West Oakland Environmental Indicators Project

hyphæ design laboratory
Ecological Design & Engineering

Prescott Greening

Using vegetative barriers to reduce emissions and exposure

Community Presentation 10.29.2925

Agenda

- Introduction & Background
- Project Area
- Vegetated Buffers
- Modeling
- IPA - project plan
- Road Diet - development & designs

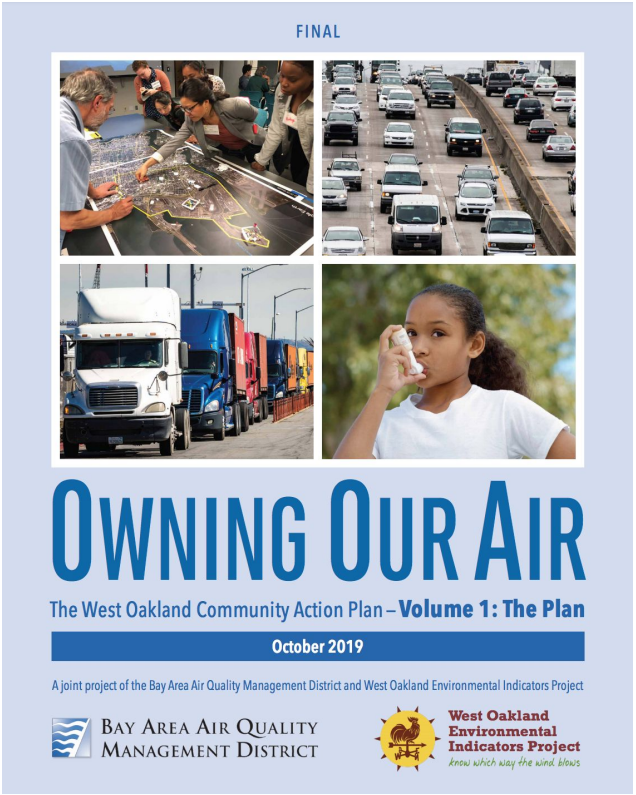
West Oakland: Inequity in Air Pollution Exposure

West Oakland has the 6th largest port in the US, and so its at the epicenter shipping, railways, and trucking.

Diesel emissions in West Oakland are 5x higher than in the rest of the city.

Children who live in the West Oakland neighborhood are 7 times more likely to be hospitalized for asthma than children elsewhere in Oakland

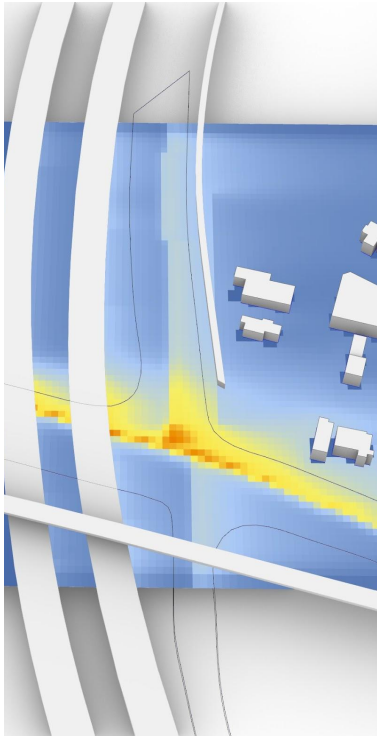
West Oakland chosen as AB 617 pilot neighborhood



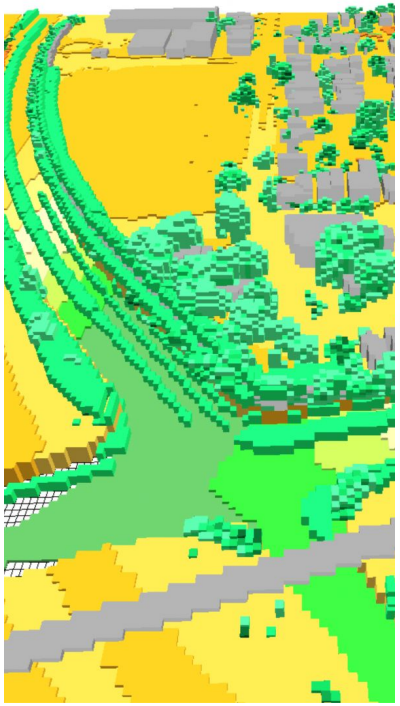
Neighborhoods that have unequal exposure to air pollution are chosen to create plans to reduce pollution.

WOEIP and the Bay Area Air District co-led the development of the **West Oakland Community Action Plan (WOCAP)**, which identifies 89 strategies to reduce pollution in the neighborhood.

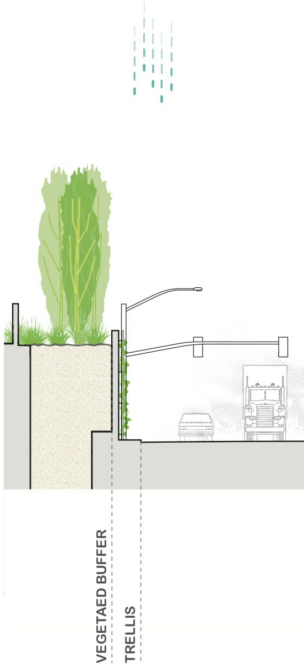
Prescott Greening Goals



Model Pollution

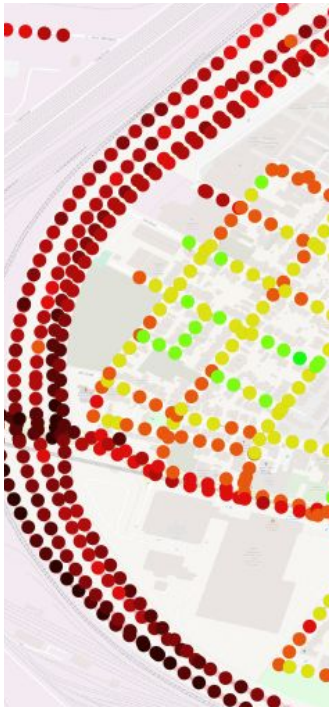


Model Solutions

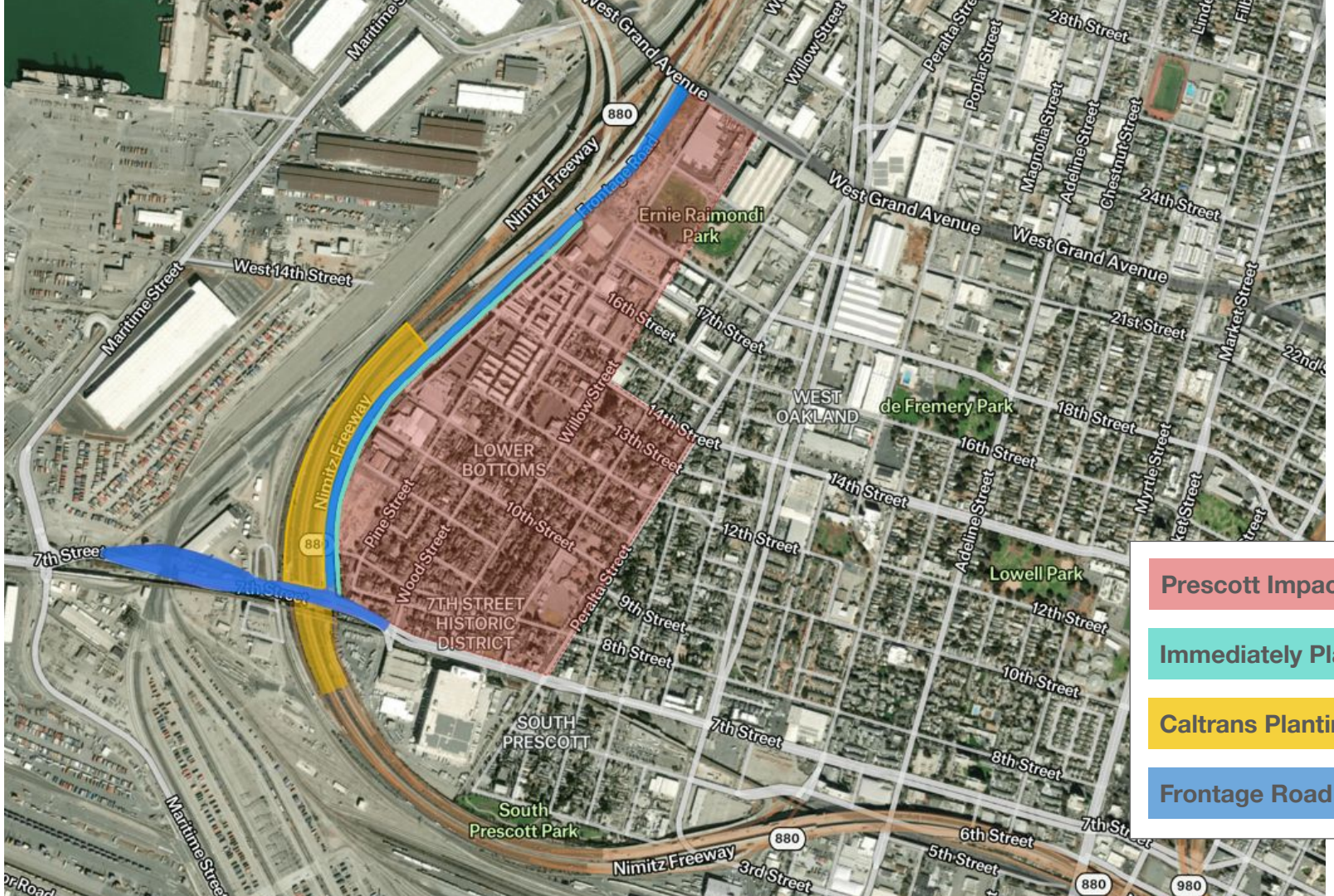


Design

Build Interventions



Monitor Results

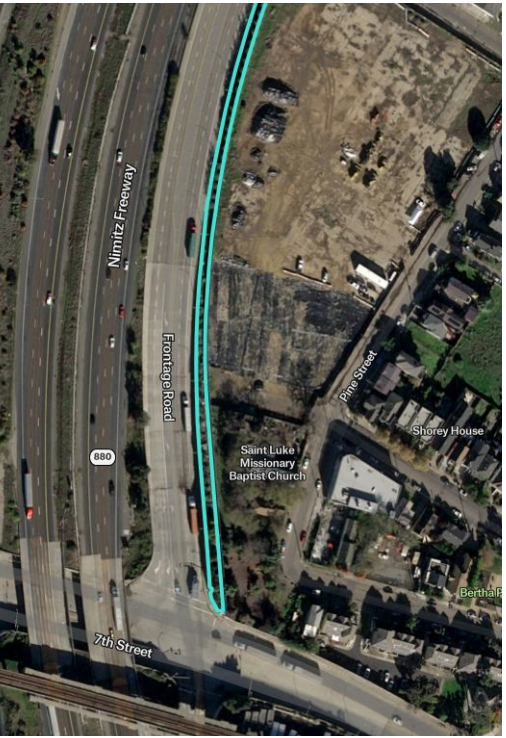

Prescott Impact Zone
Immediately Plantable
Caltrans Planting
Frontage Road Diet
Nimitz Freeway
Frontage Road
West Grand Avenue
Maritime Street
West 14th Street
Ernie Raimondi Park
LOWER BOTTOMS
7TH STREET HISTORIC DISTRICT
WEST OAKLAND
de Fremery Park
Lowell Park
SOUTH PRESCOTT
South Prescott Park
Willow Street
Peralta Street
Pine Street
Wood Street
Adeline Street
Poplar Street
Magnolia Street
Chestnut Street
Market Street
Myrtle Street
7th Street
8th Street
9th Street
10th Street
12th Street
13th Street
14th Street
16th Street
17th Street
18th Street
21st Street
24th Street
28th Street
880
980


Immediately Plantable
Caltrans Planting
Frontage Road Diet

Immediately Plantable

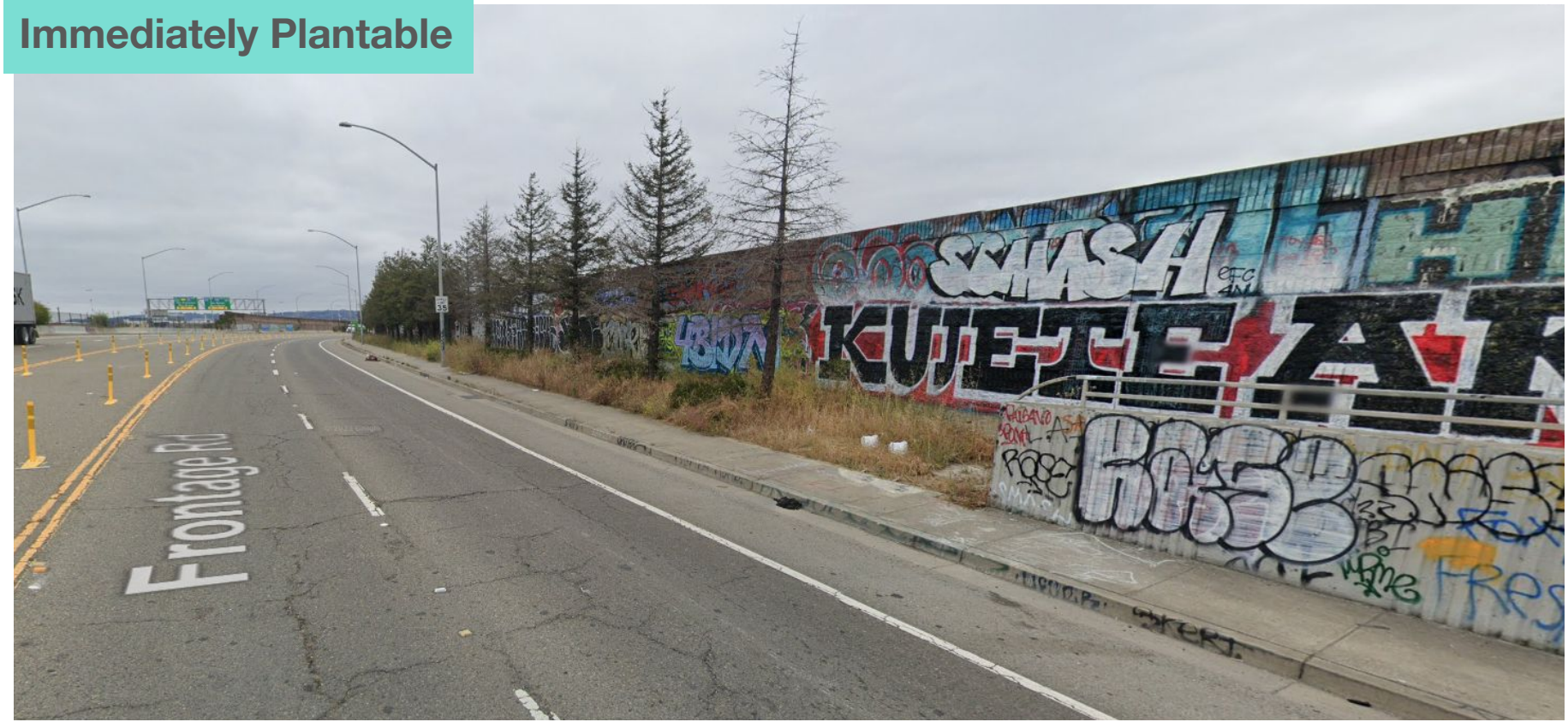
All along frontage road there are existing planters where trees could be planted.

Immediately Plantable



This area can have new trees and hanging vines.

Immediately Plantable



Goal is to create a thick buffer of trees.
Open areas can receive new trees, dead or dying trees can be replaced.

Immediately Plantable

In open areas new trees can be added.

880 Freeway - Caltrans Land

Frontage Road Diet

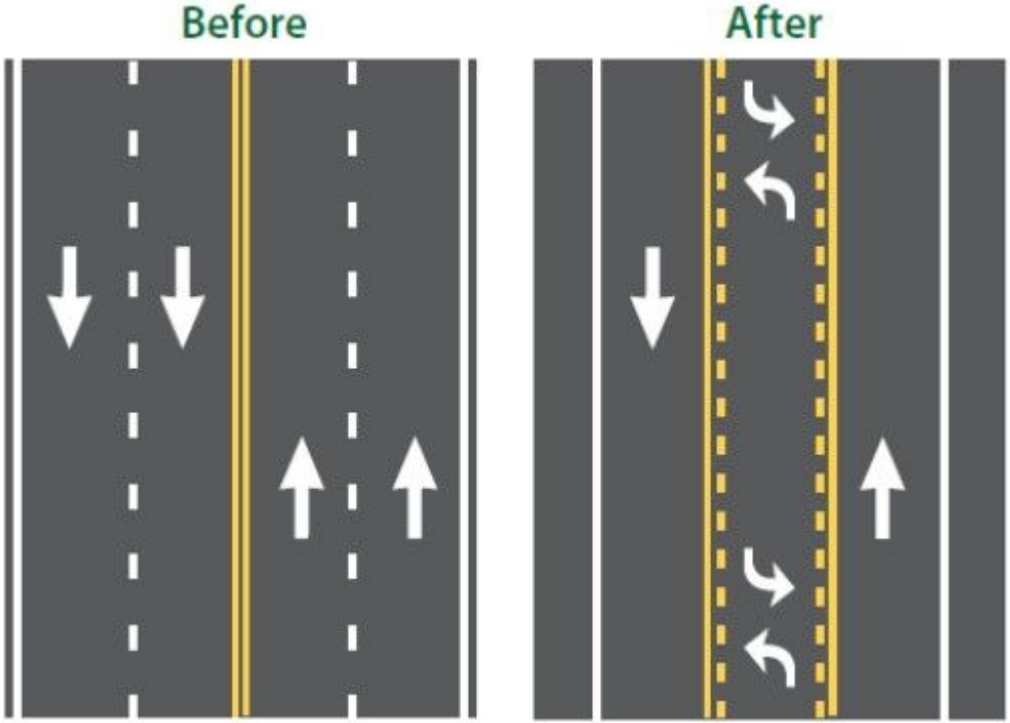
Frontage Road Diet

Frontage Road Diet

Frontage Road Diet

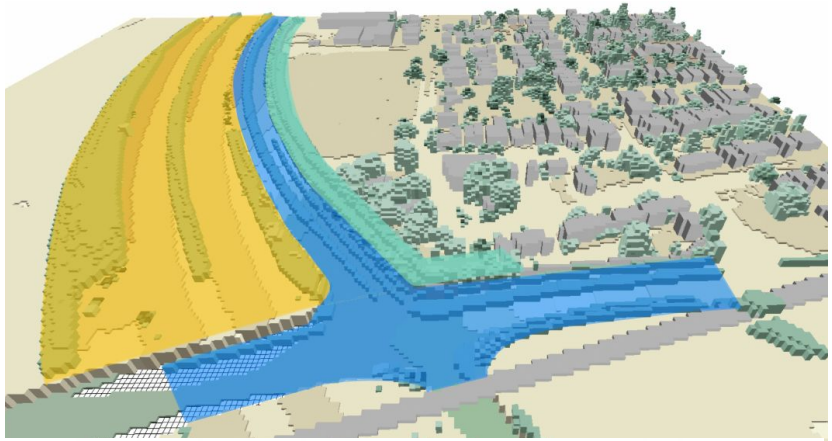
Frontage Road Diet

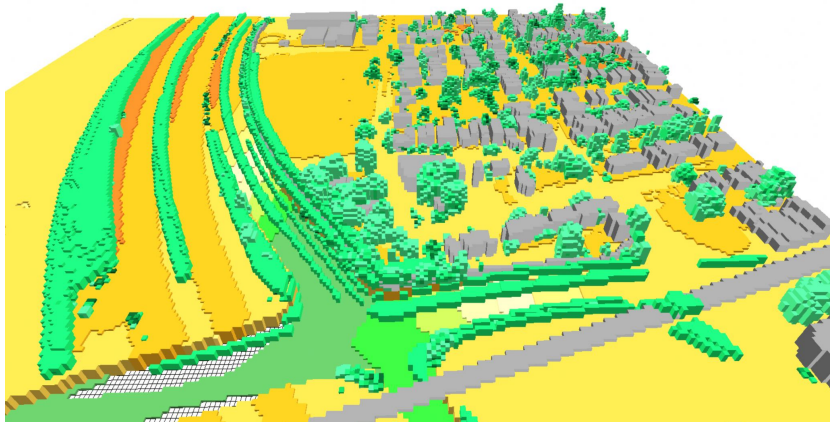
Frontage Road Diet



Utilizing the unused middle lane and reducing lane sizes could increase safety

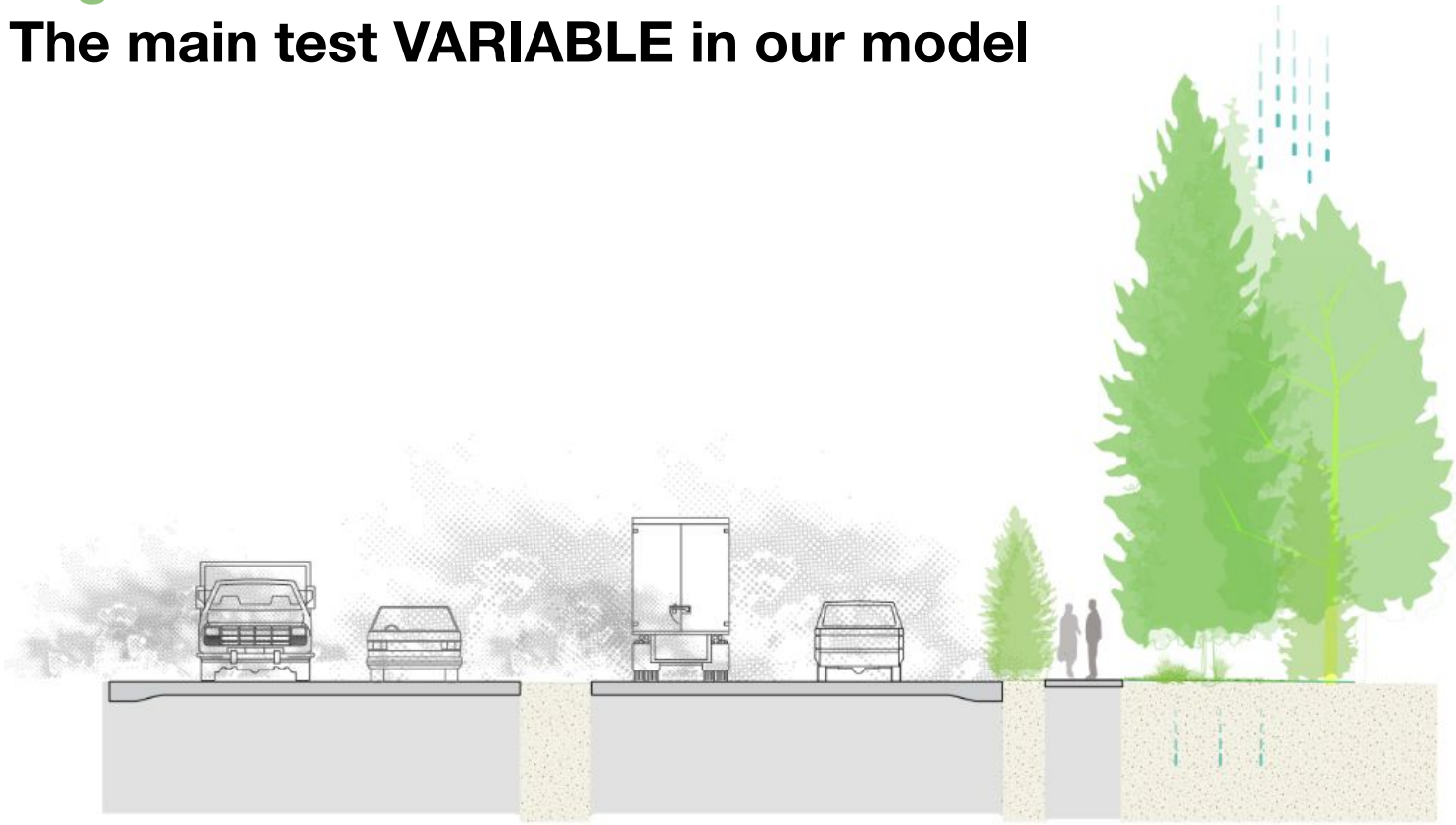
Would a vegetated buffer in these areas be effective?





Vegetated Buffers:

The main test VARIABLE in our model



The Relationship Between Trees and Human Health

Evidence from the Spread of the Emerald Ash Borer

Geoffrey H. Donovan, PhD, David T. Butry, PhD, Yvonne L. Michael, ScD, Jeffrey P. Prestemon, PhD, Andrew M. Liebhold, PhD, Demetrios Gatziolis, PhD, Megan Y. Mao

Background: Several recent studies have identified a relationship between the natural environment and improved health outcomes. However, for practical reasons, most have been observational, cross-sectional studies.

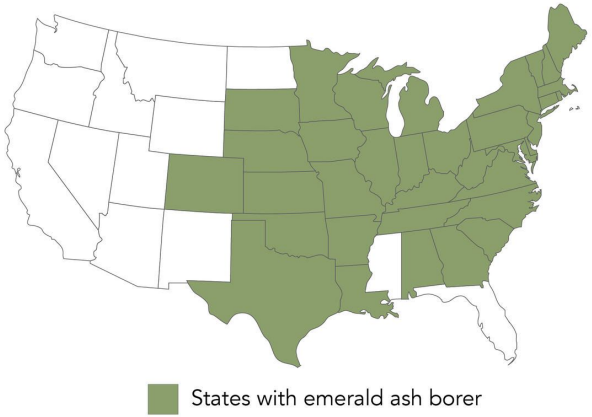
Purpose: A natural experiment, which provides stronger evidence of causality, was used to test whether a major change to the natural environment—the loss of 100 million trees to the emerald ash borer, an invasive forest pest—has influenced mortality related to cardiovascular and lower-respiratory diseases.

Methods: Two fixed-effects regression models were used to estimate the relationship between emerald ash borer presence and county-level mortality from 1990 to 2007 in 15 U.S. states, while controlling for a wide range of demographic covariates. Data were collected from 1990 to 2007, and the analyses were conducted in 2011 and 2012.

Results: There was an increase in mortality related to cardiovascular and lower-respiratory-tract illness in counties infested with the emerald ash borer. The magnitude of this effect was greater as infestation progressed and in counties with above-average median household income. Across the 15 states in the study area, the borer was associated with an additional 6113 deaths related to illness of the lower respiratory system, and 15,080 cardiovascular-related deaths.

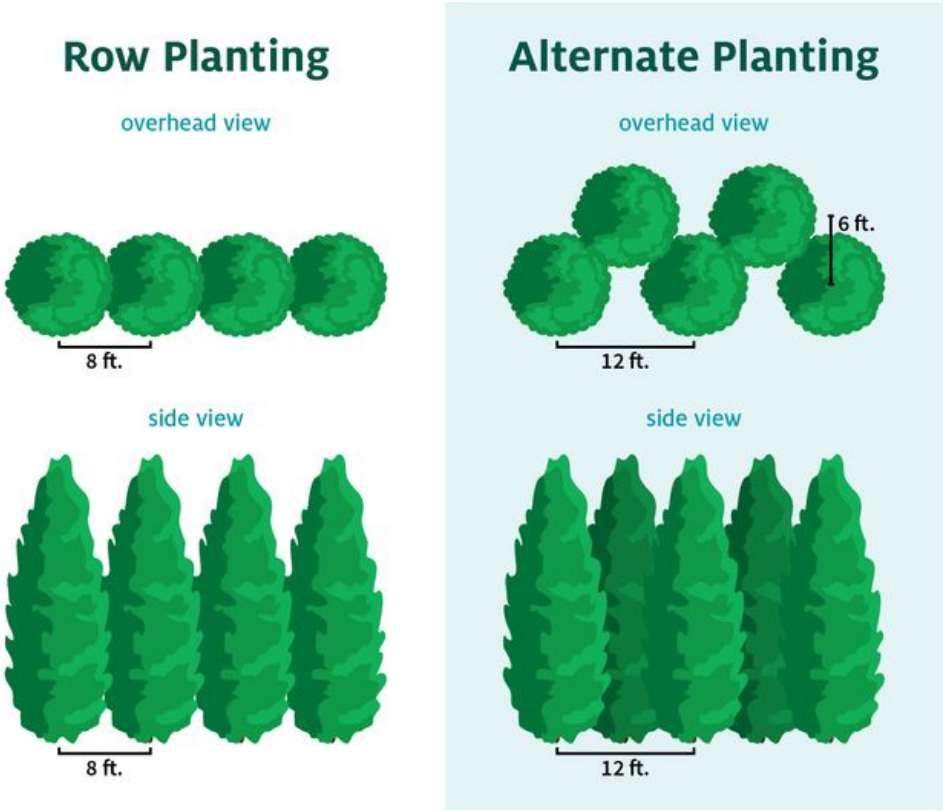
Conclusions: Results suggest that loss of trees to the emerald ash borer increased mortality related to cardiovascular and lower-respiratory-tract illness. This finding adds to the growing evidence that the natural environment provides major public health benefits.

(Am J Prev Med 2013;44(2):139–145) Published by Elsevier Inc. on behalf of American Journal of Preventive Medicine



Counties where the Emerald Ash Borer had killed more trees had more cardiovascular-related deaths

Vegetated Buffers: Using trees as technology



Vegetated air barriers optimized for mitigating air pollution must be planted close together without any gaps, otherwise the pollution can squeeze through!

According to the EPA, these are the important factors to roadside vegetation design:

Barrier Length
Extend at least 50 meters past area of concern to limit downwind concentrations

Height
At least 4 meters of height will prevent downwind spread

Porosity
High porosity leads to pollution stagnation, low porosity is similar to a wall

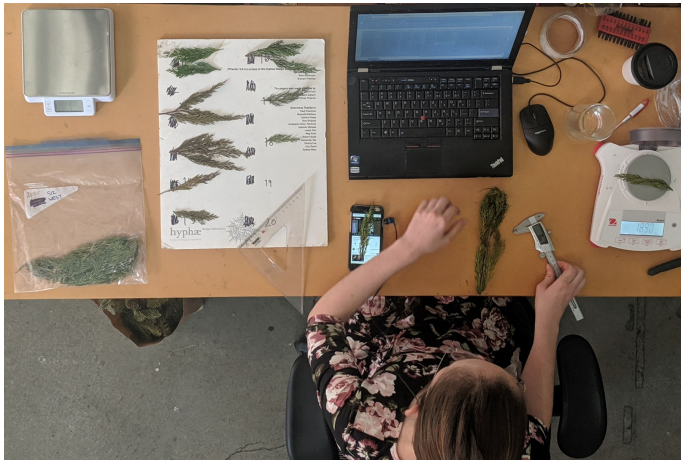
Coverage
No gaps between or below trees is ideal. Bushes can be used to block low gaps

Thickness
5-10 meters recommended, but effectiveness impacted by porosity of barrier

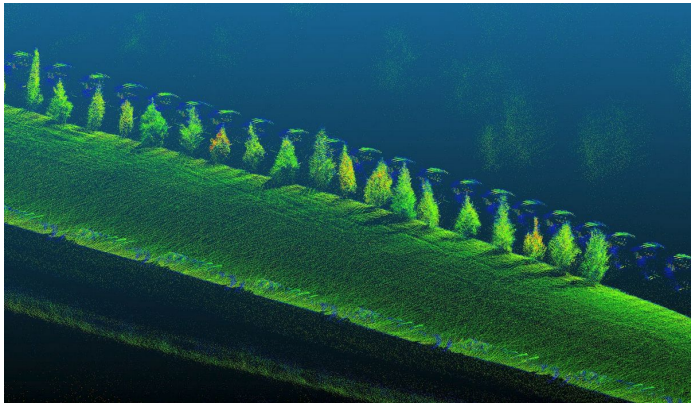
Effective Barrier

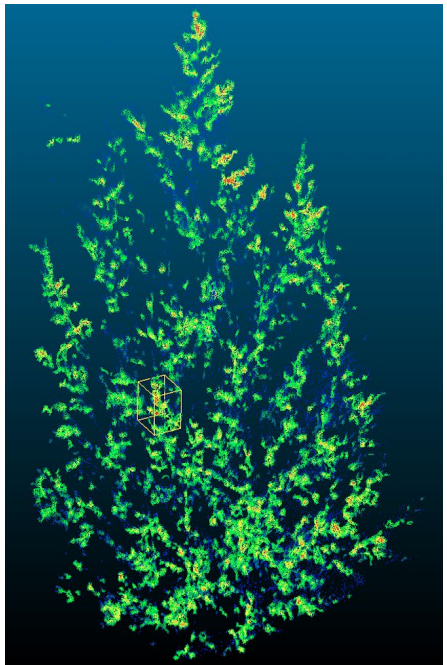
Ineffective Barrier

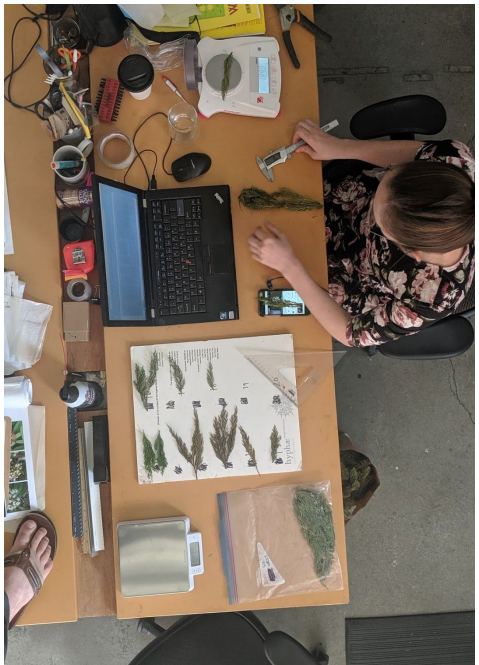
Source: Roadside Vegetation Design to Improve Local, Near-Road Air Quality. Transp Res D Transp Environ. 2017 May 4; 52(11): 354–361. doi: 10.1016/j.trd.2017.03.013

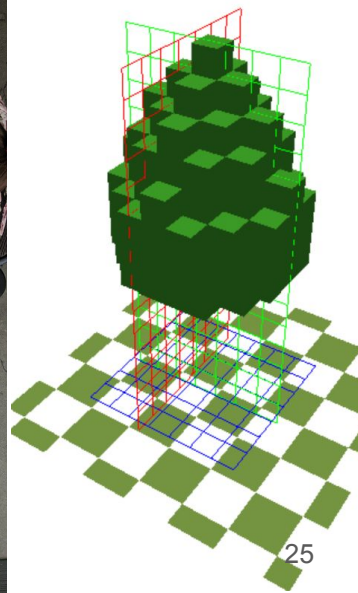


Measuring the leaf area density of trees to input into our models



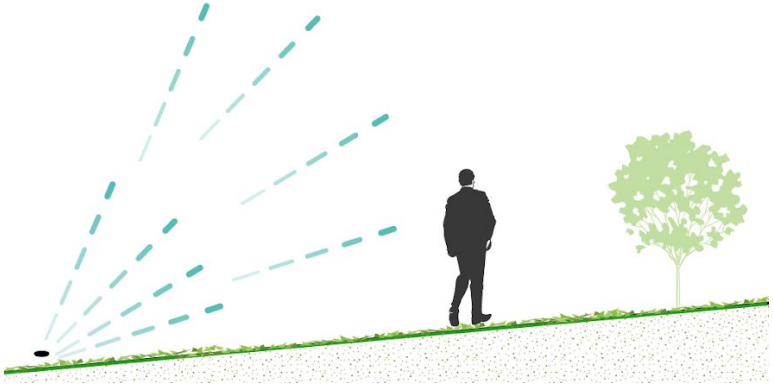






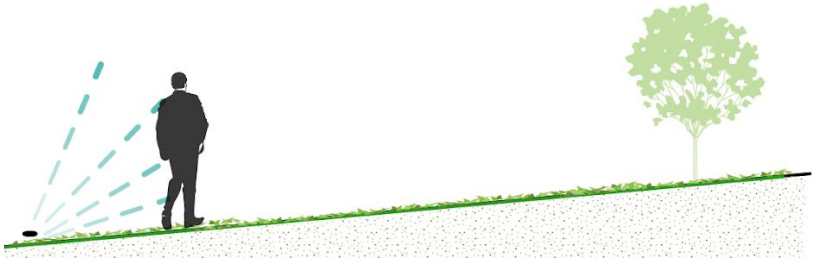
Planting a vegetated buffer closer to the source of pollution is more effective at blocking that pollution

Less effective at blocking



Less effective at blocking

More effective at blocking



More effective at blocking

Key Points about Vegetated Buffers

- Having a buffer that is tall and thick is more effective
- Using evergreen trees with dense leaves is better for blocking more pollution
- Its better to plant buffers close to the source of pollution

Pause (10 min)

- **What does Frontage road mean to you?**
  - If you know these areas, what is your experience of them?
  - How do you use the area(s)?
  - What are your concerns about these areas?

