RAD Physical Condition Assessment

Housing Authority of Bergen County

One Bergen County Plaza, Floor 2
Hackensack, New Jersey 07601
George Stavrou

RAD Program
Physical Condition Assessment
of
Carucci Apartments

281 Stuyvesant Avenue
Lyndhurst, New Jersey 07071

Prepared by:
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EMG Project #: 107534.13R-002.306
Date of Report: July 25, 2014
On site Date: March 3, 2014

GREEN RECOMMENDATIONS AT A GLANCE

GREEN CONSERVATION MEASURE	RECOMMEND FOR REHABILITATION				
BUILDING ENVELOPE	**Already Exists**	**N/A**	**Yes**	**No**	**Report Reference / Comment**
Install EnergyStar Windows	✓				Section 3.3.3
Install EnergyStar Sliding Doors		✓			Section 3.3.3
Install Storm Windows			✓		Section 3.3.3
Install Window Sun Shades				✓	Section 3.3.3
Install Additional Thermal Insulation			✓		Section 3.3.4
Install Vegetative Roofing			✓		Section 3.3.4
Install EnergyStar Rated Reflective Metal				✓	Section 3.3.4
Install EnergyStar Rated Asphalt Shingle				✓	Section 3.3.4
Convert Carpeted Surfaces to Smooth-and-Cleanable Surfaces			✓		Section 3.7.2
Replace Siding with Cementitious (cement fiber) Siding				✓	Section 3.3.2
Implement Air Leakage Control			✓		Section 3.3.2
MECHANICAL SYSTEMS	**Already Exists**	**N/A**	**Yes**	**No**	**Report Reference / Comment**
Install Vent Dampers	✓				Section 3.4.1 and 3.4.2
Convert Equipment to Electronic Ignition		✓			Section 3.4.1 and 3.4.2
Install Boiler Controls	✓				Section 3.4.2.1

GREEN CONSERVATION MEASURE	RECOMMEND FOR REHABILITATION				
MECHANICAL SYSTEMS	Already Exists	N/A	Yes	No	Report Reference / Comment
Replace Inefficient Boiler	✓				Section 3.4.2.1
Install Programmable/ Setback Thermostats			✓		Sections 3.4.2.1, 3.4.2.2
Insulate Hot Water or Steam Pipes	✓				Sections 3.4.1.1, 3.4.2.1, 3.4.2.2
Seal and Insulate Ducts	✓				Sections 3.4.2.1, 3.4.2.2
Install Geothermal Heat Pumps				✓	Energy Audit Section 4.4
Install Geothermal System for Heating and Hot Water			✓		Energy Audit Section 4.4
Install Swamp Coolers				✓	Energy Audit 5
Implement Temperature and Humidity Monitoring			✓		Section 4.4
Install Photo-Controls for Exterior Lighting					Section 3.2.6
Upgrade or Replace Inefficient Motors			✓		Energy Audit 5
Install Water-Saving Toilets			✓		Section 3.4.1.2
Install Water Saving Faucets / Showerheads	✓		✓		Section 3.4.1.2
Convert Exterior Lighting Fixtures			✓		Section 3.2.6
Convert Hot Water Heater System to Solar			✓		Energy Audit 4.1
Install EnergyStar Heating Systems			✓		Sections 3.4.2.1, 3.4.2.2
Install EnergyStar Cooling Systems			✓		Sections 3.4.2.1, 3.4.2.2

GREEN CONSERVATION MEASURE	RECOMMEND FOR REHABILITATION				
MECHANICAL SYSTEMS	**Already Exists**	**N/A**	**Yes**	**No**	**Report Reference / Comment**
Install Energy Efficient Water Heaters	✓				Sections 3.4.1.1, 3.4.1.2
INDOOR AIR QUALITY	**Already Exists**	**N/A**	**Yes**	**No**	**Report Reference / Comment**
Duct Bathroom Exhaust Fans to Exterior	✓				Section 3.4.2.2
Green Household Cleaning Products			✓		Section 4.4
Low VOC Carpeting			✓		Section 3.7.2.3
Install Rubber Walk Off Mats			✓		Section 4.4
Install Rubber Stair Treads			✓		Section 4.4
Install Carbon Monoxide Detectors	✓				Section 3.6
ELECTRICAL SYSTEMS	**Already Exists**	**N/A**	**Yes**	**No**	**Report Reference / Comment**
Install Power Co-Generation System			✓		Energy Audit 4.3
Install Fuel Cells Owned by a Property			✓		Energy Audit 4.5
Install Wind Power System			✓		Energy Audit 4.2
Install Solar PV System			✓		Energy Audit 4.1
Replace Fluorescent Lamps with EnergyStar Lamps in Apartments	✓				Section 3.7.2.4
Replace Fluorescent Lamps with EnergyStar Lamps in Common Areas			✓		Section 3.7.1.2

GREEN CONSERVATION MEASURE	RECOMMEND FOR REHABILITATION				
ELECTRICAL SYSTEMS	**Already Exists**	**N/A**	**Yes**	**No**	**Report Reference / Comment**
Replace Ceiling Fans with EnergyStar Fans in Apartments		✓			Section 3.7.2.4
Install LED Exit Signs	✓				Section 3.6
Install Occupational Sensors for Interior Lighting			✓		Energy Audit 5.3
Install EnergyStar Refrigerators			✓		Section 3.7.2.2
Install EnergyStar Dishwashers		✓			Section 3.7.2.2
Install Lighting Controls in Building			✓		Energy Audit 5.2
RECYCLING / LANDSCAPING	**Already Exists**	**N/A**	**Yes**	**No**	**Report Reference / Comment**
Consider Native / Xeriscape Landscaping Plan	✓				Section 3.2.3
Follow Integrated Pest Management Plan			✓		Part III
Implement Household Recycling Plan	✓				Section 3.2.6
Implement Household Hazardous Recycling Plan			✓		Section 3.2.6
Implement Construction Debris Recycling Plan			✓		Section 3.2.6
Porous Paving Surfaces			✓		Section 3.2.2
Install Soil Moisture Sensors			✓		Section 3.2.4
Utility Leak Monitoring Program			✓		Section 3.2.7

GREEN ELEMENT CHECKLIST AT A GLANCE

Checklist for Review of Green Physical Condition Assessment Elements	Report Reference
Sufficiently recent (within 120 days)	Cover Page - Date
Certification that contractor meets all required qualifications	Certification Section Page 1 & Appendix H
Green recommendations to reduce energy usage	Throughout Report
Green recommendations to reduce water usage	Section 3.4.1.2
Green recommendations to safeguard/improve indoor environmental air quality	Section 4.4
Summary of the green alternatives, their costs and cost/health impacts	Section 4.4
Utility/temperature and humidity monitoring costs	Section 4.4
Comments on the financial or health benefits of suggested green alternatives	Section 4.4
Green item recommendation data source and pricing identified	UW Model and Part II Energy Audit Section 1
Payback analysis when recommending replacement of traditional items with green items at the end of their useful life	UW Model
Payback analysis when recommending early replacement of existing items with green(er) items	UW Model
IPM and EA recommendations for rehab/reserves/operations	Part II Energy Audit Part III IPM Report
Evidence of sizing calculation for HVAC, or explanation as to inappropriateness	Energy Audit 3.1
Evidence the PCA contractor tested the duct-work for leakage	Energy Audit 3.1
Lighting replacements for all common areas	Section 3.7.1.2
Evidence of sizing consideration for DHW, if individual	Energy Audit 4
Kitchen and bath exhaust fans (Energy Star if cost-efficient)	Section 3.4.2.2
Carbon monoxide alarms	Section 3.6

Checklist for Review of Green Physical Condition Assessment Elements	Report Reference
Low- or non-VOC paint, caulking, sealants, etc	Sections 3.3.2
Carpet replacement (smooth surface flooring or low-VOC)	Section 3.7.2.3
Rubber walk- mats at entryways	Section 4.4
Rubber stair treads	Section 4.4
Cement board siding	Section 3.3.2
Green management of construction/rehab debris	Section 3.2.6
Green roofing (EnergyStar shingles, reflective roof, garden roof)	Section 3.3.5
Water efficient landscaping	Section 3.2.3
Thermostats (Energy Star)	Sections 3.4.2.1, 3.4.2.2
Checklist for Review of Green Energy Audit Elements	**Report Reference**
Certification that Energy Auditor meets all required qualifications	Certification Section Page 1 and Appendix H
Prudent energy-related improvements to the property with estimates of cost and financial calculations of probable payback when accounting for the remaining useful life of existing components	Energy Audit Section 5
Recommendations include such variables as operating hours, equipment efficiency, and building and occupant energy demand characteristics	Energy Audit Section 5
Building meets current code, with respect to energy-related items	Section 4.1
Actual costs, appropriate rates and utility configuration of the subject property (rather than sample or profile property)	Energy Audit 2.2
Financial calculations are sufficiently transparent to permit an understanding of the variables considered and their appropriateness	UW Model & Energy Audit Section 5
Recommendation on whether additional insulation, air sealing or caulking and sealing, is a cost-justified expenditure	Energy Audit 5.2
Co-generation, if potentially feasible	Energy Audit 4.3
Current energy usage and costs (kilowatt-hour, therms, utility cost)	Energy Audit 2.3, 2.4, 2.5
Recommended energy efficiency improvements	Energy Audit Section 5

Checklist for Review of Green Energy Audit Elements	Report Reference
Installed cost estimates for recommended energy efficiency measures	Energy Audit Section 5
Expected useful life of recommended energy measures	Energy Audit Section 5
Annual energy saving estimates (consumption and cost reductions)	Energy Audit Section 5
Simple payback period in years for each recommended measures	Energy Audit Section 5
Potential savings in water consumption expenses which are associated with energy improvements	Energy Audit Section 5

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CERTIFICATION

EMG has completed a Green Physical Condition Assessment (RPCA) and a Limited Environmental Screening of the subject property, Carucci Apartments located at 281 Stuyvesant Avenue in Lyndhurst, Bergen County, New Jersey 07071.

The RPCA was performed at the Client's request using methods and procedures consistent with good commercial and customary practice conforming with:

- Client supplied scope of work for market upgrades.
- Fannie Mae (FNMA) Document FNMA, Delegated Underwriting Services (DUS) Guide Section 3 entitled "Physical Needs Assessment Guidance to the Property Evaluator".
- Green Physical Condition Assessment Statement of Work and Contractor Qualifications.

This report is exclusively for the use and benefit of the Client identified on the first page of this report, the Clients successors, and the HUD RAD office. This report is not for the use or benefit of any other person or entity, nor may it be relied upon by any other person or entity, for any purpose, without the advance written consent of EMG. The purpose for which this report shall be used shall be limited to the use as stated in the contract between the client and EMG.

The opinions EMG expresses in this report were formed utilizing the degree of skill and care ordinarily exercised by any prudent architect or engineer in the same community under similar circumstances. EMG assumes no responsibility or liability for the accuracy of information contained in this report which has been obtained from the Client or the Client's representatives, from other interested parties, or from the public domain. The conclusions presented represent EMG's professional judgment based on information obtained during the course of this assignment. EMG's evaluations, analyses and opinions are not representations regarding the design integrity, structural soundness, or actual value of the property. Factual information regarding operations, conditions and test data provided by the Client or their representative has been assumed to be correct and complete. The conclusions presented are based on the data provided, observations made, and conditions that existed specifically on the date of the assessment.

EMG certifies that EMG has no undisclosed interest in the subject property, EMG's relationship with the Client is at arms-length, and that EMG's employment and compensation are not contingent upon the findings or estimated costs to remedy any deficiencies due to deferred maintenance and any noted component or system replacements.

EMG's PCA cannot wholly eliminate the uncertainty regarding the presence of physical deficiencies and the performance of a subject property's building systems. Preparation of a PCR in accordance with ASTM E2018-08 is intended to reduce, but not eliminate, the uncertainty regarding the potential for component or system failure and to reduce the potential that such component or system may not be initially observed. This RPCA was prepared recognizing the inherent subjective nature of EMG's opinions as to such issues as workmanship, quality of original installation, and estimating the remaining useful life of any given component or system. It should be understood that EMG's suggested remedy may be determined under time constraints, formed without the aid of engineering calculations, testing, exploratory probing, code compliance, the removal of materials, or design considerations. Furthermore, there may be other alternate or more appropriate schemes or methods to remedy the physical deficiency. EMG's opinions are generally formed without detailed knowledge from individuals familiar with the performance of the component or system.

In preparation of this report EMG has used staff who are certified to complete building energy audits by RESNET or BPI (or their training providers), or be a Certified Energy Manager (CEM), or be a State equivalent certified energy auditor, or be a professional architect, or be a registered professional engineer, or be a RESNET certified Home Energy Rater or BPI Certified Building Analyst.

EMG staff has training in evaluating building systems and conditions and continue to receive training on an annual basis. EMG staff is LEED certified or have equivalent certifications. EMG staff takes training classes in environmental and energy subjects on a regular basis with at least 10-hours of education per year.

EMG is not be under suspension or debarment by HUD, or involved as a defendant in criminal or civil action with HUD. EMG has an acceptable record of performance with HUD and has completed hundreds of reports where the residents receive Section 8 or public housing assistance. EMG produces reports that are well regarded in the marketplace in terms of content, timeliness and responsiveness. We have the capacity to complete the project inspection and prepare the report in a time frame acceptable to the Lender/Owner

Any questions regarding this report should be directed to the Program Manager at ebeeghly@emgcorp.com or at 800.733.0660, x7607.

Prepared by: Jill Orlov
Field Observer/Energy Auditor

Project Manager

Reviewed by:

Brett Byers, Reviewer for

Edward Beeghly

Program Manager

PART I – GREEN PHYSICAL CONDITION ASSESSMENT

1. EXECUTIVE SUMMARY

The Client contracted with EMG to conduct a Green Physical Condition Assessment (RPCA) and a Limited Environmental Screening consisting of field observations, document review and related due diligence tasks of the subject property, Carucci Apartments located at 281 Stuyvesant Avenue in Lyndhurst, Bergen County, New Jersey 07071. The PCA was performed on March 3, 2014.

The multi-family property has one, five-story senior apartment building containing a total of 99 rental apartment units on a site of approximately 0.89 acres. Construction of the property was completed in 1981.

On site amenities consist of a television room, community room with kitchen and laundry facilities.

Generally, the property was constructed within industry standards, has been well maintained during recent years, and appeared to be in good to fair overall condition. The property representative provided EMG documentation and information regarding maintenance procedures and capital repair/s during the past three years. These upgrades include:

- One domestic water storage tank - 2012
- Domestic and heating boilers
- Sealant replacement - 2011

EMG's cost evaluation takes into consideration these previous improvements, the quality as well as the level of maintenance and workmanship at the subject property. EMG observed elements of the reported work during the site reconnaissance.

There are a number of Critical Repairs, Rehabilitation Needs and Long Term Physical Needs which should be accomplished during the next 20 years as part of the preventive maintenance program. These needs are identified in the various sections of this report and are summarized in the tables.

The following Critical Repair items were observed:

- Suspect mold issues in common area duct system
- Suspect mold issues in some apartments including units 2B and 5N
- No property signage
- Non-continuous, one side railing in interior stair
- Inadequate heating in unit 5C – follow up study
- Follow up study regarding suspect mold
- No smoke detectors in the bedrooms
- Concrete patio repair at patio

EMG assumes that the Housing Authority will complete critical repairs as part of the rehab.

1.1. COST TABLES

The cost tables on the following pages identify the Critical Repairs, Rehabilitation Needs and Physical Needs over the Term for the property. The cost methodology is explained in Section 2 and further detail is provided for the individual cost items in report Sections 3 through 4.

Critical Needs Summary

Project Name: Carucci Apartments
Street Address: 281 Stuyvesant Avenue
City, State: Lyndhurst, New Jersey
Zip Code: 07071

Critical Repair Description	PCA Contractor Estimate	Actual Cost	Included in Rehab or To Be Completed Prior To Closing?
Remediate suspect mold in common area duct system	$2,500		Included in Rehab
Remediate suspect mold in apartments including units 2B and 5N	$1,000		Included in Rehab
Install property signage visible from street	$2,500		Included in Rehab
Non-continuous, one side only stair railings	$8,100		Included in Rehab
Inadequate heat in unit 5C - follow up study	$7,250		Included in Rehab
Mold follow up study	$5,000		Included in Rehab
Install smoke detectors in sleeping rooms, 1009 @ $347 ea	$34,700		Included in Rehab
Repair potential tripping hazard at patio	$119		Included in Rehab
ADA parking sign	$200		Included in Rehab
ADA Access Aisles	$200		Included in Rehab

TOTAL: All Critical Needs	**$61,569**	**$0**
TOTAL: Citical Needs Included in Rehab	**$61,569**	**$0**
TOTAL: Critical Needs To Be Completed Prior To Closing	**$0**	**$0**

Project Name	**Carucci Apartments**	**Total # of Units:**	**99**
Street Address	**281 Stuyvesant Avenue**	**Original PCA Submission Date:**	1/0/00
City, State	**Lyndhurst, New Jersey**	**Last Time All Bids (Budget) Updated:**	
Zip Code	**07071**		

REHABILITATION SPECIFICATIONS
IMPROVEMENTS

WORK

Work Item (A)		Description of Improvements Work (B)	Quantity (C)	Unit Cost (D)	Budget (E)	Date of Bid Expiration (F)
Rehab Items (Code, Description)		***Increase row height to fully display description text***				
3.2.2	Storm Water Drainage		0	$0.00	$0	
3.2.4	Parking and Driveways		0	$0.00	$0	
3.2.4.01	Concrete Flatwork - Patio		20	$7.85	$157	
3.2.4.02	Parking and Driveways Other #2		0	$0.00	$0	
3.2.6	Land and Grounds: Irrigation		0	$0.00	$0	
3.2.9.01	Property Signage		1	$2,500.00	$2,500	
3.2.9.02	Wood Board Fencing		0	$0.00	$0	
3.2.9.03	Dumpster Enclosure		0	$0.00	$0	
3.2.9.04	Site Other #4		0	$0.00	$0	
3.3.2.2	Exterior Walls		0	$0.00	$0	
3.3.2.3	Insulation		0	$0.00	$0	
3.3.2.4.01	Sliding Glass Doors		8	$3,001.80	$24,014	
3.3.2.4.02	Windows		0	$0.00	$0	
3.3.2.5.01	Exterior Doors		0	$0.00	$0	
3.3.2.5.02	Storm Doors		0	$0.00	$0	
3.3.2.9.01	Caulking and Sealant		0	$0.00	$0	
3.3.2.9.02	Bldg Envelope Other #2		0	$0.00	$0	
3.3.2.9.03	Bldg Envelope Other #3		0	$0.00	$0	
3.3.2.9.04	Bldg Envelope Other #4		0	$0.00	$0	
3.3.4	Roofs		0	$0.00	$0	
3.4.1.2.01	Waste piping - cast iron to PVC		90	$59.50	$5,355	
3.4.1.2.02	Domestic Water Indirect Fired Storage Tanks - 120 gallon		0	$0.00	$0	
3.4.1.2.03	DHW #3		0	$0.00	$0	
3.4.1.2.04	DHW #4		0	$0.00	$0	
3.4.1.3.01	Water Savers: Faucets		0	$0.00	$0	
3.4.1.3.02	Water Savers: Shower Heads		99	$90.00	$8,910	
3.4.1.3.03	Water Savers: Toilets		0	$0.00	$0	
3.4.2.1.01	HVAC Common Area Heating		0	$0.00	$0	
3.4.2.1.02	HVAC In-Unit Heating		99	$43.83	$4,339	
3.4.3.1.01	Bath Exhaust Fans		0	$0.00	$0	
3.4.3.1.02	HVAC Common Area Cooling		0	$0.00	$0	
3.4.3.1.03	HVAC In-Unit Cooling		0	$0.00	$0	
3.4.9.01	Programmable Thermostats		0	$0.00	$0	
3.4.9.02	Rooftop Package Unit 8.5 tons		0	$0.00	$0	
3.4.9.03	Rooftop Package Unit 5 tons		0	$0.00	$0	
3.4.9.04	Stairwell Heating		10	$553.00	$5,530	
3.5	Elevators		0	$0.00	$0	
3.5.01	Elevator Cab Finishes		0	$0.00	$0	
3.6.01	CO Detectors/Alarms		0	$0.00	$0	
3.6.02	Smoke Detectors		100	$347.00	$34,700	
3.6.03	Fire Stair Railings		200	$40.50	$8,100	
3.7.1.01	Common Area Floor Coverings		0	$0.00	$0	
3.7.1.02	Common Area Interior Lighting Bulbs		0	$0.00	$0	
3.7.1.03	Common Area Interior Lighting Fixtures		126	$110.00	$13,860	
3.7.1.04	Exit Signs		0	$0.00	$0	
3.7.1.05	Exterior Lighting		0	$0.00	$0	
3.7.1.9.01	Common Area Interior Painting		0	$0.00	$0	
3.7.1.9.02	Common Area VCT to linoleum		0	$0.00	$0	
3.7.2.1.01	Kitchen Cabinets		0	$0.00	$0	
3.7.2.1.02	Kitchen Counter Tops, Sinks		0	$0.00	$0	
3.7.2.1.03	Kitchen Floor Coverings		0	$0.00	$0	
3.7.2.11.01	Dishwashers		0	$0.00	$0	
3.7.2.11.02	Range Hoods		0	$0.00	$0	
3.7.2.11.03	Ranges		0	$0.00	$0	
3.7.2.11.04	Refrigerators 1		0	$0.00	$0	
3.7.2.11.05	Refrigerators 2		0	$0.00	$0	
3.7.2.19	Common Area Washing Machines		5	$2,182.80	$10,914	
3.7.2.19.01	Kitchen Exhaust Fans		0	$0.00	$0	
3.7.2.19.02	Kitchen Other #1		0	$0.00	$0	
3.7.2.19.03	Kitchen Other #2		0	$0.00	$0	
3.7.2.19.04	Kitchen Other #3		0	$0.00	$0	
3.7.2.2.01	Bath Counter Tops, Sinks		0	$0.00	$0	
3.7.2.2.02	Bath Floor Covering		0	$0.00	$0	
3.7.2.2.03	Bath Vanities		0	$0.00	$0	
3.7.2.29.01	Bath Other #1		0	$0.00	$0	
3.7.2.29.02	Bath Other #2		0	$0.00	$0	
3.7.2.29.03	Bath Other #3		0	$0.00	$0	
3.7.2.29.04	Bath Other #4		0	$0.00	$0	
3.7.2.3.01	Interior Carpet		0	$0.00	$0	
3.7.2.3.02	Interior Doors		0	$0.00	$0	
3.7.2.3.03	Interior Painting		0	$0.00	$0	
3.7.2.39.01	Kitchen Flooring - Apartment		0	$0.00	$0	
3.7.2.39.02	Apartment Intercom System		0	$0.00	$0	
3.7.2.39.03	ADA parking sign		2	$100.00	$200	
3.7.2.39.04	ADA Access Aisles		40	$5.00	$200	
3.7.2.4.01	Ceiling Fans		0	$0.00	$0	
3.7.2.4.02	In-Unit Lighting Bulbs		0	$0.00	$0	
3.7.2.4.03	In-Unit Lighting Fixtures		0	$0.00	$0	
3.7.2.4.04	ADA - Automated Door Opener		2	$870.75	$1,742	
3.7.2.4.05	In-Unit Electrical Other #2		0	$0.00	$0	
3.8.01	Site Light - MH Poles Convert to LED		0	$0.00	$0	
3.8.02	Common Area Dryers		0	$0.00	$0	
3.8.03	Generator - natural gas 26.25 kVa		0	$0.00	$0	

