PLACER COUNTY DEPARTMENT OF PUBLIC WORKS

ZERO EMISSION BUS ROLLOUT PLAN

Final

January 2023

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TABLES

FIGURES

ACRONYMS AND TERMS

Acronym/Term	Description
BEB	Battery-Electric Bus
BESS	Battery Energy Storage Systems
CARB	California Air Resources Board
CNG	Compressed Natural Gas
Efficiency	A measure of a vehicle's performance, expressed in kilowatt-hours per mile
FCEB	Fuel Cell Electric Bus
FTA	Federal Transit Administration
GTFS	General Transit Feed Specification
ICEB	Internal Combustion Engine Bus
ICT	Innovative Clean Transit
kV	Kilovolt
kVA	Kilo Volt-Ampere
kW(h)	Kilowatt (hour)
MW(h)	Megawatt (hour)
OEM	Original Equipment Manufacturer
PCDPW	Placer County Department of Public Works
PCT	Placer County Transit
PG&E	Pacific Gas & Electric
PV	Photovoltaic
SOC	State of Charge
TART	Tahoe-Truckee Area Regional Transit
ZE(B)	Zero-Emission (Bus)

EXECUTIVE SUMMARY

ES1 BACKGROUND

The California Air Resource Board's (CARB) Innovative Clean Transit (ICT) regulation has mandated that all transit agencies in California transition from internal combustion engine buses (ICEBs) to zero-emission buses (ZEBs) by 2040.[1] To ensure that each agency has a strategy to comply with the 2040 requirement, the ICT regulation requires each agency to submit a ZEB Rollout Plan before purchase requirements take effect. The Rollout Plan is considered a living document and is meant to guide the implementation of ZEB fleets and help transit agencies work through many of the potential challenges and explore solutions.

In accordance with the ICT regulation, the following report serves as Placer County Department of Public Work's (PCDPW) Rollout Plan. The information presented in this Rollout Plan is derived from the PCDPW's Zero Emission Bus Feasibility and Transition Plan (2022), a comprehensive framework that includes detailed analyses and actionable steps to begin the process of transitioning its fleet, pursuant to the requirements of the ICT regulation.

ES2 EXISTING SERVICE AND FLEET

The PCDPW operates fixed route, Dial-a-Ride, and commuter transit services via two fleets, Placer County Transit (PCT), and Tahoe Truckee Area Regional Transit (TART).

The two fleets operate a wide range of vehicle types to meet service requirements. These include standard buses (35 and 40-foot), cutaways of varying lengths, and motor coaches. The fleets are powered by several fuel types, including diesel, compressed natural gas (CNG), and gasoline. According to CARB's ICT regulation, all vehicles with a gross vehicle weight rating (GVWR) that exceeds 14,000 pounds are subject to replacement. Almost all the vehicles in both PCT and TART are above this threshold.

Table ES-1 summarizes PCDPW's fleets, yard locations, number of blocks and routes served, and total number of vehicles.

Table ES-1. PCDPW Service Summary

Fleet	Yard Address	No. of Blocks	No. of Routes	Total Number of Vehicles
Placer County Transit	11448 Avenue F, Auburn	18	7	29
Tahoe-Truckee Area Regional Transit	870 Cabin Creek Rd, Truckee	17	9	16

Source: PCT GTFS 2019/20 pre-pandemic service; TART GTFS Spring/Fall 2019; Placer County Vehicle Inventory, March 2021

ES3 PREFERRED ZE TECHNOLOGY AND REQUIRED FACILITY, POWER, AND ENERGY IMPROVEMENTS

At this time, the PCDPW is primarily evaluating BEB technology for adoption. Although the PCDPW would benefit from FCEB technology's range capabilities, current market research indicates limited available vehicle options (especially in the cutaway market) and hydrogen suppliers, and higher capital investment needs at the current stage. The PCDPW has not ruled out FCEB technology, and depending on market factors, may pursue this technology in the future.

1 CARB ICT Regulation

BEBs require a significant amount of electrical power. Currently, PCT and TART's yards will require power upgrades from their respective electrical utilities, Pacific Gas & Electric (PG&E) and Liberty Utilities to support the full fleet buildout.

The facility analysis finds that each facility can accommodate the charging infrastructure for early phases of the BEB fleet deployment but will eventually need upgraded service. The facility upgrade recommendations will be refined and further evaluated in subsequent stages of design implementation. Moreover, to ensure service delivery and energy resiliency during emergency outages, all sites can benefit by installing a permanent generator.

Table ES-2 summarizes the facility upgrades needed for the PCDPW's fleets to accommodate the maximum number of vehicles expected in the future fleet.

Table ES-2. Summary of Required Site Upgrades

Upgrade	Placer County Transit	Tahoe-Truckee Area Regional Transit
Electrical Service	Yes	Yes
Utility System	No	Yes
Charging Equipment	- 150 kW DC (12) charging cabinets - 1:2 cabinet to dispenser ratio	- 150 kW DC charging cabinets (9) - 1:2 cabinet to dispenser ratio - Cable retractors (5)
Charging Strategy	- Ground-Mounted Plug-In (22) - Plug-In dispenser in maintenance area (1)	- Ground-Mounted Plug-In (11) - Overhead-Mounted Plug-in (6) - Plug-In dispenser in maintenance area (1)
Electrical Equipment	- New utility transformer - New main switchboard and meter - Underground conduit to vehicle chargers	- New utility transformer - New main switchboard and meter - Underground conduit to vehicle chargers - Utility line and substation equipment upgrades

Source: WSP

ES4 ZEB TRANSITION

CONSTRUCTION SCHEDULE

Each yard's construction schedule varies based on the size of the facility and upgrade requirements. Both yards are anticipated to have the required infrastructure installed and constructed in advance of the CARB ICT regulation's first purchase requirements in 2026 (25% of all new purchases to be ZEB). Table ES-3 provides an overview of each yard's construction schedule along with the number of proposed construction phases.

Table ES-3. Construction Summary

Facility	Phase	Number of Phases	Timeline
PCT	Utility Enhancements	N/A	February 2025 – July 2026
	Design & Procurement	N/A	July 2024 – April 2026
	Construction	3	May 2026 – January 2029
TART	Utility Enhancements	N/A	July 2023 – December 2024
	Design & Procurement	N/A	January 2023 – June 2024
	Construction	3	July 2024 – October 2025

Source: WSP
Note: All phases are assumed to be inclusive of applications, permits, and bid/procurement activities.

VEHICLE PROCUREMENT SCHEDULE

The proposed procurement schedule is based on a 1:1 replacement ratio - assuming BEB battery technology advances at a rate that will eventually meet all of the PCDPW's service block range requirements. The assumed delivery dates of vehicles were developed with special consideration to vehicles' useful life, construction completion dates, and reducing impacts to maintenance staff (i.e., spreading out preventative maintenance and overhauls). Table ES-4 shows the procurement schedule for all fleets by year for all vehicle types.

Table ES-4. Vehicle Procurement Schedule

Delivered Vehicles	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
ICE Cutaways	2	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZE Cutaways	-	-	4	2	-	-	-	-	-	-	2	7	-	-	-	-	-
ICE Buses	-	4	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
ZE Buses	-	4	-	5	-	7	2	-	3	-	2	-	-	4	-	3	-

Source: WSP

ES5 LIFECYCLE COSTS AND FUNDING

LIFECYCLE COSTS

While costs for a full fleet transition are still being analyzed, it is estimated that the "cash costs" (capital, operating, and disposal) of the BEB transition would cost an estimated $34 million over a 24-year period, as compared to operating the fleet as-is ("No Build" scenario).

If the PCDPW were to continue to operate an all-ICEB fleet over the next 24 years, lifecycle direct cash costs (capital, O&M, and disposal) would be approximately $118 million. The transition to an all-BEB fleet over the same time period would cost $152 million – _or an incremental cost increase of approximately $34 million. However, some over these costs can potentially be offset by reduced emissions and other environmental benefits, potentially reducing the incremental cost to approximately $26 million. This estimate is based on a 1:1 bus replacement ratio and does not consider the capital costs associated with the purchase of additional buses (due to range limitations), on-site battery storage or photovoltaics, charge management software, or on-route charging infrastructure, if needed. The comparative costs of operating the PCDPW's existing fleet and transitioning to BEBs in year of expenditure dollars are summarized in Table ES-5.

Table ES-5. 2021-2045 Fleet Transition Costs (in millions, YOE)

Cost Categories	PCT		TART		Total	
	"No Build" Scenario	BEB Scenario	"No Build" Scenario	BEB Scenario	"No Build" Scenario	BEB Scenario
Total Capital Costs	$27	$42	$16	$24	$43	$66
Total Operating Costs	$49	$53	$27	$33	$76	$86
Total Disposal Costs	$1	-$1	$0	$0	$1	-$1
Total Cash Costs	$75	$95	$43	$57	$118	$152
Total Environmental Costs	$8	$4	$5	$3	$13	$7
Total Non-Cash Costs	$8	$4	$5	$3	$13	$7
Total Cash and Non-Cash Costs	**$83**	**$99**	**$48**	**$60**	**$132**	**$158**

Source: WSP

Note: The total costs may vary due to rounding. Rounded to the nearest whole dollar.

FUNDING

The costs associated with the PCDPW's transition can be partially (or fully funded) through the use of various existing and new funding programs. Several federal, state, regional, and other funding opportunities have a high potential to fund the PCDPW's fleets' capital projects. The federal Bipartisan Infrastructure Law (BIL) signed by President Biden in late 2021 has significantly increased funding for formula and discretionary grant programs that can be used to fund capital projects, including procurement of ZEBs, construction of associated charging and fueling infrastructure, and improvements to maintenance facilities to support ongoing operations. At the state and regional levels opportunities include California State Transportation Agency (CalSTA) Transit and Intercity Rail Capital Program (TIRCP), Caltrans Low Carbon Transit Operations Program (LCTOP), Caltrans/State Controller's Office SB1 State of Good Repair (SGR) Program, and Placer County Air Pollution Control District Carl Moyer and Community Emission Reduction Grant Programs. PCDPW's fleets are also eligible for the PG&E Electric Vehicle (EV) Fleet program.

ES6 FINDINGS

The PCDPW's analysis identifies several challenges in transitioning the fleet to BEBs. These include time constraints, unpredictable advancements in ZE technology that could risk transit performance and service reliability, and significant capital, operational, and ongoing maintenance costs. The following list of challenges is not exhaustive; however, it summarizes some of the identified issues and uncertainties that the PCDPW will have to mitigate and/or address as it transitions its fleet:

- **Uncertainty of COVID-19.** COVID-19 has impacted all facets of our global economy, including public transit. Most transit agencies in the US are observing a slow recovery in ridership and experiencing challenges to restore service to pre-COVID levels. At this time, it is still unclear what the long-term impacts will be on the PCDPW's service. There is a possibility that service ridership levels may not return to previous levels, resulting in changes to expected revenues, and capital improvement plans – including the approach to transitioning the fleet to ZEBs.
- **Rapid Technological Advancement.** The PCDPW is currently planning for a transition based on the fleet as of 2019 (pre-COVID). The PCDPW will soon need to make decisions on fleet requirements, and it is difficult to anticipate future technological changes, such as improved batteries and chargers. The PCDPW will have to make decisions to purchase fleets based on what is known at the time of the contract. This exposes the agency to a risk of missing out on improvements that come soon after contract execution, rendering purchased technologies outdated on arrival.
- **Insufficient BEB Performance and Range.** The BEB industry is constantly innovating and developing vehicles with longer ranges and more efficient batteries. However, the PCDPW's analysis indicates that some service blocks cannot be completed with existing technologies, particularly longer or hillier routes. Unless battery technologies evolve, the agency will have to invest in range-enhancing technologies to meet requirements.
- **Resiliency and Emergency Response.** The PCDPW is seeking solutions to address resiliency and emergency response within the context of a ZEB fleet. With BEBs, service will be dependent on electricity, this makes the service vulnerable during outages and wildfire emergencies.
- **High Capital and O&M Costs.** The PCDPW will exceed its existing rolling stock capital and operations budgets with a transition to ZEBs. Installing infrastructure onsite is expensive and will need to replace the existing fueling infrastructure - which is still within its useful life. Additionally, ZEBs are more expensive than ICE vehicles, and the PCDPW will have to find more funding for this additional cost.
- **Strains on Market Supply.** The ICT regulation will put a lot of pressure on OEMs to produce ZEBs at unprecedented rates. However, it is not only California that is interested in converting to ZEBs. These monumental policy changes make it challenging to meet ZEB goals for agencies if the supply of buses cannot meet demand. This may cause strains on supply, resulting in risk to meeting purchase requirement deadlines.

- **Transition Complexity.** Maintaining service and adhering to ICT regulation purchase requirements, all while managing on-site construction, facility rebuilds, temporary bus relocations, bus procurements, and utility enhancements introduces a lot of risk to the PCDPW's program. If one element of this transition doesn't go as planned, there will be implications for other components of the program.
- **Dependence on Utility Enhancements.** The PCDPW's yards will require upgraded electrical service and infrastructure. The utility application and construction process will take time and money.
- **Managing Power Demand.** The transition to BEBs will require strategies to ensure that the PCDPW can utilize power in the most efficient way. The PCDPW is coordinating with utility providers to determine methods to reduce peak demands. However, managing demand may also come at a hefty capital cost, something that staff is currently analyzing.

