San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

CALIFORNIA CLIMATE INVESTMENTS
Cap and Trade Dollars at Work

REQUEST FOR PROPOSALS

Shafter Community Emissions Reduction Program: Vegetative Barriers

The San Joaquin Valley Air Pollution Control District is seeking proposals from entities to implement Vegetative Barriers projects in the Shafter AB 617 Community.

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Request for Proposals

Shafter Community Emissions Reduction Program:
Vegetative Barriers

The San Joaquin Valley Air Pollution Control District (District) is soliciting proposals from entities (applicants) to implement Vegetative Barrier projects in the Shafter AB 617 Community boundaries. This Request for Proposal (RFP) will provide a total grant amount of up to $508,769 to the selected applicant(s) that can demonstrate the ability to efficiently and effectively implement vegetative barriers projects by working with the community to reduce emissions and to provide several key co-benefits. The Vegetative Barriers Emissions Reduction Program is a Community Identified Project that has been included and prioritized in the California Air Resources Board (CARB) and District-adopted Community Emission Reduction Program (CERP).

Introduction

Assembly Bill 617 (AB 617) requires CARB and air districts to develop and implement additional emissions reporting, monitoring, reduction plans and emission reduction measures in an effort to reduce air pollution exposure in disadvantaged communities. Shafter is one of the San Joaquin Valley (Valley) communities selected by CARB for investment of additional resources under AB 617.

AB 617 provides mechanisms and resources to invest substantial funding in the community through voluntary incentive funding measures. Most importantly, these measures are guided by the shared experience and knowledge of local community members, through their input and involvement on Steering Committees for each AB 617-selected community.

Background

The Vegetative Barriers Emission Reduction Program is a part of California Climate Investments (CCI), a statewide initiative that puts billions of Cap-and-Trade dollars to work reducing greenhouse gas (GHG) emissions, strengthening the economy, and improving public health and the environment – particularly in disadvantaged communities.

Vegetative Barriers projects use natural solutions to mitigate air quality impacts and improve public health. Projects may include planting trees or vegetative barriers in the community in order to reduce exposure to emissions and provide several key co-benefits.

Vegetative barriers, also known as windbreaks, are composed of one or more rows of trees or shrubs that may be planted in specific areas of concern in order to improve air quality in the immediate area by intercepting airborne particles, dust, chemicals, and odors. Pollutants directly emitted from cars, trucks, and other motor vehicles are found in higher concentrations near major roads. In addition, stationary sources such as

industrial facilities, factories, and agricultural operations can also contribute air pollutants to their surrounding areas. While various emission control techniques and programs exist to reduce these pollutants from mobile and stationary sources, vegetative barriers have been shown to be an additional measure to potentially reduce a population's exposure to air pollution through the interception of airborne particles and the uptake of gaseous pollutants. Examples of vegetative barriers include trees, bushes, shrubs, or a mix of these.

Generally, a higher and thicker vegetative barrier with full coverage will result in greater reductions in downwind pollutant concentrations. In addition to air quality benefits, vegetative barriers can improve aesthetics, increase property values, reduce heat, control surface water runoff, and reduce noise pollution. Factors to be considered when designing Vegetative Barriers include, but are not limited to, vegetation height, thickness, porosity, seasonal effects, vegetation air emissions (e.g. biogenic VOCs), pollution and stress resistance. Additional considerations include: soil characteristics, availability of water, control of water runoff, maintenance of the vegetative barrier, use of native and non-invasive species, and roadway safety. A full list of design considerations can be found in **Exhibit C** - EPA's *Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality,* it is also available at https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NRMRL&dirEntryId=321772&simpleSearch=1&searchAll=Recommendations+for+constructing+roadside+vegetation+barriers+to+improve+near+road+air+quality

Qualitative Benefits

Vegetative Barriers can shade buildings and reduce energy consumption by lessening the load on air conditioning systems. When planting and maintaining native and/or drought-resistant vegetation using water efficient irrigation methods, vegetative barriers can reduce water usage. In addition, planting more trees in certain areas, such as near freeways, may also help reduce noise pollution. The Steering Committee has suggested installing vegetative barriers on the perimeters of agricultural operations to reduce dust and, between local rail routes and residential areas.

Community Support for Vegetative Barriers

Community engagement continues to be an important part of the CERP development. District staff have routinely met with the respective Community Steering Committee (CSC) subcommittees. Through ongoing discussions with the Shafter CSC subcommittee for vegetative barriers and urban greening measures, the subcommittee had expressed strong interest in providing funding to support the Vegetative Barriers measure (VB.1). The Vegetative Barriers measure has been discussed at CSC meetings in addition to the outreach activities conducted to inform residents of the program and requirements for participation. Following the outreach efforts, this measure received support from the Shafter CSC and was included in the adopted CERP. This RFP was developed and modeled after existing plans and resources for similar projects within the state of California and includes feedback received from the CSC to create a program that addresses the unique needs of the community.

Schedule

Date	Event
October 20, 2026	Release Request for Proposal
December 4, 2026	Proposal submission deadline

Funding Available

The total funding available currently for the Vegetative Barriers Emission Reduction Program is $508,769 for projects within the Shafter AB 617 Community.

The applicant must be in compliance with applicable State and/or federal conflict of interest laws. To be eligible to receive incentive funding, the applicant **must** agree to disclose additional funding sources that include, but are not limited to, federal, state, and third-party private sources as follows:

1. Indicate if their organization has applied for or received funding from any other sources for this project.
2. Indicate if you intend to apply for additional funding from other sources in the future for this project.
3. Disclose the value of any current financial incentive that directly reduces the project cost including tax credits or deductions or other public financial assistance.

For any additional funding that the applicant will receive or has already received for this project, the applicant will submit copies of letter(s) of financial commitment(s), agreement(s), or grant award letter(s). Information provided may be shared as required by federal, state, and local laws. Any owner, designee, or other third party who is found to have submitted multiple applications or signed multiple contracts for this project without proper disclosure may be disqualified from funding for that project from all sources within the control of the District. Applying for or receiving funding from other sources for this project does not necessarily preclude you from this RFP.

Projects funded through existing initiatives within the community may be leveraged to expand existing projects in the Shafter AB 617 community. Applicants may use the grant awarded to them as leverage to raise matching funds for Vegetative Barriers projects. Match funding is not required for this program.

Contract Period

Applicants selected through this RFP are required to commit to their projects for a minimum of 10 years. The project implementation phase shall be completed within the first three (3) years of the contract execution date. During the contract period, Applicants must maintain the project, comply with other requirements described in this RFP, and make the project available for inspection if requested by District and/or CARB staff.

Applicant Eligibility

Applicants must meet the following criteria:

1. Applicant must be a joint powers authority, special district, non-profit, tribal government, public agency, or entity and have the necessary experience or can work with project partners with the experience to implement vegetative barrier projects within the selected AB 617 community.
2. Applicant must be the property owner or have documented authority from the property owner on which the project will be implemented;
3. Applicant must commit to implementing the project within three years of contract execution date, including irrigating and maintaining vegetative barriers planted as part of the project for the remaining portion of the contract period. The contract period will be ten (10) years from the date of execution. This commitment includes the operation and maintaining of the project including removal and replacement of dead vegetation;
4. Applicant must commit to making the project available for inspection if requested by the District or CARB staff during the entire contract period, which will be ten (10) years;
5. Applicant must contact the local County Agricultural Commissioner's Office before obtaining any plant material originating from outside the respective county to ensure all the requirements for movement of plant material into the respective county are met;
6. Applicant must ensure that trees and/or shrubs are purchased, planted, and maintained to the specifications provided in Appendix F of the CAL Fire's Urban and Community Forestry Grant Guidelines.[i]
7. Applicant shall, provide public access to the project where feasible.
8. Applicant shall obtain any required permits necessary for successful project completion;
9. Applicant must ensure that all work performed is in conformance with the California Environmental Quality Act and all other applicable statutes, rules, and regulations.
10. Applicant and project partner(s) must have financial capacity to complete, operate, and maintain the project. If the Applicant is unable to carry the financial responsibility of a reimbursement program on their own, they may partner with a local public agency or 501(c)(3) non-profit.
11. Applicant must ensure that all property taxes where the Vegetative Barrier project will be located are current at the time of application.
12. Applicant must ensure that any funds required from other sources are reasonably expected to be available in the time frame needed to carry out the project.
13. Applicant must ensure that allocated funds are used exclusively for new plantings and may be used to replace project funded trees/shrubs only if they become sick or die during the implementation phase.
14. Program funds may not be used for replacement of sick of dying trees/shrubs that were not planted as part of this program.
15. Applicant must install signage and/or markers commemorating the development of this Project. Applicant will work with the District for proper signage.

Project Eligibility

The following criteria are based on the adopted community CERP. Applicants are encouraged to review the resources provided in Exhibit D as they prepare their proposals.

1. All projects must be located within the Shafter Community boundaries and meet eligibility requirements described in this RFP.
2. Required species selection for the projects:
    a. Non-Invasive
    b. Roadway safety conformity (where applicable)
    c. Maximize GHG reductions
    d. Low-biogenic volatile organic compound (BVOC) emitting
    e. Minimize allergenic pollen
3. Vegetation Characteristics – The following plant characteristics should be considered when making species selection. A full detailed description of vegetation characteristics can be found in **Exhibit C**.
    a. Seasonal Effects
    b. Leaf Surface
    c. Air Emissions
    d. Pollution and Stress Resistance
4. Payments will be made on a **reimbursement** basis. The Grantee pays for services, products, and supplies, then submits invoices and proof of payment, and is then reimbursed.
    a. The following costs are **eligible** for funding:
        i. Supplies and materials for planting vegetative barriers
        ii. Labor and construction of the project such as removal of materials and equipment, installation of vegetative barriers, and other approved items
        iii. Contracted services related to the project
        iv. Signs and interpretive aids communicating information about the project
        v. On-going project maintenance for the continued health of the vegetative barriers for this project
        vi. Up to 25% of the grant request may be budgeted for non-construction costs, including but not limited to design, permitting, outreach, and direct project administration and management
        vii. Up to 10% may be budgeted for contingency costs
        viii. The grant amount will cover up to 100% of eligible costs
    b. The following costs are **ineligible** to receive funding:
        i. Overhead (i.e., rent, utilities, office equipment/supplies)
        ii. Operating equipment

Project Evaluation and Scoring Criteria

Applications received by the District will be distributed to District staff and the Shafter CSC, who will work in partnership to evaluate and score the projects according to the

scoring criteria described in Table 1 below. The District reserves the right to not award any grant. In the event that no applications which meet the minimum requirements of this RFP are received during the solicitation period, the District may automatically extend the solicitation until a suitable application is received. The scoring criteria and points, which were developed in partnership with the Shafter CSC, are meant to inform the decision-making process. Several of these criteria were based off of the CCI Urban Greening Guidelines[ii] and additional scoring criteria were added at the request of the sub-committee.

Table 1 – Scoring Criteria

Criteria	Points Available
Cost-Effectiveness - $/ton GHG reduced	0-30
Qualitative Benefits - Proximity to sensitive populations - Proximity to buildings to reduce energy costs - Proximity to sidewalks to shade well-traveled areas - Proximity to areas suggested by the CSC	0-25
Co-benefits - Criteria air pollutant emission reductions - Water and energy savings	0-25
Species Selection - Types of species of trees, bushes, and/or shrubs - Environmental benefits of the species selected - Consideration of initial size selection for the planting area to ensure the best chance for survival and growth	0-10
Project Readiness - Timeliness of project implementation - Leveraging existing efforts in the community - Availability of external funding	0-10

During the selection process, the District and the CSC may wish to follow up with some Applicants for clarification purposes only. No new material will be permitted at this time. Additional information provided during the bid review process is limited to clarification by the Applicant of information presented in the proposal upon request by the District and the CSC.

The determination shall be based solely on the Evaluation Criteria contained in the RFP, on evidence provided in the proposal and on any other evidence provided during the bid review process.

The District will report program information in accordance with Community Air Protection program guidelines available at: https://ww2.arb.ca.gov/sites/default/files/2025-08/FINAL_DRAFT_CAP_Incentives_2024_Guidelines_revised_May_2025_ADA_TOC.pdf.

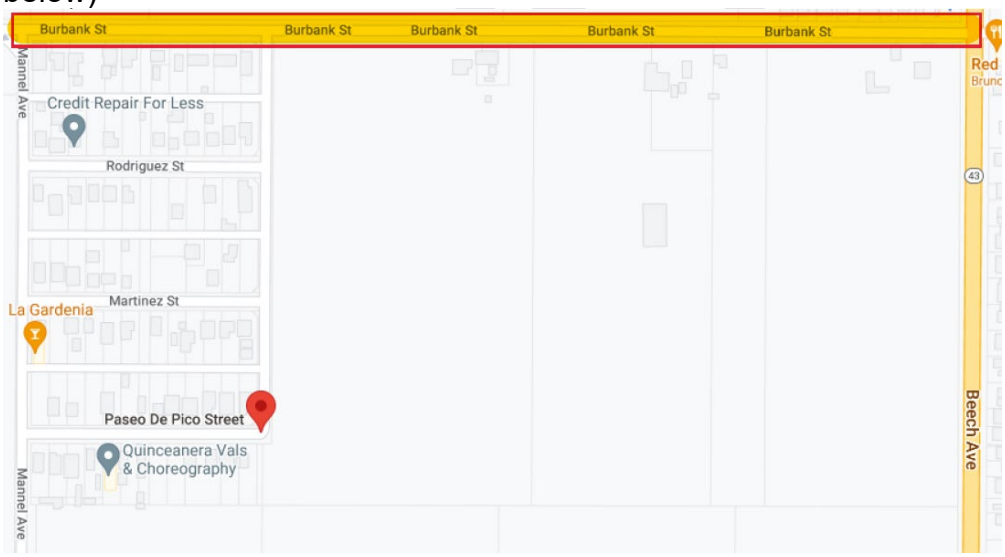
Location

The rural community of Shafter in Kern County has a current estimated population of over 19,000 residents. Geographically this community is bounded by Merced Avenue to the north, the Calloway canal and Cherry Avenue to the east, Orange Street to the south, and Scaroni Avenue to the west. This area does not encompass the entire boundaries of the City of Shafter but the core, along with the small community of Smith Corner to the south, as well as the nearby rural areas surrounding the area. The City of Shafter includes businesses, schools, and residential areas.

