## **Documentation of GHG Reduction Assumptions**

| **Methodology and Assumptions** | **Calculation** |
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| **Program T1. Commercial Fleet and Fuel Transition Program** | |
| **Average Annual GHG Reductions per Vehicle Type:** Emissions numbers are pulled from past NCDEQ VW/DERA awarded projects. Averages were used where possible, other numbers came from specific projects. Other vehicle types were calculated using the EPA's Diesel Emissions Quantifier tool.   * Electric Class 4-7: 6.6375 short tons of CO2e (per VW Phase 2); Electric Class 8: 24.75 short tons of CO2e (per VW Phase 2); Electric Yard Tractors: 63.51 short tons of CO2e (per DERA); Electric LD: 4.7 short tons of CO2e (per AFLEET 2020 Defaults); Diesel Class 4-7: 2.03 short tons of CO2e (per EPA Diesel Emissions Quantifier Tool, VW 4-7 non-refuse diesel trucks); Diesel Class 8: 13.23 short tons of CO2e (VW Phase 2)   **Vehicle Types:** Vehicle types were selected based on information gathered in NCDEQ awarded VW/DERA projects.  **Number of Vehicles per Type**: Determined number of vehicles per vehicle type using vehicle costs from VW project and funding amount for replacements of $10,387,000. Total of 56 vehicles are transitioned to cleaner vehicles:   * 16 Class 4-7 Trucks to electric ($262,600 per vehicle); 12 Class 8 Trucks to electric ($39,285 per vehicle); 10 Class 4-7 to clean diesel ($289,250 per vehicle); 8 Class 8 to clean diesel ($39,285 per vehicle); 10 Yard Tractors to electric ($39,285 per vehicle) | **Annual GHG Reductions for one Vehicle Type (short tons)** = Number of Vehicles per Type \* Average Annual GHG Reductions per Vehicle Type (short tons)  **Annual GHG Reductions for all Vehicle Types (short tons)** = Sum {Annual GHG Reductions for each Vehicle Type (short tons)}  **Total GHG Reductions for all Vehicle Types from 2025-2030 (MT) =** Annual GHG Reductions for all Vehicle Types (short tons)\* 5 (years) \* 0.90718474 (conversion to MT)  **Total GHG Reductions for all Vehicle Types from 2025-2050 (MT) =** Annual GHG Reductions for all Vehicle Types (short tons)\* 25 (years)\* 0.90718474 (conversion to MT) |
| **Program T2. EV Charging Infrastructure** | |
| **Annual GHG Reductions for Each Port:** The Afleet CFI tool was used to calculate the potential emissions reductions from the potential Level 2 ports. Moderate utilization was used and all other defaults for North Carolina utility grid were used in the Afleet CFI tool. This is a conservative approach since it does not account for continued vehicle population growth.  **Per Afleet CFI, Level 2 EVSE Annual GHG reductions:** 9.1 short tons of CO2e  **Number of Charging Ports**: Assumed cost per port = $8,254 (per NC VW charging ports projects) and $5,557,500 total funding for a total of 680 ports to be constructed  **Charger Lifespan:** The expected life of a level 2 charger is 8-10 years. Assumed the chargers will remain active for the 25-year period, being maintained and replaced as needed. | **Annual GHG Reductions for all Ports (short tons)** = 700 \* Average Annual GHG Reductions for Each Port (short tons)  **Total GHG Reductions for all Ports from 2025-2030 (MT) =** Annual GHG Reductions for all Ports (short tons)\* 5 (years) \* 0.90718474 (conversion to MT)  **Total GHG Reductions for all Ports from 2025-2050 (MT) =** Annual GHG Reductions for all Ports (short tons)\* 25 (years) \* 0.90718474 (conversion to MT) |
| **Program T3. Government Fleet and Fuel Transition Program** | |
| **Average Annual GHG Reductions per Vehicle Type:** Emissions numbers are pulled from past NCDEQ VW/DERA projects. Averages were used where possible, other numbers came from specific projects. The emissions estimate for light duty vehicles came from the AFLEET 2020 tool using the defaults. Other vehicle types were calculated using the EPA's Diesel Emissions Quantifier tool (see values in T1).  **Number of Vehicles per Type**: Assumed number of vehicles per vehicle type using vehicle cost from VW project and funding amount for replacements of $30,360,175. Total of 169 vehicles are transitioned to cleaner vehicles:   * 26 MD Class 4-7 Trucks to electric ($404,000 per vehicle); 18 MD Class 8 Trucks to electric ($445,000 per vehicle); 16 MD Class 4-7 to clean diesel ($132,353 per vehicle); 11 MD Class 8 to clean diesel ($157,140 per vehicle); 8 MD Yard Tractors to electric ($317,684 per vehicle); 90 Light-Duty Vehicles to electric ($60,000 per vehicle)   **Vehicle Types:** Vehicle types were selected based on information gathered in NCDEQ VW/DERA projects. | **Annual GHG Reductions for one Vehicle Type (short tons)** = Number of Vehicles per Type \* Average Annual GHG Reductions per Vehicle Type (short tons)  **Annual GHG Reductions for all Vehicle Types (short tons)** = Sum {Annual GHG Reductions for each Vehicle Type (short tons)}  **Total GHG Reductions for all Vehicle Types from 2025-2030 (MT) =** Annual GHG Reductions for all Vehicle Types (short tons)\* 5 (years) \* 0.90718474 (conversion to MT)  **Total GHG Reductions for all Vehicle Types from 2025-2050 (MT) =** Annual GHG Reductions for all Vehicle Types (short tons)\* 25 (years) \* 0.90718474 (conversion to MT) |
| **Program T4. Port Operations Decarbonization** | |
