within the fence will impact operations. The WTP is our first recommendation based on approximately 20 available acres outside the fenced area, which is sufficient to construct a 1 MW_{DC} solar array and potentially expand the array or add battery storage in the future. The area available on the WWTP was not large enough to accommodate a 1 MW_{DC} capacity array while still allowing for the panels to be distanced for maintenance vehicles. When row spacing was reduced to meet the desired nameplate capacity, the resulting capacity factor of the system was uneconomical. Following the Technical Analysis, this site is not recommended *(see Technical Analysis Appendix)*. All maps of the two potential sites were reviewed for suitable and non-suitable areas prior to designing the PV system models. A professional site evaluation conducted by city planners, solar developers, and consultants will be required to verify these analyses and develop site plans *(see Figure 13 for Stakeholder Map)*.

Technical Analysis

A technical analysis was completed using HelioScope, a software which uses satellite imagery to design solar PV systems. Models of the proposed array were completed for both sites (WTP and WWTP) identified by the Siting Analysis. A 500 W_{DC} panel was selected for this analysis. Assumptions made across all HelioScope models, along with justifications for their selection can be found in the Technical Appendix. Full production reports and visuals for all models can be found in the Supplemental Materials.

Area Considerations

It should be noted that the required area for the models is an underestimate because it only includes the area that the panels cover and the area between rows of panels. Using lower capacity or less efficient panels will cause the required area to increase. Altering the assumptions related to setback distances or tree heights will also change the amount of area needed for a 1 MW_{DC} capacity array. Estimates range between four to ten acres required for every 1 MW_{DC} of generating capacity depending upon the chosen panel capacity.[30,31] Eight acres is preferred because site features or characteristics may reduce available area and additional space should be factored in for energy storage, electrical equipment, and other necessary maintenance or structural equipment, including a fence around the system. John Gantner, a Civil Design Engineer from ENGIE, was consulted about required area for battery storage, interconnection, and distribution. John stated that these elements are typically grouped together in an area roughly 50 feet by 50 feet, but he noted that this area varies significantly based on the size of the site.

Row Spacing Considerations

HelioScope offers several choices regarding the spacing of rows of panels. For each site, three models were made. Two of the three were made using the "time of day" function. This function defines the row spacing based on sun angles at a specific time and date range. The panels will be spaced as close as possible while maintaining no shade in the specified range. The calculated spacing is then used to determine the Ground Cover Ratio (GCR), or the proportion of the system array used to catch sunlight. One model was made on the date of the 2020 winter solstice, to capture the scenario when the least amount of sunlight is available, and another for the date of the 2020 spring equinox, to represent a scenario with an average amount of irradiance. Row spacing must be large enough for maintenance vehicle access, so 12 feet was manually input into the recommended third model.

Water Treatment Plant (WTP) Models

Project Address: 6133 Werkner Road, Chelsea, MI 48118

Modeling variations were created for this site given considerations including shading, row spacing, and factors from the GIS analysis. Two portions of the total site area were specifically focused on and labeled "Area 1" and "Area 2," as shown in the Technical Appendix - Figure 7. Area 1 has a larger percentage of space with slope < 5%, but satellite imagery shows more trees and foliage. A portion of area 2 has slope > 5%, as well as a fence that would potentially need to be removed, but it appears already devoid of nearby trees *(see Map 2, Map 10, Figure 7)*. When cross-referenced against the maps created in the GIS analysis *(see Maps Appendix)*, both Area 1 and Area 2 show similar results, with minor differences in "surface water management" and "fence post depth: 24 inches or less" *(see Map 6 and Supplemental Materials for Soil)*. Satellite imagery shows that Area 1 is close to a power line, and both areas are close to a road, making them suitable for truck access for maintenance. HelioScope imagery showed that the space inside the fence of Area 2 was unpaved, but updated satellite imagery shows that it is paved *(see Map 10 or Figure 7)*. Area 2 should only be considered if it does not impact WTP operations. See Figure 10 and Table 8 in the Technical Appendix for information and results related to modeling the array within Area 2. Beyond these two areas, there is an even larger area that can potentially be utilized, but satellite imagery shows that trees will likely need to be cleared.

Area 1 Model:

The position of the array in Figure 8 was selected to maximize the amount of the array in portions of Area 1 with <5% slope *(see Map 2)*. However, the aspect ratio of the array could be altered if required by setback regulations. Satellite imagery shows that the land has many tall grasses on it.[32] Height of the panels can be adjusted for maintenance of current or new underlying vegetation *(see Environmental Analysis section)*. Some clearance may be necessary to create an access path from the road to the panels.

In terms of shading, there are no surrounding buildings that could cast a shadow onto the system. One tree was noted as being large enough and close enough to the system to cast a shadow onto some panels. Its estimated height and radius are shown in Figure 8. Performance metrics beyond distances and tree height/radius listed on Figure 8 are only relevant when 12-foot row spacing is modeled, as that scenario provided the highest annual energy output and system performance ratio. The scenario modeled with 12 feet of row spacing resulted in 5.6% of system loss due to shading, which is attributed to panels casting shadows on the rows of panels behind them, but was within the typical range listed by HelioScope *(see Figure 9)*. Characteristics of the three models created for Area 1 of the WTP are provided in Table 8.

Recommendations Based on Technical Analysis

The WTP is recommended as the site for the community solar array. The overall area of the site is large enough to accommodate the desired system size even with 12-foot row spacing. A 12-foot row spacing at this site was shown to result in the largest annual energy output, system performance ratio, and capacity factor. Larger row spacing will take up more available land on the site, but can reduce the amount of system losses due to shading, therefore leading to an increase in capacity factor. Additionally, there is flexibility to choose a location within the site that is optimized within the factors considered in the Siting and GIS analyses. The site is large enough to be setback from adjacent roads or properties, potentially reducing community concerns and NIMBYism. If during the design phase of the project, a panel is ultimately chosen that has a capacity less than 500 W_{DC}, there is still enough area on the site to fit a 1 MW_{DC} capacity array with rows spaced at a distance such that the resulting capacity factor is at least 15%.[iii] Finally, the size of this location allows for the expansion of the array to enable energy storage or a higher nameplate capacity in the future. It should be noted that based on satellite imagery, it is likely that trees will have to be cleared on this site.[33] Carbon offsets could be purchased to mitigate the environmental impact of clearing trees and/or native plants could be planted around the array.

Subscription Models

Low-to-Middle-Income (LMI) Residents Considerations

Definitions and Importance of Energy Equity

LMI community solar subscribers are prioritized in this feasibility report. LMI residents, for the purposes of this study, are defined as residents that are at or below the federal poverty line (FPL).[34,35] There was demonstrated support from Chelsea community members and John Hanifan to make energy equity a part of the feasibility study. Benchmarking for LMI programs of other community solar pro-

iii A 15% capacity factor was found to be at the upper bound for Michigan, given the state's geographic location and incoming solar irradiance. Lower capacity factors were found to produce uneconomical results for this project.

grams and utilities in Michigan can be seen in Tables 11 and 12 *(see LMI Appendix)*. Through calculations shown in the LMI Appendix, it is estimated that approximately 80 households in Chelsea meet this qualification *(see LMI Appendix)*. The financial model assumes that 20 LMI households will be LMI subscribers to the proposed project, equal to 25% of the estimated number of LMI households in Chelsea.

LMI Recommendations

Based on the research gathered on LMI best practices and benchmarks in Michigan, three main recommendations were created to incorporate LMI participation in the community solar project: (1) create a modern eligibility system for LMI households that is not based on credit worthiness, (2) utilize on-bill financing, and (3) collaborate with Faith in Action, which is the community action agency located in Chelsea (*see Table 2; see the LMI Appendix for more information*).

Customer Subscription Models

For community solar projects, there are multiple subscription models available to customers including owning panels and subscribing to panels. Under a subscription model, subscribers receive on-bill credits for the energy produced by the panels that they are subscribed to. There are pros and cons to each model type.[36] Ownership of panels allows participants to not have to consider inflation of payments while subscribed to the project, yet panels could be considered taxable income by the Internal Revenue Service (IRS) since electricity credits may be considered income.[37] On the other hand, subscribing to panels is more favorable to the City from a securities law perspective (*see Securities Law Appendix*). Subscriptions can be structured with upfront payments, payments over time, or a combination of the two options. We recommend a subscription model as opposed to an ownership model based on Cherryland's Spartan Solar benchmark, with upfront payments for standard subscription customers and annual payments over 20 years for the LMI subscribers (the Spartan Solar benchmark also contained a combination of upfront and annual subscription payments).[38] In the Financial Model section, it will be discussed why upfront financing for customers and 20-year financing for LMI subscribers were chosen as the overall subscription model for customers. Additionally, each MWh of electricity produced creates 1 REC, and the RECs generated from this project would belong to the City unless otherwise specified.

Financial Model[iv]

Two financial models were developed to analyze the effect of project specifications, financial inputs, and subscription models on the project's key metrics for the City, LMI customers, and standard customers, including net present value (NPV), return on investment (ROI), and internal rate of return (IRR).[v] The first model considers a scenario without a tax equity investor and the second model considers a scenario with a tax equity investor. The specified inputs feed into free cashflow tabs for each constituency, which then feed into the output tab to calculate the NPV, ROI, and IRR as applicable. These models are fully customizable and can be updated to reflect changes to the proposed project design, thereby enabling planners to see how modifications to the inputs affect each constituency differently (*see Supplemental Materials*).

The sources for each input assumption are listed in the input tabs, and a cost-benefit analysis from the L'Anse benchmark provided many of the assumptions utilized in the models.[39] A 25 year subscription is recommended in both models, based on the Lansing Board of Water and Light (LBWL) benchmark.[40] Debt

iv None of the analysis contained in this section constitutes legal or tax advice, and competent counsel should be engaged if the City decides to proceed with the project.

v The ROI and IRR were calculated to support program marketing.

is not included in the models, since the proposed subscription structures include upfront subscription payments that effectively cover the initial capital expenditure for the project.[vi] Tax and depreciation are only considered in the tax equity scenario, under the assumption that municipalities are not required to pay taxes and an accounting of depreciation is only relevant for tax purposes.[41] Finally, the projected cash flows and weighted average cost of capital (WACC) are real, so inflation is not added to the cash flows.

The tax equity scenario was considered because the non-tax-equity scenario led to a significant negative NPV for the City.[vii] This is due to the 15% capacity factor identified in the Technical Analysis, which is lower than capacity factors in other parts of the country with higher irradiation levels.[viii] Small changes to the capacity factor have an outsized impact on the NPV, since the capacity factor drives the customer rate credit and utility avoided cost rates, which are spread out over a fixed total installed cost. Thus, when designing and operating the project, particular attention should be paid to ensuring an adequate capacity factor.

The team investigated other revenue opportunities, including identifying Ryan Cook of Clear Energy Brokerage & Consulting, LLC, who is able to monetize the project's RECs in Ohio for approximately $8/REC, which is significantly higher than the $1.25-$2.50 market price for RECs sold in Michigan.[42] The team also modeled a scenario without an LMI component. However, none of these approaches resulted in a positive NPV for the City. It is important to ensure that the City, standard subscription customers, and LMI customers all have a positive NPV for the project – otherwise, it would not make economic sense for a given constituency to participate in the project. Thus, shifting costs from the City to customers to raise the City's NPV would create a material risk that customers would not purchase subscriptions to the system and the project would not be feasible.

For these reasons, we recommend that the City engage a tax equity investor for the project, although we also included the non-tax-equity model in the event that the City is willing to accept a negative NPV to avoid engaging a tax equity investor. If the City engages a tax equity investor, it would be important to start construction in 2021, before the solar Investment Tax Credit (ITC) drops from 22% to 10%.[43] If the City does not wish to engage a tax equity investor, even in light of the significant financial benefits, it should explore further modifications to the technical specifications in order to boost the system's capacity factor (such as adding trackers or bifacial panels).

The team's research and interviews identified numerous examples where tax equity investors were engaged for small community solar projects. Generally, tax equity investors prefer projects greater than 1 MW, due to the costs associated with setting up the structure.[44] However, John Kinch of Michigan Energy Options engaged a tax equity investor for the 300 kW LBWL benchmark, and there are other examples from small municipal and cooperative utilities solar projects.[45] A key challenge is identifying suitable tax equity investors for community-scale projects; however, Ryan Cook expressed an interest in engaging with the City on this topic and John Kinch would also be a good contact (*see Table 3*).

Benchmarks including the LBWL project utilized third party developers to engage tax equity investors and monetize the ITC, and this approach is recommended based off of the

vi If target subscription levels are not achieved, the City should consider issuing municipal bonds to meet the initial capital expenditure requirements.

vii The purpose of the tax equity model is to illustrate an approximate capital contribution that could be expected from a tax equity investor based off the specified inputs. However, the model does not consider complexities such as partnership capital accounts, which could affect the exact dollar amount of the capital contribution.

viii A 15% capacity factor was found to be at the upper bound for Michigan, given the state's geographic location and incoming solar irradiance. Lower capacity factors were found to produce uneconomical results for this project.

benchmarks.[ix] However, the City expressed a preference to avoid engaging a third party developer, so the team investigated an alternative public private partnership (P3) model, and the tax equity financial model is based off this alternative P3 model *(see Financial Model Appendix)*.[46] Given the City's preferences, the team did not create a model for a developer-led project.[x] In the P3 model, the City and tax equity investor would be co-members of a project company LLC that would own all of the project assets; however, the City's ownership would be through a C Corp making an IRC Section 168(h)(6)(f) election as a "blocking entity," since the City's tax-exempt status would be imputed to the LLC without a blocking entity.[47] The team identified a benchmark where the tax-exempt Eau Claire Electric Cooperative utilized a partnership flip tax equity financing to monetize the ITC, presumably by utilizing a blocker corp.[48,49] However, given the lack of P3 community solar benchmarks with a tax equity component in Michigan, experienced counsel should be engaged to ensure that the transaction structure does not violate relevant regulations.[xi]

After analyzing several possible scenarios, the proposed project specifications and tax equity financing model were chosen because the proposed project results in a positive NPV for all three constituencies *(see Supplemental Materials)*. Based on direction from the City, a 1 MW_{DC} project was specified. 500 W_{DC} panels and 15% capacity factor were chosen based on the Technical Analysis. The recommended subscription rates for both the LMI and standard subscriptions are $640/panel, and the only difference between the two subscriptions is that the standard subscription has an upfront payment, while the LMI component provides for financing over 20 years.[xii] The customer rate credit was set at the wholesale rate, as opposed to the retail rate, to avoid distributional concerns associated with non-community-solar ratepayers subsidizing community solar subscribers.[xiii] An upfront payment for the standard subscription is recommended, because this reduces the need for the City to issue municipal bonds to finance the project *(see Securities Law Appendix)*. 20 year financing is recommended for the LMI customers because this leads to positive net cashflows for the LMI customers on an annual basis. This ensures that the LMI customers do not have to pay for their subscriptions out of pocket. The subscription price of $1.28/WDC is less than the Cherryland Spartan Solar benchmark, where the price was $1.80/WDC.50 Additionally, the ROI for the standard subscription is an attractive 52.41%.[xiv]

If the City decided to go with the non-tax-equity financing model, there would be several important tradeoffs to note, even when the non-tax-equity model is optimized for upfront subscriptions to cover the cost of the system, a positive NPV for standard and LMI subscriptions (to avoid reducing the demand for the subscriptions), and positive cash flows for the LMI subscriptions in all years (*see Supplemental Materials*). First, a $1.04/$W_{DC}$ total installed cost is assumed for the non-tax-equity model, which does not account for a fence

ix Cherryland also utilized Spartan Solar as a third-party developer for its community solar project, and it presumably monetized the ITC in that manner.

x Developers generally require a 6% IRR, so this would slightly reduce the benefit of monetizing the ITC; however, the prevalence of a developer model in the relevant benchmarks indicates that the benefits outweigh the costs. Even though benchmarks were developed when the ITC was at a higher 30% rate, engaging a developer to monetize a 22% ITC would likely still improve the project's NPV.

xi Foster Swift appears to have a public-private partnership (P3) practice in Michigan.

xii We modeled an assumption that 10% of the panels would be allocated to the LMI subscription and 85% of the panels would be allocated to standard subscriptions, with 5% of the project unsubscribed. These assumptions can be easily changed in the model based on Chelsea's preferences.

xiii Community solar does not provide the same value attributes as retail power (i.e. consistent dispatchability).

xiv There is no ROI calculation for the City of Chelsea or the LMI subscription customers since there is no initial cash outlay for these constituencies according to our model.