The project(s) to be implemented through this RFP **must be** within the boundaries of the AB 617-selected community of Shafter as shown in the link below: https://sjvapcd.maps.arcgis.com/apps/webappviewer/index.html?id=b90f6aedda30431ba128ec88ae4decc5

Applicants are encouraged to consider projects in the priority locations identified by CSC, and may provide additional sites for consideration. The following locations are a few examples of suggested sites by the CSC that would benefit from Vegetative Barriers projects:

- Around Mexican Colony
- Burbank Street, from Beech Avenue to road east of Mannel Avenue (see map below)



- 7th Standard Road
- Mannel Ave
- Mannel Avenue, from Burbank Street to San Diego Street

- Fresno Ave and Mannel Ave (intersection by Sequoia Elementary School)
- Shafter Ave and Elizabeth Ave
- Both sides of San Diego Street, from Mannel Avenue to South Shafter Avenue
- North side of San Diego Street, starting at Beech Avenue to Mannel Avenue
- Beech Ave./Hwy 43, from San Diego Street to Los Angeles Street.
- Burbank Street, from Santa Fe Hwy to Poplar Avenue
- Orange Avenue, from Santa Fe Hwy to Poplar Avenue
- Riverside Avenue, from Santa Fe Hwy to Poplar Avenue
- Santa Fe Hwy, from Burbank Avenue to Riverside Avenue
- S. Shafter Avenue, from San Diego Street to the field beyond Riverside Avenue
- Enos Lane and Kratzmeyer Road (intersection by Rio Bravo-Greeley Elementary School)

Emission Reductions

Various California state and institutional bodies have developed tools to help estimate the GHG reductions and co-benefits associated with Vegetative Barriers projects. The methodology and referenced tools below are consistent with the Quantification Methodology developed for the California Natural Resources Agency (CNRA) Urban Greening Grant Program under the California Climate Investments Program.

All Vegetative Barriers project calculations can be performed in the Benefits Calculator Tool, a workbook, which has been developed by CARB for the CNRA.[iii] Project Applicants need to fill out data within two tabs in this workbook in order to quantify emissions and co-benefits. Applicants must fill out tabs “Project Info,” and “Tree Planting – ITP.” The tab “Tree Planting – ITS” should not be filled out (The “Tree Planting – ITS” tab is designed for an alternative input tab for use with alternative software that is no longer supported). Tab “New Bike-Ped Infrastructure” should not be completed, as new bicycle/pedestrian infrastructure is not included in the Vegetative Barriers Program Plan.

In order to fill out all the information as prompted in the spreadsheet, project Applicants will also need to use three external tools, as follows:

- University of California Agriculture and Natural Resources (UCANR) Water Use Classification of Landscape Species (WUCOLS IV) tool7[iv]
- California Department of Water Resources (DWR) Water Budget Workbook8[v]
- i-Tree Planting Tool9[vi]

A guide detailing how to use each of these tools can be found in Exhibit B.

Proposal Requirements and Process

Applicants must submit a completed application (Exhibit A) and requested supplemental documents listed in this RFP to the District prior to the RFP deadline. Incomplete proposals or proposals arriving after the deadline may be disqualified from consideration.

Eligible entities will submit applications that include the required information as described in this RFP. A certification section is included in the application and details applicant requirements. Participation occurs in several phases:

1. Applicants must submit the following documents in response to this RFP:
    a. Completed Application, with no fields left blank;
        i. Applicants may submit answers to Section 3 of the application on a separate document so long as the proposal answers each question in the order presented in the application and the responses are numbered accordingly.
    b. Completed Certifications Form section, signed by applicant;
    c. First page of IRS Form W-9;
    d. Completed California Natural Resources Agency (CNRA) Draft Urban Greening Benefits Calculator Tool and provide copies of the "GHG Summary" tab and "Co-benefit Summary" tab;
    e. Dated and itemized quote(s) for the project costs; and
    f. Photographs of the project site, an aerial photo of the project from an online resource, and a representation of the project plan area (i.e., site plan).

2. Once the RFP period has ended, the District and the CSC will review applications received and contact Applicants as necessary to gather additional information. The District will aim to respond to prospective Applicants within 90 days following the end of the RFP period to alert them if their projects have been selected to receive funding. However, this timeline may be extended at the discretion of the District and CSC (e.g. to reach consensus from the CSC).

3. Upon CSC consensus, applications selected for funding will be processed by District Staff and a contract will be offered to the applicant. Once both parties have agreed to sign the contract, the applicant will be notified of the contract execution, at which point Applicants may then commence work on the project. Project expenses cannot be incurred prior to contract execution. In the event that the District and the selected applicant(s) cannot agree to a contract, the District reserves the right to award the grant to the next qualified applicant(s) or close this solicitation.

4. Claim for Payments may be submitted for partial/progress payments for reimbursement throughout the project implementation period and up to 90-days following the completion of the project implementation period. A complete Claim for Payment packet is required as part of the reimbursement process and must include, but is not limited to, the invoice(s) and receipts for the services performed and materials purchased, and proof of payment for all expenses. During this time, District inspectors will inspect and take photos of the project site. District staff will review submitted claim packets and reimburse for eligible costs, up to the approved contract amount.

Proposal Submittal

All proposals must be submitted to the District according to specifications set forth in this RFP. Failure to adhere to these specifications may be cause for rejection of proposal.

Signature – All proposals shall be signed by an authorized representative of the Applicant.

Due Date – All proposals are due no later than 4:00 PM, December 4, 2026, and should be directed to:

See Thao
Air Quality Specialist II
San Joaquin Valley Air Pollution Control District
1990 E. Gettysburg Ave
Fresno, CA 93726-0244
Email: grants@valleyair.org
Subject: Shafter Vegetative Barriers Application

Grounds for Rejection – A proposal may be rejected if:

- It is not prepared in the required format, or
- It is not signed or is signed by an individual not authorized to represent the firm, or
- Received after solicitation closure.

Modification or Withdrawal – Once submitted, proposals cannot be altered without the prior written consent of the District. All proposals shall constitute firm offers and may not be withdrawn for a period of ninety (90) days following the last day to accept proposals.

Administration

1. Cost of Developing Application
   The Applicant is responsible for the cost of developing an Application, and this cost cannot be charged to the District. In addition, the District is not liable for any costs incurred during environmental review or as a result of withdrawing a proposed award or canceling the solicitation.

2. Errors
   If an Applicant discovers any ambiguity, conflict, discrepancy, omission, or other error in the solicitation, the Applicant shall immediately notify the District of such error in writing and request modification or clarification of the document. The District shall not be responsible for failure to correct errors.

3. Immaterial Defect
   The District may waive any immaterial defect or deviation contained in an Applicant's application. The District's waiver shall in no way modify the Application or excuse the successful Applicant from full compliance.

4. Disposition of Applicant's Documents

Pursuant to the District's Procurement Policy and Procedure, the District reserves the right to reject any or all proposals. On the date that the Agreement is signed, all applications and related material submitted in response to this solicitation become a part of the property of the District and public record.

5. Applicant's Admonishment
   This solicitation contains the instructions governing the requirements for funding projects submitted by interested Applicants, including the format in which the information is to be submitted, the material to be included, the requirements that must be met to be eligible for consideration, and Applicant responsibilities. Applicants must take the responsibility to carefully read the entire solicitation, ask appropriate questions in a timely manner, submit the application with all required responses in a complete manner by the required date and time, and make sure that all procedures and requirements of the solicitation are followed and appropriately addressed.

6. Agreement Requirements
   The content of this solicitation and each grant Recipient's application shall be incorporated by reference into a final grant agreement. The District reserves the right to negotiate with Applicants to modify the project scope, the level of funding, or both. If the District is unable to successfully negotiate and execute a funding agreement with an Applicant, the District, at its sole discretion, reserves the right to withdraw the pending award and fund the next highest ranked eligible project. This does not limit the District's ability to withdraw a proposed award for other reasons, including for no cause.

7. No Agreement Until Signed
   No agreement between the District and the successful Applicant is in effect until the agreement is signed by the Recipient and signed by the authorized District representative. Costs are only subject to reimbursement by the District after execution; no costs incurred prior to execution of the agreement are reimbursable.

8. No Modifications to the General Provisions
   Because time is of the essence, if an Applicant at any time, including after Preliminary Grantee Selection, attempts to negotiate, or otherwise seeks modification of, the application or proposed award, the District may reject an application or withdraw a proposed award.

9. Payment of Prevailing Wages
   Applicants must be prepared to comply with prevailing wage requirements. Prevailing wage rates can be significantly higher than non-prevailing wage rates. Failure to pay legally-required prevailing wage rates as required can result in substantial damages and financial penalties, termination of the grant agreement, disruption of projects, and other complications.

10. Solicitation Cancellation and Amendments

The District reserves the right to cancel this solicitation, revise the amount of funds available under this solicitation, amend this solicitation as needed, and reject any or all applications received in response to this solicitation.

Insurance

The selected Applicant(s) is required to maintain sufficient insurance, licenses, or other required certifications for the type of work being performed. The District may require specific insurance coverage be established and maintained during the course of the work and as a condition of award or continuation of contract.

Reporting Requirements

All projects that receive funding under this program must comply with the requirements described in Section H of Chapter 3 in the Community Air Protection Incentives 2019 Guidelines[vii]. This will involve the preparation of Semi-annual and Yearly Reports, which the District will prepare based on information collected from the selected Applicant(s). Applicant(s) must ensure that project-related information is complete, correct, supported by documentation, and supplied to the District upon request for the preparation of the reports. Some of the information to be included in these reports is described below:

- Project information, including but not limited to the following:
  - Location information.
  - Priority population identification, if applicable.
  - Approach for identifying beneficial projects (e.g. outreach efforts, community-based organization letters, etc.).
  - Project benefits (e.g. reduction of emissions, greater mobility, etc.).
- Program-level information, including but not limited to the following:
  - Employment benefits and outcomes (jobs).
  - Public transparency and outreach events (outreach).
- Status of projects and funds for each grant year of CAP incentives
- A list of any projects identified as nonperforming and a brief narrative of any related enforcement actions

The above is not an exhaustive list of reporting requirements for the selected Applicant(s) in this program and the District will work with the Applicant(s) to ensure that the required data and information are collected for the reports. For more information, please refer to the Community Air Protection Incentives 2024 Guidelines.

Contact Person

All questions concerning this RFP and application submittals should be directed to:

See Thao
Air Quality Specialist II

San Joaquin Valley Air Pollution Control District
1990 E. Gettysburg Ave
Fresno, CA 93726-0244
Phone (559) 230-6158
Email: See.Thao@valleyair.org

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[i] Appendix F, CAL FIRE Urban and Community Forestry Grant Guidelines. Available at: https://34c031f8-c9fd-4018-8c5a-4159cdff6b0d-cdn-endpoint.azureedge.net/-/media/calfire-website/what-we-do/grants/urban-and-community-forestry/ca_ira-grant-guidelines-2024_updated-4-18 2024.pdf?rev=b3552372af144fc99a7e6dab011e0ccc&hash=D5C53C64555C9F8EBF9917BE1BC1DE20 Accessed: March 2021.

[ii] Urban Greening Program Final Guidelines. Available at: https://resources.ca.gov/grants/urban-greening/ Accessed: February 2021.

[iii] CARB Urban Greening Calculator Tool (Version 3). Available at: https://ww2.arb.ca.gov/sites/default/files/auction-proceeds/cnra_ug_finaluserguide.pdf Accessed: February 2021.

[iv] WUCOLS IV Database. Available at https://ucanr.edu/sites/WUCOLS/ Accessed: February 2021.

[v] DWR Water Budget Workbook. Available at: https://cadwr.app.box.com/s/5k39tv10u42rp5bn2uebd7fodkxzgve7 Accessed: February 2021.

[vi] i-Tree Planting Calculator v2.1.2. Available at: https://planting.itreetools.org/ Accessed: February 2021.

[vii] Community Air Protection Incentives 2024 Guidelines. Available at: https://ww2.arb.ca.gov/resources/documents/community-air-protection-incentives-2024-guidelines-revised-may-2025

Exhibit A

Vegetative Barriers Application Here

VEGETATIVE BARRIERS

APPLICATION

Vegetative Barriers Emission Reduction Program is part of California Climate Investments, a statewide initiative that puts billions of Cap-and-Trade dollars to work reducing greenhouse gas emissions, strengthening the economy, and improving public health and the environment — particularly in disadvantaged communities.

SECTION 1 - APPLICANT INFORMATION (PLEASE PRINT OR TYPE)

1. Organization, Company, or Proprietor's Name (as it appears on Form W-9):		
2. Physical Address:		
3. City:	4. State:	5. Zip Code:
6. Mailing Address (if different from above):		
7. City:	8. State:	9. Zip Code:

SECTION 2- CONTACT INFORMATION (PLEASE PRINT OR TYPE)

PRIMARY CONTACT INFORMATION	
1. First and Last Name:	2. Title:
3. Phone Number:	4. Fax Number:
5. Alternate Contact Number:	6. Email (required):
SIGNING AUTHORITY INFORMATION (IF DIFFERENT FROM ABOVE)	
1. First and Last Name:	2. Title:
3. Phone Number:	4. Fax Number:
5. Alternate Contact Number:	6. Email (required):

SECTION 3 – PROJECT INFORMATION (PLEASE PRINT OR TYPE)

Applicant may submit answers to this section on a separate document so long as the proposal answers each question in the order presented and the responses are numbered accordingly.

Project Type: Vegetative Barriers

1. **Project Summary**
   Briefly describe your project including committed partners, expected implementation period, project costs and how the project will mitigate air quality impacts.

2. **Location of Project**
   Provide address or cross-streets and describe surrounding area. Please attach photographs of the project site, and aerial photo of the project from an online resource, and a representation of the project plan area (i.e., site plan).

3. Is the applicant the property owner of the land on which the project will be implemented?

☐ **Yes.**

☐ **No.** Please provide the name and contact information for the Property Owner(s) of Each Parcel within Project Footprint or provide a demonstrated plan to obtain the authority from the property owner(s).

4. Describe Proposed Greenery

Include quantity of each plant or tree to be planted. Also note environmental benefits of the selected species (e.g., if the species is native, drought resistant, non-allergenic, or low-BVOC emitting), if possible.

5. Area of Project Footprint to be created or Enhanced (acres or square footage)

6. Proposed Irrigation Systems

Describe the type of irrigation systems (e.g., drip, overhead spray)

7. Project Limitations

Describe any possible project limits such as parking, hours of operation, available staffing, user fees, seasonal restrictions, or other ecological considerations.

8. Sensitive Receptors

Provide a list of sensitive receptors (e.g., schools, day cares, residences) within 1,000 feet of the project

Name of Location	Distance from Project

9. Estimated Timeline for Project Implementation

Provide an estimated timeline for project implementation assuming project is notified of grant approval within 90 working days of submittal of application.

