Santa Clara Valley Transportation Authority

Zero-Emission Bus Blueprint

VTA Zero-Emission Bus Blueprint

NOVEMBER 2024

About VTA

The Santa Clara Valley Transportation Authority (VTA) is an independent special district that provides fixed route public transit service and paratransit service in Santa Clara County, California. VTA operates a fleet of 430 buses out of three bus depots and 98 light rail cars out of a single light rail depot.

About the Innovative Clean Transit Regulation

The Innovative Clean Transit (ICT) Regulation passed by the California Air Resources Board (CARB) in 2018 requires all transit operators in the state to transition to fully zero-emission bus fleets by 2040. Presently, two technologies meet the zero-emission standard: battery-electric buses (BEBs) and hydrogen fuel cell buses (FCEBs).

The ICT regulation sets escalating purchasing targets. In 2023, 25 percent of buses purchased must be zero-emission. The target increases to 50 percent in 2026 and 100 percent in 2029. Internal combustion engine (ICE) buses purchased before 2029 would reach the end of their 12-year expected lifespan by 2040 and would be retired from the active fleet.

CARB recognizes that zero-emission fleet transition will bear new costs and will present new challenges to transit operators that may impact their financial health or ability to deliver transit service. If complying with the purchasing targets would result in such impacts, or if zero-emission infrastructure or vehicles cannot be procured in time, agencies may request annual exemptions to meeting the purchasing targets.

Introduction

About the Zero-Emission Bus Blueprint

The Zero-Emission Bus (ZEB) Blueprint is a strategic implementation plan that charts a course for VTA's ZEB fleet transition by 2040. The ZEB Blueprint assesses the costs, risks, environmental impacts and service delivery impacts of zero-emission technologies and recommends a mixed fleet strategy that balances risk and builds resiliency. In addition, the ZEB Blueprint identifies future projects, energy needs and transition plans for each of VTA's depots and aligns them with new bus purchases. Lastly, guidance is provided about how to prioritize next steps that incorporate equity, funding and operational considerations.

The ZEB Blueprint provides flexibility, allowing VTA to adjust its approach as technologies, markets, funding and service needs evolve and agency staff gain operating experience. Cautions are provided about factors outside of VTA's control that may affect the pace of transition, and a contingency plan is identified so that VTA's ability to provide reliable transit service is not negatively impacted.

The ZEB Blueprint builds upon and supersedes the ZEB Transition Plan (2022) and Bus Rollout Plan (2020). It aligns with the 2020 Sustainability Plan, which identifies the zero-emission fleet transition as the most impactful change toward meeting 2040 emission reduction targets. Through thorough research and a detailed implementation plan, the ZEB Blueprint should strengthen VTA's ability to attract discretionary funding to pay for ZEB transition.

The ZEB Blueprint is the product of several analyses:

Zero-Emission Technology Assessment

An evaluation of the current state of battery-electric bus and hydrogen fuel cell bus technology, potential for technology advancement, potential applications to VTA service model, costs and risks.

Service Modeling Analysis

An analysis of sixty-four scenarios that evaluated different implementations of zero-emission technologies, their impacts to fleet size, service complexity and service levels.

Capital and Operating Cost Estimates

To define the financial impact and inform the development of a funding strategy.

Well to Wheels Environmental Analysis

An analysis of the carbon impacts of production and a lifetime of operation of each zero-emission technology.

Equity Analysis

An analysis of depot routes serving communities that experience disproportionately high levels of disadvantage, pollution burden, and respiratory health ailments – to determine which depots should be transitioned first to benefit those communities.

Facility Assessment

An assessment of VTA facilities and identification of facility improvements, electric charging projects, hydrogen fueling projects, electrical capacity upgrades and areas for future analysis.

Depot Layouts and Transition Strategy

A series of depot layouts showing sequential steps for transition to ensure near-term efforts supported long-term efforts, that no efforts were in conflict and that VTA's existing depots are adequate to meet future fleet storage needs.

Prioritization Guidance

Several factors will guide VTA's decisions about which projects to pursue at which depots and their timing. Those include:

- **Equity considerations –** The California Air Resources Board encourages prioritizing service to communities that experience disadvantage, higher pollution burdens and disproportionate rates of respiratory health affliction.
- **Energy considerations –** Pacific Gas & Electric (PG&E) may have limited ability to upgrade electrical capacity to depots, which could affect the pace of transition; hydrogen prices are subject to supply and demand fluctuations in the near term, as production ramps upward.
- **Fleet considerations –** Some fleets operate out of specific depots, such as the 60-foot bus fleet that operates out of VTA's North Depot. The timing of those fleet replacements will be considered.
- **Funding considerations –** State and federal funding for zero-emission is vastly inadequate and the timing of being awarded grants and their amounts are uncertain. This can affect which projects VTA pursues and when.

Zero-Emission Bus Transition Progress to Date

The ZEB Blueprint builds on planning work and a series of projects that are completed or underway.

Hydrogen Bus Pilot
(Mid-2000s)

VTA tested three hydrogen fuel cell buses as part of a Federal Transit Administration (FTA) demonstration product. At the time, the limited durability of parts, high operating costs, limited travel ranges and considerable loss of hydrogen to the atmosphere indicated the technology was not ready for wider application.

Battery-Electric Bus Pilot
(2018-2023)

VTA tested a fleet of ten battery-electric buses, but the pilot ran into setbacks. Durability problems, charger/vehicle incompatibility issues and poor manufacturer support led to an unacceptable level of downtime. Ultimately a fire on one bus led to the grounding of the fleet, as the manufacturer, having since declared bankruptcy, was unable to provide an adequate repair.

Bus Rollout Plan
(Adopted in 2020)

VTA adopted the Bus Rollout Plan in 2020 to satisfy a requirement of the Innovative Clean Transit Regulation. The document identified technology pathways to full fleet transition by 2040, but did not commit VTA to any action at the time.

Strategic Conversations with the Board of Directors
(2021)

VTA developed a near-term battery-electric bus strategy that would target shorter route assignments while preserving flexibility to pivot to hydrogen fuel cell buses for longer route assignments if battery technology advancement should fall short of expectations.

Zero-Emission Bus Transition Plan
(Adopted in 2022)

To be eligible to apply for federal funding through the Low & No Emission Bus and Bus Facilities Program, VTA adopted the Zero-Emission Bus Transition Plan which reflected earlier Board Direction. VTA won a federal grant later in the year.

Cerone Microgrid Project
(Started in 2022, completion estimated in 2026)

With the help of a grant from the California Energy Commission, VTA began a project to add charging for 34 buses, a microgrid (large backup battery) and solar panels at the Cerone Depot. A procurement of 35 battery-electric buses arriving in 2026 will complement this infrastructure.

On-Route Charging Pilot
(Fully funded in 2022)

VTA received a $14.4 million grant award from the Federal Transit Administration to test on-route charging, which can extend the travel range of battery-electric buses with in-the-field charging, at the Milpitas BART Transit Station and add some electric charging infrastructure at the Cerone Depot.

Chaboya Charging Project
(Started in 2024, design work underway)

Design work is underway for charging infrastructure that would support 55 battery-electric buses at the Chaboya Depot.

Maintenance Facility Safety Retrofits
(In progress)

Safety retrofits to provide safe access to the battery packs on top of buses as well as hydrogen detection improvements are underway.

Zero-Emission Bus Transition Objectives and Strategy

The flexible mixed fleet strategy and contingency plan discussed in the ZEB Blueprint is a product of several objectives:

No negative impacts to bus service

Zero-emission buses cost 50 to 100 percent more than internal combustion engine buses and require installing expensive, new, electric-charging or hydrogen-fueling infrastructure. Broadly, funding is inadequate to meet this need, and some transit agencies are faced with cutting their transit operating budgets, which results in service cuts, to cover the cost of transition. Many operators are struggling with the reliability of their zero-emission fleet resulting in more buses breaking down in the field or being unable to be put in service.

VTA's objective is to transition the fleet while avoiding any negative impacts to bus service. This may require requesting exemptions to complying with the ICT regulation purchasing targets and replacing some aging hybrid-diesel buses with new hybrid-diesel buses. CARB encourages agencies to request exemptions if transition would result in financial hardship for the agency or negative impacts to bus service.

1-for-1 fleet replacement

Most of VTA's route assignments fall into the 150-to-250-mile range and a few exceed 300 miles. That exceeds the travel ranges of battery-electric buses, which are conservatively estimated to travel 150 miles per charge. If route assignment ranges cannot be met by a single zero-emission bus, two zero-emission buses would be needed to replace some hybrid-diesel buses that are retired. That would increase fleet size, increase cost, increase operational complexity and potentially require additional land for bus storage.

VTA's strategy is to deploy battery-electric buses on route assignments that are under 150 miles, which comprise about 30 percent of VTA route assignments, and to deploy hydrogen fuel cell buses on route assignments longer than 150 miles. That strategy, combined with small scheduling changes on the longest route assignments, will allow for 1-for-1 fleet replacement.

Resiliency and emergency response

Battery-electric bus operations are vulnerable to prolonged electrical grid outages and hydrogen fuel cell bus operations are vulnerable to interruptions in hydrogen delivery. Relying on a single technology for the entire fleet would put VTA at risk for prolonged service outages that would leave VTA riders without mobility and impede VTA's ability to provide emergency transportation, shelter, heating and cooling in case of an emergency.

A mixed fleet strategy provides diversity in energy supply and insulates VTA against losing the ability to provide full service. Hydrogen fuel cell bus operations require multiple days of hydrogen supply to be stored at the bus depot, providing further resiliency.

Flexibility and adaptability

As zero-emission technologies evolve, prices fluctuate, products and vendors enter and leave the market and VTA gains operating experience and learns from peer agencies, it may be prudent to adjust the 70/30 percent hydrogen fuel cell/battery-electric bus strategy proposed in the ZEB Blueprint. By pursuing both technologies, VTA will be able to adjust the balance of fleet technologies and be selective about which projects it pursues and when. An update to the plan may be warranted as the zero-emission space matures.

Limit costs

VTA has an obligation to spend public funding cost-effectively. By taking a reasoned approach to transition that is founded upon thorough analysis, VTA can pursue strategies that are cost-effective for VTA's scale of operations and service model and avoid sunk costs.

Prioritize safety

Use of large-scale batteries and hydrogen bring unique fire safety concerns. Prevention, suppression and response should be evaluated as part of the transition work.

Blueprint Development

STAGE 1

Evaluation of 4x ZEB technology scenarios leading to the 'Mixed Fleet' recommendation in Feburary 2024

STAGE 2

Implementation Plan
- **Site Planning and Facility Assessement**
- **Fleet Planning**
- **Energy Strategy**

The ZEB Blueprint was developed through two stages. The first stage focused on information gathering and included a detailed analysis of the state of battery-electric and hydrogen fuel cell bus technologies, their capital and operating costs, environmental impacts of bus operation and production, and impacts to VTA's service delivery model.

Mixed Fleet Recommendations

That analysis led to a staff recommendation that was presented at the February 2024 Board Workshop to pursue a mixed fleet strategy of roughly 30 percent battery-electric buses and 70 percent hydrogen fuel cell buses. Battery-electric buses would be used for short route assignments and hydrogen fuel cell buses for long route assignments. The mixed fleet strategy would allow for 1-for-1 replacement of hybrid-diesel buses which would minimize costs by maintaining the same size fleet and by avoiding acquiring additional land to store buses. That strategy would also provide a pathway to operating the fleet entirely from fully renewable electricity and green hydrogen and provide a measure of resiliency by diversifying energy sources.

Contingency Plan

Additionally, VTA staff sought support for a contingency plan that would preserve an option to buy hybrid-diesel buses, which are less expensive than zero-emission buses and do not require new infrastructure, if fleet replacement is needed and VTA is not ready to purchase zero-emission buses due to lack of funding or if supporting infrastructure is not ready. In such case, the agency would exercise the exemption option of the CARB regulation. The Board of Directors indicated support for the staff recommendation and contingency plan, which guided the second stage of developing an implementation plan.

Stage 2 consists of an implementation plan that identifies specific projects and their locations and serves as a menu of next steps for VTA's Operations and Engineering Divisions to implement. Specifically, the implementation plan:

The implementation plan consists of several elements:

- A facility assessment that identifies electric charging and hydrogen fueling infrastructure needs, electrical capacity upgrades, facility safety improvements and topics for further evaluation.
- An implementation timeline that aligns infrastructure, facility improvements and utility capacity upgrades with VTA's fleet replacement plan
- Layouts for each of VTA's three bus depots that ensure near-term efforts support overall transition and avoid conflicts with future efforts
- An energy strategy that helps VTA manage energy loads, energy costs and provide advance notice to PG&E of VTA's future capacity needs
- Prioritization guidance for how to balance equity goals with factors like funding availability, fleet replacement needs, workforce development and utility constraints
- A funding strategy informed by detailed cost estimates

Stage 1

Technology Assessment

Technology Comparison

Each zero-emission technology comes with tradeoffs around vehicle cost, infrastructure cost, energy cost, travel range, space needs, impacts to operations and safety concerns. Each transit operator must identify the right technology(ies) and configuration for their unique constraints and service model. The tables below show key differences for the technologies.

Battery-electric buses are charged at bus depots in a strategy called depot-charging. On-route charging is a strategy to extend the travel range of these buses by providing a fast, high-powered charge to partially replenish the battery while the bus is in the field, typically at the end of a route.

Hydrogen fuel cell buses store their energy in the form of compressed hydrogen that is stored in onboard tanks. A fuel cell uses a chemical reaction to convert the hydrogen into electricity that is stored in a battery that powers the bus.