(~$0.10/$W_{DC}$ based off the L'Anse benchmark). Second, the price per panel is significantly higher at $835 for the standard subscriptions and $790 for the LMI subscriptions in the non-tax-equity model. Finally, the City's NPV is negative $113,010.35 in the non-tax-equity model compared to $8,561.88 for the tax equity scenario, which is a $121,572.23 difference. For these reasons, we strongly recommend engaging a tax equity investor for the project.

Environmental Analysis and Impacts

Based on anticipated annual energy production from the 1 MW_{DC} system at WTP Area 1 of 1.329 GWh or 1,329 MWh, we can predict mitigating 940 metric tons carbon dioxide equivalent (MT CO_2e) Scope I emissions annually.[51] This calculation assumes emissions are mitigated from marginal power plants, which are run on fossil fuels to meet supplemental, not baseload demand.[52] This is equivalent to taking 203 passenger vehicles off the road, providing electricity to 159 homes, avoiding burning over a million pounds of coal, or sequestering carbon on 1,227 acres of forest for one year in the U.S.[53] This project is estimated to increase Chelsea's renewable portfolio percentage from an anticipated 24% in 2021, through wind and landfill gas (LFG) power purchase agreements (PPAs), to 26% with added City-owned community solar *(see Environmental Analysis Appendix, Tables 13 and 14)*.[54]

After attending a presentation to benchmark the LBWL community solar project developed by Michigan Energy Options (MEO),[55] the team was inspired to recommend using native, pollinator-friendly vegetation at the site. We advise collaborating with the Michigan Wildflower Farm (*see Table 15 for contact information*) that MEO partnered with to plan and implement pollinator friendly vegetation at the site. Native plants under and around solar panels provide multiple benefits to any solar site including habitat restoration for flora and fauna including pollinators, soil remediation, water management, and aesthetic appeal.[56] Current site vegetation should be assessed for (a) native, pollinator-friendly plants presence and (b) ecosystem health to determine if restoration versus removal and planting is necessary.

Stakeholder Analysis

A stakeholder analysis was conducted to identify the persons and organizations that have an interest or stake in the development of the community solar project. By plotting the stakeholders using a stakeholder mapping method, it can be seen which stakeholders to work with, satisfy, monitor, or inform. Figure 13 illustrates our team's stakeholder analysis. Each quadrant of the map represents a different function of the stakeholders that fall in that category. A description of each quadrant of the map is listed below the figure to provide clarity and information on the roles of organizations that fall within each category. Additionally, Table 15 suggests external organizations to partner with for the development, marketing, and implementation of the community solar project.

Conclusions and Overall Recommendations

Through this year-long endeavor to explore community solar in Chelsea, the Dow Fellows team has determined a feasible path forward to develop the project. This report includes relevant regulatory, siting, technical, LMI, financial, environmental, and stakeholder analyses to inform decisions on the next steps. Supplemental materials include GIS maps, shade analysis statistics, full technical reports, and the financial model (*see Supplemental Materials on pg. 50*). An overview of final recommendations for the project can be seen in Table 2. In conclusion, this feasibility study will help to facilitate the subsequent development and implementation of a community solar project in Chelsea in 2021.

Reference Appendix

Map 1. Context Map: Potential Community Solar Sites for City of Chelsea Located in Washtenaw County, Michigan[57]

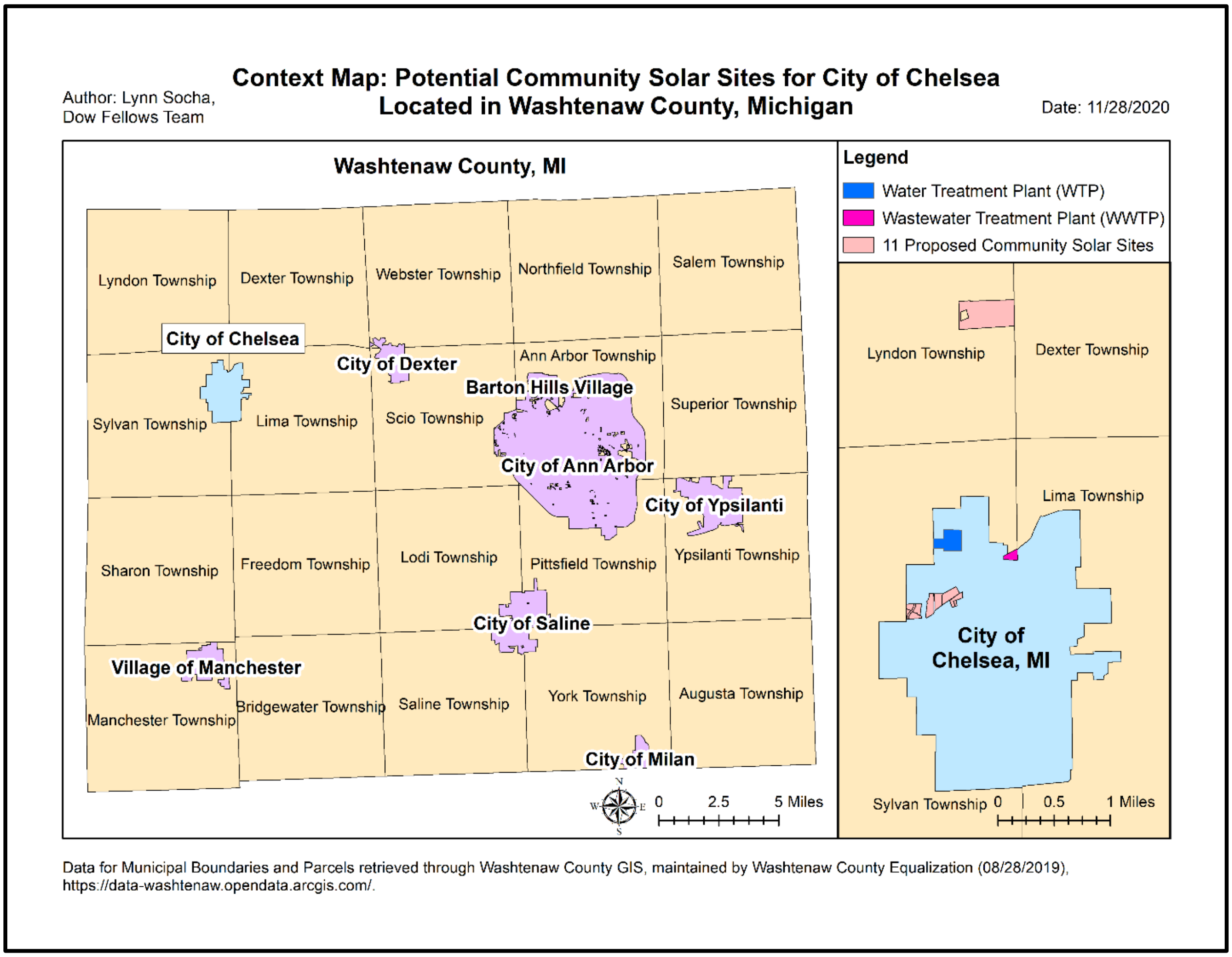


Table 1. Definitions and Abbreviations

Abbreviation or Term	Definition
"Blue Sky" Securities Law	State-level securities regulations that mandate registration and reporting requirements.
Brownfields	Any previously developed land that is not currently in use and is potentially contaminated (EPA).[58]
Capacity Factor	The maximum electric output a generator can produce under specified conditions.
FPL	Federal poverty line. A threshold to define households annualized income that qualify for certain federal programs.
Floodway or Regulatory Floodway	"the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. Communities must regulate development in these floodways to ensure that there are no increases in upstream flood elevations" (FEMA).[59]
Howey Test	Test to determine what constitutes a security, as articulated in *SEC v. W.J. Howey Co.*
I_{sc}	Short circuit current. The maximum current from a solar cell (occurs when the voltage is 0).
Interconnection Points	Generation assets interconnect with the existing electrical grid at either the transmission network level or distribution network level to carry power over long or short distances, respectively, to consumers. Interconnection points at the distribution level carry power at lower voltages over short distances to customers.
I_{mp}	Current at the maximum power point of a solar panel's I-V curve.
IRR	Internal Rate of Return
LMI	Low-to-Middle-Income residents. Used to discuss residents that fall below the federal poverty line (FPL) in the city.
MACRS	Modified Accelerated Cost Recovery System
MUNI	Municipal utility
NPV	Net present value

Abbreviation or Term	Definition
REC	Renewable energy certificate
ROI	Return on investment
SEC	U.S. Securities and Exchange Commission
Front of the meter (FTM)	Electricity produced by the project is metered by the utility and quantified.
V_{mp}	Voltage at the maximum power point of a solar panel's I-V curve.
V_{oc}	Open circuit voltage. The maximum voltage from a solar cell (occurs when the flow of current is 0).
WACC	Weighted average cost of capital

Table 2. Recommendations

Models	Criteria	Recommendation
Securities Law	Contract Structure	Engage competent counsel to ensure that the contract structure does not trip the *Howey* test and trigger registration and reporting requirements.
Consumer Protection Law	Marketing Materials	Engage competent counsel to ensure that all representations about program benefits are accurate (e.g. if Chelsea retains title to the RECs, the marketing materials should clearly state that subscribers would not have rights to any renewable attributes associated with their subscription).
Financial Model	Financing Model	Engage tax equity investor, preferably via a developer.
	Subscription Model	Upfront payments for standard subscription and 20-year financing for LMI subscription.
	Subscription Length	25 years
	Net Present Value	Positive for each constituency.
	Customer Rate Credit	$.06/kWh (i.e. wholesale rate)
Low-to-Middle-Income (LMI) Considerations	Incorporating considerations for LMI residents in Chelsea	• Create eligibility for the LMI carveout based on the following two factors: (1) resident households fall below the FPL (2) consistent utility bill repayment history. • Use on-bill financing • Seek out external funding opportunities • Collaborate with Faith in Action in Chelsea, MI

Models	Criteria	Recommendation
Siting Analysis	City of Chelsea Zoning Ordinance Update[60]	Include solar as an allowed use to ease the development of future solar projects. Specifying restrictions via zoning regulations for solar type (ground-mounted and/or roof-top), allowed zones, and size, area, or scale will enable solar energy production to meet current and future renewable energy goals (15% by 2021) "while protecting aesthetics and character."[61]
	Recommended Community Solar Project Sites	Water Treatment Plant (WTP) and Wastewater Treatment Plant (WWTP)
	Setbacks	Setback should be the distance of the building, structure, or tree's height to avoid shade impacting solar production. The City shall determine setbacks specifically for fencing based on current practices.
Environmental Analysis	Assess Vegetation on Site	Assess for (a) native, pollinator-friendly plants presence and (b) ecosystem health to determine if restoration versus removal and planting is necessary.
	Recommended Community Solar Project Site Characteristics	Use native plants under and around solar panels to provide multiple benefits: habitat restoration for flora and fauna including pollinators, soil remediation, water management, and aesthetic appeal.
Technical Model	Size of array (DC Nameplate capacity)	1.00 MWp
	Number of panels	2,000
	Size of panels	500 W_{DC}
	Optimal project site	Water Treatment Plant (WTP) Area 1
	Optimal row spacing	12 feet
	Capacity Factor	Design system for the highest possible capacity factor.
Stakeholder Analysis	Community Engagement	Engage with stakeholders in Figure 13 and Table 15 for project development.
Future Opportunities	Project Expansion (potential future Dow Fellows project)	Increase size of solar array and/or add battery storage.

Table 3. Client and Key Stakeholder Contact Information

Clients:

John Hanifan, City of Chelsea City Manager, jhanifan@city-chelsea.org, 734-475-1771 x201
Melissa Johnson, City of Chelsea Mayor, mjohnson@city-chelsea.org, 734-475-1771 x212

Other Key Stakeholders:

Brett Niemi, WPPI Energy, bniemi@wppienergy.org, 608-825-1762
John Gantner, Civil Design Engineer at ENGIE, john.gantner@engie.com, 618-977-6233
John Kinch, Michigan Energy Options (MEO), jkinch@michiganenergyoptions.org, 517-337-0422 x305
Karl Hoesch, Michigan Department of Environment, Great Lakes, and Energy (EGLE) contact, hoeschk@umich.edu, 616-836-2265
Robert LaFave, L'Anse Village Manager, manager@lansemi.org, 906-524-6116
Ryan Cook, Clear Energy Brokerage & Consulting, LLC, ryan.cook@clearenergybrokerage.com, 616-528-4682
Dr. Sarah Mills, U-M Faculty Advisor, sbmills@umich.edu, 734-615-5315

Methods and Activities Appendix

The project was approached in two phases, preliminary research followed by detailed modeling and analyses. The preliminary research included case study benchmarking, a review of relevant literature, and interviews with subject matter experts. Financial and technical models were created based on the preliminary research in addition to regulatory, siting, environmental, and stakeholder analyses.

Successful community solar projects from the Village of L'Anse, Cherryland Electric Cooperative, and the Lansing Board of Water and Light (LBWL) were used as benchmarks. Chelsea requested the Cherryland Electric Cooperative benchmark, and the others were chosen because of their geographical locations in Michigan, MUNI utility affiliation, and similar scales to the proposed project for Chelsea. Each benchmarking exercise included a review of written case studies of the respective projects, project websites, and interviews with key stakeholders, including John Kinch for the LBWL project and Robert LaFave and Brett Niemi for the L'Anse project (*See Client and Key Stakeholder Contact Information in Reference Appendix Table 3 for further information*).

In addition to the benchmarking activities, a broader literature review was also completed. Community solar project guidance resources from the U.S. Environmental Protection Agency (EPA)[62] and NREL[63,64] were imperative for developing methods. Primary sources included statutes, regulations, and court decisions. Secondary sources included news articles, internet research, and journal articles.