Include preliminary design, environmental documentation, permitting, long-term operations and maintenance commitments, and any other relevant actions as steps in this timeline.

Date	Action

Describe the measures that will be utilized to assure completion of the project within the indicated time.

10. Project Implementation

Identify the key individuals responsible for project implementation and their roles.

Name	Title/Position	Project Role

11. Project Costs

Describe the estimated costs of the project.

Description	Cost
Supplies and Materials	
Labor and Construction	
Contracted Services	
Signs and Interpretive Aids	
Non-Construction Costs	
Contingency Costs	
Other:	
Other:	
Other:	
Other:	
Other:	
Total Project Cost	

Provide quotes of project costs identified above (submit with application).

12. Funding amount requested:

13. Additional Funding Secured for this Project:

Include source of funding.

CERTIFICATIONS FORM

I have read the Eligibility Criteria and Program Guidelines and I agree to **ALL** the following terms and conditions by **signing below**:

- **I have not purchased, made any payments toward, or began any work, nor will I, until I have an executed contract from the District.**
- I understand that submission of this application does not guarantee incentive funding for the project.
- I am the property owner, have documented authority from the property owner, or have a demonstrated plan to obtain the authority from the property owner to construct and maintain the Vegetative Barriers project as described in the project application.
- I agree to complete the project implementation phase within three years of the contract execution date and maintain the project for a minimum of 10 years.
- I will make the project site available for inspection if requested by SJVAPCD and/or CARB staff during the ten (10) year contract period.
- I will provide photo documentation upon completion of the project.
- I will provide annual or bi-annual status updates in the form of a photo update and/or a tree condition report to ensure project maintenance is occurring throughout the contract period.
- I understand it is my responsibility to contact the local County Agricultural Commissioner's Office before obtaining any plant material originating from outside respective county to ensure all the requirements for movement of plant material into respective county are met.
- I understand, where feasible, projects shall provide public access.
- I will select plant species that maximize GHG reductions and minimize ROG (BVOC) and allergenic pollen.
- Project plan incorporates recommendations in the anti-displacement resources provided.
- All property taxes are current at the time of application.
- I understand that I am responsible for obtaining any permits required.
- Our organization, along with any project partners have the financial capacity to complete, operate, and maintain the project.
- I understand that any funds required from other sources must reasonably be expected to be available in the time frame needed to carry out the project.
- I understand that the final funding amount reimbursed may be less than the maximum incentive amount if the final invoice amount for the eligible costs of the project is less than the maximum incentive amount.
- I understand that the selection of a third party contractor to perform any or all of the project is completely my choice and the District does not endorse, or is not in partnership with any such contractors and shall not be responsible for any disputes arising from the work performed between the applicant and the contractor. The District will not be held liable for any disputes, circumstances or events that occur between the applicant and contractor. Contractors are independent contractors; they are not officers, representatives, agents, servants, employees, partners, associates, or joint ventures of the District.

- Projects funded by District will not be used as marketable emission reduction credits, to offset any emission reduction obligation, or for credit under any federal or state emission averaging, banking and trading program. In addition, projects funded through this program may not be used to generate a compliance extension or extra credit for determining regulatory compliance.
- Any current financial incentive that directly reduces the project cost, including tax credits or deductions, grants, or other public financial assistance for the same project, must be disclosed to the District.

I hereby certify that all information provided in this application and any attachments are true and correct to the best of my knowledge.

Signing Authority's Signature:	Date:
Print Name:	Title:

APPLICATION PACKET CHECKLIST

All proposals must be submitted according to specifications set forth in the RFP. Failure to adhere to these specifications may cause for rejection of proposal. Once submitted, proposals cannot be altered without the prior written consent of the District. A complete application packet includes the following items:

- ❑ Completed **Application**, no fields left blank.
- ❑ Completed **Certifications Form** section, signed by **Applicant.**
- ❑ First page of IRS **Form W-9.**
- ❑ Copies of the applicant's results from the "GHG Summary" tab and "Co-benefit Summary" tab from the **California Natural Resources Agency (CNRA) Draft Urban Greening Benefits Calculator Tool**
- ❑ Dated and itemized **Quote(s)** for the project costs.
- ❑ Aerial map of the project from an online resource
- ❑ Photographs of the project site and a representation of the project plan area (i.e. site plan).

All proposals are due no later than 4:00 PM, December 4, 2026. Late proposals will not be accepted under any circumstances.

Please submit your completed application packet via <u>one</u> of the following methods below to avoid duplicate submittals:

Email: grants@valleyair.org
(Subject line must indicate Shafter Vegetative Barriers Incentive Program and applicant's name)
-or-
Mail: SJVAPCD
Attn: Grants and Incentives
1990 East Gettysburg Avenue
Fresno, CA 93726-0244

<u>Don't forget to retain a full copy of the completed application for your own records</u>.
For additional assistance, please contact staff in the Grants Department at (559) 230-5800

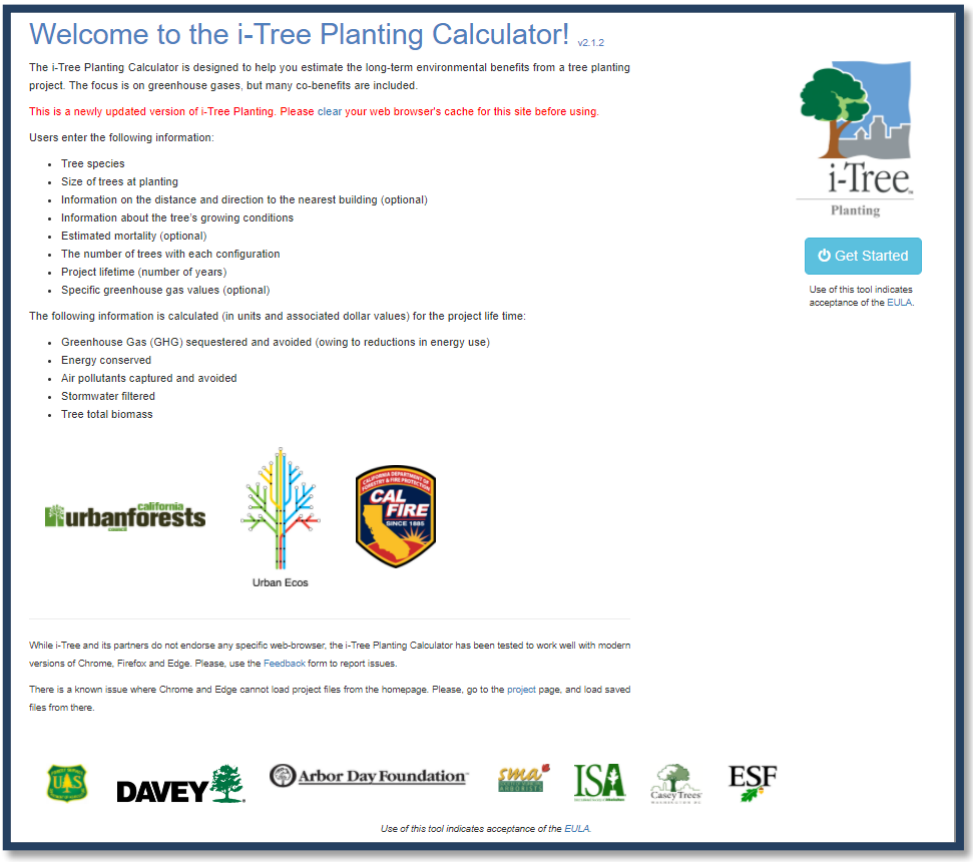
Exhibit B

Vegetative Barriers Tool – User Guide

i-Tree Planting Calculator User Guide

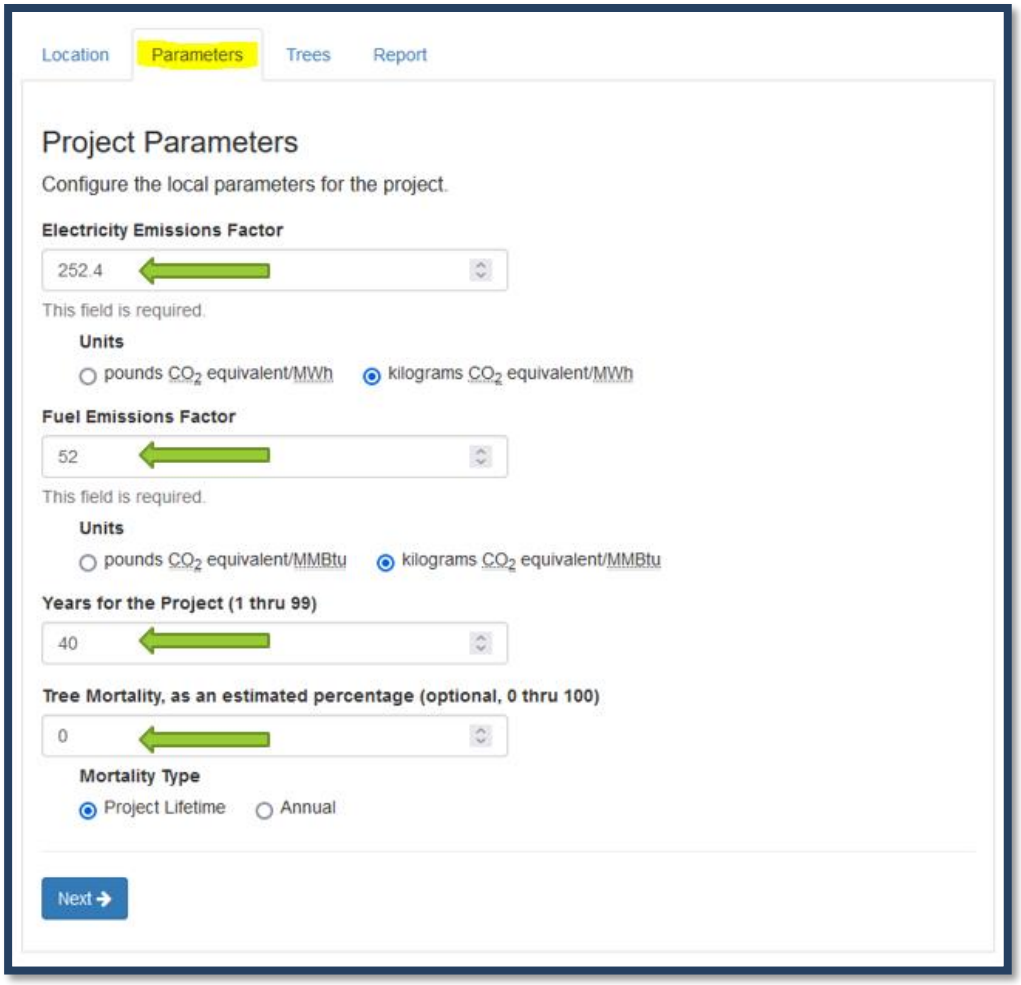
The tool **i-Tree Planting** should be used in order to help estimate the tree carbon storage, energy savings, and pollution reduction due to each group of trees to be planted. This tool can be found at https://planting.itreetools.org/

Step One – Open Tool. Once at the website, click "Get Started" on the right of the screen to access the tool, as shown below:



Step Two – Specify Project Location. Once in the tool, enter the project location (state, county, then city) as prompted from the three dropdown menus. Click next to continue.

Step Three – Specify Project Parameters. On the Project Parameters page, the Electricity Emissions Factor, Fuel Emissions Factor, Years for the Project, and Tree Mortality over Project Lifetime are all adjustable. Per CNRA guidelines, the Electricity Emissions Factor should be 227.9 kg CO2e/MWH and the Fuel Emissions Factor should be entered as 53.1 kg CO2e/MMBtu. The Years for the Project value should represent the total years of tree growth 40 years from the project start date. For example, for trees planted in the first year of the project, enter "40." For trees planted in the second year, enter "39," and so on. The Urban Greening Benefits Calculator Tool will account for the Tree Mortality over the Project Lifetime, so please enter zero for this field. See the following screenshot for an example of what this page may look like for a project within the San Joaquin Valley:



After making this change, hit next again to progress to the next tab, "Tree Planting Configurations."

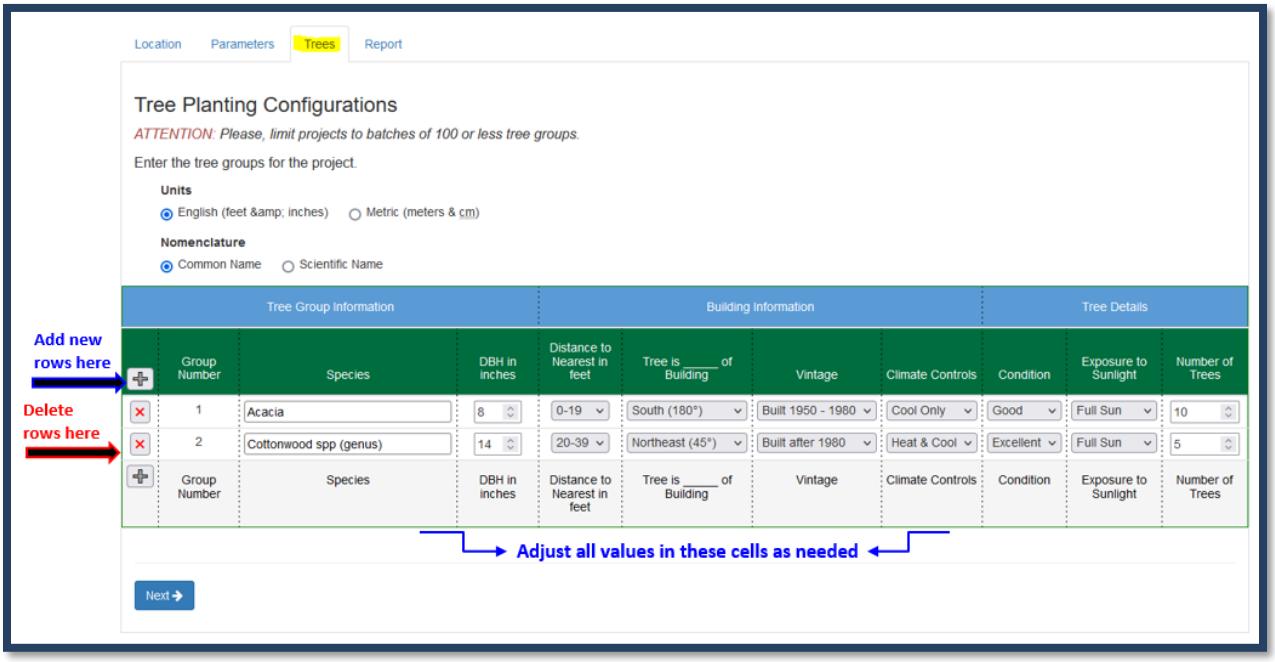
Step Four – Specify Units for Tree Planting Configurations. At the top of the Tree Planting Configurations page, the units can be adjusted between English and Metric, and it can be selected whether the tree species will be listed using their common or scientific names.