WORK						
Work Item (A)		Description of Improvements Work (B)	Quantity (C)	Unit Cost (D)	Budget (E)	Date of Bid Expiration (F)
3.8.04	ADA Stair Handrail Extensions		22	$350.00	$7,700	
3.8.05	ADA - Interior Signage Restrooms		2	$55.00	$110	
3.8.06	Remediate Suspect Mold - Common Area Ducting		1	$2,500.00	$2,500	
3.8.07	Remediate Suspect Mold - Apartments as needed inc. 2B and 5N		1	$1,000.00	$1,000	
3.8.08	Follow Up Study - Inadequate Heat in Unit 5C		1	$7,250.00	$7,250	
3.8.09	Follow Up Study - Suspect Mold		1	$5,000.00	$5,000	
3.8.10	Other #10		0	$0.00	$0	
3.8.11	Other #11		0	$0.00	$0	
3.8.12	Other #12		0	$0.00	$0	
3.8.13	Other #13		0	$0.00	$0	
3.8.14	Other #14		0	$0.00	$0	
3.8.15	Other #15		0	$0.00	$0	
N/A	Relocation Costs		N/A	N/A	$0	

Total Improvements Eligible for Rehab Escrow	**$144,081**
10.0% Contingency	**$14,408**
Total Rehab Escrow Improvements Plus Contingency = TOTAL FUNDING	**$158,489**

Comment cells provided below:

Comments:

Additional comments:

20 Year Schedule for: Carucci Apartments

Carucci Apartments

Replacement Component	2015 Rehab	2015 Year 1	2016 Year 2	2017 Year 3	2018 Year 4	2019 Year 5	2020 Year 6	2021 Year 7	2022 Year 8	2023 Year 9	2024 Year 10	2025 Year 11	2026 Year 12	2027 Year 13	2028 Year 14	2029 Year 15	2030 Year 16	2031 Year 17	2032 Year 18	2033 Year 19	2034 Year 20	20 Year Total	20 Year + Rehab
3.2.2 Storm Water Drainage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.2.4 Parking and Driveways	0	0	0	0	3,037	0	0	0	0	3,037	0	0	0	0	3,037	0	0	0	0	3,037	0	12,148	12,148
3.2.4.01 Parking and Driveways Other #1	157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157
3.2.4.02 Parking and Driveways Other #2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.2.6 Land and Grounds: Irrigation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.2.9.01 Property Signage	2,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,500
3.2.9.02 Wood Board Fencing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,125	0	0	0	0	5,125	5,125
3.2.9.03 Dumpster Enclosure	0	4,158	0	0	0	0	0	0	0	0	0	4,158	0	0	0	0	0	0	0	0	0	8,316	8,316
3.2.9.04 Site Other #4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3.2.2 Exterior Walls	0	23,304	0	0	0	0	0	0	0	0	0	23,304	0	0	0	0	0	0	0	0	0	46,609	46,609
3.3.2.3 Insulation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3.2.4.01 Sliding Glass Doors	24,014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24,014
3.3.2.4.02 Windows	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3.2.5.01 Exterior Doors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3.2.5.02 Storm Doors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3.2.9.01 Caulking and Sealant	0	0	0	0	0	0	0	0	0	0	0	0	16,328	0	0	0	0	0	0	0	0	16,328	16,328
3.3.2.9.02 Bldg Envelope Other #2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3.2.9.03 Bldg Envelope Other #3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3.2.9.04 Bldg Envelope Other #4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3.4 Roofs	0	0	73,755	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73,755	73,755
3.4.1.2.01 Waste piping - cast iron to PVC	5,355	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,355
3.4.1.2.02 Domestic Water Indirect Fired Storag	0	10,750	0	0	0	0	0	0	0	0	0	0	0	2,150	0	0	10,750	0	0	0	0	23,650	23,650
3.4.1.2.03 DHW #3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4.1.2.04 DHW #4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4.1.3.01 Water Savers: Faucets	0	30,660	0	0	0	0	0	0	0	0	0	30,660	0	0	0	0	0	0	0	0	0	61,321	61,321
3.4.1.3.02 Water Savers: Shower Heads	8,910	0	0	0	0	0	0	0	0	0	0	8,910	0	0	0	0	0	0	0	0	0	8,910	17,820
3.4.1.3.03 Water Savers: Toilets	0	31,680	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31,680	31,680
3.4.2.1.01 HVAC Common Area Heating	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4.2.1.02 HVAC In-Unit Heating	4,339	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,339
3.4.3.1.01 Bath Exhaust Fans	0	44,304	0	0	0	0	0	0	0	0	0	44,304	0	0	0	0	0	0	0	0	0	88,608	88,608
3.4.3.1.02 HVAC Common Area Cooling	0	6,050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,050	0	0	0	0	12,100	12,100
3.4.3.1.03 HVAC In-Unit Cooling	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4.9.01 Programmable Thermostats	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4.9.02 Rooftop Package Unit 8.5 tons	0	14,635	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14,635	0	0	0	0	29,270	29,270
3.4.9.03 Rooftop Package Unit 5 tons	0	0	0	6,700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,700	0	0	13,400	13,400
3.4.9.04 Stairwell Heating	5,530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,530	0	0	0	0	5,530	11,060
3.5 Elevators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5.01 Elevator Cab Finishes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58,240	0	0	0	58,240	58,240
3.6.01 CO Detectors/Alarms	0	0	0	0	0	0	0	0	0	0	12,114	0	0	0	0	0	0	0	0	0	0	12,114	12,114
3.6.02 Smoke Detectors	34,700	34,353	0	0	0	0	0	0	0	0	0	69,053	0	0	0	0	0	0	0	0	0	103,406	138,106
3.6.03 Fire Stair Railings	8,100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,100
3.7.1.01 Common Area Floor Coverings	0	7,521	0	0	0	0	0	0	7,521	0	0	0	0	0	0	7,521	0	0	0	0	0	22,562	22,562
3.7.1.02 Common Area Inter. Lighting Bulbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.1.03 Common Area Inter. Lighting Fixtures	13,860	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13,860	0	0	0	0	13,860	27,720
3.7.1.04 Exit Signs	0	0	0	0	0	0	0	5,575	0	0	0	0	0	0	0	0	0	0	0	0	0	5,575	5,575
3.7.1.05 Exterior Lighting	0	12,460	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12,460	12,460
3.7.1.9.01 Common Area Interior Painting	0	0	0	0	0	0	17,086	0	0	0	0	0	0	0	0	0	17,086	0	0	0	0	34,171	34,171
3.7.1.9.02 Common Area VCT to linoleum	0	6,827	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,827	6,827
3.7.2.1.01 Kitchen Cabinets	0	0	0	0	0	0	0	0	0	0	0	0	0	74,250	74,250	74,250	0	0	0	0	0	222,750	222,750
3.7.2.1.02 Kitchen Counter Tops, Sinks	0	0	0	0	0	0	0	0	35,640	35,640	35,640	0	0	0	0	0	0	0	0	0	0	106,920	106,920
3.7.2.1.03 Kitchen Floor Coverings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.11.01 Dishwashers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.11.02 Range Hoods	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.11.03 Ranges	0	0	0	0	0	0	20,807	20,807	20,807	0	0	0	0	0	0	0	0	0	0	0	0	62,420	62,420
3.7.2.11.04 Refrigerators 1	0	0	0	0	0	0	0	0	0	4,350	0	12,920	12,920	12,920	0	0	0	0	0	0	0	43,109	43,109
3.7.2.11.05 Refrigerators 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.19 Common Area Washing Machines	10,914	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10,914	0	0	0	0	10,914	21,828
3.7.2.19.01 Kitchen Exhaust Fans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.19.02 Kitchen Other #1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.19.03 Kitchen Other #2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.19.04 Kitchen Other #3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.2.01 Bath Counter Tops, Sinks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.2.02 Bath Floor Covering	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.2.03 Bath Vanities	0	0	0	0	0	0	0	0	0	0	0	0	26,672	26,672	26,672	0	0	0	0	0	0	80,017	80,017
3.7.2.29.01 Bath Other #1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.29.02 Bath Other #2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.29.03 Bath Other #3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.29.04 Bath Other #4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.3.01 Interior Carpet	0	0	0	0	0	0	48,391	48,391	48,391	48,391	48,391	0	0	0	0	0	0	0	0	0	0	241,956	241,956
3.7.2.3.02 Interior Doors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	152,069	0	0	0	152,069	152,069
3.7.2.3.03 Interior Painting	0	0	0	0	0	0	21,289	21,289	21,289	0	0	0	0	0	0	0	21,289	21,289	21,289	0	0	127,734	127,734
3.7.2.39.01 Kitchen Flooring - Apartment	0	0	0	0	0	0	22,037	22,037	0	0	0	0	0	0	0	0	0	0	0	0	0	44,073	44,073
3.7.2.39.02 Apartment Intercom System	0	56,133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56,133	56,133
3.7.2.39.03 ADA parking sign	200	0	0	0	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0	0	0	200	400
3.7.2.39.04 ADA Access Aisles	200	0	0	0	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0	0	0	200	400
3.7.2.4.01 Ceiling Fans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.4.02 In-Unit Lighting Bulbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.4.03 In-Unit Lighting Fixtures	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.7.2.4.04 ADA - Automated Door Opener	1,742	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,742	0	0	0	0	1,742	3,483
3.7.2.4.05 In-Unit Electrical Other #2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.01 Site Light - MH Poles Convert to LED	0	3,560	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,560	3,560
3.8.02 Common Area Dryers	0	0	0	0	0	0	19,830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,830	19,830
3.8.03 Generator - natural gas 26.25 kVa	0	24,610	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24,610	24,610
3.8.04 ADA Stair Handrail Extensions	7,700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,700

20 Year Schedule for: Carucci Apartments

Carucci Apartments

Replacement Component	2015 Rehab	2015 Year 1	2016 Year 2	2017 Year 3	2018 Year 4	2019 Year 5	2020 Year 6	2021 Year 7	2022 Year 8	2023 Year 9	2024 Year 10	2025 Year 11	2026 Year 12	2027 Year 13	2028 Year 14	2029 Year 15	2030 Year 16	2031 Year 17	2032 Year 18	2033 Year 19	2034 Year 20	20 Year Total	20 Year + Rehab
3.8.05 ADA - Interior Signage Restrooms	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	110	0	0	0	0	110	220
3.8.06 Remediate Suspect Mold - Common Are	2,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,500
3.8.07 Remediate Suspect Mold - Apartments a	1,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,000
3.8.08 Follow Up Study - Inadequate Heat in U	7,250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,250
3.8.09 Follow Up Study - Suspect Mold	5,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,000
3.8.10 Other #10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.11 Other #11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.12 Other #12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.13 Other #13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.14 Other #14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8.15 Other #15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**144,081**	**311,005**	**73,755**	**6,700**	**3,037**	**0**	**149,439**	**118,099**	**133,647**	**91,418**	**96,145**	**193,709**	**55,919**	**115,992**	**103,959**	**81,771**	**107,090**	**231,598**	**27,989**	**3,037**	**0**	**1,904,310**	**2,048,391**
Inflated Total	**144,081**	**311,005**	**75,599**	**7,039**	**3,271**	**0**	**169,076**	**136,958**	**158,865**	**111,384**	**120,072**	**247,964**	**73,371**	**155,996**	**143,309**	**115,540**	**155,098**	**343,808**	**42,589**	**4,737**	**0**	**2,375,681**	**2,519,762**

2. PURPOSE AND SCOPE

2.1. PURPOSE

The purpose of the RAD program is to allow Public Housing and Moderate Rehabilitation (Mod Rehab) properties to convert, to long-term Section 8 rental assistance contracts. The program also allows Rent Supplement (Rent Supp), Rental Assistance Payment (RAP), and Mod Rehab properties to convert tenant-based vouchers issued upon contract expiration or termination to project-based vouchers. The goal is to restructure the financing and to bring properties up to market standards through an initial rehabilitation and subsequent repairs and/or replacements over the next twenty year period. The restructuring program has three basic goals:

1. *Social* - Preserving the "affordable housing stock" by maintaining the long term physical integrity of HUD subsidized rental housing insured by FHA.

2. *Economic* - Reducing the long term Project based Section 8 rental assistance costs and reducing the costs of insurance claims paid by FHA.

3. *Administrative* - Promote greater operating cost efficiencies and establish systems to administer the program and terminate relationships owners/properties that violate agreements or program requirements

The purpose of the RAD Physical Condition Assessment is to assist the client in assessing the physical condition of the property and meeting the stated goal of the program to encourage affordable multi-family rehabilitation of properties using sustainable Green Building principles. These sustainable Green Building principles are comprises of energy efficiency, sustainability, indoor air quality, and recycling. They also incorporate the "Health Housing" approach which was established by HUD in 1999 in response to a Congressional Directive regarding growing concerns about environmental health in children. This program is designed to incorporate Green principles into property rehabilitation and scheduled repairs and/or replacements over the next twenty years.

The RAD PCA is comprises three parts:

Part 1: PCA Report comparing Traditional and Green Requirements. The traditional PCA identifies repairs and/or replacements necessary in the first year and in the subsequent twenty years. The PCA will estimate costs using both "traditional" and "Green" principles and provides discussion on the benefits (financial and otherwise) of the green alternative material or system.

Part 2: Energy Audit.

It evaluates how energy and water is used at the property. This documents and recommends energy-related improvements that can be made to the property, the costs of the improvements, and provides a simple financial payback analysis. It includes an initial assessment of potentially viable alternatives for generating electricity, heating water, and heating and cooling the conditioned space at the building.

Part 3: Utility Consumption Baseline – It contains data on utility usage at the property, both tenant-paid and owner-paid, and including all common areas for a full 12-month period. It establishes a baseline to allow for benchmarking, and for future measurement of consumption and costs. As such, the utility baseline creates a whole building consumption profile in achieving its aim of establishing the standard on which future consumption can be compared.

For this PCA, at least 25% of apartment units and a representative sample of major building systems and components were observed and their physical condition evaluated in accordance with ASTM E2018-08. The report identifies Critical Repairs, Rehabilitation Specifications, and Long Term Physical Needs. The report also estimates costs using both "traditional" and "green" principles and provides discussion on the benefits of the green alternative The standard is a non-luxury standard adequate for the rental market intended at the original approval of Project-based assistance. The physical needs identified are intended to reflect those necessary for the Project to retain its original market position as an affordable Project in a decent, safe and sanitary condition. The intent is to include those improvements that the Project requires to compete in the non-subsidized market, resulting in a marketable Project that competes on rent rather than amenities.

The property management staff and code enforcement agencies were interviewed for specific information relating to the physical property, code compliance, available maintenance procedures, available drawings and other documentation. The property systems and components were observed and evaluated for their present condition and the estimated cost for repairs and/or capital reserves are included in the cost estimates. All findings relating to these opinions of probable costs are included in the narrative sections of this report.

The physical condition of building systems and related components are typically defined as being in one of three categories: Good, Fair, and Poor. For the purposes of this report, the following definitions are used:

Good = Satisfactory as-is. Requires only routine maintenance during the reserve term. Repair or replacement may be required due to a system's estimated useful life.

Fair = Satisfactory as-is. Repair or replacement is required due to current physical condition and/or estimated remaining useful life.

Poor = Immediate repair, replacement, or significant maintenance is recommended.

In an effort to quickly find key information EMG has created the following quick reference guide for the client and report reviewer.

2.2. PROPERTY EXPECTED USEFUL LIFE ESTIMATE

Subject to the qualifications stated in this paragraph and elsewhere in this report, the remaining useful life (RUL) of the property is estimated to be not less than 35 years. The foregoing estimate as to useful life is an expression of a professional opinion and is not a guarantee or warranty, express or implied. This estimate is based upon the observed physical condition of the property at the time of the EMG's visit and is subject to the possible effect of concealed conditions or the occurrence of extraordinary events, such as natural disasters or other "acts of God", which may occur subsequent to the date of the on site visit.

The remaining useful life for the property is further based on the assumption that: (a) the Critical Repairs, Rehabilitation Needs, and future repairs for which replacements provided as capital reserves are recommended are completed in a timely and workmanlike manner; and (b) a comprehensive program of preventive and remedial property maintenance is continuously implemented using an acceptable standard of care. The estimate is made only with regard to the expected physical or structural integrity of the improvements on the property, and no opinion regarding economic or market conditions, the present or future appraised value of the property, or its present or future economic utility is expressed by EMG.

2.3. OPINIONS OF PROBABLE COST

This section provides estimates for Critical Repairs, Rehab Items, and 20 Year Reserve Items as noted within this RPCA.

These estimates are based on Invoice or Bid Documents provided either by the Owner or facility and construction costs developed by construction resources such as *EnergyStar.gov*, *R.S. Means* and *Marshall & Swift,* EMG's experience with past costs for similar properties, city cost indexes, and assumptions regarding future economic conditions.

2.4. METHODOLOGY

Based upon site observations, research and judgment, along with referencing Expected Useful Life (EUL) tables from various industry sources, EMG opines as to when a system or component will most probably require replacement. Accurate historical replacement records, if provided are typically the best sources of information. Exposure to the elements, initial quality and installation, extent of use, the quality and amount of preventive maintenance exercised, and other similar items are all factors that impact the effective remaining useful life of a system or component. The Remaining Useful Life (RUL) or effective remaining life of a component or system equals the EUL less its effective age. The estimated useful life calculations are based on those found in the Fannie Mae (FNMA) Document; FNMA, Delegated Underwriting Services (DUS) Guide Section 3 entitled "Physical Needs Assessment Guidance to the Property Evaluator".

Where quantities could not be derived from actual takeoff, lump sum or allowances are used. Estimated costs to correct are based on professional judgment and the probable or actual extent of the observed defect, inclusive of the cost to design, procure, construct and manage the corrections.

Each building system or component is further identified with the following references if costs or other actions are applicable:

RM = Routine maintenance
CR = Critical Repair
RS = Rehabilitation Scope

RR = Replacement Reserve
NA = Not Applicable

2.5. CRITICAL REPAIRS

Based on observations of readily apparent conditions, Critical Repairs have been identified as health and safety deficiencies, violations of Section 8 housing quality standards or FHA's regulatory agreement standards that require immediate attention. These repairs include conditions that endanger the safety or well being of residents. It is expected that Critical Repairs will be completed prior to closing.

2.6. REHABILITATION NEEDS AND GREEN SIGNIFICANT ADDITIONS

The Rehab cost estimate is an estimate of repairs, replacements, or significant deferred or other maintenance items recommended within the next year. The Rehab cost estimate includes items which pass the early replacement criteria or which provide a direct environmental benefit to the property. This RAD PCA identifies repairs necessary in the first year following restructuring. It offers "traditional" and "green" components that meet local building codes. It clearly identifies if "green" components exceed local building code requirements. It gives two "green" options, if available, for example evaluating 16 SEER and 19 SEER air-conditioning costs and efficiencies. It estimates costs using both "traditional" and "green" principles and it provides comments on the benefits (financial and otherwise) of the green alternative. As part of the savings analysis, the analysis includes evaluating costs and benefits for two levels of "green" for certain mandatory "green" options that may apply to the property.

Green Building or sustainable building is the practice of reducing the impact of buildings on the environment, both during construction and as part of the operation of the building systems. Their use of water, energy, and materials should be reduced through the use of new planning methods and material usage.

EMG's goal was to identify all opportunities to: 1) improve energy efficiency; 2) minimize water use; 3) use recycled or recyclable materials, 4) protect the indoor air quality; 5) reduce the 'carbon footprint' of the buildings and site; and 6) proper disposal of replaced materials.

In the table located on the following pages, EMG has identified components which will require replacement either immediately, within the first year (Rehab items), or over the course of the next twenty years (20 Year Reserve Items). We compare the cost of traditional replacements and compare them to "green" replacements. The anticipated benefits of green approaches are discussed throughout the report, along with increased short term costs for the long term benefits of choosing "Green" or sustainable alternatives.

Green Significant Additions are those items that meet the "green principles" and are recommended for early replacement in the subsequent year.

2.7. LONG TERM PHYSICAL NEEDS

Long Term Physical Needs are for recurring probable expenditures, which are not classified as operation or maintenance expenses, which should be annually budgeted for in advance. Long Term Physical Needs are reasonably predictable both in terms of frequency and cost. However, they may also include components or systems that have an indeterminable life but nonetheless have a potential liability for failure within an estimated time period. These items are included in the 20 Year Reserve Schedule.

This methodology excludes systems or components that are estimated to expire after the reserve term of 20 years and that are not considered material to the structural and mechanical integrity of the subject property. Furthermore, systems and components that were not deemed to have a material effect on the use were also excluded. Costs that are caused by acts of God, accidents or other occurrences that are typically covered by insurance, rather than reserved for, are also excluded

Replacement costs were solicited from ownership/property management, EMG's discussions with service companies, manufacturers' representatives, and previous experience in preparing such schedules for other similar facilities. Costs for work performed by ownership's or property management's maintenance staff were also considered.