Technology	Energy Storage	Propulsion	Emissions
VTA Hybrid-Diesel Bus	Renewable diesel	Diesel Engine > Battery > Electric Motor	Yes
Depot Charged BEB	Large onboard batteries	Battery > Electric Motor	No
Depot Charged BEB + On-Route Charging	Small onboard batteries	Battery > Electric Motor	No
Hydrogen Fuel Cell Bus	Compressed hydrogen	Fuel Cell > Battery > Electric Motor	No

Technology	Cost Per Bus	Approx. Travel Range	Fleetwide Replacement Ratio	Storage Space Constraint?
VTA Hybrid-Diesel Bus	$800K	400 miles	1-to-1	No
Depot Charged BEB	$1.5M	150 miles	1.2-to-1*	Yes
Depot Charged BEB + On-Route Charging	$1.4M	Unlimited**	1-to-1	No
Hydrogen Fuel Cell Bus	$1.6M	300 miles	1-to-1	No

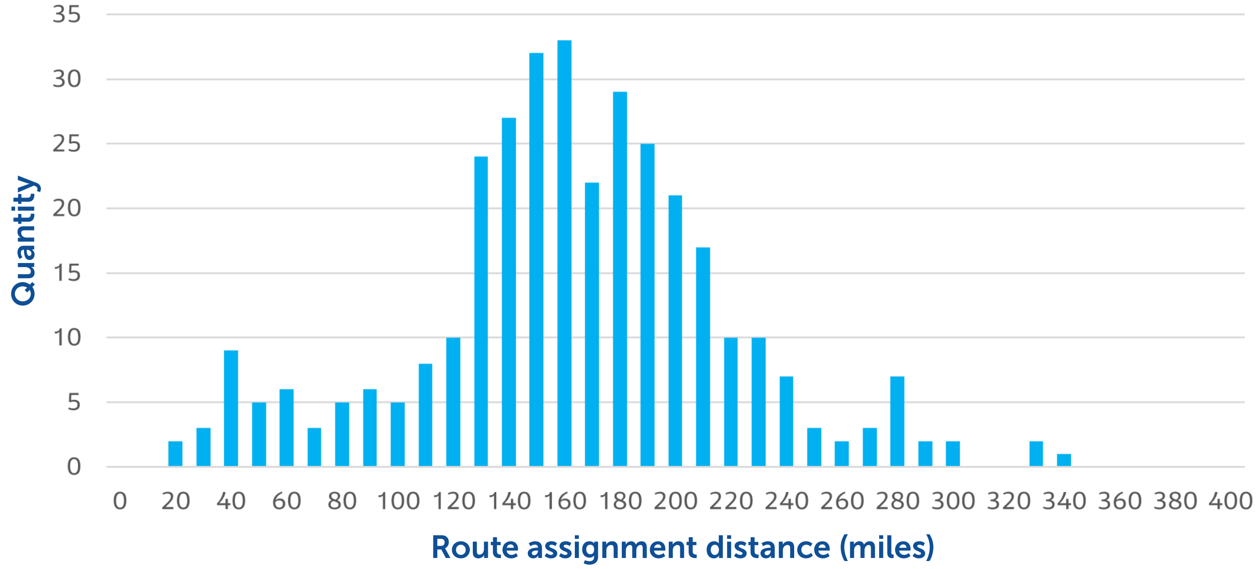
*Evaluated against VTA's service model

**Depending on on-route charging locations

Travel Range Considerations & VTA Service Model

VTA bus service employs a clever efficiency of having operators start their shift by meeting the bus along the route, relieving another operator that has completed their shift. This prevents losing time by driving back to the depot while out of service to switch drivers, which maximizes the quantity of hours VTA can provide to the public. However, this also means that VTA buses travel long distances in a day, sometimes upwards of 300 miles. Diesel-powered buses can travel 400 miles per fueling, but the shorter travel ranges of zero-emission buses, particularly battery-electric buses, make this an acute issue for VTA's transition.

August 2024 VTA Route Assignment Distances



Operational Risks

Hybrid-diesel bus operations have a track record of reliability and low risk of service interruption since transit agencies have days of fuel reserves on-site, service does not rely on in-the-field infrastructure, fueling is fast, and diesel is widely available in case buses need to travel away from depots for emergency response. Those conditions are ideal for bus operation as they provide resiliency and the ability to recover quickly if something goes wrong, but the zero-emission technologies afford less convenience or margin for error.

Battery-electric buses have shorter travel ranges and long charging times, which adds operational complexity as buses are swapped in and out of service during the day. Rigid charging schedules decrease the room for error each night to be able to provide full service to the public the following day. On-route charging adds operational risk as providing full service is reliant upon in-the-field chargers working at all times. Power outages, vandalism, behind-schedule buses and difficulty making a proper connection with pantographs can result in buses running out of charge before completing their daily service.

Hydrogen fuel cell bus operation benefits from on-site fuel reserves, and although approximately double the time for diesel fueling, hydrogen fueling can occur in a manner of minutes, allowing more recovery time in preparing buses for morning pull out. However, the potential for hydrogen supply interruptions and the general scarcity of hydrogen availability pose risks to using hydrogen-powered buses for emergency response.

Technology	Service Disruption Risk	Charging/Fueling Time	Emergency Resiliency
VTA Hybrid-Diesel Bus	Low	Fast	High
Depot Charged BEB	Medium	Slow	Medium
Depot Charged BEB + On-Route Charging	High	Slow	Medium
Hydrogen Fuel Cell Bus	Medium	Moderately fast	Medium

Service Modeling

To understand the impact each technology would have on VTA's transit operations, over sixty model runs were completed that imagined different factors like battery size, charging strategy, outside temperature and age of battery. Smaller batteries mean smaller travel ranges than large batteries. Hot or cold days will consume electricity from the battery at a greater rate to run air conditioning or heating systems, sapping travel range. A battery that is six years old and near replacement will hold about 80 percent of the charge of a new battery. VTA must plan for a worst-case scenario (extreme weather, old battery) as a default assumption.

This extremely detailed analysis yielded optimal scenarios (as shown in the table below) for depot-charged battery-electric bus operation, on-route charging aided battery-electric bus operation and hydrogen fuel cell bus operation and their fleet size requirements, change to current route assignment lengths and change in hours needed to provide equivalent revenue service as is presently provided (returning to the depot to charge adds more hours when the bus is out of service).

Table summarizing the results of service modeling across the four scenarios

Technology	Fleet Size Change	Blocks Requiring Modification	Service Hour Change to Provide Same Service as Today
Depot Charged BEB	20% Increase (+76 Buses)	71%	3% Increase
Depot Charged BEB + On-Route Charging	2% Increase (+9 Buses)	7%	<1% Increase
Hydrogen Fuel Cell Bus	No Change	7%	No Change

Wells to Wheels Emissions Analysis

The zero-emission designation refers only to vehicle emissions and does not account for any emissions that occur upstream in electricity or hydrogen production. Battery-production and battery recycling create greenhouse gas emissions as does the share of non-renewable energy associated with powering the vehicle. Presently, gray hydrogen, which is made by carbon-intensive natural gas reformation, accounts for 99 percent of commercially available hydrogen in California, but major investments in green hydrogen production are underway, including nearby production green-hydrogen production facilities.

Carbon Impacts of Bus Production and Operations
(Units are Metric Tons of CO2 Equivalent per Bus)

Technology	Battery Production	Battery Replacement	End of Life	12 Years of Operation	Total
Battery-Electric Bus	40	40	4.4	282*	**367**
Hydrogen Fuel Cell Bus + Gray Hydrogen	12	8	0.1	743	**763**
Hydrogen Fuel Cell Bus + Green Hydrogen	12	8	0.1	37	**58**

*assumes VTA's current 60/40 percent renewable/non-renewable grid energy mix

Capital and Operating Cost Analysis

A preliminary, high level vehicle, infrastructure, and maintenance cost assessment was developed for order-of-magnitude comparative purposes of each of the singular technology fleetwide scenarios. A new hybrid scenario featuring a 30 percent battery-electric buses and 70 percent hydrogen fuel cell buses was also developed as an extrapolation of depot-charged battery-electric bus scenario and hydrogen fuel cell bus scenario. That scenario envisioned using battery-electric buses on shorter route assignments and hydrogen fuel cell buses on longer routes, playing to each technology's strengths. Vehicle costs cover the first generation (around 430 buses) of zero-emission vehicles.

Technology	Vehicle Cost	Infrastructure Cost	Infrastructure + Vehicles	Annual Fuel + Maintenance
VTA Hybrid-Diesel Bus	$400M	-	$400M	$30M
Depot Charged BEB	$550M	$300M	$850M	$35M
Depot Charged BEB + On-Route Charging	$450M	$215M	$650M	$25M
Hydrogen Fuel Cell Bus	$600M	$150M	$750M	$45M
30% BEB + 70% FCEB	$550M	$150M	$700M	$40M

*Note – Estimates are for comparative purposes only. Detailed cost estimates were developed for the recommended Mixed Fleet strategy which are presented in Phase 2 of the Blueprint.

Mixed Fleet Recommendation

Past Board direction emphasized a flexible approach that would allow VTA to consider changing technology strategies as staff gained experience with battery-electric buses, saw how technology and costs evolved and learned from peer agency experiences. Given the rapid cost increases of battery-electric buses, present expectation that battery technology will not advance to achieve range parity with diesel- or hydrogen-powered buses and uncertainty around gaining electrical capacity upgrades, staff advised diversifying VTA's technology strategy to pursue a mixed fleet with an initial aim toward 70 percent hydrogen fuel cell buses and 30 percent battery-electric buses.

The 70/30 balance is based on the length of VTA's route assignments. Approximately 30 percent of VTA's bus assignments are shorter than 150 miles and can be served with battery-electric buses. The remaining assignments can fit within the 300-mile range of hydrogen fuel cell buses, with small adjustments to scheduling. Such a blend would provide the following benefits:

- Allow VTA to maintain the same fleet size of 440 buses.
- Not require an increase in the quantity of service hours (time when the bus is moving) needed to provide the same quantity of revenue hours (time when the bus is open for riders).
- Limit the amount of charging infrastructure that must be installed within bus parking areas, allowing for greater flexibility of depot use and more space-efficient bus parking than a 100% battery-electric fleet.
- Provide a measure of resiliency by diversifying energy sources. Should access to grid electricity or hydrogen supply become a temporary challenge, VTA could still roll out a portion of service.
- Give VTA options for dispatching buses for emergency responses as different fueling/charging options will exist where VTA buses are sent.
- Provide a pathway to the least carbon-intensive ZEB operations with green hydrogen.
- Maintain flexibility to change the balance of hydrogen fuel cell buses and battery-electric buses as these technologies, costs and vehicle availabilities evolve.

Stage 2

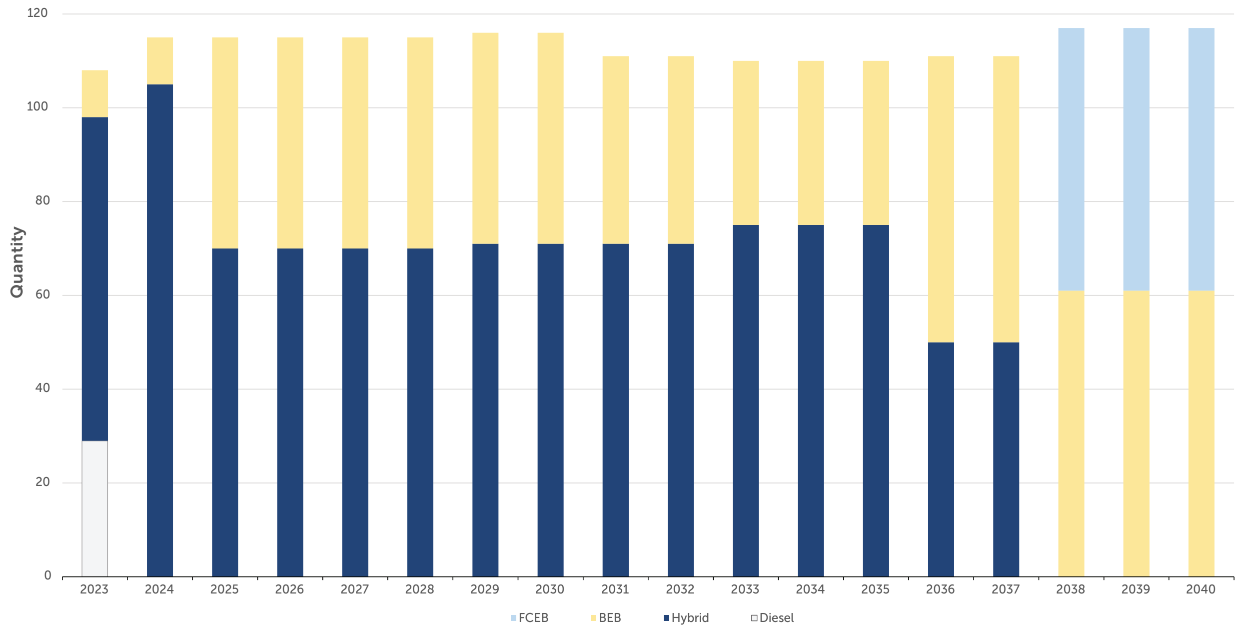
Introduction

The second stage of the ZEB Blueprint consists of an implementation plan that identifies the quantities battery-electric and hydrogen fuel cell buses that will operate out of each depot, specific facility and infrastructure projects, their location within the depots, guidance about how to prioritize implementation, capital cost estimates and areas of future analysis. Cost estimates developed during this stage employed a more detailed methodology and do not align with earlier, high-level estimates.

Cerone Depot

VTA's Cerone Bus Depot is located in North San Jose and is home to VTA's only major repair facility. The Cerone Bus Depot is envisioned to operate both battery-electric and hydrogen fuel cell buses and be transitioned over three phases.

The anticipated final fleet make-up and transition timeline is provided below.



Proposed ZEB Mix	
BEB - 40ft	61 (52%)
FCEB - 40ft	56 (48%)
Total	**117 (100%)**

Depot Phasing Layouts

The following pages show indicative changes to the layout of Cerone depot across each of the transition phases. It includes references to the infrastructure projects required to support a fully zero-emission fleet, followed by a final 'end-state' layout demonstrating what the depot could look like in 2040.

Phase 1 (2025)

The first phase of BEB deployment and procurement is underway at Cerone.

1. Purchase of 35 40' BEBs.

2. Microgrid Project: Installation of 12 chargers with 34 dispensers, solar canopies and a microgrid, containing a large backup battery that can store solar energy and charge buses. Located in the southwest area of the Cerone bus parking area.