Step Five – Enter Tree Planting Configuration Information. After the units and nomenclature items are selected (under Step Four), the following must be entered:

- **Tree Group Information**
  - Species of tree *(select from dropdown)*
  - Diameter at breast height (DBH) at time of planting
- **Building Information**
  - Distance to nearest building *(select from dropdown)*
  - Direction from nearest building *(select from dropdown the cardinal direction [e.g.,*
  - *North South, etc.] in which the tree is located when standing at the building)*
  - Age of building *(select from dropdown)*
  - Climate controls within the nearest building *(select from dropdown)*
- **Tree Details**
  - Tree condition *(select from dropdown)*
  - Exposure to sunlight *(select from dropdown)*
  - Number of trees to be planted

This information must be entered for each different group of trees that will be planted. A new group is required whenever any of the above parameters are different for a set of trees. To add a new group of trees, hit the plus sign at the far left of the table. To remove a group, click the X at the left of the row that needs to be removed.

An example of this completed tab with two groups of trees is shown below:



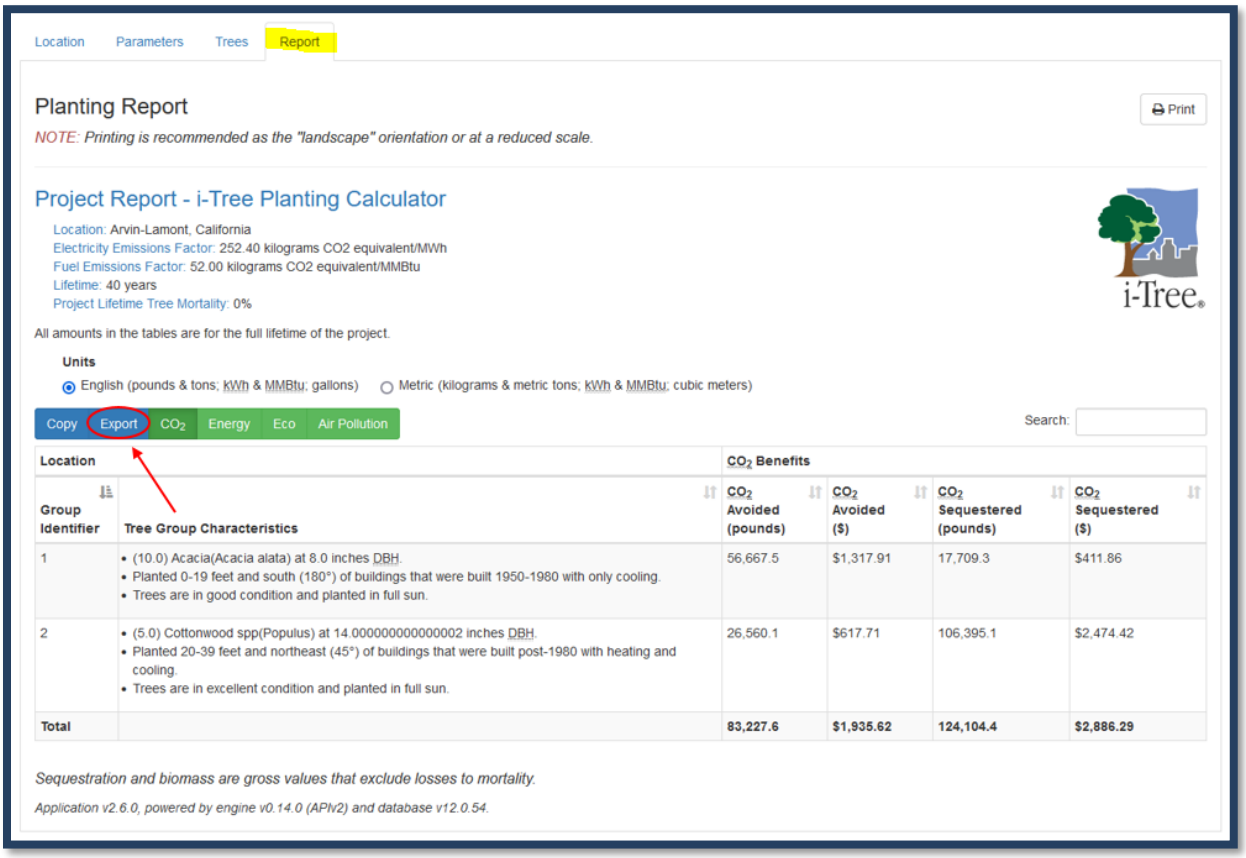
Step Six – Generate Report. After inputting this information, hit next again. This will generate the final report from i-Tree Planting.

The report has four sections within the webtool:

- "CO2" shows the pounds of CO2 avoided and sequestered and the resultant cost savings.
- "Energy" shows the electricity and other fuel savings and resultant cost savings.
- "Eco" shows the total tree biomass, rainfall interception, and the avoided runoff in gallons and resultant cost savings.
- "Air Pollution" shows the total mass of several key air pollutants that was either avoided (via deposition and dispersion) or removed (via absorption) as a result of the project.

In order to see values from all four of these tabs at once, proceed to Step Seven – Export Report.

Step Seven – Export Report.



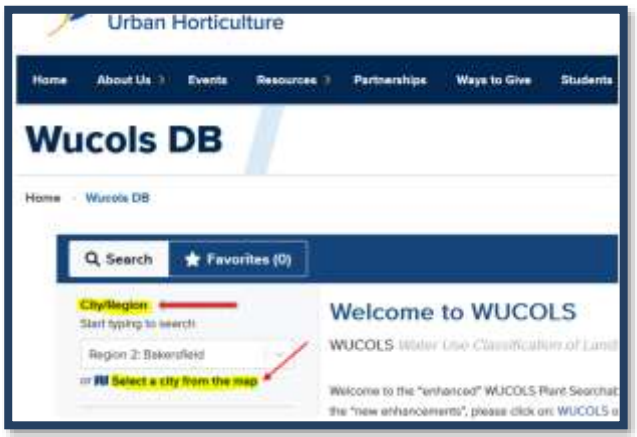
Hitting export will generate an Excel spreadsheet with all relevant values included. These values will need to be imported into tab “Tree Planting – ITP” in the CNRA Calculator Tool.

Water Use Classification of Landscape Species (WUCOLS IV) Tool User Guide
The University of California Agriculture and Natural Resources (UC ANR) **WUCOLS** tool should be used in conjunction with the DWR Water Budget Workbook in order to estimate the amount of water and type of irrigation that this project will require. This tool is available here: https://ccuh.ucdavis.edu/wucols.

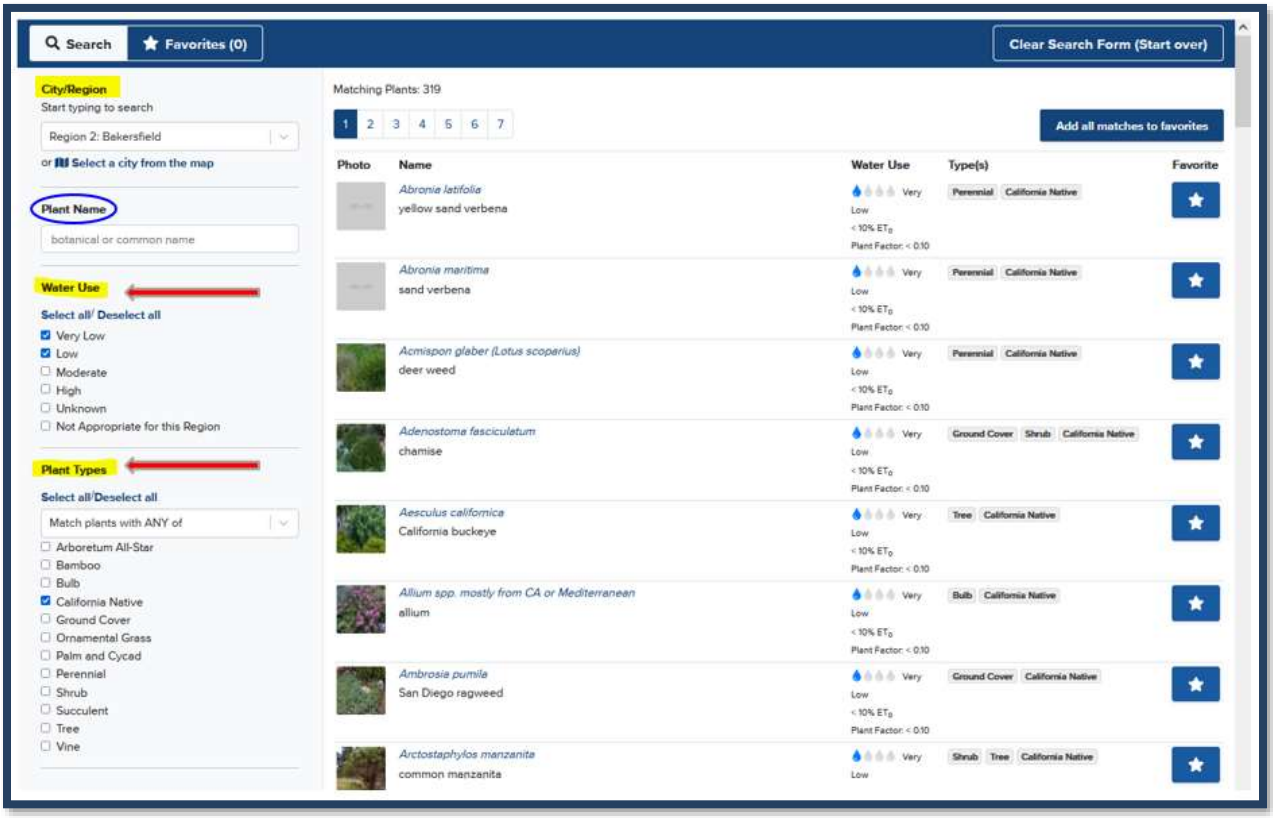
Step One – Open Plant Search Database. From the tool home page, on the right-hand side click "Plant Search Database" to enter the tool itself, as shown below:

Clicking that link will open the Plant Search Database.

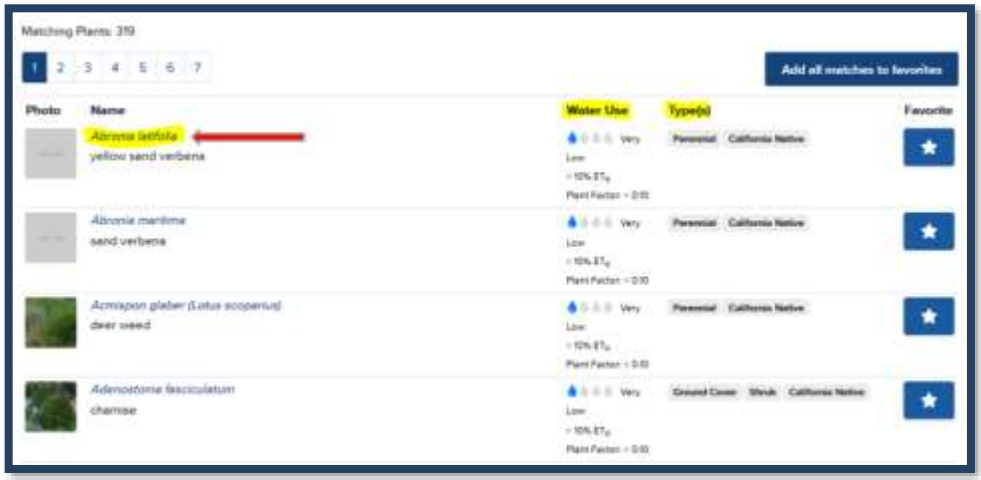
Step Two – Enter City/Region Name. Enter the city/Region in which the proposed project will be located using the drop-down menu or "Select a city from the map" option.



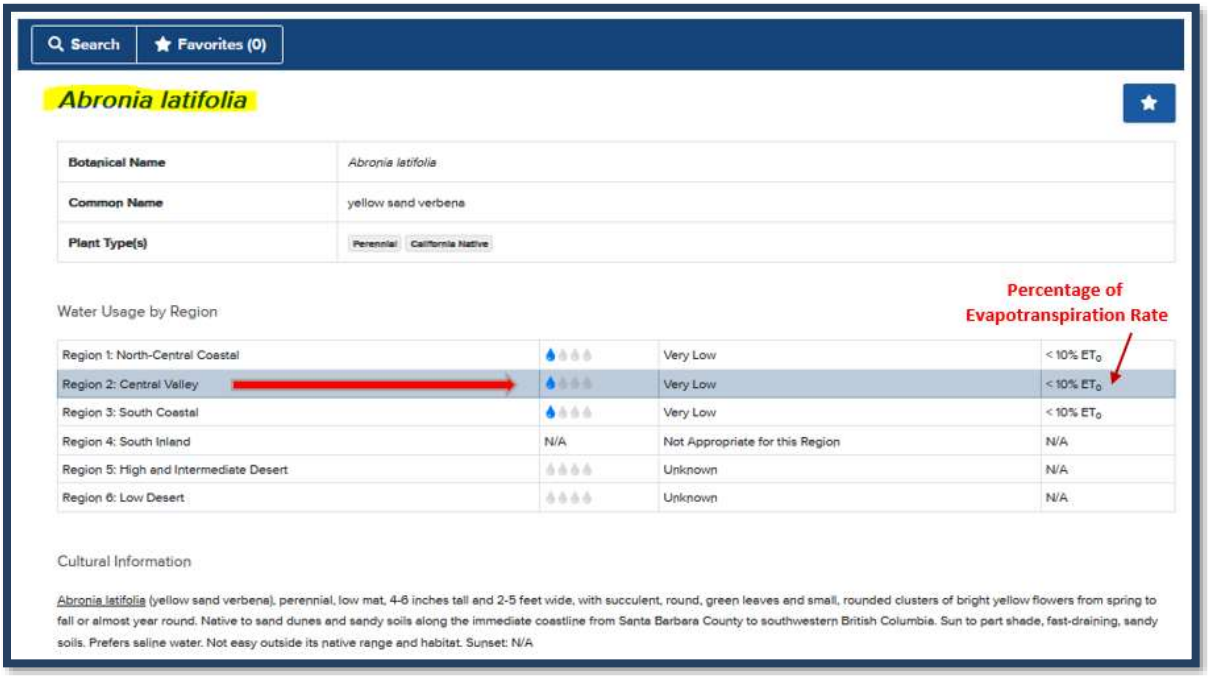
Step Three – Choose Plant Name/Type. Once the city name is entered, there are two options after the Plant Name. If the types of plant and greenery for the project have already been determined, use the "Plant Name" search box to choose the specific plants and greenery. If not, then the general Plant Type can be chosen from the list on the left, and the water usage can be chosen from the checklist on the left. In the example below, the user selected California native trees that require very low or low water usage within Bakersfield:



Step Four – Choose Plant Type. Once an appropriate plant has been identified, or once the type of plant that has already been chosen for this project is found, click on its name. An example for the first search result, *Abronia Latifolia*, is shown below:



Step Five – Obtain Evapotranspiration Rate. Click on the first selection *Abronia Latifolia*, this will take you to the next page, you will see the Water Usage by Region with the evapotranspiration rates for the chosen plant. Look for the value that matches the water usage classification for that plant, which should be highlighted in blue. An example for the first search result, *Abronia Latifolia*, is shown below:

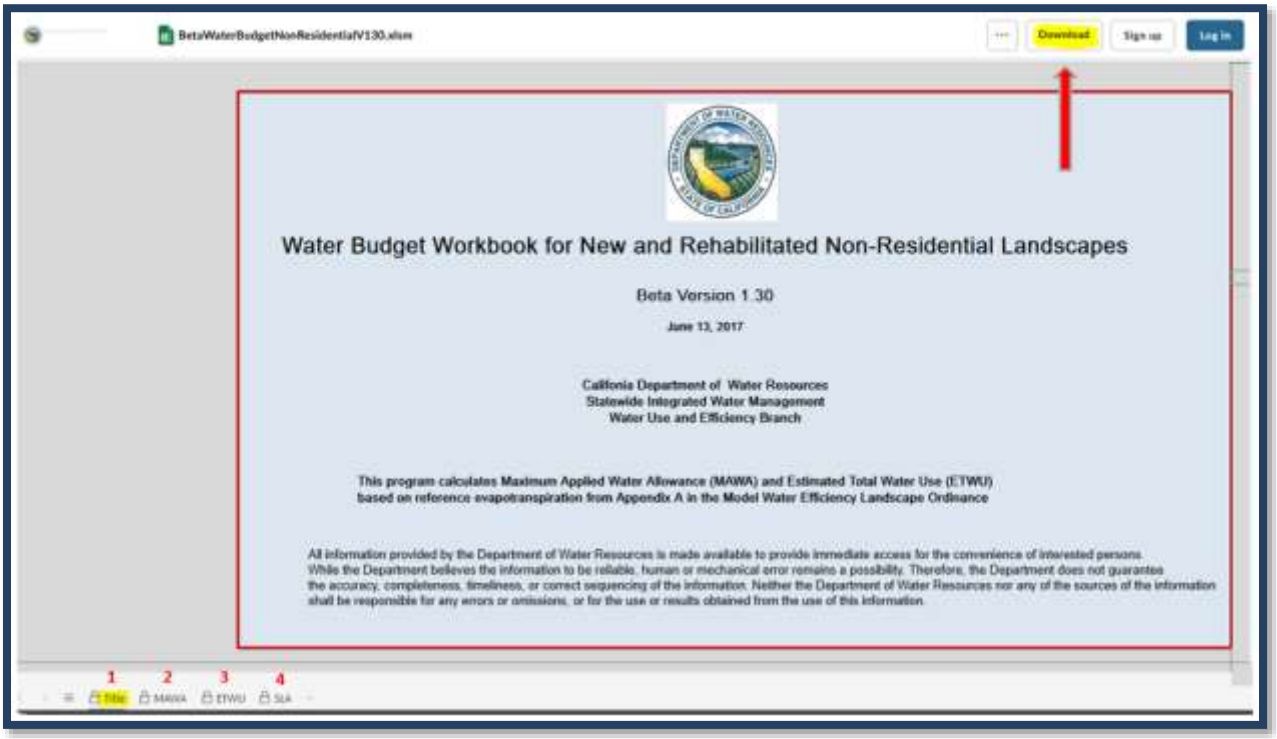


The Evapotranspiration Rate, ET_0, is shown in the last column. Take note of the average value from the column shown above. In the case where there is a range choosing the average percentage will be required. The ET_0 value needs to be obtained for all plants that are currently at the proposed project site, as well as all of the species that would be planted as part of the project itself. Once these values have been collected, they can be entered into the next tool, the ***DWR Water Budget Workbook***.

DWR Water Budget Workbook User Guide

After the WUCOLS tool is run, the California Department of Water Resources' Water Budget Workbook for New and Rehabilitated Non-Residential Landscapes **("DWR Water Budget Workbook")** should be used in order to estimate the amount of water and type of irrigation that the proposed project will require. This tool is available for download here: https://cadwr.app.box.com/s/5k39tv10u42rp5bn2uebd7fodkxzgve7

Step One – Download Tool. Clicking the link above opens an embedded workbook. In order to access the tool in Excel, click "Download" in the top right, as shown below.



This tool consists of three main tabs: Maximum Applied Water Allowance (MAWA), Estimated Total Water Use (ETWU), and Special Landscape Area (SLA).

Step Two – Specify Project Location. In the tab "MAWA," first select the city where the proposed project will be located.

For all proposed projects, this entire workbook must be filled out twice:

- Once using the current landscape characteristics of the proposed project site ("Pre-Project Scenario"), and
- Once accounting for the landscape characteristics after the proposed project is implemented ("Post-Project Scenario").

To do so, it is recommended that the applicant save two copies of the Water Budget workbook: one for the Pre-Project Scenario, and one for the Post-Project Scenario.

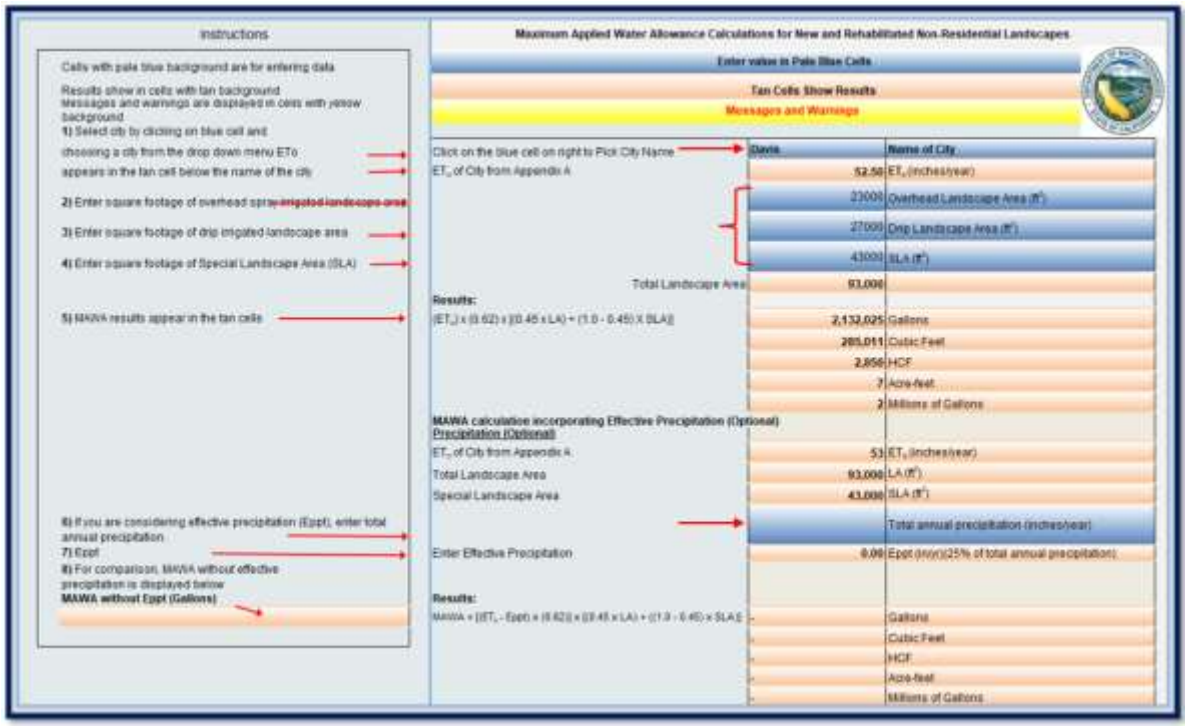
Workbook cells highlighted in blue are ones for which data should be entered. Cells highlighted in tan display results and should not be adjusted.

"MAWA" Tab

Steps One through Two should be performed in the blue highlighted cells in the "MAWA" tab. For reference, a screenshot of this tab is provided below. Note that there is additional instruction to the left of the data entry in this tab.

Step Three – Specify Project Area. Next, enter square footage of the landscape area that is irrigated via overhead spray, as well as the square footage of landscape area that is irrigated by drip irrigation. Where prompted, also enter the square footage of any special landscape area on the project site. Special landscape area includes recreational area, area permanently and solely dedicated to edible plants, and area irrigated with recycled water.

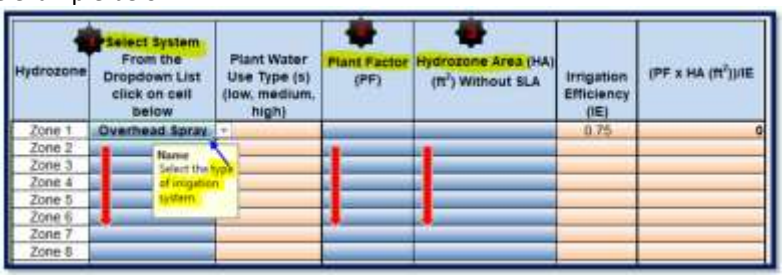
Step Four – Specify Project Precipitation. If known, enter the annual precipitation at the project site in inches per year. If the annual precipitation is unknown, this cell can be left blank.



Next, move to tab "ETWU."

Estimated Total Water Use - "ETWU" Tab

Steps Five through Eight should be performed in the blue highlighted cells in the "ETWU" tab. For reference, a screenshot of this tab is provided on the next page. Note that after download, the tool will display example data in this sheet, with six hydrozone's listed. Delete the 1) irrigation type, 2) plant factor, and 3) hydrozone area columns before starting, see example below.



Step Five – Specify Irrigation Type. Fill out the irrigation type (overhead spray or drip) for each hydrozone. A hydrozone is a portion of the landscaped area having plants with similar water needs. If two different types of tree are planted as part of this project, then each type of tree qualifies as its own hydrozone. Additionally, if certain areas of the landscape are irrigated in different ways then those areas would constitute different hydrozones as well. Special Landscape Areas do not need to be entered on this tab.

Step Six – Specify Area of Each Hydrozone. For each hydrozone, enter the area in square feet in the column labelled "Hydrozone Area Without SLA." The total area entered for all hydrozones on this page should match the total area entered on the "MAWA" tab. Special Landscape Areas do not need to be entered on this tab.

Step Seven – Enter Plant Factors. Next, input the correct plant factor for each hydrozone. This plant factor will be the average evapotranspiration rate (ET0) that was obtained from the WUCOLS tool. Each type of plant will have its own plant factor, and thus may represent its own hydrozone. Special Landscape Areas do not need to be entered on this tab.

These three items will be input into the columns highlighted in blue, as shown below for a project with six example hydrozones:

Estimated Total Water Use

Equation: ETWU = ET_o x 0.62 x [((PF x HA)/IE) + SLA]; Considering precipitation ETWA = (ETo-Eppt) x 0.62 x [((PF x HA)/IE) +SLA]

Enter values in Pale Blue Cells

Tan Cells Show Results

Messages and Warnings

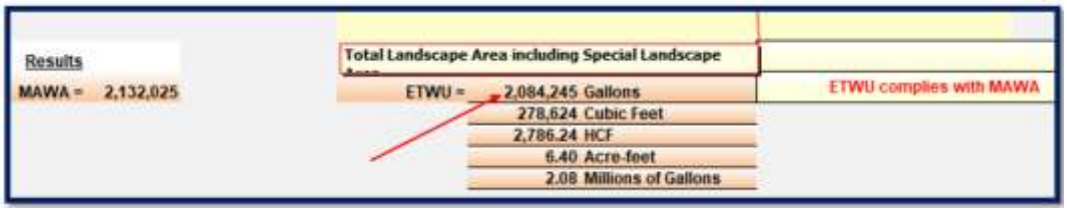
Irrigation Efficiency Default Value for overhead 0.75 and drip 0.81.

Plant Water Use Type	Plant Factor
Very Low	0 - 0.1
Low	0.2 - 0.3
Medium	0.4 - 0.6
High	0.7 - 1.0
SLA	1.0

Hydrozone	Select System From the Dropdown List click on cell below	Plant Water Use Type (s) (low, medium, high)	Plant Factor (PF)	Hydrozone Area (HA) (ft^2) Without SLA	Irrigation Efficiency (IE)	(PF x HA (ft^2))/IE
Zone 1	Overhead Spray	High	0.70	5,000	0.75	4,667
Zone 2	Overhead Spray	Medium	0.50	4,000	0.75	2,667
Zone 3	Overhead Spray	Medium	0.40	3,000	0.75	1,600
Zone 4	Drip	Low	0.30	7,000	0.81	2,593
Zone 5	Drip	Low	0.30	15,000	0.81	5,556
Zone 6	Drip	Low	0.20	16,000	0.81	3,951

Step Eight – View Results. At the bottom of this tab, the workbook will display the estimated total water usage as shown on the next page. Note this value (in gallons) for both the pre- and post-project scenarios, as it will need to be entered into tab "Tree Planting-ITP" of the CNRA calculations workbook.

Projects must comply with MAWA, per California's updated Model Water Efficient Landscape Ordinance (MWELO).1 This workbook will show if a project complies with MAWA as shown in red font in the screenshot below.