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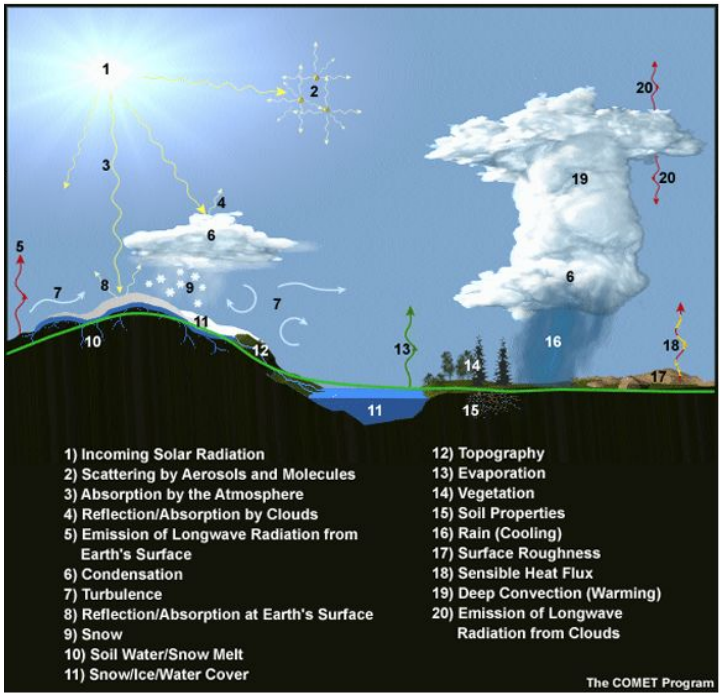
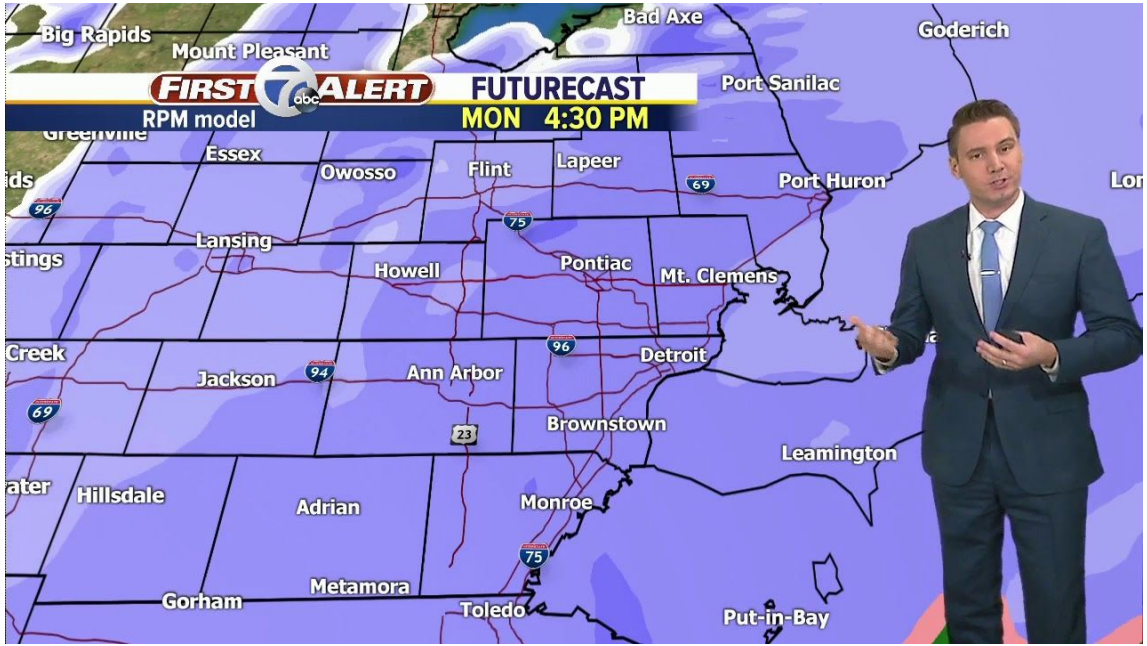
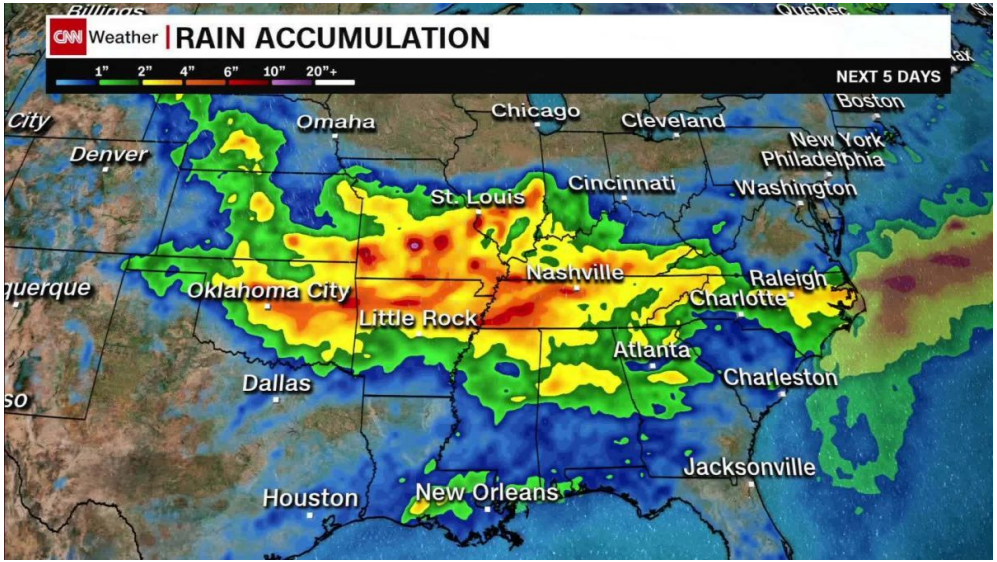
ENVIRONMENTAL MODELLING





Modeling is predicting outcomes based on a set of inputs



Modeling

Measuring

Weather predictions are not completely correct.

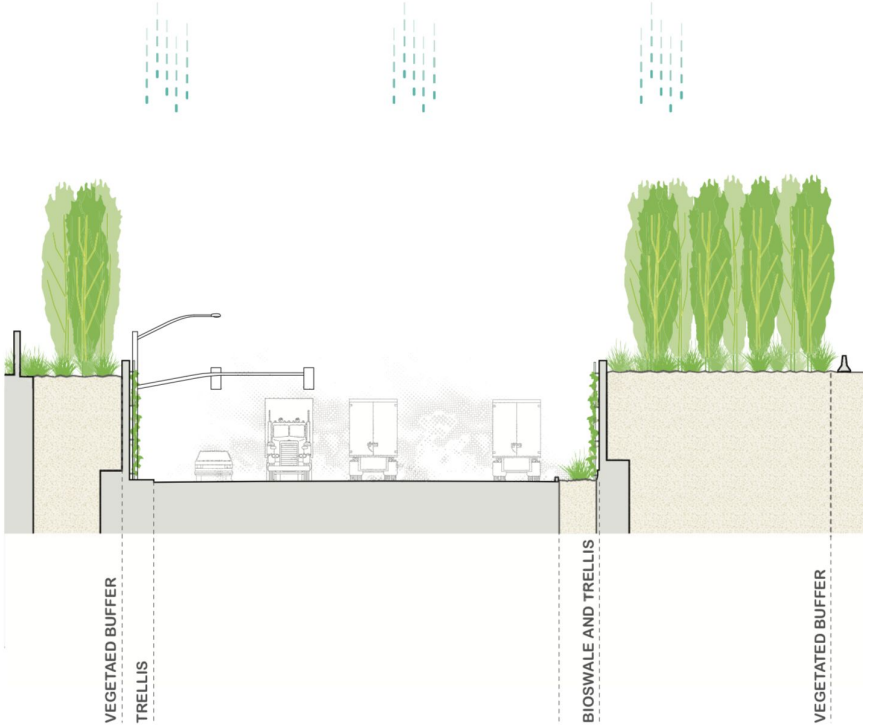
But the information that we get is still useful.

Models allow you to compare multiple options before spending the resources on creating the full sized version

Modeling the way air moves over an airplane wing

Building the first airplane


Immediately Plantable
Caltrans Planting
Frontage Road Diet


VEGETAED BUFFER
TRELLIS
BIOSWALE AND TRELLIS
VEGETATED BUFFER

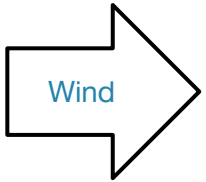
What we need to model how a green intervention impacts exposure risk

Change in Air Pollution Level =

Physical Environment

Pollution Sources

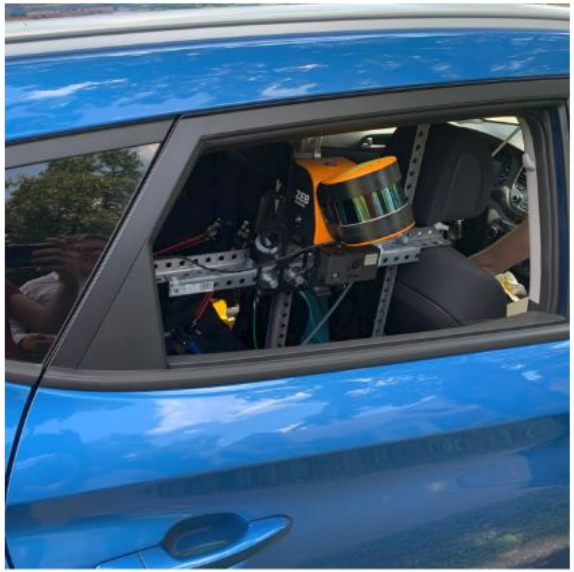
How Air Moves through the environment

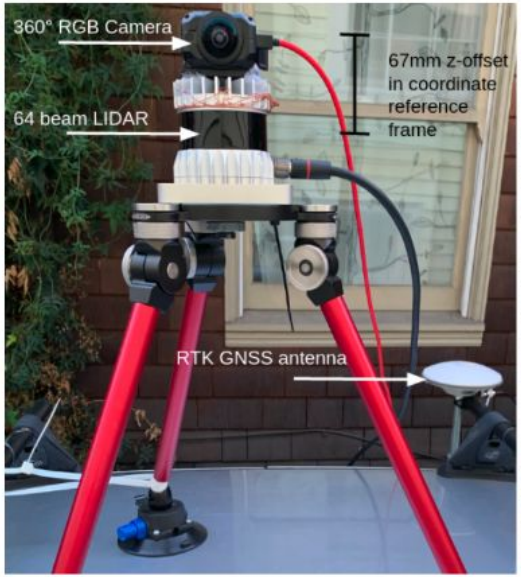


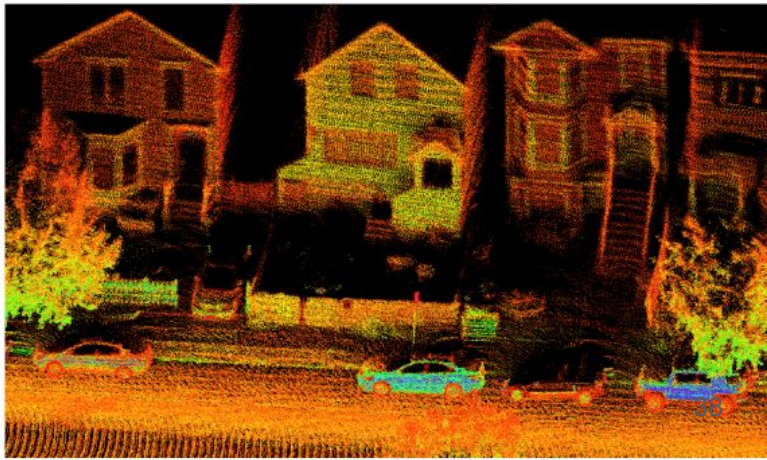
Different Buffer Designs

Collect LiDAR data of the structures and trees

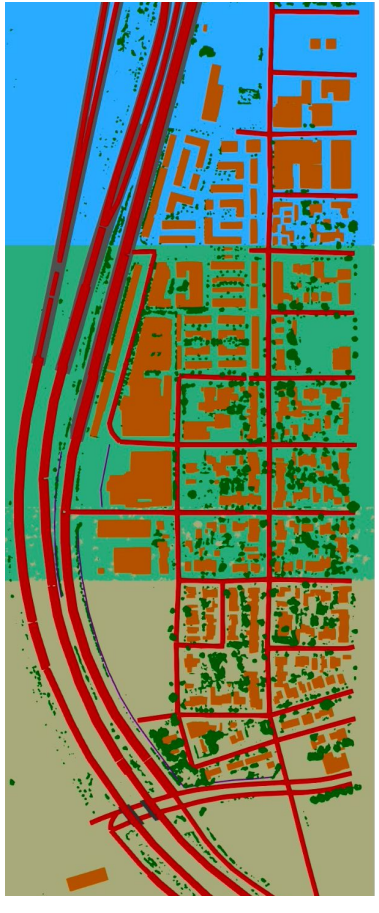
LiDAR scan process



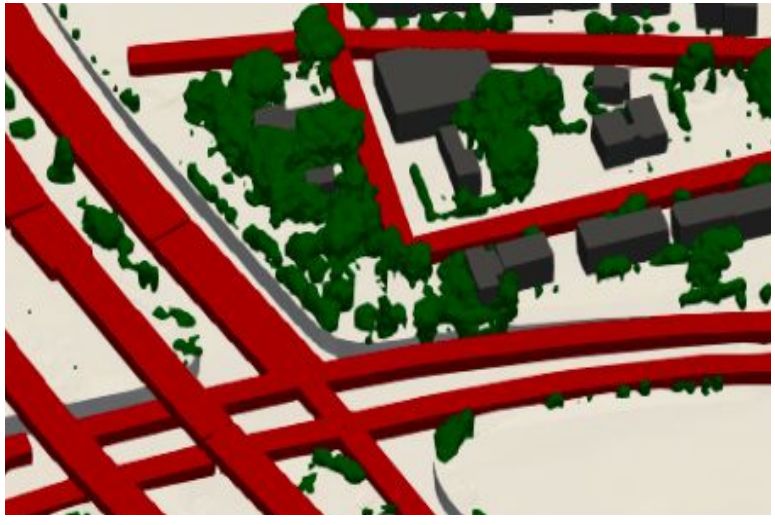


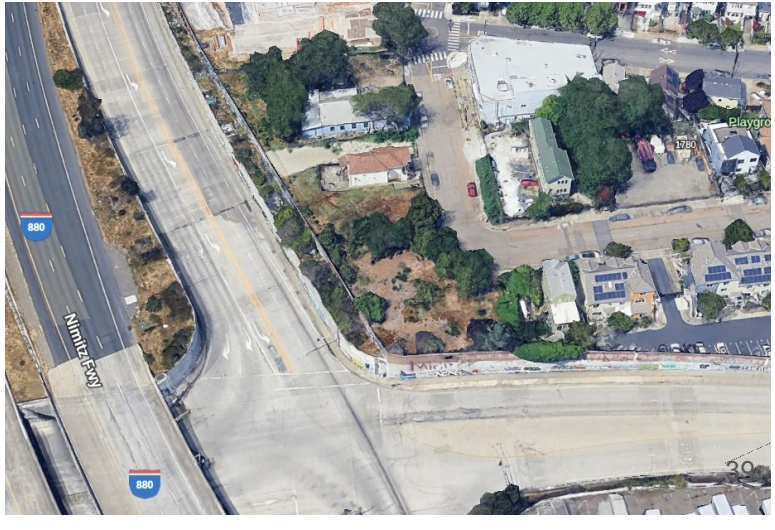


Simplify the 3D world



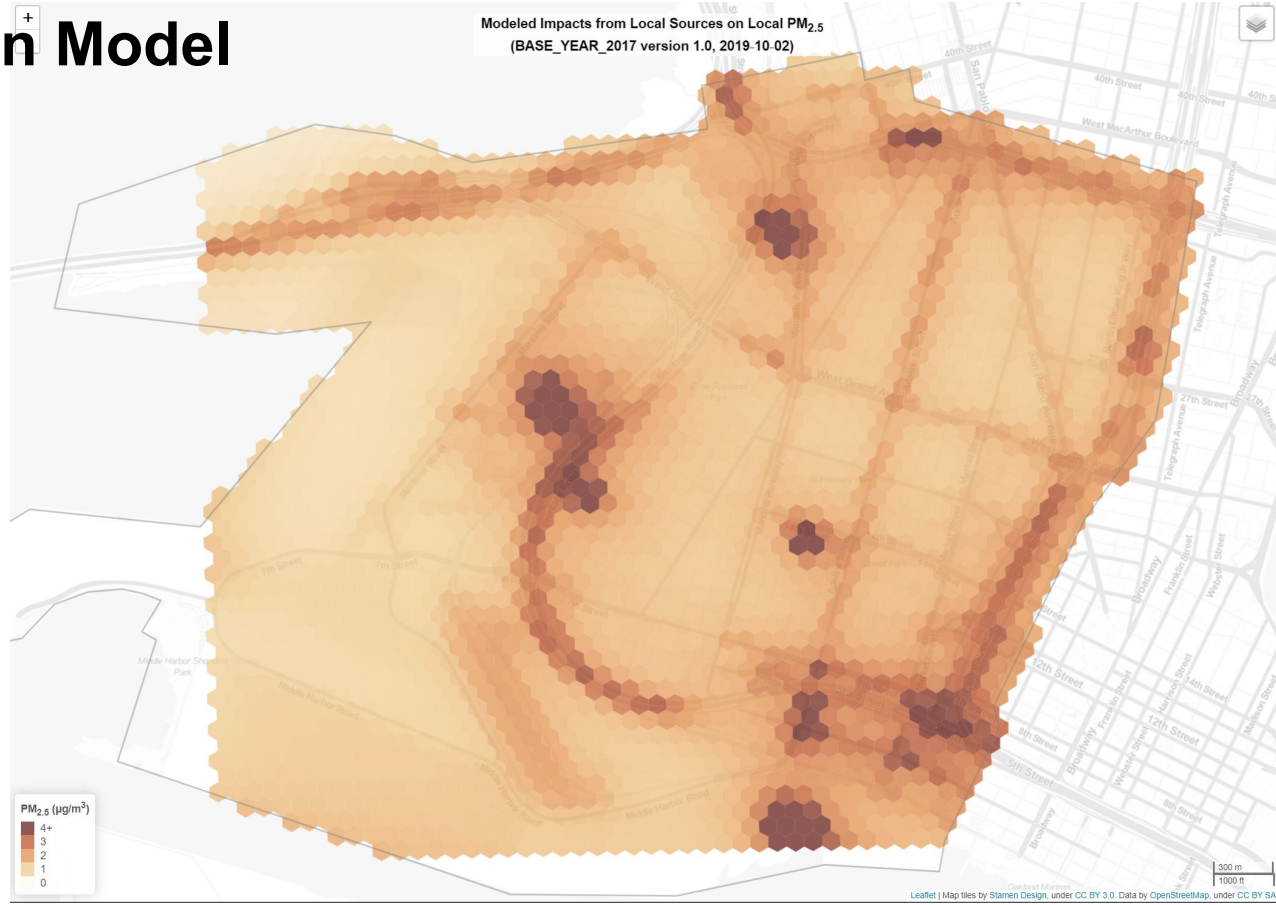
Digital Twin





BAAQMD Air Pollution Model

Bay Area Air District created used AERMOD to predict the way pollution from local sources would disperse across the city / region



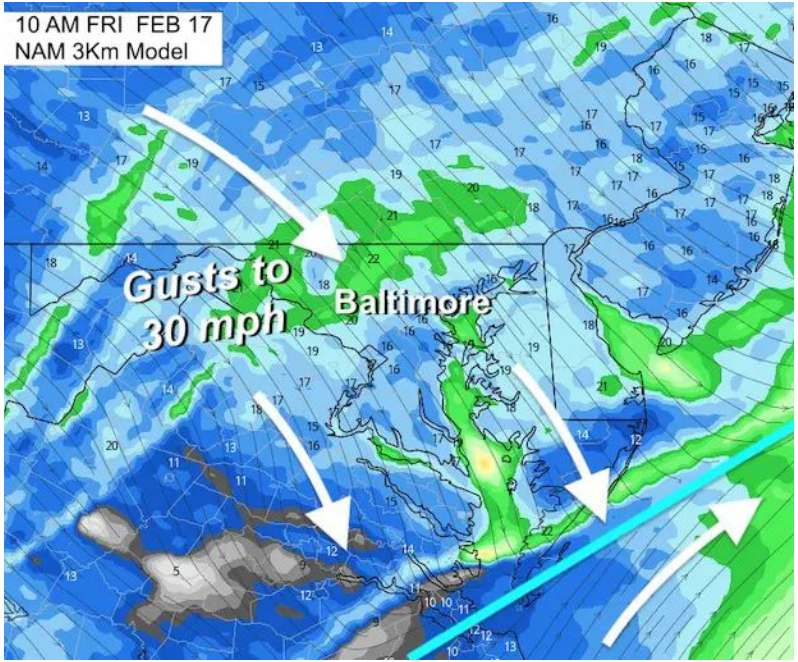
BAAD Methodology

Local $PM_{2.5}$ ($\mu g/m^3$)		
Highway		
Passenger vehicles	0.217	6%
Heavy/Medium HD trucks	0.067	2%
Light HD trucks	0.010	0%
Road dust	0.094	2%
Street		
Passenger vehicles	0.066	2%
Heavy/Medium HD trucks	0.018	0%
Light HD trucks	0.004	0%
Road dust	0.413	11%
Port		
OGV (maneuvering)	0.022	1%
OGV (berthing)	0.043	1%
Harbor craft	0.055	1%
Dredging	0.015	0%
Bunkering (tugs + pumps)	0.003	0%
Drayage trucks	0.019	1%
Road dust	0.018	0%
Cargo handling	0.009	0%
Railyard (OGRE)	0.018	0%
Railyard (BNSF)	0.004	0%
Rail		
Rail lines	0.038	1%
Railyard (UP)	0.040	1%
Permitted		
Schnitzer (stationary)	0.044	1%
EBMUD	0.033	1%
Dynegy	0.001	0%
Pinnacle Ag	0.316	8%
Sierra Pacific	0.015	0%
CASS	0.002	0%
California Cereal	0.018	0%
CA Waste (10th St)	2.151	57%
Other facilities	0.016	0%
Other		
Ferries	0.005	0%
Schnitzer (ships)	0.002	0%
Schnitzer (trucks)	0.001	0%
Truck-related businesses	0.003	0%
	3.780	**100%**

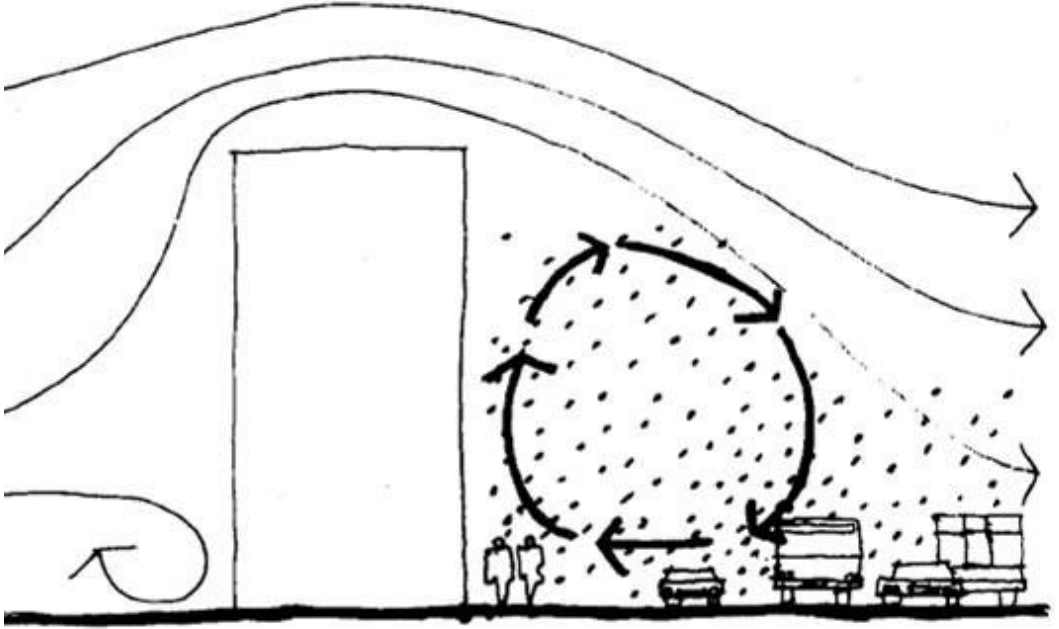
Modeled impacts from local sources.

2019-10-02 (BASE_YEAR_2017).

A larger scale model may tell you the direction of the wind. But at a smaller scale there could be areas behind buildings where the wind is blocked.

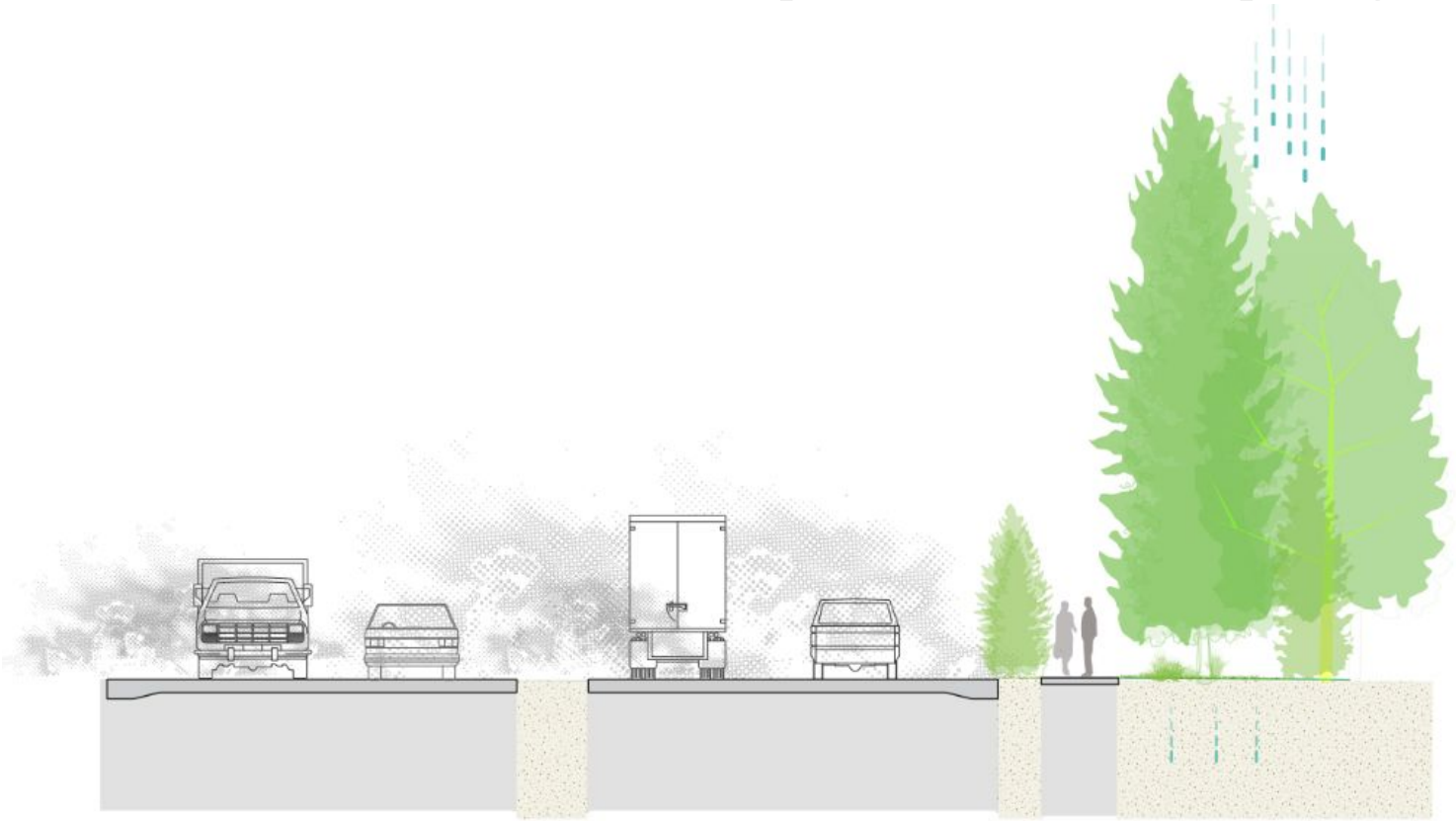


Larger scale

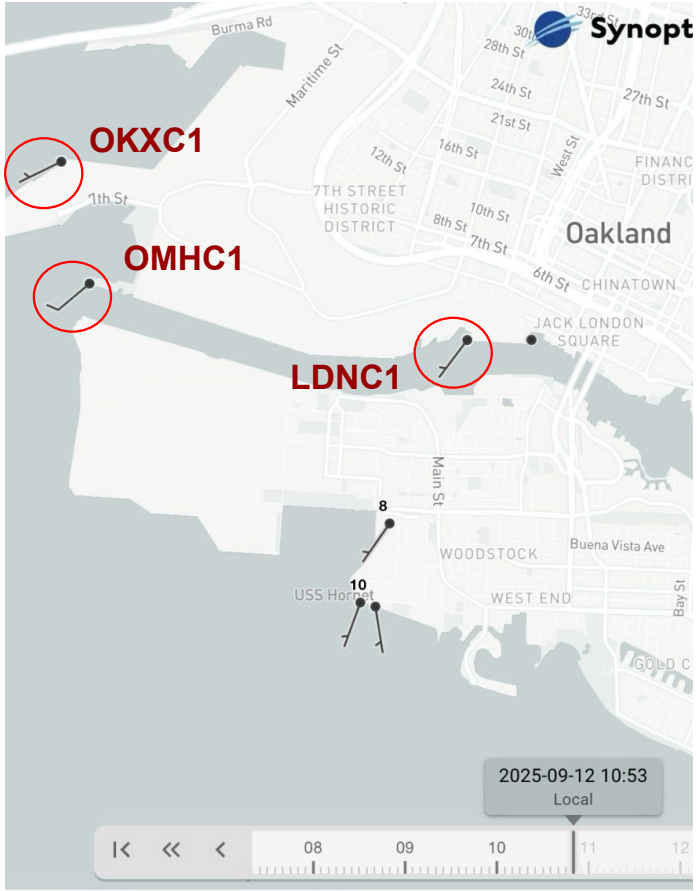


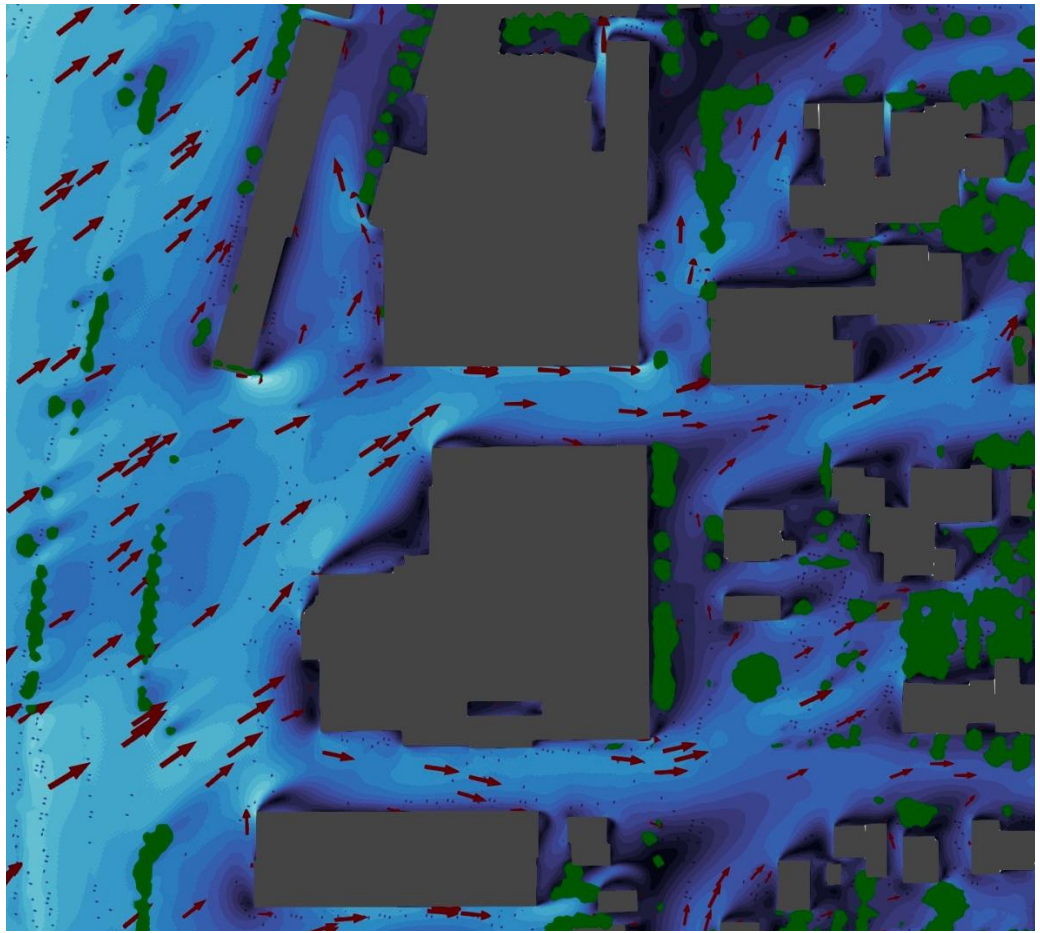
Smaller scale

AERMOD doesn't include vegetation, which is a critical part of our project

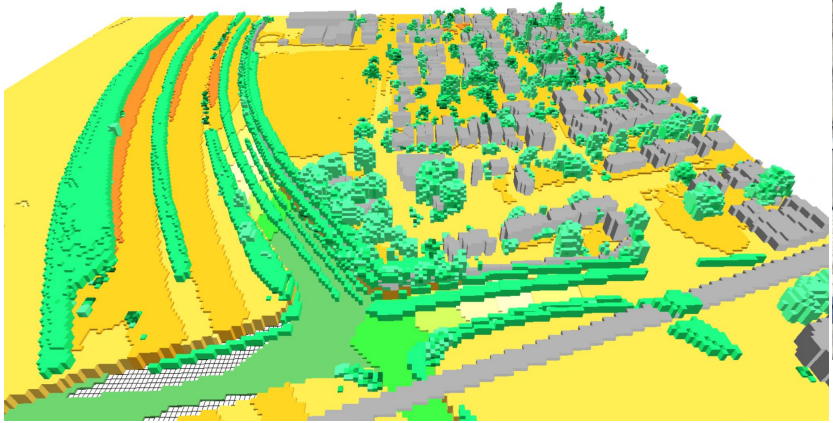


Wind Speed & Direction





Would a vegetated buffer in these areas be effective?