Interviews were also conducted outside of benchmarking. An initial meeting with Chelsea's Mayor Melissa Johnson and City Manager John Hanifan, who also manages the MUNI, provided background and guidance that was crucial to understanding how the MUNI functions and key project specifications, such as proposed project size (1 MW_{DC}) and site locations. Karl Hoesch from the Michigan Department of Environment, Great Lakes, and Energy (EGLE) was interviewed about LMI strategies for community solar. John Gantner of ENGIE's distributed renewables team was interviewed regarding technical topics. Finally, Dr. Sarah Mills from the University of Michigan Ford School of Public Policy provided insight regarding relevant regulations for community solar in rural communities (*see Client and Key Stakeholder Contact Information in the Reference Appendix Table 3 for further information*).

Securities Law Appendix

The proposed community solar model does not violate Michigan's "blue sky" laws. Michigan has a separate securities law regime contained in its blue-sky laws. However, securities issued by a political subdivision including a city or "portion" of a city are exempt from the securities laws.[65] Thus, the City of Chelsea and its utility are exempt.

Federal securities regulations take a relatively expansive view of what constitutes a security, which includes so called "investment contracts."[66] While there is not a bright line delineating what constitutes a security, federal courts are bound by the precedent contained in *SEC v. W.J. Howey Co.*[67] *Howey* articulates the four-part test: 1) an investment of money, 2) in a common enterprise, 3) with expectation of profits, 4) derived from the efforts of others. If all four prongs are met, then the contract in question is a security.

In order to mitigate the risk of a community solar arrangement being considered a security at the federal level according to the *Howey* test, a project sponsor can seek a SEC no-action letter or legal opinion that the arrangement is not a security; however, both approaches are expensive.[68] An attractive alternative is to structure the transaction in a manner that the prongs of the *Howey* test are not met. For instance, selling shares that correspond to an individual panel's output, structuring the subscriptions without upfront payments, and/or ensuring that subscribers' up-front payments are not at risk can undermine the *Howey* test's common enterprise prong in certain circumstances.[69] However, given the fact-dependent nature of the *Howey* test, it is critical to engage competent counsel to structure the contractual arrangements in a manner that does not violate the *Howey* test.

Siting Analysis Appendix

Table 4. Siting Table 1: Siting Criteria

#	Criteria	Value	Rationale	Preference
1	In City Limits	Y or N	Chelsea Municipal utility can provide distribution to parcels within city limits.	Y
2	Area	Acres	Estimates range between four to ten acres required for every 1 MW of generating capacity depending upon the chosen panel capacity. This is due to site features/characteristics that may reduce size and additional area for energy storage, electrical, and other necessary maintenance or structural equipment.	Eight acres or more is preferred. At least four acres is required.
3	Owned by City	Y or N	No land acquisition costs.	Y
4	Visibility to City	Miles	Measured radius distance from site location to city hall address, approximating the city center, to determine visibility to the public.	Less than 1.2 miles from city hall.
5	Potential Future Developme nt	Y or N	If other development was planned then this would limit project size. For example, FC-06-12-249-012 documents indicated the site of a future road, although this is no longer planned.[70]	N
6	Interconnec tion Points	Y or N	Connection to the electricity grid is possible for proposed sites. The generation asset must be able to interconnect with the existing electrical grid at the distribution network level to carry power over short distances consumers. City Staff will do distribution capacity analysis on final sites to verify.[71]	Y
7	Slope Steepness	Percentage (%)	Flat surface is needed for construction, otherwise site must be graded, adding to construction costs.[72] Slope steepness can	Less than or equal to (≤) 5% slope.[73]

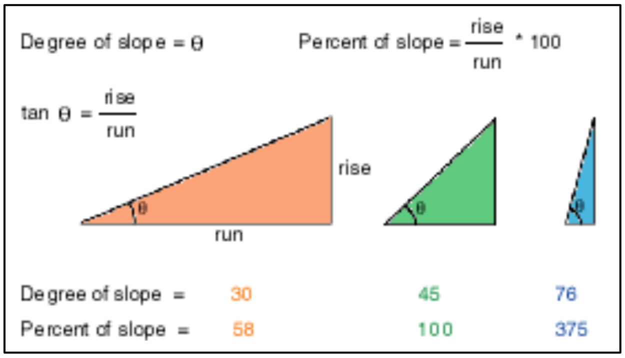
#	Criteria	Value	Rationale	Preference
			interfere with the south facing angle degree needed for capturing solar.	
8	Slope Direction (Aspect)	Degrees (°) and four cardinal or intercardinal directions (N, S, E, W, NE, NW, SE, SW)	The four cardinal directions are North South, East, and West (N, S, E, W) and the four intercardinal directions are Northeast, Northwest, Southeast, and Southwest (NE, NW, SE, SW). Avoid South to North facing slopes, otherwise site must be graded, adding to construction costs.[74]	As close to true South (S) 180° as possible. Between 135° Southeast (SE) and 225° Southwest (SW).
9	Wetlands/ waterways	Y, Partial, N and Description	Wetlands, floodplains, or other water bodies or waterways could lead to water issues.[75]	N
10	Stormwater / Drainage	Y, Partial, N and Description	Stormwater mitigation measures like swales or retention ponds are required for erosion, sediment, and water control.[76]	N
11	Soil Composition	Description	"Soil conditions impact structural design and site feasibility. Caliche or bedrock may require costly drilling. Sandy soils may require deeper post embedment to meet wind and snow loading requirements. Corrosive soils can require measures to protect embedded posts."[77]	Avoid caliche, bedrock, sandy, and corrosive soils.
12	Wildlife/ habitat/flora	Description	"Check for critical habitat, riparian areas, and endangered species of flora or fauna that may be impacted."[78]	Avoid areas of "critical habitat, riparian areas, and endangered species."[79]
13	Driveway/ access	Y or N	An existing access road without obstructions ("overhead utilities, trees, or vehicle weight limits") allows for construction equipment and materials to get to site. If no access road is available or a new driveway is needed, this adds to construction costs.[80]	Y
14	Easements/	Y or N and Description	"Are there easements or rights of way for pipelines, utilities, or rail	No crossings and impacts to current

#	Criteria	Value	Rationale	Preference
	encumbrances/rights-of-way		roads that will be crossed or impacted? Are there plans for road expansions or improvements, new pipelines, or future utility rights of way" [81] during the project's life?	and future infrastructure.
15	Cultural, agricultural, visual resources	Y, Partial, N and Description	"Are there known cultural resources on or near the site? If not, are further studies required? Is the site under agricultural protections? Is the site within a protected or sensitive viewshed?"[82]	No impacts to cultural, agricultural, visual resources.
16	Land use and building permits	Y or N and Description	Does the project align with allowed zoning, setbacks, and are building or rights of way permits required?[83] *Note:* Zoning not an issue given project is "Public Use" on City-owned lands.[84]	No conflicts with allowed zoning, setbacks, or permits.
17	Site features	Description	Identify existing buildings or structures, vegetation, and water features using satellite imagery.	No existing buildings, structures, or water features and limited low-lying vegetation.
18	Grouping of Adjacent Parcels	Group Name and Total Area (Acres)	Increases the area available for the project, allowing small parcels less than four acres to be considered.	Grouping with a total area of eight or more acres is preferred, at least four acres are required.

Table 5. Siting Table 2: Most Influential Criteria

Sites	Area (acres)	Wetlands, waterways, storm water/drainage	Site Features (buildings, structures, vegetation)	Overall Score (1 least - 5 most suitable scale)
Water Treatment Plant (WTP)	24.2486	Limited	Buildings and fencing	5
Wastewater Treatment Plant (WWTP)	5.53	Limited	No conflicting features	5
Transfer Station (Closed Landfill)	77.87	Partial	Extreme slopes	1
Departments of Water & Public Works (DPW) Grouping (Including Electric Dept.)				***2***
Department of Electric	7.7621	Partial	Buildings and dense vegetation	1
Departments of Water & Public Works (DPW) Group (Excluding Electric Dept.)				***2***
DPW Garage	0.665	Partial	Buildings	1
Depts. of Water & DPW	3.6604	Partial	Buildings	1
Depts. of Well Water & Material Storage	7.871	Partial	Buildings	2
Unnamed Parcel	5.4009	Partial	Dense vegetation	2
Detention Basin Industrial Park Group				***2***
Detention Basin (Industrial Park)	5.9442	Y	Dense vegetation	2
Industrial Park (Vacant Land)	3.35	Y	Dense vegetation	1
Outlot A Chelsea Ind. Park	1.6	Y	Dense vegetation	1

Figure 2. Percent and Degree Slope



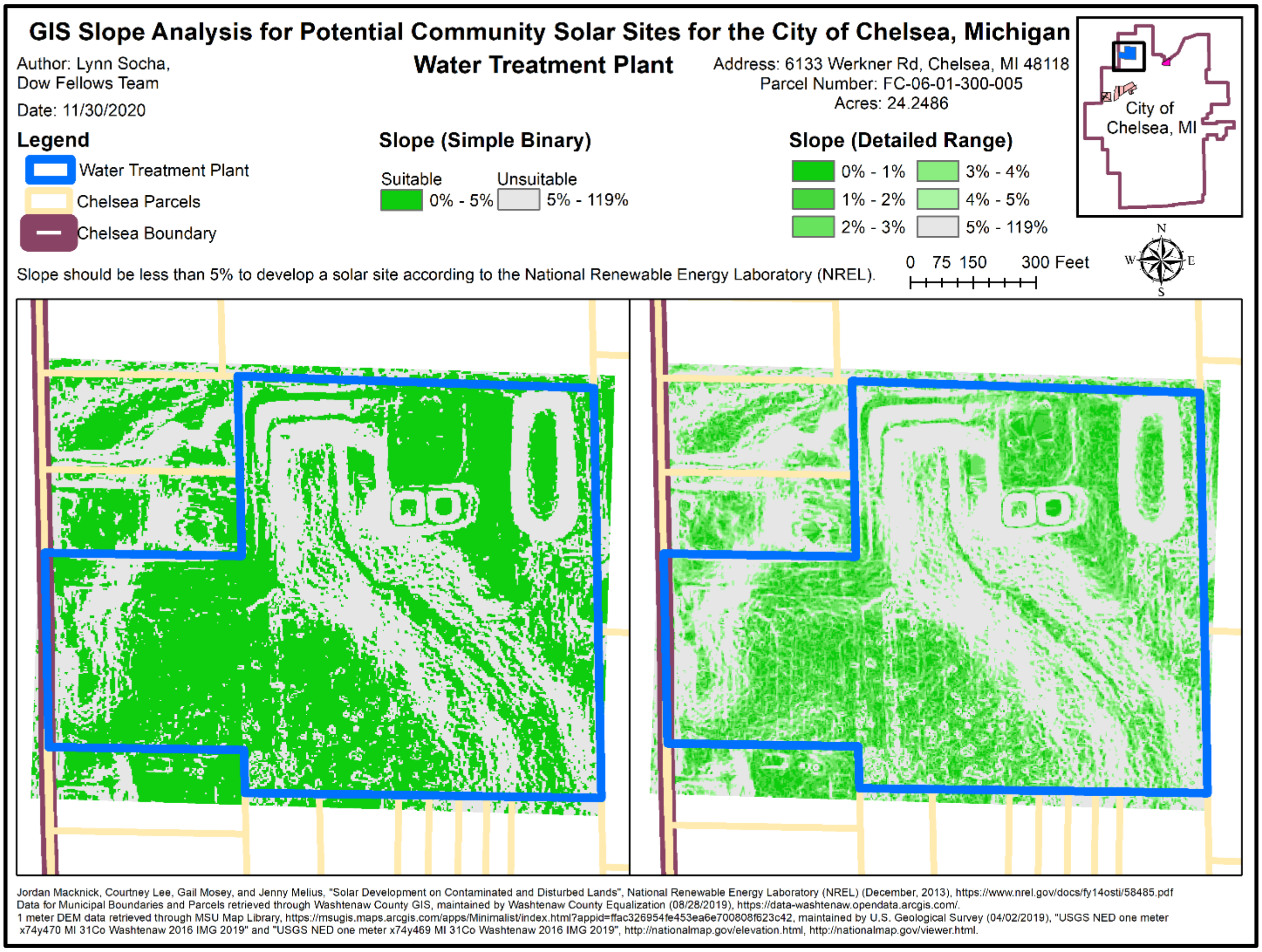
This graphic explains how to calculate and convert both percent and degree slope.[85] Examples of the results are provided for comparison. For this project, percent slope was calculated to determine areas with percent slope of less than or equal to five percent (≤ 5%) slope in alignment with NREL guidance.[86]

Maps Appendix of Recommended Sites: Water Treatment Plant (WTP) and Wastewater Treatment Plant (WWTP)

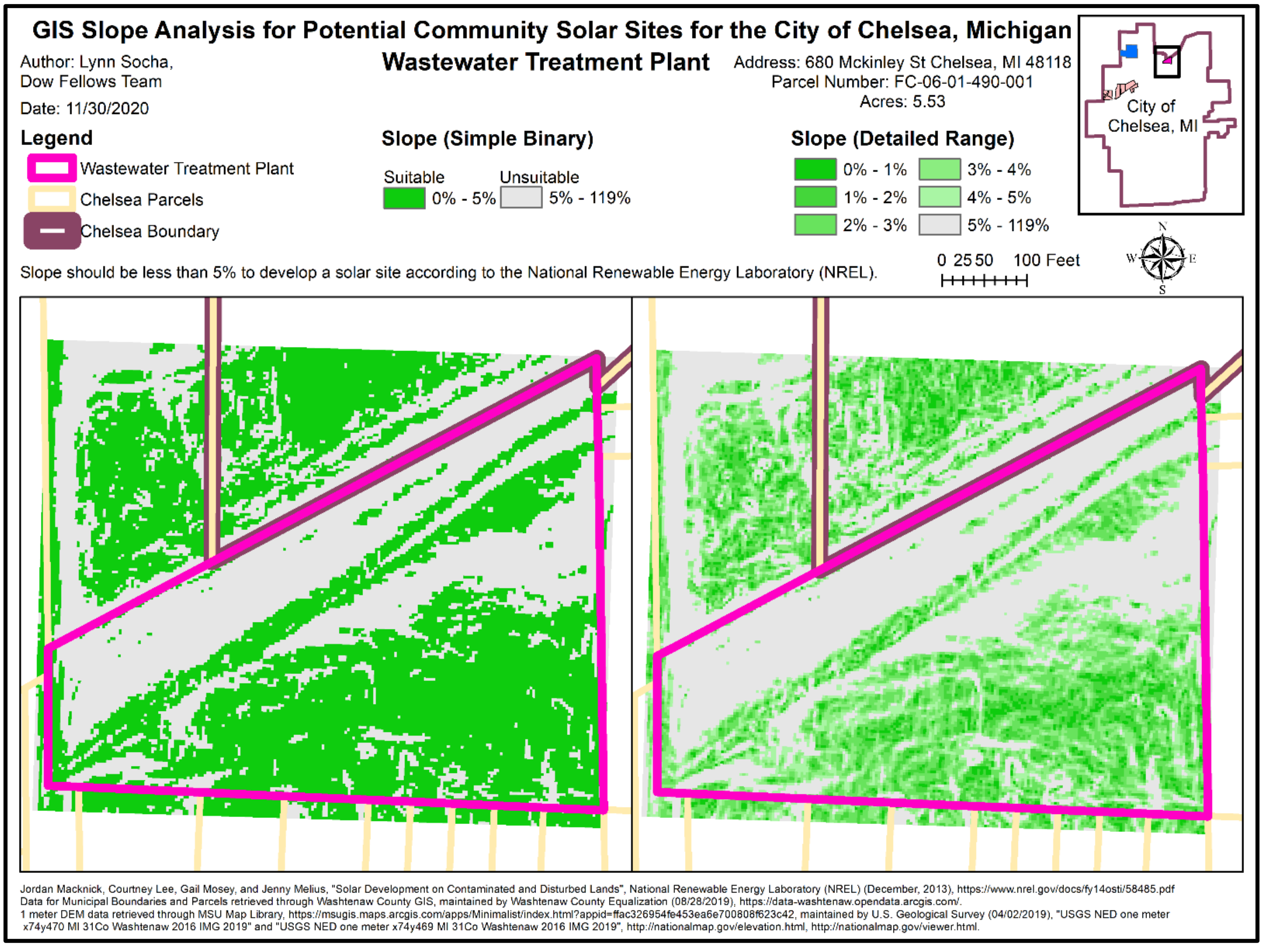
See supplemental materials for more maps.