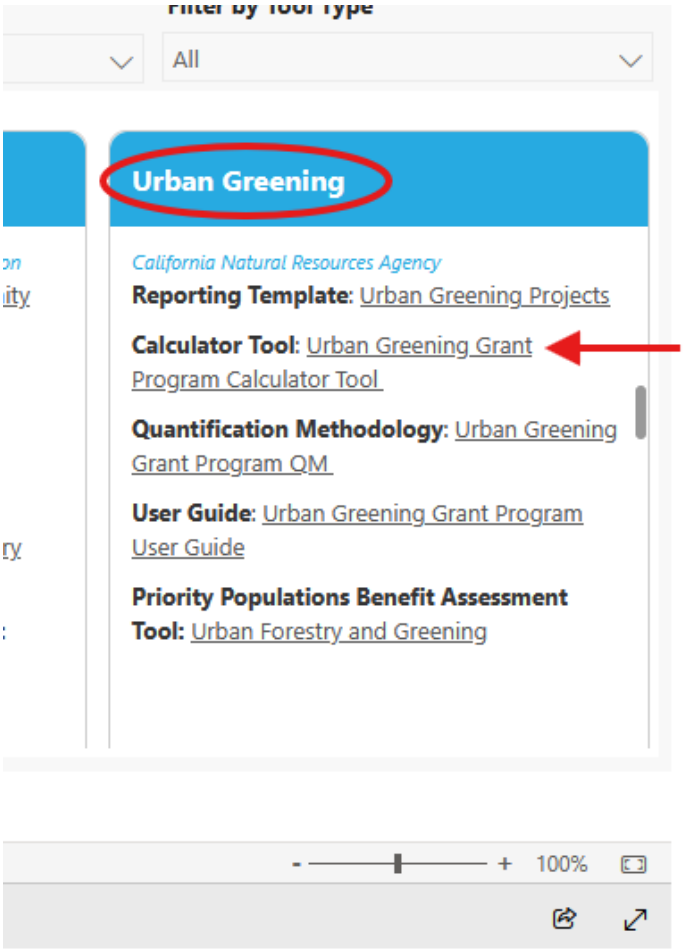
Note that the DWR Water Budget Workbook also includes a third tab, "SLA." For purposes of these projects, the inputs on this tab do not affect the project results. Therefore, this tab can be ignored.

CNRA Benefits Calculator Tool User Guide

After using i-Tree Planting, WUCOLS IV, and the DWR Water Budget Workbook, the California Natural Resources Agency (CNRA) **Benefits Calculator Tool** can be completed for the proposed urban greening project.

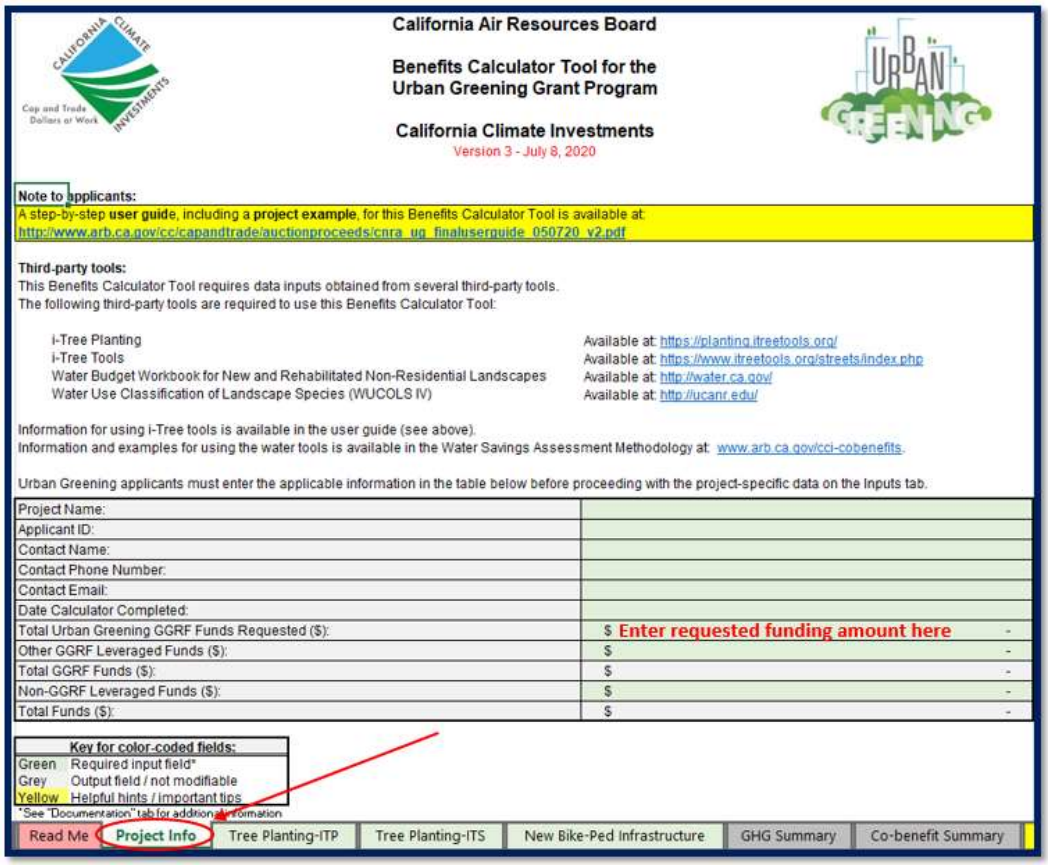
To access the tool, visit the following site: https://www.caclimateinvestments.ca.gov/tools .

Step One – Locate Tool. Scroll down to the section labelled "Urban Greening" then look for Calculator Tool: Urban Greening Grant Program Calculator Tool.



Step Two – Open Tool. Once identified, click the link for "Calculator Tool," as shown above, to open the tool. This will download an Excel file named "cnra_ug_finalcalculator_070820_v3.xlsx". Open the Excel file and click the prompt to "Enable Editing" if necessary.

Step Three – Enter Project Information. Within the Excel file, two main tabs need to be updated manually. The first is labelled "Project Info." This tab requires the applicant to enter the project name, contact information, and the requested funding amount. The items that should be filled out are highlighted in green.

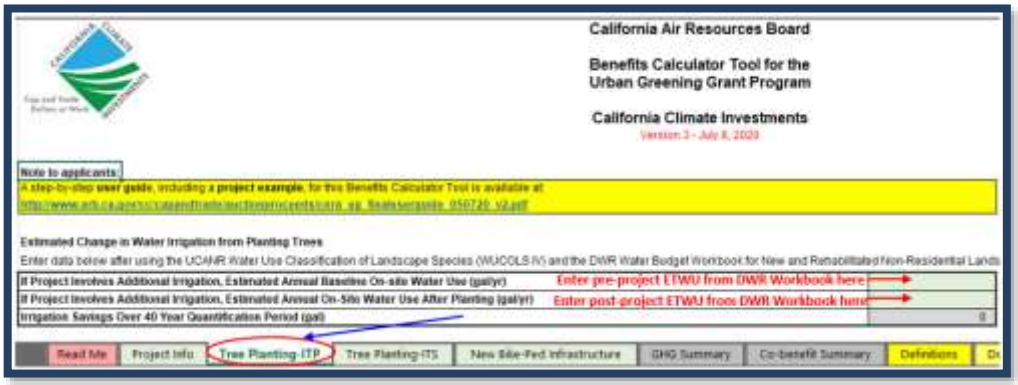


While there are multiple line items set up for funding, the total amount of funding requested under the San Joaquin Valley AB 617 program should be entered in the row labelled "Total Urban Greening GGRF Funds Requested," as shown above. Unless other funding is available, all other funding rows can be labelled as $0.

After the "Project Info" tab has been filled out, go to tab "Tree Planting-ITP." Steps Four and Five should be entered on the "Tree Planting-ITP" tab.

Step Four – Enter Water Usages.

At the top of the "Tree Planting – ITP" tab, there are two rows to enter the estimated annual baseline on-site water use and the estimated annual on-site water use after planting. Here, enter the estimate total water usage (ETWU) from the DWR Water Budget Workbook. Enter the value from the pre-project scenario in row 16, and the value from the post-project scenario in row 17, as shown below:



Step Five – Enter Data from i-Tree Planting. In the second table on the "Tree Plating – ITP" (shown below), enter the results from the i-Tree Planting Report as prompted. Enter the results for each individual group of trees in a separate row. Once all of the green cells below have been populated, this tool will calculate emission reductions as well as water and energy savings at the bottom of the tab.

The data from the i-Tree Planting output file should match the table above as shown below:

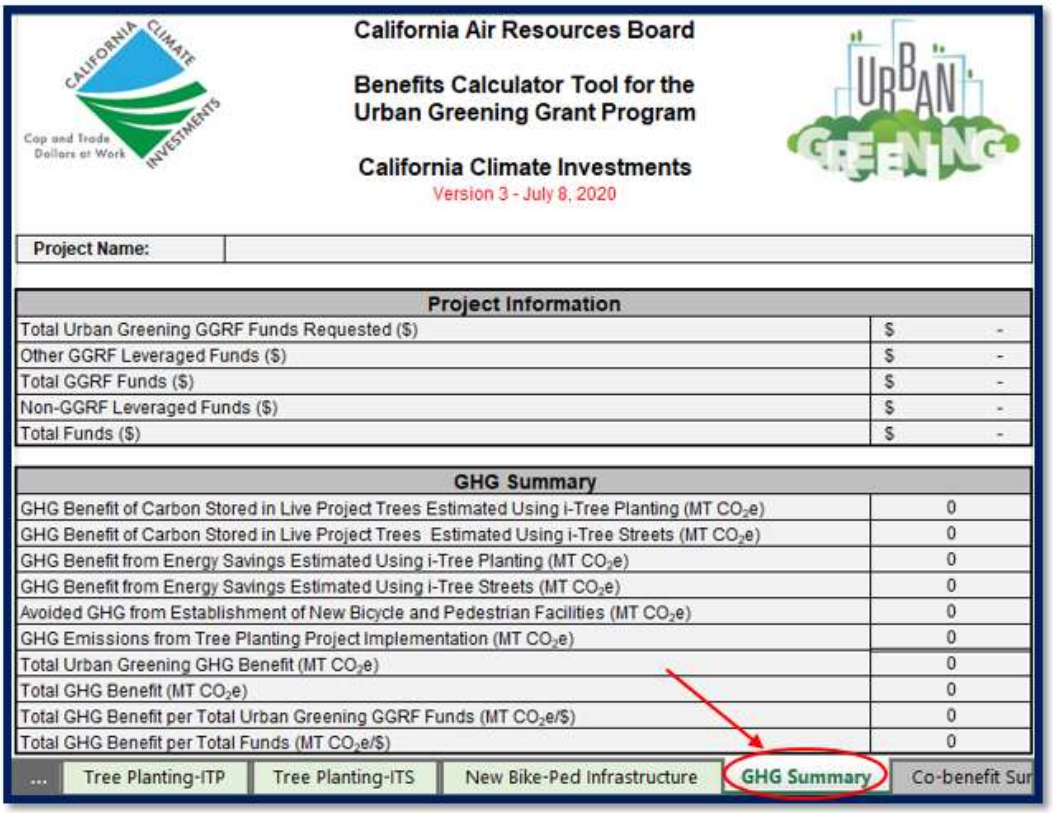
Data Label in Exported i-Tree Planting Report	Data Label in Tab "Tree Planting – ITP"
Group Identifier	Group Identifier
Tree Group Characteristics	Tree Group Characteristics
CO_2 Sequestered (pounds)	Carbon Stored in Tree Group over the 40 Year Quantification Period
Electricity Saved (kWh)	Electricity Savings from Tree Group over the 40 Year Quantification Period
Fuel Saved (MMBtu)	Natural Gas Savings from Tree Group over the 40 Year Quantification Period
NO_2 Removed (pounds)	NO_2 Removed Over the 40 Year Quantification Period
$PM_{2.5}$ Removed (pounds)	$PM_{2.5}$ Removed Over the 40 Year Quantification Period
Rainfall Interception (gallons)	Rainfall Interception Over the 40 Year Quantification Period
Avoided Runoff (gallons)	Avoided Runoff Over the 40 Year Quantification Period

The workbook contains two additional data entry tabs highlighted in green. The "Tree Planting-ITS" tab should not be filled out (the "Tree Planting – ITS" tab is designed as an alternative input tab for use with alternative software that is no longer supported).

The "New Bike-Ped Infrastructure" tab is used for estimating benefits from implementation of new bicycle or pedestrian infrastructure. This action was not identified as a requirement in the Vegetative Barrier/Urban Greening Program Plan, so this tab may also be skipped.

Step Six – View Results. Results are viewed on the gray-highlighted tabs, "GHG Summary" and "Co-benefit Summary". The applicant does not need to fill in any information in these tabs. However, the applicant shall attach a copy of these results to the San Joaquin Valley Vegetative Barriers/Urban Greening Project Application form as prompted. Screenshots of these two tabs are shown on the following pages:

Tab "**GHG Summary**:"



California Air Resources Board

Benefits Calculator Tool for the Urban Greening Grant Program

California Climate Investments

Version 3 - July 8, 2020

Project Name:	

Project Information	
Total Urban Greening GGRF Funds Requested ($)	$ -
Other GGRF Leveraged Funds ($)	$ -
Total GGRF Funds ($)	$ -
Non-GGRF Leveraged Funds ($)	$ -
Total Funds ($)	$ -

GHG Summary	
GHG Benefit of Carbon Stored in Live Project Trees Estimated Using i-Tree Planting (MT CO_2e)	0
GHG Benefit of Carbon Stored in Live Project Trees Estimated Using i-Tree Streets (MT CO_2e)	0
GHG Benefit from Energy Savings Estimated Using i-Tree Planting (MT CO_2e)	0
GHG Benefit from Energy Savings Estimated Using i-Tree Streets (MT CO_2e)	0
Avoided GHG from Establishment of New Bicycle and Pedestrian Facilities (MT CO_2e)	0
GHG Emissions from Tree Planting Project Implementation (MT CO_2e)	0
Total Urban Greening GHG Benefit (MT CO_2e)	0
Total GHG Benefit (MT CO_2e)	0
Total GHG Benefit per Total Urban Greening GGRF Funds (MT CO_2e/$)	0
Total GHG Benefit per Total Funds (MT CO_2e/$)	0

... | Tree Planting-ITP | Tree Planting-ITS | New Bike-Ped Infrastructure | GHG Summary | Co-benefit Sur

Tab "**Co-benefit Summary**:"

Project Name:	

