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City of Riverside
Zero-Emission Fleet Transition Plan

Board of Public Utilities Meeting

September 23, 2024

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Executive Summary

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Overview: RPU Zero-Emission Fleet Transition Plan

FLEET & INFRASTRUCTURE ASSESSMENT

Identify zero-emission fleet alternatives, vehicle costs and replacement schedule, infrastructure needs and costs.

1 FLEET ASSESSMENT

Evaluate zero-emission alternatives, define vehicle replacement schedule and purchase costs.

2 CHARGING AND FACILITY NEEDS

Determine charging infrastructure and facility requirements and costs to support electric load growth.

TOTAL COSTS OF OWNERSHIP AND FLEET TRANSITION DEPLOYMENT

Develop total cost of ownership for fleet transition plan through 2040, inclusive of electric and non-electric vehicles. Identify transition plan deployment options and timelines.

3 TOTAL COST OF OWNERSHIP

Calculate total cost of ownership of the fleet through 2040.

4 DEPLOYMENT OPTIONS AND TIMELINES

Propose fleet transition deployment options and timelines through 2040.

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Key Findings and Recommendations

FLEET & INFRASTRUCTURE ASSESSMENT

RPU operates **266 vehicles with 59% of the total fleet** governed by CARB Advanced Clean Fleet (ACF) regulations.

Fleet transition plan for RPU is estimated to incur **$13.9M in vehicle purchase costs**.

1 **FLEET ASSESSMENT**

Requires installation of **53 chargers** that result in an **increased 2,706-kW load** demand at two sites. City-wide load expected to **increase by 6,450-kW**.

RPU is estimated to incur **$3.77M in total infrastructure costs.**

2 **CHARGING AND FACILITY NEEDS**

TOTAL COSTS OF OWNERSHIP AND FLEET TRANSITION DEPLOYMENT

Estimated to incur **$62.1M in total ownership costs** to purchase and maintain its electric and non-electric fleet through 2040.

3 **TOTAL COST OF OWNERSHIP**

Pursue one of **two potential deployment scenarios** that allows for compliance with CARB ACF Option 1 while enabling, if necessary, delay of infrastructure costs at one site (POE).

4 **DEPLOYMENT OPTIONS AND TIMELINES**

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1 FLEET ASSESSMENT

The City plans to comply with CARB ACF regulations through Option 1 to provide greater flexibility and avoid vehicle replacements prior to end-of-life

OPTION 1 | ZEV Purchase Schedule (Default)

Driven by decision to purchase new vehicles each year

2024 → 2026

50% of purchases must be for zero-emission vehicles

2027 → Onward

100% of purchases must be for zero-emission vehicles

OPTION 2 | ZEV Milestone Schedule

Driven by established years to convert portions of fleet

% of fleet that must be ZEV	10%	25%	50%	75%	100%
Group 1: Box trucks, vans, buses with two axles, yard tractors, light-duty package delivery vehicles	2025	2028	2031	2033	2035 →
Group 2: Work trucks, day cab tractors, buses with three axles	2027	2030	2033	2036	2039 →
Group 3: Sleeper cab tractors and specialty vehicles	2030	2033	2036	2039	2042 →

NON-COMPLIANCE

Enforcement actions can include monetary penalties and registration holds, among others.

- Each violation will be assessed on a **case-by-case basis**
- Certain portions of the **Health and Safety Code** that **CARB can take enforcement action under** allow for **penalties** of up to:

$10,000 per violation, per day

Penalties are steep enough to make non-compliance an **unattractive** or **non-option**

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1 FLEET ASSESSMENT

RPU operates 266 vehicles of which 158 (59% of its fleet) are under the governance of the new CARB ACF regulations

266 vehicles

CARB ACF Regulated

158 vehicles

CARB ACF Exempt

108 vehicles

Vehicles with ZEV Alternatives

Vehicle Type	Vehicle Count
Van	16
Refuse Truck	0
Street Sweeper	2
MD Utility Service	10
MD Bucket Truck	13
HD Utility Service	13
Dump Truck	14
Flatbed Truck	9
Work Pickup Truck	71
Semi Truck	0
HD Bucket Truck	7
TOTAL	155

Vehicles with No ZEV Alternatives

Vehicle Type	Vehicle Count
Vacuum Truck	0
Tank Truck	3
Construction Truck	0
Paint Striper	0
TOTAL	3

Vehicle Type	Vehicle Count	Exemption
Sedan	8	Vehicles under 8,500 GVWR are exempt from ACF
SUV	34	Advanced Clean Cars; only ZEV options will be available for purchase starting 2035
LD Pickup Truck	54	
Paratransit Bus	0	Subject to ICT requirements for ZEV procurement, not ACF.
HD Crane	12	Heavy cranes as defined in title 13, CCR, section 2021 (b)(16).
Fire Truck	0	Emergency Vehicles are exempt from ACF
TOTAL	108	