3. Installation of BEB fast chargers.

4. A new PG&E electric service for BEB charging is planned as part of the microgrid project which will satisfy power needs for all future zero-emission phases at Cerone.

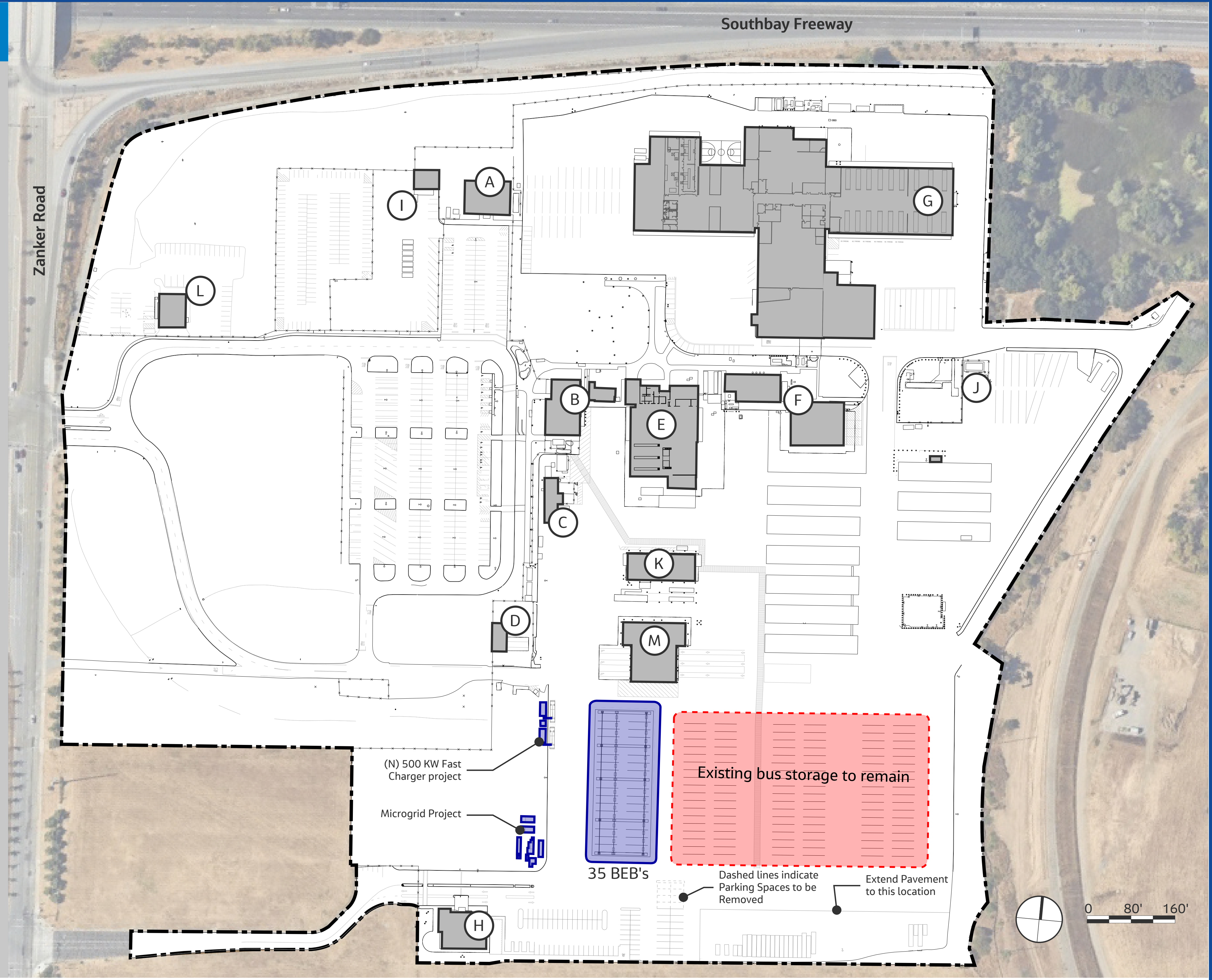
Phase 1 Bus Storage and Charging Equipment

Existing Bus Storage to Remain

Site Boundary

Note:
Refer to facility assessment summary for detailed information on building upgrades.

Phase 1 - 2025 Fleet Counts	
(35) 40' BEB	(8) 30' Hybrid
(10) Pilot BEB Proterra - Inactive	(62) 40' Hybrid
Total = 115 Buses	



Cerone Bus Depot
ZEB Blueprint 2040 Fleet Mixed BEB and FCEB

Jacobs

Phase 2 (2036)

The second phase at Cerone will be an expansion of the the BEB deployment, as well as facility upgrades and retrofits to accommodate BEBs and FCEBs. This will include:

1. Procurement of 26 40' BEB vehicles.

2. Installation of 9 additional chargers and 26 pantograph dispensers.

3. Buildings G & E (Major and Minor Maintenance) upgrades, including fire suppression and hydrogen gas detection upgrades, a new fire pump system at building G, and improvements for bus rooftop access.

4. Addition of an on-site FCEB / BEB battery storage facility, located in the vicinity of building G.

Overall BEB requirements

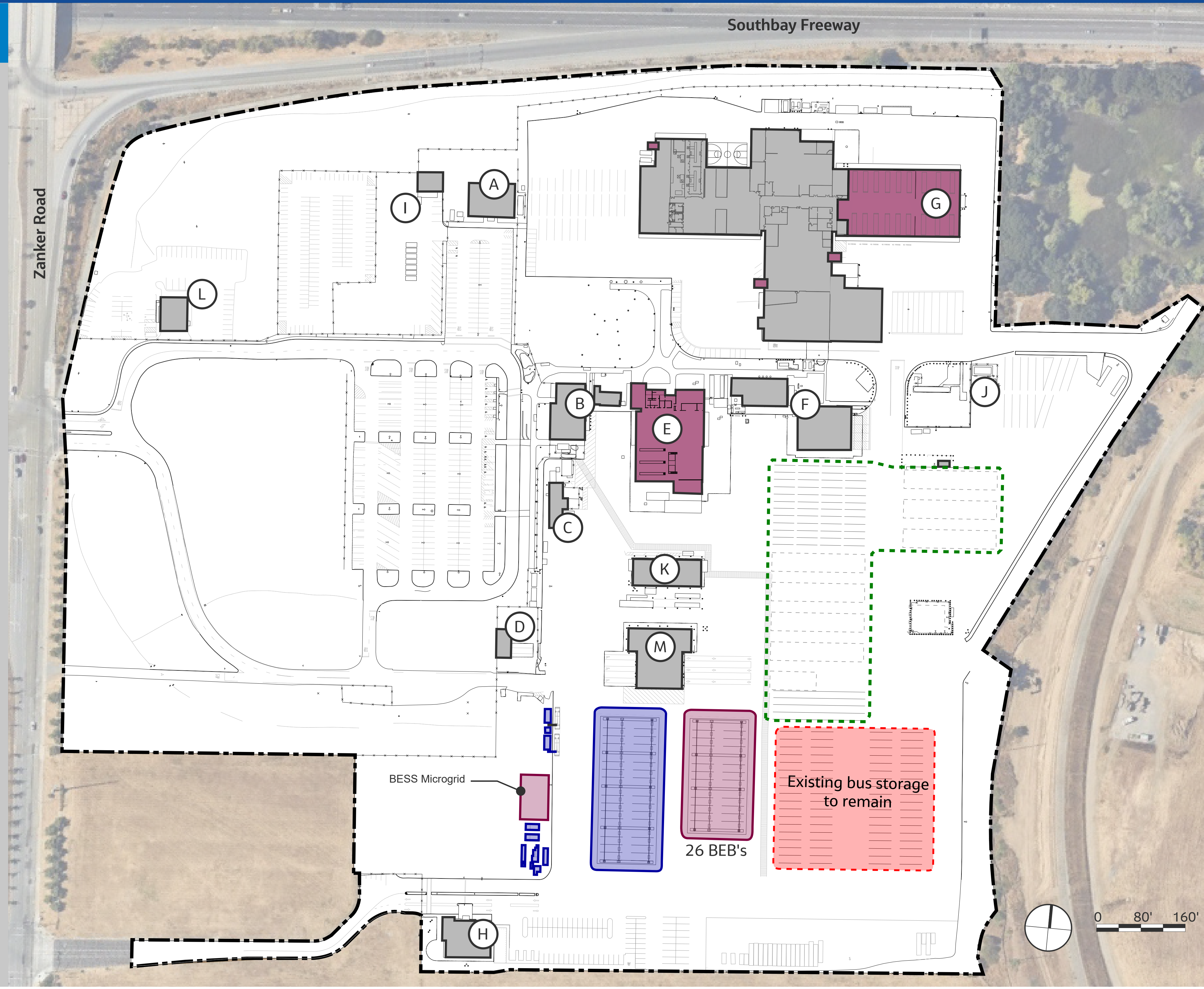
21x BEB Chargers; 61x Pantograph Dispensers

13x Maintenance Bay Plug-In Chargers

- Phase 1 Bus Storage and Charging Equipment
- Phase 2 Bus Storage and Charging Equipment
- Phase 2 Building Upgrades
- Existing Bus Storage to Remain
- Phase 2 Remove Solar Canopies and re-strip lanes for detail and stagging area
- Site Boundary

Note:
Refer to facility assessment summary for detailed information on building upgrades.

Phase 2 - 2036 Fleet Counts
(61) 40' BEB
(50) 40' Hybrid
Total = 111 Buses



Cerone Bus Depot
ZEB Blueprint 2040 Fleet Mixed BEB and FCEB

Jacobs

Phase 3 (2040)

Deployment of the central hydrogen fuel storage and dispenser facilities in one phase, with provisions for a phased expansion of dispensers as the Cerone FCEB fleet grows over time.

Hydrogen Infrastructure and Vehicles

1x Large Liquid Hydrogen Station (18k gal.) and 2x hydrogen dispensers

56 40' FCEB vehicles

Building Compliance

Building G hydrogen gas detection upgrade completed in Phase 2

Study and potential upgrade of bus wash and fueling facilities to ensure adequate hydrogen safety systems.

- Phase 1 Bus Storage and Charging Equipment
- Phase 2 Bus Storage and Charging Equipment
- Phase 3 Bus Storage
- Phase 3 Potential Building Upgrades
- Phase 3 New Tank Building

Site Boundary

Note:
Refer to facility assessment summary for detailed information on building upgrades.

Phase 3 - 2040 Fleet Counts
(61) 40' BEB
(56) 40' FCEB
Total = 117 Buses

Cerone Bus Depot
ZEB Blueprint 2040 Fleet Mixed BEB and FCEB

Jacobs

Site Layout & Circulation (2040)

Building Function and Location

- (A) Facilities Maintenance
- (B) Bus Operations
- (C) Farebox Repair
- (D) Tire Shop
- (E) Minor Maintenance
- (F) Energy Building & Fueling
- (G) Overhaul and Repair
- (H) Guard Station, Vault Room, Dispatch & Field Ops
- (I) Bus Stop Maintenance
- (J) Communications Relay Tower
- (K) FCEB Maintenance
- (L) Paratransit Operations
- (M) Bus Wash

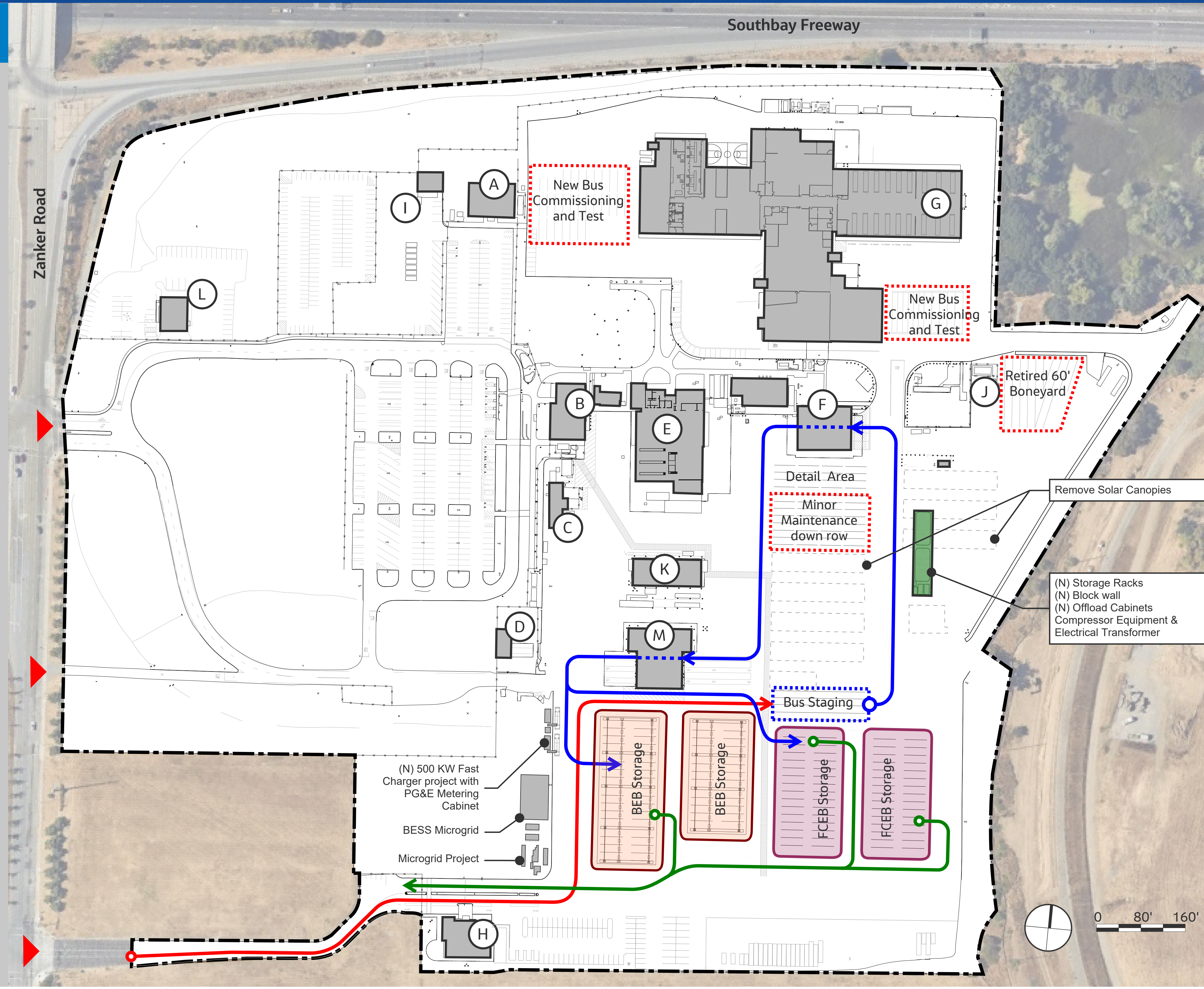
Operational Flow

- Pull-In
- Fueling, Wash, Store
- Pull-Out

FCEB Bus Storage | BEB Bus Storage

Point of Access

Site Boundary



Cerone Bus Depot
ZEB Blueprint 2040 Fleet Mixed BEB and FCEB

Jacobs

List of Projects for Cerone Depot

The projects required to support the transition to a fully zero-emission bus fleet at Cerone are outlined below, including indicative costs (to the nearest $1 Million). All costs include price escalation through the project date indicated.