Slope Analysis[87]

Map 2. GIS Slope Analysis: Water Treatment Plant (WTP)

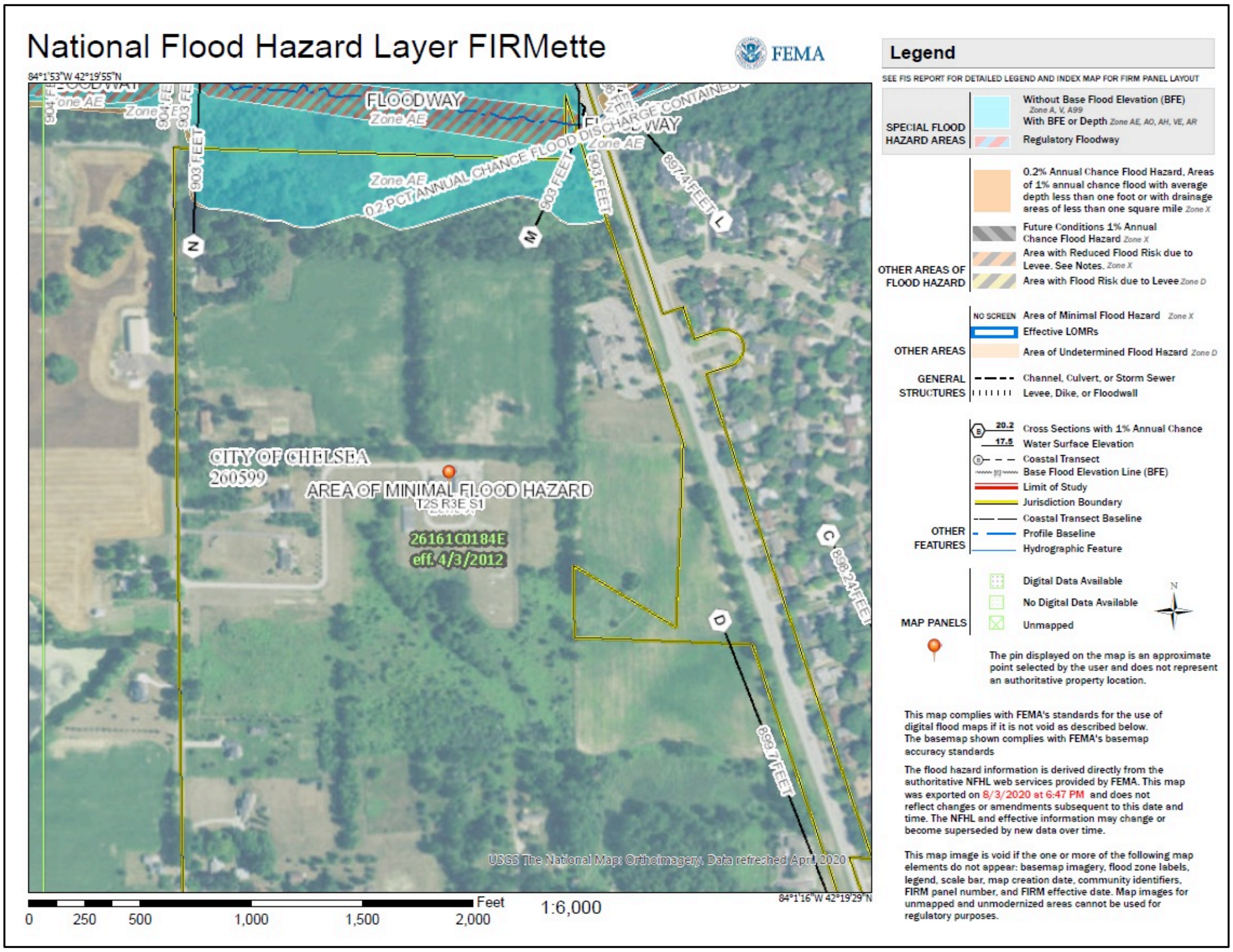


Map 3. GIS Slope Analysis: Wastewater Treatment Plant (WWTP)

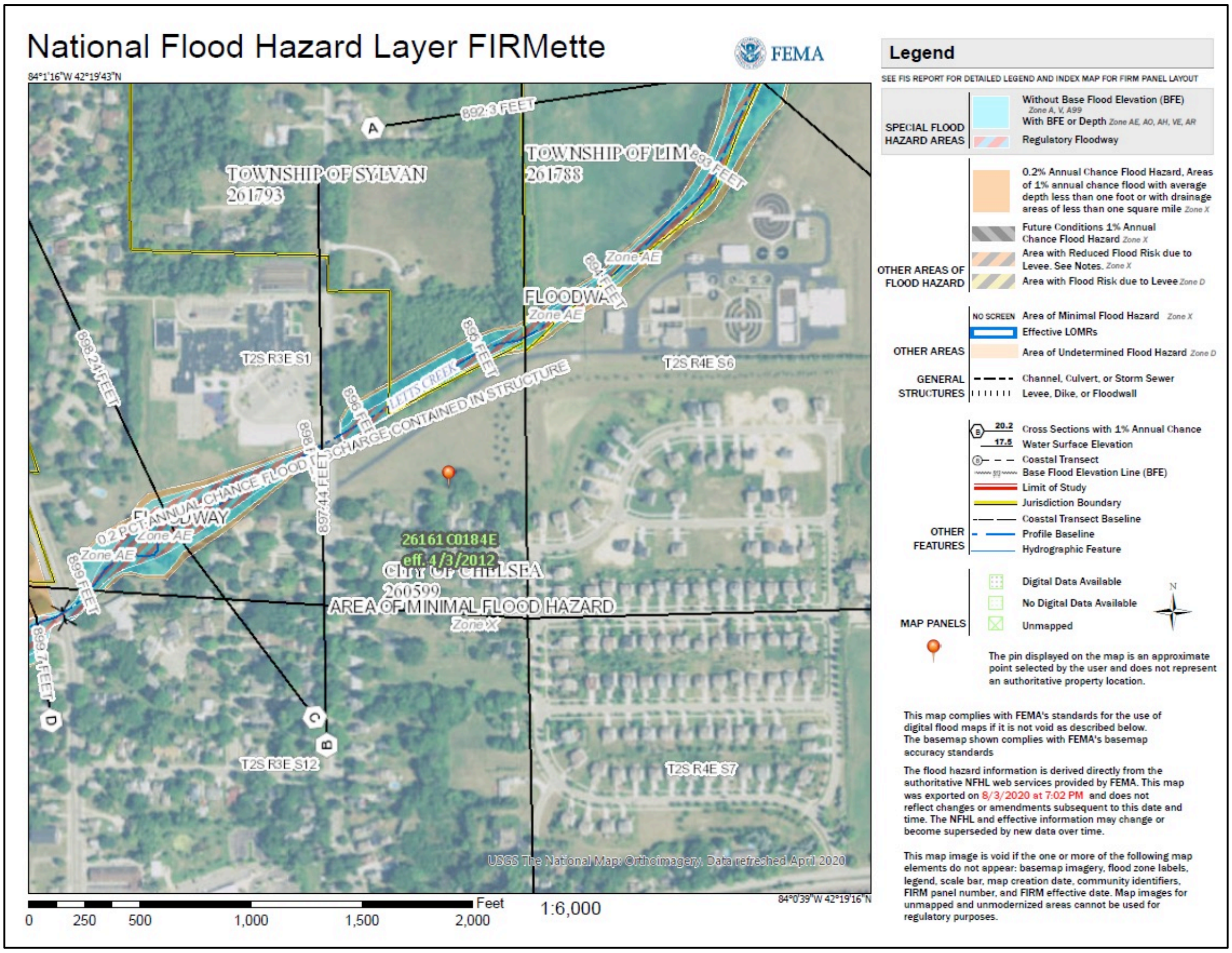


U.S. Federal Emergency Management Agency (FEMA) Flood Map Service Center Maps[88]

Map 4. Floods: Water Treatment Plant (WTP)

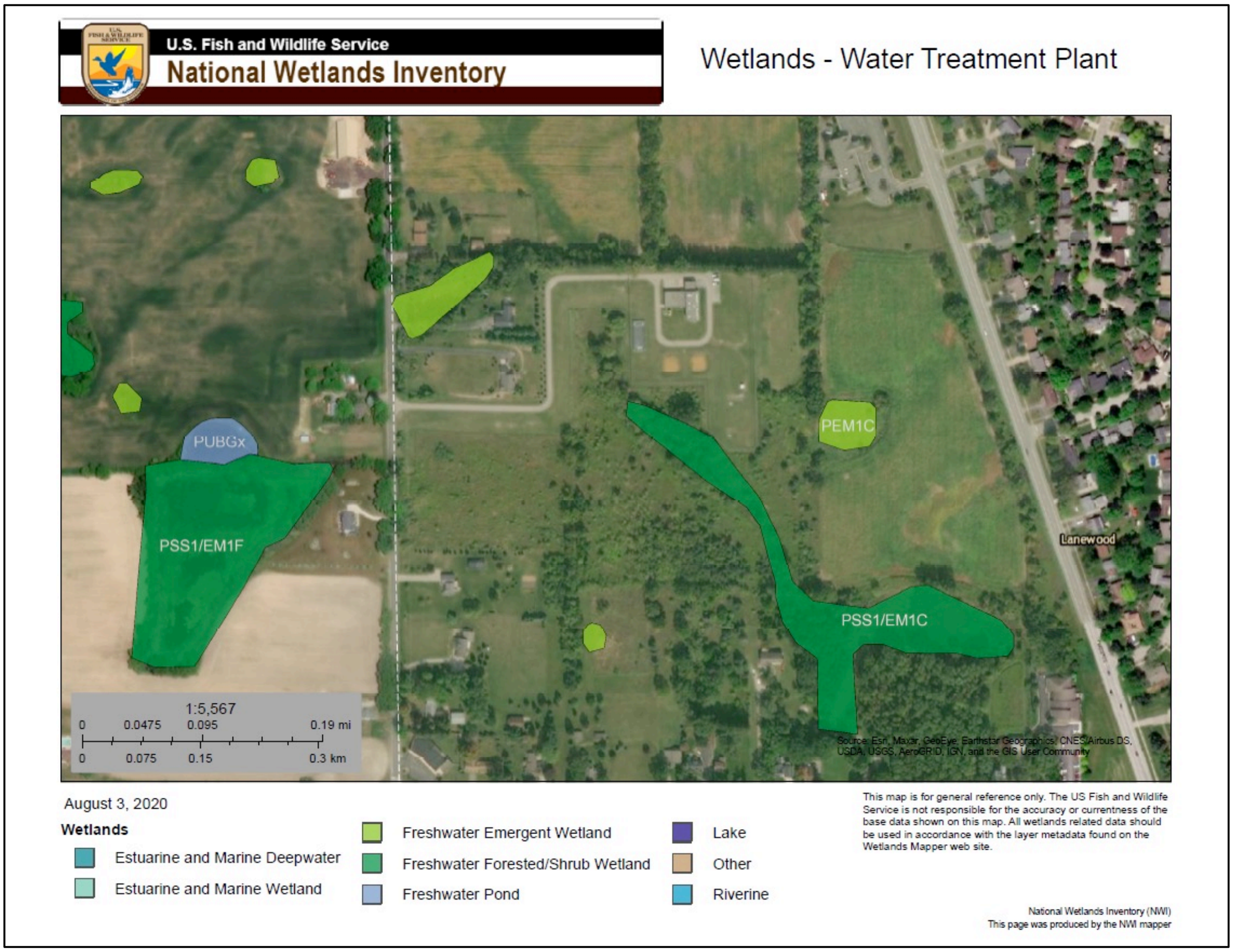


Map 5. Floods: Wastewater Treatment Plant (WWTP)

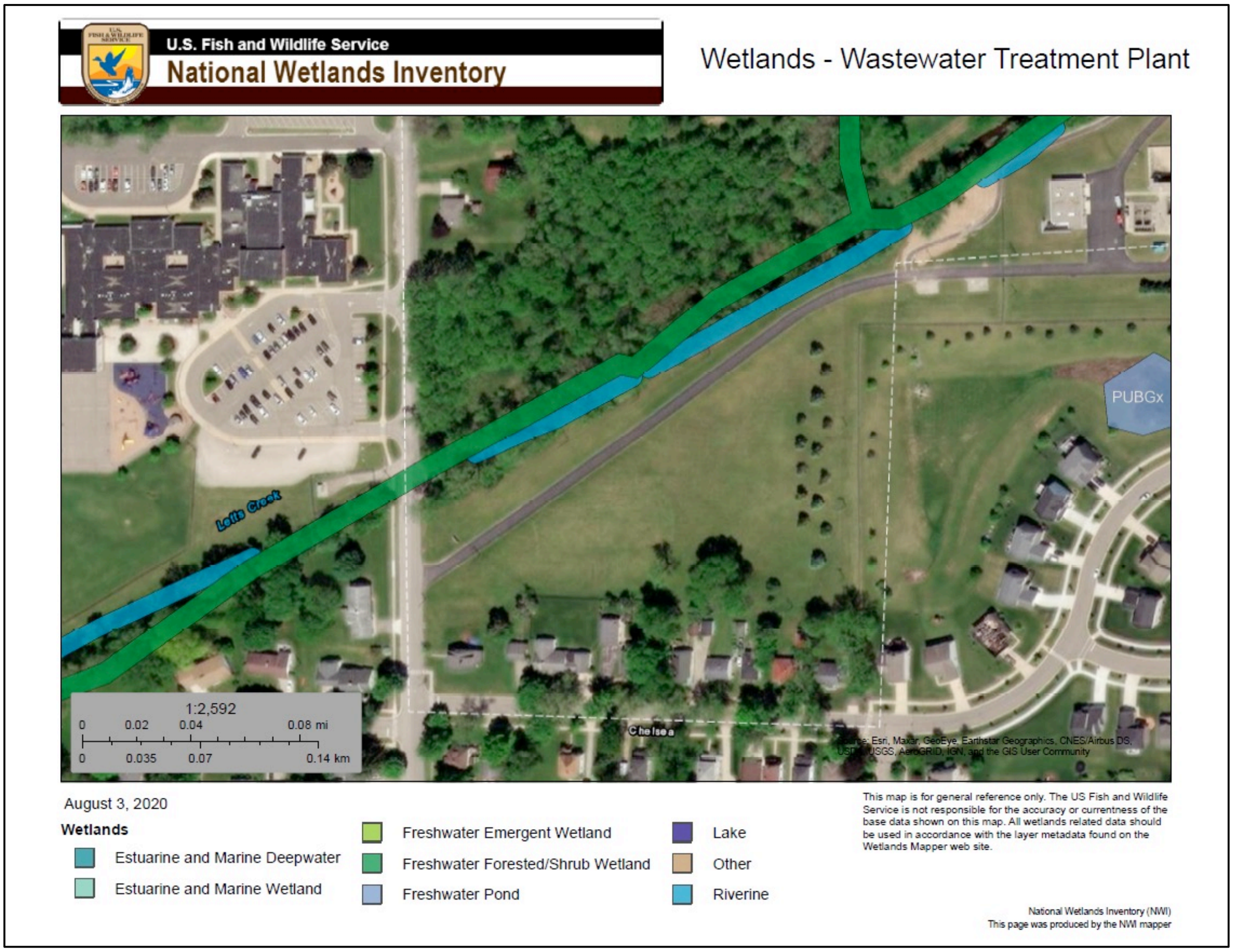


U.S. Fish and Wildlife Service (FWS) Wetlands Mapper Maps[89]