1 ROLLOUT PLAN SUMMARY

Agency Background	
Transit Agency's Name	Placer County Department of Public Works
Mailing Address	3091 County Center Dr., Suite 220, Auburn, CA 95603-2640
Transit Agency's Air District	Placer County Air Pollution Control District
Transit Agency's Air Basin	Lake Tahoe, Mountain Counties, and Sacramento Valley[2]
Total Number of Buses in Annual Maximum Service	40 (17 directly-operated and 13 purchased transportation, 10 Vanpool)[3]
Urbanized Area	Sacramento & Tahoe
Population of Urbanized Area	Sacramento - 1,723,634[4]; Tahoe - 210,000 per FAST Act
Contact information of general manager, chief operating officer, or equivalent	Ken Grehm, Director of Public Works
Rollout Plan Content	
Is your transit agency part of a Joint Group?	No
Is your transit agency submitting a separate Rollout Plan specific to your agency, or will one Rollout Plan be submitted for all participating members of the Joint Group?	N/A
Please provide a complete list of the transit agencies that are members of the Joint Group (optional)	N/A
Contact information of general manager, chief operating officer, or equivalent staff member for each participating transit agency member	N/A
Does Rollout Plan have a goal of full transition to ZE technology by 2040 that avoids early retirement of conventional transit buses?	Yes
Rollout Plan Development and Approval	
Rollout Plan's approval date	TBD
Resolution No.	2023-057
Is a copy of the Board-approved resolution attached to the Rollout Plan?	Yes
Contact for Rollout Plan follow-up questions	Will Garner Placer County Department of Public Works Deputy Director of Public Works wgarner@placer.ca.gov 530.745.7582
Who created the Rollout Plan?	Consultant
Consultant	WSP

2 California Air Basin Map

3 https://www.transit.dot.gov/sites/fta.dot.gov/files/transit_agency_profile_doc/2020/90196.pdf

4 https://www.transit.dot.gov/sites/fta.dot.gov/files/transit_agency_profile_doc/2020/90196.pdf

2 INTRODUCTION

In accordance with the California Air Resources Board's (CARB) Innovative Clean Transit regulation (ICT regulation), the following report serves as Placer County Department of Public Work's (PCDPW) Rollout Plan to transition its bus fleet to 100% zero-emission (ZE) by 2040.

The information presented in this Rollout Plan is derived from the PCDPW's Zero Emission Bus Feasibility and Transition Plan (2022), a comprehensive framework that includes detailed analyses and actionable steps to begin the process of transitioning its fleet, pursuant to the requirements of the ICT regulation.

2.1 BACKGROUND

2.1.1 CALIFORNIA AIR RESOURCES BOARD'S INNOVATIVE CLEAN TRANSIT REGULATION

Effective October 1, 2019, the ICT regulation requires all public transit agencies in the state to transition from internal combustion engine buses (ICEBs) to zero-emission buses (ZEBs), such as battery-electric buses (BEB) or fuel cell electric buses (FCEB), by 2040. The regulation requires a progressive increase of an agency's new bus purchases[5] to be ZEBs based on its fleet size.

To ensure that each agency has a strategy to comply with the 2040 requirement, the ICT regulation requires each agency, or a coalition of agencies, to submit a ZEB Rollout Plan before purchase requirements take effect. The Rollout Plan is considered a living document and is meant to guide the implementation of ZEB fleets and help transit agencies work through many of the potential challenges and explore solutions. Each Rollout Plan must include several required components and must be approved by the transit agency's governing body through the adoption of a resolution, prior to submission to CARB.

According to the ICT regulation, each agency's requirements are based on its classification as either a "Large" or "Small" transit agency. The ICT defines a Large Transit Agency as an agency that operates in the South Coast or the San Joaquin Valley Air Basin and operates more than 65 buses in annual maximum service or it operates outside of these regions, but in an urbanized area with a population of at least 200,000 and has at least 100 buses in annual maximum service. A Small Transit Agency is an agency that doesn't meet the above criteria.

The PCDPW, as a Small Transit Agency, must comply with the following requirements:

July 1, 2023 – Board of Directors (Board) approved Rollout Plan must be submitted to CARB

January 1, 2026 – 25% of all new bus purchases must be ZE

January 1, 2029 – 100% of all new bus purchases must be ZE

January 1, 2040 – 100% of fleet must be ZE

March 2021 – **March 2050** – Annual compliance report due to CARB

[5] Bus purchase refers to all new bus procurements, including new rolling stock contracts and purchase orders.

This Rollout Plan, provides the framework to transition the PCDPW's fleet(s) pursuant to the CARB ICT requirements and milestones. In accordance with CARB's Rollout Plan Guidance, the PCDPW's Rollout Plan includes all required elements. The required elements and corresponding sections are detailed below:

- Transit Agency Information (Section 1: Rollout Plan Summary)
- Rollout Plan General Information (Section 1: Rollout Plan Summary)
- Technology Portfolio (Section 2.1: Background)
- Current Bus Fleet Composition and Future Bus Purchases (Section 3: Fleet and Acquisitions)
- Facilities and Infrastructure Modifications (Section 4: Facilities and Infrastructure Modifications)
- Providing Service in Disadvantaged Communities (Section 5: Equity Considerations)
- Workforce Training (Section 6: Workforce Development and Training)
- Potential Funding Sources (Section 7: Costs and Funding Opportunities)
- Start-up and Scale-up Challenges (Section 8: Start-up and Scale-up Challenges)

Due to the rapidly evolving nature of ZEB technologies, it is likely that the recommended approaches in this Rollout Plan will be adjusted and changed over time. Areas that are currently under study will be indicated, where applicable. The service-related information in this Rollout Plan is based on 2019/20 pre-pandemic service levels.

2.1.2 PLACER COUNTY DEPARTMENT OF PUBLIC WORKS

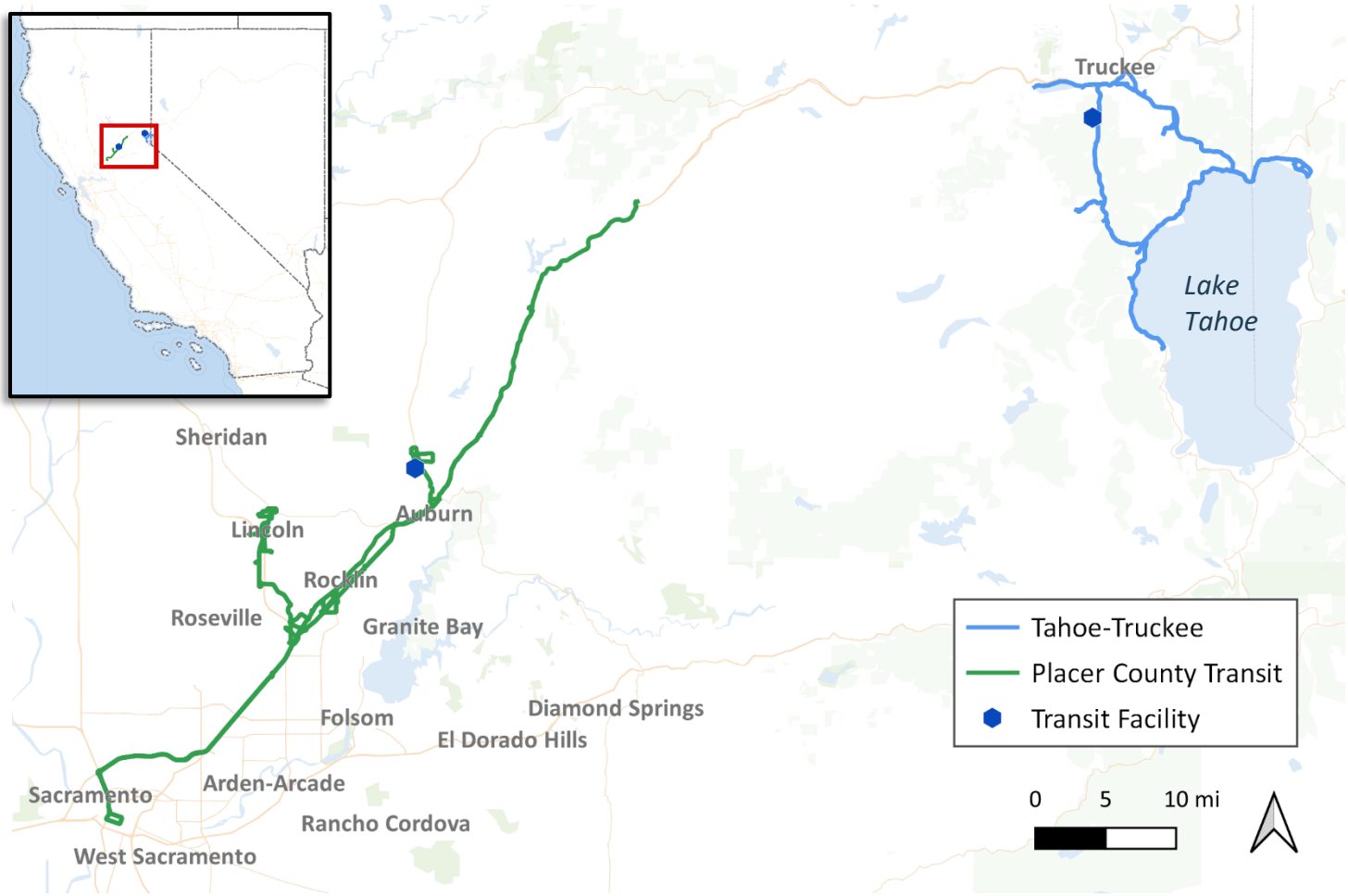
The PCDPW operates fixed route, Dial-a-Ride, and commuter transit services via two fleets, Placer County Transit (PCT), and Tahoe Truckee Area Regional Transit (TART). In addition to transit service, the PCDPW provides environmental utilities, floodplain management, engineering support, stormwater management, and the maintenance of county vehicles and roads.

SERVICE AREA

Placer County is approximately 1,407 square miles and contains the urban areas of Roseville, Lincoln, Auburn, Rocklin, Colfax-Monumental Ridge, Foresthill-Back Country, and Lake Tahoe (Figure 2-1).

According to the 2019 American Community Survey, approximately 398,000 people reside in the county, and approximately 1% of its workforce above the age of 16 use public transportation to commute to work.

Figure 2-1. The PCDPW's Service Area



Source: PCT GTFS 2019/20 pre-pandemic service; OpenStreetMap Contributors

UTILITY PROVIDER

The PCDPW is served by two utility providers – Pacific Gas & Electric (PG&E) and Liberty Utilities. PG&E, one of the largest combined natural gas and electric energy companies in the United States, services the City of Auburn – the service area of PCT. Liberty Utilities Tahoe provides reliable clean energy and electric power to the greater Lake Tahoe region – the service area of TART. As the PCDPW begins the transition to ZEB technology, it is essential to coordinate with PG&E and Liberty Utilities to assess infrastructure needs and explore PG&E's EV Fleet program and other applicable incentives.

ENVIRONMENTAL FACTORS

The PCDPW's urban areas generally have a Mediterranean climate consisting of cool, wet winters and hot, dry summers. Although it is rare, these areas can also experience snowfall. Lake Tahoe, on the other hand, has a continental climate which consists of warm, dry summers and chilly winters with regular snowfall. The average temperature in Placer County is 88 degrees in the summer and 40 degrees in the winter.[6] Placer County has varied elevation, with its highest point at 9,144 feet and its lowest elevation at 571 feet.[7] This wide range in elevation affects the relative humidity and air circulation within the county, thus creating microclimates. The operating conditions of an area, including temperature and elevation,

6 U.S. Climate Data

7 Any Place America

can drastically impact ZEB performance. It is essential that Placer County's unique operating conditions are carefully considered in subsequent stages of planning and implementation.

SCHEDULE AND OPERATIONS

The PCDPW operates (15) local fixed routes, commuter service, Dial-a-Ride service, and paratransit service through its two service fleets, PCT and TART. Table 2-1 summarizes all services and Table 2-2 provides an overview of fixed-routes.

Table 2-1. Service Summary

Fleet	Service Category	Avg. Trip Distance (mi.)	Avg. No. of Trips by Route	Avg. Speed (mph.)	No. of Routes
PCT	Local Fixed-Route	19	20	19	6
	Commuter Service	52	8	30	1
	Demand response	45-119	N/A	11	-
TART	Local Fixed-Route	14	26	14	9
	Paratransit	50	N/A	12	-

Source: PCT GTFS 2019/20 pre-pandemic service; TART GTFS Spring Fall 2019 and SRTP

Table 2-2. Fixed-Route Summary

Fleet	Route	Area Served	Days/Week	Frequency
PCT	10	Auburn, Roseville, Sacramento Light Rail Station	6	Hourly
	20	Lincoln, Rocklin, Sierra College	6	Hourly
	30	Auburn and Highway 49	6	Hourly
	40	Colfax and Auburn	5	2 round trips
	50	Taylor Road and Sierra College	5	5 round trips
	60	Commuter Service to Sacramento	5	4 inbound/4 outbound to Sacramento
	70	Lincoln	6	Hourly
TART	CB	Crystal Bay to Squaw Valley service	7	Hourly in the evenings
	Hwy267	Highway 267	7	Hourly
	Hwy89	Highway 89 service	7	Hourly
	ML	Mainline service along the western portion of Lake Tahoe service	7	Every half-hour
	TLR	Truckee Local service	7	Hourly
	WSN	Westshore service	7	Hourly in the evenings