1 Phase 1

Infrastructure Projects

START/END DATES: In progress, through to early 2028

COST: $34M

Cerone Microgrid Project

DESCRIPTION: Charging dispensers for 34 battery-electric buses, a microgrid (large backup battery) and canopy-mounted solar panels. Includes PG&E power supply upgrade.

COST: $19M

STATUS: In Progress

ANTICIPATED END DATE: April 2026

Milipitas BART Station On-Route Chargers

DESCRIPTION: On-route charging for BEBs at Milpitas Transit Center

COST: $5M

STATUS: Funded in 2022

ANTICIPATED END DATE: May 2027

Cerone High-Powered Chargers and Battery Energy Storage System

DESCRIPTION: Design work underway for charging infrastructure, supporting 55 battery-electric buses at Cerone depot

COST: $9M

STATUS: Commenced in 2024, awaiting construction funding

ANTICIPATED END DATE: January 2028

Fleet Procurement

ANTICIPATED DELIVERY DATE: From mid-2026 | **COST:** $47M

35 Battery-Electric Bus Procurement

DESCRIPTION: To coincide with Cerone Microgrid Project coming online

2 Phase 2

Infrastructure Projects

ANTICIPATED START/END DATES: Mid-2032 to mid 2036

ESTIMATED COST: $47M

Cerone BEB Charging Infrastructure

DESCRIPTION: Charging equipment, overhead gantries and pantographs

Cerone Facility Upgrades for BEBs and FCEBs

DESCRIPTION: Structural, Architectural, Mechanical & Plumbing; Electrical; Sitework; Fire Suppression, with specific elements for Maintenance Buildings E&G

Cerone Fire Prevention & Suppression Upgrades

DESCRIPTION: Evaluation and computational modeling, plus AHJ (Authorities Having Jurisdiction) consultation, to refine fire suppression system requirements specific to Cerone's bus maintenance facilities

Fleet Procurement

ANTICIPATED DELIVERY DATE: From 2036

COST: $52M

26 Battery-Electric Bus Procurement

DESCRIPTION: To coincide with Cerone Phase 2 BEB Charging Infrastructure coming online

3 Phase 3

Infrastructure Project

ANTICIPATED START/END DATES: Late 2034 to 2038

ESTIMATED COST: $68M

Cerone FCEB Infrastructure

DESCRIPTION: Installation of hydrogen tank, fueling storage and dispenser infrastructure, and power supply

Fleet Procurement

ANTICIPATED DELIVERY DATE: From 2038 | **COST:** $152M

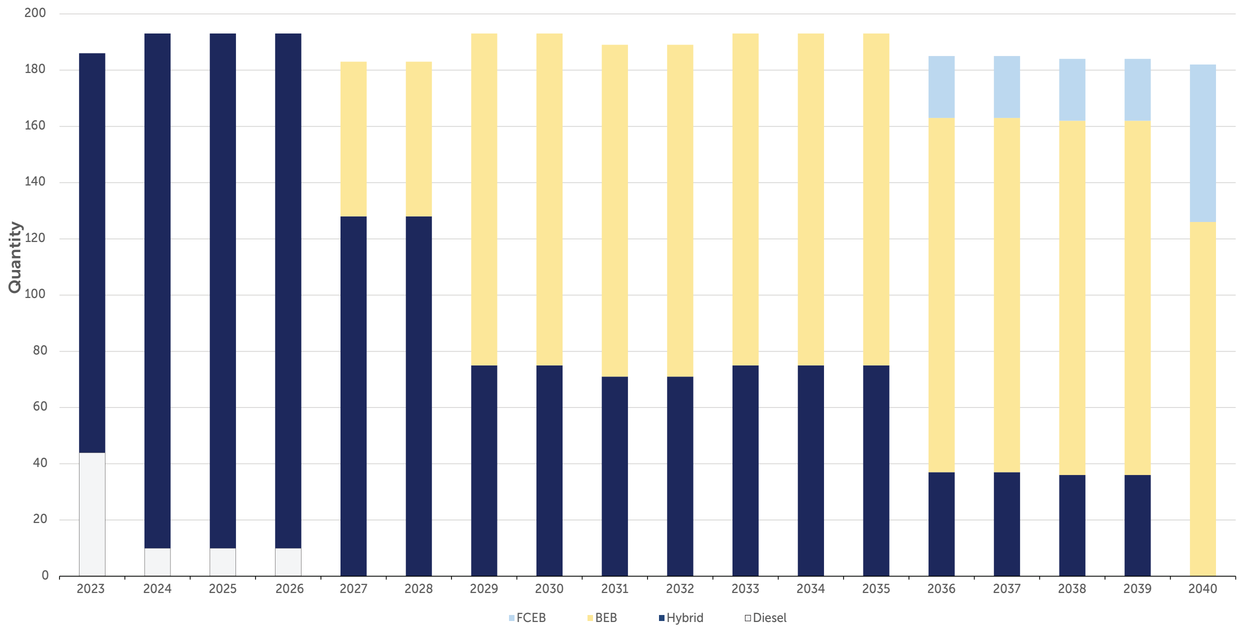
56 Fuel Cell Bus Procurement

DESCRIPTION: To coincide with Cerone Hydrogen Infrastructure Project coming online

Chaboya Depot

VTA's Chaboya Yard is located in North San Jose, housing a large bus maintenance training facility that serves the entire VTA fleet's needs. The Chaboya Bus Depot is envisioned to operate both battery-electric and hydrogen fuel cell buses and be transitioned over three phases.

The anticipated final fleet make-up and transition timeline is provided below.



Proposed ZEB Mix	
BEB - 30ft	38 (21%)
BEB - 40ft	88 (48%)
FCEB - 40ft	56 (31%)
Total	**182 (100%)**

Depot Layout

The following pages show indicative changes to the layout of Chaboya depot across each of the transition phases. It includes references to the infrastructure projects required to support a fully zero-emission fleet, followed by a final 'end-state' layout demonstrating what the depot could look like in 2040.

Phase 1 (2027)

The first phase of BEB deployment and procurement is underway at Chaboya in the design phase. This phase includes:

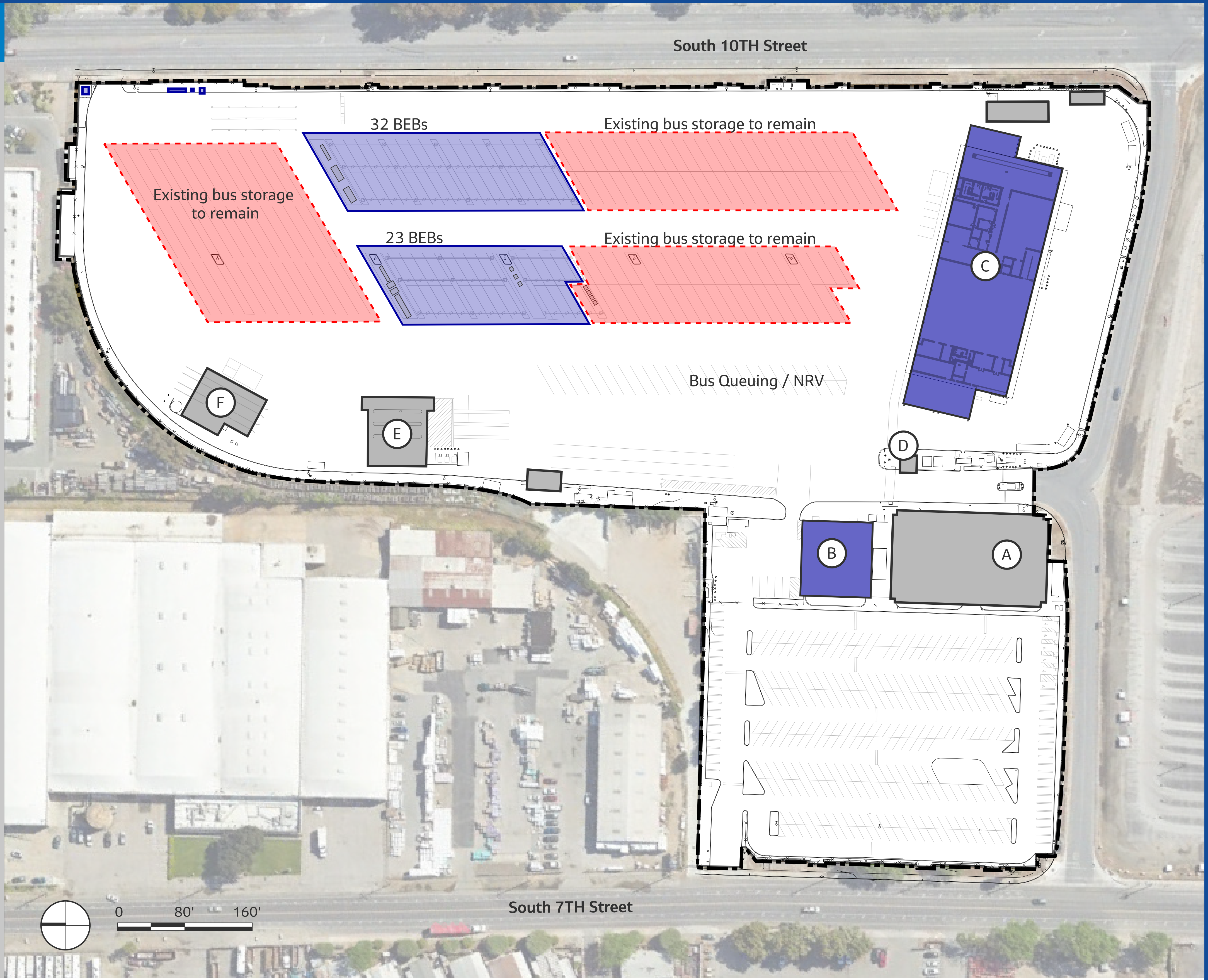
1. Purchase of 55 BEBs planned for 2027.

2. Installation of chargers with 55 pantograph dispensers.

3. Addition of a new PG&E electric service for BEB charging.

4. Upgrades to Buildings B and C fire suppression system, fire pump, hydrogen gas detection, safety upgrades, and improvements for bus rooftop access.

5. Placement of an on-site FCEB / BEB battery storage facility.



Phase 1 Bus Storage and Charging Equipment

Phase 1 Building Upgrades

Existing Bus Storage to Remain

Site Boundary

Note:
Refer to facility assessment summary for detailed information on building upgrades.

Phase 1 - 2027 fleet counts	
(55) 40' BEB	(20) 30' Hybrid
(108) 40' Hybrid	
Total = 183 Buses	

Chaboya Bus Depot
ZEB Blueprint 2040 Fleet Mixed BEB and FCEB

Jacobs

Phase 2 (2029)

The second phase of the Chaboya transition will expand the Phase 1 microgrid for the remaining BEBs. This will include:

1. Purchase of 63 battery electric buses.

2. Installation of additional chargers and 63 overhead pantograph dispensers.

3. In addition to Phase 1 electrical upgrades, VTA will need to procure ~1,750 kVA of peak capacity from PG&E to support the ~6 MW required for a 100% ZEB fleet at Chaboya (FCEB and BEB)

BEB Requirements

42x BEB Chargers; 126x Pantograph Chargers

4x Maintenance Bay Plug-In Chargers

1x Improvement for bus rooftop access in maintenance bay and associated work to enable vertical clearance.