| **Truck Miles Diverted:** Avoided CO2e for trucks estimated using total number of containers diverted from trucks (1 container/truck) to trains (200 containers/train for Charlotte, 234 containers/train for Rocky Mount); mileage from the Port of Wilmington to Charlotte (206 mi one way) or Rocky Mount (169 mi one way). To Charlotte, emissions were estimated incremental to existing shipments; therefore, container shipments diverted to train would not occur until 2036. The in-land port in Rocky Mount is new; therefore, container shipments diverted to train would start in 2025 (per EPA Emissions Factors for GHG Inventories, Table 2 Mobile Combustion CO2).  **Increased Rail Fuel:** Increase in CO2e for trains estimated using total amount of incremental rail fuel consumed by transporting containers diverted from trucks. Incremental fuel consumption was based on estimate of the additional rail revenue ton miles using an average weight of the cargo per container (40 tons/train car), transport distance from Port of Wilmington to Charlotte or Rocky Mount (206 mi, 169 mi), and number of containers transferred from trucks to trains. The Association of American Railroads reports rail fuel efficiency in 2018 at about 470 ton-miles of cargo hauled per gallon of fuel on average. The inverse of this value (0.00188 gallon per revenue ton mile) was multiplied by total revenue ton miles to estimate total fuel consumption.  **Emissions Factors:** Standard VMT emissions reductions factors were used for truck and rail calculated using EPA website. Assumed CO2 per mile (heavy truck): 1646.774194 grams (per EPA Emissions Factors for GHG Inventories, Table 2 Mobile Combustion CO2, GHG Equivalencies Calculator)  Assumed CO2 per gallon (rail): 10,180 grams (per Association of American Railroads, The Environmental Benefits of Moving Freight by Rail).  **Time Period:** The CO2 emission reductions calculated for this measure were estimated for 2025-2040 and held constant for 2045-2050 – estimated capacity limit of 50,000/yr rail containers hit in 2040. | **Reduced Annual Emissions from Decreased Trucks (MT of CO2e)** = Truck miles diverted per year (grams) \* CO2 per mile  **Increased Annual Emissions from Rail (MT of CO2e)** = Increased Rail Fuel Consumed (gal) \* CO2 per gallon  **Annual GHG Reductions (MT of CO2e) =** Increased Annual Emissions from Rail (MT of CO2e) - Reduced Annual Emissions from Decreased Trucks (MT of CO2e)  **Total GHG Reductions from 2025-2030 (MT of CO2e) =** Sum {Annual GHG Reductions (MT of CO2e) 2025: Annual GHG Reductions (MT of CO2e) 2030}  **Total GHG Reductions from 2025-2050 (MT of CO2e) =** Sum {Annual GHG Reductions (MT of CO2e) 2025: Annual GHG Reductions (MT of CO2e) 2050} |
| **Program T5. Pedestrian VMT Program0** | |
| **GHG Reductions from Single Trip:** Used CMAQ tool to determine GHG reductions from a single trip.  Assumed average trip distance of 1 mile (above 1 mile most people choose to take motorized travel).  **Number of Trips / Day:** Assumed 100 trips per day (out of 5000 trips) in targeted regions would switch from motorized to pedestrian (based on North Carolina DOT data that ~2% of trips adjust to new modes with new infrastructure)  **Number of Projects:** 11 pedestrian infrastructure projects were proposed under this measure using individual project costs determined by NCDOT and total funding of $11,811,825. | **GHG Reductions / Day / Project (kg CO2e) =** Number of Trips / Day \* GHG Reductions from Single Trip  **Annual GHG Reductions for all Projects (MT CO2e) =** GHG Reductions / Day / Project (kg CO2e) \* 365 (days/year) \* 11 (number of projects) \* 0.001 (conversion to MT)  **Total GHG Reductions for all Vehicle Types from 2025-2030 (MT of CO2e) =** Annual GHG Reductions for all Projects (MT CO2e)\* 5 (years)  **Total GHG Reductions for all Vehicle Types from 2025-2050 (MT of CO2e) =** Annual GHG Reductions for all Projects (MT CO2e)\* 25 (years) |
| **Program B1. Weatherization+ Assistance Program** | |
| **Total budget:** $14,430,000  **Average cost of WAP+ measures/home:** $15,000  **National Average Annual Elec. Use =** Calculation based on EIA Residential Energy Consumption Survey data (converted kwh to mwh)  **Rate of energy reduction:** 19%; Calculation assumes rate of energy bill savings match rate of energy consumption reductions from WAP+ measures  **Energy Bill Savings Rate from WAP+** = 19%; Calculation is based on the total savings from WAP divided by total energy bills to determine the savings rate  **National Average Annual Elec. Uses** = 19%; Calculation is based on EIA Residential Energy Consumption Survey Data (converted CCF to therms)  **Annual Weatherization Savings ($/Year):** $372; This value is based on DOE’s WAP fact sheet for “energy savings.” While not perfect, this can be used to interpolate a reduction in energy use.  **Average annual residential electricity costs** = $1,380; Value is based on the EIA Residential Energy Consumption Survey – data is nationwide since WAP savings is nationwide  **Average annual residential natural gas costs** = $630; Value is based on the EIA Residential Energy Consumption Survey – data is nationwide since WAP savings is nationwide  **National Average NG Use (CCF)** = 563; Based on the EIA Residential Energy Consumption Survey Data  **Gas National Emissions Factor:** .00531 MT  **Elec. National Emissions Factor:** .375346 MT | **Total NG Emissions (MT)** = National Average Annual Elec. Use (kwh) \* Gas National Emissions Factor (MT)  **Total number of homes (rounded down)** = Total budget / (Average Cost of WAP+ Measures/Home)  **Total Elec. Emissions** = National Average Annual Elec. Use (mwh) \* Elec. National Emissions Factor (MT)  **Total Energy Emissions/Home (MT)** = Total Elec. Emissions + Total NG Emissions  **Total GHG Reductions (Elec. And NG)** = (Total Energy Emissions/Home) \* Rate of Energy Reduction  **Total GHG Reductions from 2025 – 2030 (MT)** = Total GHG Reductions (Elec. And NG) \* Total number of homes (rounded down)  **Total GHG Reductions from 2025 – 2050 (MT)** = Total GHG Reductions from 2025 – 2030 \* 5 (years) |