Map 6. Wetlands: Water Treatment Plant (WTP)

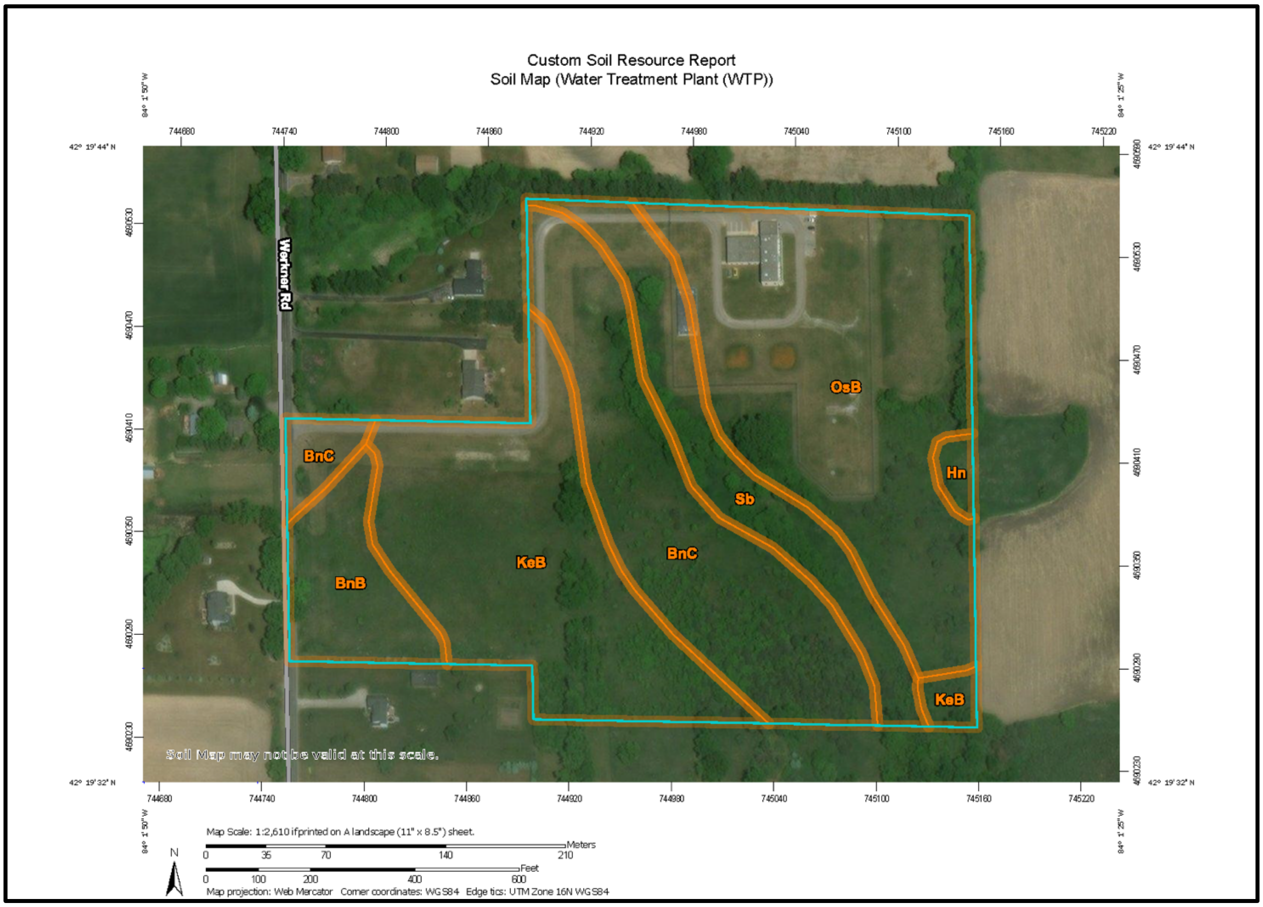


Map 7. Wetlands: Wastewater Treatment Plant (WWTP)



U.S. Department of Agriculture, Natural Resources Conservation Science, Web Soil Survey - Maps[90]

Map 8. Soil: Water Treatment Plant (WTP)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Washtenaw County, Michigan
Survey Area Data: Version 19, Jun 1, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 16, 2013—Sep 14, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Water Treatment Plant (WTP))

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BnB	Boyer loamy sand, 1 to 6 percent slopes	1.7	7.0%
BnC	Boyer loamy sand, 6 to 12 percent slopes	5.5	22.6%
Hn	Houghton muck, disintegration moraine, 0 to 2 percent slopes	0.2	0.9%
KeB	Kendallville loam, 2 to 6 percent slopes	6.2	25.4%
OsB	Oshtemo loamy sand, 0 to 6 percent slopes	8.0	32.9%
Sb	Sebewa loam, disintegration moraine, 0 to 2 percent slopes	2.7	11.1%
Totals for Area of Interest		**24.4**	**100.0%**

Map 9. Soil: Wastewater Treatment Plant (WWTP)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 16, 2013—Sep 14, 2016

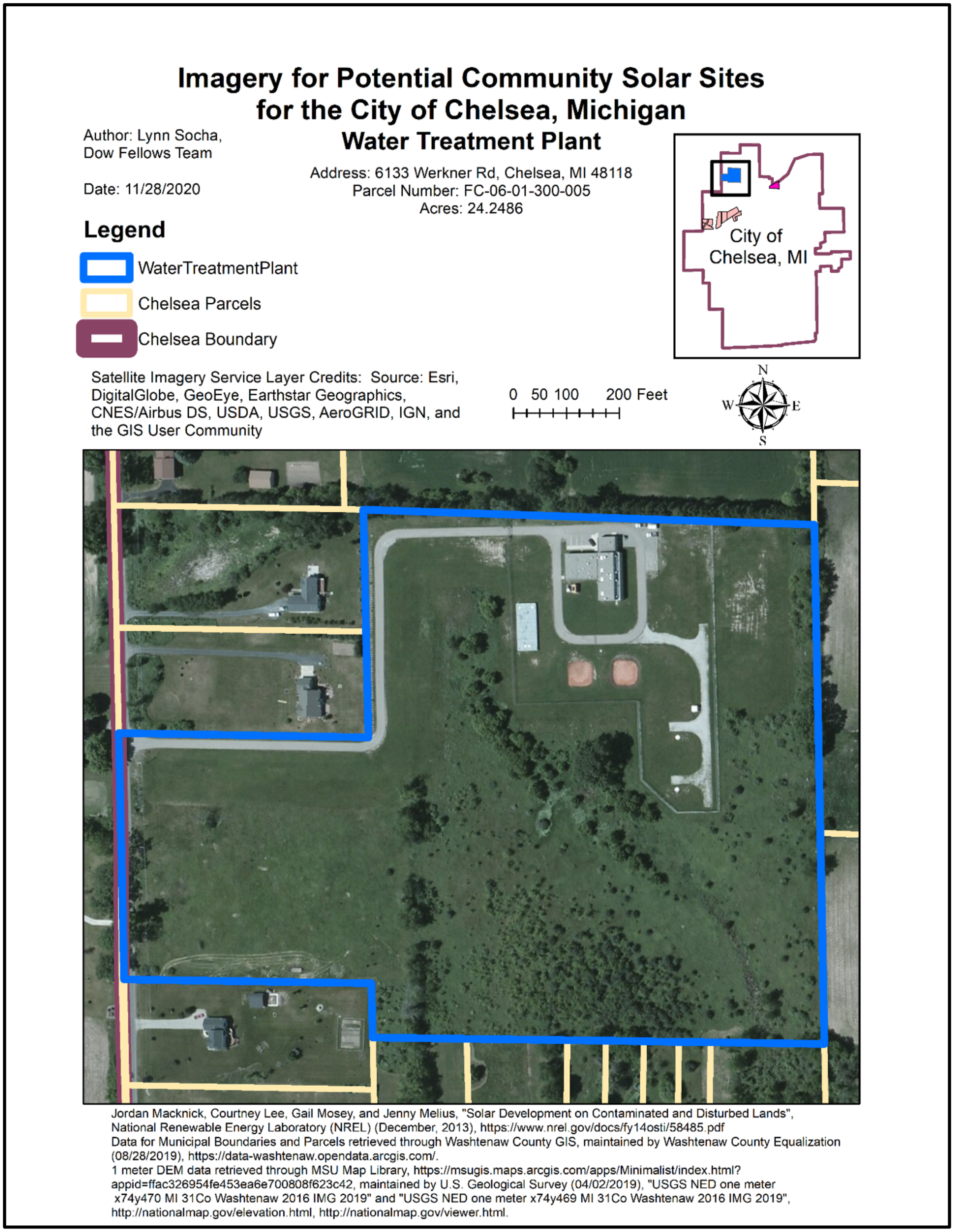
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Wastewater Treatment Plant (WWTP))

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
KeB	Kendallville loam, 2 to 6 percent slopes	4.8	92.0%
Sb	Sebewa loam, disintegration moraine, 0 to 2 percent slopes	0.4	8.0%
Totals for Area of Interest		**5.2**	**100.0%**

Satellite Imagery for Identifying Site Features[91]

Map 10. Satellite Imagery: Water Treatment Plant (WTP)



Map 11. Satellite Imagery: Wastewater Treatment Plant (WWTP)

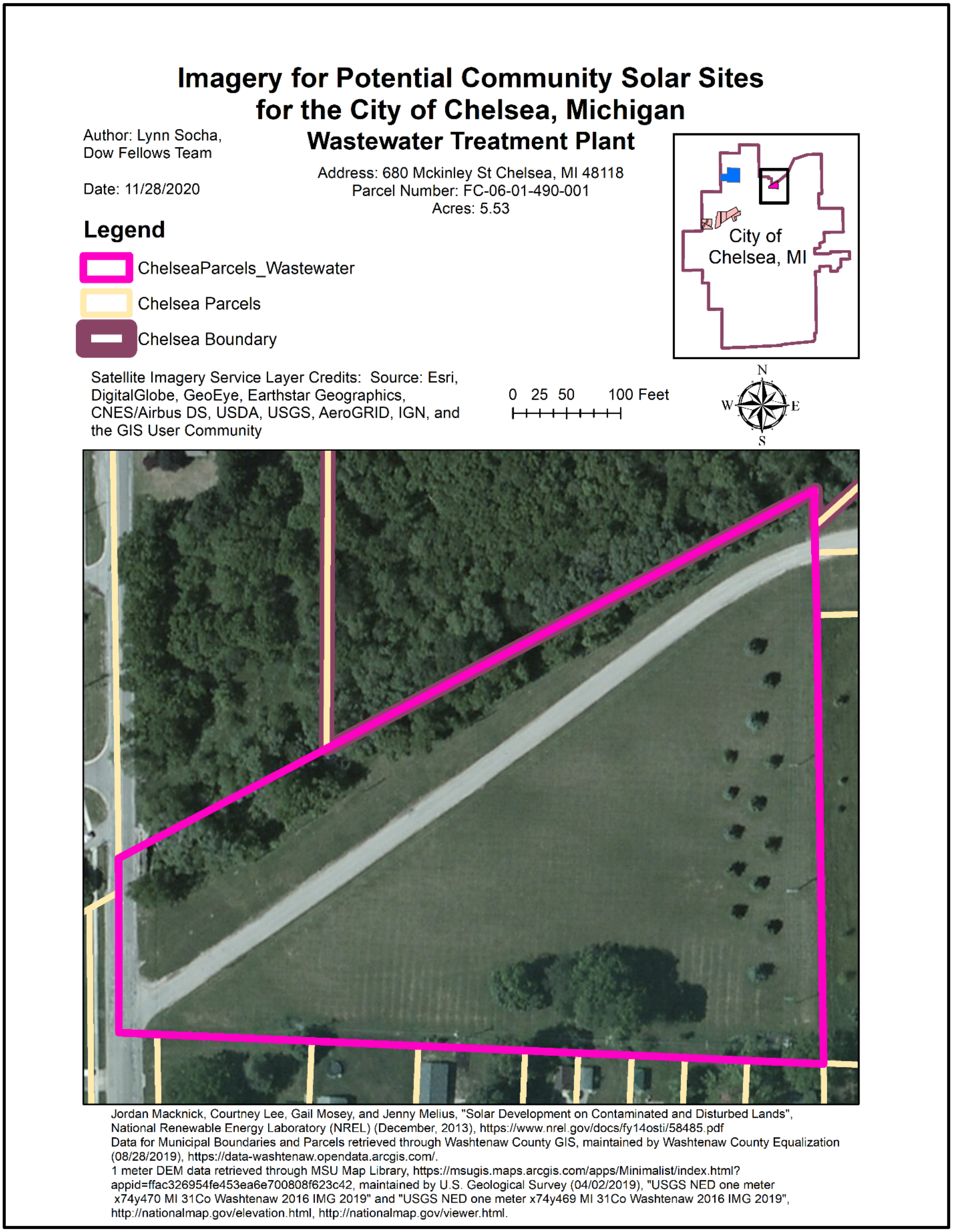


Table 6. GIS Data Table

Step #	Type	Attributes	Use	Source
1	Proposed Sites (Documents).	Parcel Number, Address, Acres.	Locate sites using Parcel Number.	John Hanifan, City Manager.[92]
2	Parcels (search using online GIS application).	Parcel Search > Search by Parcel PIN (i.e. Parcel Number).	Locate sites within Parcels (GIS Polygons) using Parcel Number.	MapWashtenaw[93] (property mapping online GIS application).
3	Parcels (Attributes).	Photos. Address with link to Google Maps. Property Information > Owner/Taxpayer Land Information > Zoning Code, Land Value, Acres.	Verify information from Proposed Sites (Documents).	City of Chelsea online Tax and Assessment Information (BS&A Online).[94] (Redirected from MapWashtenaw to view "Detailed parcel information").[95]
4	Parcels (GIS Polygons).	Shape Length (feet) and Shape Area (feet squared).	Input identifying information into Attribute Table (site name, parcel number, and address). Calculated area in acres using Calculate Geometry to verify acres attribute from Proposed Sites (Documents). Found discrepancy with parcel numbers FC-06-12-249-010 and -011.	Washtenaw County GIS Data Portal[96] > Download Data > Parcels data layer.
5	Municipal Boundaries for Townships, Cities, and Villages (GIS Polygons).	Shape Length and Shape Area.	Locate Parcels within City of Chelsea. Locate City within Washtenaw County for Context Map (see Map 1).	Washtenaw County GIS Data Portal[97] > Download Data > Municipal Boundaries data layer.
6	1-meter resolution Digital Elevation Model (DEM) data.	Elevation (meters).	GIS Slope Analysis: ArcToolbox > 3D Analyst Tools > Raster Surface > Slope.	Michigan 1 Meter DEM Download (MSU) from the USGS 3D Elevation Program (3DEP).[98]

Shade Analysis Appendix

Solar production can be greatly impacted by small amounts of shade (bolding for emphasis).[99]

- "A solar panel consists of a series string of connected cells. In a **centralized inverter system**, where panels are strung in series, if only one of the solar panels is shaded in an array, the rest of the solar panels' output diminishes."
- "**Partial shading** can **reduce efficiency by up to 50%,** whether on a single cell or entire row. Because all cells are connected in a series string, the weakest cell will bring the others down to its reduced power level."
- "**Full shading** can **reduce efficiency by 50% to 100%**, whether on a single cell or entire row."