Phase 1 Bus Storage and Charging Equipment

Phase 2 Bus Storage and Charging Equipment

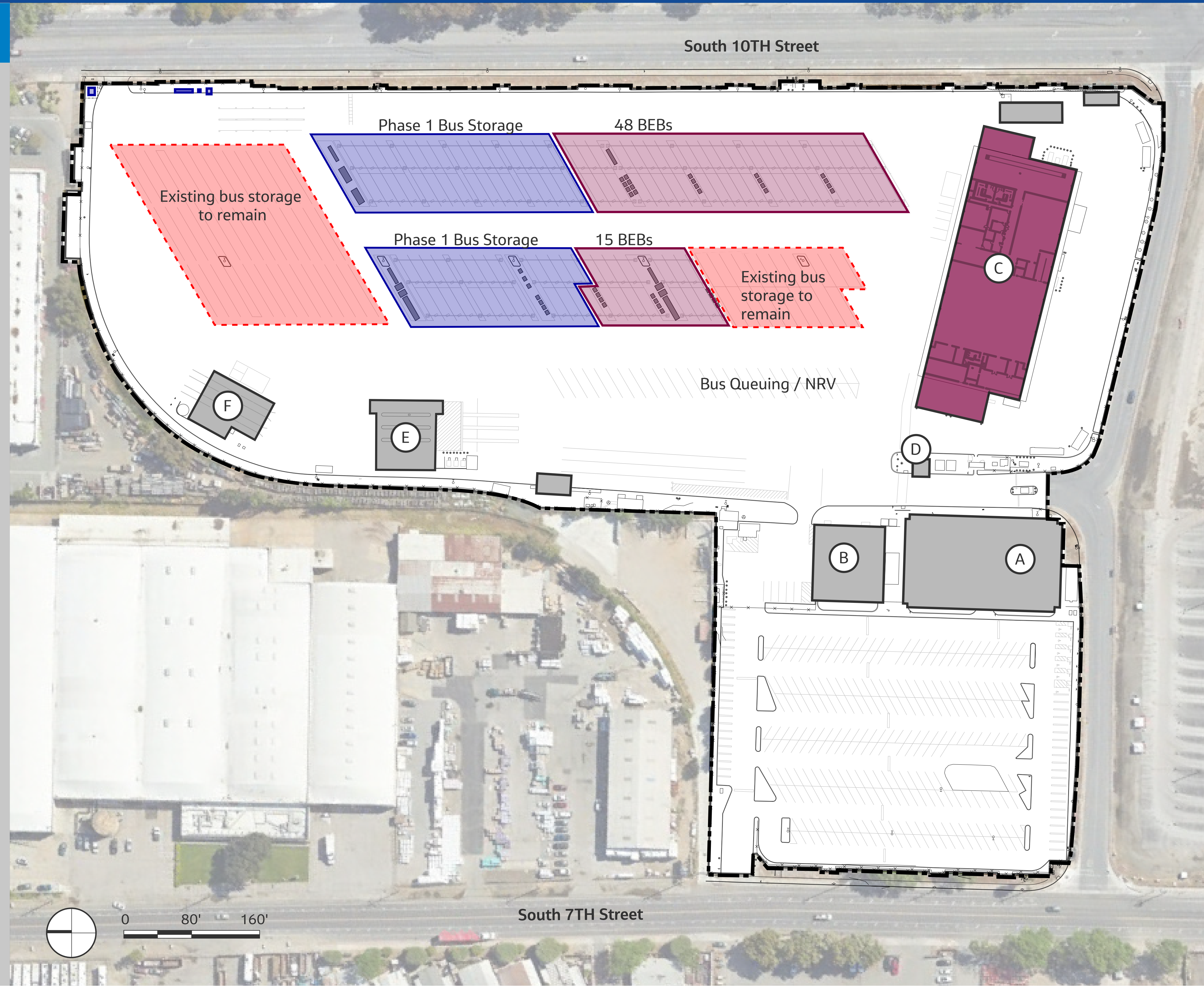
Phase 2 Building Upgrades

Existing Bus Storage to Remain

Site Boundary

Note:
Refer to facility assessment summary for detailed information on building upgrades.

Phase 2 - 2029 fleet counts	
(80) 40' BEB	(75) 40' Hybrid
(38) 30' BEB - Option to replace with 40'	
Total = 193 Buses	



Chaboya Bus Depot
ZEB Blueprint 2040 Fleet Mixed BEB and FCEB

Phase 3 (2036-2040)

The last phase at Chaboya will be the deployment of the central hydrogen fuel storage and dispenser facilities.

Hydrogen Infrastructure

1x Large Liquid Hydrogen Station (18k gal.)

2x Hydrogen dispensers at building E. These could replace existing diesel fueling bays as needed.

Building C already upgraded for hydrogen gas detection in Phase 1.

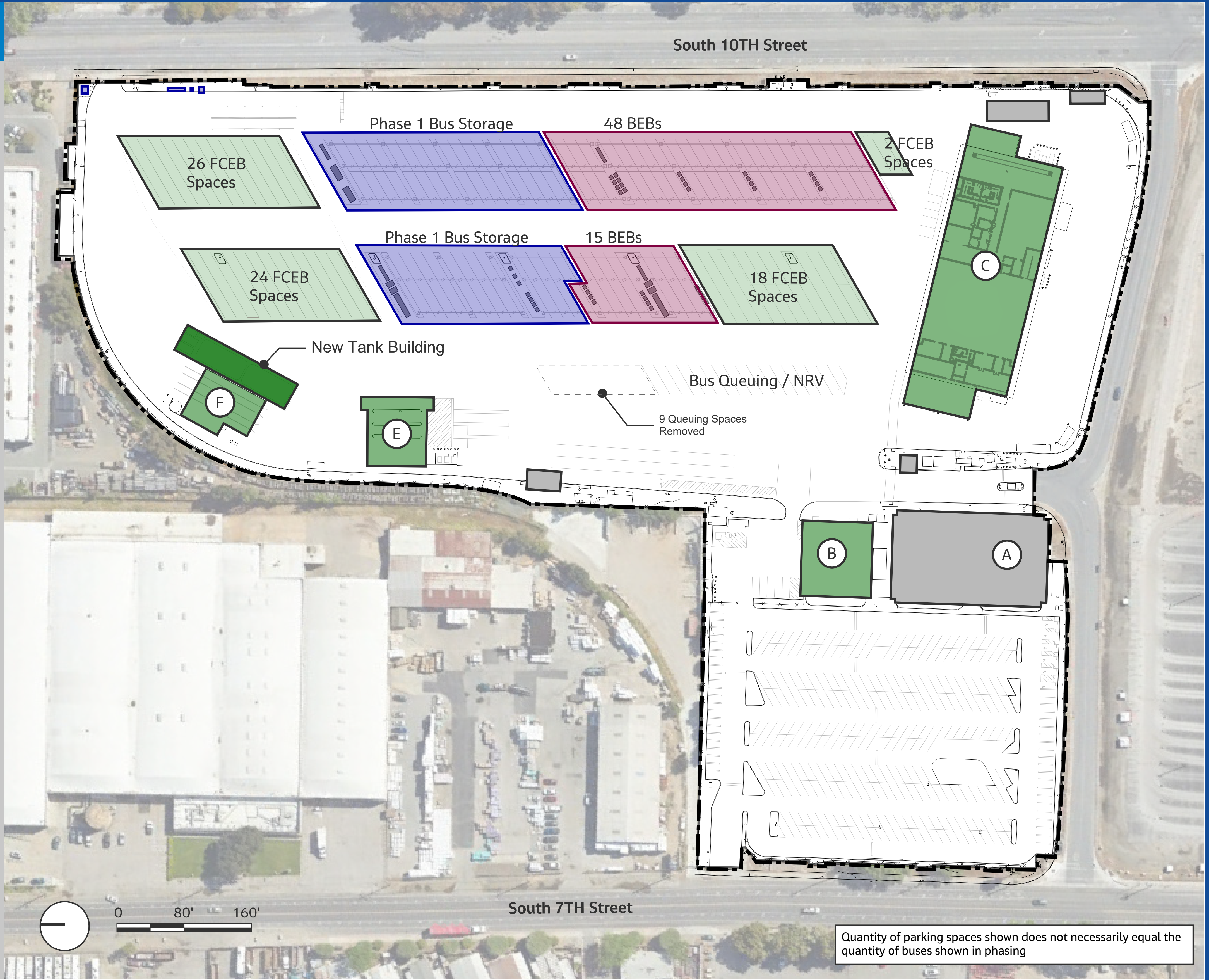
Study and considerations should also be given to bus wash and fueling facilities, and to maintenance and training Building B to ensure adequate hydrogen safety systems are installed.

- Phase 1 Bus Storage and Charging Equipment
- Phase 2 Bus Storage and Charging Equipment
- Phase 3 Bus Storage
- Phase 3 Potential Building Upgrades
- Phase 3 New Tank Building

Site Boundary

Note:
Refer to facility assessment summary for detailed information on building upgrades.

Phase 3 - 2036-2040 fleet counts	
(88) 40' BEB	(56) 40' FCEB
(38) 30' BEB	
Total = 182 Buses	



Chaboya Bus Depot
ZEB Blueprint 2040 Fleet Mixed BEB and FCEB

Jacobs

Site Layout & Circulation (2040)

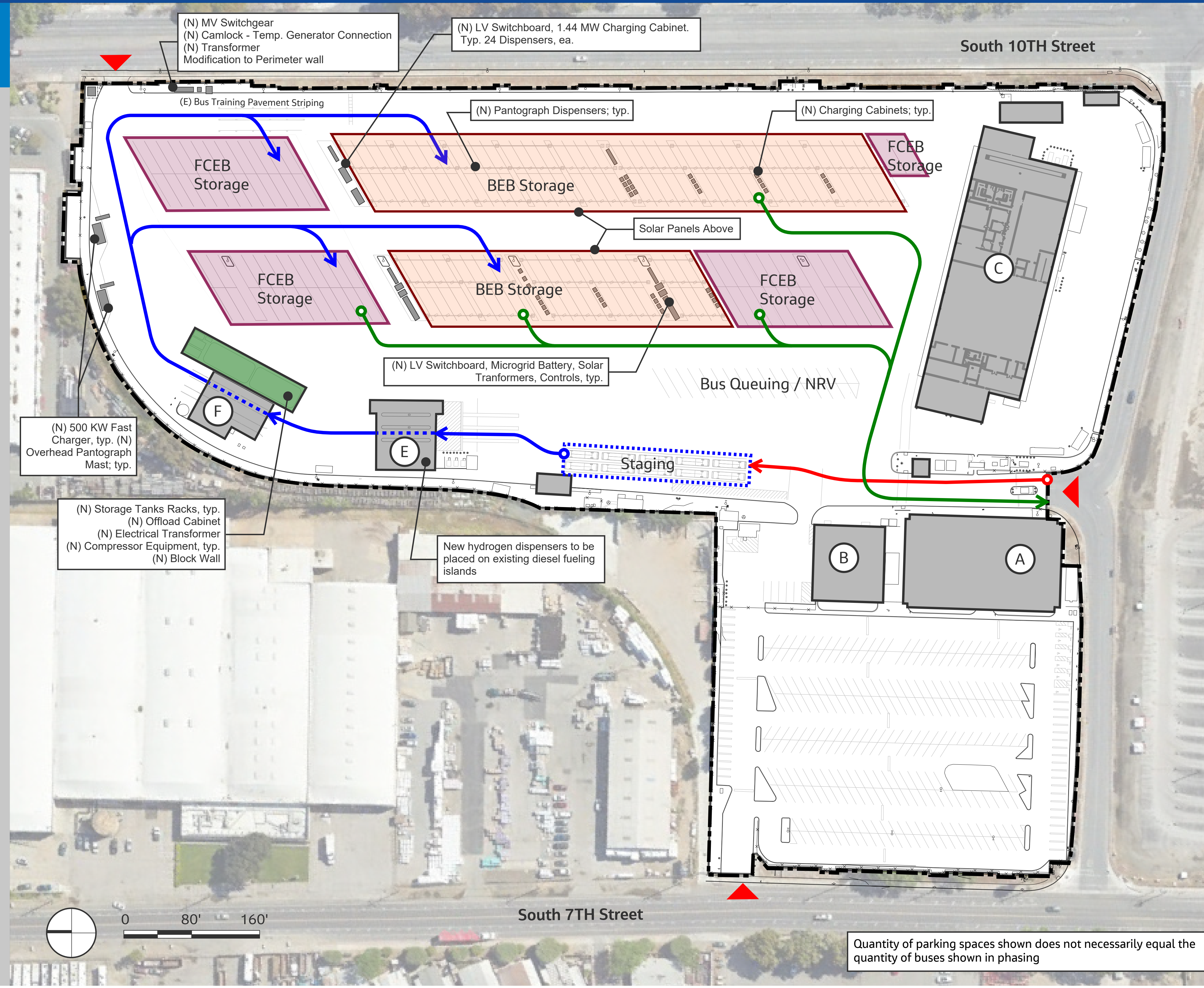
Building Function and Location

- (A) Bus Operations
- (B) Maintenance & Training Center
- (C) Minor Maintenance
- (D) Vault
- (E) Fuel Island
- (F) Bus Wash

Operational Flow

- Pull-In
- Fueling, Wash, Store
- Pull-Out

- Bus Storage
- BEB Bus Storage
- Point of Access
- Site Boundary



Chaboya Bus Depot

ZEB Blueprint 2040 Fleet Mixed BEB and FCEB

Jacobs

List of Projects for Chaboya Depot

The projects required to support the transition to a fully zero-emission bus fleet at Chaboya are outlined below, including indicative costs (to the nearest $1 Million). All costs include price escalation through the project date indicated.