| **Program B2. State Building Decarbonization and Efficiency** | |
| **Total budget:** $19,200,000  **Average cost of ECM:** $300,000; Value is based on the approximate average of lower-cost projects from WRP for NC state buildings  **Rate of Energy Reduction** = 20%; Value is a standard assumption  **National average elec. Use/ Building:** Calculation based on the DOE Average Commercial Buildings Use Per Square Foot (converted from kwh to mwh) and Average Public Building Size   * Average Commercial Buildings Elec. Use/Square Foot: 22.5 kwh; Value based on the EIA CBECs average commercial building use * Average Public Buildings Size: Approximately 20,000 square feet   **Elec. National Emissions Factor (MT):** 0.375346 MT/MWH; Value based on lb CO2e per MWH (converted lb to MT)  **National Average NG Use/Sq. Foot (Therms):** 0.000700; Value based on EIA CBECs (converted Mbtu to Therms Unit)  **Gas National Emissions Factor (MT):** 0.00531 MT/Therm | **Total NG Emissions (MT)** = (National Average NG Use/ Sq. foot) \* Gas National Emissions Factor (MT)  **Total number of Projects (rounded down)** = Total budget / Average Cost of ECM  **Total Elec. Emissions** = (National Average Elec. Use / Building) \* Elec. National Emissions Factor (MT)  **Total Energy Emissions/Building (MT)** = Total Elec. Emissions + Total NG Emissions  **Total GHG Reductions (Elec. And NG)** = (Total Energy Emissions/Building) \* Rate of Energy Reduction  **Total GHG Reductions from 2025 – 2030 (MT)** = Total GHG Reductions (Elec. And NG) \* Total number of projects (rounded down)  **Total GHG Reductions from 2025 – 2050 (MT)** = Total GHG Reductions from 2025 – 2030 \* 5 (years) |
| **Program B3. Local Public Building Decarbonization and Efficiency** | |
| **Total budget:** $23,830,000  **Average cost of ECM:** $300,000; Value is based on the approximate average of lower-cost projects from WRP for NC state buildings  **Total GHG Reductions (Elec. And NG):** Calculation assumes even split between NG and elec.  **Rate of Energy Reduction** = 20%; Value is a standard assumption  **National average elec. Use/ Building:** Calculation based on the DOE Average Commercial Buildings Use Per Square Foot (converted from kwh to mwh) and Average Public Building Size   * Average Commercial Buildings Elec. Use/Square Foot: 22.5 kwh; Value based on the EIA CBECs average commercial building use * Average Public Buildings Size: Approximately 20,000 square feet   **Elec. National Emissions Factor (MT):** 0.375346 MT/MWH; Value based on lb CO2e per MWH (converted lb to MT)  **National Average NG Use/Sq. Foot (Therms):** 0.000700; Value based on EIA CBECs (converted Mbtu to Therms Unit)  **Gas National Emissions Factor (MT):** 0.00531 MT/Therm | **Total NG Emissions (MT)** = (National Average NG Use/ Sq. foot) \* Gas National Emissions Factor (MT)  **Total Elec. Emissions** = (National Average Elec. Use / Building) \* Elec. National Emissions Factor (MT)  **Total number of Projects (rounded down) =** Total budget / Average Cost of ECM  **Total Energy Emissions/Building (MT)** = Total Elec. Emissions + Total NG Emissions  **Total GHG Reductions (Elec. And NG)** = (Total Energy Emissions/Building) \* Rate of Energy Reduction  **Total GHG Reductions from 2025 – 2030 (MT)** = Total GHG Reductions (Elec. And NG) \* Total number of projects (rounded down)  **Total GHG Reductions from 2025 – 2050 (MT)** = Total GHG Reductions from 2025 – 2030 \* 5 (years) |
| **Program I1. Industrial Electrification, Efficiency, and Process Emissions Reduction** | |
| **Total Funding**: $4,500,000  **Percentage of Energy Audits that lead to Project Implementation**: 65% per current program with WRP  **Total Implementation Funding:** Assumed “low-hanging fruit” projects (e.g. replacing lightbulbs) will be implemented following energy audit with no additional CPRG investment per current WRP program. WRP program estimates 150 facilities to be supported given total funding. WRP estimates $52,601,250 total funding based on current project costs to implement low-hanging fruit projects across all facilities receiving energy audits.  **Emissions Factor:**Assume Investment Factor of $8/MTCO2e for low-hanging fruit energy efficiency projects per WRP program. WRP estimates $350,000 per facility would result in approximately 440 MT CO2e reductions at the facility.  **Years to Implement:** Assume 3 years to implement over 2025-2030 period and 20 years over 2025-2050 period. | **Funding associated with Project Implementation ($) =** Total Funding ($) \* Percentage of Energy Audits that lead to Project Implementation  **Percentage of Implementation Funding associated with CPRG (%) =** Funding associated with Project Implementation ($) / Total Implementation Funding ($)  **Annual GHG Reductions (MT CO2e)** = (Funding Associated with Project Implementation ($) \* Percentage of Implementation Funding associated with CPRG (%)) / Investment Factor ($/MT)  **Total GHG Reductions from 2025-2030 (MT CO2e) =** Annual GHG Reductions (MT CO2e) \* 3  **Total GHG Reductions from 2025-2050 (MT CO2e) =** Annual GHG Reductions (MT CO2e) \* 20 |
| **Program I2. Industrial Decarbonization Workforce Development:** This workforce development program will enable other programs to achieve GHG emissions reductions but will not directly reduce emissions alone. | |
| **Program I3. Industrial Decarbonization Loan Fund** | |