EMG's reserve methodology involves identification and quantification of those systems or components requiring reserve funds within the evaluation period which is defined as the age minus the reserve term. Additional information concerning systems or components respective replacement costs (in today's dollars), typical expected useful lives, and remaining useful lives were estimated so that a funding schedule could be prepared. The Long Term Physical Needs presupposes that all required remedial work has been performed or that monies for remediation have been budgeted for items defined as a Critical Repair or Rehab item.

2.8. PERSONNEL INTERVIEWED

In the process of conducting the RAD PCA and follow-up telephone calls, the following personnel from the facility and government agencies were interviewed:

Name and Title	Organization	Phone Number
Robert Moore Property Manager	Housing Authority of Bergen County	201.935.0790
Phil Fucetola Building Inspector	Lyndhurst Building, Planning & Zoning Department	201.804.2490
Robert Ferrara Fire Official	Lyndhurst Township Fire Prevention Bureau	201.933.3079 x2316

EMG met with Robert Moore, Property Manager, the on site Point of Contact (POC), who was cooperative and provided information, that appeared to be accurate based upon our subsequent site observations. It is EMG's opinion that the on site contact was very knowledgeable about the subject property and questions EMG posed during the interview process. The POC's management involvement at the property has been during the last two years.

2.9. OWNER PROVIDED DOCUMENTATION

Prior to the PCA, relevant documentation was requested that could aid in the knowledge of the subject property's physical improvements, extent and type of use, and/or assist in identifying material discrepancies between reported information and observed conditions. The review of submitted documents does not include comment on the accuracy of such documents or their preparation, methodology, or protocol. The following documents were provided for review while performing the RPCA:

- Site plan
- Floor plans
- Utility billing information
- Efficiencies of existing systems

- Warranty Information

No other documents were available for review.

2.10. CAPITAL IMPROVEMENTS FOR MARKET UPGRADES

The report identifies Short Term and Long Term Physical Needs. The standard is a non-luxury standard adequate for the rental market intended at the original approval of Project-based assistance. The Capital Improvements for Market Upgrades identified are intended to reflect those necessary for the Project to retain its original market position as an affordable Project in a decent, safe and sanitary condition. The intent is to include those improvements that the Project requires to compete in the non-subsidized market, resulting in a marketable Project that competes on rent rather than amenities.

EMG has evaluated the subject property in relation to the property's marketability within the surrounding community. Based on EMG's experience and observations, no market upgrades are recommended.

2.11. PRE-SURVEY QUESTIONNAIRE

A Pre-Survey Questionnaire was sent prior to EMG's on site visit. The completed questionnaire is included in Appendix G. Information obtained from the questionnaire has been used in preparation of this RAD PCA.

2.12. WEATHER CONDITIONS

Weather conditions at the time of the on site review were partly cloudy, with temperatures in the low 20s (°F) and light to moderate winds. In addition, there were approximately six inches of snow on the ground.

3. DESCRIPTION AND OBSERVATIONS

3.1. EXISTING BUILDING GENERAL DESCRIPTION

3.1.1. Apartment Unit Types and Unit Mix

The following table identifies the reported apartment types and mix at the subject property. Measurements were provided by the Housing Authority.

Apartment Unit Types and Mix		
Quantity	**Type**	**Floor Area**
98	1 Bedroom/1 Bathroom	489 to 510 SF
1	2 Bedrooms/1 Bathroom – superintendent unit	922 SF
There is currently one vacant unit.		
There are currently no down units.		
99	**TOTAL**	

There was one vacant unit on the day of our site visit.

3.1.2. Apartment Units Observed

Approximately 25 percent of the apartment units and all vacant units were observed in order to gain a clear understanding of the overall property condition. Other areas accessed included the exterior of the entire property, the roof, and all of the interior common areas. The following apartments were observed:

Apartment Units Observed		
Unit/Floor	**Type**	**Remarks**
5N/Fifth	1 Bedroom/1 Bathroom	Occupied, fair to poor condition. The area affected by the moisture was approximately one square foot in size. No indication of mold present on the walls.
5P/Fifth	1 Bedroom/1 Bathroom	Occupied, good condition. ADA unit. Dust filled bathroom vent.
5R/Fifth	1 Bedroom/1 Bathroom	Occupied, good condition. ADA unit.
5E/Fifth	1 Bedroom/1 Bathroom	Occupied, good condition.
5C/Fifth	1 Bedroom/1 Bathroom	Occupied, good to poor condition. Cold in unit. Reportedly, bleeding radiators every week.

Apartment Units Observed		
Unit/Floor	**Type**	**Remarks**
		Thermostat set to 90, temperature is 66.
4C/Fourth	1 Bedroom/1 Bathroom	Occupied, good condition.
4S/Fourth	1 Bedroom/1 Bathroom	Occupied, fair condition.
4P/Fourth	1 Bedroom/1 Bathroom	Occupied, good condition. ADA unit.
4M/Fourth	1 Bedroom/1 Bathroom	Occupied, good condition.
3J/Third	1 Bedroom/1 Bathroom	Occupied, good condition.
3P/Third	1 Bedroom/1 Bathroom	Occupied, fair condition. ADA unit. Worn carpet.
3F/Third	1 Bedroom/1 Bathroom	Occupied, good condition.
3F/Third	1 Bedroom/1 Bathroom	Occupied, fair condition. Leak in kitchen ceiling, peeling paint.
3E/Third	1 Bedroom/1 Bathroom	Occupied, good condition. Feel breeze at closed windows.
3R/Third	1 Bedroom/1 Bathroom	Occupied, fair condition. ADA unit. Bottom of bathroom door is damaged.
2Q/Second	1 Bedroom/1 Bathroom	Occupied, good condition.
2P/Second	1 Bedroom/1 Bathroom	Occupied, good condition. ADA unit.
2I/Second	1 Bedroom/1 Bathroom	Occupied, good condition.
2R/Second	1 Bedroom/1 Bathroom	Occupied, fair condition. Past leak over bathroom ceiling.
2B/Second	1 Bedroom/1 Bathroom	Occupied, fair to poor condition. Suspect mold covering entire bathroom ceiling and some on caulk around medicine cabinet. None on walls.
2K/Second	1 Bedroom/1 Bathroom	Vacant. Good condition. Dust filled bathroom vent.
1A/First	1 Bedroom/1 Bathroom	Occupied, fair condition. Ceiling panels worn.
1E/First	1 Bedroom/1 Bathroom	Occupied, fair condition. Worn carpet - stained and wrinkled.
1R/First	1 Bedroom/1 Bathroom	Occupied, fair condition. ADA unit. Wall patches observed.
1F/First	2 Bedrooms/1 Bathroom	Occupied, fair condition. Flooring worn.
Vacant Units		
	1 Bedroom/1 Bathroom	Vacant, good condition.
Down Units		
None		

A "down unit" is a term used to describe a non-rentable apartment due to fire damage, water damage, missing appliances, damaged floor, wall or ceiling surfaces, or other significant deficiencies. The Point of Contact stated that there were no down units at the subject property.

All areas of the property were available for observation while on site.

3.2. SITE

3.2.1. Topography

Item	Description	Action	Condition	Replacement
Topography	Relatively flat	RM	Good	Traditional
Adjacent Properties	Commercial and residential	RM	Good	Traditional
Retaining Walls	Cast concrete	RM	Good	Traditional

Green Physical Condition Discussions: As part of any re-landscaping plan, incorporate design features that enhance the soil quality, reduce storm water runoff and pollution, and encourage beneficial insects and wildlife. This measure also minimizes ongoing water requirements, maintenance needs, and green waste. In addition, seek to incorporate design features into the site that channel runoff to swales, porous surfaces, and holding areas. These measures reduces water runoff, helps filter and treat storm water, and protects the local ecosystem.

Observations/Comments:

- The property topography and adjacent uses did not appear to present conditions detrimental to the property. No significant areas of erosion were observed affecting the property. Based on the results of this assessment, no further actions appear to be required at this time.
- The reinforced concrete retaining walls appear to be in good condition requiring routine maintenance.

3.2.2. Storm Water Drainage

Item	Description	Action	Condition	Replacement
Drainage Systems and Erosion Control	Surface flow and inlets to underground piping to municipal system	RM	Good	Traditional
On site Retention	Not Applicable	NA	NA	NA
Pavement System	Non-porous	RM	Good	Traditional

Green Physical Condition Discussions: Increasing porous surfaces decreases runoff and protects the health of creeks, wetlands and other bodies of water. Reducing runoff improves soil health because it retains valuable topsoil on site. EMG evaluated opportunities to increase storm water retention on site by replacing or rehabilitating parking lots, sidewalks, and other hardscape features with porous pavement. These measures help reduce water runoff, help filter and treat storm water, and protect the local ecosystem. Pervious paving surfaces can cost more than hard surfaces but can easily be incorporated into future on site hard surface repairs and replacements.

Observations/Comments:

- Evidence of storm water runoff from adjacent properties was not observed. Based on the results of this assessment, no further actions appear to be required at this time.
- The storm water system appeared to provide adequate runoff with no evidence of major ponding or erosion noted. Based on the results of this assessment, no further actions appear to be required at this time.

3.2.3. Parking, Paving and Sidewalks

Item	Description	Action	Condition	Replacement
Parking and Paving	Surface lot 48 total parking stalls, including handicapped-accessible stalls 3 handicapped-designated parking stalls of which 1 is van-designated Asphalt	RR	Good	Traditional
Sidewalks, Curbs and Gutters	Concrete	RM	Good	Traditional
Site Access	One driveway into site from adjacent street.	RM	Good	Traditional

Green Physical Condition Discussions: For replacement or rehabilitation of sidewalks and other hardscape features such as footings, mat foundations, slab on grade, slabs on metal deck, cast in place and tilt up walls, drives and equipment pads, displace Portland cement in concrete mixes with at least 20 percent recycled content materials (flyash or slag). This measure increases the durability and strength of the concrete, reduces greenhouse gas emissions associated with cement production, and helps keep flyash out of landfills.

Increasing porous surfaces decreases runoff and protects the health of creeks, wetlands and other bodies of water. Reducing runoff improves soil health because it retains valuable topsoil on site. Types of pervious or porous pavement include porous aggregate, porous turf, plastic geocells, open-jointed paving blocks, open-cell paving grids, porous concrete, granite or crushed rock, and soft porous surfacing such as bark or mulch.

Specify light color pigments or aggregates for any replacement or rehabilitation of sidewalks and other hardscape features. This measure reduces the building's cooling costs and minimizes the heat island effect by reducing the amount of heat retained by surrounding asphalt, concrete, and building structures. Adding

colorants and pigments to mixes of concrete and asphalt does not generally increase costs. Changing aggregate colors is also relatively inexpensive.

Observations/Comments:

- In order to maximize the pavement life, pothole patching, crack sealing, seal coating and re-striping of the asphaltic concrete paving will be required during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The parking area and drive aisle paving is in good condition and will not require full replacement during the reserve period. As such, a porous paving system is not recommended at this time, but should be considered when the entire existing paving system will be removed and replaced.
- The property will be subjected to only minor concrete repairs of flatwork during the life of the loan and no repairs are noted as immediate needs. High-volume fly-ash concrete mixes are widely available and typically cost the same as low-volume mixes. The recommendation is made to specify recycled concrete materials for flatwork repairs. Use of recycled concrete will comply with LEED-EB Material and Resources Credit 2 – Optimize Use of Alternative Materials.

3.2.4. Landscaping and Grounds

Item	Description	Action	Condition	Replacement
Landscaping	Trees, grass and shrubs	RM	Good	Traditional
Irrigation	Automatic underground system	RM	Good	Traditional

Green Physical Condition Discussions: As part of any re-landscaping plan, incorporate design features that enhance the soil quality, reduce storm water runoff and pollution, and encourage beneficial insects and wildlife. This measure also minimizes ongoing water requirements, maintenance needs, and green waste. In addition, seek to incorporate design features into the site that channel runoff to swales, porous surfaces, and holding areas. These measures reduces water runoff, helps filter and treat storm water, and protects the local ecosystem.

Observations/Comments:

- Landscaping is minimal at the property and improvements are not necessary or planned. However, future landscaping efforts at the property should be "sustainable" featuring native plants and shrubs. Native landscaping can achieve significant savings over time by reducing labor, water, and chemical costs.
- The in-ground sprinkler system is controlled by manual valves operated by the maintenance staff.
- EMG recommends installing soil moisture sensors to detect the amount of moisture contained in soil. Once the specified level of moisture is reached, the sensors prevent the automatic watering system from operating.
- The site point of contact reported there are no problems with the underground irrigation system. EMG recommends only ongoing routine maintenance of the system. Based on the results of this assessment, no further actions appear to be required at this time.

3.2.5. Patio, Terrace, and Balcony

Item	Description	Action	Condition	Replacement
Patios	Concrete-paved patio along southeast elevation at the north end with outdoor built-in seating and game tables	CR	Fair	Traditional
Balconies	Not applicable	NA	NA	NA

Observations/Comments:

- The ground-level patio slabs have signs of movement. Settlement was observed at one of the game table areas. Repairs consisting of removing and replacing portions of the walking surface are recommended immediately to avoid the potential for tripping. The cost for this work is included as a Critical Repair Item.
- High-volume fly-ash concrete mixes are widely available and typically cost the same as low-volume mixes. The recommendation is made to specify recycled concrete materials for flatwork repairs. Use of recycled concrete will comply with LEED-EB Material and Resources Credit 2 – Optimize Use of Alternative Materials.

3.2.6. General Site Improvements

Item	Description	Action	Condition	Replacement
Signage	Building–mounted sign with street address numbers	CR	Poor	Traditional
Site Lighting	Parking lot light standards 4 Metal Halide Fixtures @ 175 Watts Photosensor	RR	Good	Green
Building Lighting	Wall-mounted fixtures rear and sides - 6 Wall-mounted at front - 8 Surface-mounted soffit fixtures 6 Metal Halide Fixtures @ 100 Watts Photo 8 High Pressure Sodium Fixtures @ 70 Watts Photo	RR	Good	Green
Fencing	Wood boards and metal posts	RR	Fair	Traditional
Dumpsters	Set on pads in enclosure Trash compactor	RM	Fair	Traditional
Recycling & Waste Management	Recycling plan is in place Construction debris plan is recommended	NA	NA	Green

Green Physical Condition Discussions: High-density residential properties should always consider, where space permits, the provision of bike parking/storage for residents, visitors, and employees. This measure will reduce traffic and pollution while increasing occupant/worker health. Secured and covered storage can be under building overhangs, stairwells (inside or out), bike lockers, in parking garages, or other means. The property may benefit by providing bicycle storage. The property layout provides several areas that could be converted to locked bicycle storage for residents; however, management has identified that there is not a great demand for bicycle storage at the facility.

Observations/Comments:

- The window mounted property identification signage appeared to be in good to fair condition and will require routine maintenance.
- No signage was visible from the street. Installation of a post mounted or monument sign with the building name and address is recommended for emergency personnel. The cost for this work is included in the 20 Year Reserve Schedule as a Critical Repair Item.
- A payback analysis was completed for replacement of the existing building-mounted lighting with high efficacy LED wall packs. The payback period is 10.1 years and early replacement is not recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- A payback analysis was completed for replacement of the site lighting with high efficacy LED poles. The payback period is 4.4 years and early replacement is not recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- Some fence posts were missing or damaged. Some damaged sections will require replacement through routine maintenance. Based on the Estimated Useful Life and the observed conditions, fencing replacement is recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The Dumpsters are owned and maintained by the refuse contractor. Based on the results of this assessment, no further actions appear to be required at this time.
- The Dumpster enclosures are constructed of wood fencing and are in fair condition. Based on the Estimated Useful Life and the observed conditions, replacement of the wood enclosure is recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- A recycling program is in place and receptacles are adjacent to the Dumpster. Some recyclables provide revenue, which can be used for community improvements.
- EMG recommends the property owners institute a management sponsored recycling program for the proper collection and disposal of maintenance and resident generated household hazardous waste. Provide an accessible area dedicated to the separation, collection, and storage of materials; electronic equipment, computer printer ink, compact fluorescent bulbs, and lithium batteries. The addition of recycling stations for hazardous household waste is recommended as a Green Restructuring item. The cost for this work is not included at this time.
- EMG recommends the property owners institute a Green Waste Management Plan that includes items from future construction/renovation. The plan should set a 50% recycle and/or salvage goal to reduce landfill disposal. Materials to be recycled and/or salvaged include: clean dimensional wood, plywood, concrete,

CMU, brick, gypsum board, asphalt shingles, glass, carpet and pad, and pipe. This type of plan has little or no direct cost to the property. Requirements for including recycling and/or salvage costs should be added to all Requests for Proposals put out for contractor bids.

3.2.7. Utilities

The following is a table of utilities supplied to the site and the names of the suppliers:

Site Utility Providers	
Utility	**Supplier**
Sanitary sewer	Township of Lyndhurst Water Department
Storm sewer	Township of Lyndhurst Water Department
Domestic water	Township of Lyndhurst Water Department
Electric service	PSEG
Natural gas service	PSEG
Telephone service	Verizon
Cable Television	Comcast

Green Physical Condition Discussions: It is recommended that property management perform regular visual assessments of known underground piping locations. These assessments can be performed as part of routine activities such as trash pickup, lawn mowing or while walking from one area of the property to another. The purpose is to look for tell tale signs of utility piping leakage. These tell tale sign manifest themselves as wet spots, non weather related puddles, areas are always wet, soil undermining and noticeable increases in domestic water consumption. Such occurrence should be report to the local utility supplier immediately.

It is recommended that property management perform regular visual assessments of building and common area lighting. These assessments can be performed as part of routine activities such as trash pickup, lawn mowing or while walking from one area of the property to another. The purpose is to look for tell tale signs of electrical utility waste. These spot assessments document light fixtures that are on during the day, damage or missing lighting fixtures, malfunctioning timer or photo cells.

Observations/Comments:

- The on site representatives reported that the utilities provided are adequate for the property.
- Green Energy Technologies are evaluated in the Energy Audit in Part II of this report.

3.3. STRUCTURAL FRAME AND BUILDING ENVELOPE

3.3.1. Foundations

Item	Description	Action	Condition	Replacement
Floor	Concrete slab below grade basement	RM	Good	Traditional
Footings	Concrete perimeter footings and concrete pad footings	RM	Good	Traditional
Basements and Crawl Spaces	Subterranean basement with perimeter concrete retaining and bearing walls.	RM	Good	Traditional

Green Physical Condition Discussions: For replacement or rehabilitation of features such as footings, mat foundations, slab on grade, slabs on metal deck, cast in place and tilt up walls, drives and equipment pads, displace Portland cement in concrete mixes with at least 20 percent recycled content materials (flyash or slag). This measure increases the durability and strength of the concrete, reduces greenhouse gas emissions associated with cement production, and helps keep flyash out of landfills.

Observations/Comments:

- The foundations and footings could not be directly observed while on site. No apparent signs of significant cracking or movement that would indicate excessive settlement were observed. Based on the results of this assessment, no further actions appear to be required at this time.
- The construction drawings indicated concrete footings approximately ten feet below grade.

3.3.2. Exterior Walls

Item	Description	Action	Condition	Replacement
Typical Finishes and Cladding	Brick veneer	RR	Good	Traditional
Other finishes	Cast stone window sills	RM	Good	Traditional
Sealants	Caulking and sealants at joints, finish transitions, and at wall openings.	RR	Good	Traditional

Green Physical Condition Discussions:

For repainting, specify recycled-content paint. The recycled-content should be at least 50 percent and can come from post industrial or post-consumer sources. VOCs shall not exceed 250 grams per liter for recycled paint. This measure keeps unwanted paint out of landfills.

For rehabilitation or replacement of exterior siding, specify environmentally preferable siding products. Fiber cement, stucco, metal, brick and stone are durable and easy to maintain. FSC-certified wood siding is made with sustainably harvested wood. Depending on the siding product chosen, this measure may

increase durability, reduce waste, maintenance and replacement costs, or support sustainable forestry practices.

Three popular forms of siding are not recommended due to environmental and durability concerns:

- Vinyl siding is a non-recyclable product that poses a landfill burden. In addition, vinyl manufacture produces dioxin, a persistent environmental toxin.
- Conventional wood siding imposes high maintenance costs and may involve detrimental harvesting practices.
- Composition siding (or hardboard) looks like wood siding and requires more ongoing maintenance than wood siding. It is made with wood fibers from industrial process waste or fast-growing tree species. The product is susceptible to water damage when improperly installed and is not recommended.

In addition to its aesthetic function, siding protects a building's exterior walls from wind, sunlight, pests and water. The following siding options are environmentally preferable compared to vinyl, conventional wood or composition siding:

- Fiber-cement siding is gaining popularity as a safe, durable product and is made of Portland cement, sand and cellulose fibers.
- Stucco is a common siding material in many areas of the country. It is made of sand, water, and cement. Some stucco has an acrylic finish.
- Brick or stone veneers are often used in new construction to give the façade a classic look.
- Metal siding is gaining popularity due to its durability, lack of maintenance needs, and because it is lightweight.
- Wood siding certified by the Forest Stewardship Council (FSC) comes from sustainably managed forestry operations. Another environmentally preferable option is siding made from reclaimed wood that may come from old buildings, telephone poles, or river and lake bottoms. Wood can hold up with proper maintenance, but the siding options listed above are likely to last longer and require less maintenance than wood.

Observations/Comments:

- The Energy Audit recommends replacement of caulking, building sealants and weather stripping is recommended as part of the measures to control air leakage in the building. The most recent air leakage sealant replacement occurred within the last three years. The cost for this replacement work is included in the 20 Year Reserve Schedule as Reserve Item.
- The brick does not have cracking or efflorescence evident. Based on the age and the condition of the exterior walls, it is recommended that a dedicated repair program be instituted for anticipated degradation of the mortar joints and overall exterior wall performance. Walls should be routinely checked for fractured, spalling or missing mortar joints and cleaning or tuck pointing of the brick and joints should be performed where necessary. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.