1 Phase 1

Infrastructure Projects

START/END DATES: 2023 to early 2028

COST: $38M

Chaboya BEB Charging Infrastructure

DESCRIPTION: Charging dispensers for 55 battery-electric buses and canopy-mounted solar panels; includes PG&E power supply upgrade

Chaboya Facility Upgrades

DESCRIPTION: Structural, Architectural, Mechanical & Plumbing; Electrical; Sitework; Fire Suppression, with specific elements for Maintenance Buildings

Fire Prevention & Suppression Upgrades

DESCRIPTION: Evaluation and computational modeling, as well as AHJ (Authorities Having Jurisdiction) consultation, to refine fire suppression system requirements specific to Chaboya's bus maintenance facilities

Fleet Procurement

ANTICIPATED DELIVERY DATE: From 2027 | **COST:** $77M

55 Battery-Electric Bus Procurement

DESCRIPTION: To coincide with Chaboya Phase 1 BEB Charging Infrastructure coming online

2 Phase 2

Infrastructure Projects

ANTICIPATED START/END DATES: 2025 to late 2029

ESTIMATED COST: $43M

Chaboya BEB Charging Infrastructure

DESCRIPTION: Charging equipment, overhead gantries and pantographs, supporting delivery of 63 BEBs

Fleet Procurement

ANTICIPATED DELIVERY DATE: From 2029 | **COST:** $79M

63 Battery-Electric Bus Procurement

DESCRIPTION: To coincide with Chaboya Phase 2 BEB Charging Infrastructure coming online

3 Phase 3

Infrastructure Projects

ANTICIPATED START/END DATES: 2034 to mid-2036

ESTIMATED COST: $33M

Chaboya FCEB Infrastructure

DESCRIPTION: Installation of hydrogen tank, fueling storage and dispenser infrastructure, and power supply

Fleet Procurement

ANTICIPATED DELIVERY DATES: 2036 (22 buses) and 2040 (34 buses) | **COST:** $141M

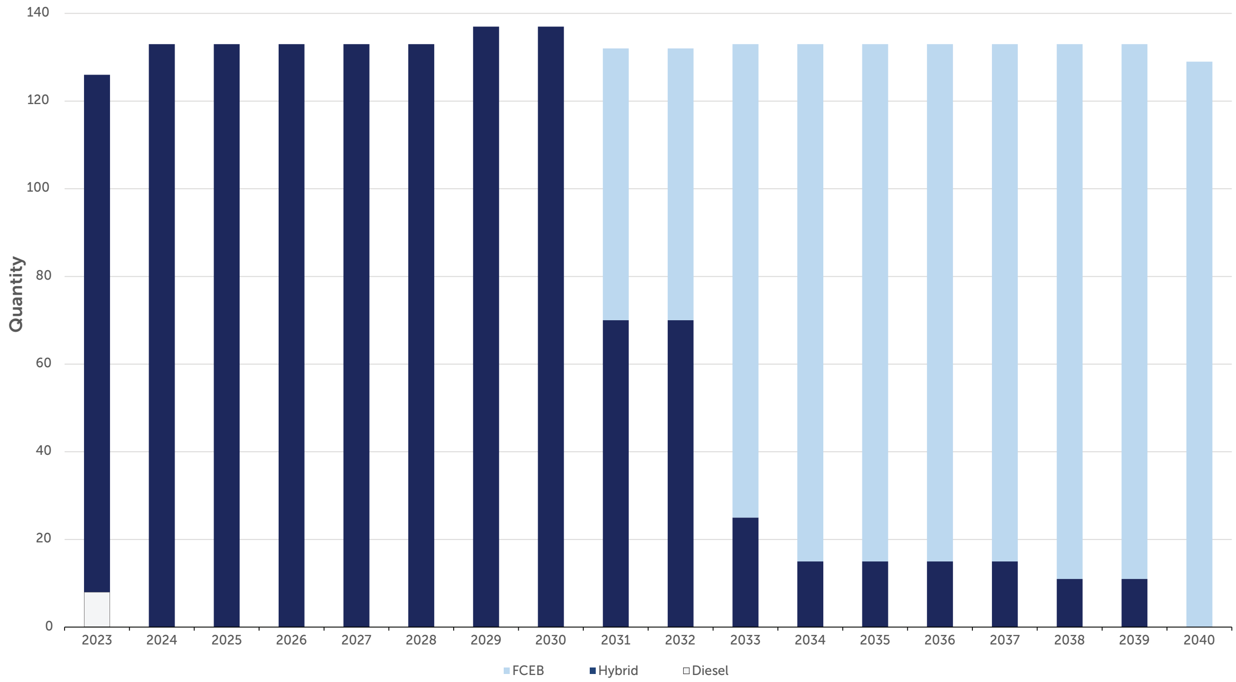
56 Fuel Cell Bus Procurement

DESCRIPTION: To coincide with Chaboya Hydrogen Infrastructure Project coming online

North Depot

North Yard is located in the City of Mountain View and home to VTA's fleet of 60ft buses. The North Bus Depot is envisioned to operate hydrogen fuel cell buses only, with the required infrastructure being transitioned over a single phase, and roll out of FCEBs over two phases.

The anticipated final fleet make-up and transition timeline is provided below.



Proposed ZEB Mix	
FCEB - 40ft	54 (42%)
FCEB - 60ft	75 (58%)
Total	**129 (100%)**

Depot Layout

The following pages show indicative changes to the layout of North depot across each of the transition phases. It includes references to the infrastructure projects required to support a fully zero-emission fleet, followed by a final 'end-state' layout demonstrating what the depot could look like in 2040.

Phase 1 (2031)

Phase 1 transition at North will include the deployment of the central hydrogen fuel storage and dispenser facilities in one phase, with provisions for a phased expansion of dispensers as the North FCEB fleet grows over time. Phase 1 will include:

1. Purchase of hydrogen fuel cell buses, both 40 ft and 60 ft. FCEB fleet will grow to 118 vehicles by 2034.

2. Installation of hydrogen infrastructure:

   1x Large Liquid Hydrogen Station (25k gal.)

   6x Hydrogen dispensers (diesel fueling for 70 buses to remain)

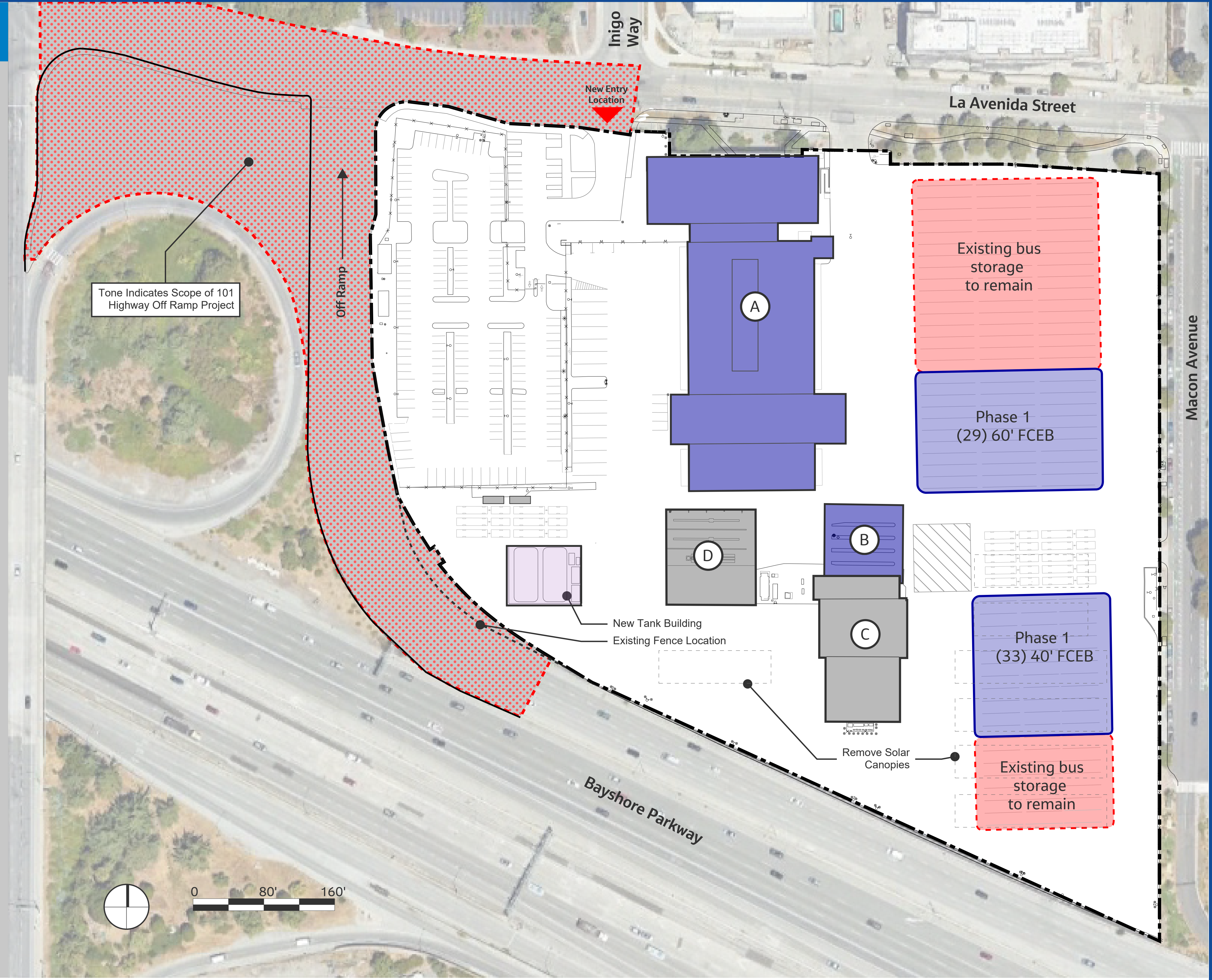
3. Removal of solar canopies

4. Upgrades of the North maintenance facility (Building A) including cranes for bus rooftop access and potential improvements to fire suppression system with a new fire pump. Study and considerations should also be given to bus wash and fueling facilities to ensure adequate hydrogen safety systems are installed.

- Phase 1 Bus Storage
- Phase 1 Building Upgrades
- New Storage Tank Building
- Existing Bus Storage to Remain
- Site Boundary

Note:
Refer to facility assessment summary for detailed information on building upgrades.

Phase 1 - 2031 fleet counts	
(33) 40' FCEB	(70) Hybrid
(29) 60' FCEB	
Total = 132 Buses	

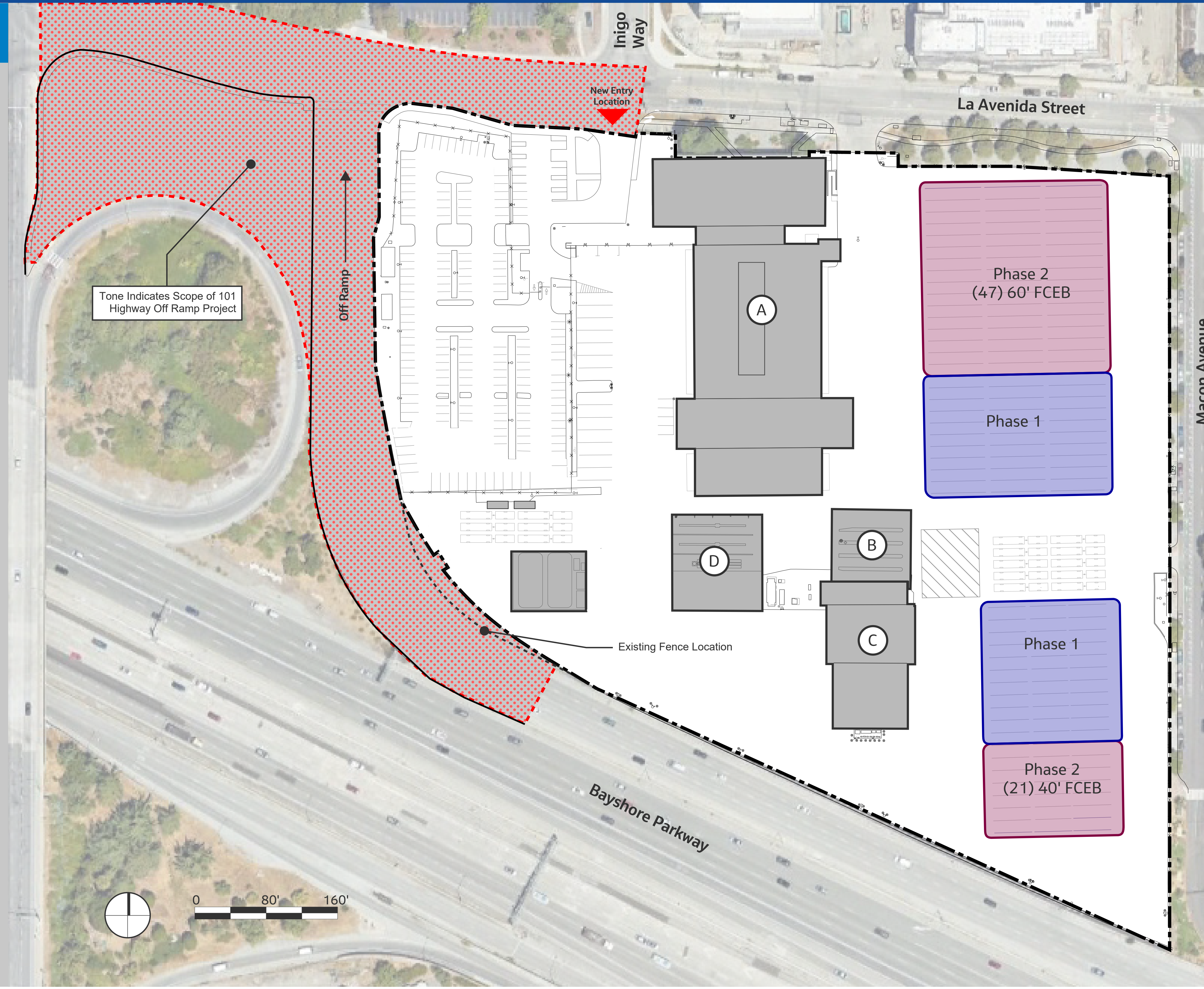


North Bus Depot
ZEB Blueprint 2040 Fleet 100% FCEB

Jacobs

Phase 2 (2040)

Remaining hybrid buses are retired and replaced with 11 FCEBs over a period of approximately 4 years from 2037 to 2040. Assuming the prior completion of all required infrastructure upgrades in Phase 1, this step completes North Yard's zero-emission bus transition.



Phase 1 Bus Storage

Phase 2 Bus Storage

Site Boundary

Note:
Refer to facility assessment summary for detailed information on building upgrades.