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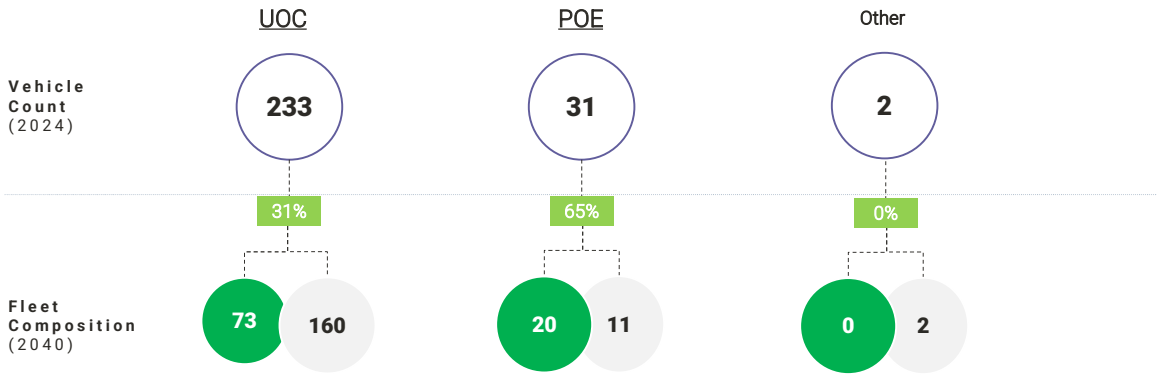
1 FLEET ASSESSMENT

RPU's vehicle replacement plan in this study results in transitioning 93 vehicles (35% of the fleet) to EV's through 2040 at two primary vehicle storage sites

RPU Vehicle Storage Sites | Total Vehicles (266)



Notes:
1. "Other" sites include RPU vehicles that are stored at Public Utility Energy (1) and Payton Ave (1)

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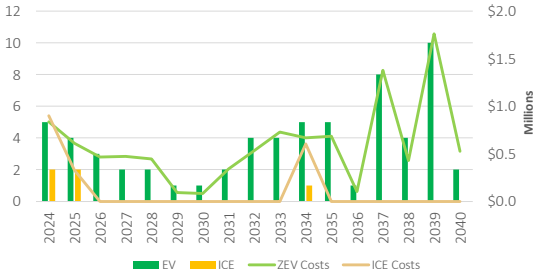
FLEET ASSESSMENT

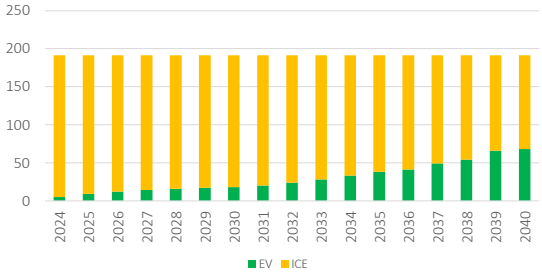
RPU is estimated to incur ~$11.9M in purchase costs (before incentives) for vehicles that are CARB ACF-regulated

Through 2040, purchase costs include $10.1M for EV's and $1.8M for non-EV's that are replaced during the initial 50% requirement years and those that lack a suitable zero-emission alternative (which are presumed to qualify for exemption).

Annual Replacement Schedule and Purchase Costs
CARB ACF Regulated Vehicles



Annual Fleet Composition
CARB ACF Regulated Vehicles



Notes:
1. EV incentives and rebates are excluded from vehicle purchase estimates (Total Incentives: $890k)

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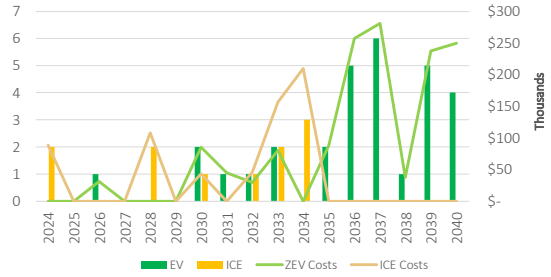
FLEET ASSESSMENT

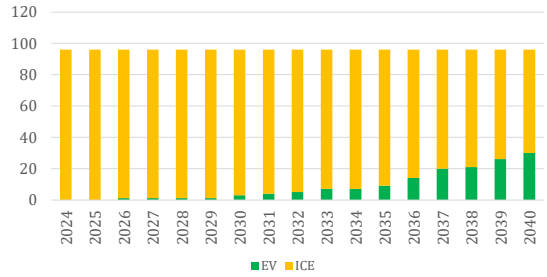
RPU is estimated to incur an additional ~$2M in purchase costs (before incentives) for vehicles that are CARB ACF-Exempt

Through 2040, purchase costs include $1.4M for EV's and $651k for non-EV's.

Annual Replacement Schedule and Purchase Costs
CARB ACF-Exempt



Annual Fleet Composition
CARB ACF-Exempt



Notes:
1. EV incentives and rebates are excluded from vehicle purchase estimates (Total Incentives: $22.5k)
2. From 2026 to 2034, the City plans to transition 50% of passenger vehicles to EV's
3. Starting in 2035, 100% of vehicles are planned to be replaced with a zero-emission alternative due to the Advanced Clean Cars regulations.

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2 CHARGING & FACILITY NEEDS

The addition of EVs to the City fleet will result in a projected increase of 6,450-kW in load demand to be served by 127 chargers. RPU accounts for 2,706-kW and 53 chargers.