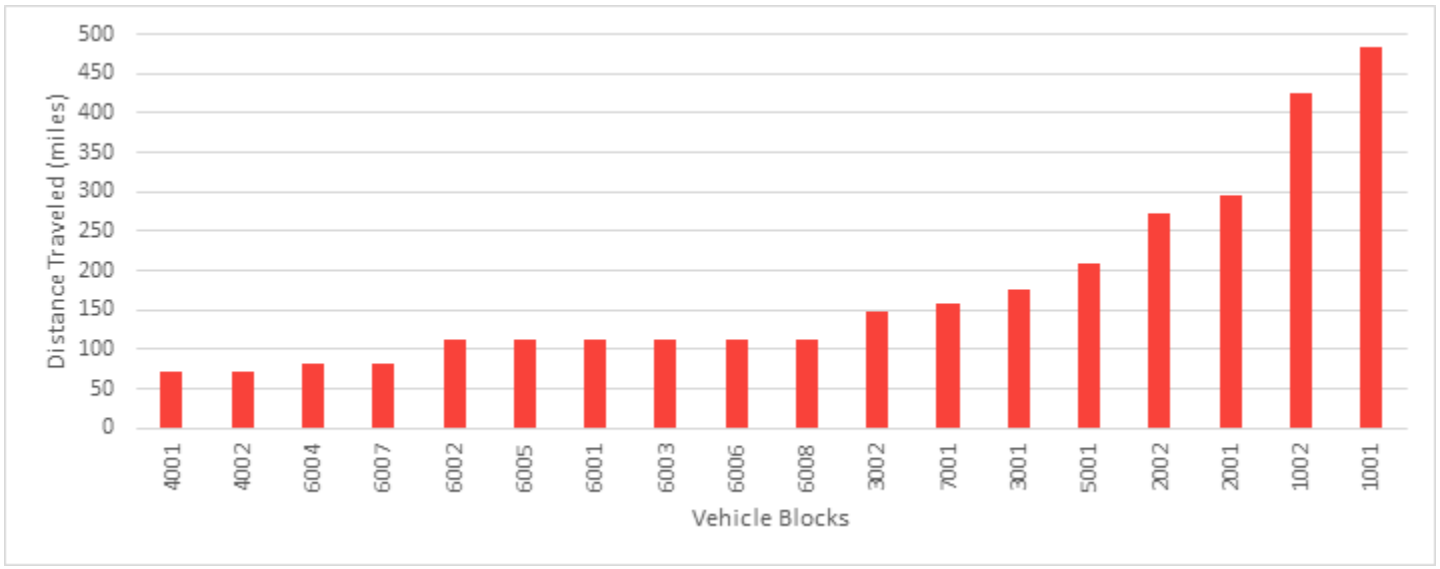
Source: PCT GTFS 2019/20 pre-pandemic service and website

PCT's fixed-route service consists of 10 service blocks across six routes and uses 11 35-foot buses and three cutaways. The commuter service consists of eight service blocks and uses five 45-foot coach buses. The service blocks range in duration from 2:15 to 17:17 hours, and in length from 72 to 483 miles.

TART operations include two types of service: dial a ride service and fixed-routes. The demand response service is run with two cutaways, while the fixed-route service consists of 14 service blocks across nine routes and uses 14 40-foot buses. The service blocks range in duration from 7:15 to 14:40 hours, and in length from 145 to 325 miles.

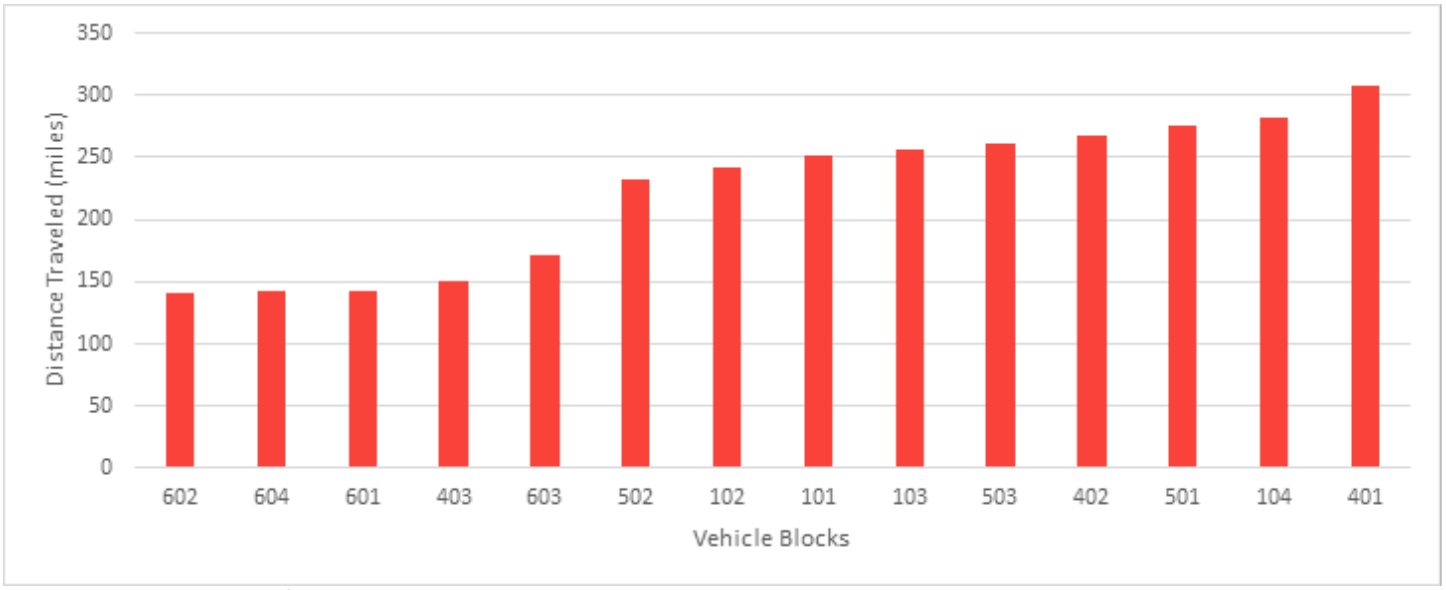
Not all of the PCDPW's routes can be served by existing BEB technology. BEBs have an average range capability of approximately 150 miles, which will meet the range requirements of just over half of PCT's blocks, and less than half of TART's. For those routes that cannot be served by BEB technology, the PCDPW may consider FCEB technology, which has an average range capability of 250 miles. Weekday block ranges for PCT and TART based routes are presented in Figure 2-2 and Figure 2-3, respectively.

Figure 2-2. PCT Weekday Block Ranges



Source: PCT GTFS 2019/20 pre-pandemic service

Figure 2-3. TART Weekday Block Ranges



Source: TART GTFS, Spring/Fall 2019

The average daily mileage for vehicles that provide demand response service varies. This is based on the demand of customers, pick-up and drop-off locations, and the capacity of local entities to provide service. Based on available data, PCT's daily distance for a demand response vehicle is between 45 and 119 miles, and TART's average daily distance for its paratransit service was 61 miles.

There are currently several ZEBs on the market that advertise ranges that exceed the needs of the PCDPW's demand response services, so it is likely that many, if not all of the PCDPW's demand response vehicles can be replaced at a 1:1 replacement ratio.

COVID-19-RELATED IMPACTS

COVID-19 directly impacted and will continue to influence the PCDPW's transition to an all-ZEB fleet due to increased uncertainty of various important factors: future ridership, required service levels, continued emergency declarations and operations, general economic health or recession, and capital funding. These considerations and the future of the pandemic will be monitored and will dictate the manner in which the PCDPW proceeds with its transition.

2.1.3 EXISTING ZEB EFFORTS

The PCDPW partnered with WSP to develop its Zero Emission Bus Feasibility and Transition Plan which will guide the PCDPW in its transition to an all-ZEB fleet and includes a series of technical reports that analyze the various components of the transition, including:

- Existing Conditions Analysis
- Service Modeling Analysis
- ZEB Facility Concepts & Phasing Strategy
- Power & Energy Analysis
- Cost & Lifecycle Analysis

The Transition Plan is also written in a manner that captures all required elements as outlined in the CARB ICT Rollout Plan guidelines.

3 FLEET AND ACQUISITIONS

The following section provides an overview of the PCDPW's existing fleet, planned ZEB technology, and proposed procurement schedule.

3.1 EXISTING BUS FLEET

The PCDPW operates a range of vehicle types to meet service requirements. This includes standard buses (35-foot and 40-foot), cutaways of varying lengths, and motor coaches. The fleet is also powered by several fuel types, including diesel, compressed natural gas (CNG), and gasoline. Table 3-1 provides a detailed overview of the PCDPW's existing bus fleet.

Table 3-1. Existing Fleet Summary

Service	Make/Model	Fuel Type	Length	In Service Year*	Bus Type	Quantity
PCT	Gillig Low-Floor	CNG	35'	2015, 2016, 2017, and 2018	Standard	11
	MCI D4500	Diesel	45'	2010	Motor coach	5
	Starcraft Allstar	Gasoline	22', 24', and 25'	2008, 2016, 2017, and 2018	Cutaway	13
TART	Gillig Low-Floor	CNG	40'	2015, 2017, 2019, 2020, 2022	Standard	11
	Gillig Low-Floor	Diesel	40'	2015	Standard	2
	NABI Low-Floor	CNG	40'	2016	Standard	1
	Starcraft Allstar	CNG	25'	2008	Cutaway	2
					Total Buses	45

Source: PCDPW Vehicle Inventory, November 2022

Note: As of January 2023, Placer County has taken delivery of two new diesel MCI 45-foot coaches to replace two 2010 diesel MCI buses. In addition, Placer County has two gasoline cutaway buses on order to replace the two 2008 cutaway buses. Delivery has been significantly delayed due to supply chain issues with the manufacturer.

3.2 ZEB TECHNOLOGY

At this time, the PCDPW is primarily evaluating BEB technology for adoption. Although the PCDPW would benefit from FCEB technology's range capabilities, current market research indicates limited available vehicle options (especially in the cutaway market) and hydrogen suppliers, and higher capital investment needs at the current stage. The PCDPW has not ruled out FCEB technology, and depending on market factors, may pursue this technology in the future.

Based on the PCDPW's existing service needs and yard configurations, it is recommended that ground mounted plug-in chargers support BEBs at both yards. Exceptions to the ground mounted plug-in solution could potentially occur at outdoor sites where snow is a concern. At these locations, charging buses with an overhead retractable plug-in dispenser may be utilized.

The proposed facility layouts for each yard are based on 150 kW DC charging cabinets in a 1:2 charging orientation (one DC charging cabinet energizes two separate dispensers/buses). This charger-to-dispenser ratio maximizes space utility, reduces capital costs, and meets the requirements to charge the fleet during servicing and dwell times on the site while minimizing the peak electrical demand. That said, the PCDPW continues to monitor technological advancements and may explore other strategies as they arise.

3.3 PROCUREMENT SCHEDULE

The PCDPW's proposed procurement schedule will enable the agency to convert its fleet to ZEBs by 2040. The proposed procurement schedule is built on the assumption that BEBs and associated battery capacities will be available to meet the PCDPW's service block ranges so that a 1:1 replacement ratio is achievable. It is essential that the delivery of new vehicles align with or *after* the completion of construction. At the end of each construction phase, there will be vehicles that have reached their end of useful life and can be replaced with new BEBs, thus early retirement should not be an issue pursuant to the ICT regulation.

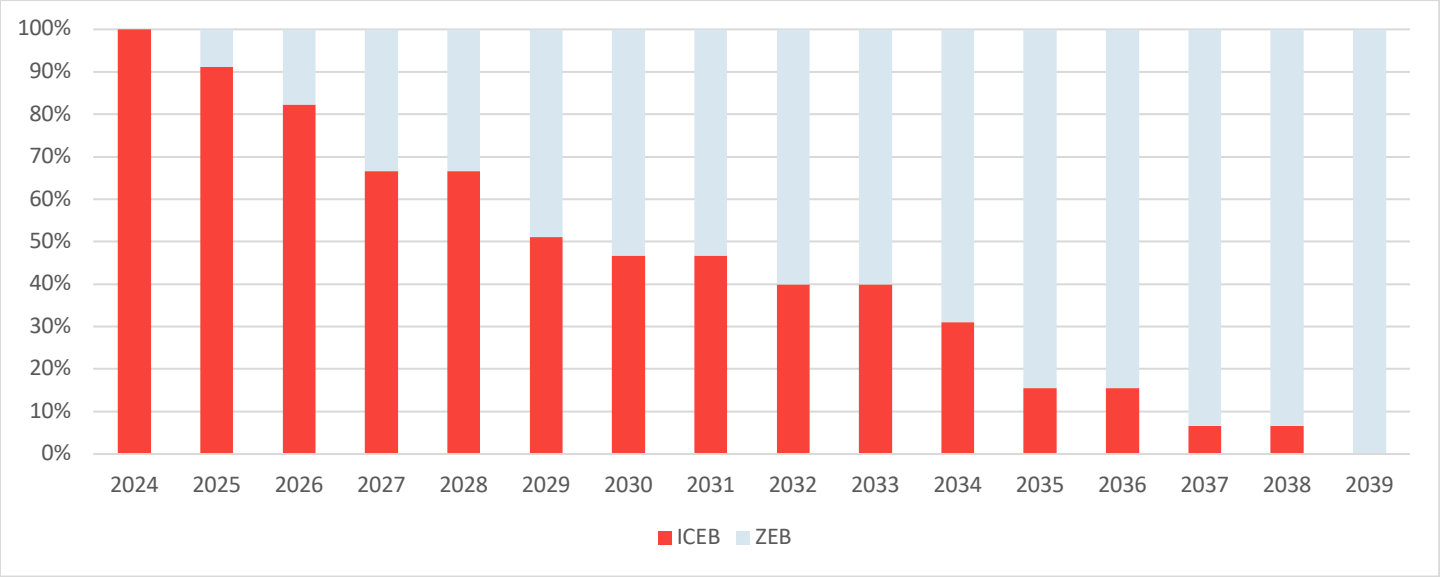
Table 3-2 summarizes the PCDPW's anticipated procurements and ICE to ZEB fleet percentage through 2040. Figure 3-1 presents the percentage of the fleet that are powered by ZE technologies or fossil fuels through 2039.