Phase 2 - 2040 fleet counts
(54) 40' FCEB
(75) 60' FCEB
Total = 129 Buses

North Bus Depot
ZEB Blueprint 2040 Fleet 100% FCEB

Jacobs

Site Layout & Circulation (2040)

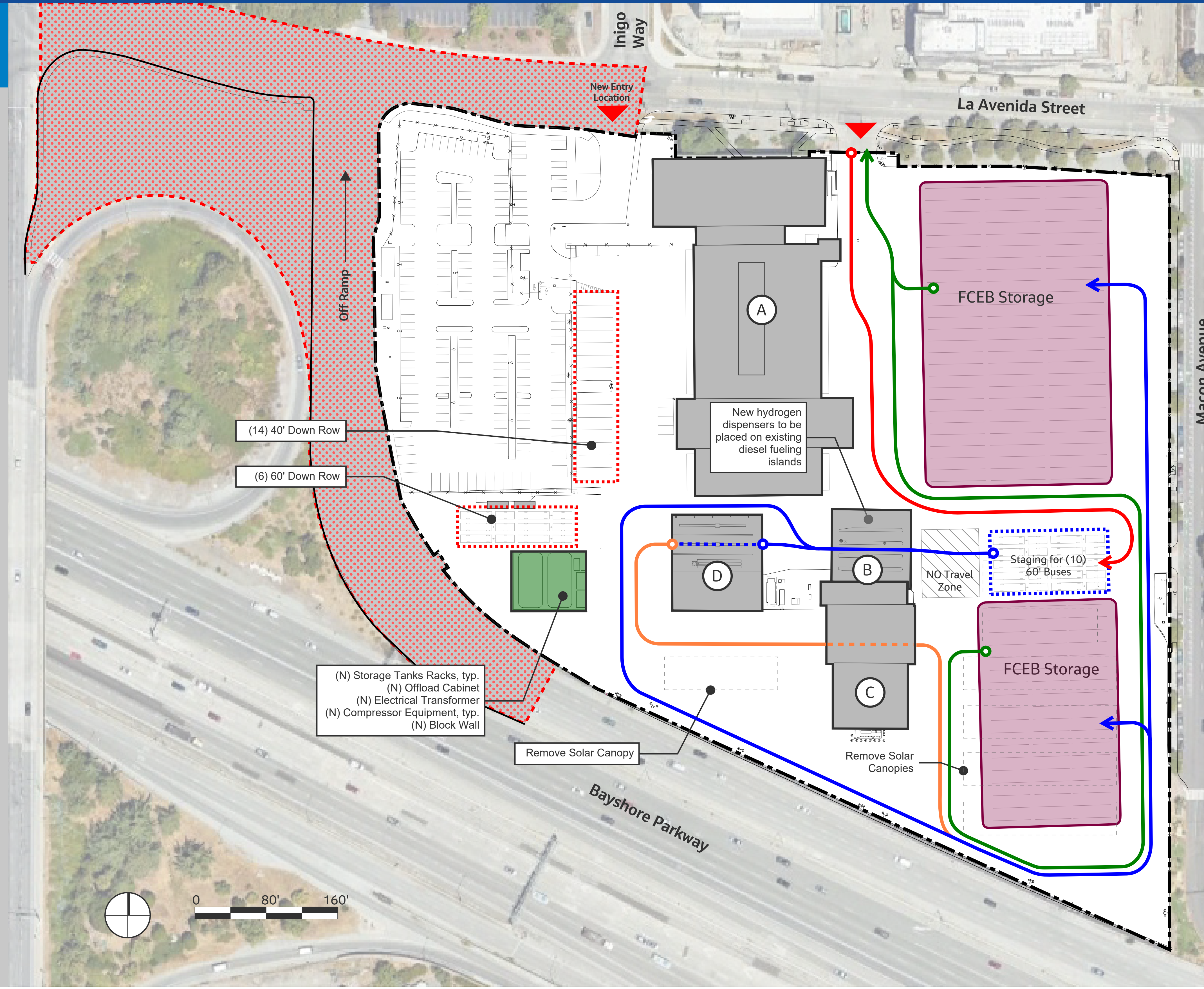
Building Function and Location

- (A) Maintenance Operations
- (B) Fuel Island
- (C) Detail Bay & Tire Shop
- (D) Bus Wash and Waste Water Treatment

Operational Flow

- Pull-In
- Fueling, Wash, Store
- Pull-Out
- Wash, Detail / Tires

- Bus Storage
- Down Row
- Point of Access
- 101 Highway Off Ramp Project
- Site Boundary



North Bus Depot
ZEB Blueprint 2040 Fleet 100% FCEB

Jacobs

List of Projects for North Depot

The projects required to support the transition to a fully zero-emission bus fleet at North are outlined below, including indicative costs (to the nearest $1 Million). All costs include price escalation through the project date indicated.

1 Phase 1

Infrastructure Projects

ANTICIPATED START/END DATES: Mid 2025 to late 2031

COST: $53M

North FCEB Infrastructure

DESCRIPTION: Installation of hydrogen tank, fueling storage and dispenser infrastructure and power supply

North Facility Upgrades

DESCRIPTION: Structural, Architectural, Mechanical & Plumbing; Electrical; Sitework; Fire Suppression

Fire Prevention & Suppression Upgrades

DESCRIPTION: Evaluation and computational modeling, as well as AHJ (Authorities Having Jurisdiction) consultation, to refine fire suppression system requirements specific to North's bus maintenance facilities

Fleet Procurement

ANTICIPATED DELIVERY DATE: 2031 (52 buses) and 2033 (56 buses) **COST:** $280M

118 Fuel Cell Bus Procurement

DESCRIPTION: To coincide with North Hydrogen (FCEB) Infrastructure Project coming online

2 Phase 2

Fleet Procurement

ANTICIPATED DELIVERY DATES: 2038 (4 buses) and 2040 (7 buses) | **COST:** $30M

11 Fuel Cell Electric Bus Procurement

DESCRIPTION: Additional fleet vehicles coinciding with the replacement of remaining hybrid-diesel buses at North

Prioritization Strategy

The ZEB Blueprint is not prescriptive and gives staff flexibility regarding the order of projects that are pursued. Several factors should be considered:

Equity Factor
The California Air Resources Board encourages transit agencies to prioritize zero-emission transit service to communities that experience disproportionately high levels of disadvantage, pollution burden, and respiratory health ailments to the extent possible. To this end, they provide a compound metric, CalEnviroScreen 4.0, that identifies these communities. Federal grant programs also prioritize equity, but use a different metric, the Climate and Economic Justice Screening Tool (CEJST). Both metrics find that in Santa Clara County, the eastern and southern portions of the urbanized area should be prioritized. These areas are largely served by routes that operate out of VTA's Chaboya and Cerone Depots. An equity strategy would prioritize transition at these depots.

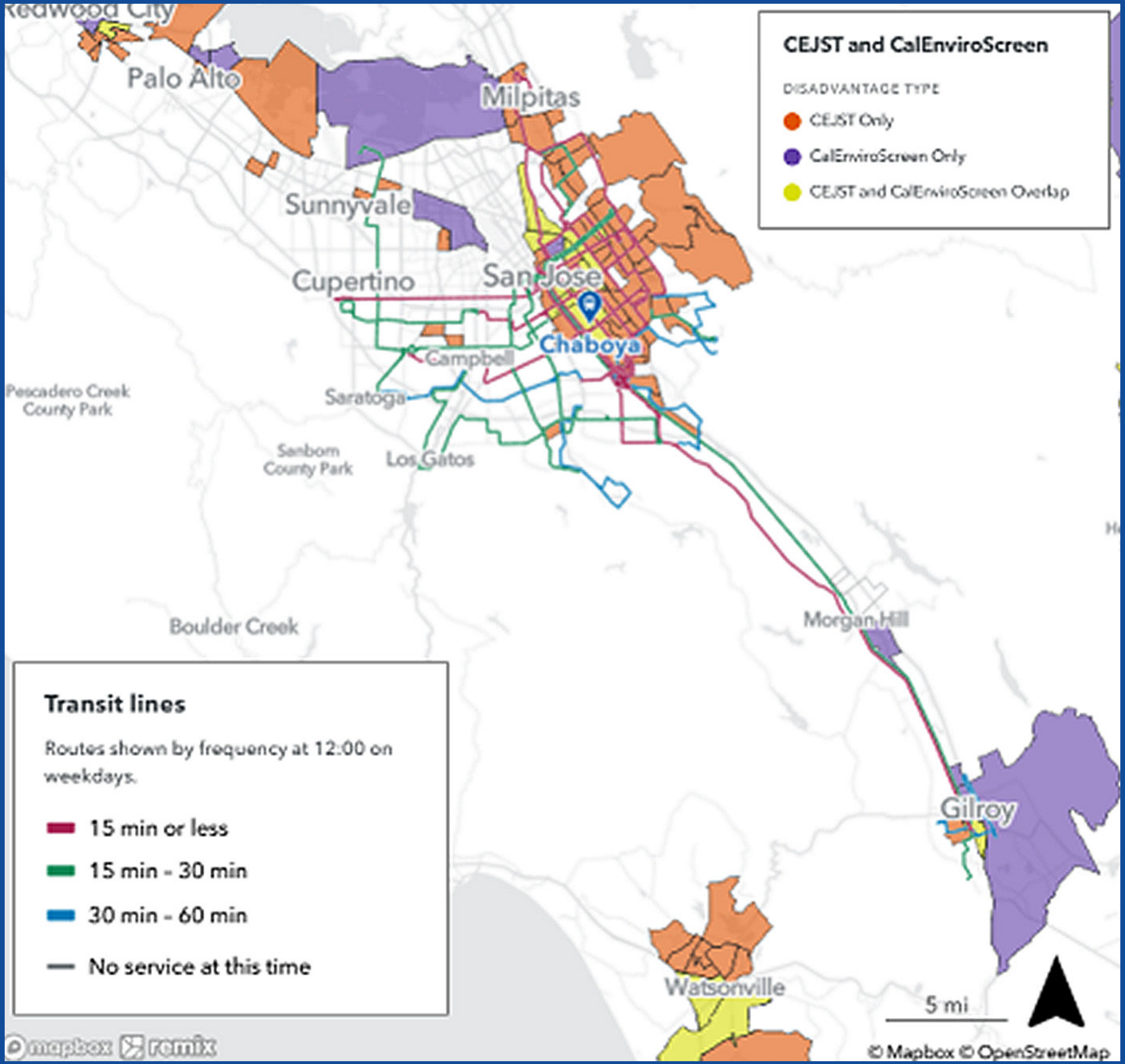
Maps are provided on the following pages showing where each depot's routes intersect with each of the CalEnviroScreen 4.0 and CEJST identified communities.

Technology Cost and Maturation Factor
Battery-electric buses are more proven than hydrogen fuel cell buses and are suitable for VTA's shorter service blocks. These shorter blocks can be prioritized while hydrogen fuel cell bus technology matures, and the quantity of hydrogen fuel cell bus manufacturers increases. Presently, the fuel cost to move a battery-electric bus is lower than a hydrogen fuel cell bus, but hydrogen costs are expected to decrease as production increases. Prioritizing battery-electric transition while hydrogen technology and costs improve appears to be a smart strategy.

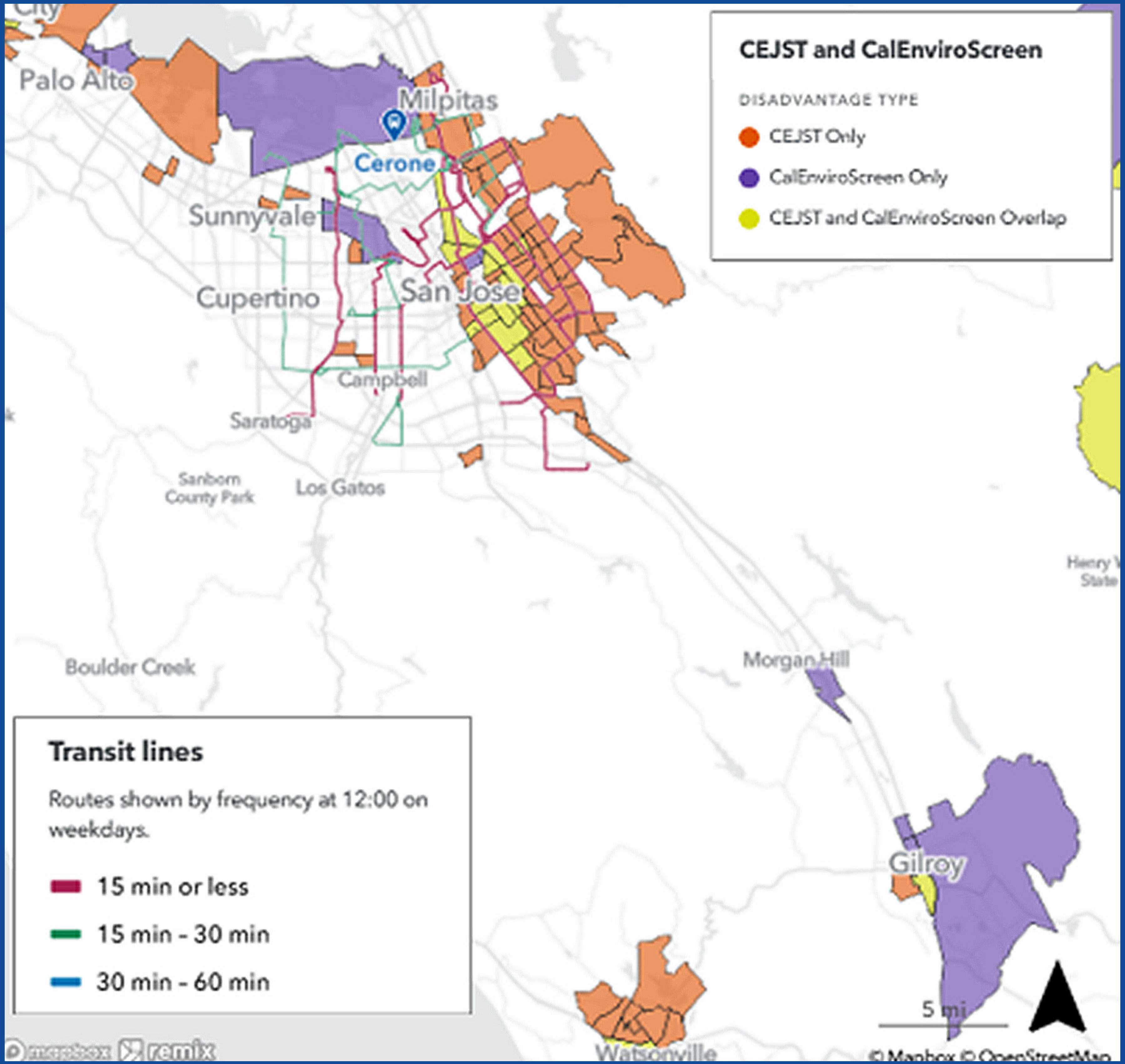
Utility Capacity Factor
Adding battery-electric buses at Cerone and Chaboya Depots will require electrical capacity upgrades that VTA can only request at the time of commencing the project. Though PG&E presently appears able to satisfy VTA's requests, denials or delays could require shifting the order of projects.