	UOC	POE	CITY HALL	CORP YARD	WATER QUALITY
EV Load Addition	2434 kW	272 kW	450 kW	3174 kW	120 kW
Future EV Fleet (2040)	73	20	34	113	5
Charger Type & Output: Number of Chargers					
7.2kW Single-Port	2	10	18	2	
40kW Dual-Port	23	5	8	37	3
120kW Dual-Port	13				
300kW Cabinet (8 Ports)				6	
Total # of Chargers	38	15	26	45	3

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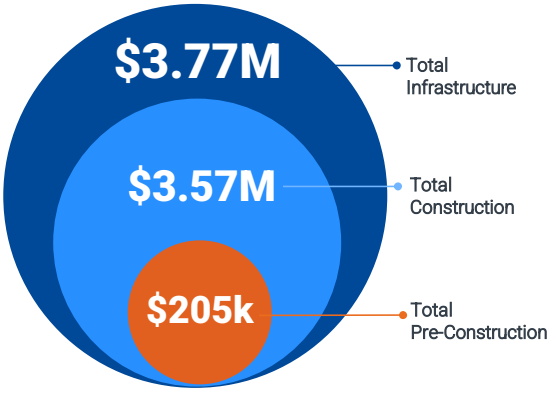
2 CHARGING & FACILITY NEEDS

RPU is estimated to incur ~$3.77M in costs relating to charging infrastructure and electrical capacity upgrades to support the 2040 ZEV fleet composition

TOTAL INFRASTRUCTURE COSTS



BY SITE

UOC	$3.091M	$1,270 per kW
POE	$679k	$2,496 per kW

Notes:
1. Infrastructure costs are at a Class 5 Level estimate: -30%/+50%
2. Detailed infrastructure cost estimate by site can be found in the section below "Fleet Replacement Plan Infrastructure Needs and Costs"

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2 CHARGING & FACILITY NEEDS

Costs for charging equipment represent the highest share (43%) of total infrastructure costs

COST CATEGORY (FROM HIGHEST TO LOWEST COST)

CHARGING EQUIPMENT 1
12 – 7.2kW AC L2 Charger Single Port
28 – 40kW DC Charger Dual Port
13 – 120kW DC Charger Single Port

ELECTRICAL WORK 2


ELECTRICAL EQUIPMENT 3
Refer to "Fleet Replacement Plan Infrastructure Needs and Costs" section for breakdown

SITE IMPROVEMENT 4
Striping & Ground Symbols
Concrete Wheel stops
Protection Bollards
Pipe Bollards Sleeves
Landscaping

DESIGN AND ENGINEERING 5
Site Walk
Electrical Engineering
Civil Engineering
Structural Engineering
Engineering techs/Graphics

ALL OTHER COSTS
Switchboard Coordination, Utility Coordination Permitting Land Survey

ALL OTHER COSTS
Demolition, Trenching and Backfill, Asphalt Paving, Concrete Work, Commissioning Support Additional Site & Electrical Work

TOTAL COST & SHARE BY COST CATEGORY

CHARGING EQUIPMENT	$1.61M	43%	
ELECTRICAL WORK	$789k	21%	
ELECTRICAL EQUIPMENT	$471k	13%	
SITE IMPROVEMENT	$196k	5%	
DESIGN AND ENGINEERING	$105k	3%	
ALL OTHER COSTS	$599	15%	

PRE-CONSTRUCTION CONSTRUCTION

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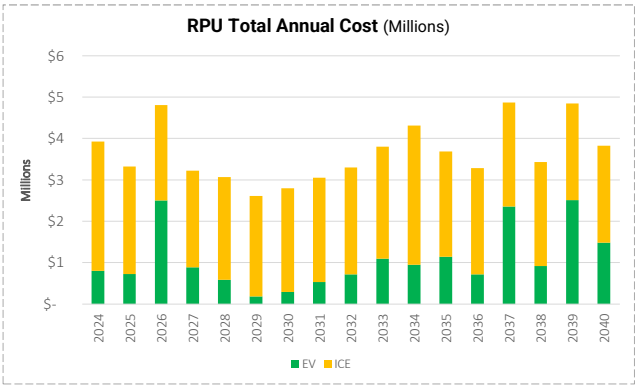
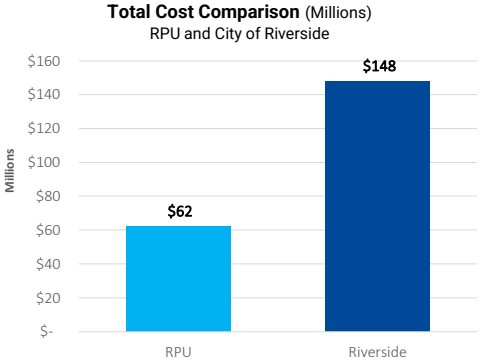
3 TOTAL COSTS OF OWNERSHIP

Through 2040, RPU is estimated to incur $62.1M to purchase and maintain its electric (and non-electric) fleet, representing 30% of the City's total estimated fleet transition costs





Notes:
1. Total Cost of Ownership includes vehicle and infrastructure purchase and lifecycle costs, as well as vehicle purchase rebates and incentives ($912.2k)
2. Vehicle salvage costs are excluded