3.3.3. Exterior and Interior Stairs

Item	Description	Action	Condition	Replacement
Exterior Concrete Stairs	The exterior stairs to the basement are constructed of cast in place concrete. The handrails are constructed of metal.	RM	Good	Traditional
Interior Concrete Stairs	The interior stairs are constructed of cast in place concrete. The handrails are constructed of metal.	CR	Good	Traditional

Observations/Comments:

- The exterior and interior stairs and handrails are in good condition and will require routine maintenance over the evaluation period.
- The interior stair railings are non-continuous and are on one side of the stair only. For life safety issues, it is recommended that the railings be replaced with code compliant railings. The cost for this work is included in the 20 Year Reserve Schedule as a Critical Repair Item.

3.3.4. Exterior Windows and Doors

Item	Description	Action	Condition	Replacement
Windows	Metal-framed, double-hung units with exterior screens Double –glazed No Low-E Coating Caulking at perimeter of frames	RR	Fair to poor	Traditional
Exterior Doors	Aluminum-framed storefront systems at the front and rear entrances Hollow metal doors in metal frames Push/pull handle hardware with deadbolts	RR	Fair	Green
Apartment Doors	Apartments accessed from interior corridor Hollow metal doors in metal frames Lever handles and knob handles with deadbolts	RM	Good	Traditional
Overhead Doors	Not Applicable	NA	NA	NA

Green Physical Condition Discussions: Windows and patio doors generally make up a significant fraction of a multi-family unit's exterior walls. They are also generally the weakest link in the building's thermal envelope. Windows can allow unwanted heat into the building during the summer and can account for as much as 25 percent of heat loss in the winter. High-performance windows help control heat gain and loss.

Unfortunately replacing single-pane windows with newer, more efficient ones is generally not cost effective as a stand-alone retrofit. Replacement is generally more cost effective when pursued in conjunction with general wall rehabilitation to address rot, water damage, and other issues.

Rehabilitation provides an opportunity for increased energy savings and thermal comfort via door replacement and repair. Poor entrance door construction, an absence of wind barriers or airlocks, and inadequate weather-stripping can allow unwanted heat and cold into the building.

Observations/Comments:

- The windows are reported to be approximately 18 years old. It was reported that an engineering study was performed five years ago due to the drafty conditions around the individual window frames even through the perimeter sealant has been replaced. A copy of the report was requested but not provided. Gaskets were added which was reported to improve the air infiltration slightly. An internal test was performed with a leaf blower. The issue still remains. The sealant of the window joints is dry rotted and cracked. The window construction does not appear to be adequate for energy efficiency. Based on their Estimated Useful Life and the observed conditions, replacements are recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- A payback analysis was completed for replacement of the existing windows with Energy Star rated units having low-E glazing and argon-filled panes. The payback period is longer than the life of the component and early replacement is not recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The building features entrance doors that provide egress to conditioned hallways. The assemblies appeared to be in good condition at the time of the inspection and do not warrant green replacement as there is little added efficiency to be gained.
- The first floor main entrance lobby features an airlock via entrance vestibule and maintaining weather stripping on these doors should be part of an ongoing operations and maintenance program. No weather stripping was observed. Daylight could be seen under the door frame. The cost of this work is relatively insignificant and can be done through routine maintenance.
- EMG recommends that all future replacements of doors exposed to the weather are performed using EnergyStar rated systems and that all future apartment and common area doors not exposed to the weather are replaced with appropriately fire rated renewable resource or rapidly renewable wood products.
- The rear doors accessing from the parking lot do not have an airlock. The corridor was very cold. Based on the Estimated Useful Life and the observed conditions, replacement of the storefront building access system with a double paned system and weather stripping is recommended. The common area doors were not found to be of good energy efficiency rating. Where possible, we recommend all future replacements utilize a well-sealed, insulated-pane storefront access system. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- No significant problems were observed with the interior apartment entry doors. Based on their Estimated Useful Life and the observed conditions, replacements are recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- All future replacements of dwelling unit doors are recommended to utilize renewable resource or rapidly renewable wood products if switching to wood.

3.3.5. Roofing

Item	Description	Action	Condition	Replacement
Type	Flat Hipped front and rear entrance canopies			
Finish	Single-ply membrane at flat roof sections Asphalt shingles at entrance canopies	RR	Good	Traditional
Maintenance	Maintained by in-house staff or outside contractor as needed			
Age	The roof finishes are approximately 18 years			
Warranties	Information regarding roof warranties or bonds was not available.			
Drainage	Internal drains Gutters and downspouts at the entrance canopies draining above grade	RM	Good to fair	Traditional
Flashing	Sheet metal with rubber membrane base and edge flashing	RR	Good to fair	Traditional
Parapet and Copings	Parapets with sheet metal copings	RM	Good	Traditional
Soffits, Eaves, and Fascias	Concealed soffits at entrance canopies	RM	Good	Traditional
Skylights	Not applicable	NA	NA	NA
Attics	Not applicable	NA	NA	NA
Ventilation	Not applicable	NA	NA	NA
Other	See above for entrance canopies	NA	NA	NA

Green Physical Condition Discussions:

Reflective Roofing

As part of any roofing rehabilitation, reduce the roof temperature by specifying cool roof products that meet Energy Star levels of efficiency. Installing a radiant barrier can reduce 90 percent or more of roof deck radiant heat. This measure reduces the air-conditioning load, minimizes the heat island effect, and extends the roof life.

To qualify for the Energy Star label, roofing products must meet the following specifications:

- For low-slope roofs (surfaces with a slope of 2:12 inches or less), the initial solar reflectance must be at least 0.65. The material must maintain a solar reflectance of at least 0.50 after three years of installation under normal conditions.

- For high-slope roofs (surfaces with a slope of 2:12 inches or greater), the initial solar reflectance must be at least 0.25. The material must maintain a solar reflectance of at least 0.15 after three years of installation under normal conditions.
- A payback analysis was performed to install an Energy Star rated reflective roofing system. The payback period was calculated as longer than the roof material useful life. Based on the results of the payback analysis, the use of reflective roofing materials is not recommended.

Vegetative Roofing

Green roofs are a combination of vegetation and soil planted on a waterproof membrane atop a roof. They reduce roof temperature, cooling costs, and storm runoff. In addition to reducing cooling costs and minimizing storm water runoff, green roofs also:

- Filter pollution
- Reduce sewage system loads
- Protect underlying roof material from UV and temperature fluctuations
- Provide habitat for small animals
- Absorb carbon dioxide (CO2)
- Offer an attractive alternative to traditional roofs
- Reduce noise transfer from the outdoors
- Based on the current roofing configuration, vegetative roofing appears to be a viable alternative. EMG recommends assessing the potential of an investment in Green Roofing. No costs are included at this time.

Observations/Comments:

- According to the Point of Contact, there are no active roof leaks. This opinion was confirmed by our visual observations.
- No evidence of roof deck or insulation deterioration was observed or, according to the Point of Contact, reported. These items should be inspected during any future roofing repair or replacement. Based on the results of this assessment, no further actions appear to be required at this time.
- No evidence of fire retardant treated plywood (FRT) was observed in EMG's limited survey, and no use of FRT was reported by the Point of Contact. Based on the results of this assessment, no further actions appear to be required at this time.
- The primary roof is approximately 18 years old. According to the Point of Contact, the previous roofing replacements have not included the complete removal of the prior roof. Based on the Estimated Useful Life and the observed conditions, replacement is recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- Roof drainage appeared to be adequate. Clearing and minor repair of drain system components should be performed regularly as part of routine maintenance.

3.4. MECHANICAL AND ELECTRICAL SYSTEMS

3.4.1. Plumbing

3.4.1.1 Common Area Plumbing and Domestic Hot Water

Item	Description	Action	Condition	Recommendation
Water Meter	Meters in basement	RM	Good to poor	Traditional
Domestic Water Supply	Copper pipe	RM	Good	Traditional
Domestic Waste and Ventilation	Cast iron pipe and some PVC pipe	CR	Good to poor	Traditional
Domestic Hot Water	Central system fed from heating boilers to 6 indirect-fired water heaters with 120-gallon capacity each	RR	Good	Green
Vent Damper	Domestic Water Boilers are equipped with vent dampers			
Electronic Ignition	Domestic Water Boilers have electronic ignitions			
Insulation	Piping and tank insulation	RR	Good to fair	Green
Common Area Restroom Fixtures	Commercial grade bath fixtures and accessories Low flow fixtures	RM	Good	Green

Observations/Comments:

- One of the two water meters is non functional. The water utility company should be contacted to replace the defective meter.
- The plumbing systems appear to be well maintained. The water pressure appears to be adequate. The plumbing systems will require routine maintenance during the reserve term.
- There is no evidence that the property uses polybutylene piping for the domestic water distribution system. In addition, the POC indicated that polybutylene piping is not used at the property.
- The waste piping is originally cast iron. Some areas have been replaced with PVC. The exposed piping in the basement is exhibiting corrosion. The remaining cast iron in the basement will require replacement. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- The pressure and quantity of hot water appear to be adequate.

- Domestic water storage tank sizing is included in the Energy Audit.
- Refer to Section 3.4.2.1 for discussions regarding the boilers.
- The hot water storage tanks vary in age. Five of them are approximately 16 years old and one is two years old. Based on the Estimated Useful Life and the observed conditions, replacements are recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item and as a Rehab Item.
- Hot water piping, tanks, and heat exchangers are well insulated.

3.4.1.2 In-Unit Plumbing and Domestic Hot Water

Item	Description	Action	Condition	Recommendation
Domestic Hot Water	Served by central system. Refer to Section 3.4.1.1.	NA	NA	NA
Insulation	Piping uninsulated	RM	NA	Green
Apartment Bathrooms	Lavatory, vanity, shower or bathtub, water closet	RR	Good to fair	Green

Where accessible we observed that the domestic hot water piping in the individual dwelling unit is not insulated.

Some of the existing showers and sinks have water saving fixtures. Plumbing fixture flow rates are detailed in the water testing table below. The existing toilets are rated at 3.5 gallons per flush (GPF).

Hot water temperature was physically measured at a random but representative number of dwelling units. The temperatures recorded are as follows:

Sample Location	Faucet Location	Measured Temperature
Dwelling Unit – 5N	Bathroom	130.4° F
Dwelling Unit – 5P	Kitchen	124.8° F
Dwelling Unit – 5R	Kitchen	122.5° F
Dwelling Unit – 5R	Bathroom	121.5° F
Dwelling Unit – 4C	Kitchen	125.4° F
Dwelling Unit – 4C	Bathroom	124.1° F
Laundry Room	No sink	No sink
Community Room	Kitchen	115° F
Rental Office	Restroom	130.8° F
Common Area Women's	Restroom	118.7° F

EMG performed a flow test of the bathroom and kitchen faucets and showerhead and found each fixture to meet the requirements of the 1995, the National Energy Policy Act as follows:

Sample Location	Fixture	NEPA Guidance – Gallon Per Minute /Flush	Flow Test Results
Dwelling Unit – 5P	Faucet - kitchen	2.2 - 2.75 gpm	2.2 gpm
Dwelling Unit – 5R	Faucet - kitchen	2.5- 3.0 gpm	2.2 gpm
Dwelling Unit – 5R	Faucet - bathroom	1.6 gpf	1.5 gpm
Dwelling Unit – 4S	Faucet - kitchen	2.2 - 2.75 gpm	2.2 gpm
Dwelling Unit – 4S	Faucet - bathroom	2.5- 3.0 gpm	2.2 gpm
Dwelling Unit - all	Toilet	1.6 gpf	3.5 gpf

Observations/Comments:

- The water pressure and quantity of hot and cold water was observed to be adequate. Based on the results of this assessment, no further actions appear to be required at this time.
- Bathroom and kitchen plumbing fixtures were generally replacements. A payback analysis was conducted for replacing 2.2 gpm faucet aerators with 1.0 gpm aerators in the bathrooms and 1.5 gpm aerators in the kitchens. The payback period is approximately 0.5 years and 0.6 years, respectively and early replacement is not recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- Shower heads were generally replacements. A payback analysis was conducted for replacing 2.5 gpm shower heads with 1.75 gpm units. The payback period is approximately 0.9 years and early replacement is recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- Water closets appear to be original high volume flush units. A payback analysis was conducted for replacing 3.5 gpf water closets with 1.2 gpf units. The payback period is approximately 15.5 years and early replacements are not recommended. Replacement with traditional 1.6 gpf units is recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The vanities are eight years of age. Based on the Estimated Useful Life and the observed conditions, replacement is recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The domestic water distribution piping does not have a history of chronic leaks. Based on the results of this assessment, no further actions appear to be required at this time.
- No polybutylene piping was observed at this property, and the maintenance supervisor reported that it was not used at the property. Based on the results of this assessment, no further actions appear to be required at this time.

- Hot water piping is poorly insulated. Approximately 975 linear feet of insulation is missing on the hot water supply piping and will require installation. Refer to the Energy Audit for further discussion and payback analysis if appropriate.

3.4.2. Heating, Ventilating, and Air-conditioning (HVAC)

3.4.2.1 Common Area HVAC

Item	Description	Action	Condition	Recommendation
Maintenance	Maintained by outside contractor			
Age and Type	The HVAC equipment appears to be less than three years old.			
Heating & Air-conditioning	Gas-fired rooftop packaged units – corridors and elevator lobby Central system with boilers – apartments and common area rooms Through the wall air conditioners – apartments, office (3) and TV room	RR	Good to fair	Green
Refrigerant	R-22			
Quantity/Capacity	Two boilers @ 750 MBH each, 93.6% Efficiency One packaged unit (north end) @ 8.5 tons, 9 EER – 1996 One packaged unit (south end) @ 5 tons, 10 SEER – 2002 One packaged unit (elevator lobbies) @ two tons, 9 SEER - 1996			
Vent Damper	Boilers are equipped with vent dampers			
Boiler Controls	The boilers are not equipped with Outside Air temperature Reset Controls			
Distribution	Ducts from roof to spaces Air handler to two-pipe distribution systems to coils – community room Two circulating pumps @ 1.5 hp	RR	Good to fair	Traditional
Controls	Local thermostats	RM	Fair	Green
Ducts	Concealed ducts above ceilings	CR	Fair to poor	Green
Insulation	Ducts not insulated Piping not insulated – air handler piping to be installed	RS	Fair	Traditional

Item	Description	Action	Condition	Recommendation
Supplemental systems	Electric space heaters in 5th floor apartment bathrooms Three hydronic unit fan coil heaters for basement	RM	Fair	Traditional
Ventilation	Bathroom and kitchen exhaust fans 26 Fans	RR	Fair	Green
Load Sizing	Manual J Load Sizing Calculations are included in the Energy Audit	NA	NA	NA

Observations/Comments:

- The boilers were installed within the last three years. The boilers have been well maintained. Based on their Estimated Useful Life and the observed conditions, replacements are not recommended during the reserve term.
- Based on the level of maintenance, type of material, and observed conditions, significant replacements of the circulation pumps and associated piping are not anticipated during the term. However, some repairs and/or replacements are anticipated during the reserve period. The cost for this work is relatively insignificant.
- Hot water piping is poorly insulated at the air handler. It was reported that the exposed line is to be insulated soon through routine maintenance.
- The rooftop package HVAC units appeared to be moderately maintained. Based on their Estimated Useful Life, replacements are recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- Duct sealing and insulation is recommended. The cost for this work is included in the 20 Year Reserve Schedule as a part of the mold remediation work.
- The supply and return vents for the rooftop units are located directly across from each other on some floors. It was also reported that the dampers on the 5th floor are typically closed to force air to reach the 1st floor.
- It was reported that the condensation build up on the duct vent in the 5th floor corridor develops mold in the warmer months. Some suspect mold was observed on the north end.
- The constant volume, gas-fired unit heaters appeared to be 15 years old. Based on the results of this assessment, no further actions appear to be required at this time.
- The stairwells are not heated. EMG recommends installing a heat source. A cost allowance is included in the 20 Year Reserve Schedule as a Rehab Item.
- The through-the-wall air-conditioning units have not been maintained. The apartment unit through-the-wall units are owned and maintained by the tenants. The three office and one TV room units are moderately maintained. Due to their estimated Remaining Useful Life (RUL), replacement is recommended during the next year. Based on the Estimated Useful Life and the observed conditions, replacements are recommended. The cost for this work is relatively insignificant and can be performed through routine maintenance.

3.4.2.2 In-Unit HVAC

Item	Description	Action	Condition	Recommendation
Maintenance	Maintained by in-house staff			
Age and Type	The baseboard radiators are original.			
Heating and Air-conditioning	Baseboard radiators Individual thru-wall air-conditioning units	CR & RM	Good to fair	Traditional
Refrigerant	Could not be determined			
Quantity/Capacity	One to two Air Conditioners – tenant owned Two Baseboard Heating Units per apartment			
Distribution	Radiant heat	NA	NA	NA
Controls	Digital thermostats	RM	Good to fair	Traditional
Ducts	Not applicable	NA	NA	NA
Insulation	Piping uninsulated	RM	Fair	Traditional
Ventilation	Bathroom exhaust fans and kitchen exhaust through the wall fans vented to the roof	RS	Fair	Green
Load Sizing	Manual J Load Sizing Calculations are included in the Energy Audit	NA	NA	NA

The apartment units are not equipped with programmable thermostats. The pre-programmed settings that come with Energy Star qualified programmable thermostats are intended to deliver savings without sacrificing comfort. Depending on the tenant's schedule, one can see significant savings. The key is to establish a program that automatically reduces heating and cooling based on the tenants' lifestyles. Programmable thermostats are not recommended for this property and no costs are provided.

The kitchen in each apartment unit is vented to the exterior by through the wall vents. The bathroom is ventilated to the exterior through wall vents.

Observations/Comments:

- The hot water baseboard fin-tube units are original. Excessive noise in the heating system was observed in some units. It was also observed that a few units did not have sufficient heat from the radiators. It was reported that a leak may be in the system; although, none was found. Unit systems, such as 5C, are being bled weekly which is helping in the short term. Testing is required to find the source of the leak. The cost for this work is included in the 20 Year Reserve Schedule as a Critical Repair Item. Due to their condition and the estimated Remaining Useful Life (RUL) of the units, some replacement should be expected during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The through-the-wall air-conditioning units are supplied by the residents and are reportedly their responsibility to maintain or replace. Based on the results of this assessment, no further actions appear to be required at this time.
- The bathroom and kitchen exhaust fans are ducted to the exterior of the building. Excessive dust build-up was observed in several units. Cleaning is performed in house and should be done more regularly. Cold

air is felt at the kitchen exhaust fan. Based on their estimated Remaining Useful Life (RUL), replacement of the exhaust fans with energy star rated fans with dampers is recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.

3.5. BUILDING ELEVATORS AND CONVEYING SYSTEMS

Item	Description	Action	Condition	Recommendation
Type and Quantity	Two traction passenger elevators with 2,500 and 2,100-pound capacities. Motors manufactured by Dover Controllers manufactured by Galaxy	RM	Good	Traditional
Maintenance	Service contract with Slade			
Inspection Certificate	Posted in cab; expired on 10/2013.			
Equipment	Located in penthouse equipment room	RR	Good	Traditional
Other Devices	Electric safety stops with emergency communication equipment	RM	Good	Traditional
Elevator Cab Finishes	Vinyl tile floor, stainless steel and plastic-laminated wood wall panels, metal panel soffited ceiling with recessed light fixtures	RR	Good	Traditional

Observations/Comments:

- According to the Point of Contact, the number of elevators and their responsiveness provides adequate service for the building. Based on the results of this assessment, no further actions appear to be required at this time.
- The maintenance staff stated that the elevator equipment is in good condition. The controllers were replaced in 2006. No problems were observed at the time of EMG's site visit. Based on the Estimated Useful Life and the observed conditions, some component repair and/or replacement is anticipated during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- Replacement of the floor finish and wall panels in the cabs is recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- According to the Point of Contact, the emergency communication equipment in the elevator operates properly. This opinion was not confirmed by our visual observations. Based on the results of this assessment, no further actions appear to be required at this time.

3.6. FIRE PROTECTION AND SECURITY SYSTEMS

Item	Description	Action	Condition	Recommendation
Sprinkler Systems	Wet pipe, automatic sprinkler system with flow switches, pull stations, and alarm horns Dry standpipes, Siamese connections and hose cabinets, backflow preventer	RM	Good	Traditional
Other Equipment and Devices	Central alarm panel in compactor room, strobe light alarms, illuminated exit signs, battery back-up light fixtures, hard-wired	RR	Good	Traditional
Special Systems	None observed	NA	NA	NA
Fire Extinguishers	Located throughout interior spaces Last service date in May 2013	RM	Good	Traditional
Fire Hydrants	Located along adjacent public streets	RM	Good	Traditional
Stair Wells	Drywall-finished stairwell walls Fire-rated doors and door hardware	RM	Good	Traditional

Smoke detectors were observed in the immediate vicinity outside of the bedroom. The smoke detectors are hardwired operated and meet the NFPA 101 requirements.

There is no fuel-fired combustion equipment in dwelling units hence carbon monoxide detectors are not required at this property.

Observations/Comments:

- Information regarding fire department inspections is included in Section 4.2.
- Per the NFPA 101 requirements, smoke detectors are not located at appropriate locations. Smoke detectors are required in every bedroom, in the immediate vicinity of the bedrooms outside of the bedroom, and on all levels of the dwelling unit. Additionally, the smoke detectors must be hard-wired, or the battery operated-type must have 10-year life, be tamper resistant, and are not interchangeable with appliances or toys. As such, smoke detector installation is required in all of the above noted locations. No smoke detectors were observed within the bedrooms. The cost for this work is included in the 20 Year Reserve Schedule as a Critical Repair Item and Reserve Item. There is no Green Alternative for this item.
- The fire sprinklers are inspected by a qualified contractor on a routine basis. The fire sprinklers will require routine maintenance during the reserve term.
- The fire extinguishers are serviced annually. The fire extinguishers were serviced and inspected within the last year.
- The pull stations and alarm horns will require routine maintenance during the reserve term.
- Exit sign and emergency light replacement is considered to be routine maintenance.
- The central alarm panel is serviced regularly by a qualified fire equipment contractor. Equipment testing is not within the scope of a Physical Condition Assessment. Based on inspection documents displayed by the panel, the central alarm panel has been inspected within the last year. Based on the Estimated Useful

Life and the observed conditions, replacement is recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item. There is no Green Alternative for this item.