Figure 3. Partial shading of one or multiple cells[100]

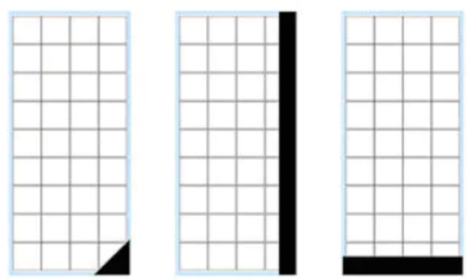
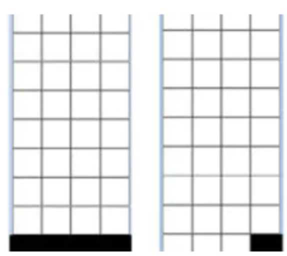
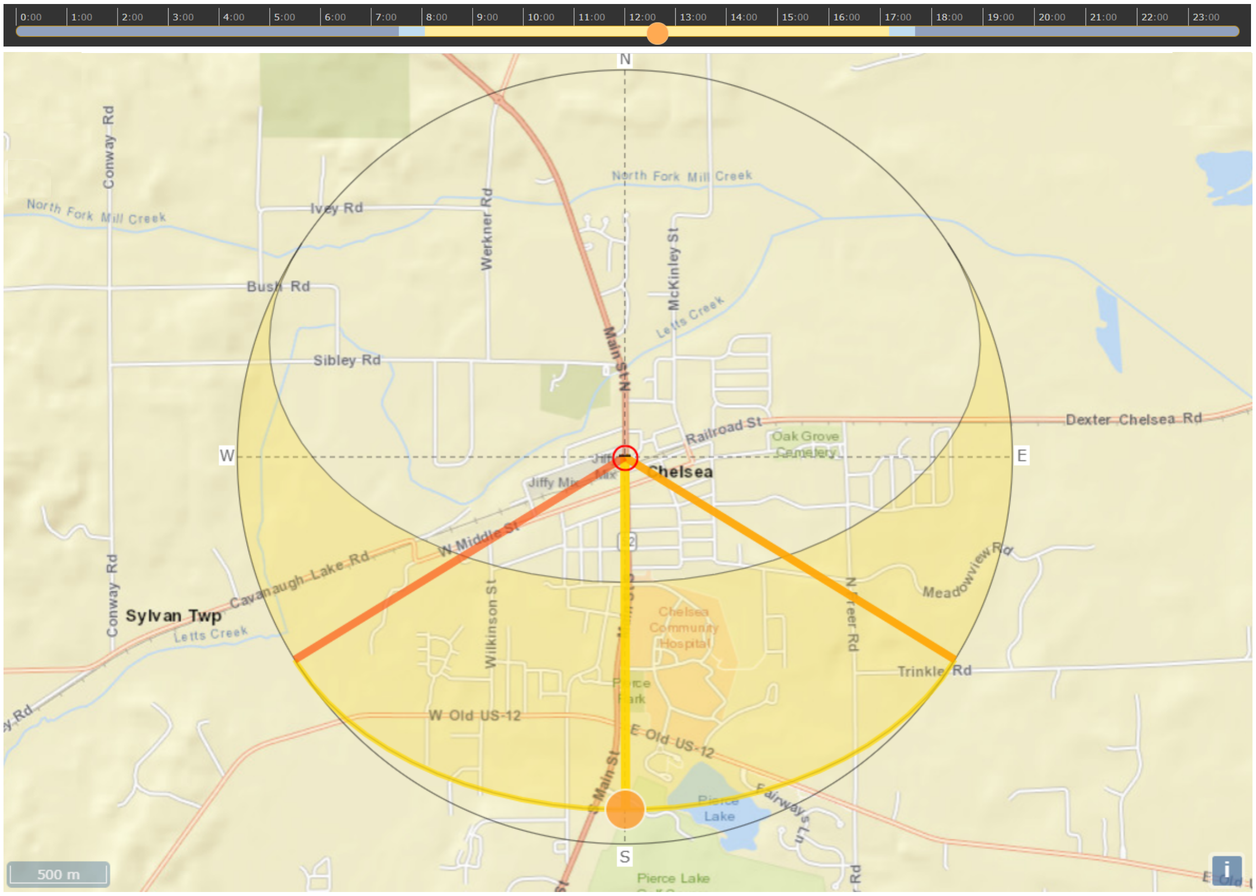


Figure 4. Full shading of one or multiple cells[101]



A shade analysis was conducted to determine the amount of potential interference from shade cast by buildings, structures, or trees to solar energy production. The analysis used Microsoft Excel and R Studio to predict shade length based on object heights in 10 feet intervals (10, 20, 30, and 40 feet) to represent one to four story tall buildings. 40 feet is the maximum height of buildings and structures set by the City of Chelsea's Zoning Ordinance, with accessory buildings or structures limited to 14 feet.[102] Shadow lengths were acquired from SunCalc after inputting location (Chelsea, Michigan), date (winter or summer solstice or autumn or spring equinox), and object level or height in meters.[103] The winter solstice was chosen to inform final results given that this day produces the longest shadows. Based on the analysis results, we recommend a setback between the solar array and adjacent building, structure, or tree that is at least the length of the adjacent object's height to avoid shade impacting solar production *(see Supplemental Materials).*

Figure 5. Solar Path in Chelsea, Michigan for Winter Solstice of 2020 (Map)[104]



The area left of the dark orange line represents sunset. The yellow line pointing true South (S) 180° represents the culmination, or when the sun reaches its highest point. The area right of the light orange line represents sunrise.

Figure 6. Solar Path in Chelsea, Michigan for Winter Solstice of 2020 (Data)[105]

Location: 138 E Middle St, Chelsea, MI, 48118, USA
Time: 21.Dec.2020, 12:31 UTC-5

Solar data for the Location		**Geo data for the Location**		
Dawn:	07:30:05	Height:		281m
Sunrise:	08:01:41	Latitude:	N 42°19'6.59''	42.31850°
Sun peak level:	12:34:29	Longitude:	W 84°1'8.4''	-84.01900°
Sunset:	17:07:18	Timezone:	America/Detroit	EST
Dusk:	17:38:54			
Duration:	9h5m37s			
Altitude:	24.27°			
Azimut:	179.12°			
Shadow length:	6.76	at an object level:	3.048m	

Location: 138 E Middle St, Chelsea, MI, 48118, USA
Time: 21.Dec.2020, 12:31 UTC-5

Solar data for the Location		**Geo data for the Location**		
Dawn:	07:30:05	Height:		281m
Sunrise:	08:01:41	Latitude:	N 42°19'6.59''	42.31850°
Sun peak level:	12:34:29	Longitude:	W 84°1'8.4''	-84.01900°
Sunset:	17:07:18	Timezone:	America/Detroit	EST
Dusk:	17:38:54			
Duration:	9h5m37s			
Altitude:	24.27°			
Azimut:	179.12°			
Shadow length:	13.52	at an object level:	6.096m	

Note: Object Height is set to 3.048 meters (10 feet) and 6.096 meters (20 feet) to represent the height of a one- or two-story building. Based on this data and the shade analysis results, we recommend a setback between the solar array and adjacent building, structure, or tree that is at least the length of the adjacent object's height to avoid shade impacting solar production.

Technical Analysis Appendix

Assumptions for Modeling Parameters:
Racking Type: Fixed Tilt Racking[xv]
Azimuth: 180° (South-facing)
Tilt: 30° [xvi]
Height: 3 ft (distance between ground and the lowest part of the tilted panels)
Panel Orientation: Landscape
Frame Layout: 4 up and 1 wide

Panel Selection and Considerations:
The selected panel for the technical analysis was a 500 W_{DC} panel manufactured by Trina Solar. The specifications of this particular panel are shown below in Table 7.

Table 7. Specifications for the panel used in HelioScope modeling.

Power	500 W_{DC}
Technology	Si- Mono[xvii] (150 cells)
Dimensions	1.098 m x 2.176 m
V_{mp}	42.8 V
V_{oc}	51.7 V
I_{sc}	12.28 A
I_{mp}	11.698 A

This selection was made to represent state-of-the-art solar panels, as 500 W_{DC} does not yet represent the industry standard, and Trina is a top global manufacturer of solar panels. Increases in panel capacity are beneficial for driving the balance-of-system costs per watt down. Additionally, fewer panels are needed to meet the desired capacity of a project, so less racking, framing, and fewer electrical connections are needed. Due to a larger production of energy per acreage, less area is needed for designs that use high capacity panels. However, it should be

[xv] Chelsea should consult with a developer regarding improved efficiency with either single or dual-axis tracking panels, and subsequent impacts on the capital cost of the project.
[xvi] This tilt angle was found to result in a higher system capacity factor for a given 1.00 MW (DC) nameplate capacity when compared to a tilt angle of 35° or when tilting at the same angle as the latitude of the site (42°)
[xvii] Monocrystalline silicon cells have higher efficiencies than polycrystalline cells, but also come at higher costs. This tradeoff should be considered in consultation with the project developer. Further, bifacial cell technologies are becoming more common, and can also be used to increase the efficiency of the array.

noted that higher capacity panels are likely to come with a higher upfront cost. The current industry standard average power rating of installed PV panels is around 380 W.[106] Using published information about the system capacity and number of panels used in the L'Anse community solar array as well as two different Spartan Solar community solar arrays, the panel capacity for these benchmarks was estimated to be 325 W_{DC}, 322 W_{DC}, and 276 W_{DC} respectively. The use of a higher panel capacity for this project could set Chelsea apart as a community solar project using leading-edge technology.

Inverter Selection:

The inverter chosen for the technical analysis was a Sunny Boy 7.7-US (240 V) string inverter. automatically calculates a string size and reports a quantity of inverters such that the resulting DC/AC ratio is approximately 1.25. The manufacturer for the chosen inverter, SMA, is well established in the industry, and the resulting system losses were found to be within the typical ranges suggested by HelioScope. [107] An electrical engineer should be consulted when selecting the final system components.

Area 1 Model – WTP:

Table 8: A summary of the characteristics for the three models created for this area within the WTP.

Table 8. Summary characteristics for Area 1 design variants

	Design 1 (Winter Solstice)	Design 2 (Spring Equinox)	Design 3 (Manually input spacing)
Row Spacing	3.3 feet	9 feet	12 feet
GCR	0.90	0.67	0.58
Nameplate System Capacity	1.00 MWp	1.00 MWp	1.00 MWp
Number of Panels	2,000	2,000	2,000
Area	1.35 acres	1.88 acres	2.25 acres
System Performance Ratio	67.0%	78.7%	81.1%
Annual Energy Output	1.10 GWh	1.29 GWh	1.33 GWh
Capacity Factor	12.5%	14.7%	15.2%

Area 2 Model – WTP:

The distances between the array and surrounding boundaries are shown in Figure 10. This figure also illustrates the height/setback/radius assumptions for the building and trees identified to cause shading effects. The two trees could be cleared to reduce losses due to shading. Given the total amount of area on this site, there is clearance for the aspect ratio or layout of the system to be altered if needed to comply with setback regulations. Google Earth imagery indicates that the land in Area 2 is already cleared, with no grasses growing on it.

HelioScope imagery showed that the space inside the fence of Area 2 was unpaved, but updated satellite imagery shows that it is paved (*see Figure 7*). Area 2 should only be considered if it does not impact Water Department operations. Performance metrics beyond distances and tree height/radius listed on Figure 10 are only relevant when 12 feet of row spacing is modeled, as that scenario provided the highest annual energy output and system performance ratio. A summary of the characteristics for the three models created for this area within the WTP is provided below in Table 9.

Table 9. Summary characteristics for Area 2 design variants

	Design 1 (Winter Solstice)	Design 2 (Spring Equinox)	Design 3 (Manually input spacing)
Row Spacing	3.3 feet	9 feet	12 feet
GCR	0.90	0.67	0.58
Nameplate System Capacity	1.00 MWp	1.00 MWp	1.00 MWp
Number of Panels	2,000	2,000	2,000
Area	1.93 acres	2.58 acres	2.80 acres
System Performance Ratio	65.6%	78.0%	80.8%
Annual Energy Output	1.08 GWh	1.28 GWh	1.32 GWh
Capacity Factor	12.3%	14.6%	15.1%

The same inverter was chosen when modeling Area 2 as was used in Area 1. Losses due to mismatch (differences in the electrical characteristics of the modules) were found to be slightly higher. Full production reports and visuals for all three models can be found in the provided supplemental materials (*see Supplemental Materials*).

WWTP Model:

Project Address: 680 McKinley Street, Chelsea, MI 48118

The total available area for this site is less than the WTP, so the entire area was used to model the proposed solar array, regardless of what was found in the GIS analyses. For row spacing, the same three scenarios were modeled. A summary of the resulting characteristics for these three models is provided below in Table 10. Overall, it is recommended that the WTP be prioritized for the array location, instead of the WWTP. At the WWTP, narrow row spacing is required to reach the desired nameplate capacity, which is unlikely to allow for adequate maintenance access. Although annual energy output increased with smaller row spacing, the system performance ratio and capacity factor decreased to a level that is uneconomical. Furthermore, there is insufficient space on the property to enable a future expansion of the array. Figure 11 in the Technical Appendix shows the setback distances and tree height/radius assumptions made for this site. Full production reports and visuals for all three row spacing models simulated at this location can be found in the Supplemental materials (see Supplemental Materials).