Co-benefits and Key Variables Summary	
Urban Greening GGRF Funds	
Total $PM_{2.5}$ Emission Reductions (lb)	0
Total NOx Emission Reductions (lb)	0
Total ROG Emission Reductions (lb)	0
Total Diesel PM emission reductions (lb)	0
Remote PM2.5 Emission Reductions (lb)	0
Remote NOx Emission Reductions (lb)	0
Remote ROG Emission Reductions (lb)	0
Trees Planted	0
Total Water Savings (gal)	0
Annual Water Savings (acre feet/year)	0
Fossil Fuel Based Energy Use Reductions (kWh)	0
Fossil Fuel Based Energy Use Reductions (therms)	0
Energy and Fuel Cost Savings ($)	$0
Passenger VMT Reductions (miles)	0
Fossil Fuel Based Transportation Fuel Use Reductions (gal)	0
Travel Cost Savings ($)	$0
Total	
Total $PM_{2.5}$ Emission Reductions (lb)	0
Total NOx Emission Reductions (lb)	0
Total ROG Emission Reductions (lb)	0
Total Diesel PM emission reductions (lbs)	0
Remote PM2.5 Emission Reductions (lb)	0
Remote NOx Emission Reductions (lb)	0
Remote ROG Emission Reductions (lb)	0
Trees Planted	0
Total Water Savings (gal)	0
Annual Water Savings (acre feet/year)	0
Fossil Fuel Based Energy Use Reductions (kWh)	0
Fossil Fuel Based Energy Use Reductions (therms)	0
Energy and Fuel Cost Savings ($)	$0
Passenger VMT Reductions (miles)	0
Fossil Fuel Based Transportation Fuel Use Reductions (gal)	0

... GHG Summary | Co-benefit Summary | Definitions | Documentation

Exhibit C

USEPA-Recommendations for Contructing Roadside Vegetation Barriers

United States
Environmental Protection
Agency

EPA 600/R-16/072 | July 2016 | www.epa.gov/research

Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality

Office of Research and Development
National Risk Management Research Laboratory, Air Pollution Prevention and Control Division

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Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality

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National Risk Management Research Laboratory, Air Pollution Prevention and Control Division

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1.0 Introduction

Public health concerns related to near-road air quality is an important environmental issue because there are an increasing number of health studies linking adverse health effects to populations spending significant amounts of time near high-traffic roads (HEI, 2010). These effects may be attributed to increased exposure to particulate matter, gaseous criteria pollutants, and air toxics emitted by vehicle activity on the road. The significant impact of traffic emissions on urban populations all over the world has motivated research on methods to reduce exposure to these pollutants. While vehicle emission control techniques and programs to directly reduce air pollutants emitted to the air from transportation sources are vital components of air quality management, these programs often take a long time to fully implement. Thus, other mitigation options, including the preservation and planting of roadside vegetation and the construction of roadside structures such as noise barriers, are some of the few near-term mitigation strategies available for urban developers and facilities already subject to high pollution levels near roads. These mitigation methods, if successful, can complement existing pollution control programs and regulations, as well as provide measures to reduce impacts from sources that are difficult to control such as brake and tire wear and re-entrained road dust.

Several studies have investigated the role of vegetation on pollutant concentrations in urban areas employing modeling, wind tunnel, and field measurements (Baldauf et al., 2008; Brode et al., 2008; Hagler et al., 2012; Nowak, 2005; Nowak et al., 2000; Stone and Norman, 2006; Tong et al., 2015). Roadside vegetation has been shown to reduce a population's exposure to air pollution through the interception of airborne particles or through the uptake of gaseous air pollution via leaf stomata on the plant surface (Petroff et al., 2009) in addition to affecting pollutant transport and dispersion. Noise barriers combined with mature vegetation have also been found to result in lower ultrafine particle concentrations along a highway transect compared to an open field or a noise barrier alone (Baldauf et al., 2008; Bowker et al., 2007). Pollution removal (O_3, PM_{10}, NO_2, SO_2, CO) by urban trees in the United States (US) has been estimated across the continental United States using the U.S. Forest Service's i-Tree model (Nowak et al., 2014).

Removal of gaseous pollutants by trees can be permanent, while trees typically serve as a temporary retention site for particles. The removed particles can be re-suspended to the atmosphere during turbulent winds, washed off by precipitation, or dropped to the ground with leaf and twig fall (Nowak et al., 2000). These removal mechanisms can impact local air, water and soil pollution; thus, careful consideration of the land uses that surround roadside vegetation are needed when choosing species.

Trees can also act as barriers between sources and populations, although vegetation is inherently more complex to study than solid structures and the effectiveness of vegetative barriers at reducing ultrafine particle (UFP) concentration has been shown to be variable (Hagler et al., 2012). This variability is likely due to a number of confounding factors. The complex and porous structure of trees and bushes can modify near-road concentrations via pollutant capture or through altering air flow, which can result in either reduced dispersion through the reduction of wind speed and boundary layer heights (Nowak et al., 2000; Wania et al., 2012) or in enhanced dispersion due to increased air turbulence and mixing. Recirculation zones have also been observed immediately downwind of forested areas with a flow structure consistent with an intermittent recirculation pattern (Detto et al., 2008; Frank and Ruck, 2008). Vegetation type, height, and thickness can all influence the extent of mixing and pollutant deposition experienced at the site. The built environment also matters greatly – air flow and impacts of trees are substantially different for a street canyon

environment than an open highway environment (Buccolieri et al., 2009; Buccolieri et al., 2011; Gromke et al., 2008).

In addition to air quality benefits, roadside vegetation can improve aesthetics, increase property values, reduce heat, control surface water runoff, and reduce noise pollution (with dense, thick and tall stands). However, vegetation can also affect driver sight lines, protrude into clear zones along highway right-of-ways, contribute to debris on roads, present fire hazards, and be pathways for pests and invasive species; thus, the benefits and potential unintended consequences of roadside vegetation need to be considered for any application.

This guidance provides insight into roadside vegetation design characteristics that have been shown to most effectively reduce near-road air pollutant levels downwind of major highways in order to implement this feature as an air pollution mitigation strategy. This guidance is written for general considerations applicable to multiple scenarios, so does not address specific siting or permitting requirements that might be required in certain circumstances, such as planting in a highway right-of-way or within a city park.

2.0
Physical Design Recommendations

Barrier Physical Characteristics

Generally, a higher and thicker vegetation barrier will result in greater reductions in downwind pollutant concentrations. While studies evaluating varying heights of vegetation barriers have been minimal, several studies have investigated the effect of height on pollutant reductions for solid noise barriers. Figure 1 shows results of Computational Fluid Dynamic (CFD) modeling of solid noise barriers of varying heights, indicating that higher barriers require additional plume transport and dispersion above the structure, resulting in greater downwind pollutant reductions.

While the porosity of vegetation will allow some air movement through the barrier, the height of the structure will still force some air flow up and over the vegetation, increasing dispersion. The porosity and thickness of the vegetation will affect the amount of air flow allowed through the structure compared with flow forced up and over. Generally, the lower the porosity and thicker the barrier, the more air flow forced over the structure. At extremely low porosities, the vegetation will affect pollutant transport and dispersion in a similar manner as a solid noise barrier. However, vegetation barrier design should allow some air flow through the vegetation in order to enhance particulate removal. Previous studies suggest porosities between 0.5 and 0.9 to be most effective (see Tong et al., 2016 for summary).

The integrity of the vegetation barrier must be maintained in order to allow for pollutant reductions downwind. Studies have shown that gaps in vegetation barriers can lead to increased pollutant concentrations downwind, sometimes higher than concentrations would be if no barrier were present. These increases can occur because pollutant emissions from the road funnel through the gaps; in addition, the highly porous vegetation can cause winds to stagnate also leading to higher downwind concentrations. Figure 2 provides examples of a) effective barriers that have full coverage from ground to top of canopy and b) ineffective vegetation barriers due to gaps that may result in higher pollutant concentrations.

In order to achieve sufficient physical characteristics of a vegetation barrier, multiple rows and types of vegetation may be most feasible. For example, a barrier could consist of a row of bushy plants and shrubs followed by a row of trees to enable a barrier with full coverage from the ground to top of canopy at the initial planting, yet achieve higher canopy heights than feasible by bushy plants alone. In addition, rows of multiple vegetation types may allow for sufficient downwind pollutant removal while the vegetation grows over time after first planting. This approach will ensure sufficient density for pollutant removal at the initial planting, while allowing for increased pollutant removal as the vegetation matures. This process will also limit concerns of promoting plant monocultures.

In addition to passing through gaps, pollutants can also meander around the edges of a roadside vegetative barrier. Thus, if a vegetative barrier will be constructed for a specific facility (e.g. school, daycare, elderly care facility) or neighborhood, it should extend sufficiently beyond the area of concern. Research on solid noise barriers suggests that the barrier should extend at least 50 meters laterally beyond the area of concern in order to maximize reductions in downwind concentrations (Baldauf et al., 2016). If extending the barrier laterally is not feasible, extending the barrier perpendicular to the road, wrapping around the area of interest, has been shown to be effective as well (Brantley et al., 2014).

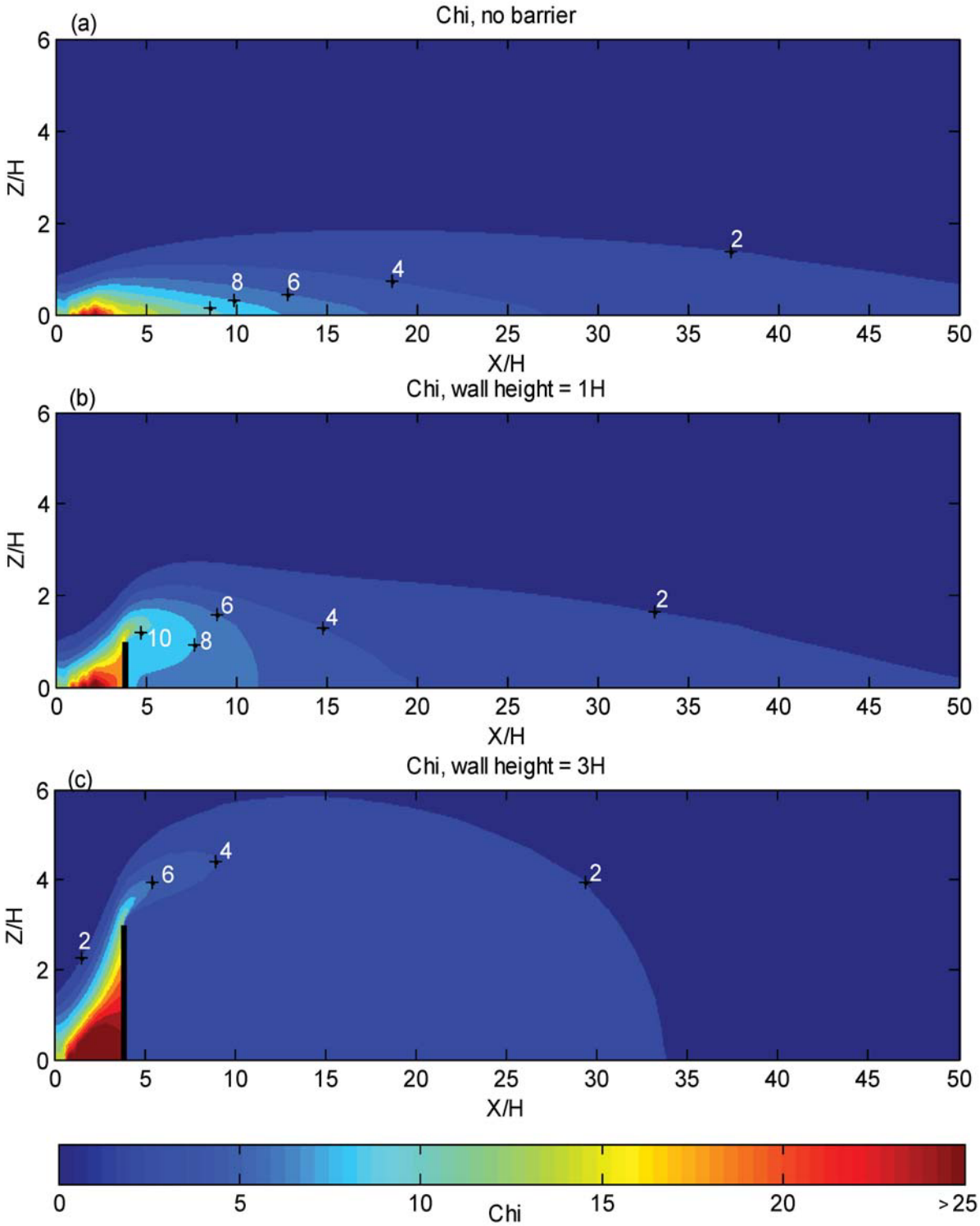

Figure 1. CFD modeling analysis of varying solid noise barrier heights. For the figure above, the top panel shows no barrier, the middle panel a barrier of height, H, and the bottom panel a barrier of height 3H. The distances downwind are also relative to the barrier height. As an example, for H=6 meters, the middle panel would represent a 6 meter tall barrier and the bottom panel an 18 meter tall barrier, and the x-axis distance values would also be multiplied by 6 meters. For this figure, Z represents the vertical height above ground and X the distance from the nearest travel lane on the road (Hagler et al, 2012).