- The exit stairwells appear to have been constructed in accordance with applicable codes in force at the time of construction. The stairwells appear to be in general compliance.
- The stairwell doors and door hardware are fire-rated. Components bearing certification labels are displayed on the doors.

3.7. INTERIOR ELEMENTS

3.7.1. Common Areas

3.7.1.1 Interior Finishes

The following table identifies the interior common areas and generally describes the finishes in each common area.

Common Areas						
Renovations/FF&E	The common areas were last renovated at least ten years ago. The FF&E primarily consists of chairs, desks, tables, customer waiting area furniture, and office equipment					
Area	**Floor**	**Walls**	**Ceilings**	**Action**	**Condition**	**Replacement**
Rental Office	Carpet	Painted drywall	Suspended T-bar with tiles	RR	Good to fair	Green
Lobbies	Carpet	Painted drywall	Suspended T-bar with tiles	RR	Good to fair	Green
Elevator lobbies	Carpet	Painted drywall	Suspended T-bar with tiles	RR	Good to fair	Green
Corridors	Carpet	Painted drywall	Suspended T-bar with tiles	RR	Good to fair	Green
Common Area Restrooms	Ceramic tile	Ceramic tile wainscots	Painted drywall	RR	Good	Traditional
Common Area Kitchen	Vinyl Composite Tile	Painted drywall	Suspended T-bar with tiles	RR	Good to fair	Traditional

Area	Floor	Walls	Ceilings	Action	Condition	Replacement
Laundry Room	Vinyl Composite Tile	Painted drywall	Suspended T-bar with tiles	RR	Good to fair	Traditional
Community Room	Vinyl Composite Tile	Painted drywall	Suspended T-bar with tiles	RR	Good to fair	Traditional
TV Room	Carpet	Painted drywall	Suspended T-bar with tiles	RR	Good to fair	Traditional
Laundry Equipment	5 Washers, Residential style, Coin-Op 5 Dryers, Residential style, Coin-Op			RR	Good to fair	Green

Green Physical Condition Discussions: For all residential or commercial-grade clothes washers, purchase or lease products that are Energy Star–qualified with a modified energy factor (MEF) of at least 1.72 and a maximum water factor of 8.0. For all residential-grade clothes dryers, purchase or lease products that are natural gas–fueled and ventless (require no exhaust). In addition, look for a dryer with a moisture sensor that automatically shuts off when your clothes are dry. This measure reduces energy and water bills.

Consider energy conservation measures, such as scheduling of operation of laundry facilities during non-peak electrical demand periods and using cold water rinse cycles in all new machines. Although warm or hot water is necessary to wash many types of clothing, cold water can be used in the rinse cycle for all applications. Converting laundries to cold rinse cycle can generate significant energy savings by cutting down on hot water use.

Observations/Comments:

- Based on the Estimated Useful Life and the observed conditions, painting of the interior walls is recommended during the next year. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- Recommended replacement of the common community room and laundry flooring within should use a green natural linoleum product, as this material has an extended useful life and natural anti-microbial properties. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The estimated Remaining Useful Life (RUL) of the finishes indicates that some replacement of carpeting and ceiling finishes will be necessary during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The building's laundry room contains washers and dryers owned and maintained by the property. Two washers have been recently replaced in 2011. Ages of the remaining washing machines range from six to ten to approximately 20 years old. The dryers are approximately 13 years old.
- Due to the estimated Remaining Useful Life (RUL) replacement of the washers and dryers is anticipated during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item. The Green Alternative is recommended.

- EMG recommends the common laundry facilities are modified to a cold water rinse cycle in an effort to conserve energy. Conversion of the laundry rinse cycle to cold water is part of the energy star replacements.

3.7.1.2 Building Electrical Service and Lighting

Item	Description	Action	Condition	Recommendation
Service Type	Underground lines to pad-mounted transformer			
Service Size	1,600-Amp and 2,000-Amp, 120/208-Volt, three-phase, four-wire, alternating current (AC)			
Electric Meters and Equipment	Two main meters in basement adjacent to electrical switchgear Sub-meters in corridor electrical rooms Circuit breaker panels located inside	RM	Good	Traditional
Wiring	Copper wire in metallic conduit and in non-metallic sheathed cable	RM	Good	Traditional
Common Area Lighting	Energy Efficient Fluorescent Light Fixtures 4 foot linear T-8 fixtures, 28 Watt – 2nd floor corridor, common area restrooms and trash rooms 4 foot linear T-12 fixtures, 40 Watt – remaining common areas	RR	Good	Green
Emergency generator	Natural gas powered 45 kW emergency electrical generator	RR	Good	Traditional

Observations/Comments:

- The electrical power was reported to be adequate for the building demands. Based on the results of this assessment, no further actions appear to be required at this time.
- The switchgear, circuit breaker panels and electrical meters appeared to be in good condition. Based on the results of this assessment, no further actions appear to be required at this time.
- The emergency generator is reportedly exercised weekly and appeared to be in good condition. This equipment will require routine maintenance. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- A payback analysis was completed for replacement of the existing common area fluorescent lighting with Energy Star rated Super T-8 light bulbs and electronic ballasts. The payback period is 7.5 years and early replacement is recommended. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.

3.7.2. Dwelling Units

3.7.2.1 Cabinetry and Countertops

The kitchen cabinets are constructed of wood. The countertops are wood and have a plastic-laminated finish.

Green Physical Condition Discussions: Cabinet and countertop replacement projects should specify durable, formaldehyde-free materials, which will increase indoor air quality. Cabinets should feature hardwood assemblies and doors, or exterior-grade plywood or formaldehyde-free MDF boxes assembled with adhesives, screws, and bolts. Many composite woods are produced with formaldehyde binders that off-gas after installation. Formaldehyde glues in composite wood products come in two forms: urea and phenol. Urea-formaldehyde binders are more common.

Observations/Comments:

- The kitchen cabinets and countertops are replacements from ten to 12 years ago. Based on their Estimated Useful Life and the observed conditions, replacement is recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.

3.7.2.2 Appliances

Each apartment unit kitchen typically includes the following appliances:

Appliance	Comment
Refrigerator	Frost-free
Range	Electric
Hood	Not provided
Dishwasher	Not provided
Disposal	Not provided

Green Physical Condition Discussions: Rehabilitation projects should encourage the use of EnergyStar rated refrigerators, dishwashers, and clothes washers as part of any appliance replacement. EnergyStar® appliances save water, energy, and money. EnergyStar is a joint program of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE). It is a voluntary labeling program that aims to reduce greenhouse gas emissions by helping consumers to purchase the most energy-efficient products available. EnergyStar sets standards for energy efficiency that roughly target the upper 20 percent of current off-the-shelf technologies. Products that meet the energy efficiency requirements are eligible for the EnergyStar label. In addition to saving energy, many qualified products also save water. The planned rehabilitation project should include replacement of all refrigerators within the dwelling units and community room. In addition, the community room dishwasher should be replaced. The recommendation is made to ensure that EnergyStar compliant refrigerators be installed. Electric ranges are not rated by EnergyStar.

Observations/Comments:

- None of the kitchen appliances are original. Apartment appliances are reportedly replaced on an "as needed" basis. It was reported that 90% of the refrigerators are two to three years old with the remaining at five to six years old. The ranges are approximately ten to 15 years old.
- The majority of the refrigerators are Energy Star rated. Based on their estimated Remaining Useful Life (RUL) and their observed condition, the refrigerators will require replacement during the reserve term.
- A payback analysis was completed for replacement of the existing refrigerators with Energy Star rated refrigerators. The payback period is 2.1 years and early replacement is not recommended for the older and newer units. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The ranges appear to be well maintained. Based on their estimated Remaining Useful Life (RUL) and their observed condition, the ranges will require replacement during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.

3.7.2.3 Interior Finishes

The following table generally describes the interior finishes in apartment units:

Typical Apartment Finishes			
Room	**Floor**	**Walls**	**Ceiling**
Living room	Carpet	Painted drywall	Painted drywall
Kitchen	Vinyl tile	Painted drywall	Painted drywall
Bedroom	Carpet	Painted drywall	Painted drywall
Bathroom	Ceramic tile	Painted drywall with ceramic tile tub or shower surround	Painted drywall

The interior doors in each apartment unit are painted hollow-core wood doors set in wood frames. Wardrobe closets are accessed by sliding doors.

Green Physical Condition Discussions: Flooring products may emit formaldehyde and other VOCs. As part of any flooring replacement, specify flooring products that have been tested and approved for low emissions according to the California "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers," also known as Specification 01350. Any adhesives used in installing flooring materials should be under 50 gm/VOCs). This measure will improve indoor air quality for occupants and reduce environmental damage associated with VOCs. In addition, to improve indoor air quality, alternate flooring materials should be explored (e.g. natural linoleum, bamboo, wool, natural grasses/fibers and ceramic tile). Vinyl flooring is often referred to as "linoleum;" however, does not feature the same physical properties of linoleum. The use of natural linoleum will reduce replacement costs, increase durability, and minimize the impact on the environment. Natural linoleum is made from rapidly renewable materials including linseed oil (from flax), powdered wood and/or cork, ground limestone, resin binders, and dry pigments with a natural jute fiber backing. Where carpet is installed or replaced,

specification of low-VOC carpet (Carpet and Rug Institute (CRI) "Green Label"), and a "green" installation method (e.g. no adhesives for carpet padding or carpet, air changes after installation, etc.) is recommended.

Observations/Comments:

- The residential units are typically renovated upon tenant turnover. The renovation generally consists of floor finish cleaning or replacement, interior painting, general cleaning, and repair or replacement of any damaged items.
- The interior finishes in the apartment units are not original. Apartment 2B bathroom ceiling is covered in suspect mold; although, none is on the walls. Based on estimated Remaining Useful Life (RUL), apartment unit painting will be required during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.
- The floor coverings in the apartment units are worn with isolated staining. Based on their estimated Remaining Useful Life (RUL), the carpet and vinyl flooring will require replacement during the reserve term. The recommendation is made for future improvements and replacement to use linoleum with no-VOC adhesive. The property is converting to all vinyl flooring as units turnover. The cost for this work is included in the 20 Year Reserve Schedule as a Rehab Item.
- The interior doors and door hardware are in good to fair condition requiring routine maintenance.

3.7.2.4 In-Unit Electrical Service and Lighting

Item	Description	Action	Condition
Apartment Service Size	60-Amps, 120/240-Volt, single-phase, three-wire, alternating current (AC).		
Electric Equipment	Circuit breaker panels at each apartment	RM	Good
Wiring	Copper wire in non-metallic sheathed cable	RM	Good

Lighting fixtures in the apartments are a mixture of residential-style fixtures. The following table describes the lighting configuration in each apartment unit type.

Apartment Unit Lighting (Bulbs)				
Apartment Unit Type	**Incandescent (60 Watt)** Fixtures/Bulbs	**Incandescent (40 Watt)** Fixtures/Bulbs	**Fluorescent (CFL, 75 Watt)** Fixtures/Bulbs	**Fluorescent Linear** Fixtures/Bulbs
1-Bedroom	-	-	4 CFL (LR, K, BA, entry hall)	-
2-Bedroom	-	-	4 CFL (LR, K, BA, entry hall)	-

Apartment Unit Lighting (Bulbs)				
Apartment Unit Type	**Incandescent (60 Watt)** Fixtures/Bulbs	**Incandescent (40 Watt)** Fixtures/Bulbs	**Fluorescent (CFL, 75 Watt)** Fixtures/Bulbs	**Fluorescent Linear** Fixtures/Bulbs
TOTALS	**0**	**0**	**396**	**0**

An intercom system located in each unit provides remote access at the front entry.

Ground fault circuit interrupters (GFCI) were observed in the kitchen and bathroom in each unit.

Observations/Comments:

- The electrical service to the tenant units is adequate. The observed wiring was copper.
- The interior light fixtures appeared to be in good condition. Based on the Estimated Useful Life and the observed conditions, replacements are recommended during the reserve term. Replacement of bulbs is the responsibility of the tenants or routine maintenance.
- The intercom system is still in use by the residents. Equipment testing is beyond the scope of an RPCA. Based on the Estimated Useful Life and the observed conditions, replacements are recommended during the reserve term. The cost for this work is included in the 20 Year Reserve Schedule as a Reserve Item.

3.8. OTHER STRUCTURES

Not applicable. There are no major accessory structures.

4. CODE COMPLIANCE AND ACCESSIBILITY

4.1. ENERGY CONSERVATION CODE REVIEW

The Energy Conservation Code applies to new construction and is utilized as minimum requirement standard. The methodology of this report offers assurance that recommended "green" replacements exceed the requirements of the local energy conservation code.

The 2009 version of the New Jersey Energy Conservation Construction Code was formally adopted on September 7, 2010. All projects permitted after this date will require compliance with the code. The ECCC is based upon the 2009 version of the International Energy Conservation Code (IECC). Based upon the current interpretation of the IECC, and the original date of construction of the property built in 1982, regulations regarding energy efficiency cannot be retroactively applied to the property. However, the recommended green replacements within the 12-month repair schedule of this report exceed the performance requirements set by the IECC as outlined in the following table:

Energy Conservation Code (ECC)			
Equipment Type	**Subcategory or Rating Condition**	**Local ECC Minimum Efficiency**	**EMG Green Replacement Recommendation**
Heating	Gas Furnace	90% AFUE	AFUE > = 95 or EnergyStar Rated
Cooling	Central Air-conditioning	13 SEER	>13 SEER or EnergyStar
Appliances	Appliances	No Standard	EnergyStar Rated
Insulation	Ceiling /Attic	R Value 38	R Value 40 and meet 2009 IECC & Amendments
Insulation	Floor above crawlspace or unfinished basement	R Value 30	R Value 38 and meet 2009 IECC & Amendments
Window	Double Glazed	U Factor 0.35	U factor < = 0.30 or EnergyStar Rated

Energy Conservation Code (ECC)			
Equipment Type	**Subcategory or Rating Condition**	**Local ECC Minimum Efficiency**	**EMG Green Replacement Recommendation**
Water heater	Natural Gas	In accordance with prevailing federal minimum standards	EnergyStar Rated
Water heater	Electric	In accordance with prevailing federal minimum standards	Energy Factor > = 0.82 or a thermal efficiency of at least 90%.

4.2. BUILDING, ZONING, AND FIRE CODE COMPLIANCE

According to the New Jersey state Bureau of Housing Inspection, the Bureau does not have an annual inspection program for the Housing Authority. The Housing Authority performs self-inspections. A copy of the original Certificates of Occupancy were requested but were not available.

According to Phil Fucetola at the Lyndhurst Building and Planning Department, code compliance information can only be obtained through submission of a written request under the Freedom of Information Act (FOIA). A request was submitted, and a copy of the request is included in Appendix E. Significant information will be forwarded upon receipt.

According to Robert Ferrara of the Lyndhurst Fire Prevention Bureau, there are no current fire code violations on file. The department inspects annually and the last inspection occurred on July 23, 2013.

According to the Flood Insurance Rate Map, published by the Federal Emergency Management Agency (FEMA) and dated September 30, 2005, the property is located in Zone X, defined as an area outside the 500-year flood plain with less than 0.2% annual probability of flooding. Annual Probability of Flooding of Less than one percent.

According to the 1997 Uniform Building Code Seismic Zone Map of the United States, the property is located in Seismic Zone 2A, defined as an area of low to moderate probability of damaging ground motion.

4.3. ACCESSIBILITY

Section 504 of the Rehabilitation Act of 1973 is a Federal accessibility law that was enacted on June 2, 1988. Section 504 applies to multi-family properties that have or are currently receiving funding from a Federal source. In the case of new construction, substantial rehabilitation (15 or more units with the cost of alteration is 75 percent or more of the replacement cost of the completed facility), and Other Alterations (modernizations and alterations to the property), the property must have a minimum of five percent mobility accessible units and two percent of the units for visual / audio hearing impairments. The percentage can be increased by HUD involved at their discretion. In the case of Other Alterations, exceptions can be considered due to undue financial burdens or structural restrictions. However, the exceptions do not relieve the recipients from compliance utilizing other units/buildings or other methods.

Reasonable Accommodations as described in 24 CFR 8.4(b)(i), 8.24 and 8.33 are described as follows: When a family member requires an accessible feature(s) or policy modification to accommodate a disability, property owners must provide such feature(s) or policy modification unless doing so would resulting in a fundamental alteration in the nature of its program or result in a financial and administrative burden.

The Uniform Federal Accessibility Standard (UFAS) 24 CFR part 40 was adopted by HUD and made effective October 4, 1984. The UFAS applies only to new construction or to alterations to the existing buildings. Alterations are defined as work that costs 50 percent or more of the building's value when the work performed occurs within a twelve month period.

The Fair Housing Amendments Act (FHA) of 1988 amended Title VIII of the Civil Rights Act of 1968 to aid in the prohibitions against discrimination in housing on the basis of disability and familial status. The Fair Housing Act also made it unlawful to design and construct certain "covered multi-family dwellings" for first occupancy after March 13, 1991, in a manner that makes them inaccessible to persons with disabilities. The Fair Housing Act also established design and construction requirements to make such dwellings readily accessible to, and usable by, persons with disabilities.

Covered multi-family structures meeting the FHA criteria, and first occupied on or after March 13, 1991, are required to comply fully with FHA. Existing facilities constructed prior to this date are not addressed by FHA unless the property receives federal subsidies. EMG provides a general assessment of the property's construction as it pertains to FHA. EMG does not assess FHA accessibility as it pertains to discrimination against persons as outlined in the Civil Rights Act.

Fair Housing Act FHA requires that certain "covered multi-family buildings" be accessible. FHA indicates that all ground floor units on a property, be upgradeable to accommodate persons that are mobility impaired. The elements as defined by FHA for accessibility are outlined on EMG's Accessibility Checklist included in the Appendices.

Generally, Title III of the Americans with Disabilities Act (ADA) prohibits discrimination by entities to access and use of "areas of public accommodations" and "commercial facilities" on the basis of disability. Regardless of their age, these areas and facilities must be maintained and operated to comply with the Americans with Disabilities Act Accessibility Guidelines (ADAAG).

Buildings completed and occupied after January 26, 1992 are required to comply fully with ADAAG. Existing facilities constructed prior to this date are held to the lesser standard of complying to the extent allowed by structural feasibility and the financial resources available; otherwise a reasonable accommodation must be made.

During the RAD PCA, a limited visual observation for accessibility was conducted. The scope of the visual observation was limited to those areas set forth in the EMG Accessibility Checklist provided in Appendix F. It is understood by the Client that the limited observation described herein does not comprise a full Accessibility Compliance Survey, and that such a survey is beyond the scope of EMG's undertaking. Only a representative sample of areas were observed and, other than as shown on the accessibility checklist, actual measurements were not taken to verify compliance.

Based on the date of construction, 1981, the accessibility standards that apply to the Project are 504 and the ADA Guidelines. However, as the property is not new construction, or completing substantial rehabilitation or other rehabilitation, the property is only required to complete reasonable accommodations. Property management stated that Section 504 requests are completed on an individual case-by-case basis. Based on EMG's observations and interview of the Property Manager, the property is generally compliant with Section 504. Presently, over five percent of the units are accessible for individuals with mobility impairments according to property management. There are approximately eight units at present which have visual / audio modifications, thus exceeding the two percent accessible requirements of 504.

Based on EMG's observations, the facility did not appear to be accessible with ADA. Elements e observed at the property that were not accessible are as follows:

Parking

- Signage indicating accessible parking spaces for cars and vans was not provided. The signage is mounted at a non-compliant height.

  Estimated Cost: 2 @ $100 each = ... $200

Exterior Accessible Route

- Access aisles adjacent to parking spaces, crossing hazardous vehicle areas, and from main roadways or public transportation stops to the accessible building sidewalks and entrances are not provided. The front stall does not have adequate width between the sidewalk and the ramp. The two stalls in the rear are to be the designated standard and van stalls.

  Estimated Cost: 40 LF @ $5 LF = ... $200

Common Area Accessible Route

- The automated door opener reportedly does not allow enough time for entry.

  Estimated Cost: 2 @ $870.75 each = ... $1,741.50
- Stair handrails do not extend beyond the top and bottom risers.

  Estimated Cost: 22 landings @ $350 each = ... $7,700
- Compliant signage indicating accessible entrances and general information is not provided. No ADA signage on the common area restrooms is provided.

  Estimated Cost: 2 @ $55 each = ... $110

A full Accessibility Survey may reveal further aspects of the facility which are not in compliance.

The cost to address the achievable items noted above is included as an Accessibility item in the Rehab Cost Tables. These corrective actions are not design standards and should not be interpreted as all inclusive. Building and structural design elements need to be reviewed by a local licensed architect or professional engineer for appropriate remedial action.

4.4. INDOOR AIR QUALITY AND MOLD

EMG performed a limited visual assessment of indoor air quality improvement opportunities in readily accessible interior areas of the property. EMG recommends that property owners and tenants consider implementing the following methods to improve indoor air quality:

- Utilize non-toxic cleaning products can often be made with products you already have in your home, including baking soda, vinegar, and lemon juice
- Designate an outside area, away from doors, windows, and air intakes for your HVAC system for smoking
- Minimize allergy and asthma triggers from pests like cockroaches and mice, keep food tightly sealed, and allow eating only in certain areas. Clean those areas daily.
- When dusting, wipe down surfaces with a damp cloth to keep the dust down. Mop regularly.
- Carpets hold a lot of dust and can also hold moisture. Clean up spills immediately and get the area very dry to reduce the possibility of mold growth.
- If you have hardwood floors or other smooth surfaces underneath the carpet, consider removing carpeting completely.
- Eliminate "dust catchers" from sleeping areas. These include fabric curtains, and stuffed animals.
- Plants can purify some toxins from the air, but also can hold a lot of dust, and if overwatered, mold. Dust your plants regularly and don't overwater. Remove plants from rooms where sensitive individuals spend a lot of time, especially the bedroom.
- Wash bedding at least weekly in hot water to eliminate dust mites. Cold water washes designed to eliminate dust mites can also be found in online stores.
- Check your temperature and humidity levels. High temperatures and humidity levels can lead to mold growth.
- Consider carpeting that comes from sources that are naturally void of VOCs and other toxins. Moving away from petrochemical-based products, even if they are recycled, and are using natural fibers such as wool, jute, sisal, hemp, or coir (from coconut husks) benefit both environmentally-sensitive tenants and the environment.
- Install rubber "walk-off" mats or rugs for inside or outside of apartment unit doorways that can be washed in hot water (to eliminate dust and other particulate).
- Install rubber stair treads on common area stairways that can be easily swept, vacuumed and washed to eliminate dust and other particulate.