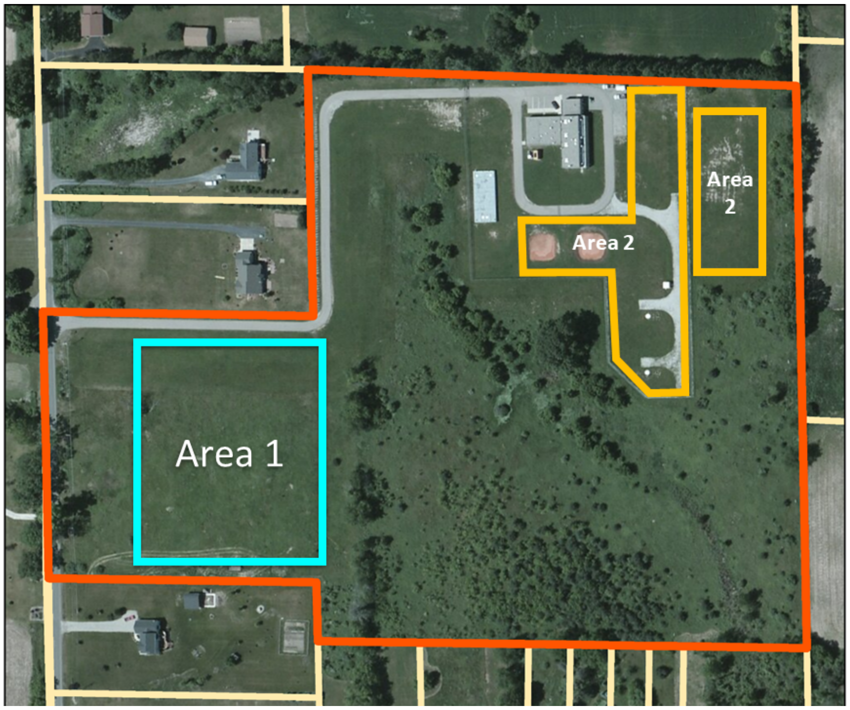
Table 10. Summary characteristics for WWTP design variants

	Design 1 (Winter Solstice)	Design 2 (Spring Equinox)	Design 3 (Manually input spacing)
Row Spacing	3.3 feet	9 feet	12 feet
GCR	0.90	0.67	0.58
Nameplate System Capacity (DC)	0.940 MWp	0.676 MWp	0.594 MWp
Number of Panels	1,880	1,352	1,188
Area	2.50 acres	2.50 acres	2.50 acres
System Performance Ratio	63.4%	72.9%	75.3%
Annual Energy Output	977.1 MWh	808.2 MWh	733.2 MWh
Capacity Factor	11.2%	13.6%	8.37%

The same inverter was chosen when modeling the WWTP as the WTP. Losses due to mismatch were found to be slightly higher, and above the typical range suggested by HelioScope. Shading losses were also higher due to the proximity of nearby trees.

HelioScope Models Visuals

Figure 7. Water Treatment Plant (WTP) Area 1 and 2



Note: Area 2 should only be considered if it does not impact Water Department operations.

Figure 8. Water Treatment Plant (WTP), Area 1, 12 ft row spacing Site Plan

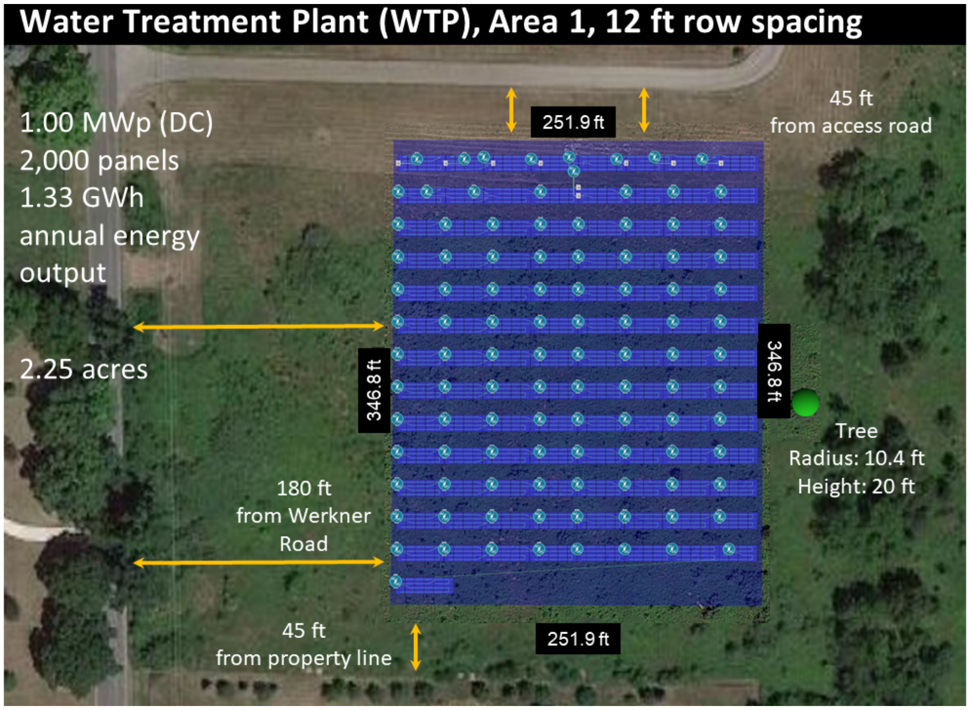


Figure 9. Water Treatment Plant (WTP), Area 1, 12 ft row spacing shade heatmap

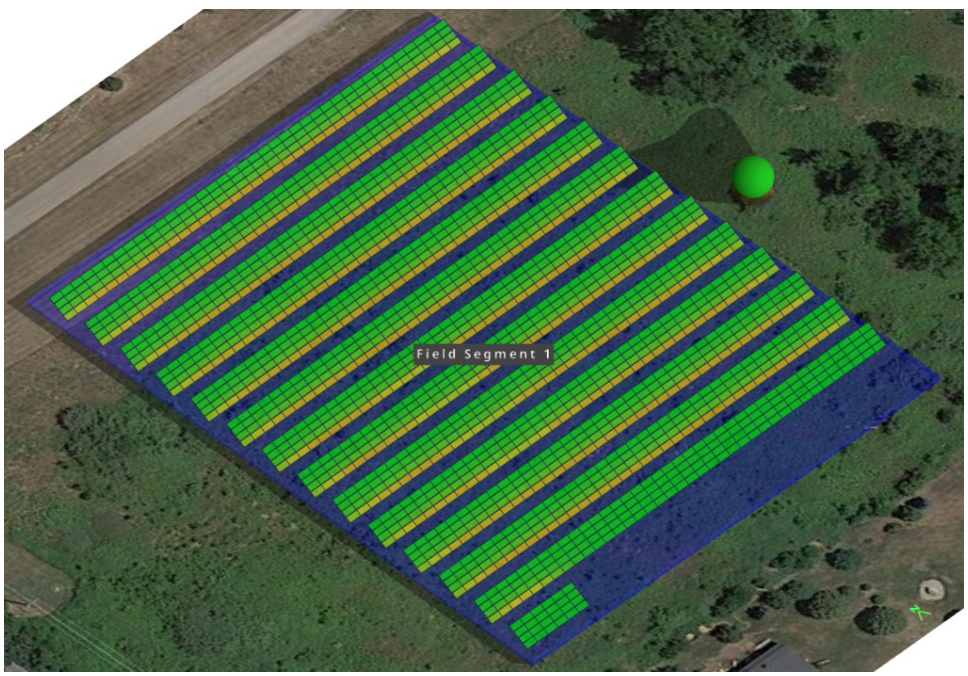
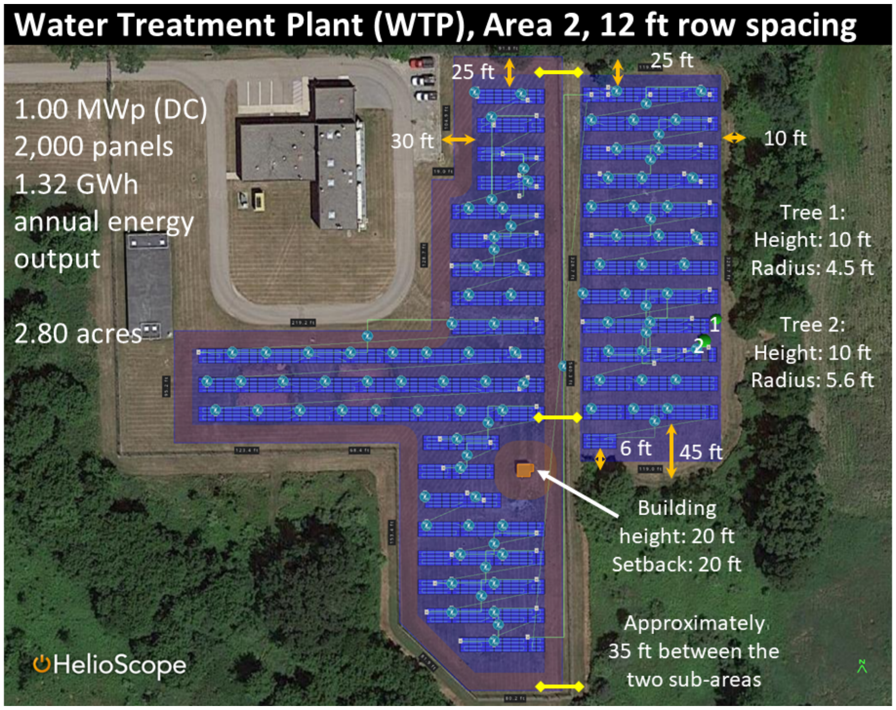
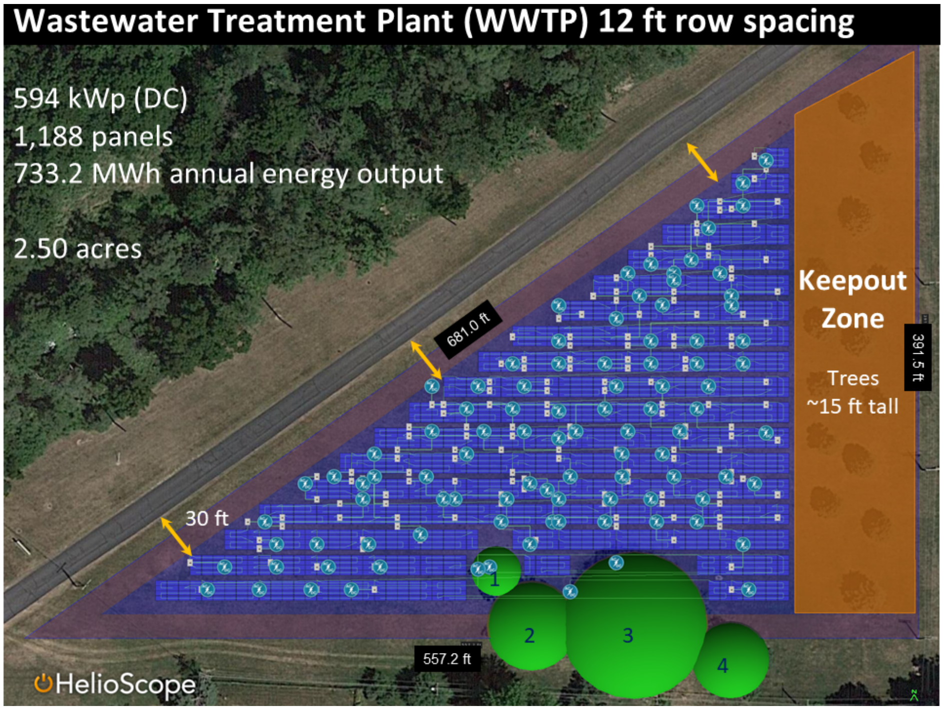


Figure 10. Water Treatment Plant (WTP), Area 2, 12 ft row spacing Site Plan



Note: HelioScope imagery showed that the space inside the fence of Area 2 was unpaved, but updated satellite imagery shows that it is paved (*see Figure 7 or Map 10*). Area 2 should only be considered if it does not impact Water Department operations.

Figure 11. Wastewater Treatment Plant (WWTP) 12 ft row spacing Site Plan



Trees:

1. Height: 15 ft; Radius 15.5 ft
2. Height: 20 ft; Radius: 28.8 ft
3. Height: 40 ft; Radius 46.0 ft
4. Height: 20 ft; Radius 24.1 ft

Low-to-Middle-Income (LMI) Appendix

(% people below FPL from city data) x (Total population of Chelsea) ÷ (2.5 people/household) =
3.7% x 5,416 people ÷ 2.5 people/household = 80 households

Recommendations for LMI household participation are as follows:

- Eligibility for subscription to the project based on two factors: resident households that fall below the FPL and demonstrate a consistent utility bill repayment history. Bill repayment history can show creditworthiness in the utility context without checking credit scores, which can be compromised based on systematic shortcomings of the U.S. credit system.[108]
- Use on-bill financing: Under this model, LMI customers will pay a fixed annual fee for their community solar subscription over a 20-year period, and this fee will be incorporated into their existing utility bill. Since the revenue from the community solar subscription is greater than the annual cost, each LMI customer will effectively receive a small on-bill credit that reduces their electrical bill.[xviii] On-bill financing is favorable when incorporating an LMI subscription model into the community solar project because (a) LMI customers do not require upfront capital to participate in the community solar subscription, and (b) customers will be able to see long-term savings on their electricity bills over a 20-year time period.[109]
- Collaborate with Faith in Action: This organization is a Community Action Agency (CAA) in Chelsea, MI. Their mission is to help serve low-income residents of the community. The City already has a strong relationship with this agency, which will aid in broaching a partnership for the LMI program for subscribing to the community solar project. See Table 15 on external stakeholder organizations for contact information.[110]

[xviii] Traverse City Cherryland Co-op and L'Anse's community solar projects use on-bill financing for LMI programs.