| **Loan Fund Assumptions:**   * % of CPRG Measure: 45%; Total CPRG Funding: $15,000,000; % Leverage Estimate: 200%; * Direct Funds Invested: $6,750,000; Calculation based off proposed funding directed to this program; Funds Leveraged: $13,500,000; Calculation based off % Leverage Estimate of Direct Funds Invested   **Factor Investment:** Factor Investment ($/MMBtu): $46.8; Calculation is based on the average of WRP – EPA Carbon Road Mapping Project (Automotive mfg 2023, Textiles mfg 2023, Aluminum Foundry 2024) and WRP optics mfg 2023.  **Factor Investment ($/MTCO2e):** $566;Calculations is based on the average of WRP – EPA Carbon Road Mapping Project (Automotive mfg 2023, Textiles) and WRP optics mfg 2023. WRP data comes from recent EPA funded project, “Net Zero Carbon Road Mapping for NC Manufacturers” and historic empirical data from performing approximately 600 energy assessment in C/I/I sectors. | **Annual Loan Program GHG Reductions (MT)** = Funds Leveraged / (Factor: Investment $/MTCO2e)  **Funds Leveraged** = Direct Funds Invested \* (% Leverage Estimate)  **Direct Funds Invested** = (% of CPRG Measure) \* Total CPRG Funding  **Total GHG Reductions from 2025-2030 (MT) =** Annual Loan Program GHG Reductions \* 5 (years)  **Total GHG Reductions from 2025-2050 (MT) =** Annual Loan Program GHG Reductions \* 25 (years) |
| **Program W1. Organic Waste Reduction** | |
| **School Refrigerator Assumptions:**   * Number of Schools = 1,250; Calculation is based on half of the number of NC Schools * Total Cost of Refrigerator/School: $875,000; Number of Schools\*Average Refrigerator Cost ($700)   **General Organic RFP Assumptions:**   * Total funding amount: $3,494,999; Estimated Cost/Program: $160,000 * Food waste diverted from a landfill(lb/YR): 300,000lbs; Food waste calculation is based on the Morrisville Food Diversion Program * Number of Programs: 21; Total funding amount/(Estimated cost/program) * Amount of Food Waste Diverted (tons) 3276.56 tons; Cost of Disposal ($/ton): $31   **Morrisville Food Waste Assumptions:**   * Annual Food Waste Diverted from Landfill Emissions: 75.22 MT; Food Waste Diverted and Composted: 22.82 MT; Food waste diverted from a landfill (tons/yr) 150 tons; (Food waste diverted from a landfill(lb/YR)/2000); Food waste diverted from a landfill(lb/YR): 300,000lbs; Food waste calculation is based on the Morrisville Food Diversion Program * Morrisville Food Diversion Program = $130,000   **Backyard Composting Assumptions:**   * GHG from Landfilling: 8692 MT; Calculation is based on the WARM Model; GHG from Composting: -2637 MT; Calculation is based on the WARM Model * Food Waste (lb/gal): 3.8lbs * Backyard Composting (capacity lb/4-6 weeks): 304lbs; Backyard Composting (80Gls)\*Food Waste (lb/Gl); Backyard Composting (capacity lbs/YR): 2,635lbs; (52/6\*Backyard Composting (capacity lb/4-6 weeks)) * Backyard Program: $500,000 | **Annual School Refrigerator Reductions** = 2821 MT  **Annual General Organics RFP Reductions** = 2141 MT  **Annual Morrisville Food Waste Reductions (MT)** = Food Waste Diverted from Landfill Emissions – Food Waste Diverted and Composted  **Annual Backyard Composting Reductions** **(MT)** = (GHG from Landfilling/YR) – (GHG from Composting/YR)  **Annual GHG Reductions for all Organic Waste Strategies** = Sum {Annual GHG Reductions for each Organic Waste Strategy}  **Total GHG Reductions for all Organic Waste Strategies from 2025-2030 (MT) =** Annual GHG Reductions for all Organic Waste Strategies \* 5 (years)  **Total GHG Reductions for all Organic Waste Strategies from 2025-2050 (MT) =** Annual GHG Reductions for all Organic Waste Strategies \* 25 (years) |
| **Program W2. Waste Operations Electrification and Decarbonization** | |
| **Number of Waste Trucks:**   * Remaining RFP Funds: $2,000,000 * Cost/EV Truck: $250,000 * Number of Wake Forest Demo Trucks: 8 * Number of RFP Trucks:8; Determined number of trucks using vehicle costs from Wake Forest Demo and funding amount under Remaining RFP Funds.   **Miles Driven Per Truck:** Miles Driven/Truck: 23,400 miles. Miles driven is based off literature citing about 25,000 miles/year. Therefore, our assumption is conservative.   * Fuel price (private): $4.68   Fuel Economy (MPDGE): 1.7   * Determined use of Low Nox Engine by confirmation with a private company. * Days Trucks are Operated: 255 days   **Emission Factors:**   * Diesel GHG Emissions/YR: 171.91 MT CO2e * EV GHG Emissions/YR: 71.85 MT CO2e | **Annual Wake Forest Demo Reductions** = Number of Wake Forest Demo Trucks \* Annual GHG Emissions Difference (MT)  **Total RFP Reductions** = Cost Difference/EV \* Annual GHG Emissions Difference (MT)  **Annual GHG Emissions Difference (MT)** = (Difference in GHG Emissions/YR)  **Difference in GHG Emissions/YR (MT)** = (Diesel GHG Emissions/YR)\*(EV GHG Emissions/YR)  **Annual GHG Reductions for one Waste Operation Strategy** = Number of Waste Trucks \* Average Annual GHG Emissions Difference  **Annual GHG Reductions for all Waste Operations Strategies** = Sum {Annual GHG Reductions for each Waste Operations Strategy}  **Total GHG Reductions for all Waste Operations Strategies from 2025-2030 (MT)** = Annual GHG Reductions for all Waste Operations Strategies \* 5 (years)  **Total GHG Reductions for all Waste Operations Strategies from 2025-2050 (MT)** = Annual GHG Reductions for all Waste Operations Strategies\* 25 (years) |
| **Program W3. Landfill Gas Reductions** | |
| **Total Funding:** $4,499,999  **Cost/Acre:** $1,00,000  **Reductions/Acre (MT):** 450 MT CO2eq. Assumption is based on the average that 300-600 tons CO2eq/year is used | **Project Minimum** = (Cost/Acre) \* 10  **Total Acres from Program** = Total Funding / Project Minimum (10 acres) \* 10  **Total GHG Reductions from 2025-2030 (MT)** = Total Acres from Program \* Reductions Per Acre (MT CO2eq/year) \* 5  **Total GHG Reductions from 2025-2050 (MT)** = Total Acres from Program \* Reductions Per Acre (MT CO2eq/year) \* 25 |