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4 DEPLOYMENT TIMELINE

RPU can pursue either the "default" scenario or delay deployment of charging infrastructure at POE by swapping non-electric vehicles with UOC or through off-site charging

Scenario #1(Default)

- A: 2025 | 2026 | 2027 – 2040*
- B: 2026 | 2027 | 2028 – 2040*

✓ Deployment of charging infrastructure at each site in alignment with proposed vehicle replacement schedule

Scenario #2 (Vehicle Swap or Off-Site Charging)

- A: 2025 | 2026 | 2027 – 2040*
- B: 2034 | 2035 | 2036 – 2040*

✓ Delay charging infrastructure deployment at POE by allotting its EV purchase requirements to UOC and "swapping" from UOC the equivalent non-EV. Alternatively, maintain EV purchase schedule for POE and leverage off-site charging.

Planned EV replacements at POE (2026 to 2034)

SUV's	4
Light-Duty Pickup Trucks	2

Vehicle swap options at UOC (total vehicle count)

SUV's	37
Light-Duty Pickup Trucks	67

*Additional charging equipment is assumed to be installed in alignment with EV additions

A UOC B POE

PRE-CONSTRUCTION | CONSTRUCTION | +CHARGING EQUIPMENT

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Fleet Replacement Plan Infrastructure Needs and Costs (by Site)

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Utility Operations Center
(2911 Adams Street)

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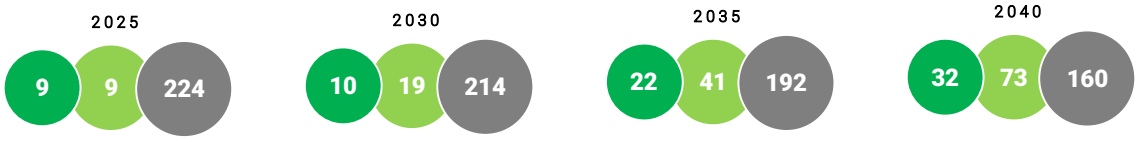
By 2040, our proposed vehicle replacement schedule will result in 73 vehicles (31% of the UOC fleet) to be transitioned to EV's

VEHICLE REPLACEMENT SCHEDULE

Vehicle Type	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	TOTAL
SUV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
Light-Duty Pickup Truck	0	0	0	0	0	0	1	1	0	0	0	1	1	2	0	1	1	8
Van	1	0	1	0	0	0	0	1	1	1	0	1	0	2	1	0	0	9
Medium-Duty Bucket Truck	2	2	2	1	1	0	0	0	0	0	0	0	0	2	0	0	1	11
Heavy-Duty Bucket Truck	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	4
Dump Truck	0	0	0	0	1	0	0	1	1	2	1	1	0	2	0	0	1	10
Flatbed Truck	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Work Pickup Truck	1	2	0	0	0	1	1	0	2	1	4	3	1	2	3	7	0	28
Heavy-Duty Semi Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	5	4	3	2	2	1	2	3	4	4	5	6	2	10	4	13	3	73

FLEET COMPOSITION (233 total vehicles)



EV Addition
Total EV's in Fleet
Total Non-EV's in Fleet

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Under the 40kW scenario – the UOC will require 38 chargers to be installed

#	Vehicle Type	ZEV Make	ZEV Model	HOURS OF CHARGING FOR 0-100% (FULL)*					CHARGER/VEHICLE				
				Level 2 (7.2kw)	Level 2 (19.2kw)	Level 3 (40kw)	Level 3 (60kw)	Level 3 (120kw)	Level 2 (7.2kw)	Level 2 (19.2kw)	DC dual port (40kw)	Level 3 (60kw)	Level 3 (120kw)
1	Sedan	Nissan	Leaf	6.2	2.3	1.3	0.8	0.4					
2	SUV	Hyundai	Ioniq 5 Standard Range	9.0	3.4	1.8	1.2	0.6	2.0				
3	Light-Duty Pickup Truck	Ford	F-150 Lightning	15.1	5.7	3.1	2.0	1.0		8.0	4.0		
4	Paratransit Bus	GreenPower	EV Star BEB	18.2	6.8	3.7	2.5	1.2					
5	Van	Envirotech	Logistics Van	16.4	6.1	3.3	2.2	1.1		9.0	4.5		
6	Refuse Truck	Peterbilt	520EV	61.1	22.9	12.4	8.3	4.1					
7	Street Sweeper	Battle Motors	Electric Elgin Broom Bear	61.7	23.1	12.5	8.3	4.2					
8	Medium-Duty Utility Service Truck	Rizon	e18M	12.7	4.7	2.6	1.7	0.9					
9	Heavy-Duty Utility Service Truck	Battle Motors	LET2 - Electric	61.7	23.1	12.5	8.3	4.2					
12	Medium-Duty Bucket Truck	Terex	HR55 All Electric Bucket Truck	32.4	12.2	6.6	4.4	2.2			0.0	11.0	5.5
13	Heavy-Duty Bucket Truck	Lion	Lion8	38.9	14.6	7.9	5.3	2.6				4.0	2.0
14	Dump Truck	Battle Motors	LET2 - Electric	61.7	23.1	12.5	8.3	4.2				10	5.0
15	Flatbed Truck	Rizon	e18M	12.7	4.7	2.6	1.7	0.9		1.0	0.5		
18	Work Pickup Truck	Optimal EV	EV E1 Cutaway Chassis	17.4	6.5	3.5	2.4	1.2		28.0	14.0		