Table 3-2: PCDPW ZEB Deliveries and Fleet Composition, 2024 - 2040

Year	Planned ZEB Deliveries		Planned ICE Deliveries		Total ZEB Fleet		Total ICE Fleet		Total Vehicle Fleet	ZEB Fleet %	ICE Fleet %
	Buses	Cutaways	Buses	Cutaways	Buses	Cutaways	Buses	Cutaways			
2024	-	-	-	2	-	-	30	15	45	0%	100%
2025	4	-	4	7	4	-	26	15	45	9%	91%
2026	-	4	-	-	4	4	26	11	45	9%	91%
2027	5	2	3	-	9	6	21	9	45	24%	76%
2028	-	-	-	-	9	6	21	9	45	24%	76%
2029	7	-	-	-	16	6	14	9	45	40%	60%
2030	2	-	-	-	18	6	12	9	45	44%	56%
2031	-	-	-	-	18	6	12	9	45	44%	56%
2032	3	-	-	-	21	6	9	9	45	56%	44%
2033	-	-	-	-	21	6	9	9	45	60%	40%
2034	2	2	-	-	23	8	7	7	45	76%	24%
2035	-	7	-	-	23	15	7	-	45	84%	16%
2036	-	-	-	-	23	15	7	-	45	100%	0%
2037	4	-	-	-	27	15	3	-	45	100%	0%
2038	-	-	-	-	27	15	3	-	45	100%	0%
2039	3	-	-	-	30	15	-	-	45	100%	0%
2040	-	-	-	-	30	15	-	-	45	100%	0%

Source: WSP

Figure 3-1: PCDPW Fleet Composition, 2024 – 2039



Source: WSP

3.3.1 ZEB RANGE REQUIREMENTS AND COSTS

Approximately half of the PCDPW's existing bus blocks travel farther than 150 miles per weekday – a range that exceeds current batteries' capabilities.[8] To reduce impacts to service, there are several strategies that the PCDPW may consider to meet service (range) requirements, including midday charging, opportunity charging, additional bus purchases, and/or the incorporation of FCEB technology. In addition, with battery technology rapidly evolving, future battery capacities and efficiencies may be sufficient to serve all blocks. However, this currently appears as a risk to the full conversion to BEB and is discussed later in this Plan.

3.3.2 ZEB CONVERSIONS

Conventional bus conversions to ZEB technologies are not currently being considered. However, the PCDPW will remain open to conversions if they are deemed financially feasible and align with ZEB adoption goals.

8 This is based on January 2020 (pre-COVID) service.

4 FACILITIES AND INFRASTRUCTURE MODIFICATIONS

The following sections provide an overview of the existing facilities, and proposed charging strategies, infrastructure, yard improvements, and program schedule to successfully meet the requirements of the ICT regulation.

4.1 OVERVIEW OF EXISTING FACILITIES

The PCDPW has two separate transit facilities (hereinafter also referred to as "yards"). The PCT yard is in unincorporated North Auburn and stores 29 vehicles. The TART yard is in Truckee and stores 16 vehicles. Table 4-1 summarizes the number and type of buses that are currently stored at each yard. The facility analysis finds that each yard has enough available power to support the early phases of BEB deployment but will eventually need upgraded electrical service for their respective full buildouts.

Table 4-1. Summary of Existing Yards and Fleets

Service	Address	Standards	Cutaways	Coaches	Total
PCT	11448 Avenue F, Auburn	11	13	5	29
TART	870 Cabin Creek Rd, Truckee	14	2	-	16
				Total	45

Source: PCDPW Vehicle Inventory, November 2022

4.2 EXISTING CONDITIONS

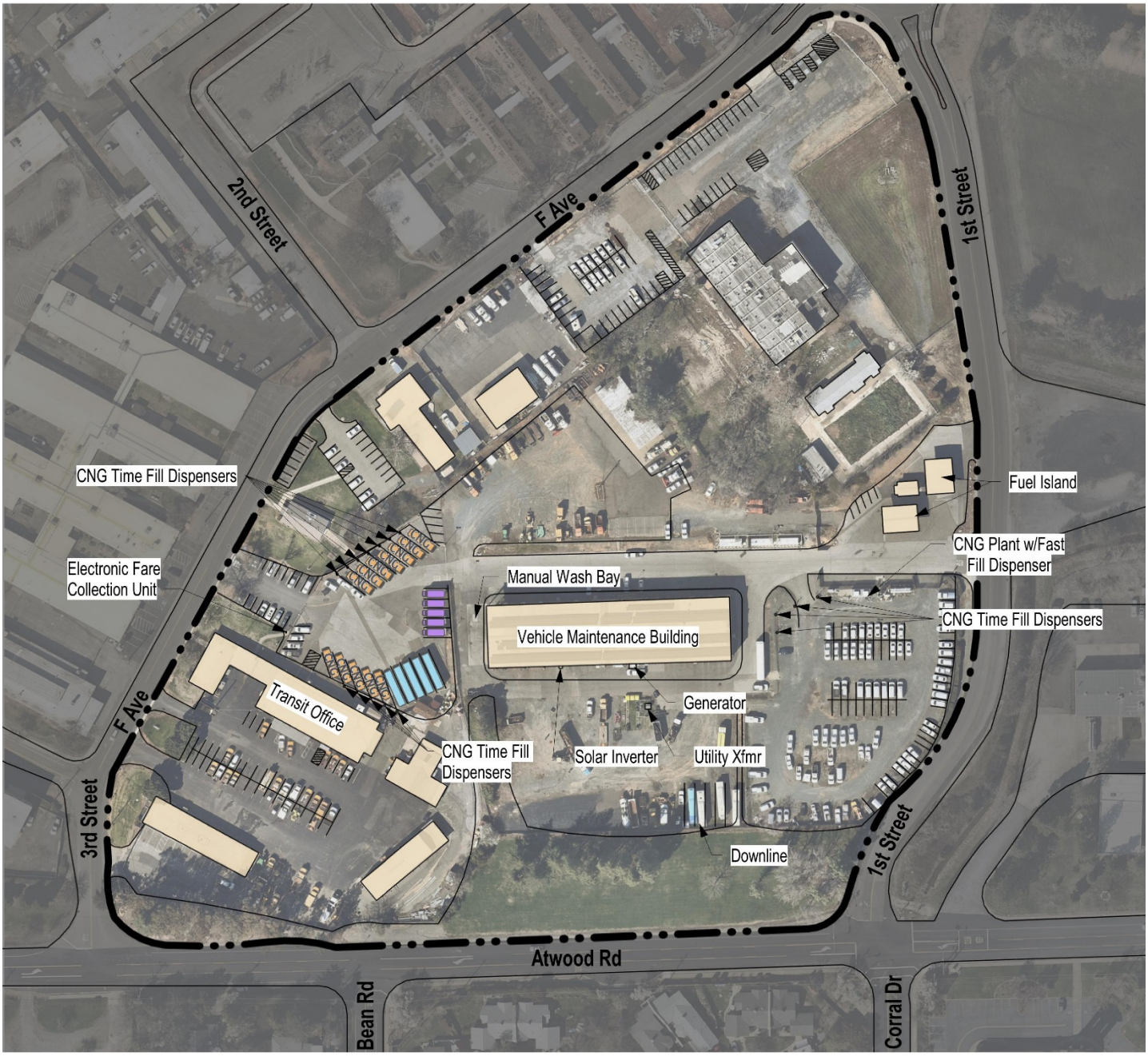
4.2.1 PCT FACILITY

The PCT yard is located at 11432 F Avenue in Auburn. The transit operations share the site with the PCDPW and despite having a relatively small, dedicated portion of the overall site, transit operations still have adequate room to support the current fleet (Figure 4-1).

INFRASTRUCTURE

Site infrastructure consists of a CNG plant that connects to the 12 time fill CNG dispensers located in parking stalls, the outdoor manual wash bay, the maintenance shop, two dedicated maintenance bays for larger transit vehicles, and work bays for the smaller cutaway vehicles, which are also used to service smaller public works vehicles. The site also contains four additional fast fill dispensers that primarily support public works vehicles as well as a nearby fuel island where vehicles utilizing diesel or gasoline are fueled. There are currently no plans for future site improvements that would affect the transit operations areas.

Figure 4-1. PCT Existing Site Plan

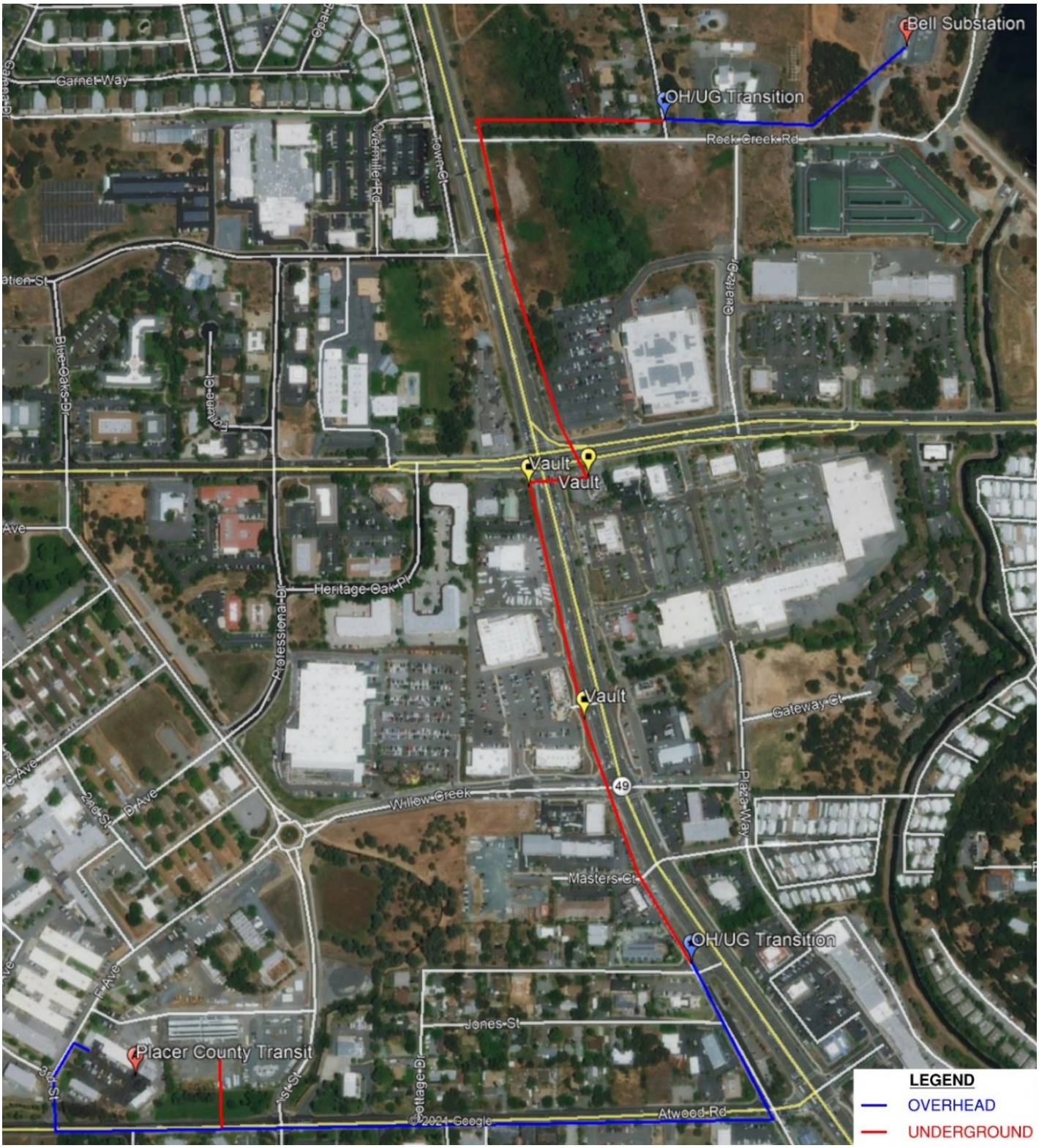


Source: Google Earth

POWER

Power is provided to the site by the PG&E Bell Substation via the Bell 1110 Circuit, as shown in Figure 4-2. The Bell 1110 Circuit is a 12-kilovolt (kV) circuit that has both overhead and underground sections. If utility upgrades are required, PG&E may need to replace a portion or all the length of the overhead and underground electrical conductors. The Bell 1110 Circuit has an existing capacity of 12.2 MW and PG&E estimates that the projected peak load of this circuit is 10 MW, leaving approximately 2.2 MW of available capacity. If new service is necessary from future transit upgrades, PG&E will most likely need to construct upgrades to a portion of the 12 kV equipment on this distribution line or substation.

Figure 4-2. Bell 1110 Circuit Pathway



Source: WSP

Power from the Bell 1110 Circuit serves two utility feeds: 1) an onsite pad-mounted utility transformer located in front of the vehicle maintenance building and 2) a 12 kV – 240/120V, single-phase, pole mounted PG&E-owned transformer. This

pole transformer is located approximately 260 feet from PCT and is likely shared with adjacent buildings. The onsite pad-mounted utility transformer likely feeds the vehicle maintenance building.