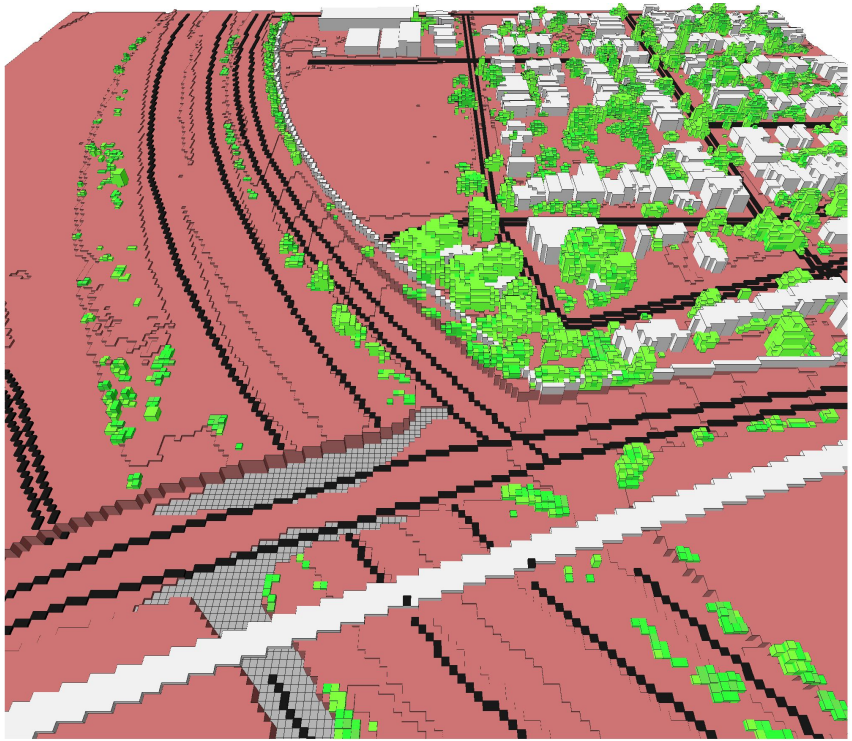


Modeling Key Points

- A model uses inputs to make predictions
- Models aren’t always accurate, but they are still useful
- We working on trying to make the inputs that we use more accurate so that we can try to get more accurate results
- We are developing models that can test the differences between different planting interventions

In the first round of simulations we compared different scenarios.

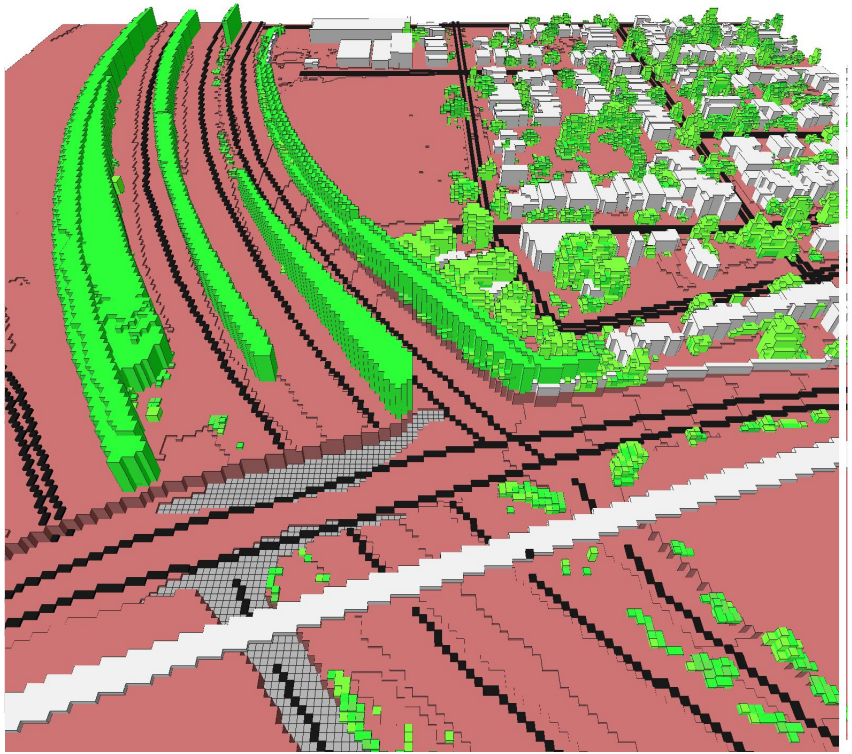
sim #	Name	Immediately Plantable Area (IPA)	Caltrans	Road Diet
1	No Veg	-	-	-
2	Existing Vegetation	-	-	-
3	CalTrans + IPA	x	x	-
4	CalTrans + Road Diet (opt 1)	-	x	x
5	Road Diet (opt 1) Only	-	-	x
6	IPA Only	x	-	-
7	Caltrans Only	-	x	-
8	Caltrans + IPA + Road Diet (Opt 2)	x	x	x



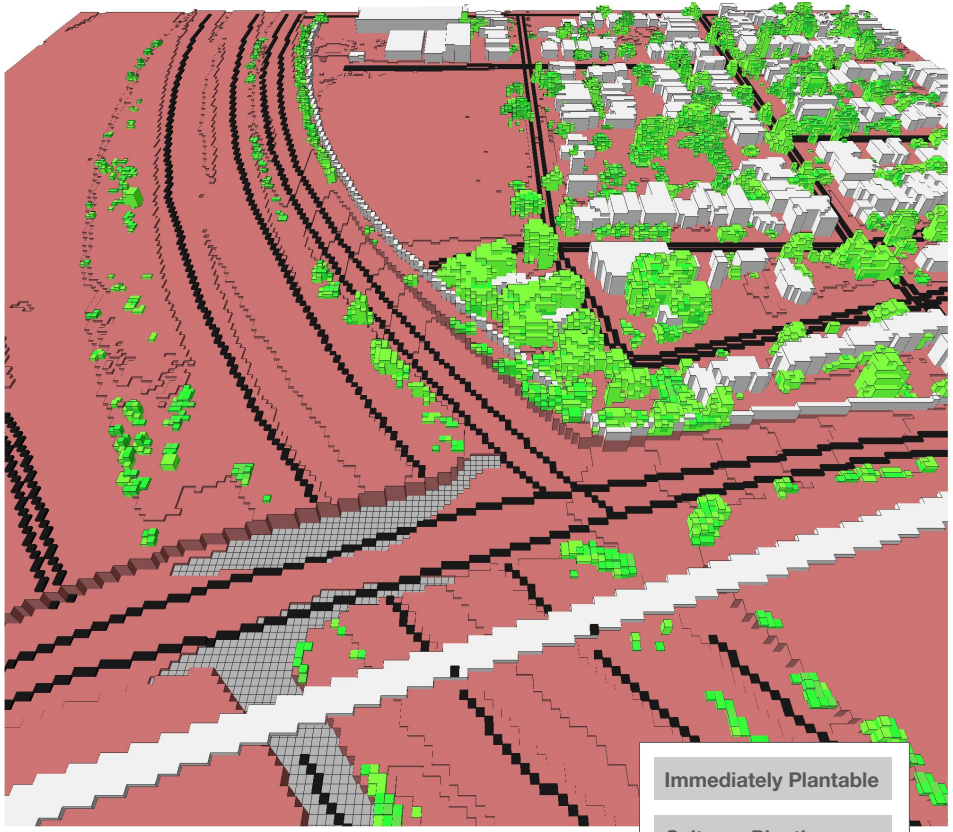
First we test how pollution moves in the existing conditions

In the first round of simulations we compared different scenarios.

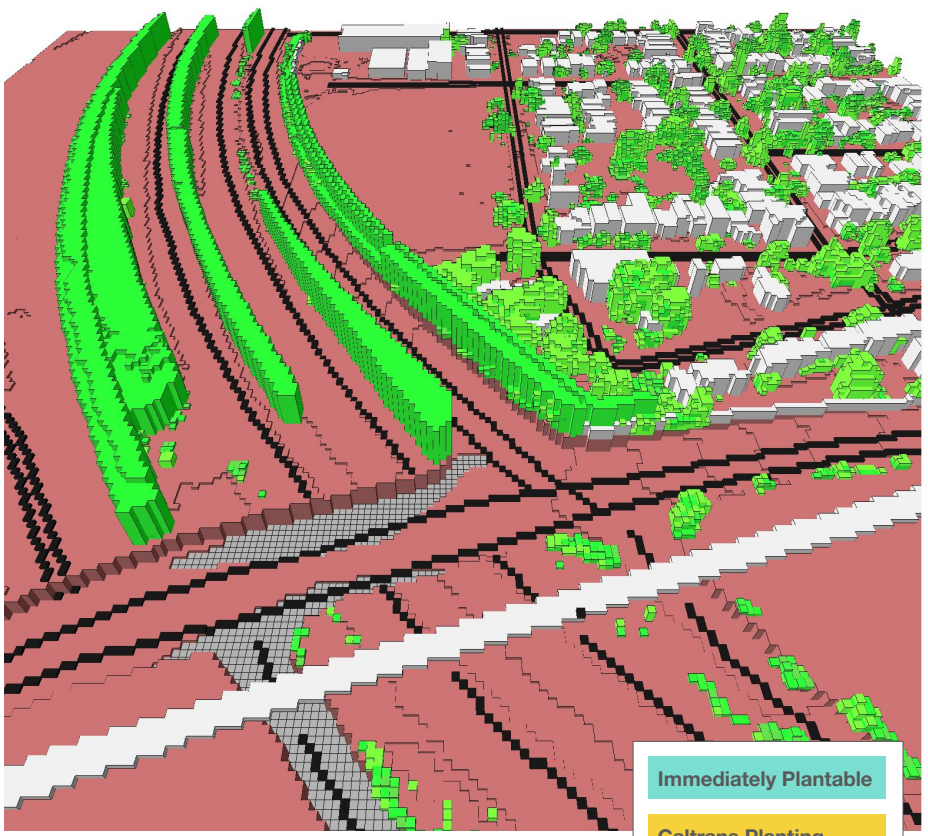
sim #	Name	Immediately Plantable Area (IPA)	Caltrans	Road Diet
1	No Veg	-	-	-
2	Existing Vegetation	-	-	-
3	CalTrans + IPA	x	x	-
4	CalTrans + Road Diet (opt 1)	-	x	x
5	Road Diet (opt 1) Only	-	-	x
6	IPA Only	x	-	-
7	Caltrans Only	-	x	-
8	Caltrans + IPA + Road Diet (Opt 2)	x	x	x



Then we test it with vegetated buffers added



Existing vegetation

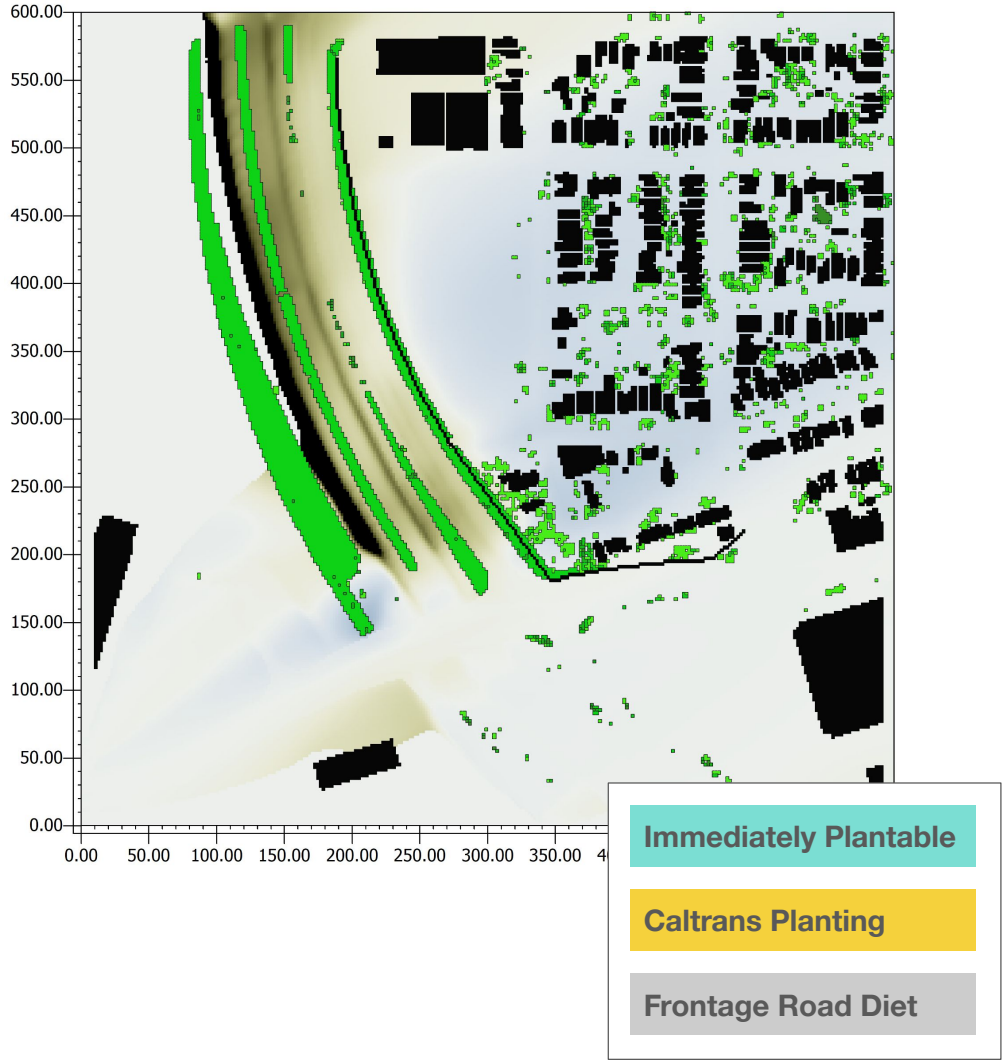


Vegetated buffers added

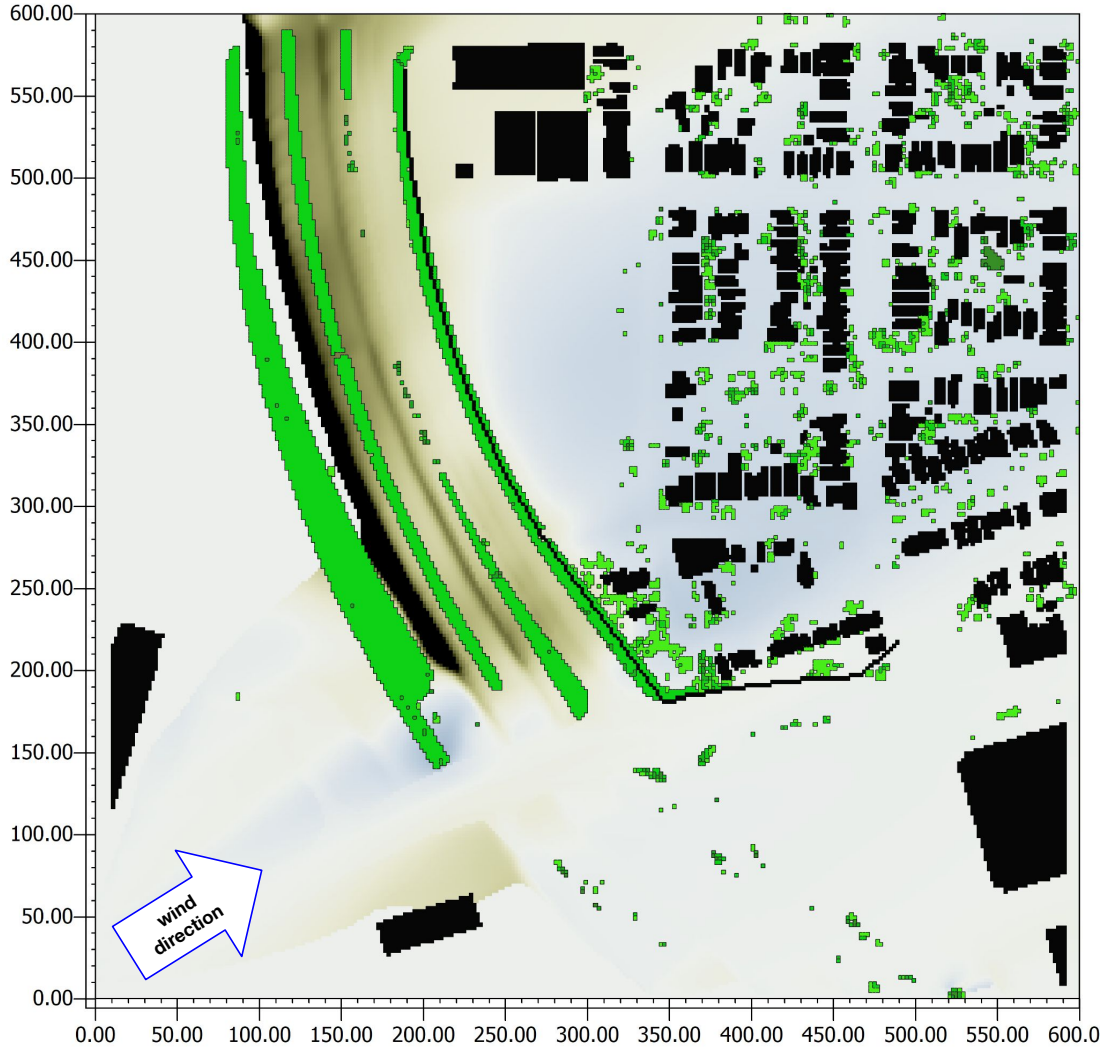
3) Caltrans + IPA

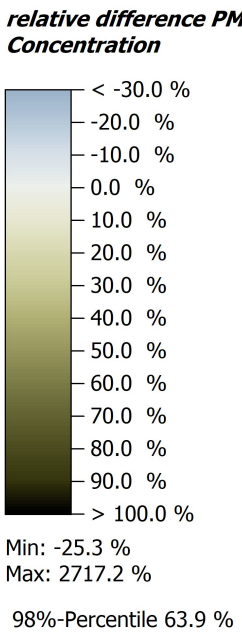
sim #	Name	Immediately Plantable Area (IPA)	Caltrans	Road Diet
1	No Veg	-	-	-
2	Existing Vegetation	-	-	-
3	CalTrans + IPA	x	x	-
4	CalTrans + Road Diet (opt 1)	-	x	x
5	Road Diet (opt 1) Only	-	-	x
6	IPA Only	x	-	-
7	Caltrans Only	-	x	-
8	Caltrans + IPA + Road Diet (Opt 2)	x	x	x

Results show improvement in the neighborhood

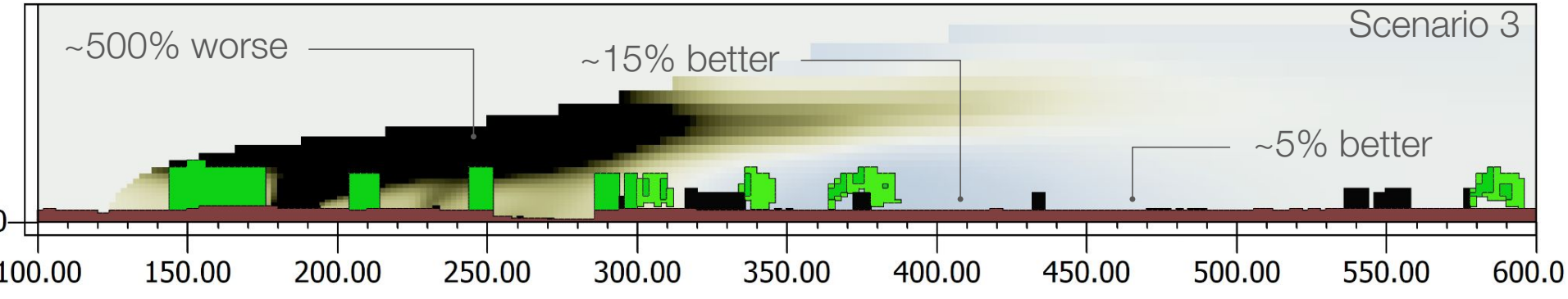


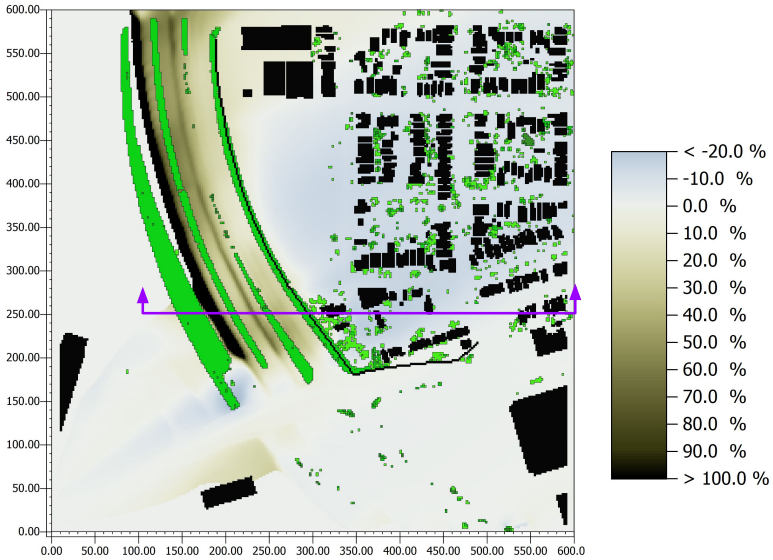
Caltrans + IPA





Areas that are blue have improved air quality compared to baseline, and areas that are darker brown have worse air quality than baseline.

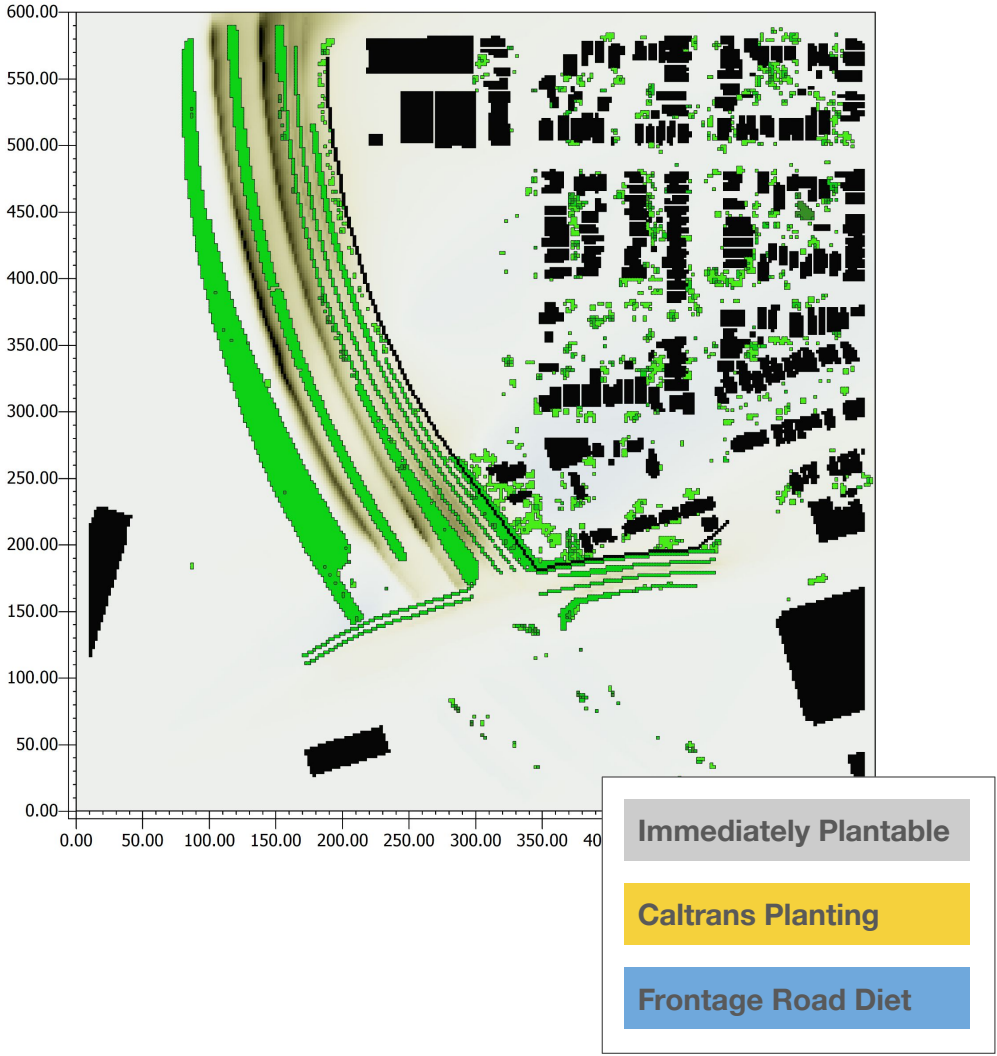




In section it's easier to see that pollution is collecting and pluming at the freeway when vegetation is added

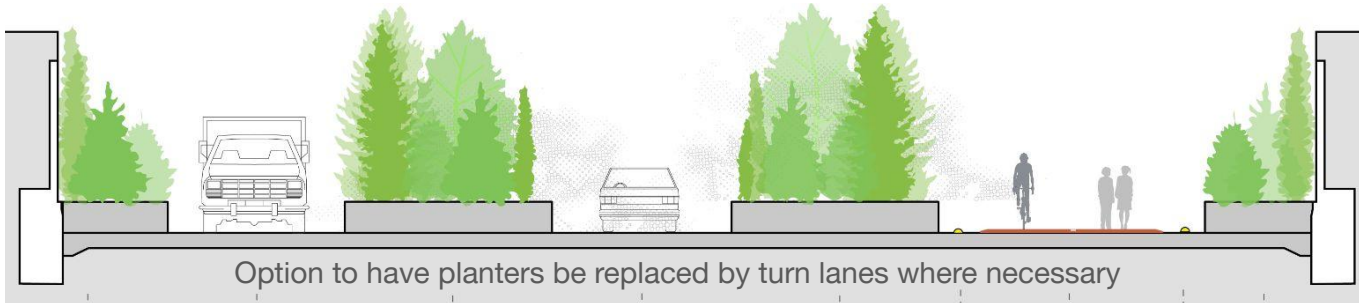
4) Caltrans + Road Diet

sim #	Name	Immediately Plantable Area (IPA)	Caltrans	Road Diet
1	No Veg	-	-	-
2	Existing Vegetation	-	-	-
3	CalTrans + IPA	x	x	-
4	CalTrans + Road Diet (opt 1)	-	x	x
5	Road Diet (opt 1) Only	-	-	x
6	IPA Only	x	-	-
7	Caltrans Only	-	x	-
8	Caltrans + IPA + Road Diet (Opt 2)	x	x	x



Frontage Road Diet

Option 1

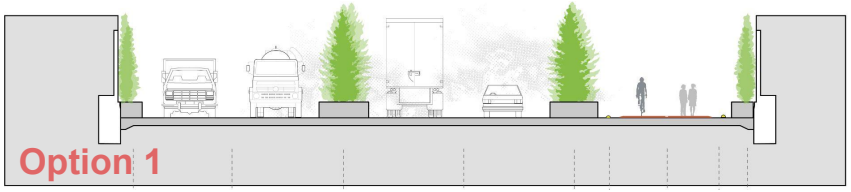


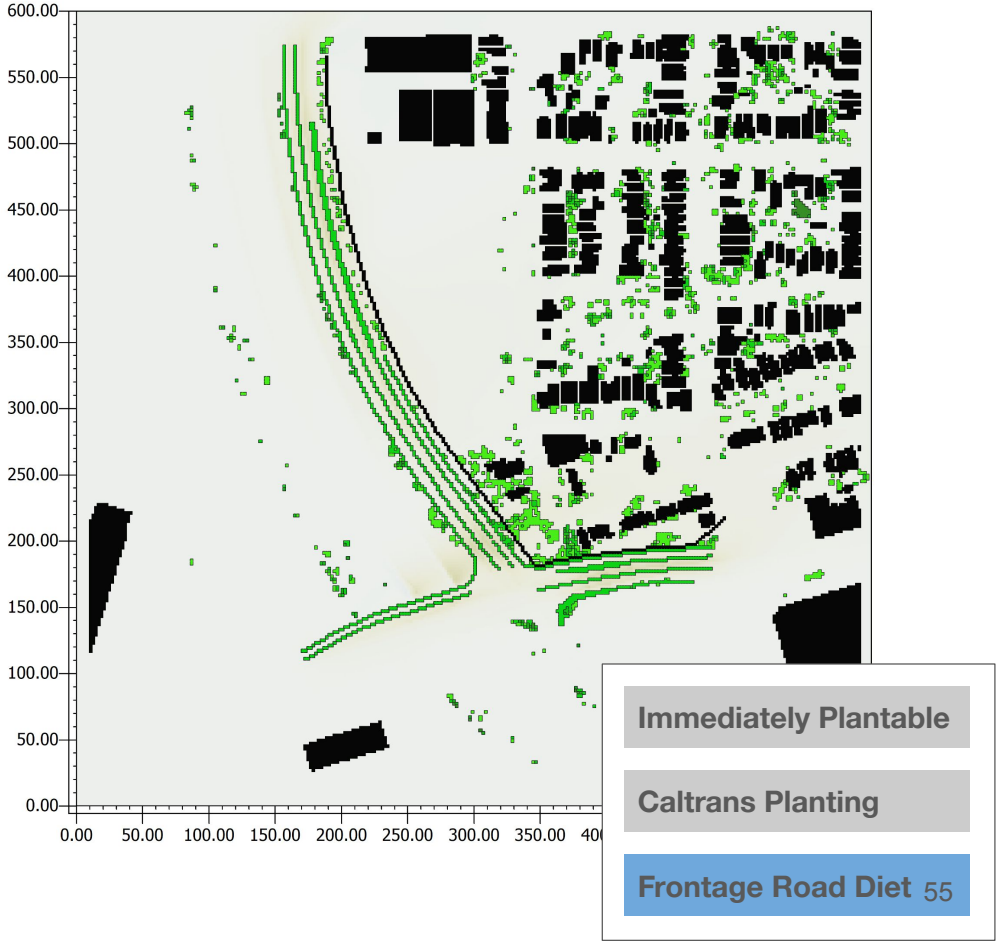
Option 2

Option 3

5) Road Diet Only

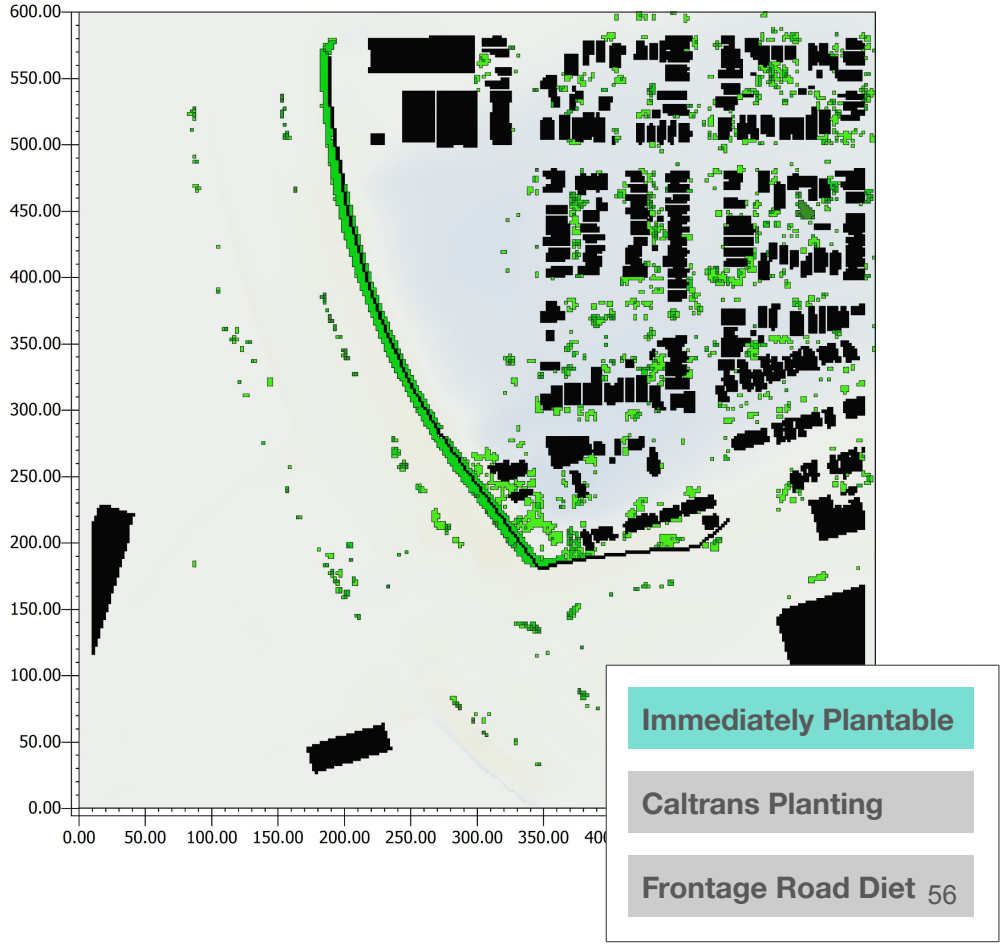
sim #	Name	Immediately Plantable Area (IPA)	Caltrans	Road Diet
1	No Veg	-	-	-
2	Existing Vegetation	-	-	-
3	CalTrans + IPA	x	x	-
4	CalTrans + Road Diet (opt 1)	-	x	x
5	Road Diet (opt 1) Only	-	-	x
6	IPA Only	x	-	-
7	Caltrans Only	-	x	-
8	Caltrans + IPA + Road Diet (Opt 2)	x	x	x