						Total
Total - 19.2kW Scenario	2	46	0	25	13	**73**
Total - 40kW Scenario	2	0	23	0	13	**38**
DELTA (NUMBER OF CHARGERS)						**36**

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A new service and utility transformer is recommended for installation of the 38 chargers to serve the 73 EV's planned at the site by 2040

Existing Main	480V 3Θ, 1600 A, kAIC
New Service	4000A, 480V, 3Θ
New Utility Transformer	2500 kVA
New Switchboard	1-4000A, 480V, 3Θ

kW Total		2434
Charger Quantity	7.2 kW	2
	40 kW	23
	120 kW	13

Amps	
@208V	8453
@480V	3662

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We recommend a new service be installed at the UOC to handle the 2040 load demand (2434kW) from new EV's

NEC Demand Load

2434kW or 676 Amps at 480V

Provides Required Capacity? NO

New Service Required? YES

Key Findings & Recommendations

01

Current existing infrastructure could potentially serve new EV charging at this site.

Age of existing switchboard and replacement part would be a concern for a construction project.

02

Coordinate with operations to identify best locations to accommodate electrical installation at Level 2 and Level 1 of garage. Space is limited for new service equipment.

Additional equipment would be required above the existing EV infrastructure to energize spaces to meet ZEV fleet conversion goals.

03

The exiting EV panel board would not be able to support the final ZEV and BEV load deployment at this site.

A new service while challenging to locate would allow for easy allotment of electricity as fuel for fleet management.

A new service is recommended to be installed and billed on RPU-EV rates.

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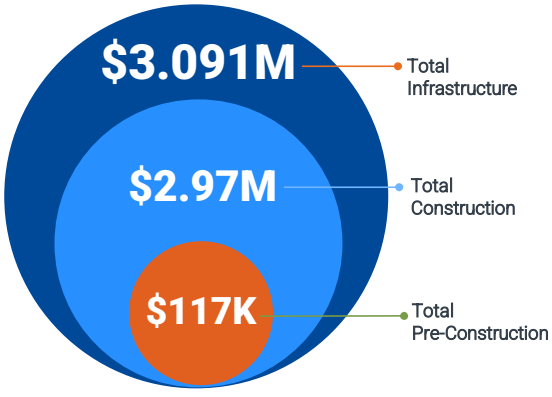
We estimate an investment of ~$3.091M to install charging infrastructure and upgrade site electrical capacity to meet 2040 load demand for the 73 electric vehicles

TOTAL INFRASTRUCTURE COSTS



BY COST CATEGORY

Description	Total
Design and Engineering	$60,812
Switchboard Coordination	$4,428
Utility Coordination	$12,832
Permitting	$18,448
Land Survey	$20,940
PRE-CONSTRUCTION	$117,460
Demolition	$38,346
Trenching and Backfill	$61,463
Asphalt Paving	$68,860
Site Improvements	$134,980
Concrete Work	$107,026
Electrical Work	$667,913
Electrical Equipment - Procurement & Installation	$399,402
Charging Equipment - Procurement & Installation	$1,411,202
Commissioning Support	$28,861
Additional Site & Electrical Work	$56,318
CONSTRUCTION	$2,974,372
TOTAL	$3,091,831

Notes:
1. Infrastructure costs are at a Class 5 Level estimate: -30%/+50%
2. Detailed infrastructure cost estimate assumptions can be found in the Appendix of this deliverable

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Costs for charging equipment will represent the highest share (45%) of total infrastructure costs for the City in its fleet transition

COST CATEGORY (FROM HIGHEST TO LOWEST COST)

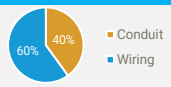
TOTAL COST & SHARE BY COST CATEGORY

1 CHARGING EQUIPMENT

2 – 7.2kW AC L2 Charger Single Port
23 – 40kW DC Charger Dual Port
13 – 120kW L3 Dual Port

CHARGING EQUIPMENT: $1.4M, 45%

2 ELECTRICAL WORK



ELECTRICAL WORK: $667k, 22%

3 ELECTRICAL EQUIPMENT

1 – 4000A SWBD
1 – 2500KVA XFMR (from utility)
1 – 15KVA XFMR
1 – 100A Distribution Panel

ELECTRICAL EQUIPMENT: $399k, 13%

4 SITE IMPROVEMENT

Striping & Ground Symbols
Concrete Wheel stops
Protection Bollards
Pipe Bollards Sleeves
Landscaping

SITE IMPROVEMENT: $134k, 4%

5 DESIGN AND ENGINEERING

Site Walk
Electrical Engineering
Civil Engineering
Structural Engineering
Engineering techs/Graphics