EMG performed a limited visual assessment for the presence of mold, conditions conducive to mold, and evidence of moisture in readily accessible interior areas of the property. EMG did not note obvious visual indications of the presence of mold, conditions conducive to mold, or evidence of moisture in readily accessible interior areas of the property. No further action or investigation is recommended regarding mold at the property.

EMG performed a limited visual assessment for the presence of mold, conditions conducive to mold, and evidence of moisture in readily accessible interior areas of the property.

Suspect mold growth was observed in the following areas:

- Closet ceiling of unit 5N. The area affected by the moisture was approximately one square feet in size.
- Bathroom of 2B. The area affected by the moisture was approximately 35 square feet in size.
- North end of corridor at 5th floor supply vent. The area affected by the moisture was approximately one square feet in size. It was reported that the area of mold is much more prevalent and may affect the southern end of the corridor and within the adjacent apartments as well.

Remediation can be conducted by properly trained building maintenance staff. In addition, the source of this moisture should be addressed in order to prevent future mold problems. The estimated costs of corrective action are of a minimal quantity, and consequently, are considered to be part of routine maintenance operations. No other costs are included in the tables. If the mold is of an area larger than observed, prior to remediation by personnel specifically trained in the handling of hazardous materials, a mold assessment should be conducted by a health and safety professional with experience performing microbial investigations. The estimated costs of corrective action shall be determined as part of the mold assessment recommended. The estimated costs of corrective action are not included in the tables at this time.

Observations/Comments:

- EMG recommends installing rubber "walk-off" mats or rugs for inside or outside of apartment unit doorways that can be washed in hot water (to eliminate dust and other particulate). Wash the mats regularly and install a durable mat outside, in front of main building entry doorways. The cost for this work is included in the 20 Year Reserve Schedule as a Green Significant Addition.

4.5. FOLLOW UP RECOMMENDATIONS

Conditions observed require the following detailed studies:

- Unit 5C was reported to have inadequate heat. The heating pipes are constricting and expanding and making noises. The pipes are bled weekly if not more at times. A leak is assumed to be in the system.
- Suspect mold in 2B and 5N and on duct vent on north end of 5th floor corridor. Due to the mold reported to be larger than observed, mold assessment should be conducted by a health and safety professional with experience performing microbial investigations is recommended.

Cost allowances for these studies are included in the Critical Repairs cost estimate.

5. ENVIRONMENTAL CONCERNS

The Environmental Restrictions Checklist was completed by an EMG Registered Architect or Professional Engineer through interviewing a knowledgeable person associated with the Project (e.g., a Project manager, maintenance person or owner who has been involved with the Project for a sufficient period of time so as to be familiar with any environmental issues); followed by a walk-through assessment, providing a cursory observation of representative areas of the Project and surrounding properties viewed from the Project. The information provided by the knowledgeable person associated with the Project is assumed to be complete and correct.

Based solely upon review of the information obtained from the Environmental Restrictions Checklist, the following is a discussion of the positive response:

Based on review of this information, further inquiry is needed to assess the environmental conditions for the purposes of appropriate inquiry.

The electric utility company, PSE&G should be contacted due to the construction of the property in 1981 and before the 1984 cut off of using PCB's in transformers.

RAD Environmental Restrictions Checklist

Project Name and Location (Street, City, County, ST, Zip Code):	**Owner Name, Address (Street, City, ST, Zip Code), and Phone:**
Carucci Apartments 281 Stuyvesant Avenue Lyndhurst, New Jersey 07071	Housing Authority of Bergen County One Bergen County Plaza, Floor 2 Hackensack, New Jersey 07601 201.336-7624 George Stavrou

Project Description:

The multi-family property has one, five-story apartment building containing a total of 99 rental apartment units on a site of approximately 0.89 acres. Construction of the property was completed in 1981.

ENVIRONMENTAL REVIEW FINDINGS	**YES**	**NO**
FLOOD PLAIN		
Is the project located in a FEMA Special Flood Hazard Area?		√
Identify Map Panel and Date: Map #34003C0235G, September 30, 2005		
Does the project currently carry Flood Insurance?		√
Do any structures appear to be within or close to the floodplain.?		
HISTORIC PRESERVATION		
Is the property listed on the National Register of Historic Places?		√
Is the property located in a historic district listed on the National Register of Historic Places?		√
Is the property located in a historic district determined to be eligible for the National Register?		√

AIRPORT HAZARDS		
Is the project located in the clear zone of an airport? (24 CFR Part 51 D).		√
HAZARDOUS OPERATIONS		
Is there any evidence or indication of manufacturing operations utilizing or producing hazardous substances (paints, solvents, acids, bases, flammable materials, compressed gases, poisons, or other chemical materials) at or in close proximity to the site?		√
Is there any evidence or indication that past operations located on or in close proximity to the property used hazardous substances or radiological materials that may have been released into the environment?		√
EXPLOSIVE/FLAMMABLE OPERATIONS/STORAGE (24 CFR Part 51C)		
Is there visual evidence or indicators of above ground storage tanks (fuel oil, gasoline, propane etc.) or operations utilizing explosive/flammable material at or in close proximity to the property?		√
FOR YES RESPONSES, SUMMARIZE RESTRICTIONS BELOW:		

ENVIRONMENTAL REVIEW FINDINGS	YES	NO
TOXIC CHEMICALS AND RADIOACTIVE MATERIALS		
Petroleum Storage		
Is there any evidence or indication of the presence of commercial or residential heating activities that suggest that underground storage tanks may be located on the property?		√
If yes, are any such tanks being used? If yes, indicate below whether the tank is registered, when it was last tested for leaks, the results of that test, and whether there are any applicable state or local laws that impose additional requirements beyond those required under federal law.		
Are there any out-of-service underground fuel storage tanks? If yes, indicate whether the tank was closed out in accordance with applicable state, local and federal laws.		√
Is there any evidence or indication that any above ground storage tanks on the property are leaking?		√
Polychlorinated Biphenyls (PCB)		
Is there any evidence or indication that electrical equipment, such as transformers, capacitors, or hydraulic equipment (found in machinery and elevators, installed prior to July 1, 1984) are present on the site?	√	
If yes, is any such equipment (a) owned by anyone other than a public utility company; and (b) not marked with a "PCB Free" sticker?		√
If yes, indicate below whether such equipment has been tested for PCBs, the results of those tests, and (if no testing has been performed) the proposed testing approach. (Electrical equipment need not be tested but will be assumed to have PCBs) – **Multiple calls to PSE&G were unsuccessful.**		
If PCBs are found in non-electrical equipment over 50ppm it must be replaced or retrofitted, otherwise any equipment with PCBs or assumed to have PCBs require an O&M Plan.		

Asbestos-containing Materials (ACM)		
Is there any evidence or indication of ACM insulation or fire retardant materials such as boiler or pipe wrap, ceiling spray, etc. within the buildings on the property? If yes, the property is required to have an Operations and Maintenance Plan for asbestos-containing materials.		√
Lead Based Paint		
Are there residential structures on the property that were built prior to 1978?		√
If yes, has the property been certified as lead-free?		
If property has not been certified as lead-free, has a Risk Assessment been completed?		
If yes, has the owner developed a plan including Interim Controls to address the findings of the Risk Assessment including Tenant notifications and an Operations and Maintenance plan?		
If yes, has a qualified Risk Assessor reviewed the Owner's plan and O&M plan for compliance with 24 CFR 35?		
OTHER RESTRICTIONS		
Are there any other restrictions, including easements, on this property that you are aware of (other than those included above) (e.g. pipeline, aviation, microwave, utility, rights of way (ROW), ingress/egress etc.)		√
FOR YES RESPONSES, SUMMARIZE RESTRICTIONS BELOW:		
Transformers potentially containing PCB's are located on the Project. Based on information provided by the utility company, the transformers may contain PCB's. As such, EMG recommends that an Operations & Maintenance Program be implemented. No costs are included for PSE&G to investigate if the transformer should be replaced. Contacted Joe Walsh at PSE&G 201.330.6532 and left message regarding whether the transformer has been tested for PCB's. Pertinent information will be forwarded upon receipt. The utility company should be contacted to verify if the on site transformer was manufactured after July 2, 1979 and does not contain PCB's		

6. GREEN BUILDING PRINCIPLES

Green Building or sustainable building is the practice of reducing the impact of buildings on the environment, both during construction and as part of the operation of the building systems. Their use of water, energy, and materials should be reduced through the use of new planning methods and material usage.

EMG's goal was to identify all opportunities to: 1) improve energy efficiency, 2) minimize water use, 3) use recycled or recyclable materials, 4) protect the indoor air quality, 5) reduce the 'carbon footprint' of the buildings and site, and 6) proper disposal of replaced materials.

The available Green Building Alternatives have been evaluated and are described in terms of cost and specification in the Mark to Market Underwriting tool. Where available, the Green Alternatives evaluated exceed the requirements of the current local energy conservation code. We compare the cost of traditional replacements and compare them to "green" replacements. The anticipated benefits of green approaches are discussed along with increased short term costs for the long term benefits of choosing "Green" or sustainable alternatives.

PART II – ENERGY AUDIT

1. EXECUTIVE SUMMARY

The Client contracted with EMG to conduct an Energy Audit consisting of field observations, utility review, benchmarking, and energy saving recommendations for the subject property, Carucci Apartments located at 281 Stuyvesant Avenue in Lyndhurst, Bergen County, New Jersey 07071. The RPCA was performed on March 3, 2014.

The multi-family property has one, five-story apartment building containing a total of 99 rental apartment units on a site of approximately 0.89 acres. Construction of the property was completed in 1981.

On site amenities consist of a television room, community room with kitchen and laundry facilities.

Many of the items covered in the RPCA also provide useful information to the energy audit. In lieu of redundant reporting on these items, the following table provides report references to relevant items in the RPCA:

Component	PCA Report Reference Section	Comments
Insulation (Wall, Attic, and Basement)	4.1	New construction code requirements outlined in Section 4.1.
Exterior Doors	3.3.3	Energy Star replacements recommended at end of EUL.
Storm Doors	Not applicable	The property does not have storm doors.
Dishwashers	Not applicable	The property does not have dishwashers
Windows	3.3.3	Existing double hung windows are double paned. Entrance storefront windows and doors are single paned. Energy Star replacements recommended at end of EUL.
Sliding Glass Doors	Not applicable	The property does not have sliding glass doors.
Thermostats	3.4.2.1, 3.4.2.2	Setback thermostats not recommended for use in senior properties.
Domestic Water Heaters	3.4.1.1, 3.4.1.2	Water storage indirect water tanks - Energy Star replacements recommended at end of EUL.

Component	PCA Report Reference Section	Comments
Refrigerators	3.7.2.2	Replacement with Energy Star units recommended at end of EUL.
Water (Flow, Temperature)	3.4.1.2	Water testing outlined in section 3.4.1.2.
Ventilation	3.4.2.2	Replacement with Energy Star equipment recommended. See Green Comparison table.
Interior Lighting	3.7.2.4	CFL retrofit is in place in the apartments.
Common Areas	3.7.1.2	T-8 ballasts/bulbs recommended, Occupancy sensors recommended.
Exterior Lighting	3.2.6	Replace HPS wall packs with LED wall packs.
Furnaces – natural gas	3.4.2.1, 3.4.2.2	Property has one air handler in community room. Replacement with high efficiency model recommended. See Green Comparison table.
Boilers (natural gas)	3.4.2.1, 3.4.2.2	Replacement complete with high efficiency models. See Green Comparison table.
Heat Pump	3.4.2.1, 3.4.2.2	Property does not have heat pumps.
PTAC	3.4.2.1, 3.4.2.2	Property does not have PTAC units.
AC (thru-the-wall)	3.4.2.1, 3.4.2.2	Residents supply their own (up to 2) Office (3) and TV room - Replacement with high efficiency models recommended. See Green Comparison table.
Laundry Area	3.7.1	Energy Star washers with cold rinse restriction recommended – property owned.
Other Commercial Space	Not applicable	Property does not have commercial spaces. The community room and kitchen can be rented out to the community.
HVAC system conversion	3.4.2	System conversion not recommended.

Component	PCA Report Reference Section	Comments
Utility Rate Options	1.1 (Energy Audit)	Current utility rates were reviewed and appear acceptable. The existing utility rates are similar to the typical rates observed at similar properties.

2. UTILITIES & BENCHMARKING

2.1. UTILITY METERING

On site Utilities

The following is a summary of relevant information, addressed within the Utilities Data Sheet. See Section 3.2.7 for a listing of Utility Service providers.

Question	Answer
Water	
Identify the provider of water to the property.	Township of Lyndhurst Water Department
Is gray water or well water is used for some purposes	No
How is the water usage measured	Two meters for the entire building
Is the water paid by the residents via a separate meter?	No
Are there separate meters at the unit level	No
Is there a single water intake for each unit with unit specific water heaters	No
Where are the water meters physically located?	Basement adjacent to fire sprinkler riser
What is the number of water meters	Residential: 0 Common: 0 Master Meters: 2 Commercial: 0
Electric	
Are there any site generating activities to supplement (wind, solar)	No

Question	Answer
Electric	
What is the meter configuration? (How many covering what usage	One sub-meter per apartment unit Two master meters for the entire building
Is the electricity paid by the residents via a separate meter?	Yes
Where are the electric meters physically located?	Sub-meters located in meter bank room off each elevator lobby Master meters adjacent to switchgear in basement
Are property and residential unit use separately metered?	Yes
Are there unit level electric meters or unit level breaker boxes?	Yes
What is the number of electrical meters	Residential: 99 Common: 0 Mixed Residential & Common: 2 Commercial: 0
Heating Fuel	
How is the property heated?	Boilers with hydronic baseboards – apartments and TV room and office RTU's – corridors and elevator lobbies
What is the heat source	Natural gas
Are there individual heating units for each unit?	No - radiators
Are there individual meters for the heating fuel?	No

Question	Answer
Heating Fuel	
Are there separate heat sources for common areas/commercial areas?	Yes
Are all units/areas heated the same way?	No – see above
Is the heating fuel included in a utility paid by the tenant via a separate meter	No
For natural gas heat source, what is the number of heating fuel meters?	Residential: 0 Common: 0 Mixed Residential & Common: 1 Commercial: 0
Additional Utility Use Questions	
Are stoves electric or gas?	Electric
Are water heaters electric or gas?	Gas – domestic water storage indirect tanks
Are there individual unit water heaters?	No
Are there different utility uses by building (rental or office/community use) due to renovations or scattered sites?	No

2.2. UTILITY RATES

Based upon the utility information provided about the Carucci Apartments, the following energy rates were utilized in determining existing and proposed energy costs.

Electricity (Blended Rate)	Natural Gas	Water / Sewer
$0.12/kWh	$0.33/therm	$5.77/kGal

The data analyzed provides the following information: breakdown of utilities by consumption, cost and annual profile, baseline consumption in terms of energy/utility at the facility, the Energy Use Index, or Btu/sq ft, and cost/sq ft. For multiple water meters, the utility data was combined to illustrate annual consumption for each utility type.

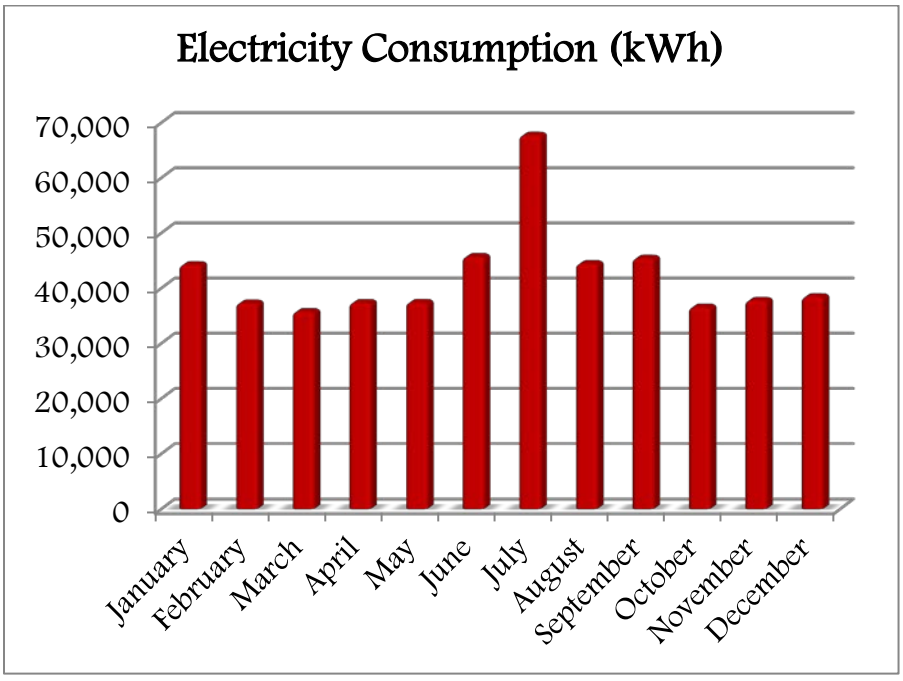
2.3. ELECTRICITY

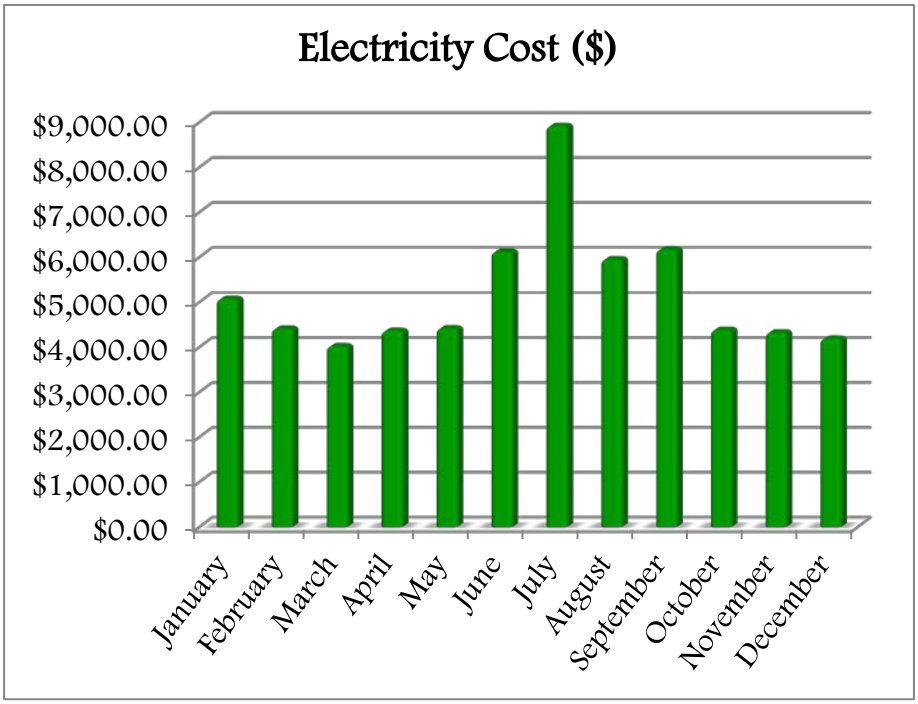
The electricity requirements of the facility are satisfied by **PSE&G**.

Based on the electric usage and cost information provided, the average price paid during the past 12 months was $0.12 per kWh. The total annual electricity consumption for the 12-month period analyzed is 508,184 kWh for a total cost of $62,335.57.