**MSAs:**

| **Methodology and Assumptions** | **Calculation** |
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| **Program CPRC1. Building EE and Emissions Reduction** | |
| **Average cost of WAP+ Measures/Home:** Assumed $15,000  **Total Budget for WAP+ Implementation:** $950,000  **National Average Annual Elec. Use:** Value based on EIA Residential Energy Consumption Survey Data (converted kwh to mwh)  **Elec. National Emissions Factor (MT):** 0.375346 MT; Value based on lb CO2e/mwh (standard lb to MT conversion)  **Rate of Energy Reduction for WAP+:** 19%; Value assumes rate of energy bill savings matches rate of energy consumption reductions from WAP+ measures  **National Average Annual NG Use (therms):** 583.83; Value based on EIA Residential Energy Consumption Survey data (converted CCF to Therms Unit; CCF \* 1.037)  **Gas National Emissions Factor:** 0.00531 MT  **Average Annual Residential Energy (Elec. + NG) Costs:** $2,010; Value based on EIA Residential Energy Consumption Survey – data is nationwide since WAP Savings in Nationwide  **Average Weatherization Savings ($/Year):** $372; This value is based on DOE’s WAP fact sheet for energy savings”. While not perfect, this can be used to interpolate a reduction in energy use.  **Total Budget:** $4,037,500  **Average Cost of ECM:** $300,000; Value based on approximate average of lower-cost projects from WRP for NC State Buildings  **Total MT Reductions (Elec. + NG) for Non-Res.:** Calculation assumes even split between NG and elec.  **Rate of Energy Reduction:** Assumed 20%  **National Average Elec. Use Per Building:** 450mwh; Calculation based on DOE Average Commercial Building using 22.5 kwh per sq. foot and average public building size approximately 20,000 square feet  **National Average NG Use Per Sq. Foot:** 0.000700 therms; Value based on EIA CBECs (Mbtu to Therms Conversion) | **Total NG Emissions for WAP+ =** National Average Annual NG use (therms) \* Gas National Emissions Factor (MT)  **Total Elec. Emissions for WAP+** = National Average Annual Elec. Use (mwh) \* Elec. National Emissions Factor (MT)  **Total MT Reductions (Elec. + NG) for WAP+** = Total Elec. Emissions + Total NG Emissions  **Total Number of Homes for WAP+** = Total Budget for Implementation / (Average Cost of WAP+ Measures/Home)  **Annual GHG Reductions for WAP+** = Total MT Reductions (elec. + NG) \* Total Number of Homes (Rounded Down)  **5 year GHG Reductions for WAP+ (MT)** = Annual MT \* 5 (years)  **25 year GHG Reductions for WAP+ (MT)** = Annual MT \* 25 (years)  **Total Elec. Emissions** = National Average Elec. Use Per Building (mwh) \* Elec. National Emissions Factor  **Total NG Emissions** = National Average NG Use per Sq. Foot \* Gas National Emissions Factor  **Total Energy Emissions per Building (Elec. + NG)** = Total Elec. Emissions + Total NG Emissions  **Total MT Reductions (Elec. + NG) for Non-Res.** = Total Energy Emissions per Building (Elec. + NG) \* Rate of Energy Reduction  **Total Number of Projects (Rounded Down)** = Total budget / Average Cost of ECM  **5 year GHG Reductions for Non-Res.** = Total MT Reductions (Elec. + NG) \* Total Number of Projects (Rounded Down)  **25 year GHG Reductions for Non-Res.** = 5 year GHG Reductions for Non-Res \* 5 (years)  **Total GHG Reductions from 2025-2030 (MT)** = SUM {Total GHG Reductions from 2025 - 2030 for each Building Type}  **Total GHG Reductions from 2025-2050 (MT)** = SUM {Total GHG Reductions from 2025 - 2050 for each Building Type} |
| **Program CPRC2. VMT Reductions** | |
| **Gasoline Vehicle FE:** Assumed 22 mpg  **Intervention Lifetime:** Assumed 10 years  **Number of E-bikes/Scooters:** Assumed 200  **Car Use avoided/ car:** Assumed 1,000 miles/year  **Motor Gasoline Heating Value** (0.125 mmBtu/gallon) and **Motor Gasoline CO2e** (70.469 kg/mmBtu) values pulled from the solid, gaseous, liquid and biomass fuels: Federal Register (2009) EPA; 40 CFR Parts 86, 87, 89 et al; Mandatory Reporting of Greenhouse Gases; Final Rule, 30Oct09, 261 pp. Tables C-1 and C-2 at FR pp. 56409-56410. Revised emission factors for selected fuels: Federal Register (2010) EPA; 40 CFR Part 98; Mandatory Reporting of Greenhouse Gases; Final Rule, 17Dec10, 81 pp.  **Avoided Miles:** Assumed 12,000 miles  **Annual Miles per van:** Assumed 8,000 miles  **Number of Electric Vans:** Assumed 19 vans, 15 passengers/van  **Gasoline Vehicle Occupancy:** 1.6  **kg Co2e reduced per day per project:** 37.41kg; Value pulled from CMAQ tool | **Miles Avoided** = Intervention Lifetime (years) \* Number of E-bikes/Scooters \* (Car use avoided / Car)  **Gasoline Avoided (Gallons)** = Miles Avoided / Gasoline Vehicle FE  **Gasoline GHG Emissions Avoided (MT)** = Gasoline Avoided (Gallons) \* Motor Gasoline Heating Value (mmBtu/gallon) \* Motor Gasoline CO2e (kg/mmBtu) / 1000  **Avoided Gasoline (Gallons)** = Avoided miles / Gasoline Vehicle FE  **Avoided Gasoline Emissions (MT)** = Avoided Gasoline (Gallons) \* Motor Gasoline Heating Value (mmBtu/gallon) \* Motor Gasoline CO2e (kg/mmBtu) / 1000  **Total GHG Reductions from 2025 - 2030 for Fares/Micro mobility =** (Gasoline GHG Emissions Avoided + Avoided Gasoline Emissions) – (E-bike/Scooter GHG Emissions)  **Total GHG Reductions from 2025 - 2050 for Fares/Micro mobility =** Total GHG Reductions from 2025 - 2030 for Fares/Micro mobility \* 5 (years)  **Displaced Vehicle Miles** = Annual Miles per Van \* Number