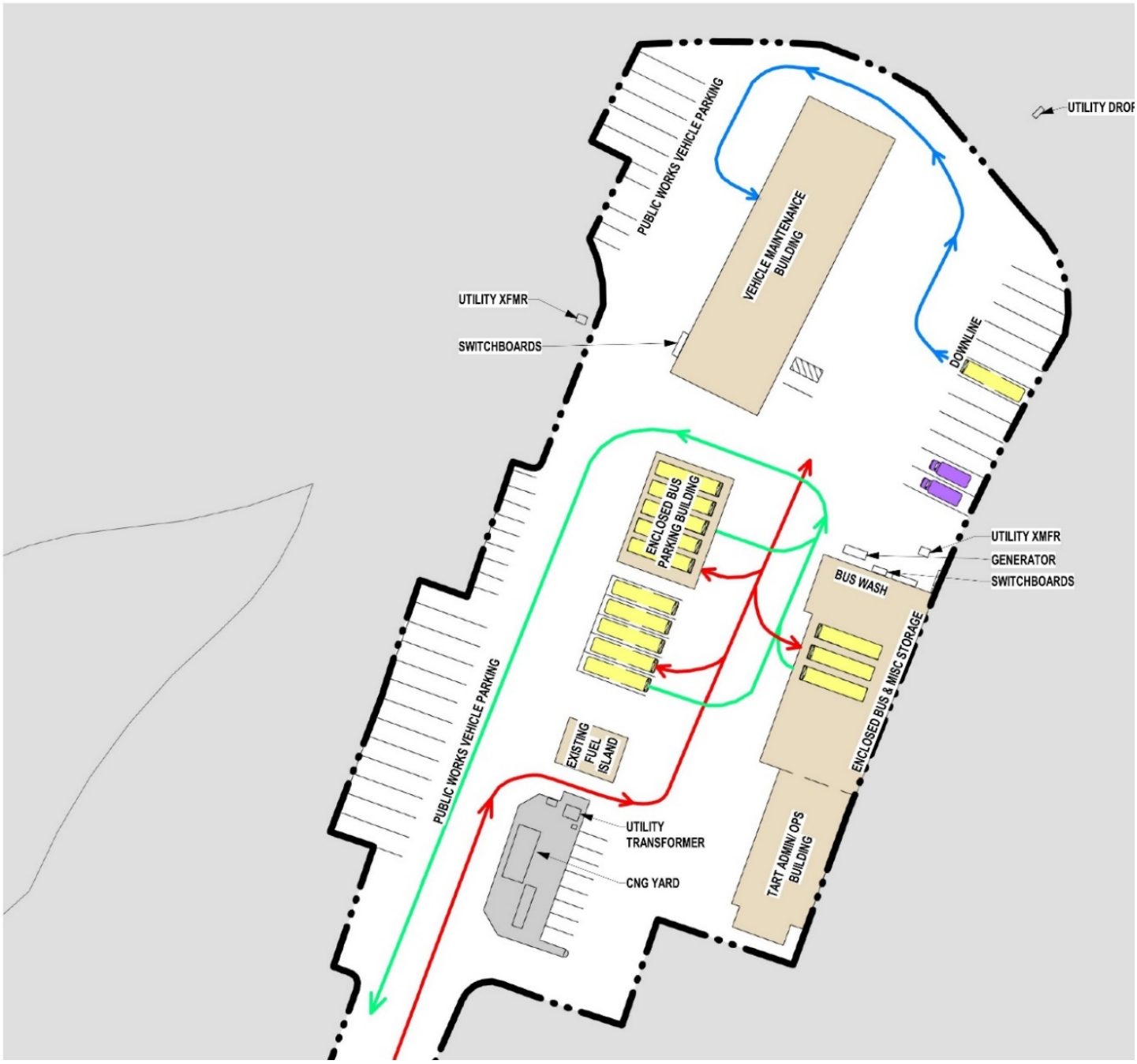
4.2.2 TART FACILITY

The TART operations and maintenance facility is located at 870 Cabin Creek Road in Truckee. The transit operations share this site with the PCDPW's Roads Department. Currently, all shop operations have been moved north to a new maintenance facility that supports both transit and public works vehicles. All seven maintenance bays use mobile lift units for flexibility and approximately three of the seven are dedicated to support transit vehicles. The perimeter of the site is dedicated to public works vehicle parking and spaces for down vehicles awaiting maintenance.

INFRASTRUCTURE

The previously used maintenance facility provides a space for light vehicle maintenance, enclosed parking for three transit buses, and the manual washing bay. Vehicles are fueled with at the CNG plant or the diesel fuel island. Gasoline is purchased at local gas stations. Several uncovered parking spaces and a small, enclosed parking building that can support five transit buses is located at the center of the site (Figure 4-3). This site has significant area available for future expansion if needed and there is adequate room to accommodate electrification infrastructure. There are no currently planned modifications to the site facilities.

Figure 4-3: TART Existing Site Circulation

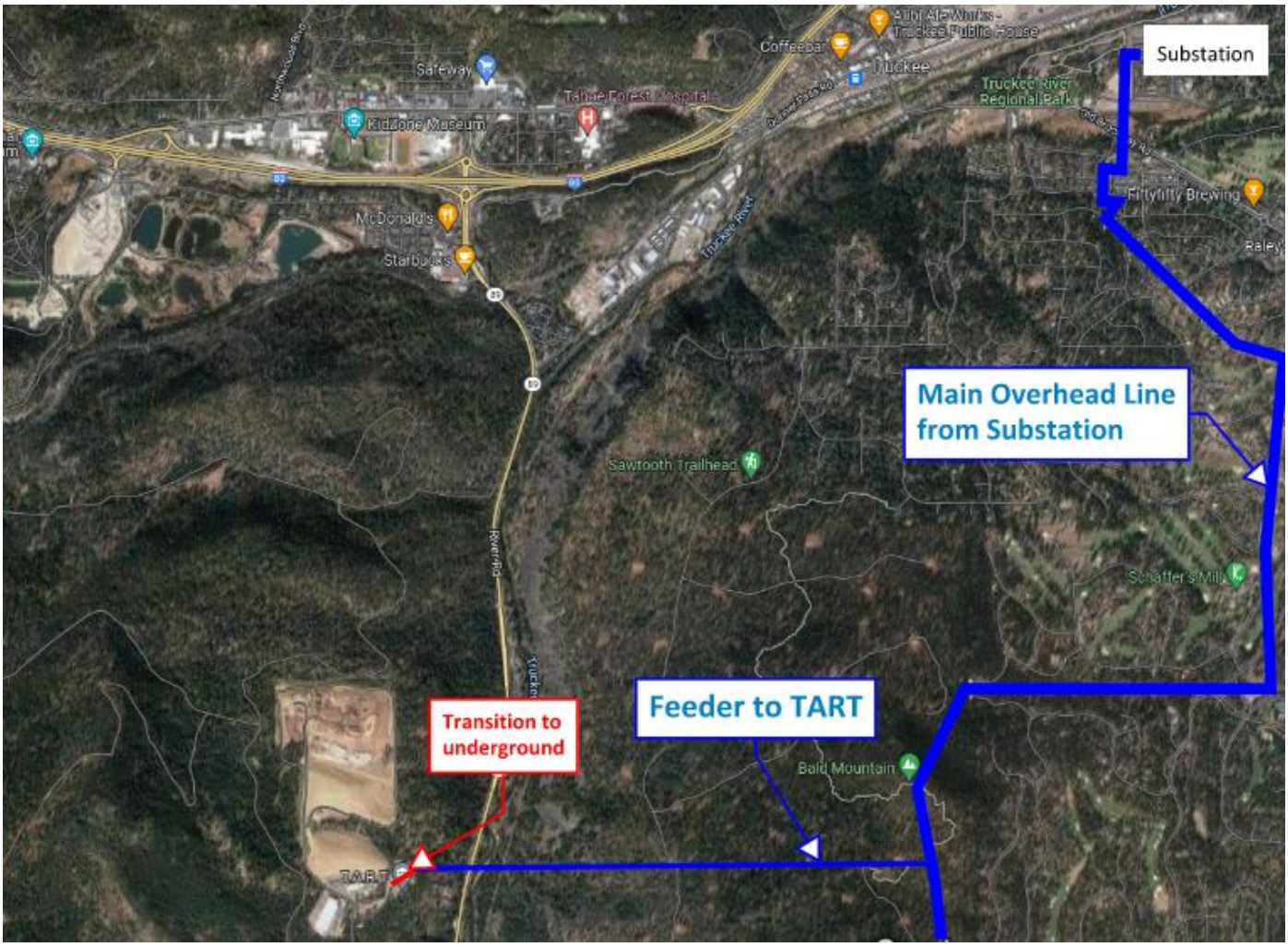


Source: WSP

POWER

TART's power is provided by a substation located approximately 5.3 miles from the transit yard at 10958 River View Dr, as shown in Figure 4-4. Liberty Utilities will require a detailed load study to verify the circuit's path and feeder capacity. The feeder appears to be routed along accessible paths until the Bald Mountain region, however, it crosses the Truckee River and Highway 89 near TART.

Figure 4-4. Feeder from Substation to TART



Source: WSP

At TART's operations and maintenance yard, the Liberty Utility overhead feeder ends at a riser pole that feeds a pad-mounted transformer. The pad-mounted transformer is near the overhead distribution pole. After the transformer, it transitions to underground conduit to the Tika Energy recording utility meter and underground service termination cabinet the bus wash. After the cabinet, there are six panelboards on-site.

4.3 PLANNED ZEB MODIFICATIONS

The PCDPW's transition to a ZEB fleet will require an increase in the electrical supply to the site, enhancements and expansions of electrical equipment, and the installation of chargers, dispensers, and other components at both PCT and TART locations. Based on several factors, the PCDPW analyzed a ground-mounted plug-in BEB strategy for both yards. However, the PCDPW has not ruled out the use of FCEB technology at this time.

The proposed layouts are based on utilizing a 150-kW DC charging cabinet in a 1:2 or 1:3 charging orientation (one DC charging cabinet energizes two or three separate dispensers/buses). This charger-to-dispenser ratio would meet the requirements to charge the PCDPW's fleet overnight while also minimizing costs.

The PCDPW will transition each site in several construction phases. These phases will ensure continuous service over the course of the transition and allow the PCDPW to accommodate utility and funding schedule constraints. The number of phases and details on bus relocations are currently being analyzed and will be finalized in the ongoing Feasibility and Fleet Transition Plan Study.

4.3.1 PCT PLANNED ZEB MODIFICATIONS

Due to the existing parking layout and operations (buses currently back into parking stalls along the perimeter of the parking area), ground-mounted plug-in charging was determined to be the most suitable method of charging for this site. Dispensers will be located at the rear end of each parking stall to facilitate easy access to bus charging ports.

Currently there are 12 parking stalls equipped with time-fill CNG stations at the rear of the stall. As charging infrastructure is phased in at the site, these time-fill CNG positions will need to be decommissioned to allow for the installation of the charging infrastructure. Figure 4-5 illustrates the proposed facility concept to support the electrification transition.

Figure 4-5. PCT Preliminary Facility Concept

Source: WSP

CHARGING INFRASTRUCTURE

12 DC charging cabinets and 22 DC plug-in dispensers are needed to support the 22-vehicle fleet as shown in Table 4-2. All remote dispensers will be ground-mounted units with integral cord management systems. An additional plug-in dispenser should also be installed in the maintenance area to provide the charging needed to support maintenance functions. The maintenance area dispenser can potentially provide charging for two maintenance bays if positioned between them and if it utilizes an optional longer cord (in excess of 15 feet).

Table 4-2. PCT Recommended Charging Infrastructure

Component	Quantity
150 kW DC Charging Cabinet	12
Plug-in DC Dispenser	22
Plug-in DC Dispenser in Maintenance Area	1

Source: WSP

UTILITY INFRASTRUCTURE

PCT's current electrical service is not adequate to support the additional electrical demand for any of the proposed charging infrastructure. Based on the analysis, the following facility electrical upgrades are required as described in Table 2-1. The final electrical infrastructure sizing will be determined by the PCDPW's decision on load management and discussions with PG&E.

Table 4-3: PCT Electrical Upgrades (and Role)

Responsible Party	Item
PG&E	Install a 2000 kVA transformer (for managed charging) or 3000 kVA transformer for unmanaged charging near the vehicle maintenance building.
	Electrical conduit from transformer to metering cabinet
PCDPW	Install a 480 V main switchboard & 4000 A utility metering cabinet. The switchboard should be microgrid ready if a battery storage system is desired.
	Concrete pads and conduit for transformer and switchboard
PCDPW (OPTIONAL) Resiliency Equipment	1000-kW generator (automatic or manual transfer switch)
	Solar PV system & battery energy storage system (BESS)

Source: WSP

PHASING AND CONSTRUCTION STRATEGY

The following section provides an overview of the proposed improvements in each anticipated phase. PCT's transition is anticipated to occur in three phases. A "phase" is a portion of the yard that is undergoing construction during a period of time. Typically, a yard will have several planned phases to minimize disruption to existing service and operations – the alternative would be to retrofit the yard all at once. Buses that are typically stored in an area that is going through phased construction can be relocated on site - if space allows - or temporarily parked at another facility or location.

PHASE 1: MAY 2026 – OCTOBER 2026

Phase 1 would include the installation of a new utility service transformer, one low voltage switchboard, three charging cabinets, and five plug-in dispensers to serve the cutaway buses parked along the eastern edge of the bus parking area. A low output charger for the maintenance area will be installed as a part of this phase and will be tied into the existing switchboard.

During this phase, cutaway buses may need to be temporarily relocated for overnight parking. While there will be some trenching across the yard area, it should be achieved with minimal interference with buses moving in and out of the facility or vehicles accessing the existing maintenance building from the south.

PHASE 2: NOVEMBER 2026 – APRIL 2027

This phase includes the extension of power from the switchboard installed in Phase 1 along the southside of the bus parking area. In this phase, five charging cabinets will be installed to support 10 dispensers inside the bus parking area to support the five 45-foot buses as well as five 35-foot buses. During this phase the CNG dispensers in this area will need to be decommissioned and removed from service.

During the construction of Phase 2, the buses at the 10 affected parking positions may need to be relocated for a portion of the construction process. Once the CNG dispensers are removed, the five affected CNG buses will need to be refueled from the existing CNG refueling island at the eastern portion of the property until the construction is complete.

PHASE 3: AUGUST 2028 – JANUARY 2029

The third and final phase includes the extension of power from the switchboard installed in Phase 1 along the eastern boundary of the bus parking area to the area adjacent to the buses on the north side of the bus parking area. In this phase, four charging cabinets will be installed to support seven dispensers inside the bus parking area to support the remaining 35-foot buses. During this phase the CNG time fill dispensers in this area will need to be decommissioned and removed from service.