The following table details in monthly electricity consumption and cost for the property:

Billing Month	Consumption (kWh)	Unit Cost	Total Cost
January	44,256	$0.11	$5,072.05
February	37,301	$0.12	$4,409.35
March	35,748	$0.11	$4,018.81
April	37,378	$0.12	$4,360.35
May	37,405	$0.12	$4,416.04
June	45,712	$0.13	$6,121.45
July	67,740	$0.13	$8,918.30
August	44,434	$0.13	$5,952.66
September	45,429	$0.14	$6,171.69
October	36,572	$0.12	$4,382.62
November	37,766	$0.11	$4,324.96
December	38,444	$0.11	$4,187.31
Total	**508,184**	**$0.12**	**$62,335.57**


Electricity Consumption (kWh)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
January
February
March
April
May
June
July
August
September
October
November
December


Electricity Cost ($)
$9,000.00
$8,000.00
$7,000.00
$6,000.00
$5,000.00
$4,000.00
$3,000.00
$2,000.00
$1,000.00
$0.00
January
February
March
April
May
June
July
August
September
October
November
December

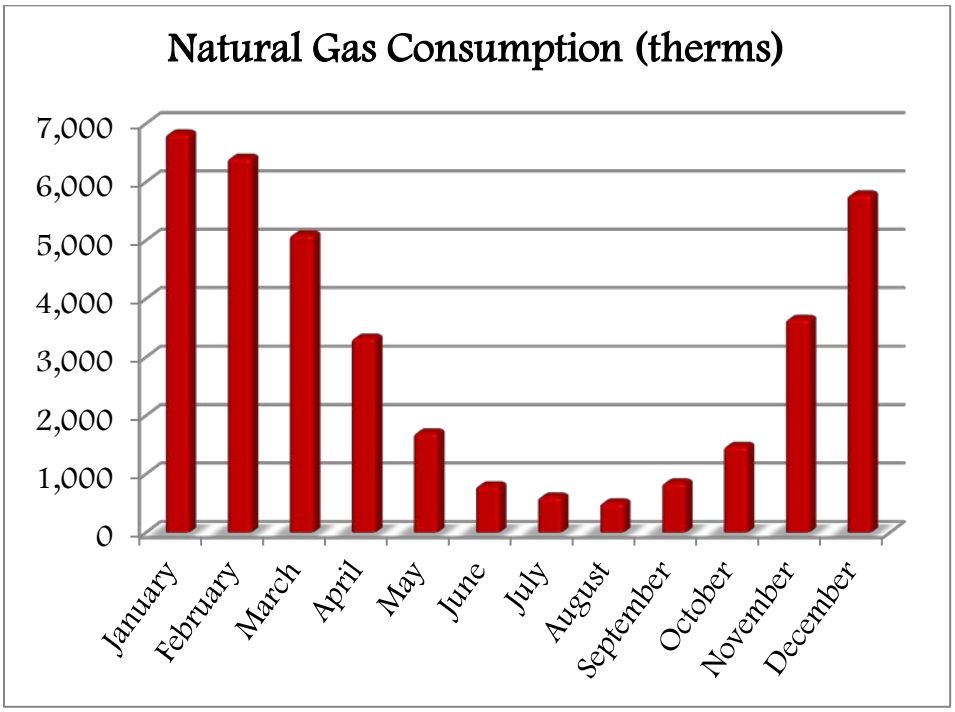
2.4. NATURAL GAS

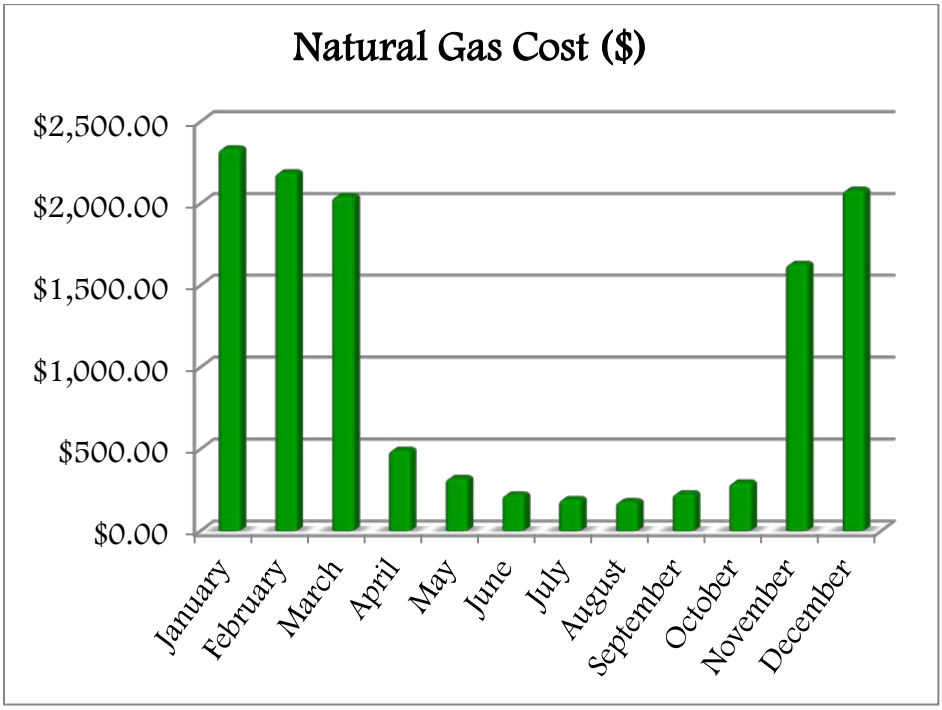
The natural gas requirements of the facility are satisfied by PSE&G.

Based on the provided natural gas usage and cost data, the average price paid during the past 12 months was $0.33 per therm. The total annual natural gas consumption for the 12-month period analyzed is 37,158 therms for a total cost of $12,202.83.

The following table details in monthly natural gas consumption and cost for the property:

Billing Month	Consumption (Therms)	Unit Cost	Total Cost
January	6,833	$0.34	$2,334.55
February	6,422	$0.37	$2,188.26
March	5,106	$0.40	$2,041.96
April	3,337	$0.15	$493.40
May	1,716	$0.19	$320.77
June	811	$0.27	$220.44
July	618	$0.31	$192.94
August	517	$0.35	$178.52
September	859	$0.26	$227.56
October	1,488	$0.20	$294.00
November	3,660	$0.45	$1,628.82
December	5,790	$0.36	$2,081.61
Total	**37,158**	**$0.33**	**$12,202.83**


Natural Gas Consumption (therms)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
January
February
March
April
May
June
July
August
September
October
November
December


Natural Gas Cost ($)
$2,500.00
$2,000.00
$1,500.00
$1,000.00
$500.00
$0.00
January
February
March
April
May
June
July
August
September
October
November
December

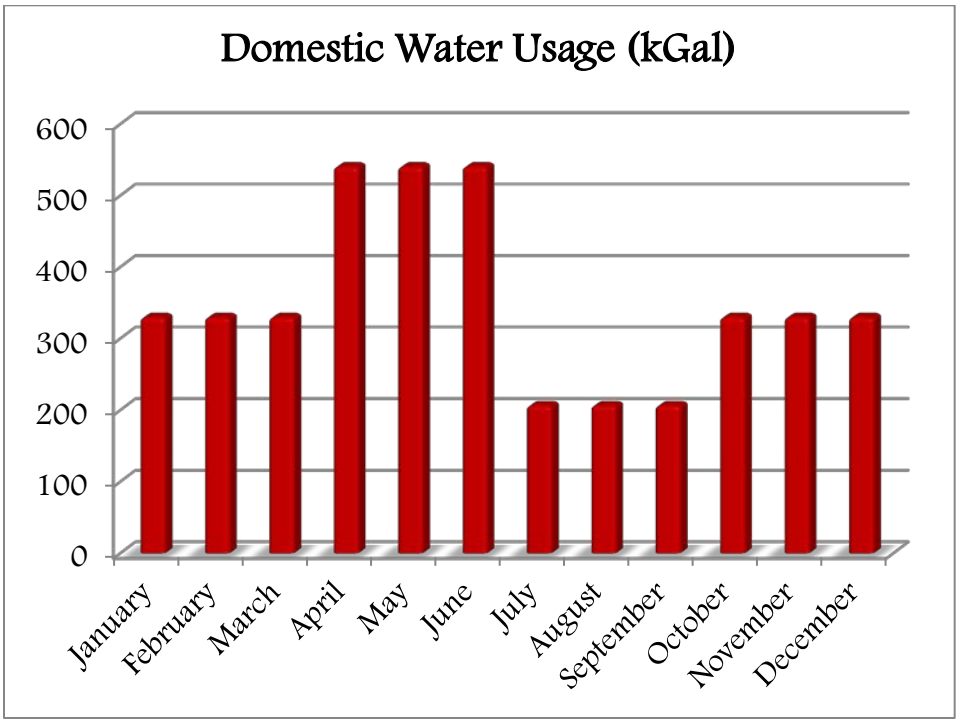
2.5. DOMESTIC WATER

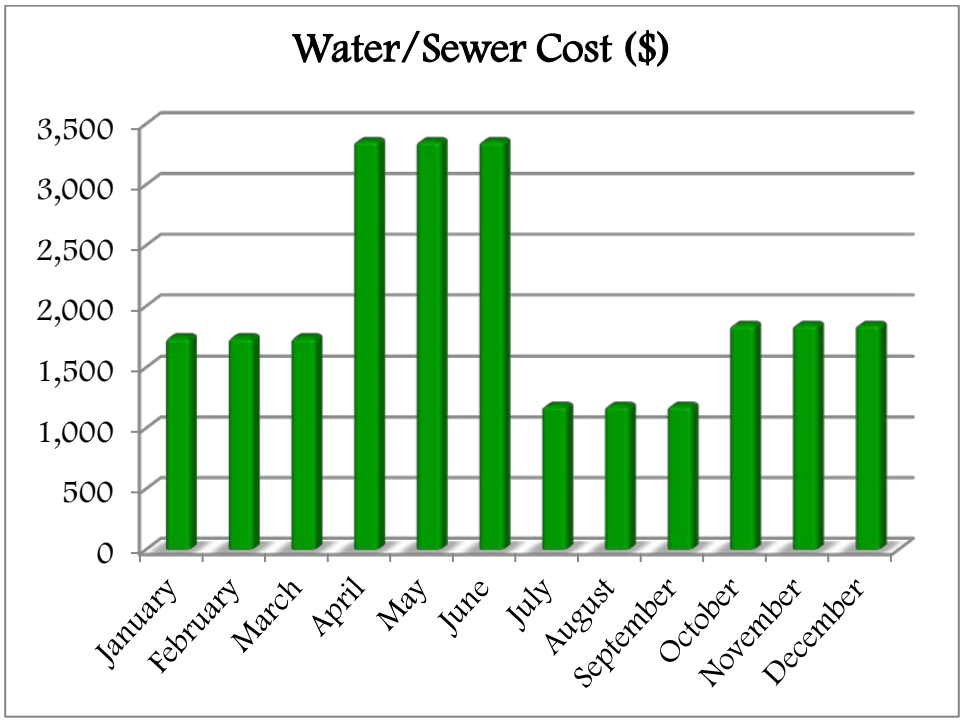
The domestic water requirements of the facility are satisfied by Township of Lyndhurst Water Department.

Based on the provided domestic water usage and cost data, the average price paid during the past 12 months was $5.77 per thousand gallons (kGal). Domestic water is billed on a quarterly basis. The total annual domestic water consumption for the 12-month period analyzed is 4,227 kGal for a total cost of $24,408.40.

The following table details in monthly domestic water consumption and cost for the property:

Start Date	Consumption (kGal)	Unit Cost	Total Cost
January	330	$5.28	1,745
February	330	$5.28	1,745
March	330	$5.28	1,745
April	541	$6.21	3,359
May	541	$6.21	3,359
June	541	$6.21	3,359
July	207	$5.72	1,185
August	207	$5.72	1,185
September	207	$5.72	1,185
October	330	$5.59	1,848
November	330	$5.59	1,848
December	330	$5.59	1,848
Total	**4,227**	**$5.77**	**$24,408.40**


Domestic Water Usage (kGal)
600
500
400
300
200
100
0
January
February
March
April
May
June
July
August
September
October
November
December


Water/Sewer Cost ($)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
January
February
March
April
May
June
July
August
September
October
November
December

2.6. BENCHMARKING

The following table lists the building's area and its total energy and cost indices. The total energy index is a measure of energy intensity, or annual energy usage per square foot of building area. Similarly, the energy cost index is a measure of annual energy costs per square foot of building area. This data is primarily used to measure a facility's energy intensity against that of other similar buildings. EMG researched data from the Energy Information Administration and reviewed the Energy Star Portfolio Manager Tool and found inapplicable information on subsidized rental housing. Based on EMG's experience and data from the Handbook of Energy audits, 7th edition by Albert Thumann, P.E., and C.E.M. and William J. Younger, C.E.M. published by the Association of Energy Engineers, the mix of similar housing units typically have an energy intensity of between 60 and 200 KBtu/SF/yr. Carucci Apartments is within this range.

Heated Area (SF)	Total Annual Cost Of Energy ($)	Energy Cost Intensity $/SF-Year	Total Energy Intensity (KBTU/SF-YR)
70,281	$74,539	$1.01	74.2

Although regression model-based benchmarking is not a perfect science, it serves as a good initial indication of whether a particular building or project currently uses more or less water than would normally be expected for that size and type of building in that climate.

The results from the utility analysis and the HUD Water Benchmarking Tool indicate that the subject property is slightly above the average benchmark for water consumption performance with 41 out of 100 as scored against peers.

HUD Residential Water Use Benchmarking Tool

For single-family, semi-detached, row/townhouse, multi-family walk-up and elevator buildings.

The HUD Residential Water Use Benchmarking Tool quantifies the performance of a user-defined building relative to the family of HUD residential buildings. A score of 75 denotes performance at the top 25th percentile of HUD residential buildings. A score of 50 denotes performance at the 50th percentile (in the middle) of HUD residential buildings. For definitions or help on the terms below, simply click on any underlined text. Click on "Return" text to come back to this page.

Directions: Provide entries in the gray spaces below with your building description and annual water consumption.

Building Description

ORNL 8/22/2007

Building Name: Carucci Apartments (optional entry)

5-digit Zip Code: 07071 Not Sure?

Mapping Location: Newark, NJ

	Gross Floor Area of Building(s) (ft2)	Building(s) is Single-Family Detached or Semi-Detached? (Y/N)	Is Residents Water Use Paid Directly by the PHA? (Y/N)	Number of Units in Building(s)	Number of Units in Building(s) with In-Unit Laundry Hookups or Central Laundry Access?	How Many Buildings share this Water Meter?
Building Description:	73,468	N	Y	99	99	1

Annual Consumption

Building Annual Water Use:	4,227,000	(gallons/year)
Building Annual Water Use Cost:	24,408	($/year)
Average Annual Water Cost:	$0.6	($/100 gallons)

Results

	Your Building	HUD Typical
Score Against Peers	41	50
Annual Water Use (gal/year)	4,227,000	3,599,995
Annual Water Use Intensity (gal/ft2-year)	57.5	49.0
Annual Water Cost Intensity ($/ft2-year)	0.33	0.28
Total Annual Water Cost ($/year)	24,408	20,787

The results from the utility analysis and the HUD Energy Benchmarking Tool indicate that the subject property is slightly below average for energy consumption performance with 49 out of 100 as scored against peers.

HUD Residential Energy Use Benchmarking Tool

For single-family, semi-detached, row/townhouse, multi-family walk-up, and elevator buildings.

The HUD Residential Energy Use Benchmarking Tool quantifies the performance of a user-defined building relative to the family of HUD residential buildings. A score of 75 denotes performance at the top 25th percentile of HUD residential buildings. A score of 50 denotes performance at the 50th percentile (in the middle) of HUD residential buildings. For definitions or help on the terms below, simply click on any underlined text. Click on "Return" to come back to this page.

***Directions**: **Provide entries in ALL the** grey spaces **that apply for your** Building Description **and** Annual Energy Consumption.*

Building Description

Preliminary: 9/17/07

Building Name	Carucci Apartments (optional entry)
5-digit Zip Code:	07071 Not Sure?
Mapping Location:	Newark, NJ
Heating Degree Days	4910
Cooling Degree Days:	1052

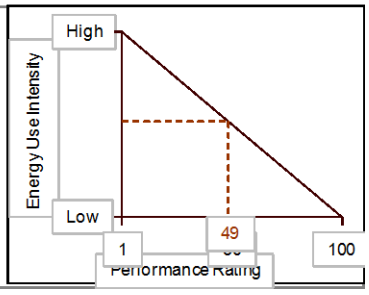
	Gross Floor Area (ft2)	Total Number of Units	Is This a Multifamily Building with Central Laundry? (Y/N)	Is this a Multi-Family Walkup Building? (Y/N)	Heated Floor Area (ft2)	Year Built
Building Description:	73,468	99	Y	N	70,281	1981

Annual Consumption

	Electricity	Gas	#2 Fuel Oil	#4 Fuel Oil	District Steam	District Hot Water	Propane
Select Units:	kWh	Therms	Gal	Gal	kLbs	MMBtu	Gal
Energy	508,184	37,158					
Cost ($)	62,336	12,203					
Calculated unit cost:	$0.12 $/kWh	$0.33 $/therm	$/gallon	$/gallon	$/klbs	$/kBtu	$/gallon

Results

	Your Building	HUD Typical
Score Against Peers	**49**	**50**
Building Site Energy Use (kBtu/year)	**5,449,724**	**5,387,659**
Site Energy Use Intensity (kBtu/ft2-year)	**74.2**	**73.3**
Energy Cost Intensity ($/ft2-year)	**1.01**	**1.00**
Total Annual Energy Cost ($/year)	**74,539**	**73,690**



3. LOAD SIZING

3.1. HVAC SIZING RESULTS

The majority of the ducting system for the forced air HVAC system is concealed by finished walls and ceilings. EMG was able to observe a limited amount of ducting in close proximity to the rooftop units and air handling unit. Based on the limited observations of the type and level of duct work installation materials and methods EMG suspects more than 6 percent leakage loss during heating and cooling seasons.

The following is the efficiency information on the existing heating system:

Location Serviced	Description	Estimated Efficiency
Corridors – north end	Trane RTU - 8.5 tons, 1996 - - YCH103B3L0DD	80%
Corridors – south end	American Standard RTU - 5 tons, 2002 - YSC060A3..	Approximately 79%
Elevator lobbies	Trane RTU -2 tons, 1996 - YCC024F1L0BC	80%
Community room	Air handling unit	Approximately 80%
Remaining areas of building including all apartments	Two boilers @ 750 MBH each	93.6%

The following is the efficiency information on the existing cooling system:

Location Serviced	Description	Estimated SEER Rating
Corridors – north end	RTU - Trane/American Standard RTU - 8.5 tons, 1996 - YCH103B3L0DD	9 EER
Corridors – south end	RTU - American Standard RTU - 5 tons, 2002 - YSC060A3..	10 SEER
Elevator lobbies	RTU - Trane - 2 tons, 1996 - YCC024F1L0BC	9 SEER
Community room	Air handling unit	NA

Manual J calculations estimate the building heat gain or loss based on the construction materials, level of insulation, door and window types and building orientation. The existing system appears to be appropriately sized based on the Manual J calculations. Future replacements should have an output rating that matches the current ratings.

Unit Type	Calculated Cooling Load	Calculated Heating Load
1 bedroom	1.2 tons	15,316 Btu/hr
2 Bedroom	1.3 tons	24,393 Btu/hr
Rental Office	0.8 tons	6,289 Btu/hr
Central System – heating only		

3.2. DOMESTIC WATER HEATER SIZING RESULTS

A sizing analysis was completed for the existing domestic water heating system, using Bradford-White's RightSpec® Sizing Software. The sizing analysis indicates that the existing equipment is appropriately sized for the projected hot water demands. It is recommended that the equipment be replaced with similar sized domestic water heaters.

The results of the analysis are summarized in the table below.

Equipment	Input Capacity	Storage Capacity
Existing Domestic Water Heating System	Boilers (2)	(6) 120-gallon indirect fired storage tanks

4. GREEN ENERGY TECHNOLOGY

4.1. SOLAR ENERGY FEASIBILITY

A photovoltaic array is a linked collection of photovoltaic modules, which are in turn made of multiple interconnected solar cells. The cells convert solar energy into direct current electricity via the photovoltaic effect. The power that one module can produce is seldom enough to meet requirements of a home or a business, so the modules are linked together to form an array. Most PV arrays use an inverter to convert the DC power produced by the modules into alternating current that can plug into the existing infrastructure to power lights, motors, and other loads. The modules in a PV array are usually first connected in series to obtain the desired voltage; the individual strings are then connected in parallel to allow the system to produce more current. Solar arrays are typically measured by the peak electrical power they produce, in watts, kilowatts, or even megawatts.

When determining if a site is suitable for a solar application, two basic considerations must be evaluated:

- At minimum, the sun should shine upon the solar collectors from 9 AM to 3 PM. If less, the application may still be worthwhile, but the benefit will be less.
- The array should face south and be free of any shading from buildings, trees, rooftop equipment, etc. If the array is not facing directly south, there will be a penalty in transfer efficiency, reducing the overall efficiency of the system.

Solar Arrays can be mounted on the ground and used as fencing, etc. or on the roof of a building. If the solar system is to be roof-mounted, a rough rule of thumb is that 200 to 400 square feet of roof space is needed for a 2 kilowatt (kW) installation. On flat surfaces (roofs or ground), tilted panel mounting can orient the PV panels to maximize energy generation and ensure visibility of the panels. The angle of the tilt is generally equal to the latitude of the location. Solar systems produce energy for as low 1.5-2¢ per kilowatt hour or $4-6 per million BTU delivered. Most electric utility customers spend about 7-15¢ per kilowatt hour ($20-44 per million BTU). Solar electricity costs about $10 to $12 a watt installed. Each standard solar panel is typically 4′ by 8′ and has a power generation capability between 185 watts/8 SF and 225 watts/8 SF. Typically, 200 watts/8 SF or 25 watts / SF are a good estimate to use.

Element	Response
Does the property have a south facing roof or available land of more than 250 square feet per required Solar Array Panel?	**Yes – flat roof**
Is the area free from any shading such as trees, buildings, equipment etc throughout the whole day?	**Yes**
Is the property in an area with acceptable average monthly sunlight levels? http://www.verdeenergy.com/InsolationMap.pdf	**Yes**

Element	Response
Has the roofing been replaced within the past 3-5 years?	**No**
Is the roof structure sufficient to hold solar panels?	**Yes & verify with contractor**
Is the property located in a state eligible for net metering? http://www.seia.org/research-resources/net-metering-state	**Yes**

Solar collectors gather the sun's energy, transform its radiation into heat, and then transfer that heat to water, solar fluid, or air. The solar thermal energy can be used in solar water-heating systems, solar pool heaters, and solar space-heating systems.

Most solar water-heating systems for buildings have two main parts: a solar collector and a storage tank. There are four main types of solar collectors, integral collector-storage collector, evacuated-tube collector, and most common collector is called a flat-plate collector. The flat-plate collector is mounted on the roof and it consists of a thin, flat, rectangular box with a transparent cover that faces the sun. Small tubes run through the box and carry either water or other freeze resistant fluid, such as an antifreeze solution, to be heated. The tubes are attached to an absorber plate, which is painted black to absorb the heat. As heat builds up in the collector, it heats the fluid passing through the tubes. The heated glycol circulates through seamless copper coils to a separate storage hot water tank. Water in the tank passes over the coils and is heated to be used for residential and commercial domestic hot water or potential space heating use through a custom design HVAC system.

Solar Hot Water Questionnaire	Response
Does the property have a south, east, or west facing roof or available land of more than 100 square feet per required Solar Collector Panel?	**Yes**
Is the area free from any shading such as trees, buildings, equipment etc throughout the whole day?	**Yes**
Can the collectors be mounted at an incline of roughly 25-45 degrees? (equal to latitude of property)	**Yes**
Is the property in an area with acceptable average monthly sunlight levels?	**Yes**
Has the roofing been replaced within the past 3-5 years?	**No**

Solar Hot Water Questionnaire	Response
Is the roof structure sufficient to hold solar thermal collectors?	**Yes & verify with contractor**
Does the property have a central domestic hot water system?	**Yes**
Is there potential for solar pool heating?	**Not Applicable**
Is sufficient mechanical room space available to fit additional solar hot water storage tanks?	**No**

The annual performance of a solar water heating system with a storage tank is dependent on system characteristics, solar radiation available, ambient air temperature and on heating load characteristics which require further in depth analysis.