Table 11. Michigan Utility LMI Programs

Utility	Best Practices & Programs

Traverse City Cherryland Co-op[111] - Electric Cooperative	• ~50 LMI participant households
	  • Eligibility:
	    • Previously weatherized households,
	    • At or below FPL
	  • On-bill financing
	  • Receive monthly bill credit of $0.10/kWh for 9 panel shares
	  • Translates to $350 yearly in bill credits
	• Project funded by Michigan Agency for Energy (MAE), Northwest Michigan Community Action Agency (NMCAA), Cherryland Electric Cooperative (Co-op)
	• Free home energy assessment

L'Anse Community Solar[112] - Municipal Utility	• 25 LMI participant households
	  • Eligibility:
	    • Previously weatherized
	    • At or below 200% of FPL
	  • On-bill financing
	  • Receive monthly bill credit of $0.90/panel/month for up to 10 panel shares
	  • Each home given weatherization upgrades
	• Panels paid for by the Michigan Office of Climate and Energy

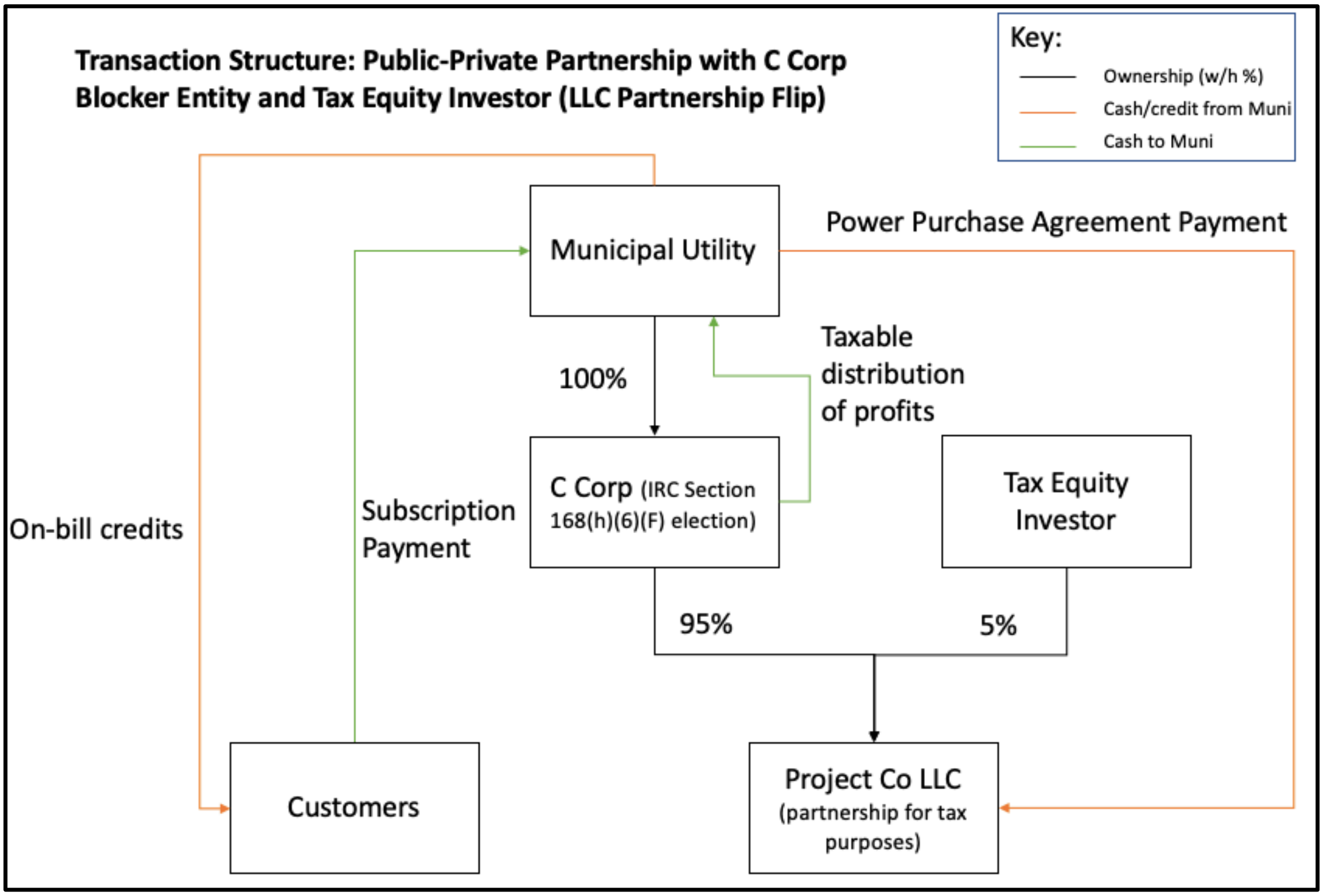
Utility	Best Practices & Programs
DTE Energy[113] - Michigan Investor Owned Utility (IOU)	• Energy Efficiency Assistance Program: Weatherization includes caulking, weather stripping, insulation and programmable thermostats. • Residential Income Assistance Program: Low-income customers, at or below 150 percent of the federal poverty level, may qualify for a $7.50 per month credit on their electric account and/or a $11.25 per month credit on their gas account. • Low Income Self Sufficiency program: Affordable fixed monthly payments based on income and energy usage. Past due balances are frozen at the time of enrollment and may be reduced if regular monthly payments are made. Additionally, self-sufficiency training and dedicated customer advocates are ready to assist participants. There are protections from shut off while on the plan and no late payment charges while enrolled in the program. • Rider 4 Waiver for Low Income Housing: Applicable Owners or authorized agents of a newly constructed or rehabilitated multifamily dwelling, shall have the opportunity to avoid the requirement of metering each residential housing unit separately.
Consumers Energy[114] - Michigan Investor Owned Utility (IOU)	• CARE Program: A portion of your monthly electric bill will be paid by the program. Any past due balance you might have will be gradually forgiven as a reward for on time payments.

Table 12. Local and State LMI Energy Programs

Program	Level (Local, State, Federal)	Description
City of Chelsea EnergySmart Incentive Program[115]	Local	Rebates for recycling old appliances and purchasing LED lightbulbs. Currently, ~100-200 people per year participate in this program.
Michigan Energy Assistance Program (MEAP)[116]	State	MEAP works with LMI households to provide assistance in supplementing energy bills and self-sufficiency services.

Financial Model Appendix

Figure 12. Diagram of Proposed Tax Equity Structure



The public-private partnership (P3) structure with a C Corp making the 168(h)(6)(f) election is necessary to avoid ownership of partnership interests by a tax-exempt entity, which would undermine the ability to monetize the depreciation under a "partnership flip" model.[117] A "partnership flip" structure is recommended for the tax equity financing, since this structure allows the City to retain control of the project company LLC (through a blocking entity) as a partner prior to the flip, and as the sole member after the flip. In the partnership flip model, the City-owned blocking entity would form an LLC together with the tax equity investor.[118] The LLC would enter into a PPA with the MUNI to sell the power generated by the project back to the MUNI, and the proposed PPA price would equal the sum of the total subscriptions received and the utility's avoided costs associated with the subscribed panels, minus the value of the customer rate credits. This structure effectively pays the project company the value of the subscriptions in exchange for the energy produced under a PPA and parallels the Eau Claire Energy Cooperative case.[119] This structure is feasible because tax exempt entities in Michigan are allowed to enter into a PPA, but alternative structures like a sale-leaseback arrangement would undermine the ability to monetize the Investment Tax Credit (ITC).[120,121]

In order to comply with Internal Revenue Service (IRS) requirements, 99% of the tax credits and 5% of project's cashflows would be allocated to the tax equity investor before the flip, the blocking entity would receive 99% of the tax credits (now worthless due to the allowed bonus depreciation utilized by the tax equity investor) and would continue to receive 5% of the project's cashflows after the flip, and the flip would take place after year 5.[122] After the flip, the blocking entity would have the option to purchase the tax equity investor's partnership interests for their pre-determined fair market value, and the blocking entity would exercise this option in year 6.

The tax equity model breaks out the cashflows for the project company, the City, standard and LMI customers, as well as the tax equity investor. However, it is important to note that while tax assumptions were used in calculating the tax equity investor's cashflows and the City's cashflows (due to the taxable distribution from the blocking entity), this model does not consider every conceivable tax complexity and does not constitute tax or legal advice. Independent tax and legal advisors should be engaged if the City decides to pursue this option. The model's purpose is to show the impact from the tax equity investor's capital contribution on each constituency's NPV, and while the exact dollar amount of the capital contribution will likely change based off a more robust analysis by tax professionals, it is illustrative of the magnitude of an expected initial capital contribution and the effect on the respective NPVs. The year 6 buy out was modeled, so cashflows for the tax equity investor were not included after year 6. Additionally, allowed bonus depreciation in year 1 was utilized, instead of a 5-year MACRS depreciation, since this leads to a higher NPV for the tax equity investor and thus a greater capital contribution to achieve the same target IRR. The cashflows in the Tax Equity Worksheet are based off assumptions from the Department of Energy's guide to the ITC.[123] Additionally, while the costs associated with structuring a tax-equity partnership flip can range from 2-2.5% of total installed costs, and might be somewhat higher due to the complexity of the proposed structure involving a tax-exempt municipality, these costs appear to be justified by the tax equity investor's initial capital contribution.[124]

Environmental Analysis Appendix

Table 13. Projected Energy Supply Mix (2021) for City of Chelsea, MI (Results)

Projected Energy Supply Mix (2021) for City of Chelsea, MI		
	% of Energy Mix	Annual MWh
Without Community Solar Project (WTP, Area 1, 12 ft row spacing)		
Renewable Energy (Wind & LFG PPAs):	24%	20,413
Fossil Fuels and Other Sources:	76%	63,011
Total Energy:	100%	83,424
With Community Solar Project (WTP, Area 1, 12 ft row spacing)		
Renewable Energy (Wind, LFG, & Solar):	26.02%	21,742
Fossil Fuels and Other Sources:	73.98%	61,682
Total Energy:	100%	83,424

Table 14. Projected Energy Supply Mix (2021) for City of Chelsea, MI (Calculations)

Projected Energy Supply Mix (2021) for City of Chelsea, MI		
	% of Energy Mix	Annual MWh
Without Community Solar Project (WTP, Area 1, 12 ft row spacing)		
Renewable Energy (Wind & LFG PPAs):	=((16576+3837)/83424)*100	=16576+3837
Fossil Fuels and Other Sources:	=((83424-(16576+3837))/83424)*100	=83424-(16576+3837)
Total Energy:	100%	83,424
With Community Solar Project (WTP, Area 1, 12 ft row spacing)		
Renewable Energy (Wind, LFG, & Solar):	=((16576+3837+1329)/83424)*100	=16576+3837+1329
Fossil Fuels and Other Sources:	=((83424-(16576+3837+1329))/83424)*100	=83424-(16576+3837+1329)
Total Energy:	100%	83,424

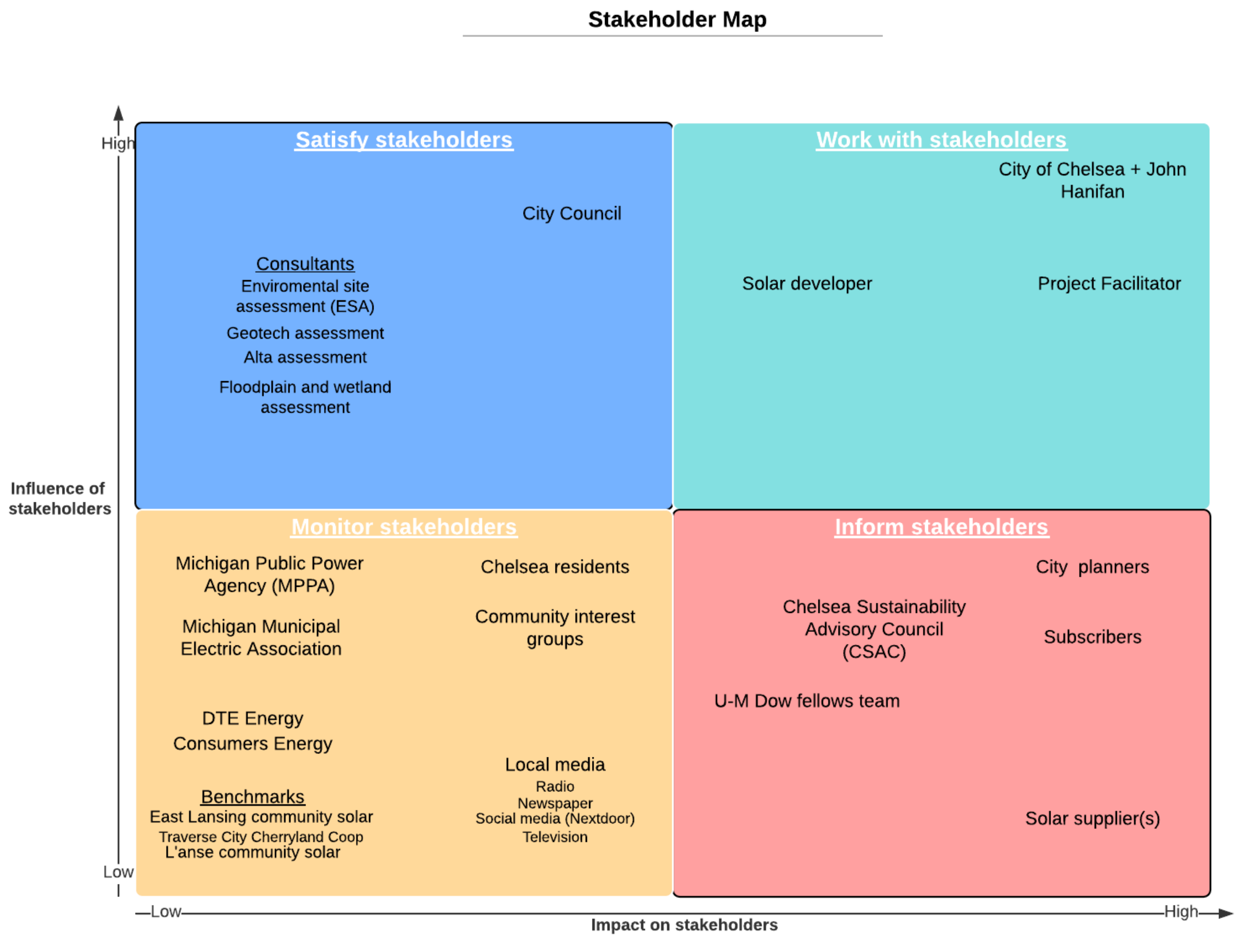
Notes:

Proposed site: Water Treatment Plant (WTP), Area 1, 12 ft row spacing, 1,329 annual MWh projected.
Assumes projected Total Energy supplied or consumed does not increase after Community Solar Project.
Source: Energy Services Project, Forecasted ATC Energy Supply Position for CHEL table, on page 1 of Chelsea Hedge Plan Position 10.12.2020 (Hanifan & Chelsea Community Solar, 2020).[125]

Key:		
Provided		
Calculated		

Stakeholder Appendix

Figure 13. Stakeholder Analysis Matrix[126]



Work with stakeholders: High impact, high influence stakeholders with whom to collaborate with and keep fully engaged.

Satisfy stakeholders: High influence, low impact stakeholders that can have influence over a project, but do not want to be involved in the details. Keep them up to date.

Inform stakeholders: Low influence, high impact stakeholders who can offer great insights and ideas for the project, but do not need to be satisfied 100% of the time.

Monitor stakeholders: Low impact, low influence stakeholders that require on-going communication about the project's progress.

Table 15. Potential Organizations to Partner with for Project Development, Marketing, and Implementation

Organization	Potential Roles	Point of Contact
City of Chelsea Sustainability Advisory Commission (CSAC)	Community outreach and feedback from city council for City of Chelsea	CSAC members: Brian Bieber, Tom Girard, Frank Hammer, Tony Iannelli, John Salyer, Craig Toepfer
Faith in Action	Community Action Agency (CAA) in Chelsea for LMI programs	Sheri Montoye, Director, sherimontoye@faithinaction1.org
Michigan Energy Options (MEO)	• Solar consultant • Head of East Lansing's community solar project	John Kinch, Executive Director, jkinch@michiganenergyoptions.org
ENGIE	Solar developer	Gabriel Vanloozen, Distributed Renewables Intern & U-M Dow Fellow, gsv@umich.edu
Michigan Wildflower Farm	• Habitat restoration organizer • Restored habitat for East Lansing's community solar project	Esther Durnwald, Owner of Michigan Wildflower Farm, michiganwildflowerfarm@gmail.com
Chelsea High School Biology Club	Education and outreach to youth in Chelsea, MI	Holly Reiser, Biology Club Advisor, hreiser@chelsea.k12.mi.us
Arcadia	Manage subscriptions to project	support@arcadia.com

Supplemental Materials

Supplemental Material Shared Google Drive Link:
https://drive.google.com/drive/folders/1DIYfdJ__l5O6ye0eSUS4Bf60kAOTECcw?usp=sharing

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