of Electric Vans / Gasoline Vehicle Occupancy  **Displaced Gasoline (Gallons)** = Displaced Vehicle Miles / Gasoline Vehicles FE  **Annual Reductions for EVs** = Displaced Gasoline (Gallons) \* Gasoline Heating Value (mmBtu/gallon) \* Motor Gasoline CO2e (kg/mmBtu) / 1000  **Total GHG Reductions from 2025 - 2030 for EVs =** Annual Reductions for EVs \* 5 (years)  **Total GHG Reductions from 2025 - 2050 for EVs =** Annual Reductions for EVs \* 20 (years)  **kg Co2e reduced across VMT projects** = (kg Co2e reduced per day per project) \* 365 (days in a year) \*2 (projects) \* 5 (total years)  **Total GHG Reductions from 2025 - 2030 for VMTs =** Total kg CO2e Reduced \* 0.0001 (Conversion of kg to MT)  **Total GHG Reductions from 2025 - 2050 for EVs =** Total GHG Reductions from 2025 – 2030 for VMTs \* 5 (years)  **Total GHG Reductions from 2025-2030 (MT)** = SUM {Total GHG Reductions from 2025 - 2030 for each VMT Type}  **Total GHG Reductions from 2025-2050 (MT)** = SUM {Total GHG Reductions from 2025 - 2050 for each VMT Type} |
| **Program C1. Building Decarbonization** | |
| **Industrial Buildings:**   * Direct Funds Invested: $1,076,013 * Factor: Investment $ / MT: $566 * Factor: Investment $ / MMBtu: $46.80   **MUD:**   * Units possible per $10k: 270 units; Calculation based on total budget divided by cost per unit * Total Budget: $2,706,706 * Cost per Unit: Assumed $10,000 * Annual GHG Savings (lbs): 1,516,725 lbs; Calculation based on units possible per $10k \* 5,617.5 * Lifetime GHG Savings (lbs): 30,334,500 lbs; Calculation based on units possible per $10k \* 112,350 * Lifetime Energy Savings (MWh): 19,421,10 MWh; Calculation based on units possible per $10k \* 71.93 | **Annual Energy Reduction Outcome for Industrial Buildings (MMBtu)** = Direct Funds Invested / (Factor: Investment $ / MMBtu)  **Annual GHG Reductions Outcome for Industrial Buildings (MT)** = Direct Funds Invested / (Factor: Investment $/MT)  **2025 – 2030 GHG Reduction, 2 year implementation for Industrial Buildings (MT)** = Annual GHG Reductions Outcome (MT) \* 3 (years)  **2025 – 2050 GHG Reduction, 2 year implementation for Industrial Buildings (MT)** = Annual GHG Reductions Outcome (MT) \* 20 (years)  **Annual GHG Reductions for MUDs (MT)** = Units possible per $10k \* 2.54  **5 year GHG Reductions for MUDs (MT)** = Annual MT \* 5 (years)  **25 year GHG Reductions for MUDs (MT)** = Annual MT \* 25 (years)  **Total GHG Reductions from 2025-2030 (MT)** = SUM {Total GHG Reductions from 2025 - 2030 for each Building}  **Total GHG Reductions from 2025-2050 (MT)** = SUM {Total GHG Reductions from 2025 - 2050 for each Building} |
| **Program C2. VMT Reductions** | |
| **VMT:**   * Total years: 5 years * Number of Projects: 5 projects * kg CO2e Reduced / Day / Project:Value pulled from CMAQ tool   **Transit Rider Support:** Motor Gasoline Heating Value (mmBtu/gallon) and Motor Gasoline CO2e (kg/mmBtu) values pulled from the solid, gaseous, liquid and biomass fuels: Federal Register (2009) EPA; 40 CFR Parts 86, 87, 89 et al; Mandatory Reporting of Greenhouse Gases; Final Rule, 30Oct09, 261 pp. Tables C-1 and C-2 at FR pp. 56409-56410. Revised emission factors for selected fuels: Federal Register (2010) EPA; 40 CFR Part 98; Mandatory Reporting of Greenhouse Gases; Final Rule, 17Dec10, 81 pp.   * Gasoline vehicle FE: Assumed 22 mpg * Car use avoided / pass: Assumed 730 miles/year * Number of Transit Passes: Assumed 200 * Intervention Lifetime: Assumed 5 years   **Access Solutions:**   * Car use avoided/bike: Assumed 1,608 miles / year * Number of e-bikes: Assumed 400 * E-bike Lifecycle CO2 emissions (g/km): Assumed 22 g/km * Intervention Lifetime: Assumed 10 years | **Total kg CO2e reduced across all VMT projects** = (kg CO2e reduced / day / project) \* 365 (Days in a year) \* Total Years \* Number of projects  **Total VMT GHG Reductions for 5 years (MT)** = Total kg CO2e Reduced \* 0.001 (Conversion of kg to MT)  **Total VMT GHG Reductions for 25 years (MT)** = Total VMT GHG Reductions for 5 years \* 5 (years)  **Miles Avoided Annually for Transit Rider Support** = (Car use avoided / pass) \* Number of Transit Passes  **Gasoline Avoided for Transit Rider Support (gallons) =** Miles Avoided Annually / Gasoline Vehicle FE (mpg)  **Annual Transit Rider Support GHG Reductions (Gasoline)** = Gasoline Avoided (gallons) \* Motor Gasoline Heating Value (mmBtu/gallon) \* Motor Gasoline CO2e (kg/mmBtu) / 1000  **Total Transit Rider Support GHG Reductions for 5 years (MT)** = Annual Transit Rider Support GHG Reductions (Gasoline) \* 5 (years)  **Total Transit Rider Support GHG Reductions for 25 years (MT)** = Total Transit Rider Support GHG Reductions for 5 years \* 5 (years)  **Miles Avoided Annually for Access Solutions (Miles/ Year)** = (Car use avoided/bike) \* Number of E-bikes  **Annual Access Solutions GHG Reductions (E-bike emissions)** = Miles Avoided Annually \* 1.61 \* E-bike Lifecycle CO2 emissions (g/km) / 1000 / 1000  **Total Access Solutions GHG Reductions for 5 years (MT)** = Annual Access Solutions GHG Reductions \* 5 (years)  **Total Access Solutions GHG Reductions for 25 years (MT)** = Total Access Solutions GHG Reductions for 5 years \* 5  **Total GHG Reductions from 2025-2030 (MT)** = SUM {Total GHG Reductions from 2025 - 2030 for each VMT Type}  **Total GHG Reductions from 2025-2050 (MT)** = SUM {Total GHG Reductions from 2025 - 2050 for each VMT Type} |