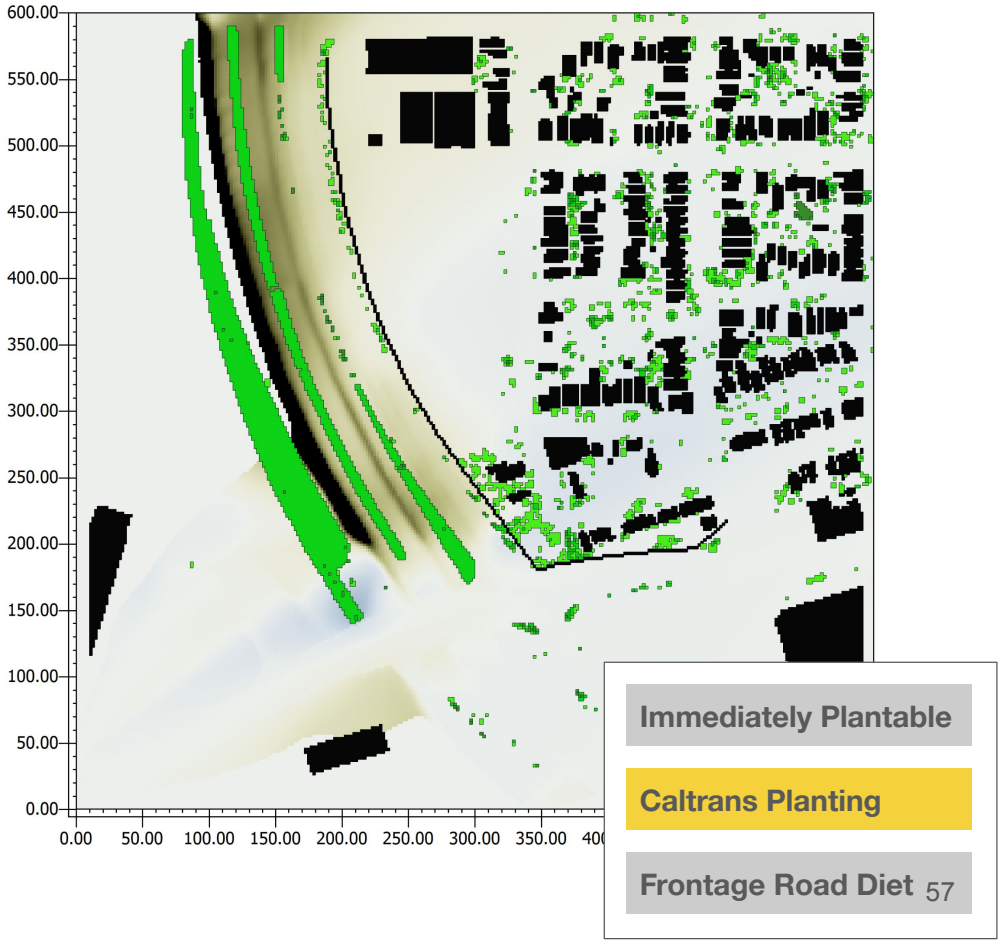
6) Immediately Plantable Only

sim #	Name	Immediately Plantable Area (IPA)	Caltrans	Road Diet
1	No Veg	-	-	-
2	Existing Vegetation	-	-	-
3	CalTrans + IPA	x	x	-
4	CalTrans + Road Diet (opt 1)	-	x	x
5	Road Diet (opt 1) Only	-	-	x
6	IPA Only	x	-	-
7	Caltrans Only	-	x	-
8	Caltrans + IPA + Road Diet (Opt 2)	x	x	x



7) Caltrans Only

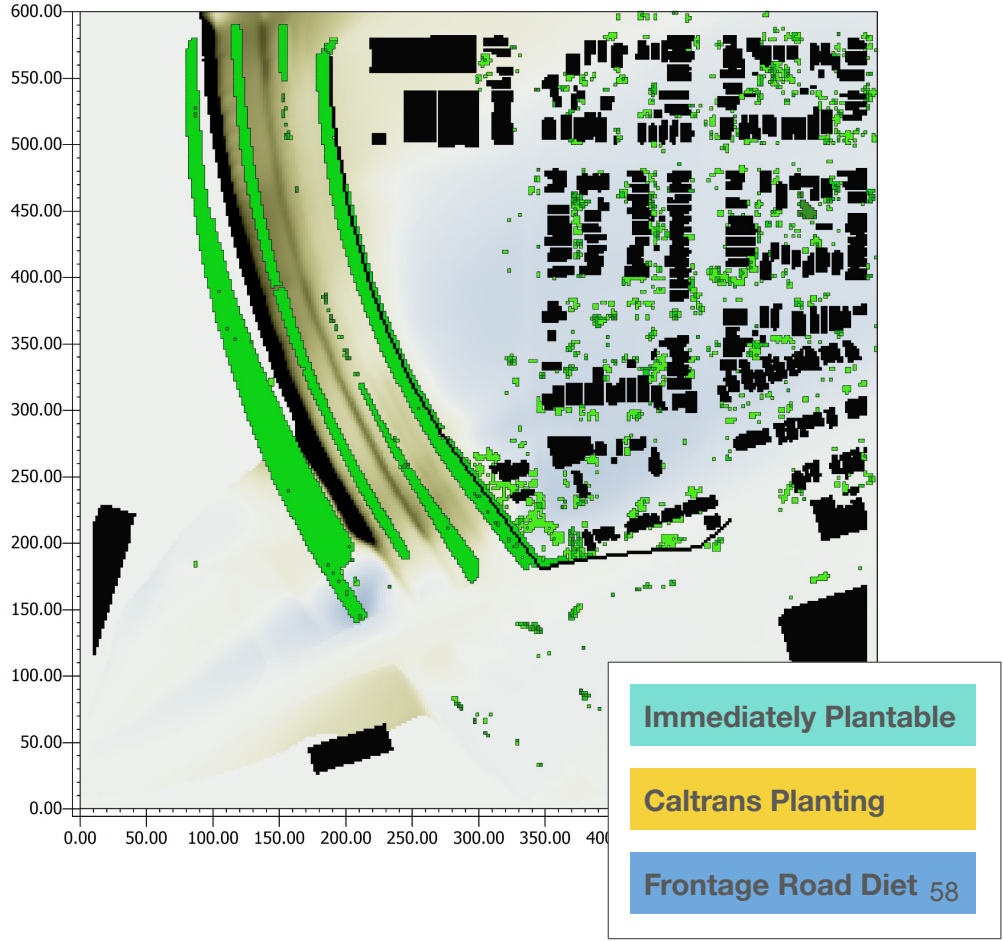
sim #	Name	Immediately Plantable Area (IPA)	Caltrans	Road Diet
1	No Veg	-	-	-
2	Existing Vegetation	-	-	-
3	CalTrans + IPA	x	x	-
4	CalTrans + Road Diet (opt 1)	-	x	x
5	Road Diet (opt 1) Only	-	-	x
6	IPA Only	x	-	-
7	Caltrans Only	-	x	-
8	Caltrans + IPA + Road Diet (Opt 2)	x	x	x



8) Caltrans + IPA + Road Diet

sim #	Name	Immediately Plantable Area (IPA)	Caltrans	Road Diet
1	No Veg	-	-	-
2	Existing Vegetation	-	-	-
3	CalTrans + IPA	x	x	-
4	CalTrans + Road Diet (opt 1)	-	x	x
5	Road Diet (opt 1) Only	-	-	x
6	IPA Only	x	-	-
7	Caltrans Only	-	x	-
8	Caltrans + IPA + Road Diet (Opt 2)	x	x	x

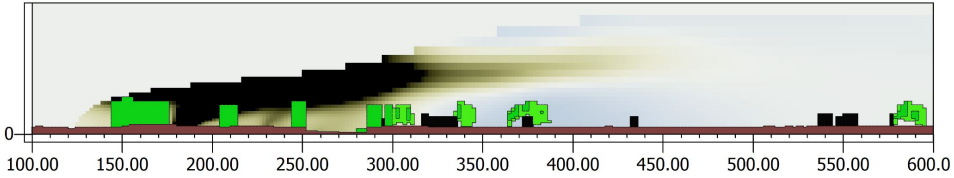
In our 8th simulation we looked at all of the scenarios all together



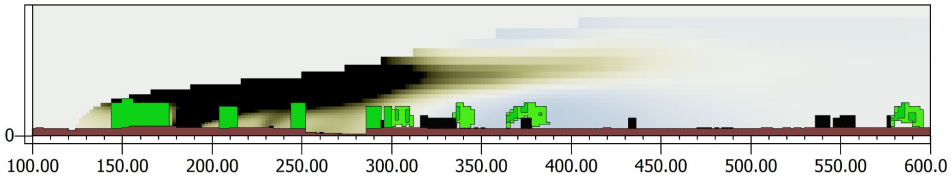
Interpretation of Results

	sim #	Name	Immediately Plantable Area (IPA)	Caltrans	Road Diet
	1	No Veg	-	-	-
	2	Existing Vegetation	-	-	-
2nd	3	CalTrans + IPA	x	x	-
	4	CalTrans + Road Diet (opt 1)	-	x	x
	5	Road Diet (opt 1) Only	-	-	x
3rd	6	IPA Only	x	-	-
	7	Caltrans Only	-	x	-
1st	8	Caltrans + IPA + Road Diet (Opt 2)	x	x	x

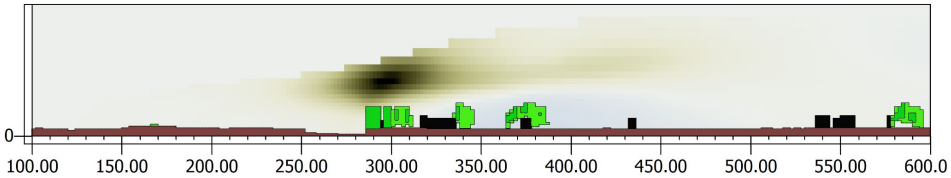
1) Caltrans + IPA + Road Diet



2) Caltrans + IPA



3) Immediately Plantable Only



Key Takeaways

- Digital versions of vegetated buffers in different planting areas were compared to baseline conditions to see where pollution would be improved, and where it would be worsened.
  - Pollution concentration is higher front of the buffer
  - Pollution concentration is lower behind the buffer
  - The positive effect of the buffer eventually diminishes further downwind

- The immediately plantable area had a noticeable effect, and is the easiest place to begin planting right away

Improvements to models

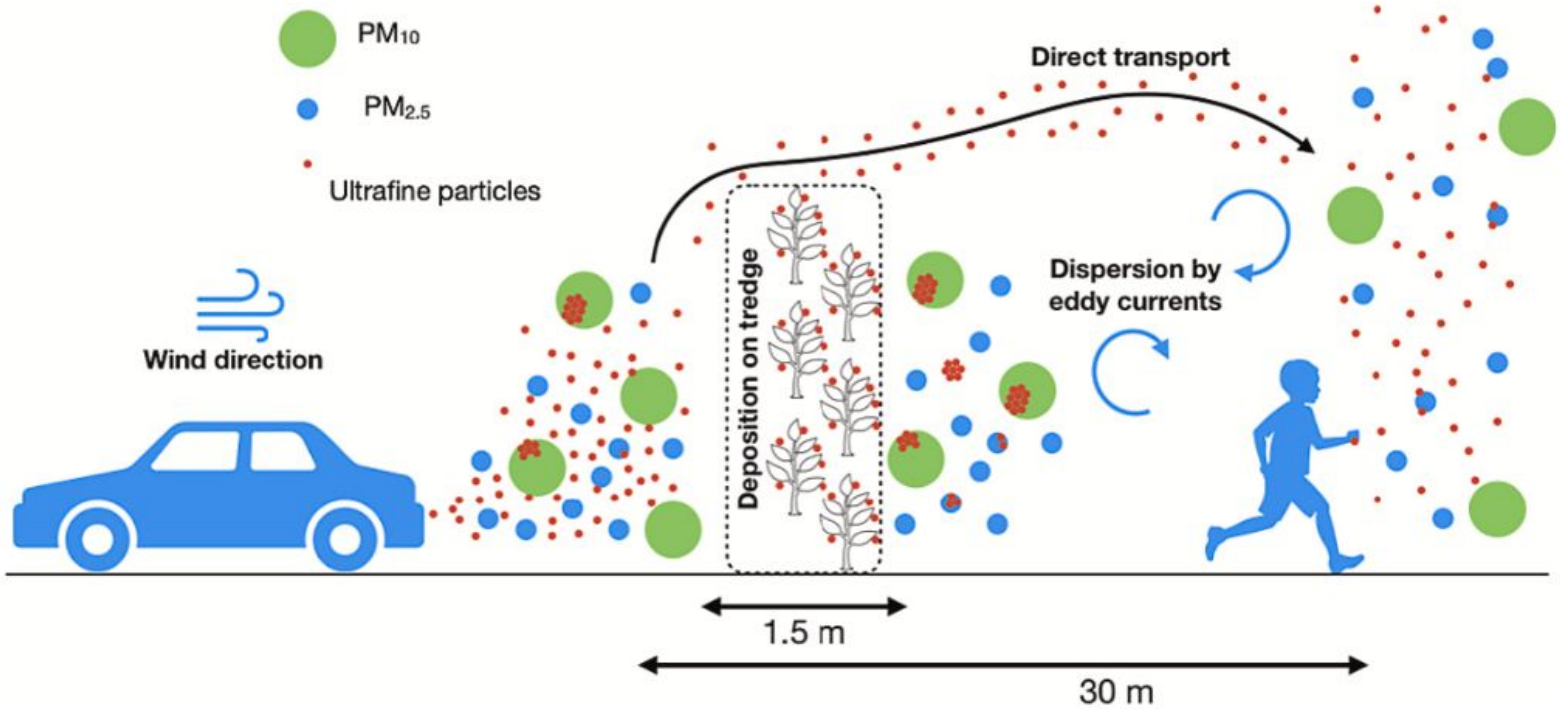
A different modeling approach would be used for the next round of simulations:

- **Better software**
  - Use OpenFOAM instead of ENVI-met
  - This allows for more complex mathematics

- **Better data**
  - Traffic counts
  - Technical assistance from the Air District

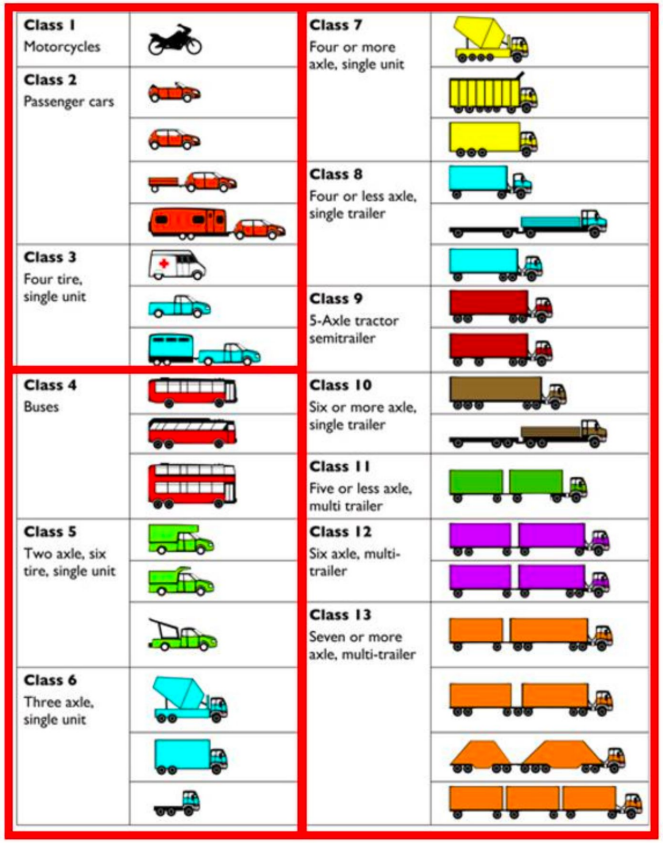
- **Expand the area we are studying**

Better software



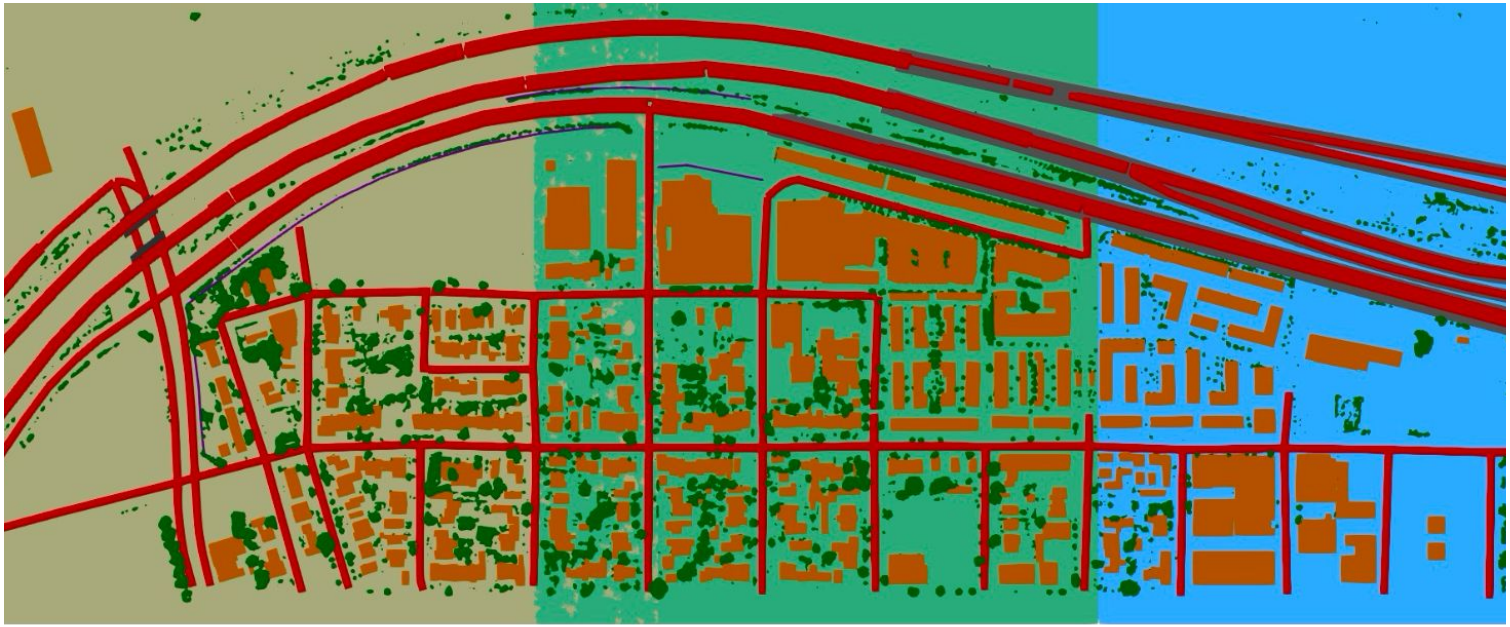
More complex mathematics can be used to represent things like turbulence and pollution deposition

Better data



We obtained better traffic data after the first round of simulations that we wanted to include

Expanding the area



In our first simulations we looked at one portion of the road, but we wanted to study the rest as well

Pause (10 min)

- **Are there any questions about modeling?**

Agenda

- Introduction & Background
- Project Area
- Vegetated Buffers
- Modeling
- IPA - project plan
- Road Diet - development & designs

Immediately Plantable

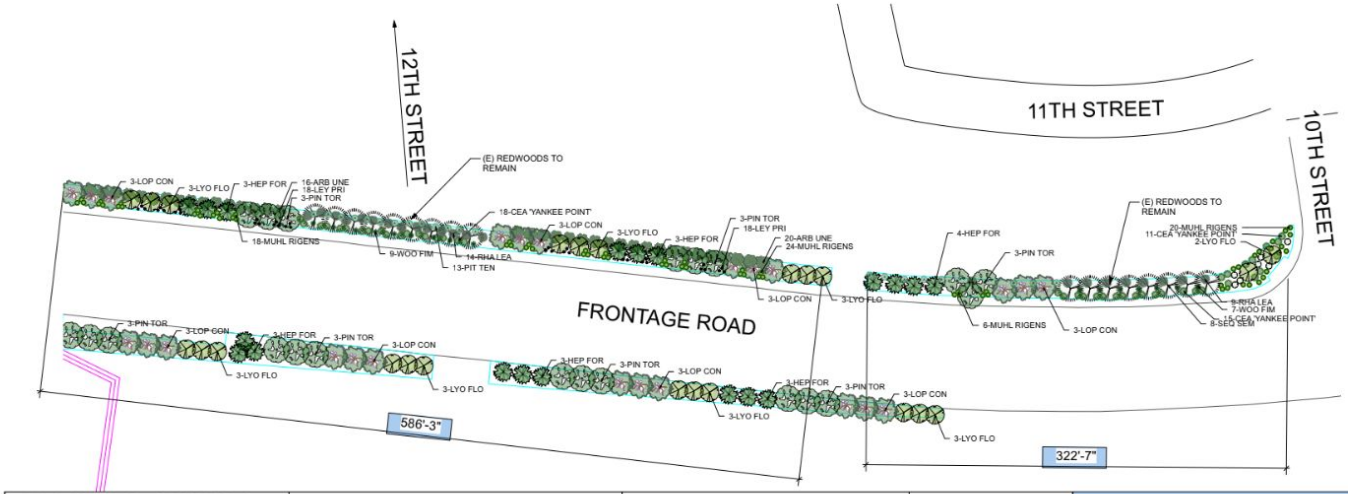
All along frontage road there are existing planters where trees could be planted.

Immediately Plantable Area

Things to consider:

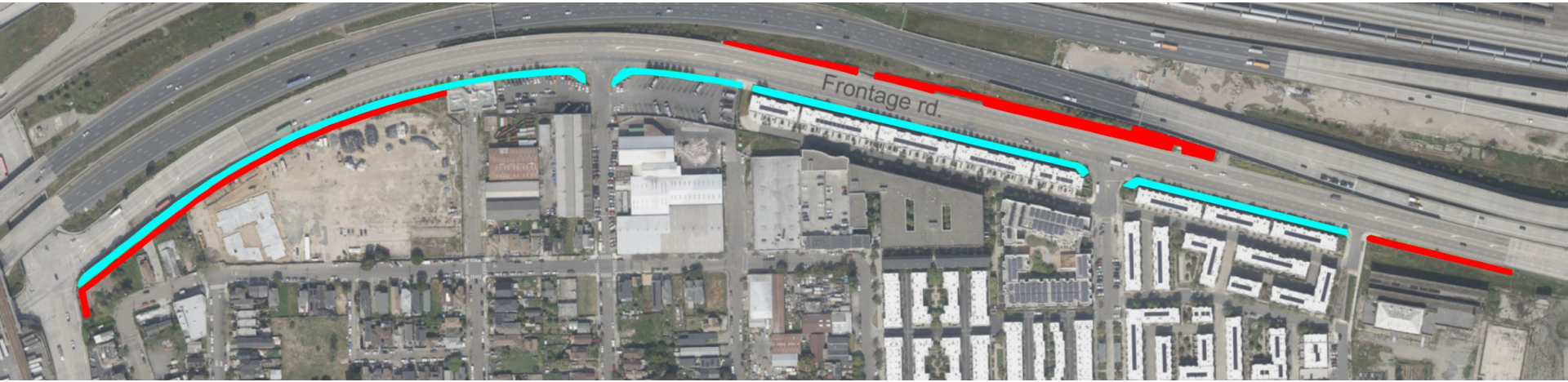
- Who owns the land?
- What permits are required?
- How do we get water there?
- How much will it cost?

Planting Plans for Pricing



Planting plans were created for the entire area to determine how much it would cost to do a full planting.

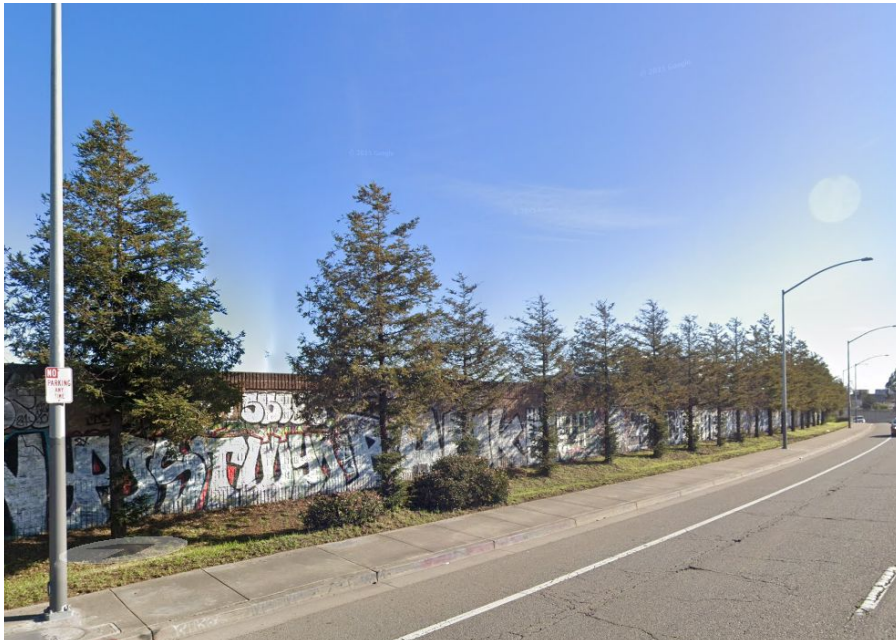
Immediately Plantable Area - Assessing Feasibility



- Water - some areas don’t have existing water connections.
- Permitting - areas within the city land can be grouped together
- Impact - which areas should we prioritize if we don’t have enough budget

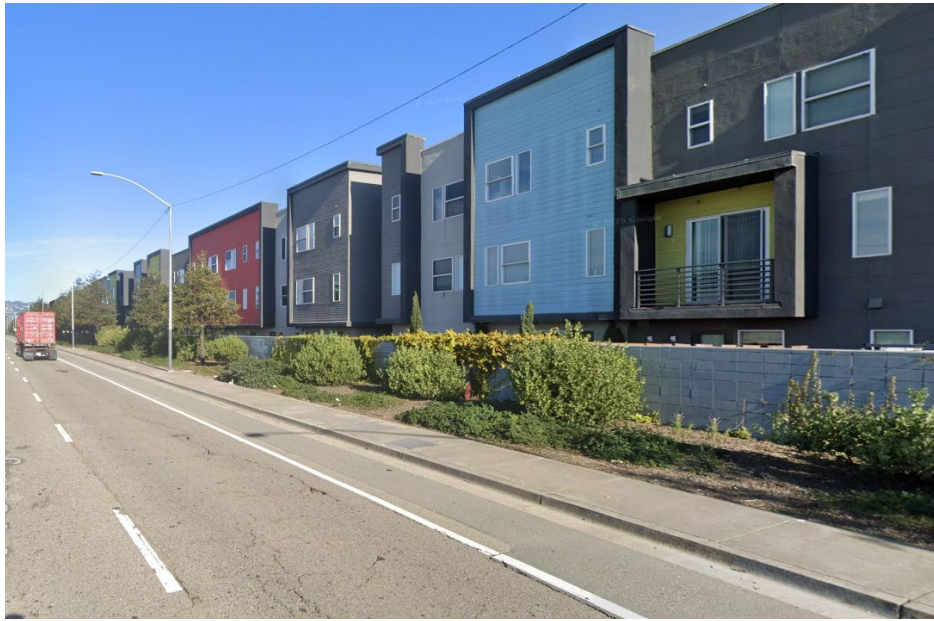
Immediately Plantable Area

Plant new trees and replace redwoods that are unhealthy



Plant trees and shrubs

Immediately Plantable Area

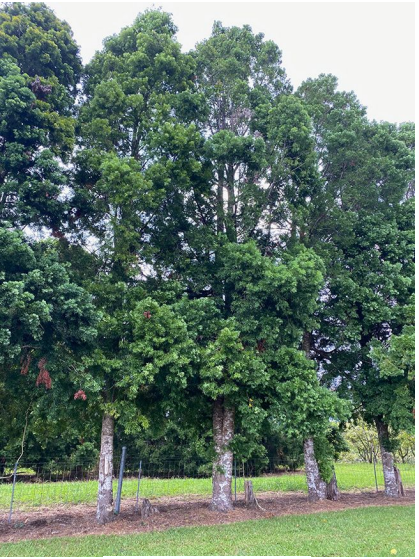


Fill in gaps with new trees. Add more understory shrubs

Immediately Plantable Area

This section has many trees. Fill in gaps and add shrubs

Tree Species



Fern Pine

Long Leafed Yellowwood

Japanese Blueberry Tree

Indian Laurel Columns

The tree species chosen are all evergreen trees that work well as hedges

Shrub Species

Bottlebrush

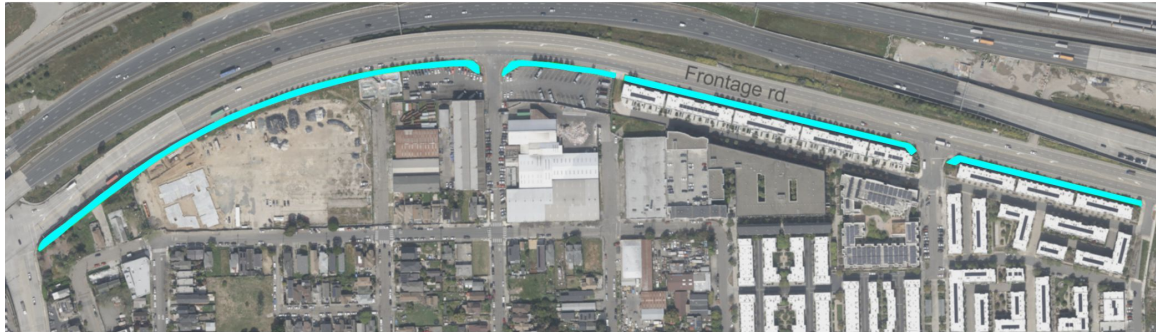
California Lilac

Manzanita

Indian Laurel Columns

The shrubs are evergreen, and support native pollinators & birds

Immediately Plantable Area

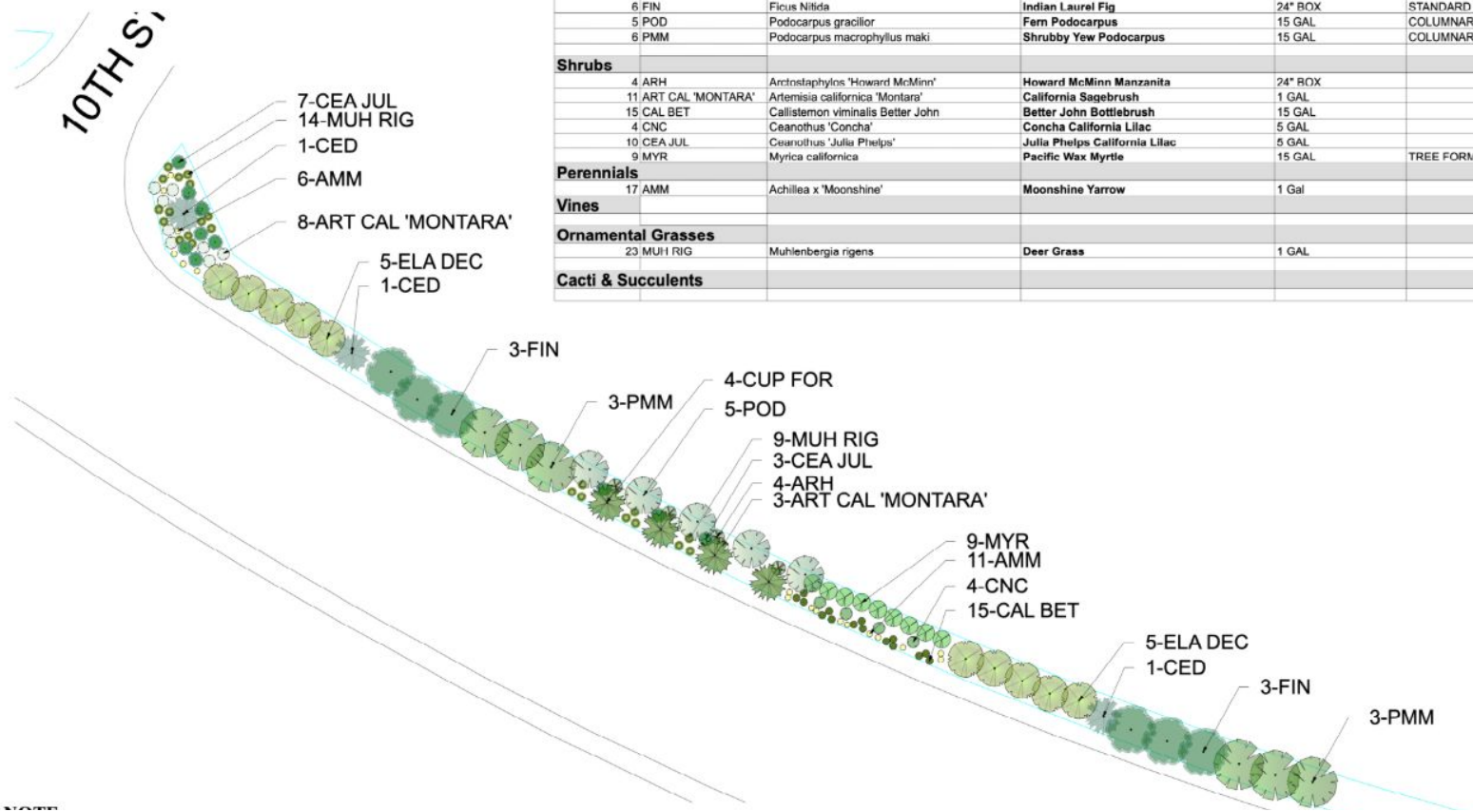


After trees and shrubs have been added, the area will be watered with a newly repaired irrigation system.