During the construction of Phase 3, the buses at the seven affected parking positions may need to be relocated for a portion of the construction process. Once the CNG dispensers are removed, the seven affected CNG buses will need to be refueled from the existing CNG refueling island at the eastern portion of the property until the construction is complete. Also, the drive between the bus parking area and the vehicle maintenance building will be impacted while the required duct-bank is installed. This work should be performed in phases to minimize interruption to operations in the area.

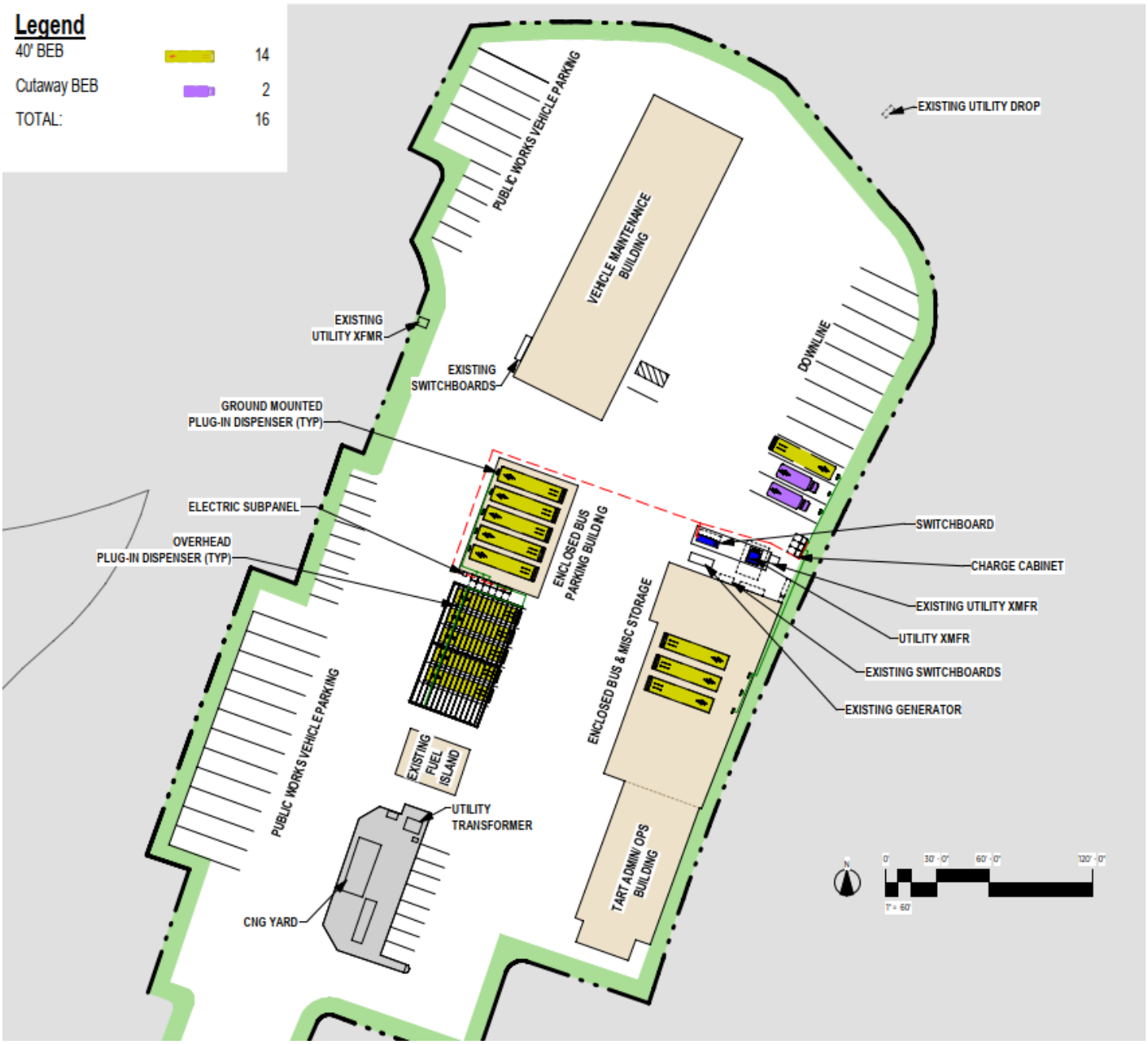
4.3.2 TART PLANNED ZEB MODIFICATIONS

TART's facilities have several distinct parking areas to be electrified. For the indoor parking stalls and those along the eastern edge of the paving, ground mounted plug-in charging was deemed the most suitable as those locations offered prime locations for mounting the plug-in dispensers on walls at the back of the indoor stalls, and pedestal mounted dispensers at the outdoor parking stalls. These dispensers should be procured with integral cord management.

For the six remaining outdoor parking stalls, due to the accumulation of snow at the site during the winter months, having the buses located indoors or under cover was noted as very desirable. As such it was determined that these remaining six outdoor parking stalls would be outfitted with an overhead structure that could provide weather protection, a location for overhead plug-in dispensers to mount and a potential location for a future solar array. The charging cords for the overhead mounted dispensers would utilize a retractor system that can be lowered for bus charging and raised when not in use. Each retractor would be controlled by a switch located on the columns of the new structural frame.

The area near the existing service transformer for the operations and old maintenance building has been identified as the proposed location for a new utility transformer and switchboard to support the new charging equipment. Figure 4-6 illustrates the proposed facility concept to support the electrification transition.

Figure 4-6. TART Preliminary Facility Concept



Source: WSP

CHARGING INFRASTRUCTURE

Nine DC charging cabinets and 17 DC plug-in dispensers are needed to support the 17 fleet vehicles as shown in Table 4-4. All remote dispensers will be ground-mounted units with integral cord management systems. An additional plug-in dispenser should also be installed in the maintenance area to provide any charging needed to support maintenance functions for the electric fleet. This dispenser can potentially be energized from an initially installed charging cabinet if the unit is located near the maintenance building and can support three-plus dispenser connections, or a dedicated lower output (25-50kW) DC charger can be located adjacent to the maintenance building to specifically serve the maintenance area charging needs. Lower output chargers are appropriate for the maintenance area as they are not intended to be used

to fully charge a bus overnight and are instead intended to provide minimal charging to support maintenance diagnostics needs, and ensure buses are able to exit the by under their own power. This dispenser can potentially provide charging for two maintenance bays if positioned between them and if it utilizes an optional longer (15-foot+) cord.

Table 4-4. TART Recommended Charging Infrastructure

Component	Quantity
150 kW DC Charging Cabinet	9
Plug-in DC Dispenser	17
Plug-in DC Dispenser in Maintenance Area	1

Source: WSP

UTILITY INFRASTRUCTURE

Similar to the PCT yard, the TART yard's existing electrical service is not adequate to support the electrification of all assigned vehicles. However, based on conversations with Liberty Utilities[9], there appears to be sufficient power to support some charging in the first of three phases of construction. Table 4-5 lists the facility electrical upgrades required. The final electrical infrastructure sizing is determined by the PCDPW's decision on load management and coordination with Liberty Utilities during the engineering phase.

Table 4-5: TART Electrical Upgrades (and Role)

Responsible Party	Item
Liberty Utilities	Install a 2000 kVA transformer (for managed charging) or 3000 kVA transformer for unmanaged charging located on astern portion of site, fed by overhead distribution pole.
	Electrical conduit from transformer to metering cabinet
PCDPW	Install a 480 V main switchboard & 4000 A utility metering cabinet. The switchboard should be microgrid ready if a battery storage system is desired.
	Concrete pads and conduit for transformer and switchboard
PCDPW (OPTIONAL) Resiliency Equipment	CNG or diesel backup generator (automatic or manual transfer switch).
	Solar PV system with BESS.

Source: WSP

PHASING AND CONSTRUCTION STRATEGY

PHASE 1: JULY 2024 – DECEMBER 2024

This phase includes the construction of a new utility service transformer, one low voltage switchboard, three charging cabinets, and six plug-in dispensers to serve the buses parked along the eastern edge of the development and the buses parking inside the old maintenance building. The installation of a low output charger for the maintenance area will be installed as a part of this phase and will be tied into the existing switchboard in the area. During the construction of Phase 1, buses will be able to maintain their current parking arrangement with limited impacts. As previously noted, it is assumed that existing site power is sufficient to support the planned charging infrastructure in Phase 1 (approximately three 150 kW charging cabinets).

PHASE 2: JANUARY 2025 – MAY 2025

This phase includes the extension of power from the switchboard installed in Phase 1 to the southside of the bus parking building where an electrical subpanel will be installed to distribute power to all the planned charging cabinets to be located

9 Based on email correspondence in July 2021, Liberty Utilities noted that TART could serve approximately 500 KVA of additional load without upgrades.

in this area. In this phase, three charging cabinets will be installed to support five dispensers inside the bus parking building.

During the construction of Phase 2, there will be some impact to operations as trenching will be needed across the drive aisle to the maintenance building. However, bus circulation on the site will have to be temporarily modified to route buses along the western drive to access the maintenance bays and the eastern edge parking area. All buses will be able to maintain their current parking arrangement during this phase. It should be noted that prior to implementation of this phase, Liberty Utilities will need to have made upgrades to their existing service capacity available to the site.

PHASE 3: JUNE 2025 – OCTOBER 2025

Phase 3 construction is scheduled to begin in June 2025 and end in October 2025. This phase includes the installation of three charging cabinets on the southside of the bus parking building adjacent to the cabinets installed in Phase 2. It will also include the construction of the overhead roof structure as well as the installation of six overhead mounted dispensers and their associated cord retraction systems. During this phase the existing time-fill CNG dispensers in this area will be decommissioned and removed. During the construction of Phase 3, the remaining CNG buses will need to be temporarily relocated to the eastern edge parking area.

4.4 TRANSITION CONSIDERATIONS

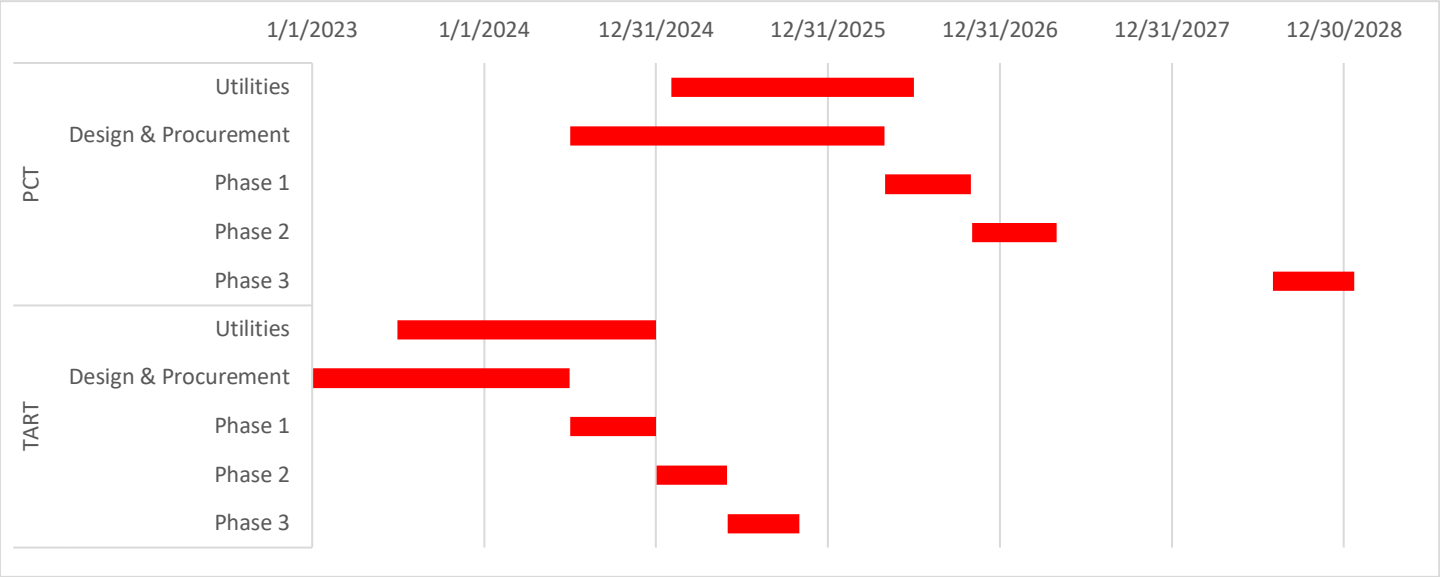
There are multiple factors and timetables that must be considered to meet the PCDPW's ZEB fleet goals in accordance with the ICT regulation. Since BEBs are not operational unless the facilities are in place to energize them, it is essential to meet deadlines because it can impact both service and ICT regulation compliance. The following provides a brief overview of the various processes and timetable assumptions.

- **Bid Documents:** The electrification process will require multiple subject matter experts, planners, designers, architects, engineers, OEMs, and contractors. For this reason, multiple requests for proposals (RFPs) or invitations for bid, will need to be developed and put out for bid for various phases of the project.
- **BEB-Supporting Enhancements:** For BEB site enhancements, it is assumed that each "phase" of construction at a yard will take approximately six months to be completed. For example, a yard with three distinct phase would take approximately 18 months to be BEB-ready.
- **Utility Infrastructure Enhancements**: The PCDPW will have to upgrade electrical service to each of their sites to support ZEBs. This process includes an application, a study, permitting, planning and design, and construction.
- **Bus Procurements:** Bus procurements will have to be aligned with the construction of charging equipment at the yard and utility enhancements.
- **Environmental Clearance:** Due to the PCDPW's potential wildfire risk, additional safety provisions may be required.
- **Temporary Relocations:** Vehicles may require temporary relocation during construction phases.
- **Yard Management and Operations:** During construction, more considerations to how buses are parked, operated, and dispatched will be required.