## Low-Income and Disadvantaged Communities (LIDACs) Measurement Approach

To track, measure, and report benefits over time, NCDEQ will employ measured and modeled approaches. NCDEQ will capture actual KPI data whenever possible. A modeled approach where actual data accruing to specific census tracts is not easily or accurately measured may be necessary. Using GIS, the project impact area will be overlaid with the LIDAC map, then KPI data for the project tracked proportionally across the impacted census tracts, as shown in Figure 8. The project and portfolio dashboard insights, shown in Figure 9, inform decisions, help identify opportunities for improvement, and communicate achieved benefits transparently to stakeholders. Figures 1-7 depict geospatial maps of North Carolina’s LIDACs for the Building, Industry, and Waste sectors programs.

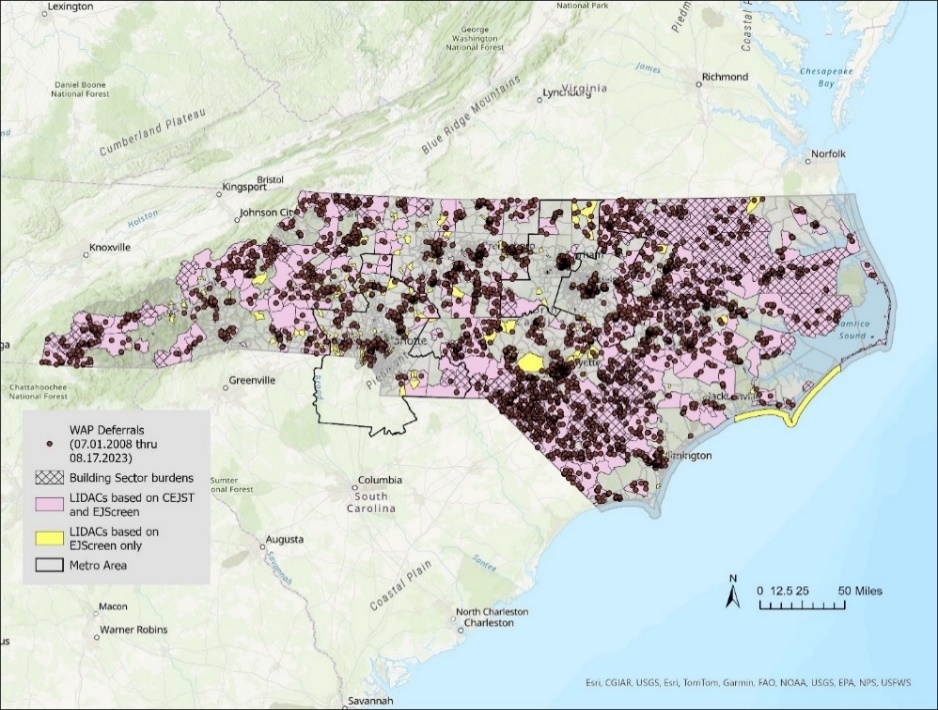
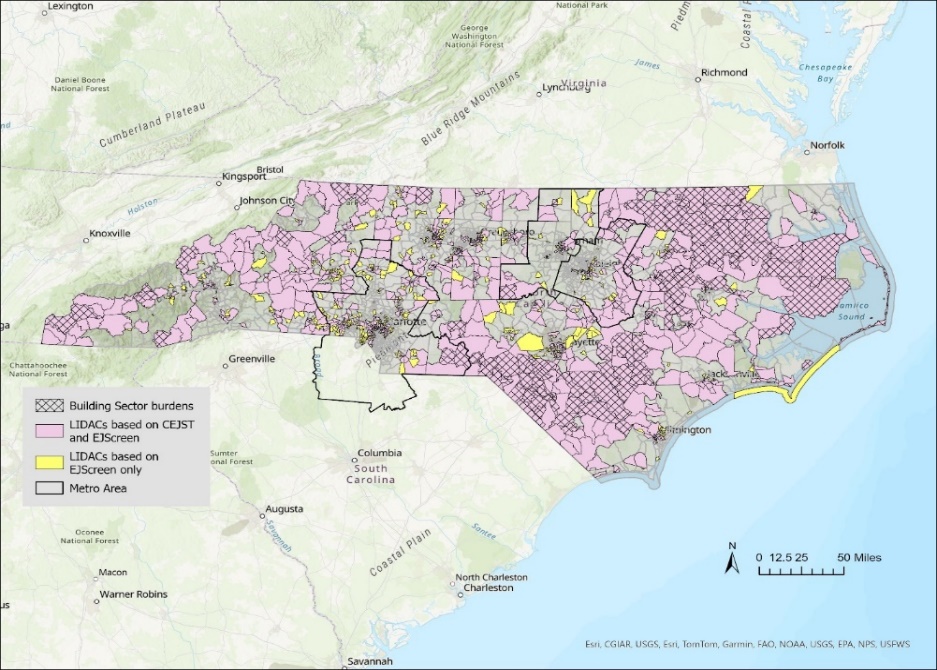
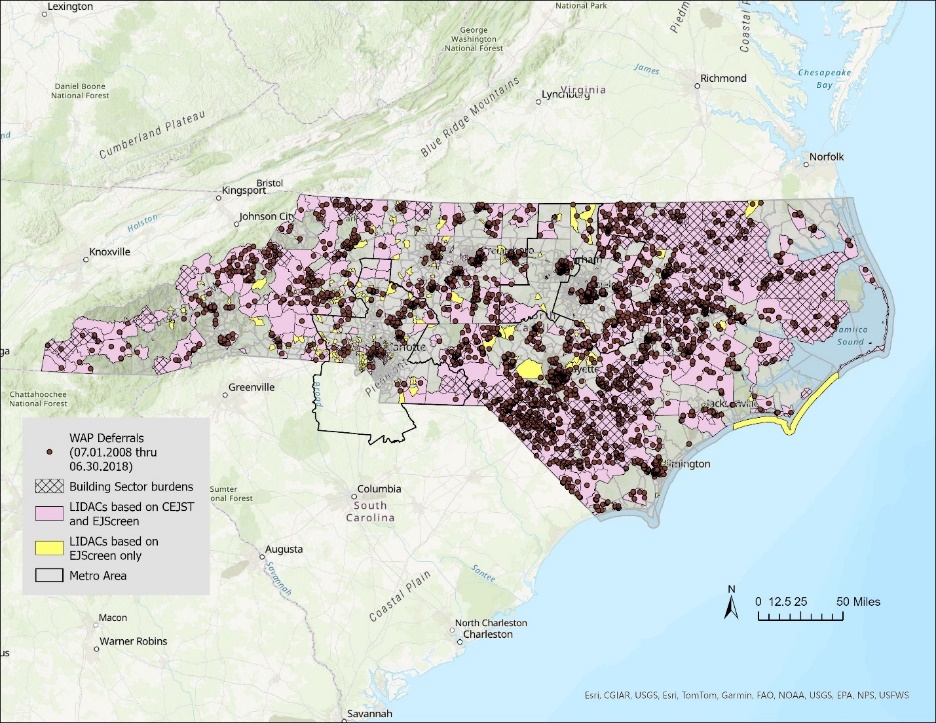
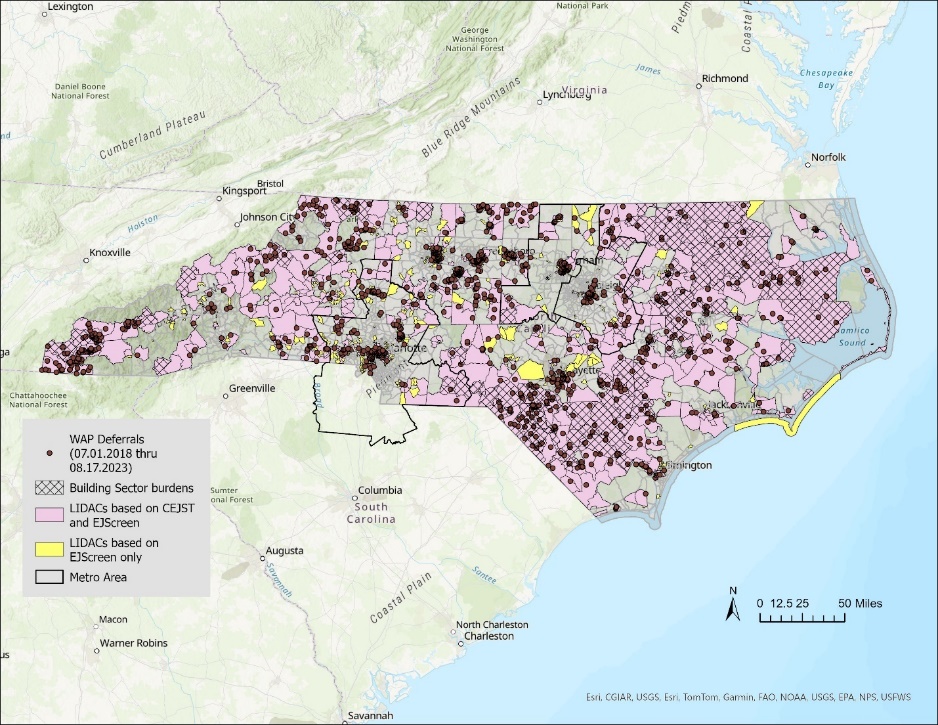


Figure 2: Building Sector WAP Deferrals (7/1/2008 – 6/30/2018)

Figure 1: Building Sector

Figure 4: Building Sector WAP Deferrals (7/1/2018 - 8/17/2023)

Figure 3: Building Sector WAP Deferrals (7/1/2008 - 8/17/2023)