Trees and shrubs need supplemental water, especially during the summer months, until they have become established.

The first three years the trees and shrubs will be maintained.

1 ZONE 2 - END OF RETAINING WALL TO 10TH STREET
Scale: 1" = 20'-0"



Plant List

Qty	ID	Botanical Name	Common Name	Scheduled Size	Remarks
Trees					
3	CED	Cedrus atlantica 'Argentea Fastigiata	**Narrow Atlas Cedar**	24" BOX	STANDARD FORM
4	CUP FOR	Cupressus forbesii	**Tecate Cypress**	24" BOX	STANDARD FORM
10	ELA DEC	Elaeocarpus decipiens	**Japanese Blueberry Tree**	24" BOX	STANDARD FORM
6	FIN	Ficus Nitida	**Indian Laurel Fig**	24" BOX	STANDARD FORM
5	POD	Podocarpus gracilior	**Fern Podocarpus**	15 GAL	COLUMNAR FORM
6	PMM	Podocarpus macrophyllus maki	**Shrubby Yew Podocarpus**	15 GAL	COLUMNAR FORM
Shrubs					
4	ARH	Arctostaphylos 'Howard McMinn'	**Howard McMinn Manzanita**	24" BOX	
11	ART CAL 'MONTARA'	Artemisia californica 'Montara'	**California Sagebrush**	1 GAL	
15	CAL BET	Callistemon viminalis Better John	**Better John Bottlebrush**	15 GAL	
4	CNC	Ceanothus 'Concha'	**Concha California Lilac**	5 GAL	
10	CEA JUL	Ceanothus 'Julia Phelps'	**Julia Phelps California Lilac**	5 GAL	
9	MYR	Myrica californica	**Pacific Wax Myrtle**	15 GAL	TREE FORM
Perennials					
17	AMM	Achillea x 'Moonshine'	**Moonshine Yarrow**	1 Gal	
Vines					
Ornamental Grasses					
23	MUH RIG	Muhlenbergia rigens	**Deer Grass**	1 GAL	
Cacti & Succulents					

NOTE

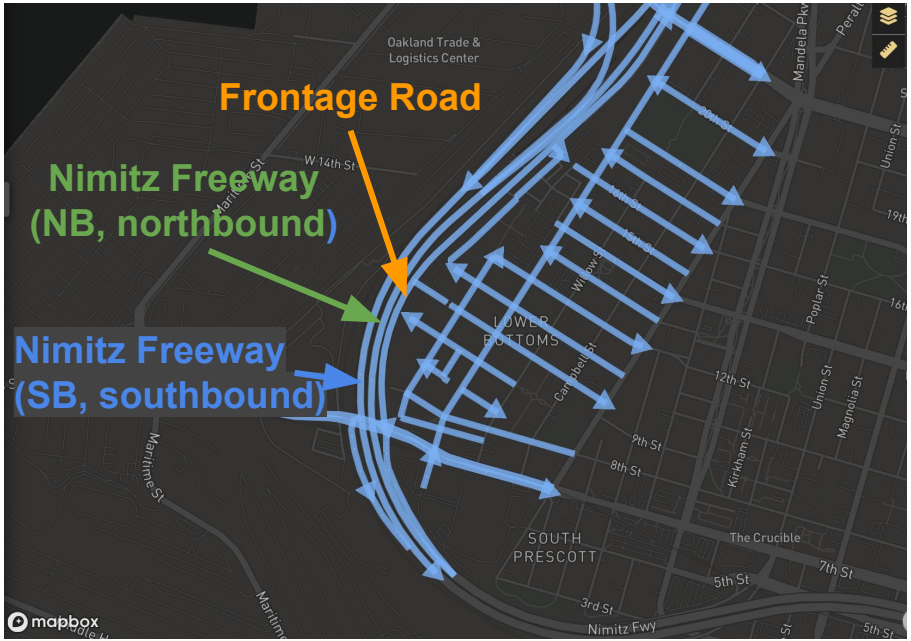
Pause (10 min)

- **Questions**
  - What’s exciting about this?
  - What’s missing?
  - What else would you like to know or see?

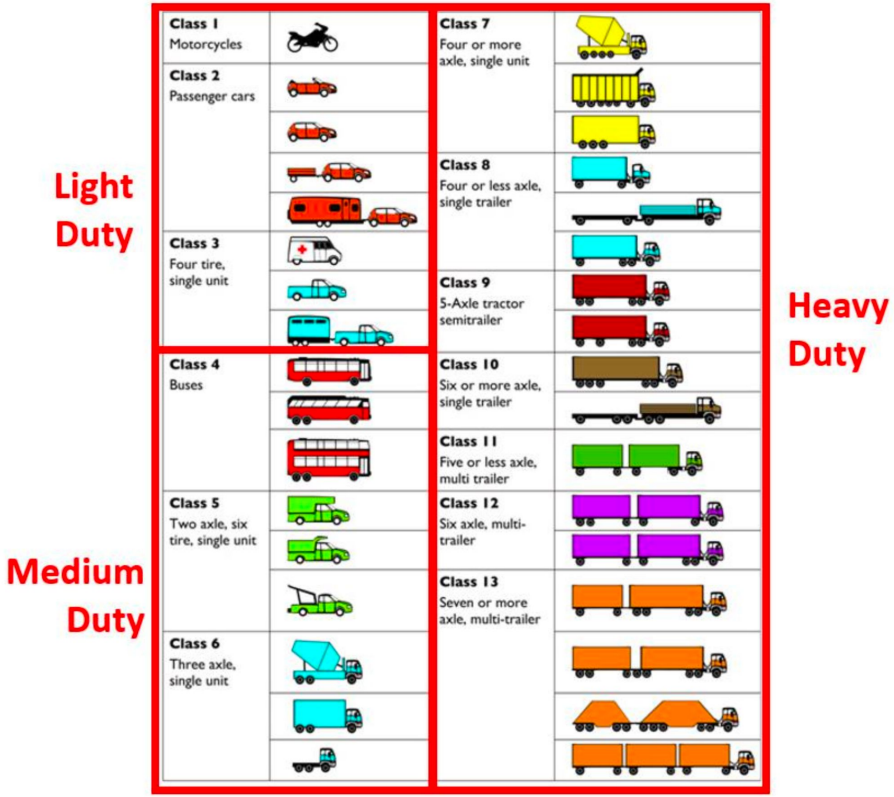
Agenda

- Introduction & Background
- Project Area
- Vegetated Buffers
- Modeling
- IPA - project plan
- Road Diet - development & designs
  - Traffic Data (and why that matters)
  - How models influenced the design
  - Concept Designs

Traffic Data

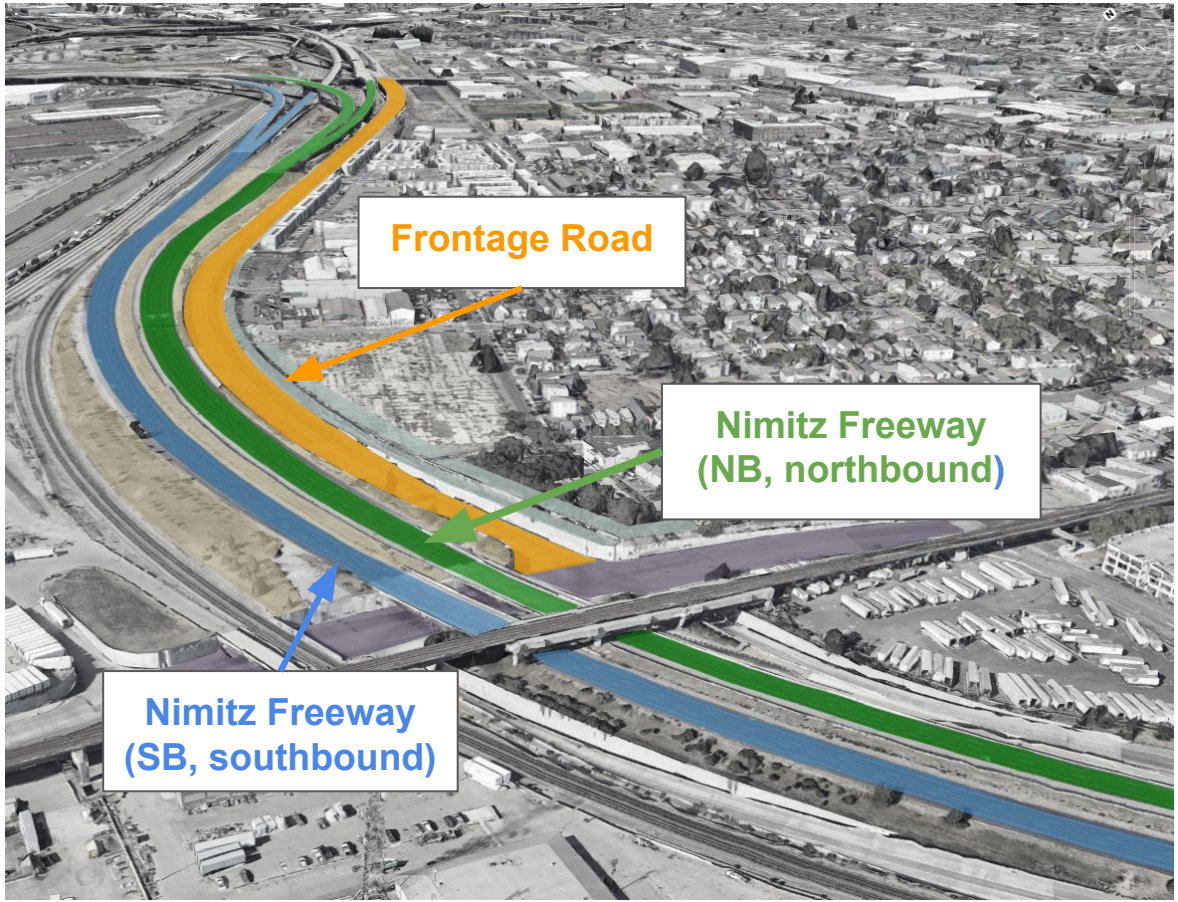


Analysis of vehicles and trucks
Output includes traffic count and moving speed.

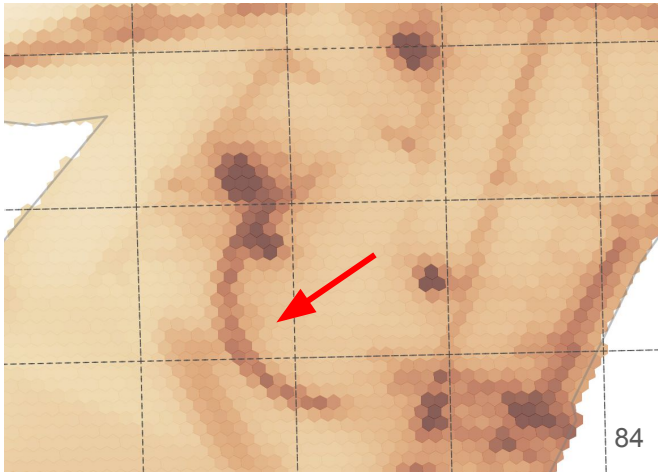


STREETLIGHT

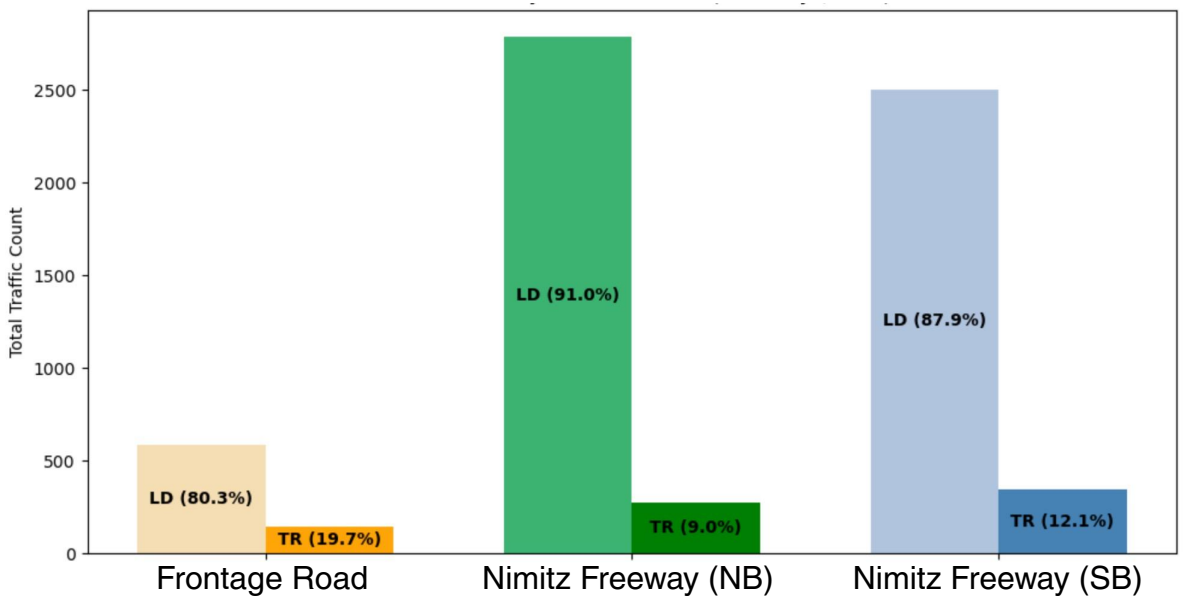
Major road segments being studied



These road segments have high traffic counts. The emissions that come from this traffic can be seen in the Air District's pollution model of PM 2.5



Total traffic counts on major road segments

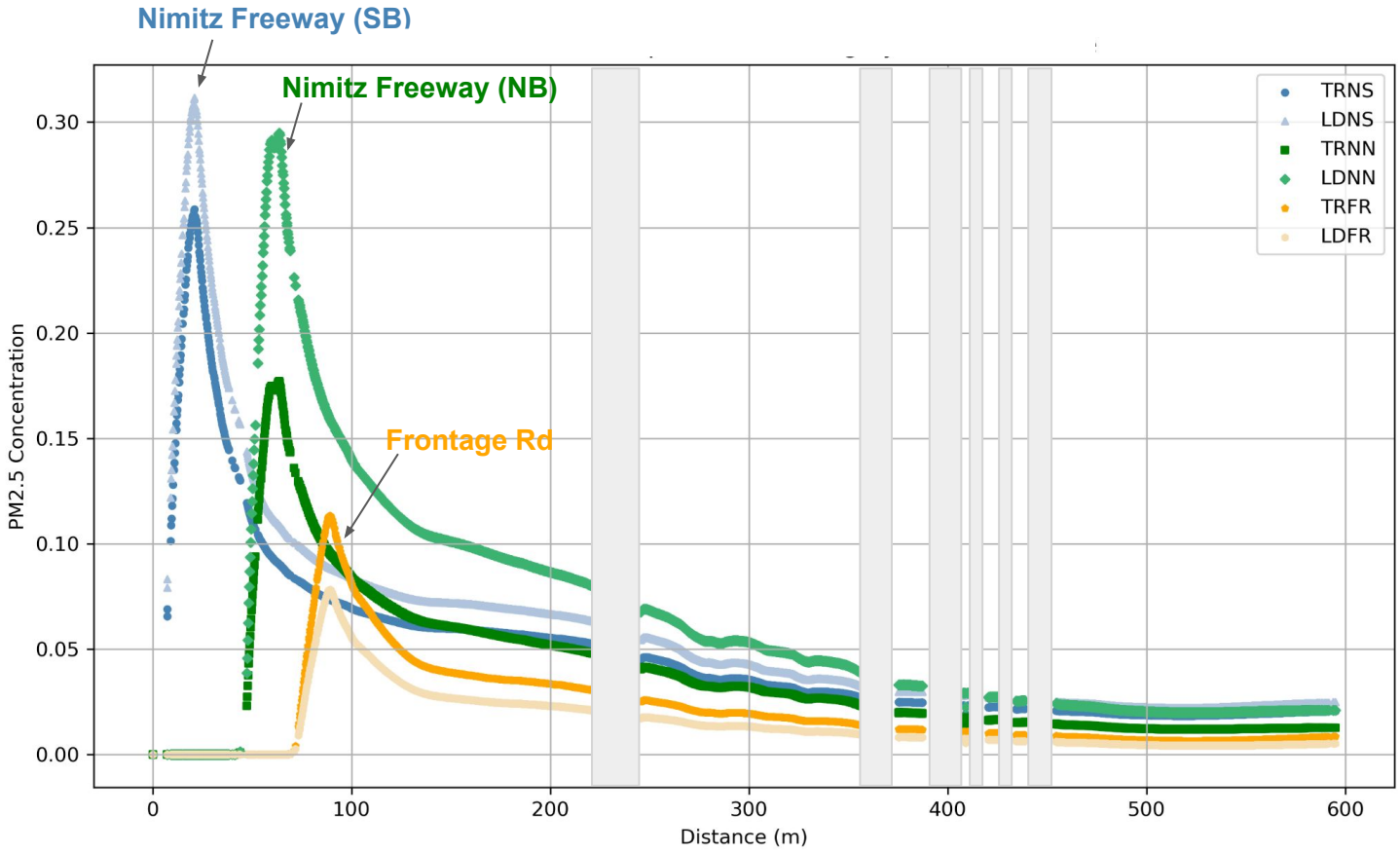


LD = Light-duty (passenger cars) TR = trucks

This graph shows the total traffic count at 1pm on a weekday for Frontage Road and the two lanes of the Nimitz Freeway.

The light-duty passenger cars make up 80-90% of the traffic for each of these roadways.

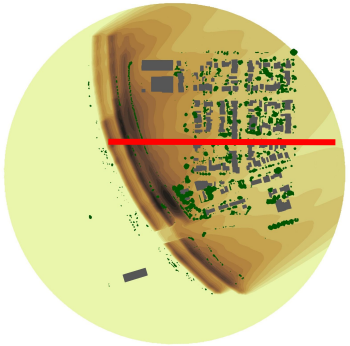
PM2.5 concentration **(Light-duty & Truck)** @ 1.5 m above ground



TRNS: Truck Nimitz (SB)
LDNS: Light-duty Nimitz (SB)

TRNN: Truck Nimitz (NB)
LDNN: Light-duty Nimitz (NB)

TRFR: Truck Frontage Rd
LDFR: Light-duty Frontage Rd



Building

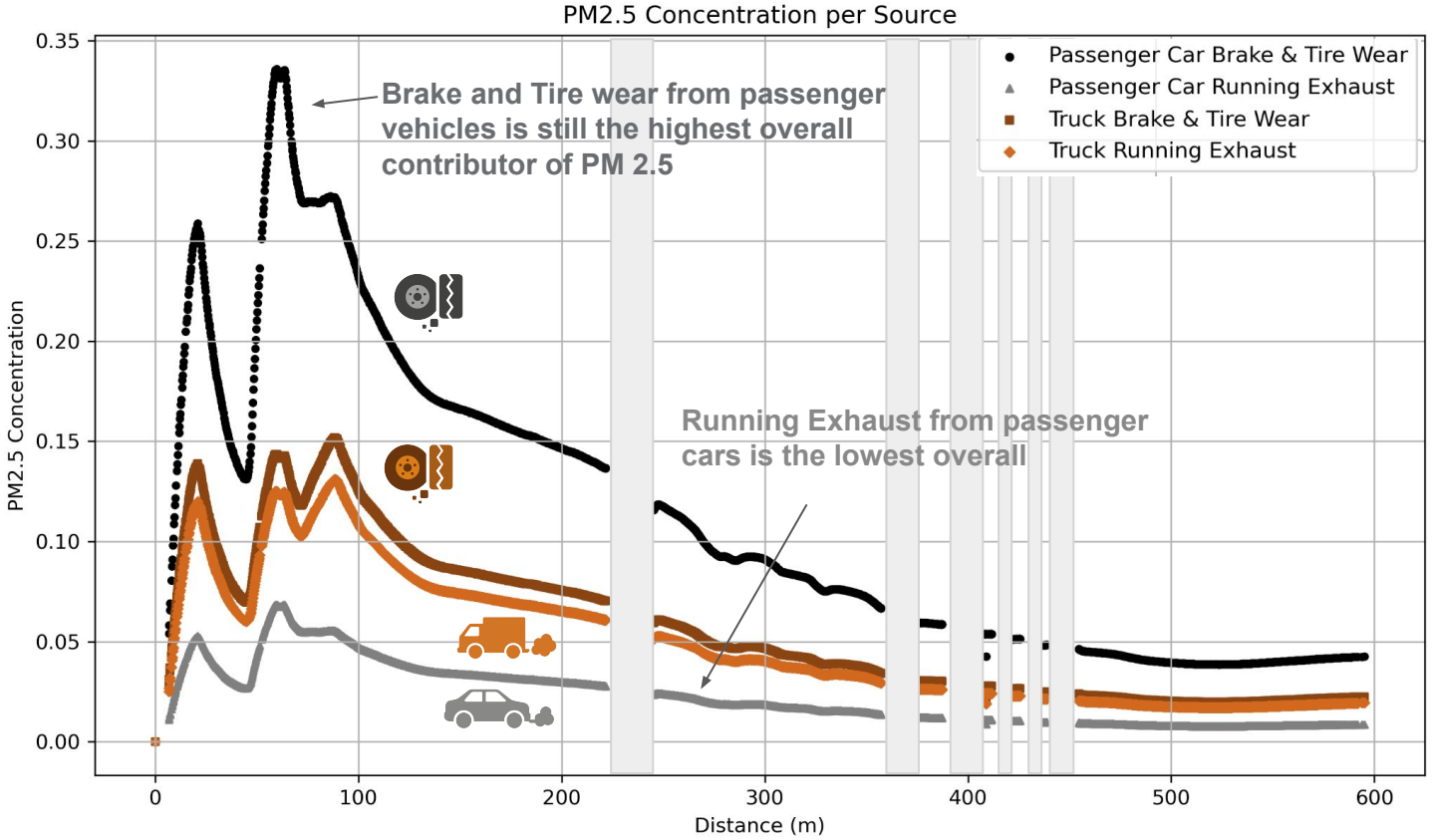
Emission Factors

EMFAC

Vehicle Category	Fuel Type	Total	Exhaust	Tire Wear	Brake Wear
Light-duty (passenger)	Gasoline	9.1×10^{-3}	16.9%	24.1%	58.9%
Medium-duty (trucks)	Diesel	5.8×10^{-2}	47.8%	6.8%	45.4%
Heavy-duty (trucks)	Diesel	4.9×10^{-2}	44.1%	11.9%	43.9%

- PM2.5 emitted by the vehicle per distance travelled
- **Exhaust Emissions** come out of the vehicle tailpipe while traveling on the road.
- **Tire Wear Emissions** and **Brake Wear Emissions** originate from tires and brakes as a result of wear.

PM 2.5 concentration by source pedestrian level



This means that even if passenger cars eventually become electric, that is only reducing the smallest contributor to PM 2.5.

Building

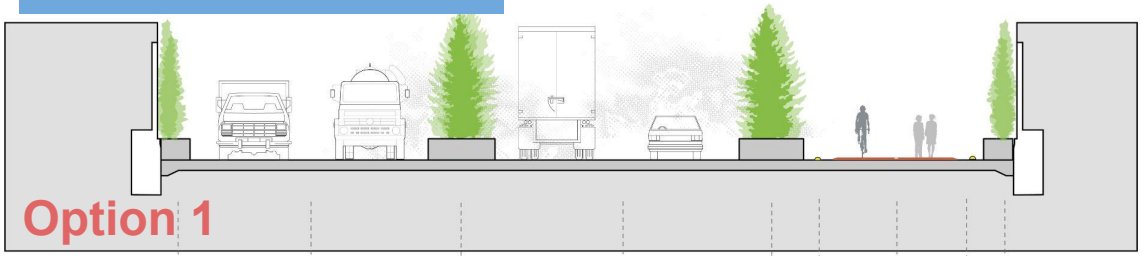
Key Takeaways:

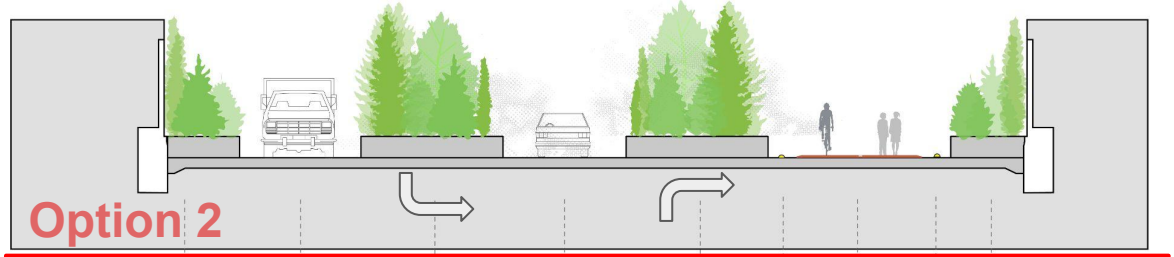
1. The majority of pollution is coming from the freeway rather than frontage road
   - Emissions from the freeway are being primarily produced by light-duty (passenger) vehicles.
   - Emissions from frontage road are predominantly from trucks

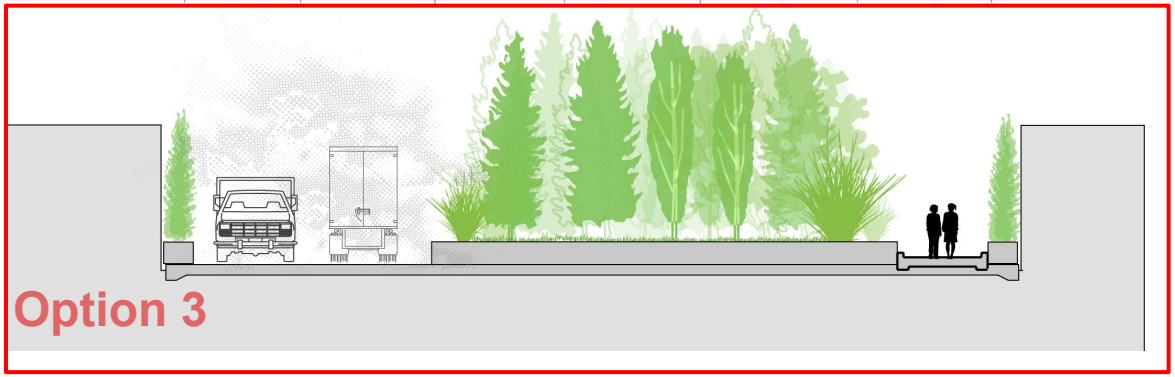
2. Brake and Tire wear is the highest contributors of PM 2.5 for operational emissions for both light-duty (passenger) and heavy-duty (trucks) vehicles.
   - If all light-duty (passenger) vehicles were suddenly electric, only ~10% of the PM2.5 concentration is removed.

Design Development

Frontage Road Diet





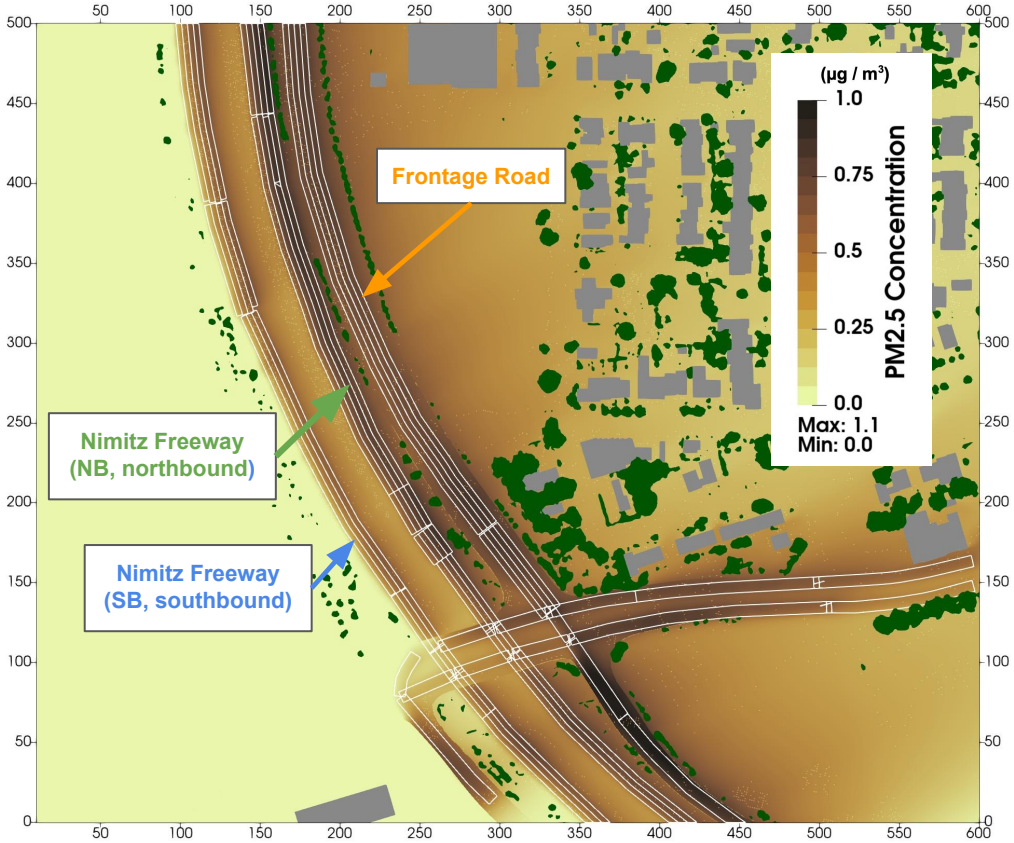


The initial ENVI-met models of Option 1 were not having the desired buffer effects.

Of the initial designs, Option 3 was favored at initial WOCAP feedback meetings.

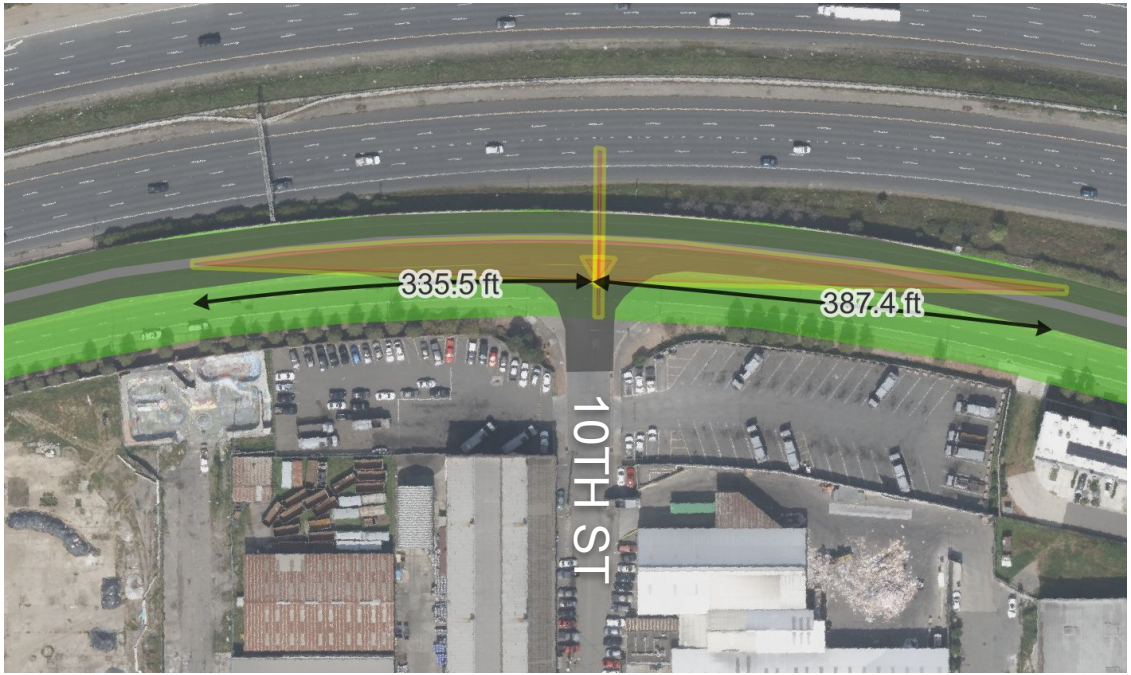
It was decided that the designs moving forward would explore a larger planter on one side, leaving either 1 or 2 lanes in each direction.

Incorporating traffic data



Initial CFD models of the newly acquired traffic data showed that the freeway was contributing a majority of the pollution.

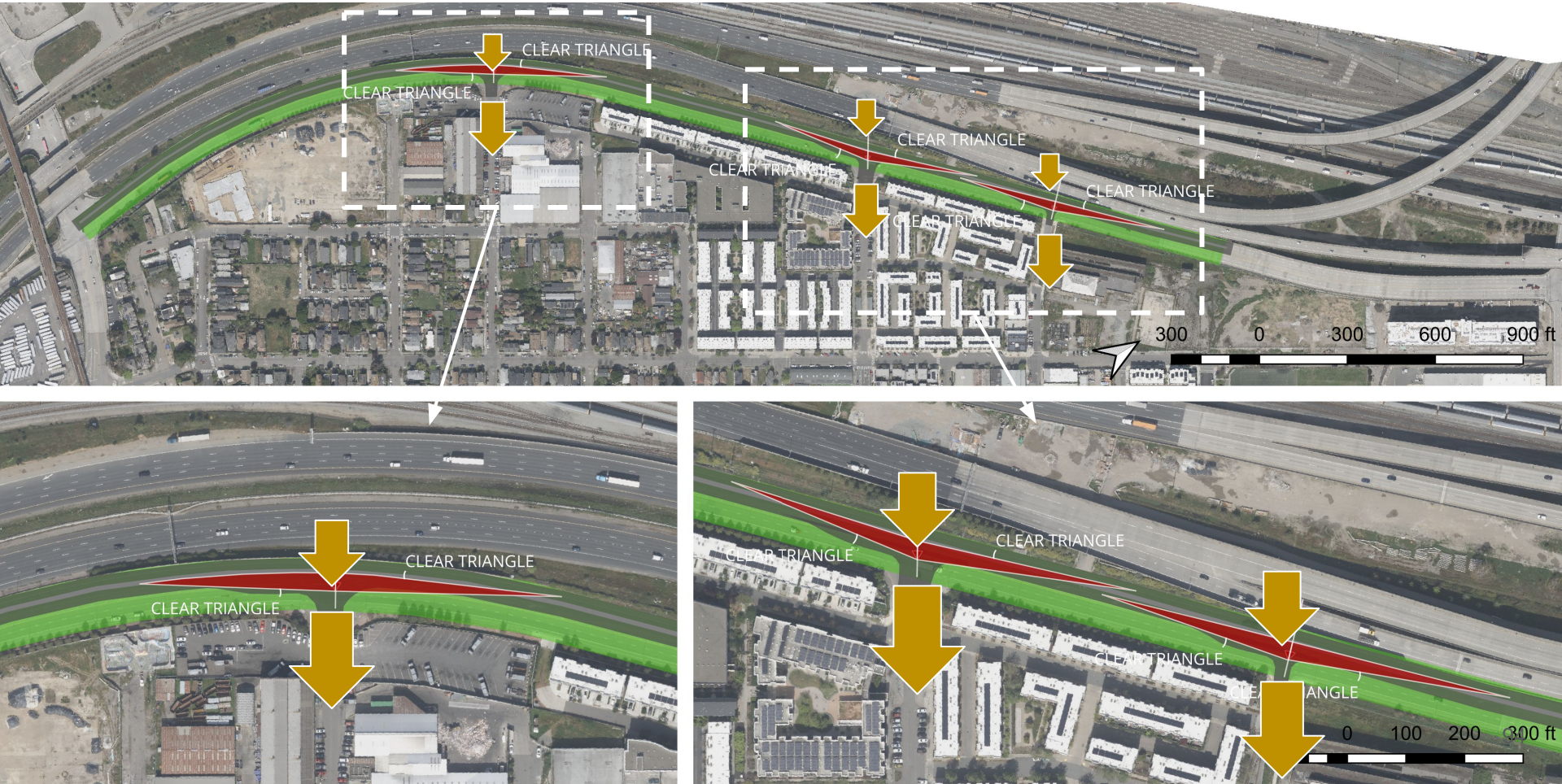
Intercepting the pollution from the freeway should be prioritized in the next buffer designs.