DESIGN AND ENGINEERING: $60k, 2%

ALL OTHER COSTS

Switchboard Coordination, Utility Coordination Permitting Land Survey

ALL OTHER COSTS

Demolition, Trenching and Backfill, Asphalt Paving, Concrete Work, Commissioning Support Additional Site & Electrical Work

ALL OTHER COSTS: $672k, 14%

PRE-CONSTRUCTION | CONSTRUCTION

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UTILITY POE
(3920 Mulberry Street)

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By 2040, our proposed vehicle replacement schedule will result in 20 vehicles (64% of the POE fleet) to be transitioned to EV's

VEHICLE REPLACEMENT SCHEDULE

Vehicle Type	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	TOTAL
SUV	0	0	1	0	0	0	0	0	1	1	0	1	1	3	1	1	0	10
Light-Duty Pickup Truck	0	0	0	0	0	0	1	0	0	1	0	0	3	1	0	1	3	10
TOTAL	0	0	1	0	0	0	1	0	1	2	0	1	4	4	1	2	3	20

FLEET COMPOSITION (36 total vehicles)

EV Addition
Total EV's in Fleet
Total Non-EV's in Fleet

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Under the 40kW scenario – POE will require 15 chargers to be installed

#	Vehicle Type	ZEV Make	ZEV Model	HOURS OF CHARGING FOR 0-100% (FULL)* Level 2 (7.2kw)	Level 2 (19.2kw)	Level 3 (40kw)	Level 3 (60kw)	Level 3 (120kw)	CHARGER/VEHICLE Level 2 (7.2kw)	Level 2 (19.2kw)	DC dual port (40kw)	Level 3 (60kw)	Level 3 (120kw)
1	Sedan	Nissan	Leaf	6.2	2.3	1.3	0.8	0.4	0.0				
2	SUV	Hyundai	Ioniq 5 Standard Range	9.0	3.4	1.8	1.2	0.6	10.0				
3	Light-Duty Pickup Truck	Ford	F-150 Lightning	15.1	5.7	3.1	2.0	1.0		10.0	5.0		
4	Paratransit Bus	GreenPower	EV Star BEB	18.2	6.8	3.7	2.5	1.2					
5	Van	Envirotech	Logistics Van	16.4	6.1	3.3	2.2	1.1					
6	Refuse Truck	Peterbilt	520EV	61.1	22.9	12.4	8.3	4.1					
7	Street Sweeper	Battle Motors	Electric Elgin Broom Bear	61.7	23.1	12.5	8.3	4.2					
8	Medium-Duty Utility Service Truck	Rizon	e18M	12.7	4.7	2.6	1.7	0.9					
9	Heavy-Duty Utility Service Truck	Battle Motors	LET2 - Electric	61.7	23.1	12.5	8.3	4.2					
12	Medium-Duty Bucket Truck	Terex	HR55 All Electric Bucket Truck	32.4	12.2	6.6	4.4	2.2					
13	Heavy-Duty Bucket Truck	Lion	Lion8	38.9	14.6	7.9	5.3	2.6					
14	Dump Truck	Battle Motors	LET2 - Electric	61.7	23.1	12.5	8.3	4.2					
15	Flatbed Truck	Rizon	e18M	12.7	4.7	2.6	1.7	0.9					
18	Work Pickup Truck	Optimal EV	EV E1 Cutaway Chassis	17.4	6.5	3.5	2.4	1.2					

						Total
Total - 19.2kW Scenario	10	10	0	0	0	20
Total - 40kW Scenario	10	0	5	0		15
DELTA (NUMBER OF CHARGERS)						5

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A new service and utility transformer is recommended for installation of the 15 chargers to serve the 20 EV's planned at the site by 2040

Existing Main	208V 3Θ, 400A, kAIC
New Service	600A, 480V, 3Θ
New Utility Transformer	250kVA
New Switchboard	600A,480V, 3Θ

kW Total		272
Charger Quantity	7.2 kW	10
	40 kW	5

Amps	
@208V	944
@480V	409

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We recommend a new service be installed at the Utility POE to handle the 2040 load demand (272kW) from new EV's

NEC Demand Load

272kW or 409 Amps at 480V

Provides Required Capacity? **NO**

New Service Required? **YES**

Key Findings & Recommendations

01

Current existing infrastructure could potentially serve new EV charging at this site.

Age of existing switchboard and replacement part would be a concern for a construction project.

02

The exiting EV panel board would not be able to support the final ZEV and BEV load deployment at this site.

03

A new service while challenging to locate would allow for easy allotment of electricity as fuel for fleet management.