4.5 SUMMARY OF YARD ENHANCEMENTS AND SCHEDULE

As indicated above, there are multiple prevailing factors that will dictate the PCDPW's transition schedule. Figure 4- illustrates a conceptual schedule that meets and *exceeds* ICT regulation goals. This schedule is designed to support BEB operations starting in 2025 but is highly contingent on the PCDPW's funding and the utilities' ability to meet construction deadlines.

Figure 4-7. Conceptual Schedule



Source: WSP

By 2039, all of the PCDPW's yards will be capable of operating a 100% BEB fleet. Table 4-6 shows the facility statistics at the end of each phase.

Table 4-6. Available Parking and Charging Positions, by Phase

Fleet	Phase	Parking Capacity		Infrastructure	
		Standard Parking	Charging Positions	Plug-in Dispensers	Charging Cabinets
PCT	Existing	22	0	0	0
	Phase 1	17	5	5	3
	Phase 2	7	15	15	8
	Phase 3	0	22	22	12
	100% Build-out	0	22	22	12
TART	Existing	17	0	0	0
	Phase 1	11	6	6	3
	Phase 2	6	11	11	6
	Phase 3	0	17	17	9
	100% Build-out	0	17	17	9

Source: WSP

5 EQUITY CONSIDERATIONS

The following section provides an overview of disadvantaged communities within the PCDPW's service area and information on how the PCDPW plans to ensure that ZEBs are prioritized in these communities.

5.1 DISADVANTAGED COMMUNITIES

Disadvantaged communities (DACs) refer to areas that suffer the most from a combination of economic, health, and environmental burdens. The California Environmental Protection Agency (CalEPA) and California's Senate Bill 535, define a "disadvantaged" community as a community (census tract) that is located in the top 25th percentile of U.S. Census tracts identified by the results of the California Communities Environmental Health Screening Tool (CalEnviroScreen). CalEnviroScreen uses environmental, health, and socioeconomic data to measure each census tract (community) in California. Each tract is assigned a score to gauge a community's pollution burden and socioeconomic vulnerability. A higher score indicates a more disadvantaged community, whereas a lower score indicates fewer disadvantages.

The replacement of conventional buses with ZEBs will yield many benefits in the communities they serve, including a reduction of noise and harmful pollutants. Given that DACs are disproportionately exposed to these externalities, they should be considered and prioritized during initial deployments of ZEBs. The PCDPW will take into consideration DACs when making deployment decisions.

5.2 SUMMARY OF THE PCDPW'S DACs

To understand the potential benefits that ZEBs will provide to DACs in the PCDPW's service area, it is necessary to establish if (1) a yard is in a DAC, and (2) if its routes travel within or alongside a DAC boundary.

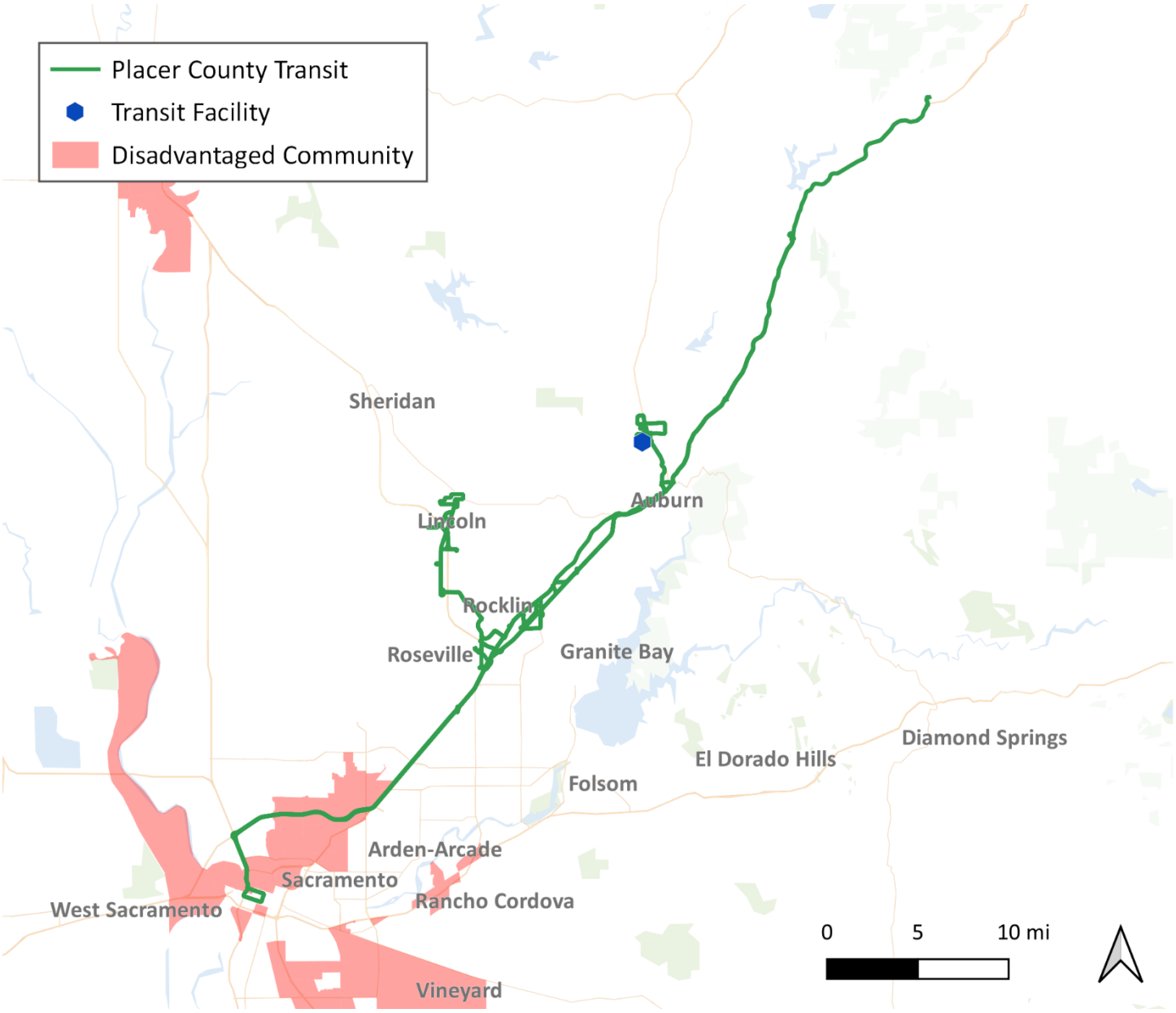
Of the two systems, only PCT operates in and serves DACs. Approximately 10% of fixed-route mileage is operated in DACs in the area. The DAC-serving routes are summarized in Table 5-2 and illustrated in Table 5-1.

Table 5-1. Summary of DAC-Serving Routes

Transit Systems	DAC-Serving Routes
PCT	Commuter Express
TART	None

Source: WSP, CalEnviroScreen 4.0 (2021),

Figure 5-1. Disadvantaged Communities Served by the PCDPW



Source: WSP, CalEnviroScreen 4.0 (2021), OpenStreetMap Contributors

6 WORKFORCE DEVELOPMENT AND TRAINING

The following section provides an overview of the required skills to train the PCDPW's staff and the general approach to adequately training them on the new fleet.

6.1 REQUIRED SKILLS AND STAFFING

The transition to an all-ZEB fleet will significantly alter the PCDPW's service and operations. Converting to ZEBs – BEBs, in particular – will require changes to standard operating procedures and will impact all facets of the organization. It is expected that most training will be informed by service manuals and recommendations by the selected vehicle and charger OEM(s); however, there will be instances where outside training and resources will be leveraged. It should be noted that it is expected that all staff that work at or support the two facilities will need to take an introductory BEB course. At least two personnel at each site will need to become certified for high-voltage bus repair and maintenance. The introductory course should inform staff on why the PCDPW is transitioning its fleet, how the conversion will impact them, and how to prioritize safety when in the vicinity of these vehicles and charging equipment. The PCDPW will ensure that 5% of any Federal Transit Administration Low-No Emission (LoNo) grant funding awarded is utilized to train the workforce. The vast majority of training will be provided through the OEM and purchased with vehicles, however, the PCDPW will continue to explore and leverage other programming that will ensure its workforce is prepared for the operations and maintenance of the next generation of vehicles. Table 6-1 provides an overview of the anticipated required skills to successfully operate and maintain the future fleet, by general job classification (internal and external).

Table 6-1. Summary of Job Classifications and Required Skills

Job Classification	Description
Training Instructors and Staff	Training Instructors will be the custodians of BEB knowledge. Trainers should receive their training directly from the vehicle and charging infrastructure OEMs (original equipment manufacturer) with hands-on modules. Refresher training for Training Instructors should be completed annually at a minimum. This will include both the PCDPW and any contracted staff.
Mechanics, Facility, and Management Supervision	Mechanics, Facility, and Maintenance Supervisors will need to be fully aware of resources available to them to ensure the safe operation of BEBs. The resources and information that they will need to possess, to include standard operating procedures and preventative maintenance practices, will have to be adequate and thorough to ensure that subordinate personnel are well-trained and knowledgeable of the systems.
Dispatchers and Road Supervisors	Dispatchers and Road Supervisors will need to be trained to troubleshoot service issues and assist operators while in the yard, deadheading, or while in revenue service. Additionally, Road Supervisors will need to be trained in troubleshooting to properly assist during a failure of equipment or an emergency. Dispatch staff will need to monitor the SoC of the BEB. Annual refresher training for Dispatchers and Road Supervisors, especially around emergency procedures, troubleshooting and best practices is recommended.
Operators	Operators must be trained on the operation and charging of the BEBs. The operation of the bus can have a significant impact on battery performance, and operators need to understand the impacts of the use of HVAC, regenerative braking, and how to safely charge the vehicle, if needed. Operators will also need to be trained on pre-trip and post-trip safety inspections of BEB vehicles.

Job Classification	Description
Utility Cleaners	For the cleaning staff their responsibilities on both the inside and the outside of the bus will remain the same. Not all Utility Cleaners physically operate or maintain the vehicle, which means the full operator or maintenance training program is not essential for everyone. However, since they will be working in the proximity of high voltage, it is essential that they understand the safety elements of the vehicles In addition, any commercial driving license-holding Utility Cleaner, that maneuvers the buses within the lot or between facilities, will receive the full Operator training course.
Facility Technicians and Maintenance Staff	Facility Technicians will be trained on all (non-bus) equipment applicable to the mechanic's grade. Additional training in the area of the charging infrastructure will include the following: asset records, system drawings, maintenance manuals, preventive maintenance task descriptions for new equipment, PPE, high-voltage, and training provided by the charger OEM. Mechanics will be responsible for maintaining the vehicles – preventative and corrective maintenance, and mid-life overhauls. All mechanics should receive PPE and high-voltage training, training for maintenance and troubleshooting vehicles and charging infrastructure. There should be annual refresher classes as part of the training program.
Safety Staff	Safety is everyone's job. However, Safety Staff will need to be knowledgeable of the hazards of BEB, proper PPE procedures, and any egress procedures. The safety department will also be coordinating with both PCDWP and local first responders to ensure they have the training required to perform their jobs in a safe and efficient manner.
Schedulers/Planners	With decreased range, vehicle capabilities will need to be an item that service planners consider when making schedules. Service planners need to understand vehicle procurement so that they can create schedules in advance of BEB delivery.
First Responders	Local fire station staff will need to be familiarized with the new buses and supporting facilities.
Tow Truck Service Providers	Tow truck providers will need to be familiarized with the new buses and proper procedures for towing ZEBs.

Source: WSP

The PCDPW's existing Fleet Services Staff consists of 23 personnel in varying roles (Table 6-2). Administrative staff includes an accounting technician, a staff services analyst, the public works manager, and the assistant fleet services superintendent. Based on the aforementioned required skills, the administrative staff will be expected to have a cursory understanding of BEBs – via an introductory course. The PCDPW's mechanics and equipment service workers will be thoroughly trained on the operation and maintenance of BEBs. It is expected that the learning curve will be steep, as the propulsion system of BEBs is not the same as an ICEB. However, at this point, it does not appear that there will be any impacts to staffing as a result of the transition. The assigned training will be logged and tracked via internal systems as current training is.

Table 6-2. The PCDPW's Existing Fleet Services Staff

Job Title	Location	Number of Staff
Accounting Technician	PCT	1
Equipment Mechanic	PCT	3
	TART	1
Equipment Mechanic/Welder	PCT	2
	TART	1
Equipment Service Worker II	PCT	5

Job Title	Location	Number of Staff
	TART	2
Master Equipment Mechanic	PCT	2
Supervising Mechanic	PCT	2
	TART	1
Public Works Manager	PCT	1
Staff Services Analyst II	PCT	1
Assistant Fleet Services Superintendent	PCT	1
	Total	23

Source: PCDPW Fleet Services Staff (2022)

6.2 TRAINING APPROACH

Training for the operation, maintenance, and handling of BEBs will be conducted after buses are procured and in advance of delivery. Specific Training courses, schedules, and equipment will be included in procurement documents, as they are with all existing procurements. It is expected that all relevant personnel will be sufficiently trained before buses arrive. If other OEM-provided buses are procured in the future and/or if new components, software, or protocols are implemented, it is expected that the PCDPW's staff will be trained well in advance of the commissioning of these additions. Table 6-3 provides an example of training modules and the estimated hours based off of a peer agency's estimated requirements.