(a) (b)

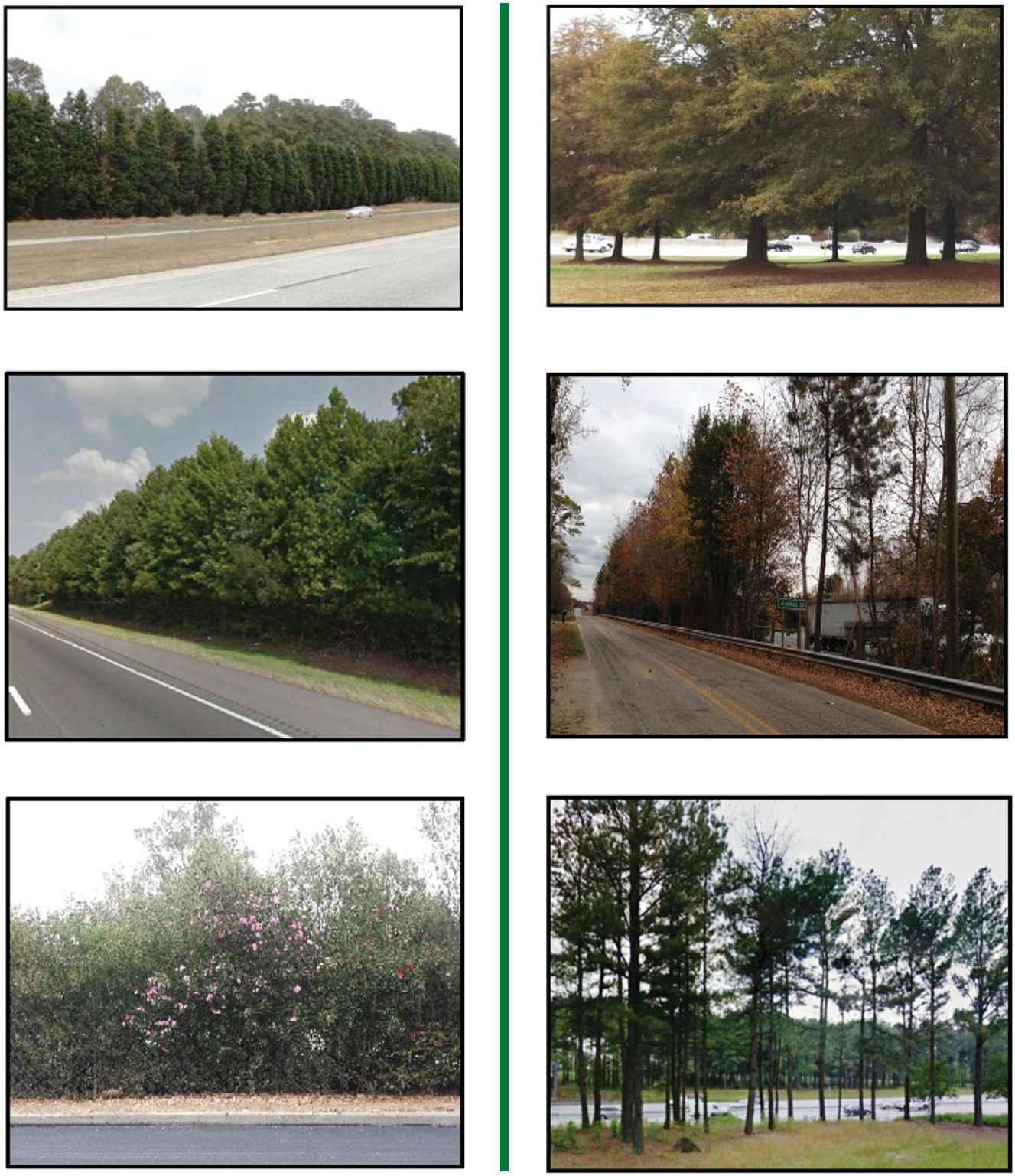

Figure 2. Examples of effective (a) and ineffective (b) roadside barriers.

Vegetation Characteristics

Certain types and species of vegetation will provide more air quality benefits compared to other types of vegetation. When considering the design and construction of a vegetation barrier, optimal physical characteristics should be favored to the extent feasible. However, given the vast number of vegetation species, and the regional differences in the feasibility and effectiveness of specific species for a roadside barrier, specific recommendations cannot be made. The U.S. Forest Service's i-Tree model (https://www.itreetools.org) can provide a list of potential species that best meet the factors listed below, although users need to identify whether particular vegetation types can survive and prosper in a particular area of interest.

Seasonal Effects:

The vegetation chosen for a barrier should not be subject to significant changes in characteristics and integrity during changing seasons. Therefore, deciduous trees that lose leaves during the cold season should not be considered for a barrier to mitigate air quality impacts. Instead, trees that are not subject to significant seasonal changes, such as coniferous plants, should be considered. Other shrubs and bushes that are not subject to seasonal changes can also be considered as part of a roadside barrier.

Leaf Surface Characteristics:

Leaf surfaces can also enhance particulate removal through diffusion and interception. Trees and bushes with waxy and/or hairy surfaces have been shown to preferentially remove particulates compared to smooth leaf surfaces. In addition, vegetation with leaf and branch structures that provide increased surface area for particle diffusion are preferred (Tong et al., 2016). Figure 3 provides some example leaf surfaces.

Vegetation Air Emissions:

When selecting vegetation for a roadside barrier, especially at locations where sensitive populations may be spending significant amounts of time, care must be taken to choose species that do not emit compounds which can increase air pollution or allergic responses. Compounds that can be emitted by vegetation include volatile organic compounds (VOCs), which can enhance the formation of ozone, and high-allergy pollens. Both can exacerbate respiratory effects and should be avoided for roadside barriers.

Resistant to Air Pollution and Other Environmental Stressors:

Vegetation implemented in a roadside barrier must also be resistant to air pollution and other traffic stressors since concentration levels will be high. If the vegetation is not resistant and cannot maintain its integrity, gaps will form in the barrier, potentially leading to increased pollutant concentrations downwind as discussed previously. Air pollutants emitted by traffic can include the typical tailpipe emissions like CO, NOx, and particulates; materials from brake and tire wear; re-entrained road dust; and salt and sand used for road surface treatment during winter weather conditions.

(a)

(b)

Figure 3. Example leaf characteristics including a) waxy pine needles and b) hairy leaf surfaces.

Other Considerations:

In addition to air quality considerations, other potentially beneficial and adverse aspects of vegetation need to be considered in the construction and use of a roadside barrier. These considerations include general physical and species-specific factors. While location-specific factors will need to be addressed on an individual basis, some general considerations include:

Vegetation Maintenance – The roadside vegetation will need to be maintained in order to provide a protective barrier from air pollution exposures yet not lead to safety concerns from reduced visibility or falling debris. Maintenance requirements will depend on vegetation type and species, so a plan should be in place when selecting and constructing the barrier for optimal long-term performance. These requirements include watering and fertilization needs, trimming and other pruning requirements, and overall plant care. Maintenance should also include vegetation replacement due to die-off, disease, or damage from accidents.

Water runoff control – An additional benefit of a roadside vegetation barrier can be the control and containment of surface water runoff from the impervious road and supporting infrastructure. Roadside barriers constructed to provide water runoff control can prevent localized flooding as well as improve water quality in the area. For certain regions of the country, drought resistant vegetation that can also resist high-water events may be most appropriate.

Native species – Whenever feasible, native species should be considered for implementing the roadside barrier. Native species may more likely be robust and resistant to local climatic conditions.

Non-invasive species – Vegetation barriers should not be constructed from invasive species that may not be contained within the project area of interest, and may create problems at other locations or at the roadside.

Non-poisonous species – For roadside vegetation barriers located near sensitive populations, the vegetation should not be poisonous or have the potential to cause harm in other ways. However, when the barrier can be isolated, this factor may not be a concern.

Roadway Safety – Planting on or near a highway right-of-way (ROW) requires consideration of potential safety issues. In most cases, the applicable highway department will require approvals for planting near roads due to these issues. Concerns may include creating undesirable wildlife habitat near roadways (e.g. deer and other animals that can exacerbate auto accidents), preserving safe lines-of-sight and viewshed standards for drivers on the road, maintaining compatibility of the chosen vegetation species with existing species, and not obstructing outdoor advertising.

3.0
Vegetation with Noise Barriers

Although limited, some research suggests that combining vegetation with a solid noise barrier can lead to further downwind pollutant reductions than either vegetation or a solid noise barrier alone (see Baldauf et al., 2008). For vegetation planted with a solid noise barrier, the overall considerations should be the same as for vegetation alone. However, for the vegetation to have an additive effect for pollutant reductions, the vegetation should exceed the top of the noise barrier by a sufficient height in order to allow air flow through and over the plants to enhance pollutant removal and air mixing.

Solid barriers can vary in height; research on air pollution reductions from these structures has been conducted for heights between 4.5 and 6 meters. A vegetation barrier should extend at least 1 meter above the barrier, although the higher and thicker the plants, the greater the downwind reduction. For shorter solid barriers, vegetation should extend above the barrier to a height of at least 6 meters to maximize the potential for downwind pollutant reductions. Figure 4 provides examples of combinations of vegetation with solid noise barriers that could lead to increased reductions in downwind air pollutant concentrations.

Previous research is based on vegetation planted behind the noise barrier (opposite side from the road), although bushes or plants in front could provide an added reduction if sufficiently away from the solid barrier to allow air to flow through. Some modeling studies suggest that "green walls" such as ivy or other climbing vegetation on solid noise barriers may improve local air quality; however, no air quality measurement studies have been conducted to confirm or negate these model results.

No research has been done on whether gaps or spaces in vegetation along solid walls can lead to increased downwind concentrations. Since solid noise barriers alone can reduce downwind pollutant concentrations, gaps in accompanying vegetation would likely not have the same detrimental effects as with vegetation alone, although no empirical evidence exists to confirm this assumption.

(a)

(b)

Figure 4. Examples of effective combinations of vegetation with solid noise barriers. Panel (a) shows vegetation behind the barrier (as studied in Baldauf et al., 2008) while panel (b) shows bushy vegetation in front of the barrier (no empirical evidence available).

4.0
Summary

Research shows that roadside vegetation affects nearby air quality. If properly designed, vegetation barriers can be used to reduce near-road air pollution, either alone or in combination with solid noise barriers. The important factors to consider for effective roadside vegetative barriers are included in the summary table at the end of this document.

Additional Resources

Many resources exist which can aid in the siting, design and maintenance of roadside vegetation barriers to provide air quality and other benefits to local communities. Just a few examples include:

- USDA Forest Service i-Tree program (**www.iTreetools.org**)
- State and local extension services
- EPA Stormwater Calculator (**https://www.epa.gov/water-research/national-stormwater-calculator**)
- EPA EnviroAtlas (**https://www.epa.gov/enviroatlas**)

Acknowledgements

Special thanks go to the many experts who provided advice and comments for the development of these recommendations.

These experts include David Nowak (U.S. Forest Service), Greg McPherson (U.S. Forest Service), Kevin Jefferson (Urban Releaf), David Ralston (Bay Area Air Quality Management District), Tom Hanf (Michigan DOT), Drew Buckner (Michigan DOT), Gorette Yung (Michigan DOT), Kevin Sayers (Michigan DEQ), Sheila Batka (U.S. EPA), Ken Davidson (U.S. EPA), Bob Newport (U.S. EPA), Laura Jackson (U.S. EPA), Sue Kimbrough (U.S. EPA) and Vlad Isakov (U.S. EPA).

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Summary Table

Barrier Characteristic	Recommendation	Description
Physical Characteristics		
Height	5 meters or higher (or extend 1+ meter above an existing solid barrier)	The higher the vegetative barrier, the greater the pollutant reductions. A minimum of 5 meters should provide enough height to be above typical emission elevations for vehicles on the road. However, heights of 10 meters or more would likely provide additional pollutant reductions.
Thickness	10 meters or more	The thicker the vegetative barrier, the greater the pollutant reductions. A minimum thickness of 10 meters should provide enough of a barrier to remove particulate and enhance dispersion. However, gaps in the barrier should be avoided. Multiple rows of different types of vegetation (e.g. bushes, shrubs, trees) should be considered for maximum coverage and pollutant removal during all stages of the barrier.
Porosity	0.5 to 0.9	Porosity should not be too high to allow pollutants to easily pass through the barrier or cause wind stagnation. As the porosity gets lower, the vegetation barrier will perform similarly to a solid barrier, which may limit the amount of particulate removal since air is forced up and around the plants.
Length	50 meters or more beyond area of concern	Extending the barrier beyond the area of concern protects against pollutant meandering around edges. May also consider constructing the barrier perpendicular from the road depending on land availability.
Vegetation Characteristics		
Seasonal Effects	Vegetation not subject to change by season	Vegetative barrier characteristics must be consistent throughout all seasons and climatic conditions in order to ensure effective pollutant reductions.
Leaf Surface	Complex waxy and/or hairy surfaces with high surface area	Leaf surfaces with complex and large surface areas will capture and contain more particulate pollutants as air passes through the structure.
Air Emissions	Vegetation with low or no air emissions	Vegetation used for roadside barriers should not be sources of air pollution, either at the local or regional scale.
Pollution and Stress Resistant	Resistant to effects of air pollution and other stressors	Vegetation must be able to survive and maintain its integrity under the high pollution levels and stress that can occur near roads in order to provide effective pollution reductions from traffic emissions. In addition to air pollution, other stressors can include salt and sand for winter road conditioning and noise impacts

Summary Table

Barrier Characteristic	Recommendation	Description
Other Considerations		
Maintenance	Plan must be in place to properly maintain vegetative barrier	Proper vegetation maintenance must be provided in order for the barrier to survive and maintain its integrity to provide effective pollution reductions from traffic emissions.
Water Runoff	Contain surface water runoff and improve water quality	Roadside vegetative barriers constructed appropriately can provide an added benefit of controlling and containing surface water runoff from the road, which can also improve local water quality.
Drought Resistant	Choose species resistant to drought and flooding	Many regions face climatic conditions of extended drought followed by localized flooding. Vegetative barrier must maintain its integrity under these conditions in order to provide effective pollution reductions.
Native Species	Choose native species	Native species will be more robust and resistant to climatic conditions in the area of interest; thus, maintaining its integrity under these conditions in order to provide effective pollution reductions.
Non-invasive	Choose non-invasive species	The use of non-invasive species will ensure effective pollutant reductions without potential unintended consequences from invasive species adversely effecting nearby land uses.
Non-poisonous	Choose non-poisonous species if sensitive populations will be nearby	Non-poisonous species are strongly encouraged and should be used if the barrier will be at a location with sensitive populations, such as elementary schools, parks, and recreation fields where small children may be active and in close contact.
Roadway Safety	Maintains safety for drivers on the road; conforms to local safety and permit requirements	Prior to planting, ensure vegetation plan will meet all safety and other local permit requirements (e.g. local highway department, city planning department) to preserve sight-lines and vegetation compatibility while avoiding potential wildlife/auto accidents and obstruction of outdoor advertising.

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Exhibit D

Helpful Resources Here

Helpful Resources

Applicants are encouraged to review the following resources provided as they prepare their proposals.

Plant Selection Resources

- SelecTree: A Tree Selection Guide
  - https://selectree.calpoly.edu/
- Allergy-Free Gardening Considerations for Asthmatic and Sensitive Residents
  - http://www.allergyfree-gardening.com/
- California Native Plant Society Calscape Tool
  - https://www.calscape.org/

Anti-Displacement Resources

- Greening without Gentrification Guide
  - https://www.ioes.ucla.edu/wp-content/uploads/archive/2019/11/Greening-without-Gentrification-report-2019.pdf

Additional Guidelines

- Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality
  - https://www.epa.gov/air-research/recommendations-constructing-roadside-vegetation-barriers-improve-near-road-air
- CAL FIRE Standards and Specifications for Purchasing, Planting, and Maintaining Trees
  - https://californiareleaf.org/wp-content/uploads/2021/03/Tree-planting-guidelines_final.pdf
- Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality
  - https://19january2017snapshot.epa.gov/sites/production/files/2016-08/documents/recommendations_for_constructing_roadside_vegetation_barriers_to_improve_near-road_air_quality.pdf