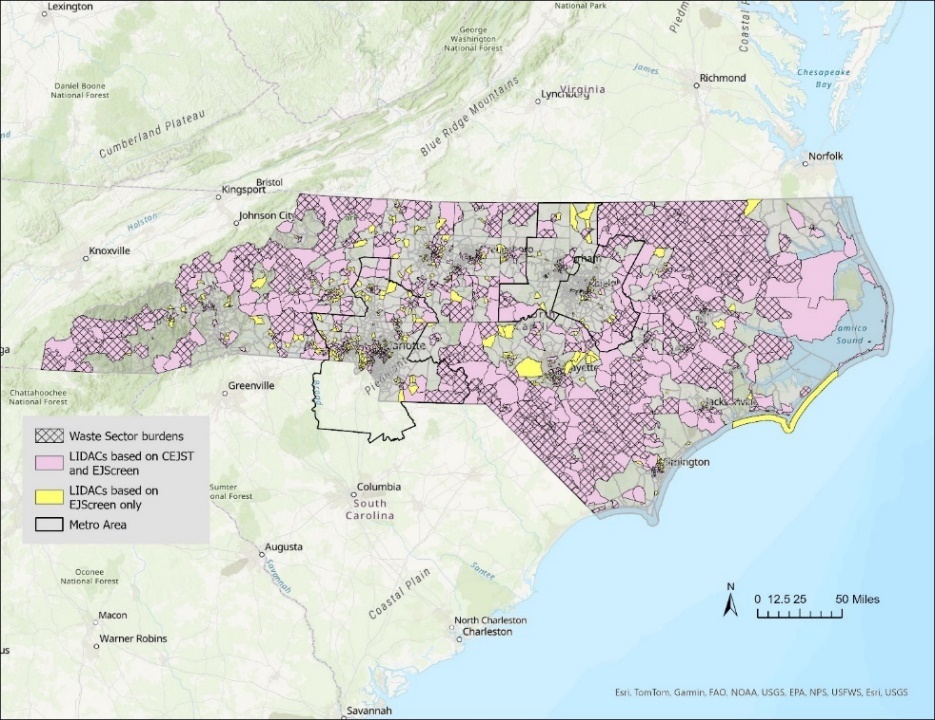
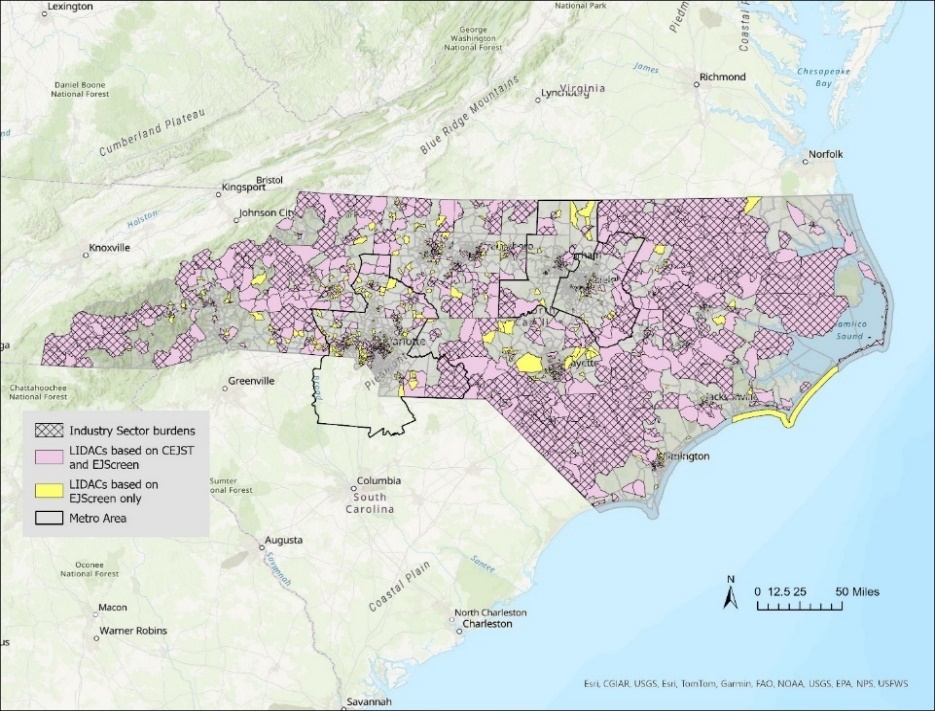
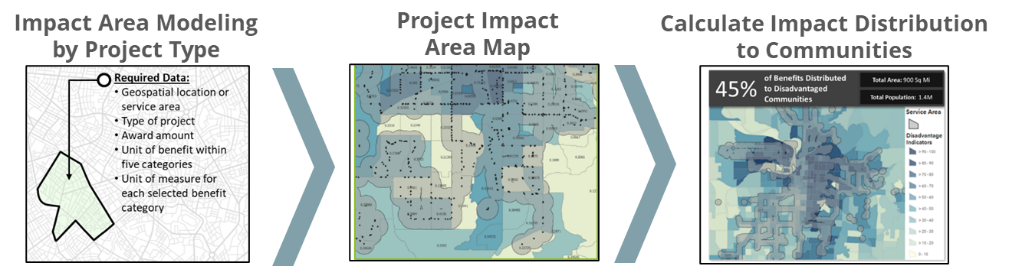


Figure 8: Geospatial Benefits Measurement Approach, Individual Project

Figure 5: Industry Sector

Figure 6: Waste Sector

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Figure 7: Waste Sector Landfills

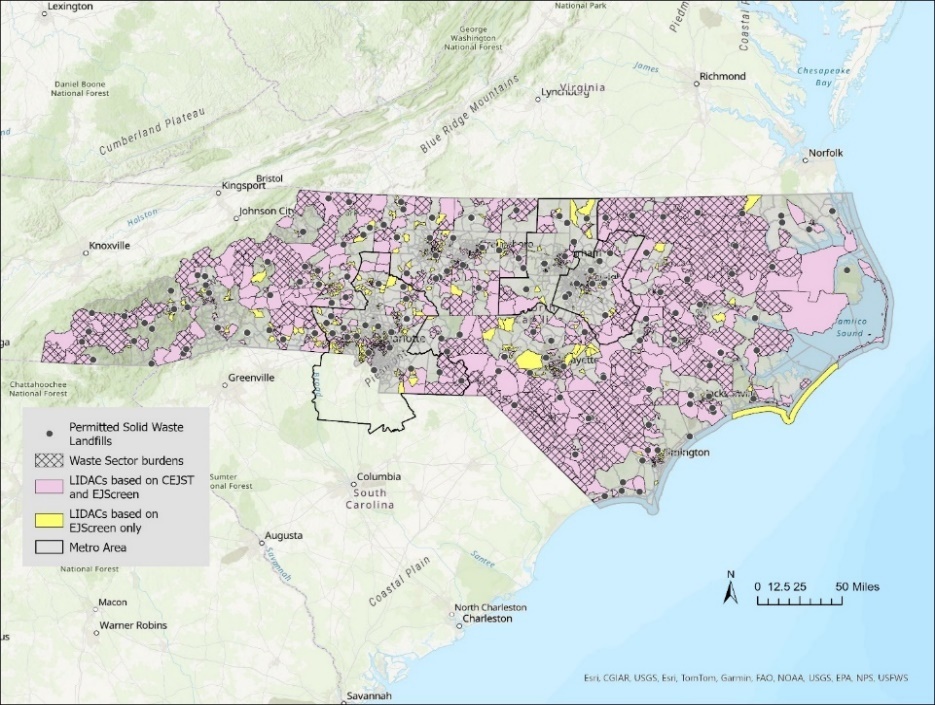
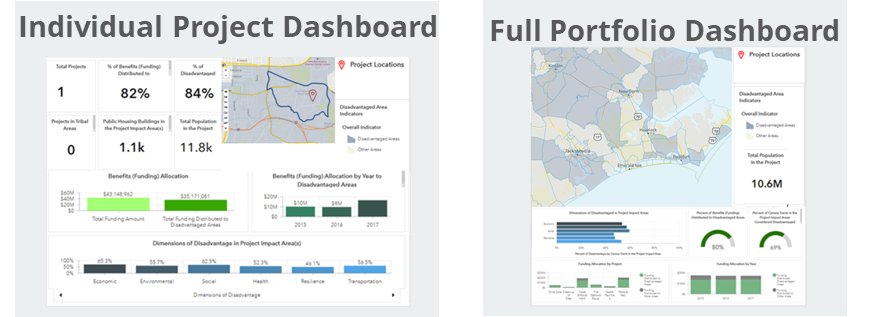


Figure 9: Geospatial Community Impacts Dashboard, Project and Portfolio Views



**Impact Area Modeling by Project Type**

**Project Impact Area Map**

**Calculate Impact Distribution to Communities**

Individual Project Dashboard

Full Portfolio Dashboard