A new service is recommended to be installed and billed on RPU-EV rates

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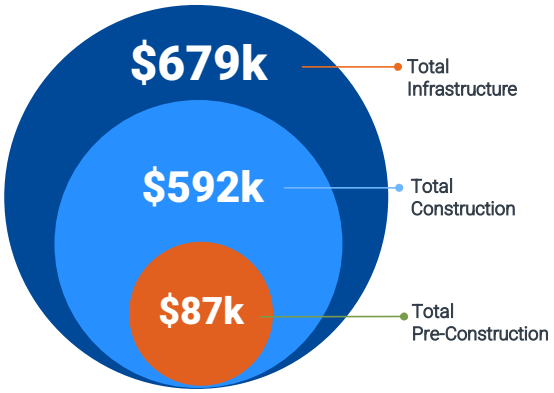
We estimate an investment of ~$679k to install charging infrastructure and upgrade site electrical capacity to meet load demand for the 20 electric vehicles

TOTAL INFRASTRUCTURE COSTS



BY COST CATEGORY

Description	Total
Design and Engineering	$44,708
Switchboard Coordination	$3,581
Utility Coordination	$10,379
Permitting	$11,999
Land Survey	$17,017
PRE-CONSTRUCTION	$87,684
Demolition	$13,415
Trenching and Backfill	$20,202
Asphalt Paving	$22,994
Site Improvements	$61,677
Concrete Work	$36,959
Electrical Work	$120,897
Electrical Equipment - Procurement & Installation	$72,194
Charging Equipment - Procurement & Installation	$198,100
Commissioning Support	$20,476
Additional Site & Electrical Work	$24,835
CONSTRUCTION	$591,749
TOTAL	$679,433

Notes:
1. Infrastructure costs are at a Class 5 Level estimate: -30%/+50%
2. Detailed infrastructure cost estimate assumptions can be found in the Appendix of this deliverable

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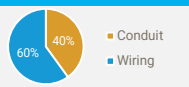
Costs for charging equipment will represent the highest share (29%) of total infrastructure costs for the City in its fleet transition

COST CATEGORY (FROM HIGHEST TO LOWEST COST)

1 CHARGING EQUIPMENT
10 – 7.2kW AC L2 Charger Single Port
5 – 40kW DC Charger Dual Port

2 ELECTRICAL WORK


3 ELECTRICAL EQUIPMENT
1 – 600A SWBD
1 – 250KVA XFMR (from utility)
1 – 75KVA XFMR
1 – 200A Distribution Panel

4 SITE IMPROVEMENT
Striping & Ground Symbols
Concrete Wheel stops
Protection Bollards
Pipe Bollards Sleeves
Landscaping

5 DESIGN AND ENGINEERING
Site Walk
Electrical Engineering
Civil Engineering
Structural Engineering
Engineering techs/Graphics

ALL OTHER COSTS
Switchboard Coordination, Utility Coordination Permitting Land Survey

ALL OTHER COSTS
Demolition, Trenching and Backfill, Asphalt Paving, Concrete Work, Commissioning Support Additional Site & Electrical Work

TOTAL COST & SHARE BY COST CATEGORY

CHARGING EQUIPMENT	ELECTRICAL EQUIPMENT
$198k 29%	$72k 11%
ELECTRICAL WORK	**SITE IMPROVEMENT**
$120k 18%	$61k 9%
DESIGN AND ENGINEERING	**ALL OTHER COSTS**
$44k 7%	$182k 27%

PRE-CONSTRUCTION CONSTRUCTION

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APPENDIX

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Off-Site Charging Opportunities

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Public DCFC stations provide additional operational support during ZEV fleet transition

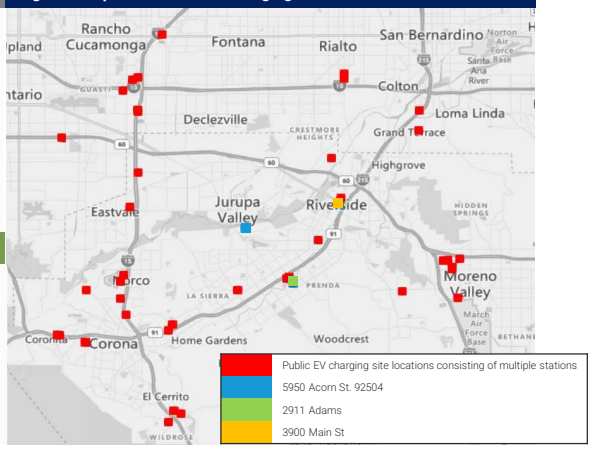
Total Number of Public Charging Sites & DC Ports

		Locations	DC Ports
1	UOC	42	144
2	POE	37	146
3	Water Quality	31	149

Public Charging Considerations

- Based on RPU's duty-cycles, all anticipated ZEV replacements through 2040 can rely solely on RPU-owned charging infrastructure
- Public charging may offer **supplemental charging** if:
  - ZEV is delivered ahead of on-site charging installation completion
  - Vehicle travels much higher than average duty-cycle, especially on high temperature days (as identified by EV Range Analysis) and needs on-route charging
- Leveraging public charging will impact operations and should not be considered a long-term solution

Regional Map of Public DCFC Charging Sites



Notes:
1. Map illustrates locations of public charging facilities with DCFC charges within a 10-mile radius of the RPU's vehicle storage sites
2. Currently, there are no planned deployments of DCFC chargers within this 10-mile radius limit

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Infrastructure Cost Assumptions (by Site)

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Assumptions, Exclusions, Clarifications that apply to all Sites

1. Cost validity for 30 days from 06/XX/2024
2. Pricing excludes permit fees
3. Includes project management & construction management efforts
4. Includes insurances, overheads, & contingencies
5. Excludes escalation on construction labor, electrical equipment cost, and materials cost
6. Includes budgetary local and state tax on electrical equipment & materials
7. Considers Autel OEM for charging equipment
8. Construction labor tasks based on Union wage rates
9. On-site security, during construction, is excluded