Funding Factor
VTA's strategy to pay for zero-emission transition, particularly new infrastructure, is to win grants through competitive programs. The priorities of each grant program are different and may favor certain projects over others. That could lead VTA to prioritize projects that have the highest likelihood of being funded. Since the timing of winning grants is uncertain and sometimes partial awards are given, the order projects are pursued and the scale of their implementation may be influenced by VTA's ability to win grants.

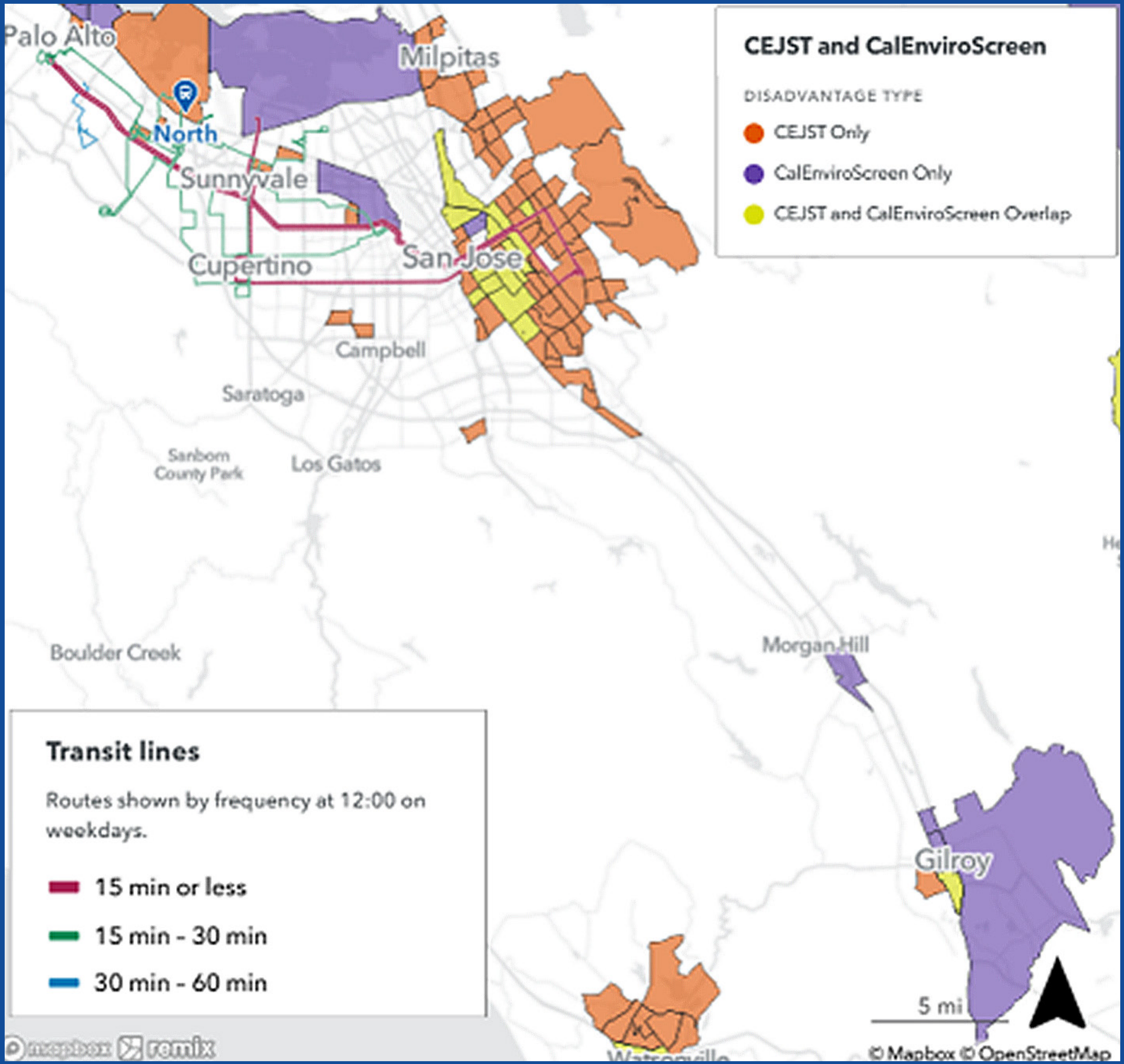
Fleet Replacement Factor
VTA aims to replace the oldest buses first, which would prioritize projects at Cerone and Chaboya Depots. Some fleets, like VTA's 60-foot articulated bus fleet, only operate out of the North Depot. Installation of supporting infrastructure may be prioritized for North Depot when that fleet is nearing retirement.



CEJST and CalEnviroScreen Disadvantaged Communities served by bus routes operating from Chaboya Yard



CEJST and CalEnviroScreen Disadvantaged Communities served by bus routes operating from Cerone Yard



CEJST and CalEnviroScreen Disadvantaged Communities served by bus routes operating from North Yard

2040 Full Fleet Transition

VTA has prepared an indicative timeline demonstrating a potential pathway for ZEB infrastructure and fleet replacement projects to be delivered. The projects are discreet, allowing flexibility for the order in which they are delivered.

The Transition Plan Timeline is provided on the next page.

In Summary:

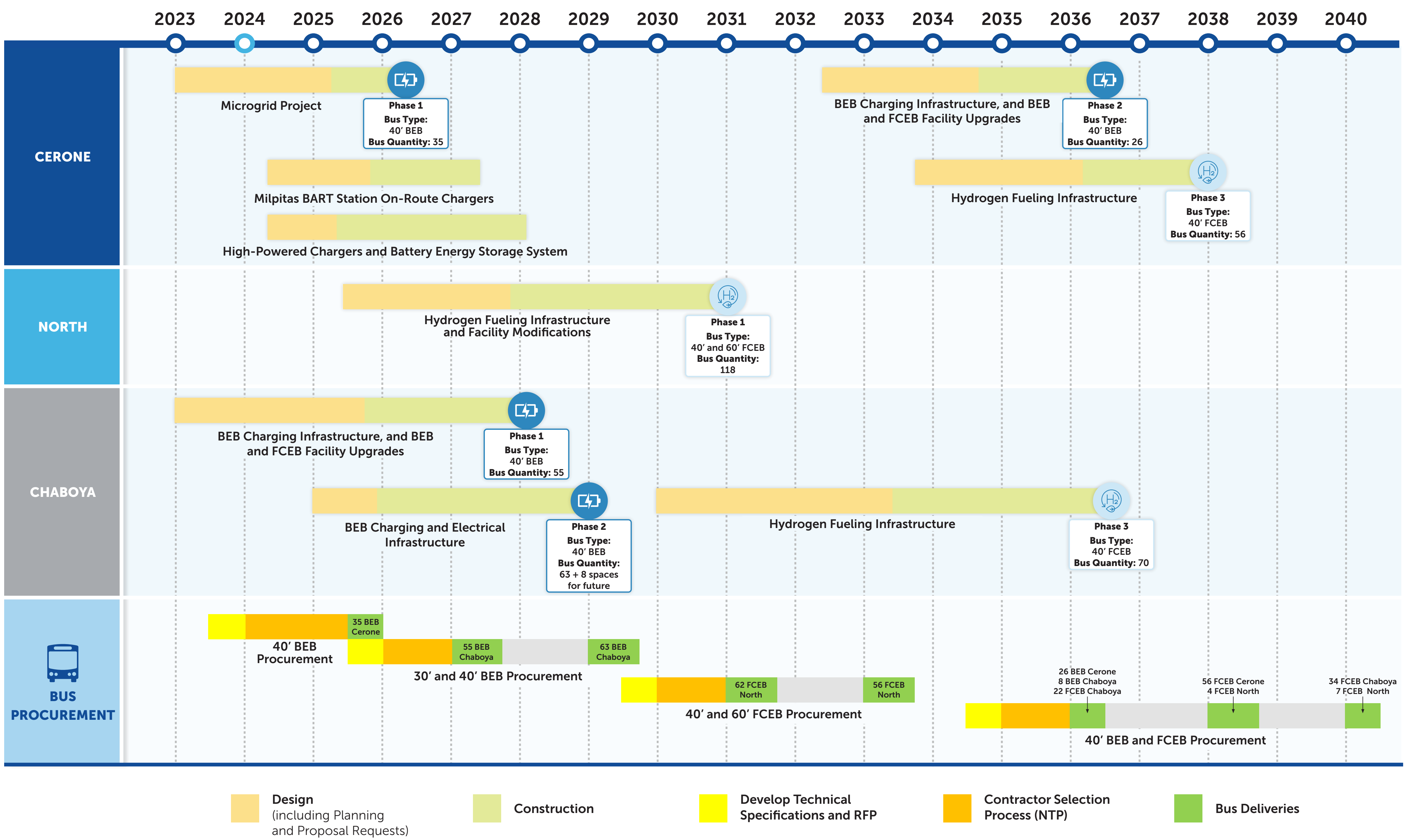
- Existing projects (Cerone Microgrid, Milpitas BART Station Overhead Chargers and Cerone High Powered Charger projects) are included.
- BEB infrastructure projects at Cerone and Chaboya are split into two phases each, with immediate roll-out of BEB fleet vehicles upon completion. This is followed by a final third phase for hydrogen infrastructure construction and two-year roll-out of FCEBs.
- A single phase for hydrogen infrastructure construction is planned for North, followed by a two-year roll-out of FCEBs.

The anticipated final fleet mix and composition, per depot, is as follows:

Table 8: VTA mixed zero-emission bus fleet composition, by length and depot

Type	Length	Cerone	Chaboya	North	Total
BEB	30		38		**38**
	40	61	88		**149**
FCEB	40	56	56	54	**166**
	60			75	**75**
	Total	**117**	**196**	**119**	**428**

ZEB Transition Fleet and Facilities Implementation Plan



VTA ZEB Project Timeline for Full Fleet Transition by 2040

Funding Strategy

The ICT Regulation is an unfunded mandate, which places pressure on transit agencies to cover the costs of transition. VTA will largely seek to fund its zero-emission fleet transition through state and federal grant programs, but these programs are highly competitive and underfunded (as of 2024).

There are a few strategies VTA can pursue that will improve chances of being funded through these programs:

1. Taking an aggressive approach and applying to all programs that align with VTA's transition.
2. Adopting the ZEB Blueprint, which demonstrates a cohesive commitment to full fleet transition. This document will increase the confidence of grantor agencies that VTA has a clear and well-researched plan.
3. Identifying matching funds early through VTA's biennial budgeting process, which enhances grantor agency confidence that VTA will be able to deliver on its match for any grant awards.
4. Coordinating infrastructure installations with fleet purchases, which demonstrates to grantor agencies there is little likelihood of stranded assets, such as buses that lack chargers.

Challenges

Several factors that are outside of VTA's control may affect the rate at which VTA makes transition progress. Accordingly, each successive step that VTA takes should be made cautiously, ensuring that it aligns with the overall transition goals that prioritize preventing negative impacts to VTA's ability to deliver service.

Rising Costs
The per-vehicle cost of zero-emission buses has increased over the past several years and is now 50 to 100 percent greater than the hybrid-diesel buses that these buses would replace. Significant inflation in heavy materials that occurred in the early 2020s has driven bus and supporting infrastructure costs upward. Similarly, operating and maintenance costs for zero-emission buses have been higher than diesel-powered buses, partly owing to decreased build quality that prioritized lightness over durability, leading to extensive downtimes for repair. The price of hydrogen appears to be on the rise, perhaps a product of growing demand and limited supply.

Funding Availability
The ICT Regulation does not provide any funding for transit agencies to cover the costs of transition and state and federal sources are vastly inadequate to meet this need. Some transit operators are faced with the choice of cutting their transit operating budgets to find funding for zero-emission flee transition. Those agencies argue that the resulting service cuts would induce more private vehicle driving and greenhouse gas emissions, making negative progress toward emissions goals.

The largest funding source for zero-emission fleet transition, the Federal Transit Administration's Low/No Emission Bus & Bus Facilities Program, received $9 billion in collective funding requests in 2024, but could only provide $1.5 billion in funding. A recent analysis led by the Metropolitan Transportation Commission estimated a $7 billion need just for the nine-county Bay Area, but only anticipated that $2 billion would be available through state and federal programs between 2024 and 2040.

Vehicle Reliability
Transit operators across the state are struggling with zero-emission bus reliability with many experiencing unacceptable rates of downtime due to repair or charging failures. Travel ranges for battery-electric buses have been disappointing, particularly during hot and cold weather. VTA's initial fleet of ten battery-electric buses was grounded after a component fire occurred and the manufacturer, having since declared bankruptcy, was unable to provide an adequate repair. Several agencies are scaling back their zero-emission bus transition ambitions or pausing transition programs entirely due to reliability problems.

Utility Capacity
Battery-electric bus fleets require large amounts of electricity, and it is unclear if utility capacity upgrades can be completed at the scale and timing needed to support VTA's fleet transition. Some transit operators have had their requests for capacity upgrades declined or delayed. VTA can only request capacity upgrades when it is ready to begin a project, but there is no guarantee that electrical capacity that exists today will exist in the future.

Bus Manufacturing Concerns
The quantity of Buy-America compliant bus manufacturers has decreased from 11 in 2014 to just two—Gillig and New Flyer—in 2024. Those manufacturers are currently facing financial challenges due to demand reductions that occurred after the onset of the COVID-19 pandemic and recent heavy materials inflation. This limits competition and choice for buyers and raises questions about the long-term viability of these companies. Transit agencies rely on manufacturers to provide technical training, replacement parts and warranty support over the lifetime of the vehicle. These support services are especially important when onboarding new technologies where agency staff have yet to develop these specialized skills.

Retaining Flexibility

Though the ZEB Blueprint charts a course for full fleet transition by 2040, it is unlikely that VTA's actual transition will perfectly align with this plan. Technology will advance in unpredictable ways. Market factors will cause prices to fluctuate. Vendors will enter and exit the market. VTA will have to adapt, perhaps by adjusting the balance of fleet technologies, pace of transition or pursuing different projects or depot layouts.

Each successive transition step can be guided by the expertise VTA gains along the way from its own zero-emission operating experience and from coordinating with peer transit agencies. The ZEB Blueprint is meant to be flexible and it may be prudent to update this document between now and 2040.

Santa Clara Valley Transportation Authority