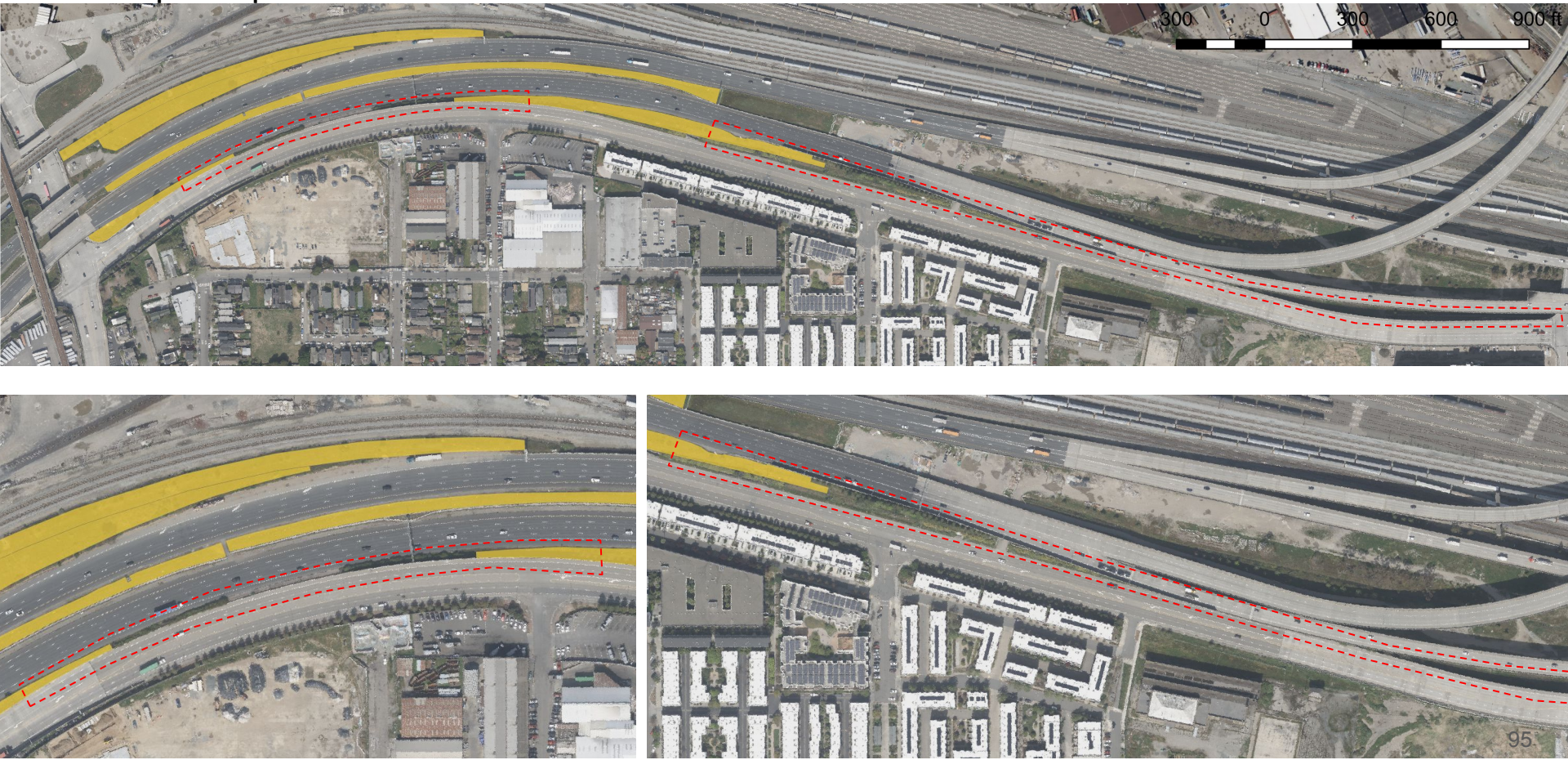
At intersections there is a gap in the buffer.

The thickness also must be reduced to accommodate sight lines.

There are 3 intersections along Frontage Road where this occurs.



The plantable area along Caltrans ROW thins or disappears in several places. The road diet could help compensate in those areas.



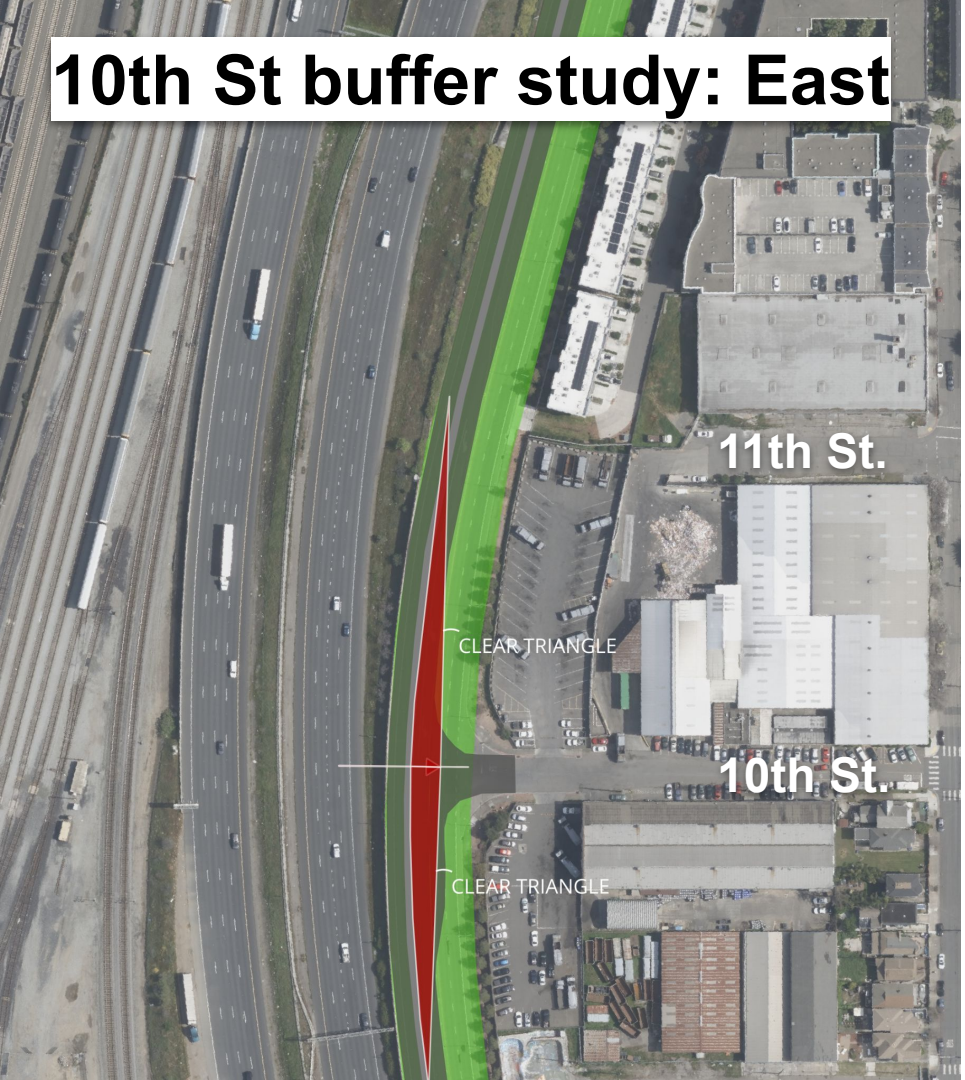
A buffer on the western side of Frontage could be continuous

Eastern Buffer - blocks both freeway and frontage, but with gaps

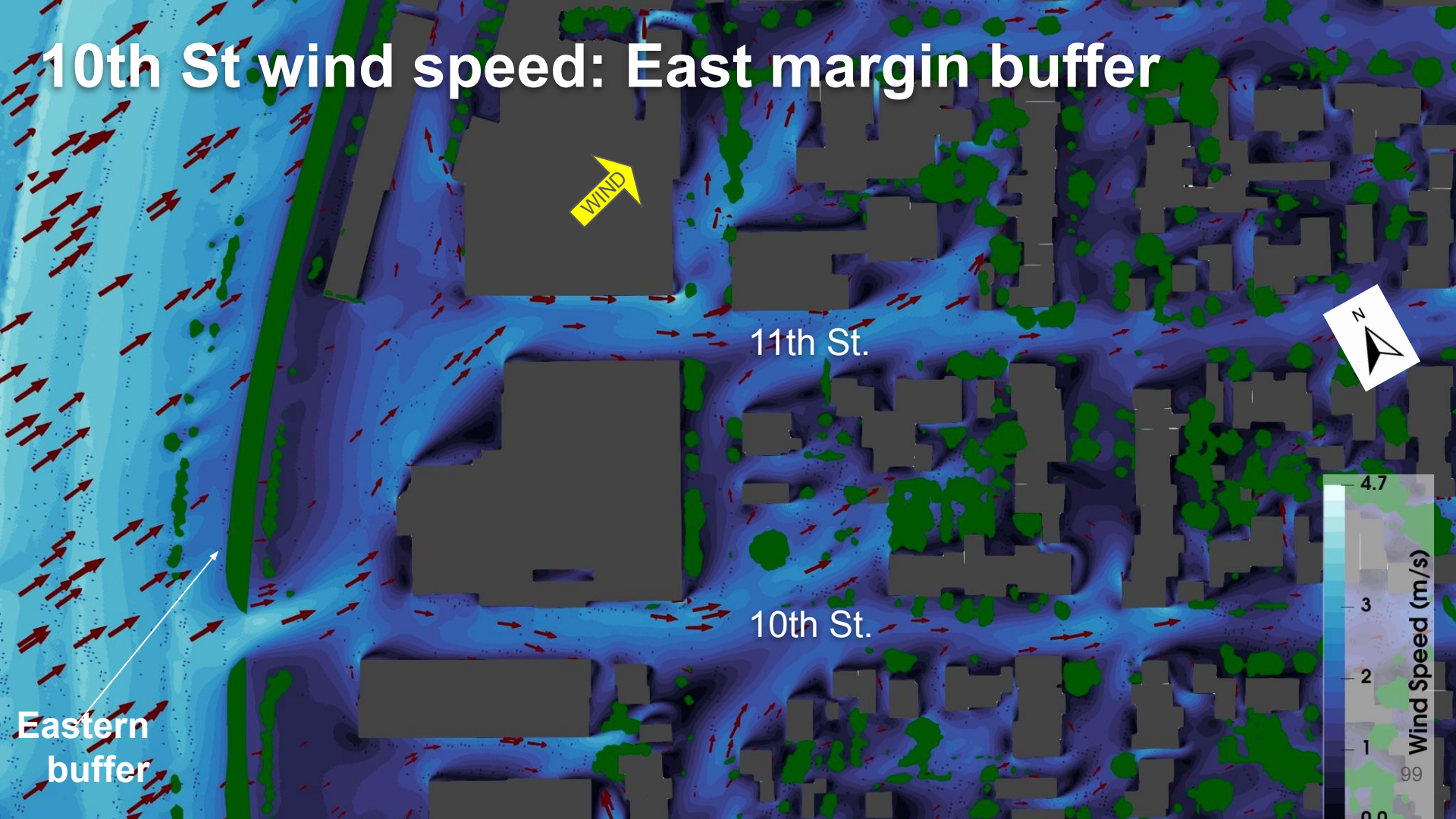
Western Buffer - completely blocks the freeway, doesn't block frontage.

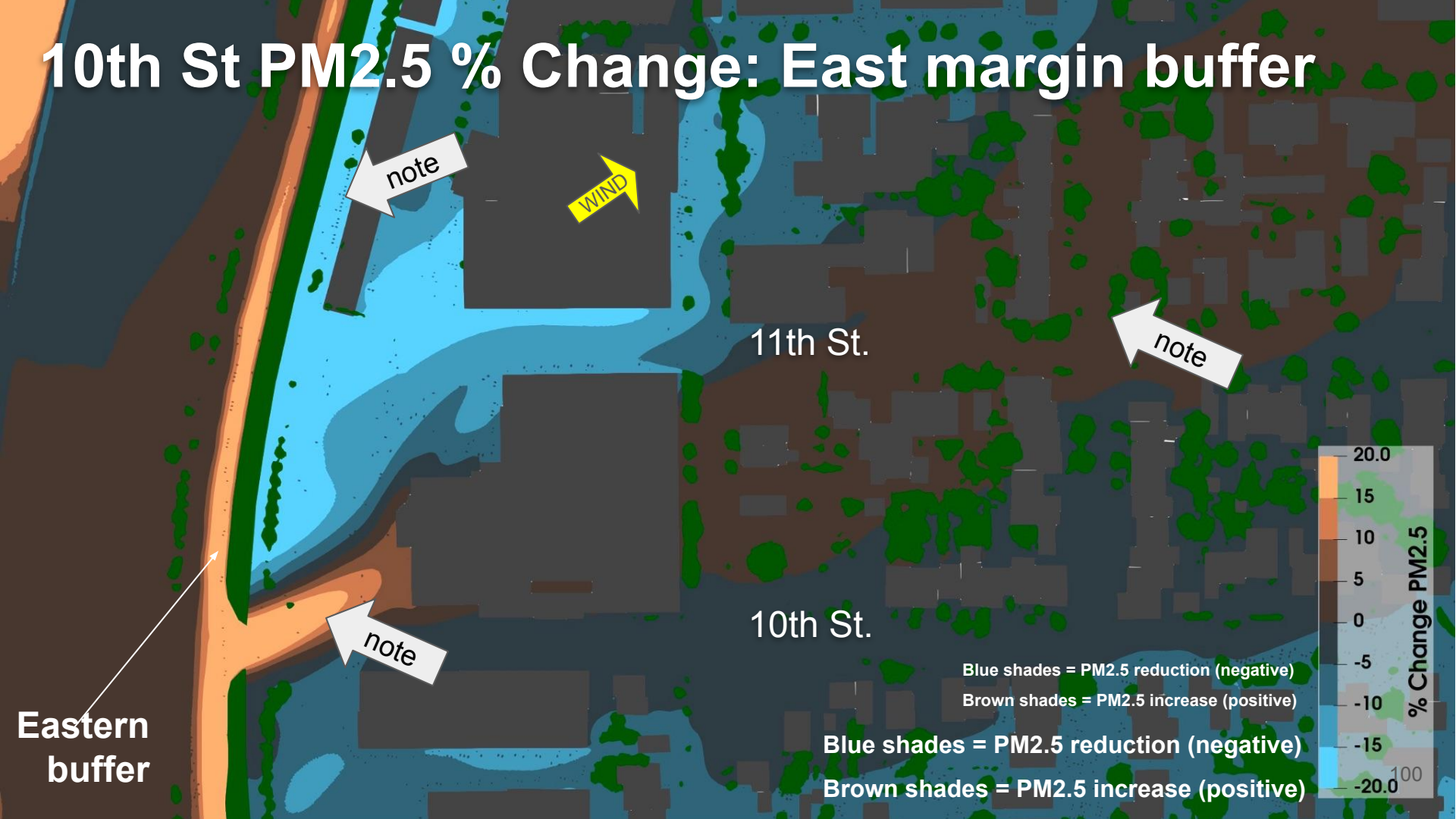
The next simulations would compare these two design alternatives.

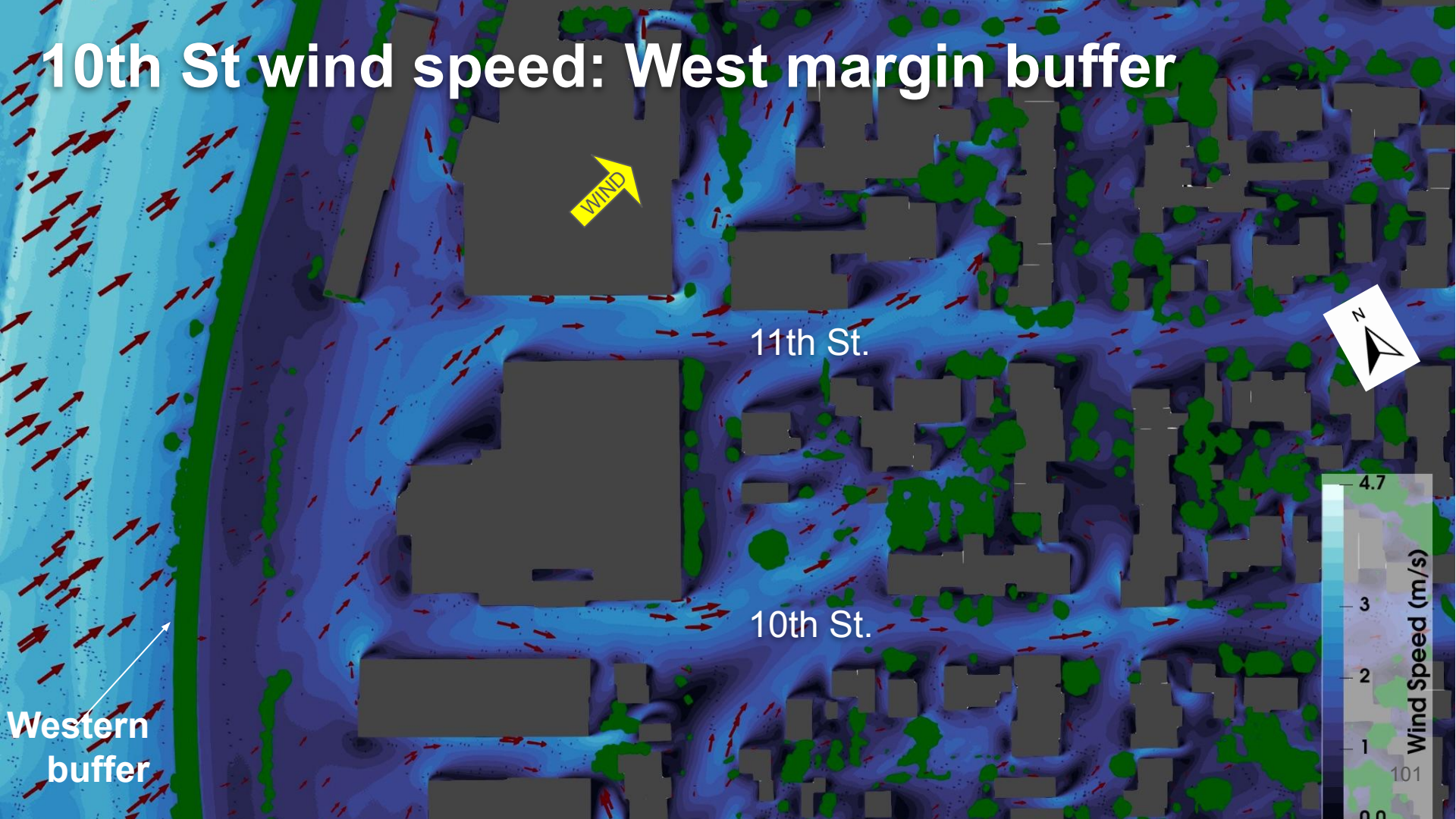
Comparing Eastern vs Western Buffers


10th St buffer study: East
11th St.
CLEAR TRIANGLE
10th St.
CLEAR TRIANGLE

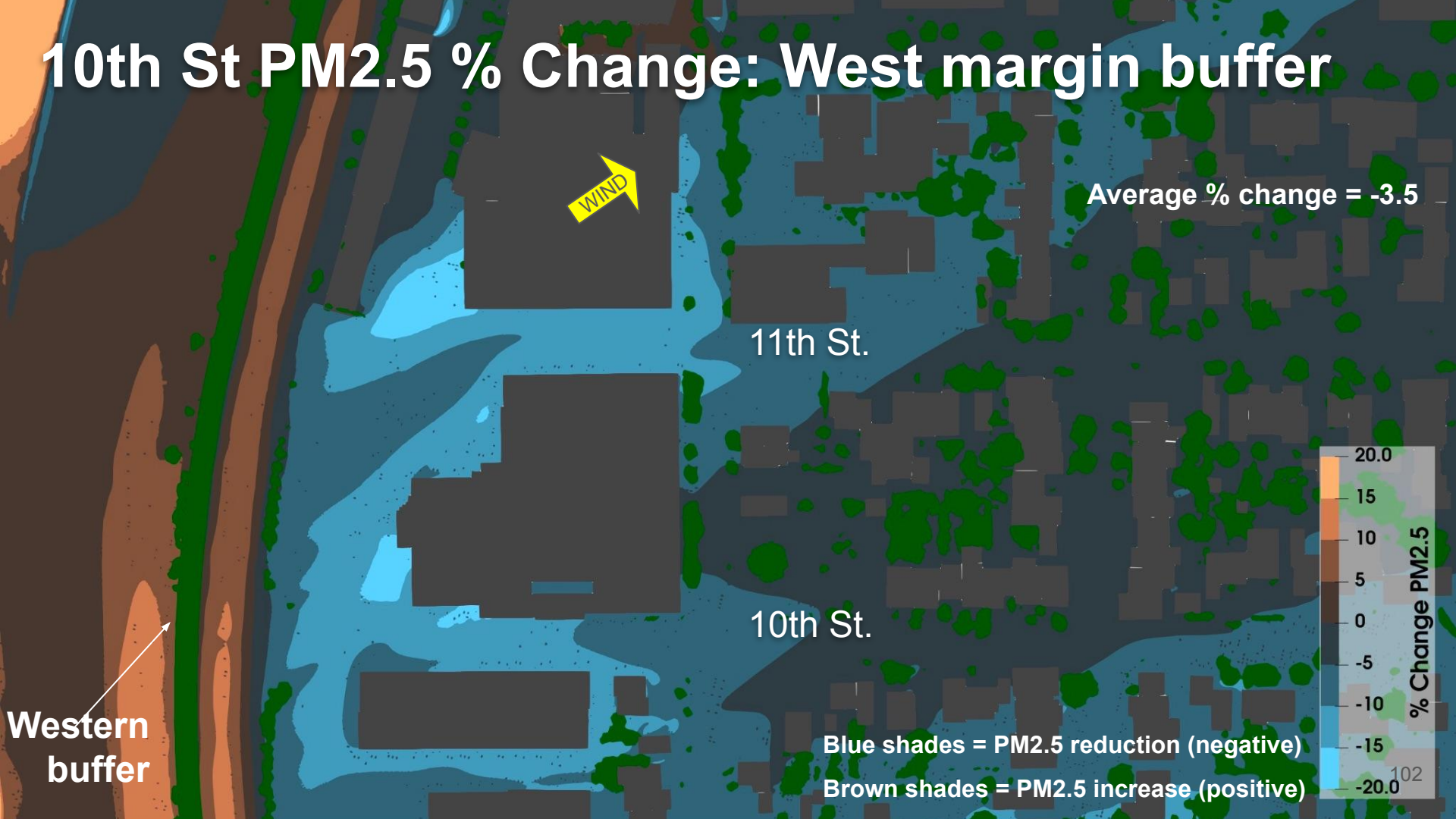

10th St buffer study: West
11th St.
10th St.

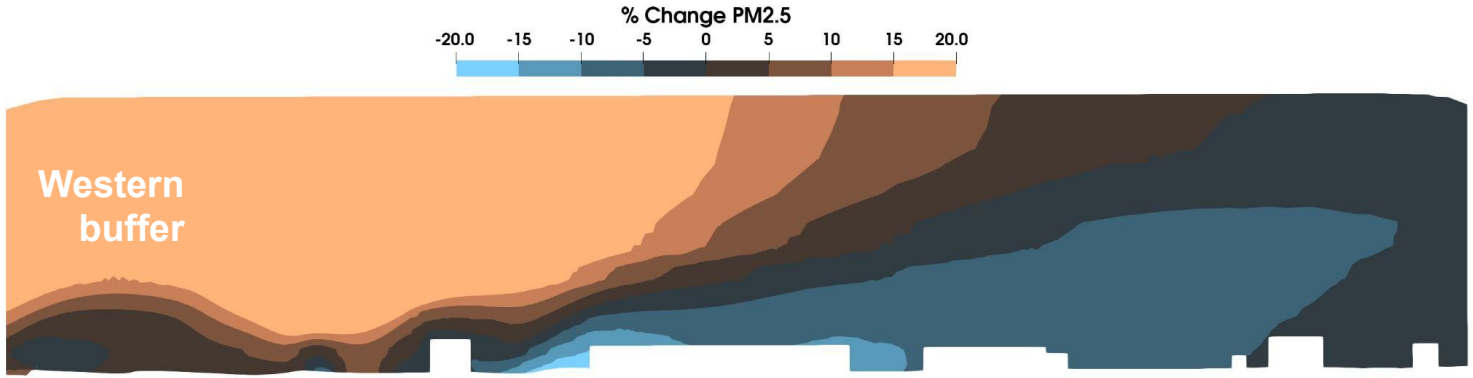

10th St wind speed: East margin buffer
WIND
11th St.
10th St.
N
Eastern buffer
4.7
3
2
1
0.0
Wind Speed (m/s)
99

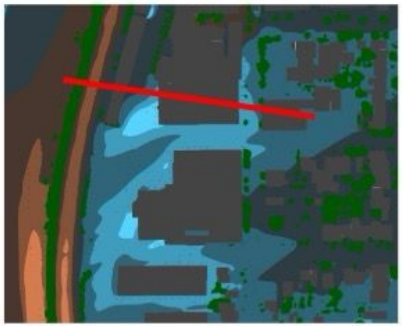

10th St PM2.5 % Change: East margin buffer
note
WIND
11th St.
note
10th St.
note
Eastern buffer
Blue shades = PM2.5 reduction (negative)
Brown shades = PM2.5 increase (positive)
20.0
15
10
5
0
-5
-10
-15
-20.0
% Change PM2.5
Blue shades = PM2.5 reduction (negative)
Brown shades = PM2.5 increase (positive)
100

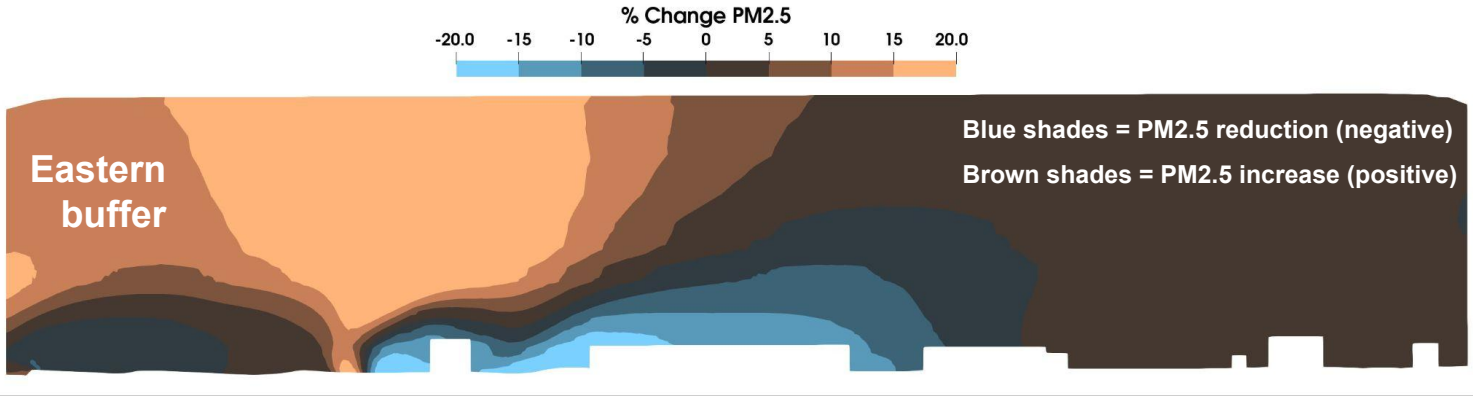

10th St wind speed: West margin buffer
WIND
11th St.
10th St.
N
4.7
3
2
1
0.0
Wind Speed (m/s)
101
Western buffer

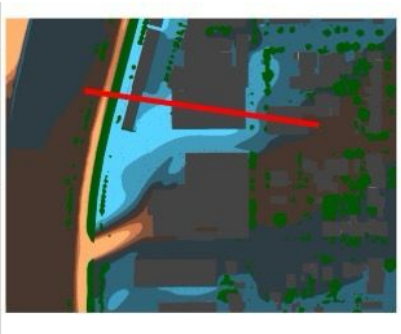
10th St PM2.5 % Change: West margin buffer





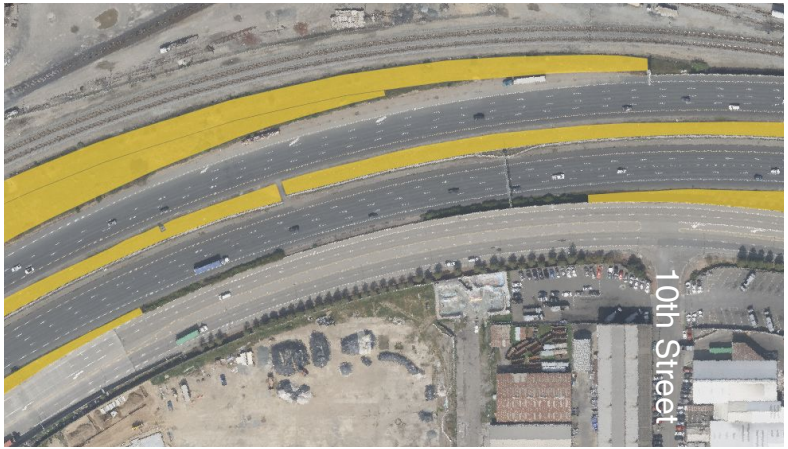






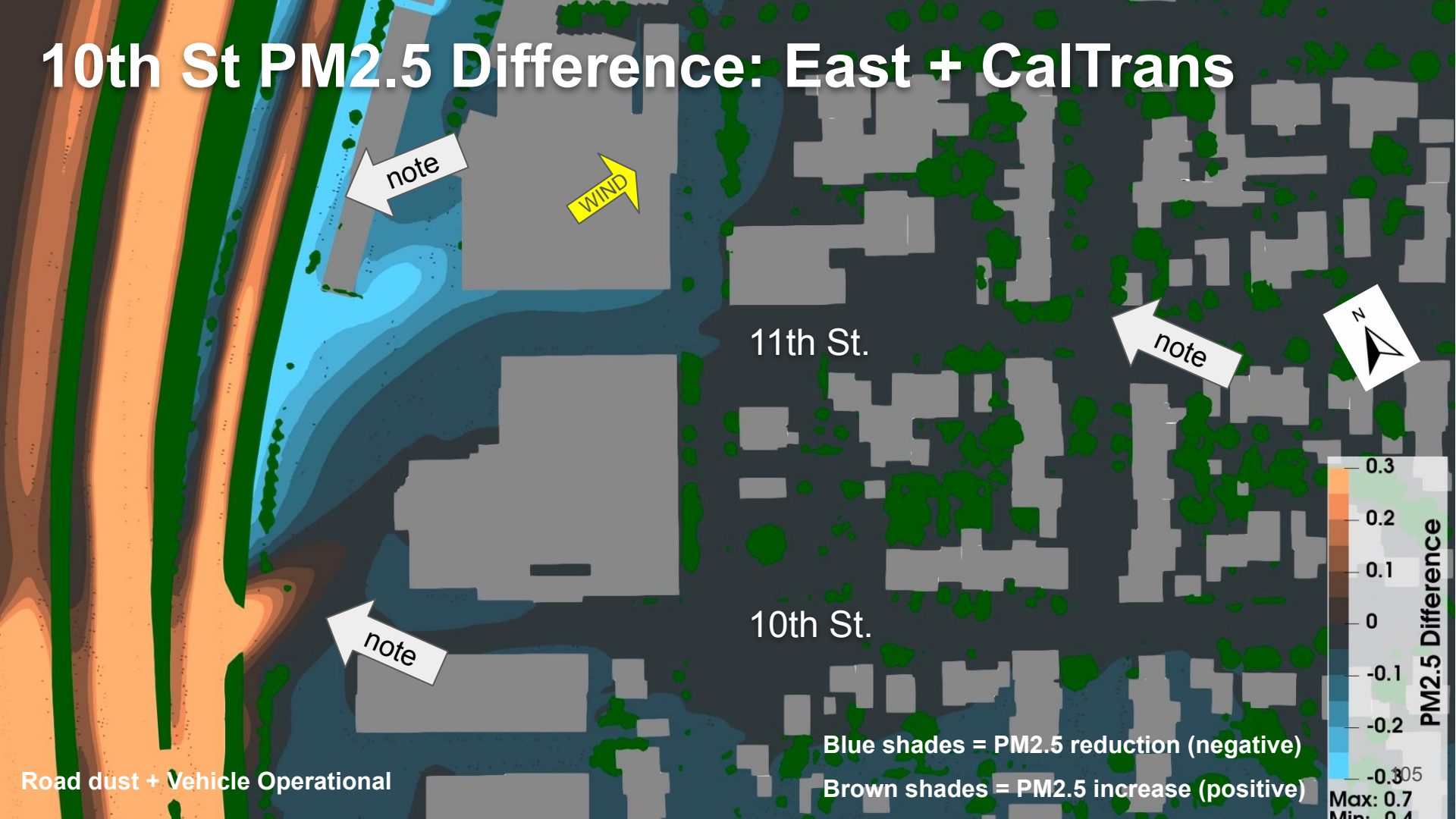
In section the pollution can be seen pluming over the neighborhood.
The area next to the building, where the sidewalk is, is significantly better with the eastern buffer. The overall pollution interception is better with a western buffer.