Table 6-3. BEB Training Modules (Sample)

Module	Hours
General Vehicle Orientation	8
Multiplex System	32
Entrance and Exit Doors	8
Wheelchair Ramp	4
Brake Systems and Axles	16 (8 per axle)
Air System and ABS	8
Front and Rear Suspension, Steering, and Kneeling	8
Body and structure	4
Propulsion & ESS Fam/HV Safety	24
Charging Equipment	4
Electric HVAC, AC Maintenance (Vendor Specific)	24
Propulsion & ESS Troubleshooting	16
Operator Orientation	8
Towing and Recovery	4

Source: SFMTA, 2019

The PCDPW has engaged with WSP to assess the workforce skills gap as part of the overall Zero Emissions Transition Plan. The PCDPW's mechanics currently do not have any familiarity with electrical work, even at the low-voltage level, an electrical principal's foundation training course will need to be added to the curriculum in addition to the ZE transition training.

Additional training courses have been identified to assist in closing any workforce gaps, such as:

- Foundational Electrical Principal Course
- Advanced Electrical Principles
- Multimeter Usage Hands On Workshop

- PPE Use and Care for High Voltage
- Advanced diagnostic tools Hands On Workshop

These classes will equip an experienced mechanic with many valuable skills to transition safely and competently to working on BEBs. The majority of training for the PCDPW will be provided by the OEM or staff. To ensure that the training staff has full knowledge of the programs and systems available, the PCDPW will utilize OEM training resources to prepare the training staff. By using a combination of OEM and in-house trainers, the PCDPW will have a variety of resources to support a successful program. Training for the ZE transition will include:

- Utilization of OEM training staff
- Utilization of contract labor to supplement staff where needed
- Development of new training materials especially for the PCDPW and partner resources
- Utilization of training resources and partnerships from labor
- Utilization and partnerships from the International Transportation Learning Center
- Repurposing of existing in-house knowledge, protocols and procedures from other modes that work with high voltage such as rail.

The PCDPW does not anticipate that any of the current workforce will be displaced due to the implementation of the ZEBs. The workforce will all receive the proper training, coaching and refresher training to ensure they may continue to operate and maintain the PCDPW fleet safely and efficiently.

At this time, it is anticipated that the majority of training will be funded through the vehicle and infrastructure costs; however, the PCDPW will continue to evaluate and consider additional and external training that will benefit the fleet and personnel. To determine whether or not and/or the type of training needed, the PCDPW will rely on supervisory maintenance staff for lessons learned and the identification of shortfalls.

7 COSTS AND FUNDING OPPORTUNITIES

The following section identifies preliminary costs and potential funding sources that the PCDPW may pursue in its adoption of BEBs.

7.1 ESTIMATED CAPITAL AND OPERATING COSTS

While costs for a full fleet transition are still being analyzed, it is estimated that the "cash costs" (capital, operating, and disposal) of the BEB transition would cost an estimated $34 million over a 24-year period, as compared to operating the fleet as-is ("No Build" scenario).

If the PCDPW were to continue to operate an all-ICEB fleet over the next 24 years, lifecycle direct cash costs (capital, O&M, and disposal) would be approximately $118 million. The transition to an all-BEB fleet over the same time period would cost $152 million – _or an incremental cost increase of approximately $34 million. However, some over these costs can potentially be offset by reduced emissions and other environmental benefits, potentially reducing the incremental cost to approximately $26 million. This estimate is based on a 1:1 bus replacement ratio and does not consider the capital costs associated with the purchase of additional buses (due to range limitations), on-site battery storage or photovoltaics, charge management software, or on-route charging infrastructure, if needed. The comparative costs of operating the PCDPW's existing fleet and transitioning to BEBs in year of expenditure dollars are summarized in Table 7-1.

Table 7-1: 2021-2045 Fleet Replacement Cost Comparison (in millions of YOE$)

Cost Categories	PCT		TART		Total	
	"No Build" Scenario	BEB Scenario	"No Build" Scenario	BEB Scenario	"No Build" Scenario	BEB Scenario
Total Capital Costs	$27	$42	$16	$24	$43	$66
Total Operating Costs	$49	$53	$27	$33	$76	$86
Total Disposal Costs	$1	-$1	$0	$0	$1	-$1
Total Cash Costs	$75	$95	$43	$57	$118	$152
Total Environmental Costs	$8	$4	$5	$3	$13	$7
Total Non-Cash Costs	$8	$4	$5	$3	$13	$7
Total Cash and Non-Cash Costs	**$83**	**$99**	**$48**	**$60**	**$132**	**$158**

Source: WSP

Note: The total costs may vary due to rounding. Rounded to the nearest whole dollar.

7.2 POTENTIAL FUNDING SOURCES

To date, the PCDPW has applied for and been awarded various state several grants to support its ZEB transition (Table 7-2).

Table 7-2. Summary of the PCDPW's Funding

Funding Agency	Funding Mechanism	Year	Status	Award	Description
FTA	Low- or No-Emission Vehicle Grant	2019	Not Awarded	N/A	Applied for $1.53M to purchase two BEBs
Caltrans	Low Carbon Transit Operations Program (LCTOP)	2018-2021	Awarded	$327K	Awarded $327K for charging infrastructure at the TART facility.
California Department of Housing and Community Development	Sustainable Transportation Infrastructure Grant through an Assignment Agreement with Placer County	2019	Awarded	$3.58M	Through a workforce housing partnership with Housing and Community Development, will receive $3.58M in funding for buses and infrastructure at TART. Will also include the development of 56 affordable units.
FTA	Low- or No-Emission Vehicle Grant	2022	Not Awarded	Not Awarded	Applied for $1.60M to purchase two BEBs
FHWA/FTA	Congestion Mitigation Air Quality funds (CMAQ)	2024	TBD	TBD	Applied for $700K to purchase one BEB

Source: WSP

There are several potential federal, state, local, and project-specific funding and financing sources that may be available to the PCDPW. The PCDPW also plans to leverage utility-based programs to minimize or eliminate the cost of electrical infrastructure. The following subsections provide a brief overview of some of the federal and state opportunities that PCDWP will continue to monitor and consider.

7.2.1 FEDERAL FUNDING

The Infrastructure Investment and Jobs Act, signed into law in November 2021 as the Bipartisan Infrastructure Law (BIL), provides for the lion's share of transportation-related formula and discretionary grant assistance that comes from the U.S. federal government. This legislation included a reauthorization of the programs included in the Fixing America's Surface Transportation (FAST) Act along with the creation of new ones. Overall, the BIL authorizes more funding opportunities to accommodate the country's transition to a more climate-friendly transportation system. Existing and new formula funding and discretionary grant programs will receive an historic investment of federal funds that will be eligible for fleet electrification and associated infrastructure projects.

The federal funding options include the following:

- US Department of Transportation (USDOT) Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Program;
- FTA Capital Investment Grants (CIG) – Small Starts;

- FTA Section 5307: Urbanized Area Formula Grants;
- FTA Section 5311: Formula Grants for Rural Areas;
- FTA Section 5339: Bus and Bus Facilities Program, both formula and competitive;
- FTA Low or No Emission Vehicle Program – Section 5539 (C);
- Federal Highway Administration (FHWA) Carbon Reduction Program;
- FHWA Electric Vehicle (EV) Charging Formula Funding and Grant Program;
- US Department of Energy (USDOE) Alternative Fuel Tax Credit;
- US Department of Treasury (USDT) New Markets Tax Credit (NMTC) Program; and,
- USDT Opportunity Zones.

OTHER FEDERAL FUNDING OPPORTUNITIES

The BIL amends other programs and funding sources that could potentially be used for BEB purchases or other projects. These include:

- FHWA Surface Transportation Block Grant (STBG) Funding eligible uses expanded to include installation of EV charging infrastructure.
- FHWA Congestion Mitigation and Air Quality (CMAQ) funding eligible uses expanded to include the purchase of medium- or heavy-duty zero emission vehicles and related charging equipment.

7.2.2 STATE FUNDING

A variety of funding programs within the state of California support transit fleet electrification efforts and achieve the CARB ICT regulation. The state funding options include the following:

- CARB Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP);
- CARB State Volkswagen Settlement Mitigation;
- California State Transportation Agency (CalSTA) Transit and Intercity Rail Capital Program (TIRCP);
- California Transportation Commission (CTC) Solution for Congested Corridor Programs (SCCP);
- Caltrans Low Carbon Transit Operations Program (LCTOP);
- Caltrans Local Transportation Fund (LTF);
- Caltrans State Transit Assistance (STA);
- Caltrans State of Good Repair Program (SGR);
- CALSTART Clean Mobility Options (CMO); and,
- California Energy Commission (CEC) Clean Transportation Program

Additionally, the PCDPW can benefit from tax exemptions in California to aid in the fleet electrification transition. BEB purchases are exempt from California sales and use taxes when purchased by a transit agency and electricity that local agencies or public transit operators use as motor vehicle fuel to operate public transit services is exempt from applicable user taxes imposed by California counties.

8 START-UP AND SCALE-UP CHALLENGES

The PCDPW's analysis identifies several challenges in transitioning the fleet to BEBs. These include time constraints, unpredictable advancements in ZE technology that could risk transit performance and service reliability, and significant capital, operational, and ongoing maintenance costs. The following list of challenges is not exhaustive; however, it summarizes some of the identified issues and uncertainties that the PCDPW will have to mitigate and/or address as it transitions its fleet:

- **Uncertainty of COVID-19.** COVID-19 has impacted all facets of our global economy, including public transit. Most transit agencies in the US are observing a slow recovery in ridership and experiencing challenges to restore service to pre-COVID levels. At this time, it is still unclear what the long-term impacts will be on the PCDPW's service. There is a possibility that service ridership levels may not return to previous levels, resulting in changes to expected revenues, and capital improvement plans – including the approach to transitioning the fleet to ZEBs.
- **Rapid Technological Advancement.** The PCDPW is currently planning for a transition based on the fleet as of 2019 (pre-COVID). The PCDPW will soon need to make decisions on fleet requirements, and it is difficult to anticipate future technological changes, such as improved batteries and chargers. The PCDPW will have to make decisions to purchase fleets based on what is known at the time of the contract. This exposes the agency to a risk of missing out on improvements that come soon after contract execution, rendering purchased technologies outdated on arrival.
- **Insufficient BEB Performance and Range.** The BEB industry is constantly innovating and developing vehicles with longer ranges and more efficient batteries. However, the PCDPW's analysis indicates that some service blocks cannot be completed with existing technologies, particularly longer or hillier routes. Unless battery technologies evolve, the agency will have to invest in range-enhancing technologies to meet requirements.
- **Resiliency and Emergency Response.** The PCDPW is seeking solutions to address resiliency and emergency response within the context of a ZEB fleet. With BEBs, service will be dependent on electricity, this makes the service vulnerable during outages and wildfire emergencies.
- **High Capital and O&M Costs.** The PCDPW will exceed its existing rolling stock capital and operations budgets with a transition to ZEBs. Installing infrastructure onsite is expensive and will need to replace the existing fueling infrastructure - which is still within its useful life. Additionally, ZEBs are more expensive than ICE vehicles, and the PCDPW will have to find more funding for this additional cost.
- **Strains on Market Supply.** The ICT regulation will put a lot of pressure on OEMs to produce ZEBs at unprecedented rates. However, it is not only California that is interested in converting to ZEBs. These monumental policy changes make it challenging to meet ZEB goals for agencies if the supply of buses cannot meet demand. This may cause strains on supply, resulting in risk to meeting purchase requirement deadlines.
- **Transition Complexity.** Maintaining service and adhering to ICT regulation purchase requirements, all while managing on-site construction, facility rebuilds, temporary bus relocations, bus procurements, and utility enhancements introduces a lot of risk to the PCDPW's program. If one element of this transition doesn't go as planned, there will be implications for other components of the program.
- **Dependence on Utility Enhancements.** The PCDPW's yards will require upgraded electrical service and infrastructure. The utility application and construction process will take time and money.
- **Managing Power Demand.** The transition to BEBs will require strategies to ensure that the PCDPW can utilize power in the most efficient way. The PCDPW is coordinating with utility providers to determine methods to reduce peak demands. However, managing demand may also come at a hefty capital cost, something that staff is currently analyzing.

RESOLUTION #2023-057
APRIL 4, 2023

Before the Board of Supervisors
County of Placer, State of California

In the matter of: A Resolution approving the Placer County Department of Public Works Zero Emission Bus Rollout Plan

Resolution No: 2023-057

The following Resolution was duly passed by the Board of Supervisors of the County of Placer at a regular meeting held April 4, 2023, by the following vote:

Ayes: GORE, LANDON, JONES, HOLMES

Noes: NONE

Absent: GUSTAFSON

THE FOREGOING INSTRUMENT IS A CORRECT COPY OF THE ORIGINAL ON FILE IN THIS OFFICE ATTEST

MEGAN WOOD
Clerk of the Board of Supervisors, County of Placer, State of California
Deputy Clerk

Signed and approved by me after its passage.

Chair, Board of Supervisors

Attest:
Clerk of said Board

WHEREAS, The State of California Air Resources Board (CARB) Innovative Clean Transit (ICT) regulation became effective October 1, 2019, and requires all public transit agencies to transition their eligible transit vehicle fleets to zero emission by 2040; and

WHEREAS, the CARB ICT defines Placer County as a small transit agency, and is required to begin conversion to Zero Emission Bus (ZEB) with at least 25% of bus purchases as ZEBs beginning in 2026; and

WHEREAS, California Code of Regulations Title 13, Division 3, Chapter 1 ICT regulation requires small transit agencies to submit a complete ZEB Rollout Plan by July 1, 2023; and

WHEREAS, the California Code of Regulations Title 13, Division 3 Chapter 1, Article 4.3, Part 2023.1 (d)(2) Zero Emissions Bus Rollout Plan Requirements requires that a small transit agency Zero Emissions Bus Rollout Plan must be approved by its governing Board through the adoption of a resolution; and

WHEREAS, the Placer County Department of Public Works has completed a ZEB Rollout Plan in accordance with the CARB ICT regulation.

NOW, THEREFORE, BE IT RESOLVED by the Board of Supervisors of the County of Placer, State of California, that the Board hereby approves the Placer County Department of Public Works Zero Emission Bus Rollout Plan.