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Assumptions, Exclusions, Clarifications that apply to all Sites

1. Pricing includes commissioning support
2. Pricing includes AC & DC feeders testing & documenting results
3. Pricing includes Torqueing feeder terminations to specification
4. Assumes standard, non-rocky, soil condition
5. Assumes normal working hours 7:00 AM - 5:00 PM, Monday thru Friday
6. Based on theoretical design, actual price may vary
7. Assumes no additional new lighting is required
8. Pricing excludes construction and design of new (or modification of existing) stormwater system
9. Pricing excludes costs for equipment extended warranty, cloud subscription, software and cable management system, and shipping

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Utility Operations Center
(2911 Adams Street)

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Charging and Facility Infrastructure Needs Assessment

Existing Main	480V 3Θ, 1600 A, kAIC

kW Total		2434	Amps	
Charger Quantity	7.2 kW	2	@208V	8453
	40 kW	23		
	300 kW	13	@480V	3662

New Service	4000A, 480V, 3Θ
New Utility Transformer	2500kVA
New Switchboard	1-4000A, 480V, 3Θ

Breaker/ C&W, L2 - 7.2kW	2 X (40A/2P, 2- #8 ,#10G in 1" PVC)
Breaker /C&W, L3 - 40kW	34 X (60A/3P, 3#4, #10G in 1.25" PVC)
Breaker/C&W, L3 - 300kW	7 X (180A/3P, 2X (3-3/0, 6xG in 2.5" PVC_

LV Transformer	1- 15 kVA- 480V/ 240, 1Θ
LV TF Breaker/C&W	1-40A/2P, 2-#8, #10g in 1"PVC
LV Panel	60A, 120/240V, 1Θ
LV Panel Breaker/C&W	1-100A/2P 3-#1, #8G in 1.25"PVC

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Site-Specific Assumptions, Exclusions, Clarifications

1. Pricing excludes EV signage
2. Pricing includes wheel stops per EV stall for L2 and 40kW chargers
3. Striping of EV parking stalls are excluded
4. 4" (D) x 3' (H) HDPE Pipe Bollards are included for each dispenser location
5. Protection bollards for main SWBD are included in pricing

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UTILITY POE
(3920 Mulberry Street)

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Charging and Facility Infrastructure Needs Assessment

Existing Main	280V 3Θ, 400A, kAIC

kW Total		272	Amps	
Charger Quantity	7.2 kW	10	@208V	944
	40 kW	5	@480V	409
	300 kW	0		

New Service	600A, 480V, 3Θ
New Utility Transformer	250kVA
New Switchboard	600A, 480V, 3Θ

Breaker/ C&W, L2 - 7.2kW	10 X (40A/2P, 2- #8 ,#10G in 1" PVC)
Breaker /C&W, L3 - 40kW	5 X (60A/3P, 3#4, #10G in 1.25" PVC)

LV Transformer	1- 75 kVA- 480V/ 240, 3Θ
LV TF Breaker/C&W	1-125A/3P, 3#1, #8G in 2" PVC
LV Panel	200A, 120/208V, 3Θ
LV Panel Breaker/C&W	1-200A/3P, 2 x (4-3/0, #6G in 2.5" PVC)

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Site-Specific Assumptions, Exclusions, Clarifications

1. Pricing excludes EV signage
2. Pricing includes wheel stops per EV stall for L2 and 40kW chargers
3. Striping of EV parking stalls are excluded
4. 4" (D) x 3' (H) HDPE Pipe Bollards are included for each dispenser location
5. Protection bollards for main SWBD are included in pricing

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Data and Analysis Assumptions

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Total Cost of Ownership

	Data	Key Assumptions
1	Fuel Efficiency when no rated MPGe from OEM	• Used EPA calculation to determine • Then discounted by 10% as manufacturer specifications are often known to be overstated • Base assumption is that actual MPGe is 90% of listed
2	Annual Maintenance Costs	• Maintenance cost data is still limited for this market • Available data suggests 50% lower costs when compared to ICE vehicles • Assumed a conservative 40% reduction in costs compared to representative ICE vehicle type • Repair costs increase with higher mileage; cost escalator will be applied during modeling
3	Other Costs	• *Infrastructure & installation* – costs incurred over 2 years (pre-construction costs in Yr. 1, construction in Yr. 2) • *Diesel fuel costs* – forecasted based on US EIA *base case* scenario projections • *Gasoline fuel costs* – forecasted based on US EIA *high oil price* scenario projections • *CNG fuel costs* – escalated at 3% per year based on market forecasts • *EV rebates* – max HVIP rebates per applicable electric vehicle purchased; decreasing by 10% year over year • *Salvage costs* – assumed 10% of original vehicle purchase price for vehicles at or beyond end of useful life • Power costs – assumed a single site subject to the Schedule SMEVC (Separately Metered EV Charging) rate • *EV costs* – reducing costs 40% from 2020 to 2030, then increasing prices at 3% inflationary estimate
4	Other	• Vehicles replaced before construction is completed will have to be charged publicly

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Heather Donaldson –Project Director

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