How does planting Caltrans impact the pollution?

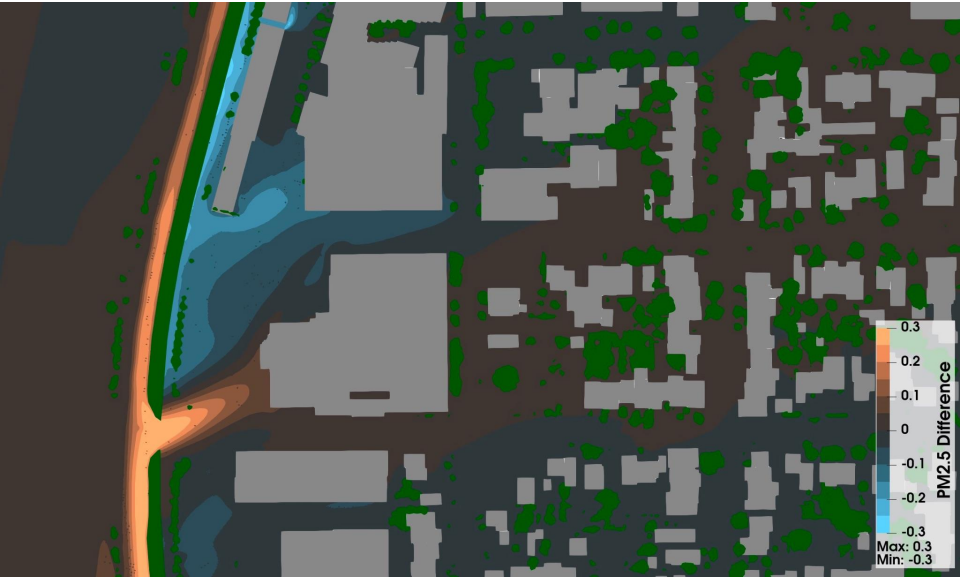


There could be opportunities in the future to plant a buffer along the Caltrans ROW.

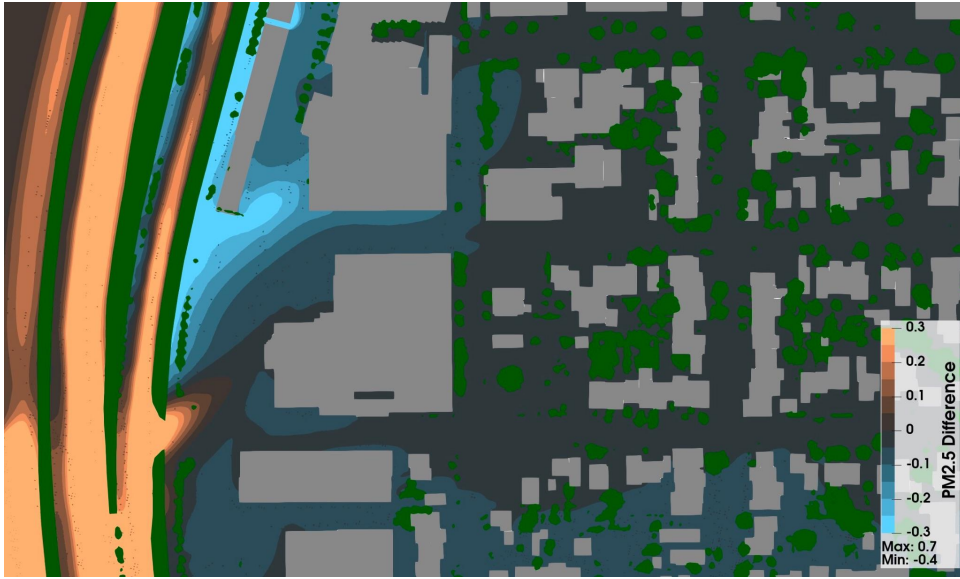
The eastern and western buffers at 10th were modeled with the addition of a Caltrans planting, to see how this would impact the interception of pollution.


10th St PM2.5 Difference: East + CalTrans
note
WIND
11th St.
note
N
note
10th St.
Blue shades = PM2.5 reduction (negative)
Brown shades = PM2.5 increase (positive)
Road dust + Vehicle Operational
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
PM2.5 Difference
Max: 0.7

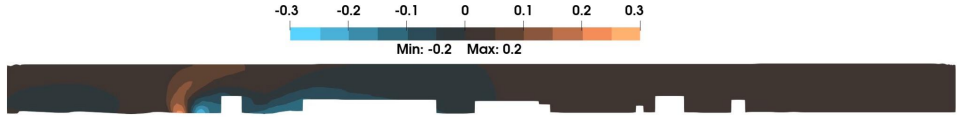
Eastern Buffer PM 2.5 concentration comparison

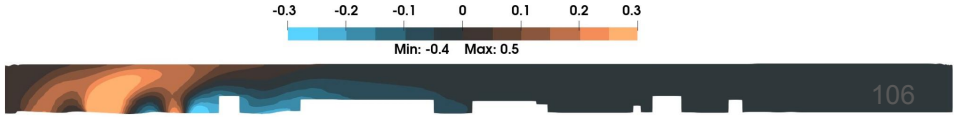


Eastern Buffer Alone

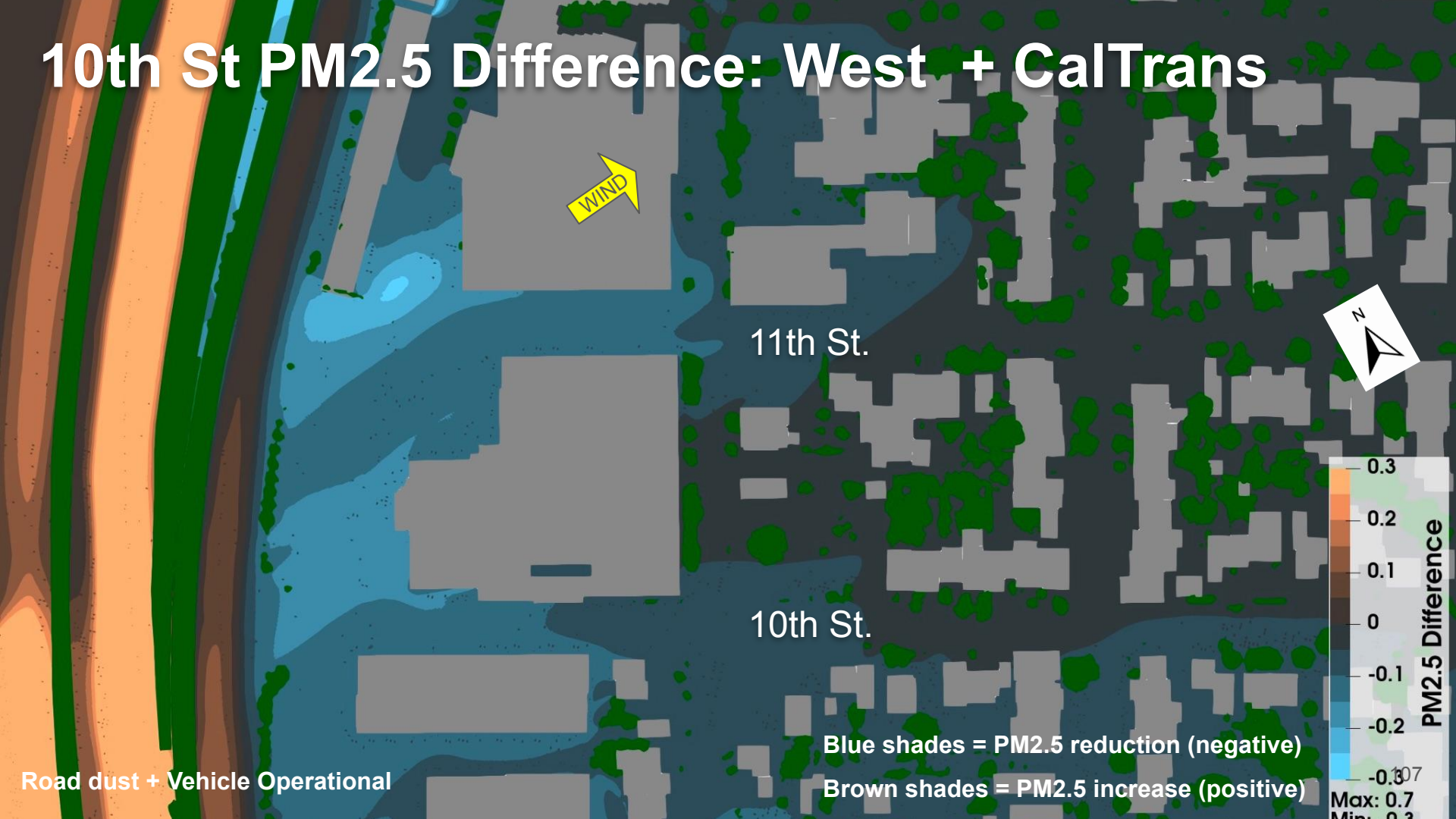


Eastern Buffer with
Caltrans ROW planting

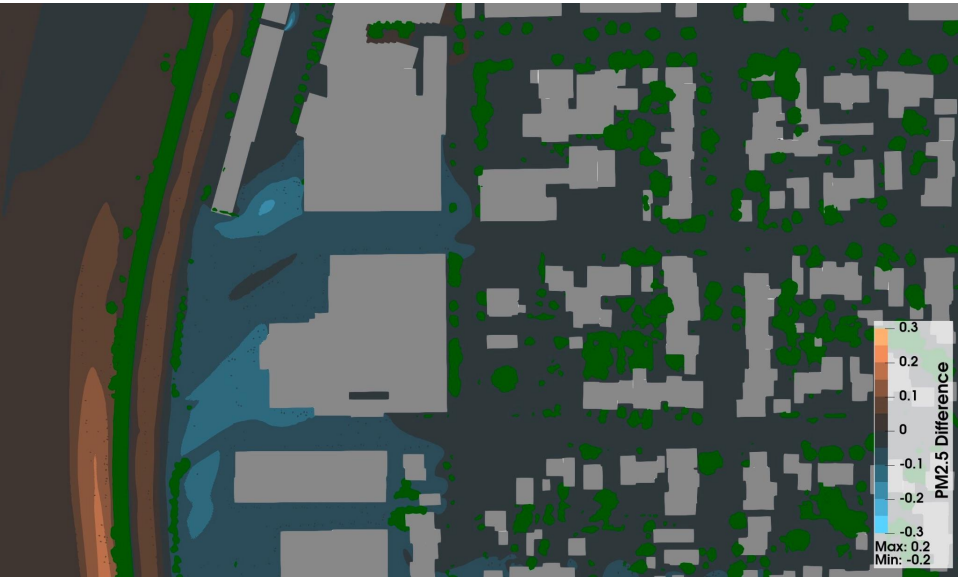




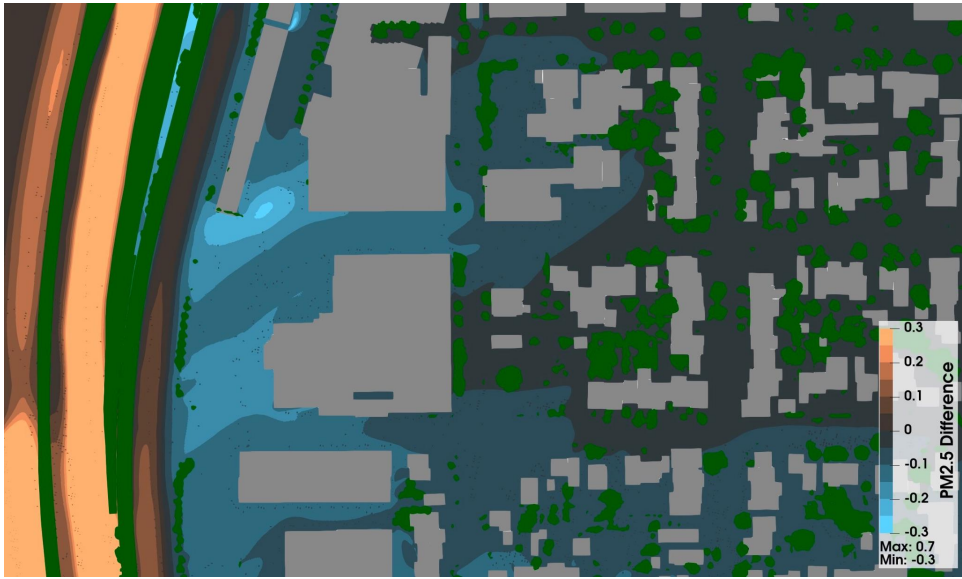
10th St PM2.5 Difference: West + CalTrans



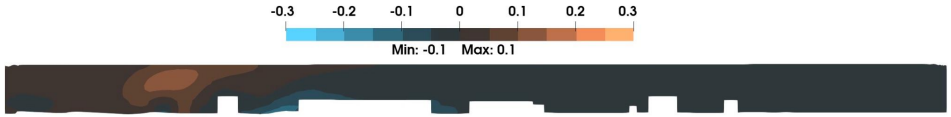
Western Buffer PM 2.5 concentration comparison

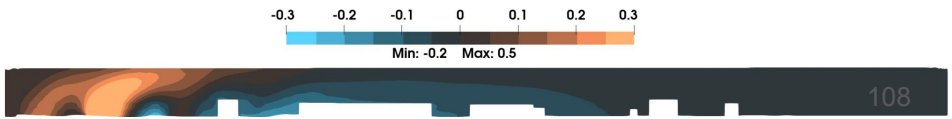


Western Buffer Alone

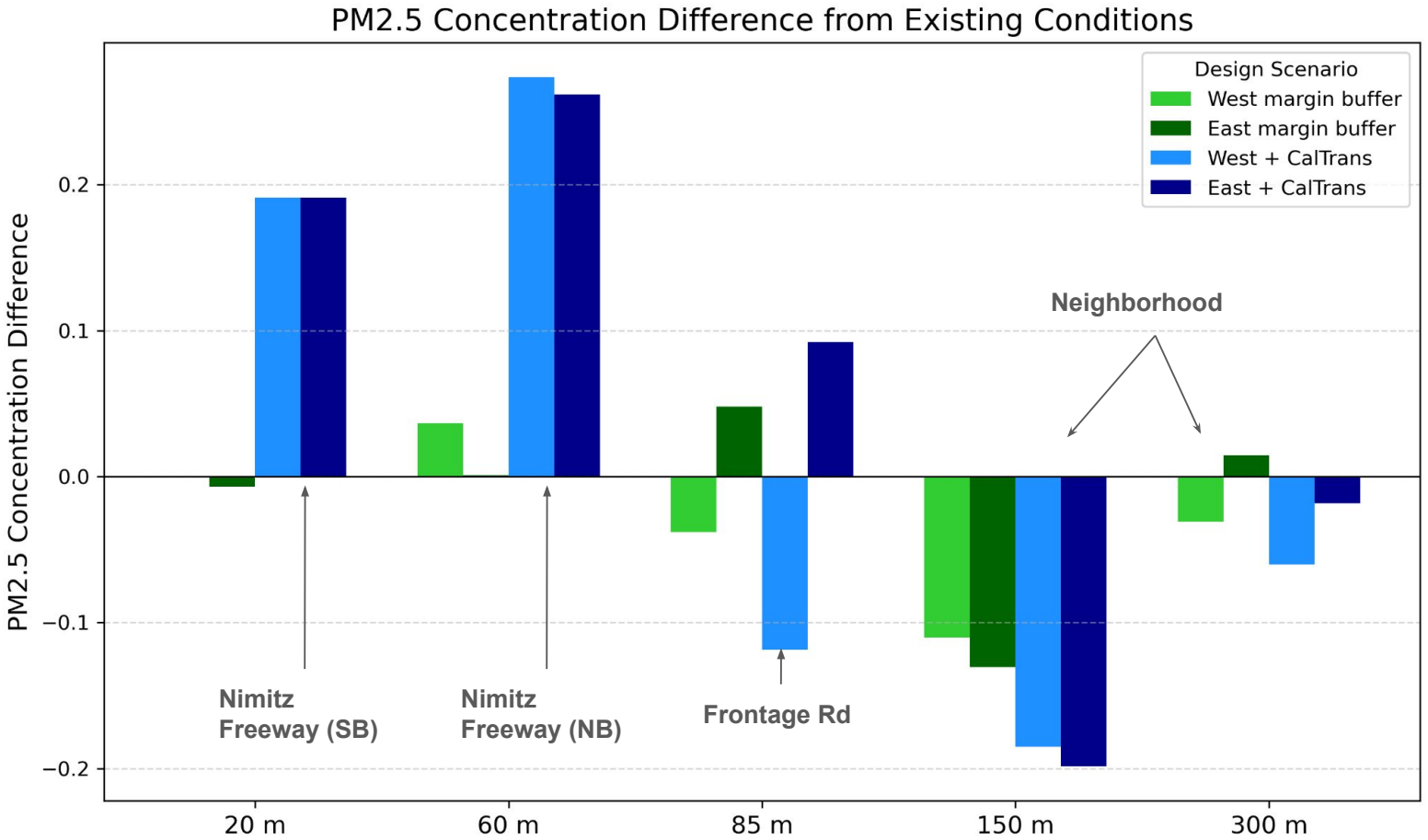


Western Buffer with
Caltrans ROW planting



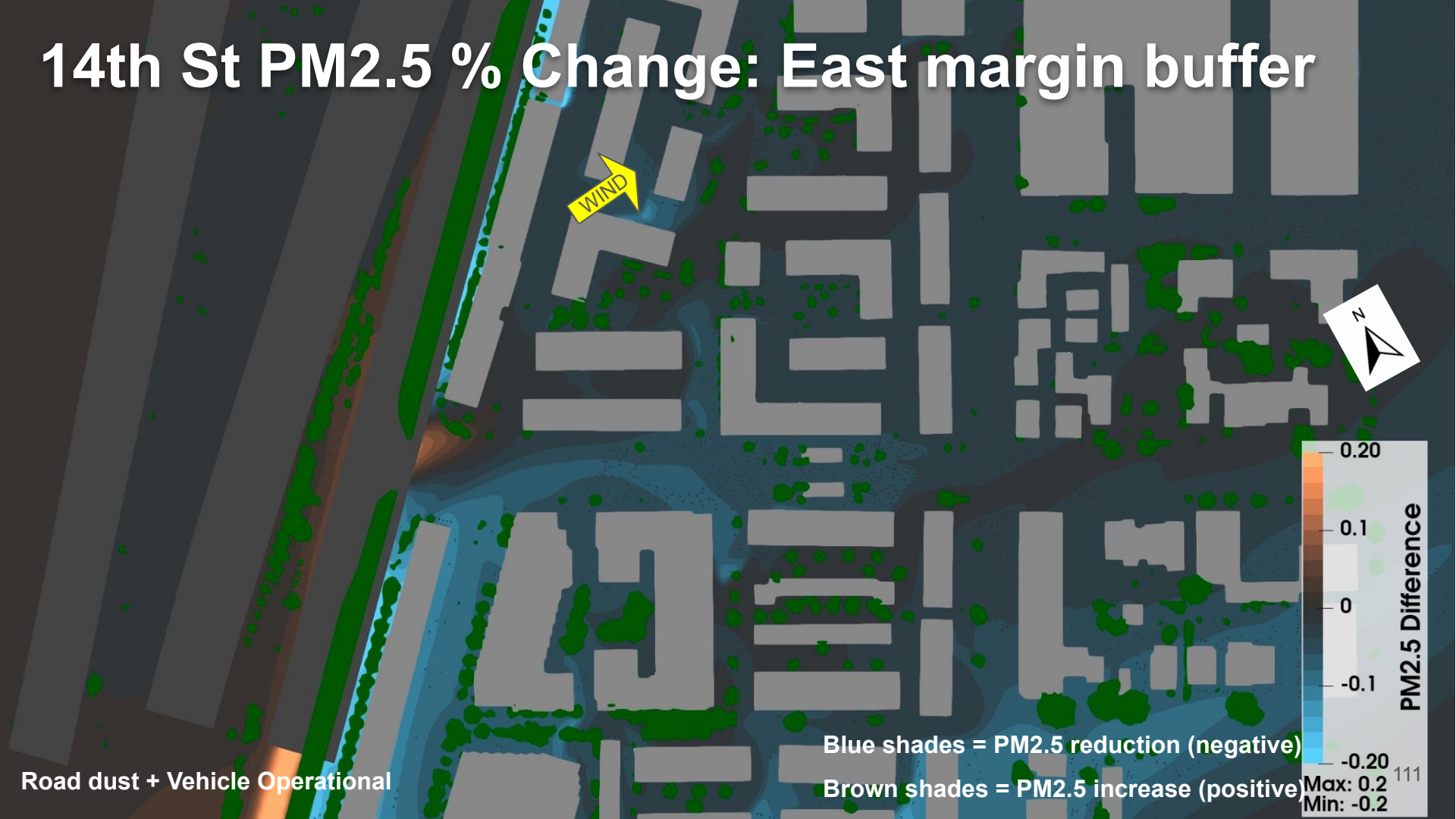


Comparing all scenarios at 10th

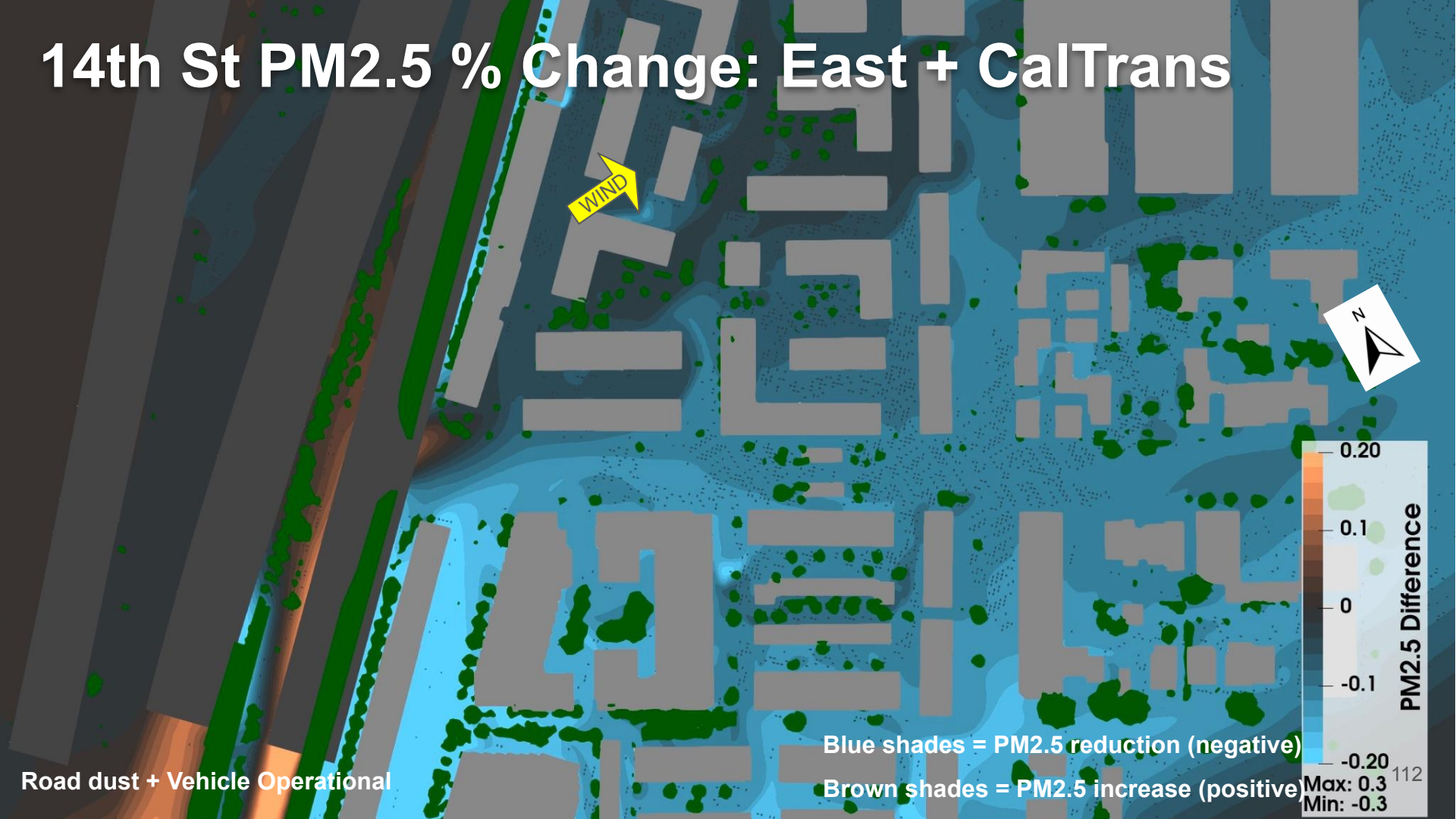


Comparing Eastern vs Western Buffers

14th St PM2.5 % Change: East margin buffer

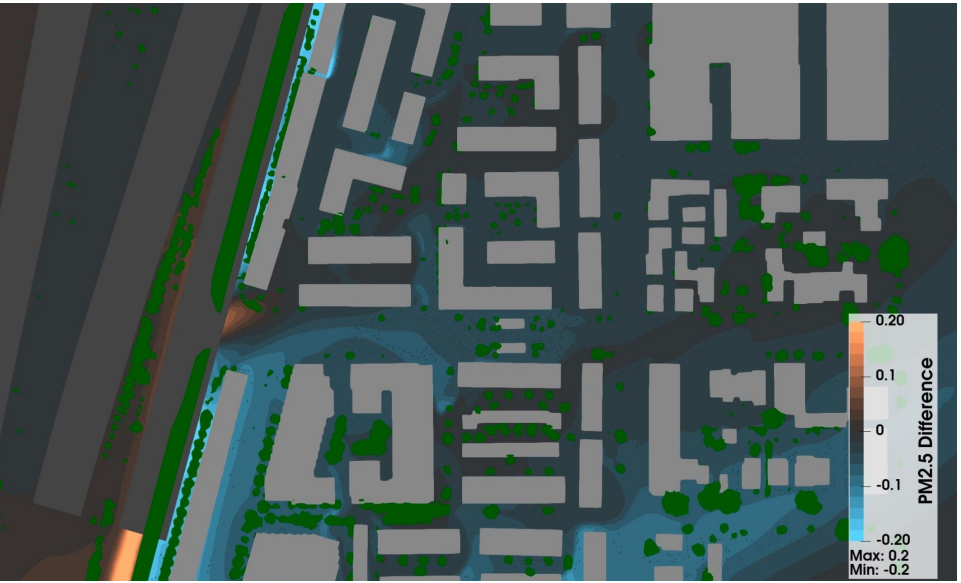


14th St PM2.5 % Change: East + CalTrans

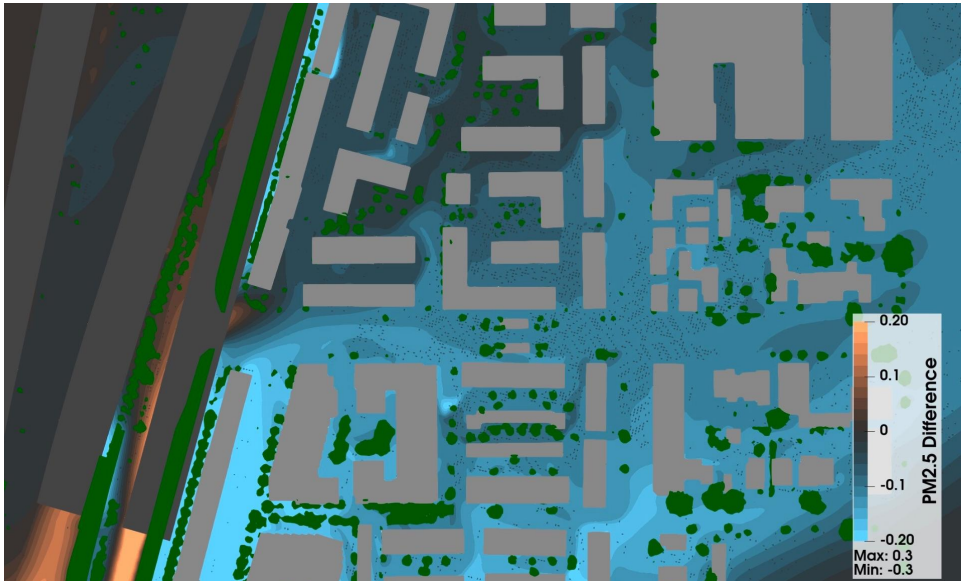


Eastern Buffer PM 2.5 concentration comparison

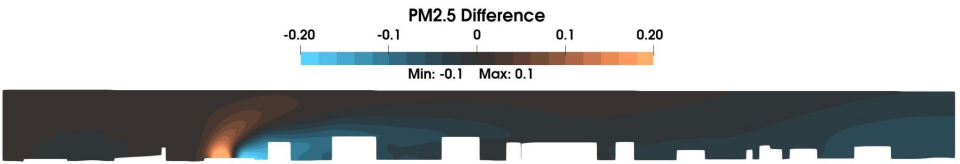
Note: this is concentration at 1.5 meters, pedestrian level. That is why the freeway pollution is not shown as the freeway rises

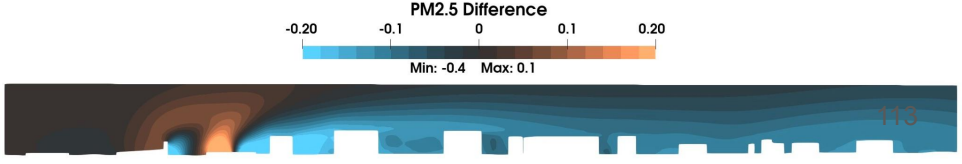


Eastern Buffer Alone

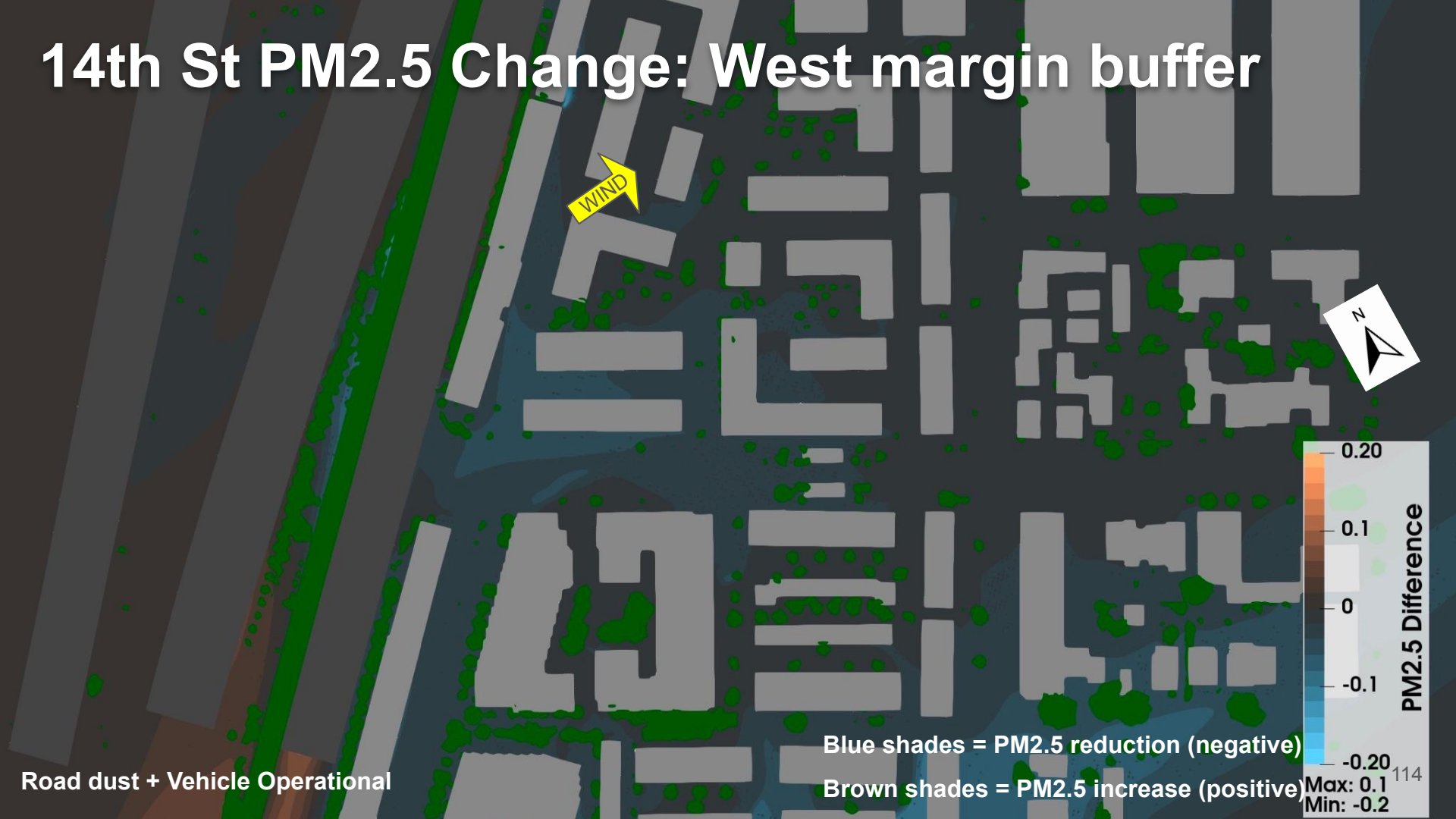


Eastern Buffer with
Caltrans ROW planting





14th St PM2.5 Change: West margin buffer

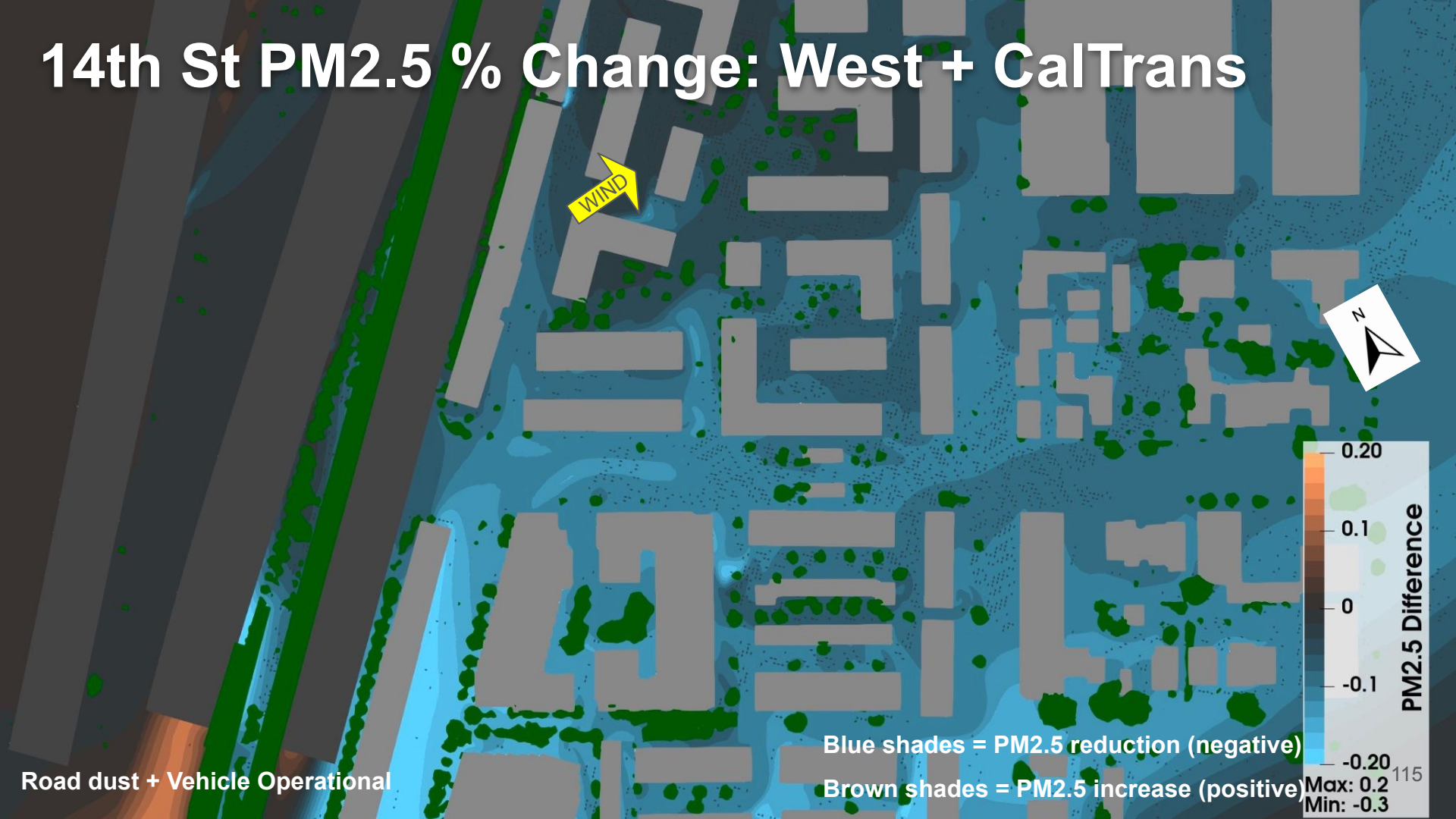


Blue shades = PM2.5 reduction (negative)

Brown shades = PM2.5 increase (positive)

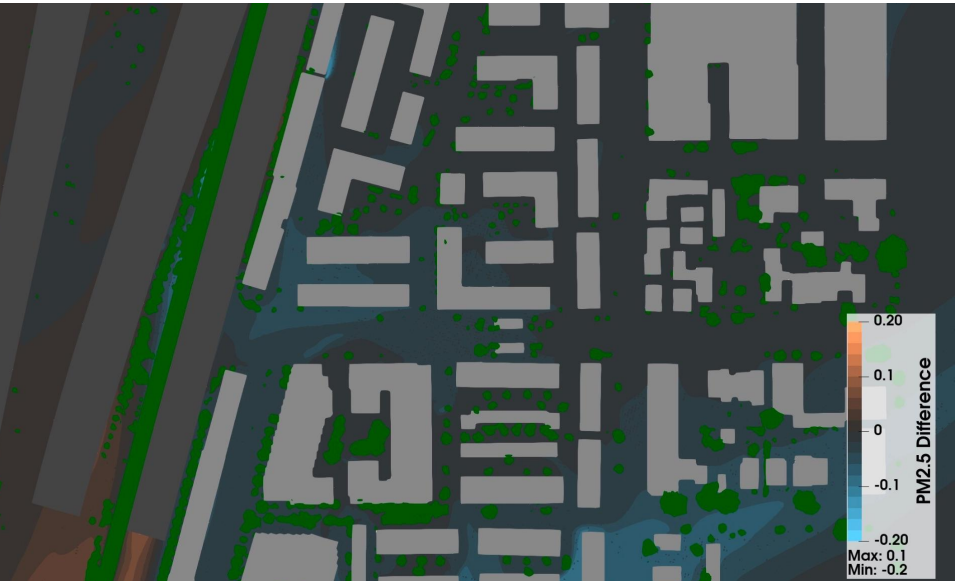
Road dust + Vehicle Operational

14th St PM2.5 % Change: West + CalTrans

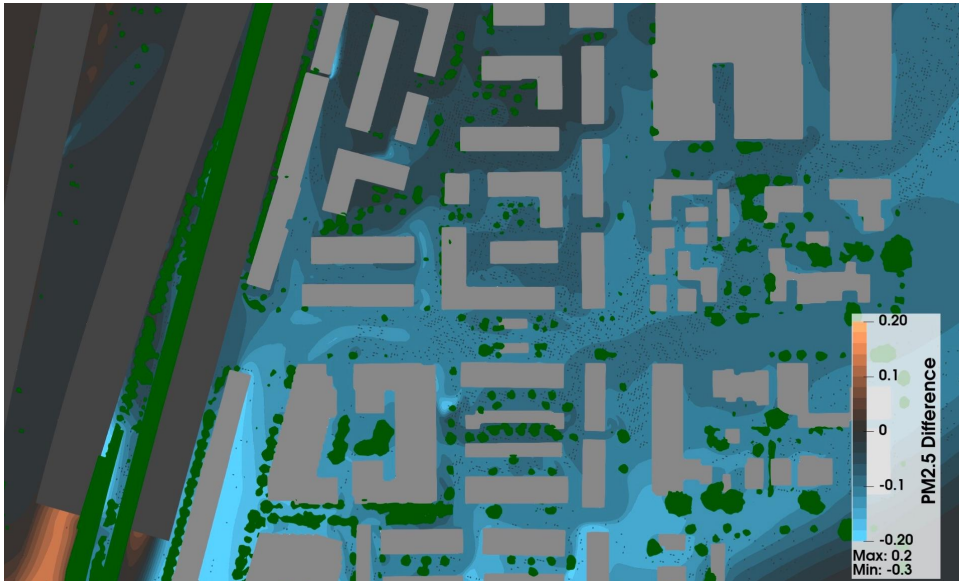


Western Buffer PM 2.5 change comparison

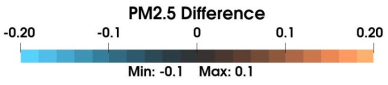
Note: this is concentration at 1.5 meters, pedestrian level. That is why the freeway pollution is not shown as the freeway rises

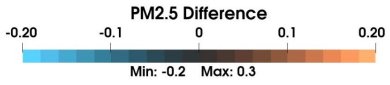


Western Buffer Alone

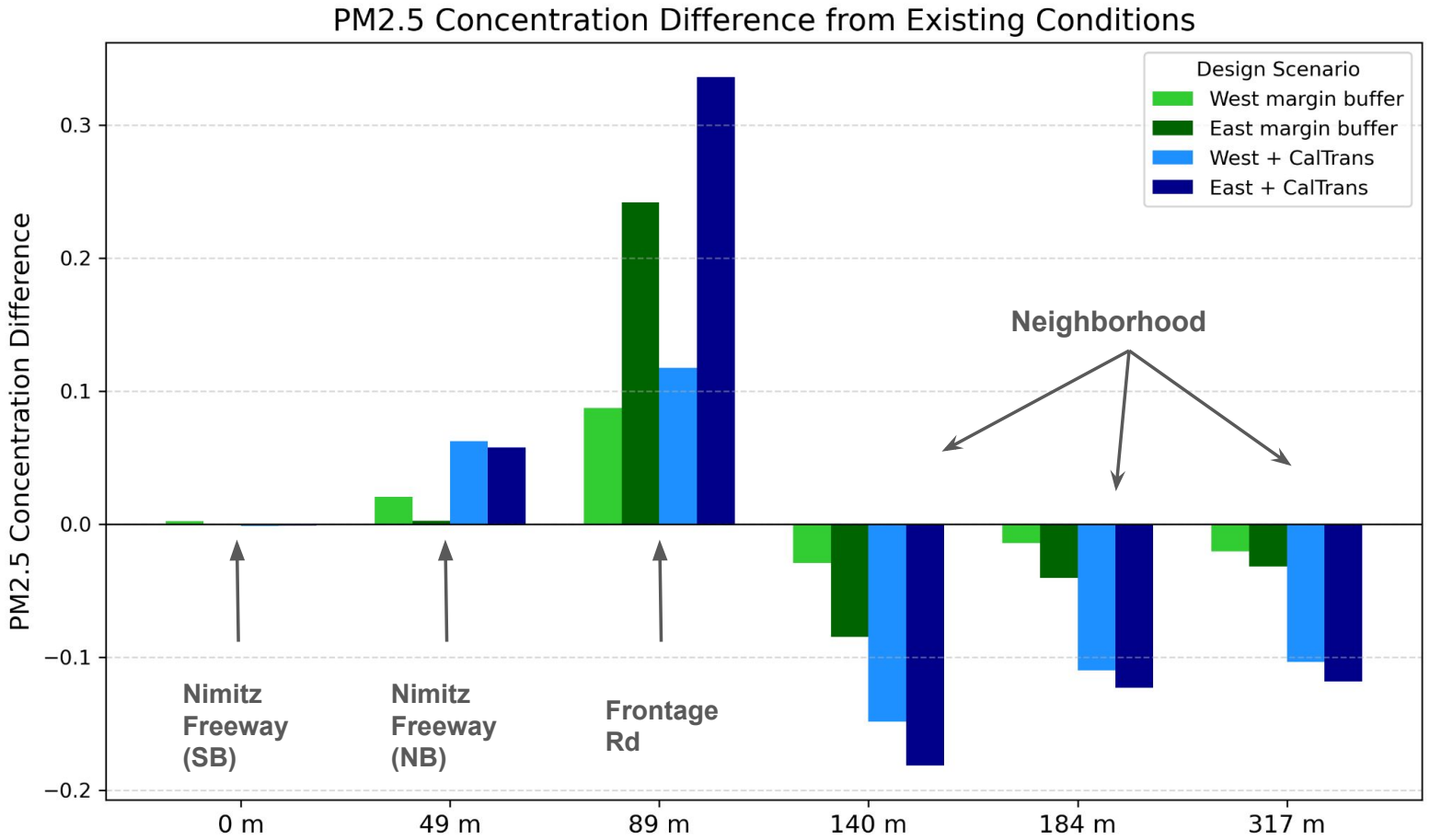


Western Buffer with
Caltrans ROW planting





Comparing all scenarios at 14th



Concept Designs

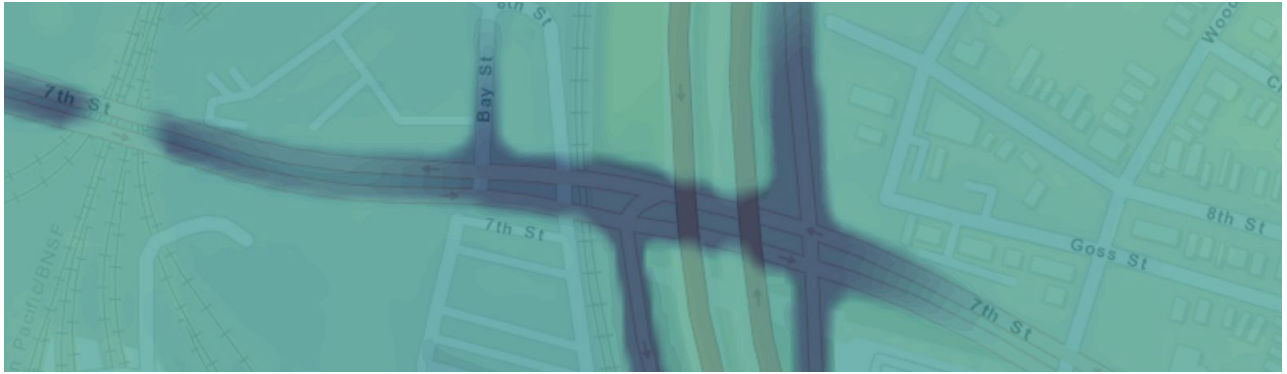
Concept Designs

The final concept designs explore a strategic hybrid of the east and western buffers to attempt to capture the benefits of both approaches.

- The western buffer can buffer the freeway at critical points to maximize the benefits to air quality.
- An eastern buffer to the north can create visual & sonic separation between Frontage and the densely populated apartment buildings.

Concept Designs

Lower elevation at 7th creates flooding issues



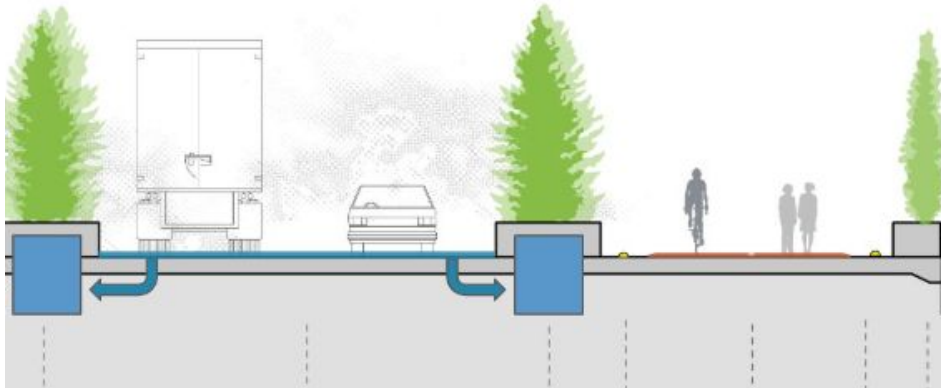
Elevation maps show that the intersection of 7th and Frontage is one of the lowest places in all of West Oakland.

Lower elevation at 7th creates flooding issues

During high rain the low elevation of this intersection has already created flooding issues.

Planters can could act as swales for intercepting and collecting excess water.

Lower elevation at 7th creates flooding issues



As the street descends, the water could collect in stepped bioswales, slow it down and keep it from flooding the lower areas.

An area at the bottom could serve as a place to save water and for irrigation, to be pumped out when full.

Concept Designs

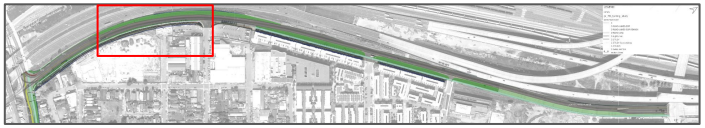
At the end of frontage we have 3 turn lanes.

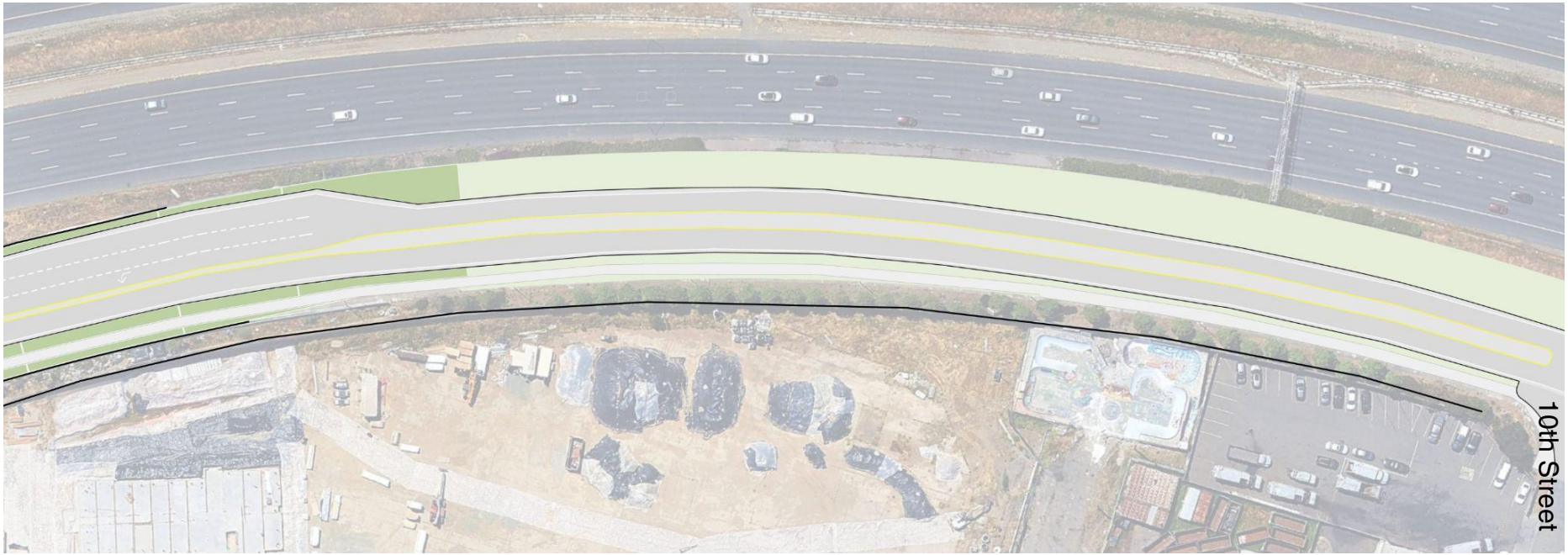
This is to prevent trucks from backing up along the road.

Existing Street


Proposed Design

Concept Designs





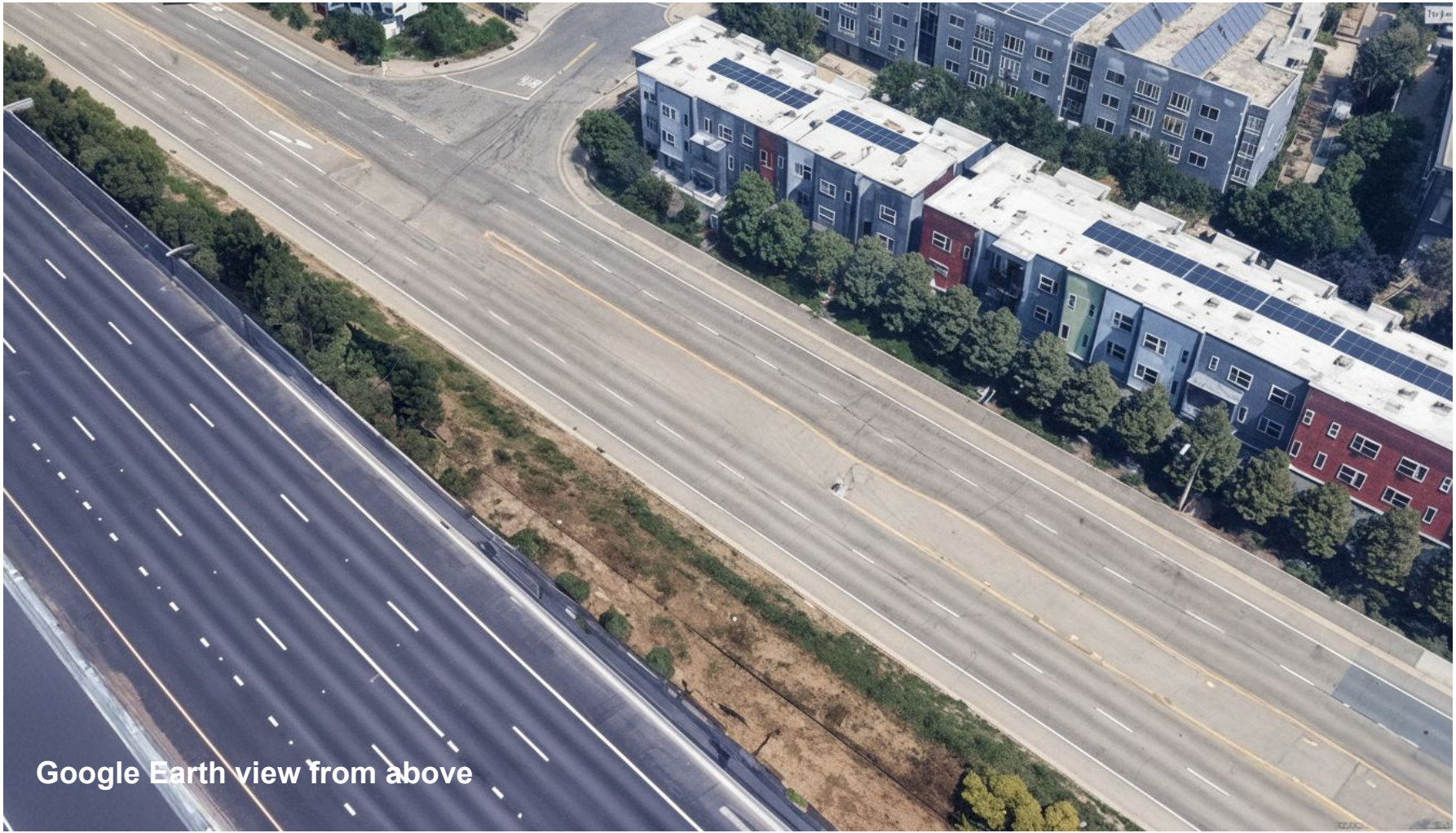
As the design moves north, the western buffer expands and buffers the pollution from the freeway. There is now one lane going in each direction, with a middle lane to accommodate turns.

Concept Designs

At the apartment buildings, the buffer transitions to the eastern side.

Existing Street


Proposed Design


Google Earth view from above


Proposed Design


Proposed Design

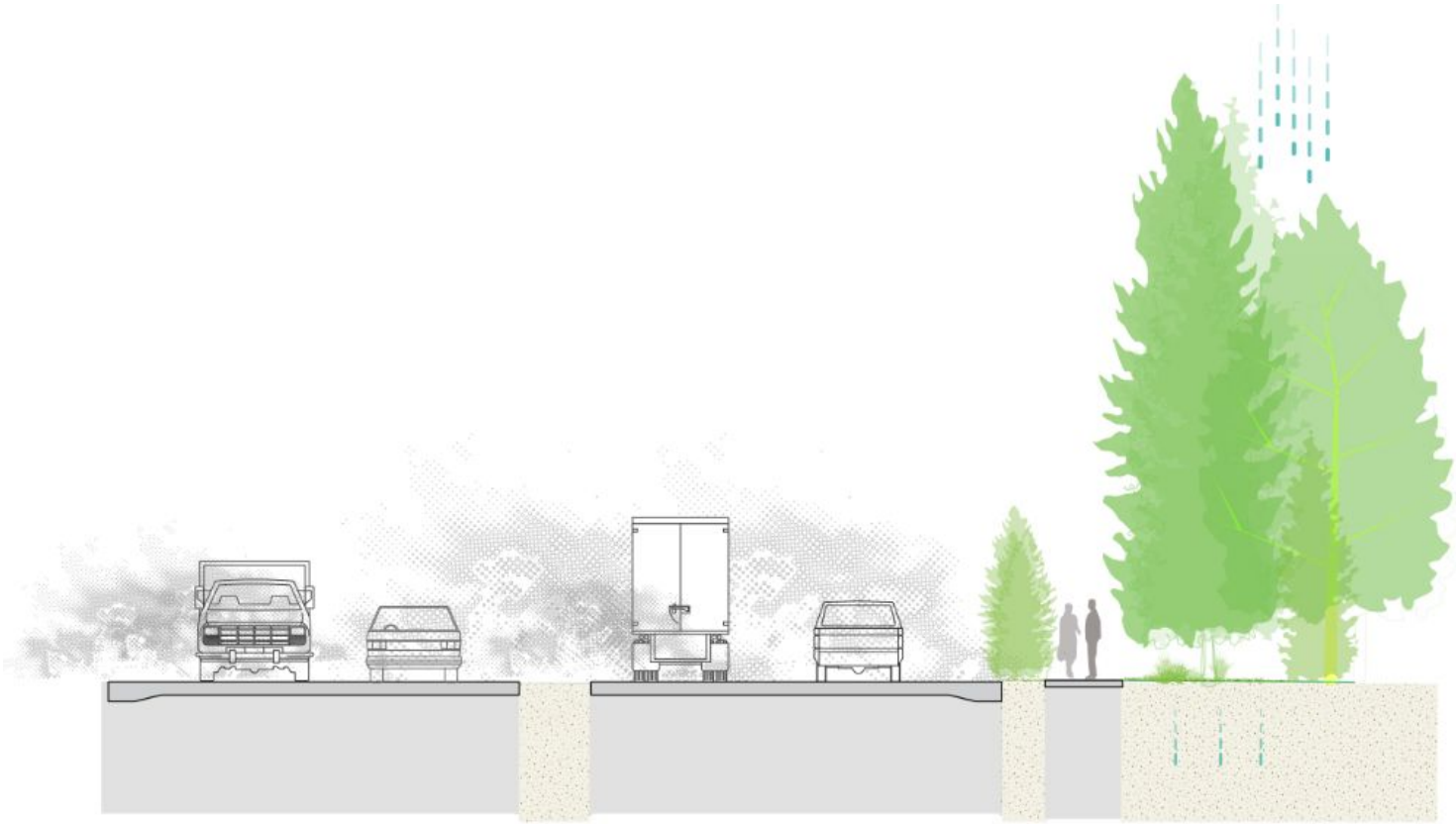
Conclusion

- Introduction & Background
- Project Area
- Vegetated Buffers
- Modeling
- IPA - project plan
- Road Diet - development & designs

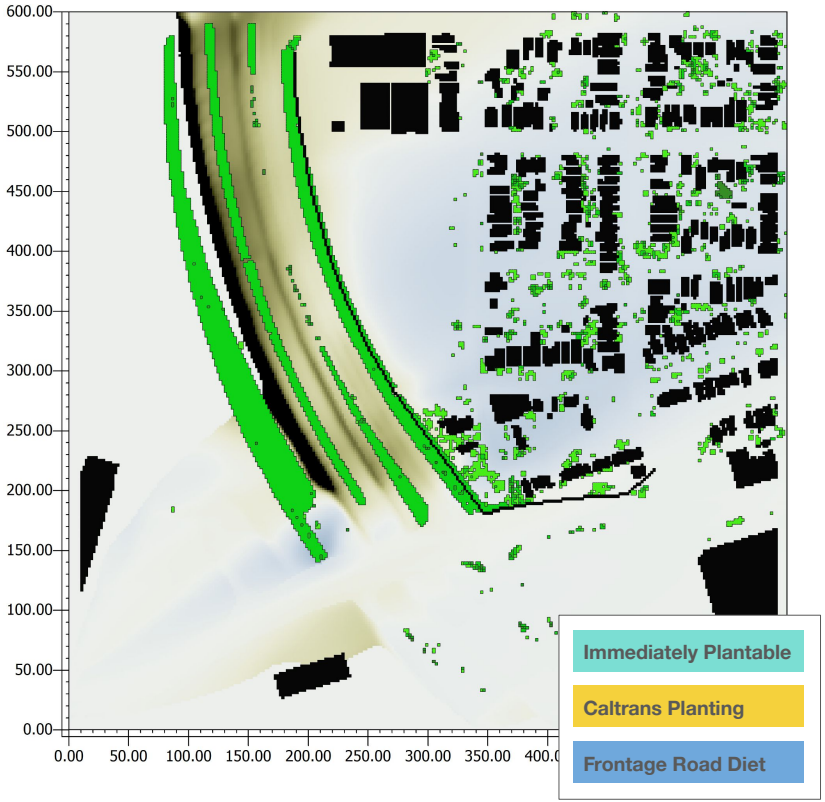
Conclusion


Immediately Plantable
Caltrans Planting
Frontage Road Diet

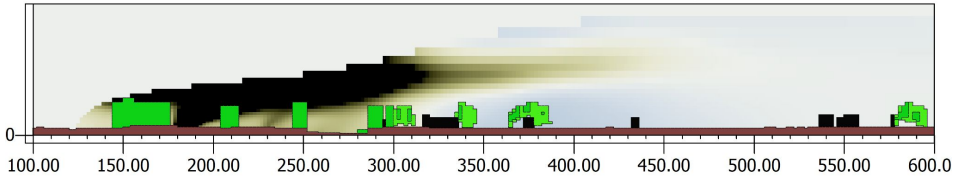
Conclusion



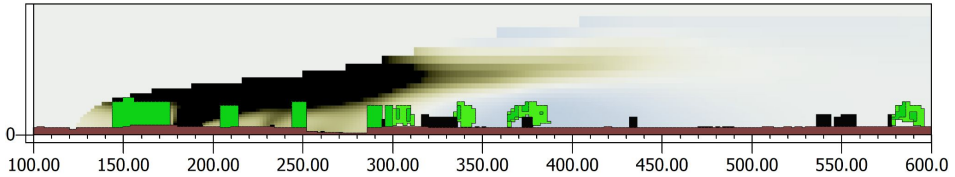
Conclusion



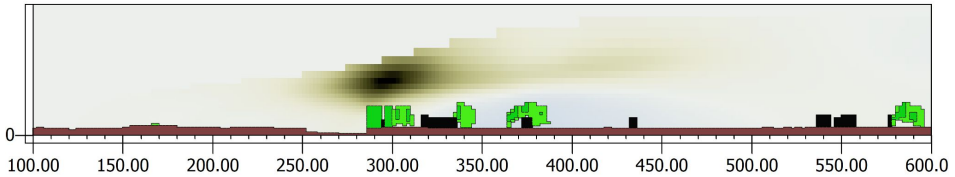
1) Caltrans + IPA + Road Diet



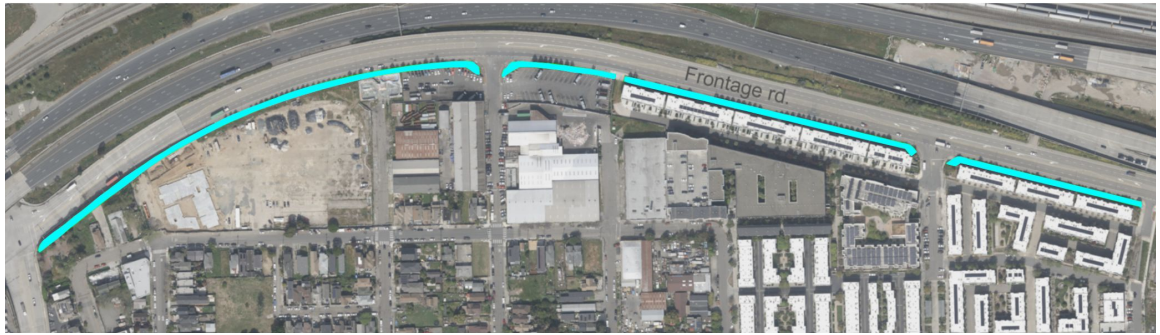
2) Caltrans + IPA



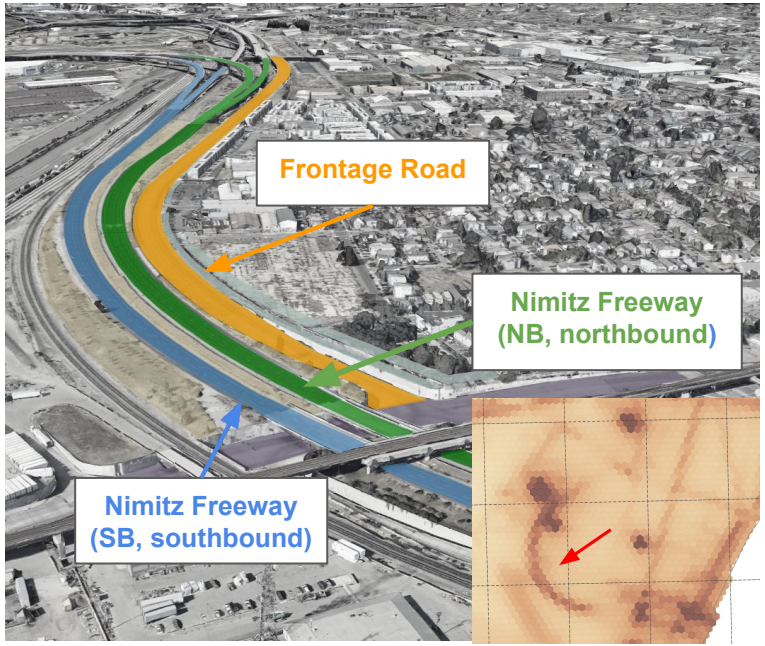
3) Immediately Plantable Only



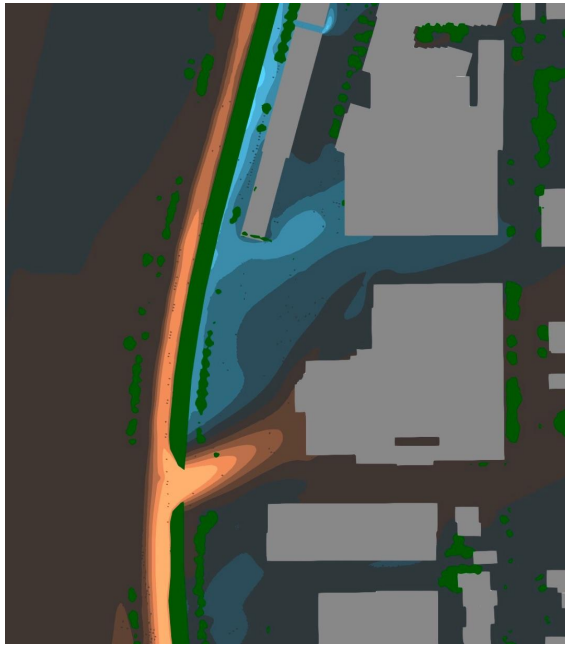
Conclusion



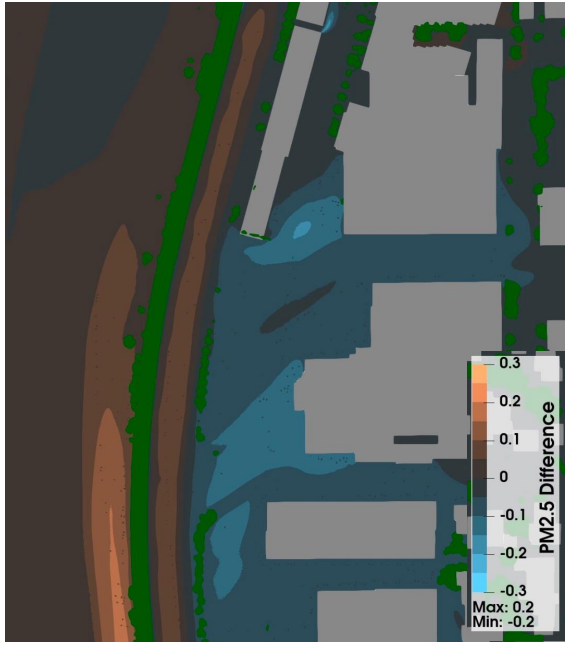
Conclusion



Freeway is the biggest source of pollution



Eastern buffer



Western buffer