4.2. WIND ENERGY FEASIBILITY

Wind energy (or wind power) refers to the process by which wind turbines convert the movement of wind into electricity. Winds are caused by the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth. Humans use this wind flow for many purposes: sailing boats, pumping water, and also generating electricity. Wind turbines convert the kinetic energy of the moving wind into electricity. A small wind energy system can provide a practical and economical source of electricity if all the following apply to the project:

Element	Response
Property has a good wind resource? *Based on a review of the windpower resource map at http://www.windpoweringamerica.gov/wind_maps.asp*	**No**
Project is located on at least one acre of land in a rural area?	**No**
Increased noise levels from the turbines is not a factor for the site and neighboring sites?	**No**
Project site has large amounts of undeveloped land that can be utilized for wind energy towers?	**No**

4.3. COMBINED HEAT AND POWER (CHP) FEASIBILITY

The average efficiency of the fossil-fueled power plants in the U.S. is 33% and has remained virtually unchanged for 40 years. This means that two-thirds of the energy in the fuel is lost as heat, and 8% of the remainder is lost in transmission and distribution over wires. Combined Heat and Power (CHP)–also known as "cogeneration"—is the sequential production of two or more useful forms of energy from a single fuel consuming device. CHP systems recycle waste heat and convert it to useful energy, and they can achieve overall efficiencies of over 80%.

CHP can significantly reduce a multi-family building's annual energy costs. Instead of buying all the building's electricity from a utility and separately purchasing fuel for its heating (mechanical) equipment, most–or even all–of the electricity and heat can be produced for less money by a small on site power plant operating at a higher combined efficiency. The best economic prospects for CHP are single buildings with at least 100 units, master metered for utilities, with access to natural gas. The type of CHP system commonly applied to multi-family housing uses a "prime mover," that is, a reciprocating engine similar to that found in a car or truck, or a microturbine, that drives a generator to produce electricity. The heat (thermal energy) produced by this process is recovered and used to produce hot water or steam, operate a chiller or serve as a desiccant, instead of being exhausted from the engine and transferred through the engine radiator. CHP systems also often lead to increased ability to handle electric loads during power outages.

The following is a preliminary analysis to explore if CHP is an option that should be further investigated for the project. If three are answered "yes," the next step in assessing the potential of an investment in CHP is to perform a Level 1 Feasibility analysis to estimate the preliminary return on investment. The EPA CHP Partnership offers comprehensive Level 1 analysis services for qualifying projects and can provide contact information to others who perform these types of analyses.

Element	Response
Project pays more than $.07/ kWh on average for electricity (including generation, transmission and distribution)?	**Yes**
Is there concern about the impact of current or future energy costs on the property?	**No**
Is your building located in a deregulated electricity market?	**Yes**
Are there concerns about power reliability? Is there a substantial financial impact to your building or residents if the power goes out for 1 hour? For 5 minutes?	**No**
Does the project have thermal loads throughout the year (including hot water, chilled water, hot air, steam, etc.)?	**Yes**
Does the building have an existing central plant?	**Yes**

Element	Response
Is there a plan to replace, upgrade or retrofit central plant equipment within the next 3-5 years?	**No**
Is there a plan for a significant building expansion or new construction project within the next 3-5 years?	**No**
Has the project already implemented energy efficiency measures and still have high energy costs?	**No**

4.4. GEOTHERMAL ENERGY FEASIBILITY

Geothermal systems utilize the relatively constant temperature of the earth as a heat synch to reject or absorb heat for a heating or cooling system. The predominant use of energy in such a system is the pumping energy used to circulate the fluid medium. Geothermal system configurations require wells to be bored into the ground to accommodate a pipe loop. A geotechnical survey of the property is required in order to estimate the cost of a geothermal installation. Generally multiple wells are required for multi-family applications and the costs become prohibitive if the electricity rate is reasonable.

4.5. FUEL CELL TECHNOLOGY

Fuel cell technology is in the early stages of development and to date is only being utilized in large commercial and industrial applications. EMG does not recommend the further exploration of fuel cell technology for the subject property based on high development cost, lack of technology for small scale applications and potential safety concerns in residential applications.

4.6. GREEN ENERGY TECHNOLOGY RECOMMENDATIONS

Observations/Comments:

- Since there was a positive response to three or more of the preliminary Solar Energy analysis questions. EMG recommends assessing the potential of an investment in Solar Energy to estimate the preliminary return on investment. Consultation with an installing contractor is recommended.
- Since there was a negative response to preliminary Wind Energy analysis questions EMG concludes that further investigation of feasibility is not warranted at the subject property.
- Since there was a negative response to three or more of the preliminary CHP analysis questions, EMG concludes that further investigation of feasibility is not warranted at the subject property.
- Geothermal systems are not recommended for further study at this property. The cost of obtaining a geotechnical survey of the property and drilling the multiple wells required is likely prohibitive considering the reasonable electricity rate in the area.

- Since fuel cell technology is primarily used on large commercial and industrial applications, EMG concludes that further investigation of feasibility is not warranted at the subject property. No further action is needed at this time.

5. ENERGY CONSERVATION MEASURES

5.1. ENERGY CONSERVATION RECOMMENDATIONS

EMG has identified Energy Conservation Measures (ECM) for this property. The basis for an ECM recommendation is a payback of less than the remaining useful life of the system or component. Recommended energy efficiency improvements and the installed cost estimates for recommended energy efficiency measures are provided in the following table:

Priority	Brief description of ECM	Initial Investment	Annual Savings	Payback Period (yrs)	Component EUL (yrs)
2	Replace Fluorescent Fixtures in Common Areas with T-8 Bulbs & Electronic Ballasts	$9,828	$754	13.0	15
2	Replace Site Light Fixtures with High Efficacy LED Fixtures	$12,460	$331	10.1	15
2	Replace Site MH Light Fixtures with High Efficacy LED Fixtures	$3,560	$139	4.4	15
1	Seal and Insulate Ducts	$1,260	$1,215	1.0	30
3	Replace Older Inefficient Air Conditioners- 2 ton units	$14,625	$1,191	12.3	15
2	Replace Older Inefficient Window ACs- 12060 Btuh units	$1,508	$243	6.2	15
3	Replace Existing Washing Machines With Energy Star Certified Washing Machines	$12,250	$3,070	4.0	15
2	Replace Older Plumbing Fixtures with Low Flow Devices	$39,701	$4,997	7.9	20

5.2. ENERGY CONSERVATION DESCRIPTIONS

The following descriptions provide a summary of each energy savings recommendation, along with specific implementation considerations for Carucci Apartments. These energy conservation measures are recommended for implementation as part of the Green Rehabilitation Significant Additions.

ECM: Seal and Insulate Ducts

In buildings with forced-air heating (or cooling) systems, warm (or cold) air is distributed to each room through flexible or sheet metal ductwork. The air travels from the furnace, heat pump, or air conditioner through a supply duct to each room, and it returns to the furnace or heat pump through a return duct to be heated (or cooled) again.

Forced-air distribution systems can lose energy in two ways. First, uninsulated ducts running through unconditioned spaces such as basements, crawlspaces, and attics loose energy through conduction. Second, ducts lose energy through leaks, or convection. Studies show that duct leaks typically raise a home's heating and cooling costs by 20-30 percent. That figure can double in homes where ducts are not insulated. When supply ducts leak to an unconditioned space, less air reaches the room or apartment. To make matters worse, because not enough air is reaching the conditioned space, the room or apartment may become depressurized, which causes outside air to rush into the space through any path it can find, such as around windows or doors. The furnace (or air conditioner) then has to work harder to heat or cool the space.

When return ducts have leaks, air from unconditioned spaces enters the return duct, reducing the amount of heated (or cooled) air that can enter it through the return grille. Because air cannot leave the room through the grille, the room or apartment becomes pressurized, and the air, seeking another escape route, squeezes its way to the outside. Not only do leaky return ducts waste energy, but they can cause indoor air quality problems as fumes from combustion appliances, vapors from household cleaners stored in the basement, and soil gases such as methane enter the conditioned space.

To cut energy waste, ducts should be sealed to eliminate any leaks, and then wrapped with insulation. The first step to sealing ducts is to diagnose where the leaks are. This process requires diagnostic tools such as blower doors or pressurization devices and should be done by experienced technicians.

This ECM recommends sealing and insulating the ductwork connecting to the rooftop units at the property. Refer to the ECM Worksheet in Appendix C for energy savings calculations.

ECM: Replace Inefficient Air Conditioners

Due to age or lack of proper maintenance, or both, older air conditioners may not operate as efficiently as they did when they were new. In addition, technological developments have produced great advances in air-conditioning efficiency, making many older air-conditioning systems obsolete. Replacing older air-conditioning units can generate substantial electricity and cost savings for the housing authority.

This ECM recommends replacement of rooftop units at the property. Replacements should include energy efficient rooftop units. Refer to the ECM Worksheet in Appendix C for energy savings calculations.

ECM: Replace Standard Fluorescent Lamps with Energy-Saving Lamps in Common Areas, and Install Electronic Ballasts in Common Areas

Developments that have relatively old fluorescent lighting in common areas can realize modest energy savings by simply replacing the existing fluorescent lamps (tubes) with energy saving lamps which use 10 to 20 percent less electricity. Energy-savings lamps are T12 size (1.5 inches in diameter) and are designed to replace older lamps of the same size. Additionally, a very common and effective lighting improvement is to replace old fluorescent lamps and ballasts with new T8 (1 inch in diameter) lamps and electronic ballasts. "ballast" is a device that all fluorescent lights require in order to turn on and give off light. The ballast controls the light output as well as the energy use. By replacing magnetic ballasts and existing fluorescent lamps with electronic ballasts and new fluorescent lamps, significant savings can be achieved.

This ECM recommends energy efficient light fixtures and bulbs at the property. Replacements should include replacing T12 fixtures with T8 or T5 fixtures. Refer to the ECM Worksheet in Appendix C for energy savings calculations.

ECM: Install Lighting Controls in Common Areas

In many developments, lights in common areas are left on regardless of whether they need to be, some staying on 24 hours a day. In some community areas and offices with windows, light from the outside can make full fluorescent lighting unnecessary for much of the day. In both cases, lighting controls can save energy by controlling the operation of fluorescent lights according to how much light is actually needed.

This ECM recommends additional occupancy sensors in the common areas at the property. Refer to the ECM Worksheet in Appendix C for energy savings calculations.

ECM: Convert Exterior Lighting Fixtures

In developments where mercury vapor, incandescent, or halogen exterior lighting fixtures illuminate exterior areas such as grounds or parking lots, substantial savings can be realized by converting these fixtures to high pressure sodium (HPS) or metal halide lighting. In addition, the color quality of both types of lighting is much better than that of mercury vapor lamps. In some cases, such as porch lights, compact fluorescent lamps may be the most appropriate replacement for incandescent lighting.

This ECM recommends replacing metal halide fixtures to LED fixtures at the property. Refer to the ECM Worksheet in Appendix C for energy savings calculations.

ECM: Install Energy- and Water-Efficient Washers

A typical clothes washer will cost more than $1,200 to operate over its lifetime, and has a significant impact on water and sewer costs. The national average for water and sewer costs is estimated to be $4.53 per 1000 gallons. This brings the total cost for water and sewer over the life of the clothes washer to be around $675. If your PHA's cost of energy or water exceed the national average, or if residents use clothes washers more frequently, consider purchasing high-efficiency, low-water-use clothes washers. Additionally, clothes washers impact the energy use of clothes dryers depending on how dry the clothes are after the spin cycle. Some high-efficiency clothes washers have faster spin speeds that remove more water, so less energy will be needed for drying.

In the past decade, the energy efficiency of standard top-loading washers has doubled. Most new models offer various controls over wash and rinse temperatures and load size. Some models have a "suds saver" option to save soapy water from one cycle to the next. Certain high-end machines automatically sense load size, dirtiness of water, and fabric type and adjust water level and wash cycle automatically.

This ECM recommends replacing common area washers with energy efficient units at the property. Refer to the ECM Worksheet in Appendix C for energy savings calculations.

ECM: Install Low-Flow Plumbing Fixtures (Aerators, Showerheads, Toilets)

About half the hot water consumed in a typical household is for bathing, and another 7 to 14 percent is used in the sink. By reducing the flow of water coming from the shower and faucets, water efficient showerheads and faucet aerators can generate significant energy savings at low cost and with easy installation. In addition to saving energy, showerheads and aerators save on water and sewer costs, which are rising in many areas.

Older showerheads deliver as much as 5 to 10 gallons per minute (GPM). New showerheads are required to be water efficient, delivering 2.5 GPM or less at a standard water pressure. Water-efficient, or low-flow, showerheads are designed to provide an acceptable shower at a greater reduced flow rate. Most are equipped with a button to switch the water off at the showerhead, to wave water while shaving or lathering. Water-efficient showerheads should not be confused with the flow restrictors used in the 1970s and early 1980s, which simply reduced the flow rate far below design level, often resulting in an unacceptable shower.

The average faucet has a flow rate of about 3 to 5 GPM. Adding a screw-in faucet aerator reduces the flow to 0.5 to 1.5 GPM in the bathroom and 2.2 GPM in the kitchen. In addition to saving energy and water, the "foamier" water that comes from faucet aerators wets objects better than water from a faucet with no aerator, which tends to bounce off the object rather than thoroughly wetting it.

In some areas, water and sewer rates have increased dramatically over the past few years and are rivaling the cost of energy. Reducing water use through conservation strategies can generate significant cost savings. Significant advances in technology over the past decade have resulted in the availability of reliable, high-quality water-saving toilets on the market.

Some water providers offer rebates and incentives for replacing inefficient toilets. Contact your provider to see if there is a program available.

This ECM recommends 1.6 gpf toilets at the property to replace the standard flush toilets in the apartments. Refer to the ECM Worksheet in Appendix C for energy savings calculations.

5.3. ENERGY CONSERVATION MEASURES CONSIDERED

The table below is a summary of Energy Conservation Measures considered as part of EMG's review of the energy use at the property. The review of the property was not limited to the below list of ECMs; however, these are those that typically have a quantifiable payback or can be documented. The actual ECM calculations can be found in Appendix C to this report.

	Item	Recommend	Already exists	Payback Period > EUL	Infeasible	Comment (req for all infeasible)
Architectural/Building Envelope ECMs						
1	Install Replacement Windows	✓		✓	✓	
2	Install Window Sun Shades: South-facing windows	✓				
3	Install Window Sun Shades: East & West-facing windows	✓				
4	Install Roof Insulation: R10					
5	Install Roof Insulation: R20	✓				
6	Install Wall Insulation				✓	
7	Control Air Leakage	✓	✓			Weather sealing performed recently with replacement of sealant. Need better windows
Space Heating and Cooling ECMs						
8	Install Vent Dampers		✓			
9	Install Energy Management Systems (EMS)				✓	Elderly housing
10	Convert to Electronic Ignition		✓			
11	Install Boiler Controls		✓			
12	Replace Inefficient Heating Plant		✓			
13	Install Programmable/ Setback Thermostats				✓	No costs due to elderly housing

	Item	Recommend	Already exists	Payback Period > EUL	Infeasible	Comment (req for all infeasible)
Space Heating and Cooling ECMs						
14	Insulate Hot Water or Steam Pipes	✓				
15	Seal and Insulate Ducts	✓				
16	Install Geothermal Heat Pumps			✓	✓	No water source heat pumps
17	Replace Inefficient Air Conditioners/fan coils	✓				No Air-conditioning for apartments except per tenant
18	Install Swamp Coolers					Not Applicable for this part of the country.
Domestic Water & Heating Systems ECMs						
19	Install Water-efficient Showerheads and Faucet Aerators		✓			
20	Insulate Hot Water Tanks		✓			
21	Install Hot Water (DHW) Off-Peak Controls		✓			Needs to be part of EMS system
22	Replace Inefficient Water Heaters	✓				Water storage indirect fired tanks served by high efficiency boilers
Lighting System ECMs						
23	Replace Older Fluorescent Lamps with Energy-Saving Lamps in Apartments	✓				
24	Install Electronic Ballasts in Building	✓				
25	Install Lighting Controls in Building	✓				
26	Convert Exterior Lighting Fixtures	✓				

	Item	Recommend	Already exists	Payback Period > EUL	Infeasible	Comment (req for all infeasible)
Lighting System ECMs						
27	Install Photo-Controls for Exterior Lighting		✓			
Miscellaneous ECMs						
28	Upgrade or Replace inefficient Motors	✓				Small capacity motors only
29	Install Water-Saving Toilets	✓				
30	Convert Water Supply Pumps					None at property
31	Install Check Metering or Individual Metering		✓			Electric only
Additional ECMs to Consider						
32	Convert Hot Water Heater System to Solar			✓	✓	
33	Install Soil Moisture Sensors	✓				
34	Install Direct Use Geothermal System for Heating and Hot Water				✓	
35	Install Occupational Sensors for Interior Lighting	✓				Some exist
36	LED Exit Signs		✓			

6. OPERATIONS AND MAINTENANCE

6.1. RESIDENT EDUCATION

A significant portion of each unit's energy consumption is also due to tenant-owned electronics and appliances. The property management should consider working with the utility providers (electricity, water, gas) to educate tenants on saving energy. Tenant behavior change could ultimately account for on average 5% to 8% energy savings per unit. Likewise, management should consider preparation of Operations and Maintenance Manuals for the maintenance staff, regarding HVAC systems, Electrical systems and Plumbing systems to ensure proper operation, future maintenance, and appropriate repair. The Green O&M plan should address the following points:

- A description of maintenance practices that use a materially lower use of chemicals thought to be harmful to humans and where practicable, that use more recycling (including construction debris removal). Should the Owner decide to proceed with the Green Initiative, any pending construction and maintenance activities are required to subscribe to construction waste minimization practices. This includes construction waste management, segregation, and the promotion of recycling and reuse. The Owner/Contractor should consider the donation of salvageable equipment/materials to non-profit entities for reuse. The future O&M plan is required to have a detailed section regarding green waste minimization practices. It is important to note that waste minimization typically saves money, as it reduces tipping charges and disposal costs.
- Specification of green cleaning products and materials that are biodegradable and contain low or no volatile organic compounds.
- Include a Resident Involvement, Outreach, and Incentive Plan, featuring Green Training which is applicable to the recommended rehabilitation items.(e.g. programmable thermostats, etc.).
- An Integrated Pest Management Plan (IPM) is to be adopted, to include periodic interior and exterior inspections and best management practices for pest control.
- Operations and maintenance inspection checklists for routine inspections by management/maintenance staff involving landscaping, building envelope penetrations, dumpster location cleanliness, litter control, and water leaks.
- Operations and maintenance requirements for routine cleaning of walk-off matting, common area recycling bins, and other Green Components warranting daily/weekly upkeep to prevent pest, odor and allergen build-up.
- Specify green landscaping methods, to include waste minimization practices (mulching and composting of yard waste), and fertilizer treatment schedules (where fertilizers are used, they should be applied in several smaller applications in lieu of one heavy application).
- Indoor Environmental Quality (IEQ) testing protocols are to be established, including routine schedules for monitoring of resident comfort (e.g. temperature and relative humidity are significant indicators of indoor

air quality and for avoiding mold problems), as well as protocols for reactive testing (e.g. specialty testing to occupancy complaints).

- Energy and Water Usage Monitoring. Management is required to establish a tracking mechanism for utility consumption in order to benchmark the effects of the Green improvements.

6.2. OPERATIONS AND MAINTENANCE RECOMMENDATIONS

The following general operations and maintenance recommendations should be continued or implemented.

Building Envelope:

1. Caulking and weather stripping is functional and effective.
2. Holes are patched in the building envelope.
3. Automatic door closing mechanisms are functional.
4. Interior vestibule doors are closed.

Heating and Cooling:

1. The burners are clean and fuel/air ratios are optimized.
2. Heat exchange surfaces of furnaces are clean and free of scale.
3. Temperature settings are reduced in unoccupied areas and set points are seasonally adjusted.
4. Control valves and dampers are fully functional.
5. Equipment is inspected for worn or damaged parts.
6. Ductwork is sealed.
7. Hot air registers, and return air ductwork are clean and unobstructed.
8. Air dampers are operating correctly.
9. Heating is uniform throughout the designated areas.
10. Evaporator and condenser coils in AC equipment are clean.
11. Air filters are clean and replaced as needed.

Domestic Hot Water:

1. Domestic hot water heater temperature is set to the minimum temperature required.
2. Tank-type water heaters are flushed as required.

Lighting:

1. Over-lit areas are managed by bi-level switching or photocell controls.

2. Only energy efficient replacement lamps are used and in-stock.
3. Lighting fixture reflective surfaces and translucent covers are clean.
4. Walls are clean and bright.
5. Timers and/or photocells are operating correctly on exterior lighting.

Tenant areas:

1. Refrigerator and freezer doors close and seal correctly.
2. Kitchen exhaust fans are only used when needed.
3. Office/ computer equipment is either in the "sleep" or off mode when not used.
4. All other recommended equipment specific preventive maintenance actions are conducted,
5. Usage demands on the building/ equipment have not changed significantly since the original building commissioning or the most recent retro-commissioning.
6. Recommend tenants use Energy Star rated computers and copiers.

Equipment Replacement:

1. All equipment replacements are not over/ undersized for the particular application.
2. All equipment replacements should be energy conserving devices.

15. APPENDICES

APPENDIX A: Photographic Record
APPENDIX B: Site Plan
APPENDIX C: Energy Audit Calculations
APPENDIX D: Manual J and Hot Water Heater Calculations
APPENDIX E: Supporting Documentation
APPENDIX F: EMG Accessibility Checklist
APPENDIX G: Pre-Survey Questionnaires
APPENDIX H: Resumes

APPENDIX A:
PHOTOGRAPHIC RECORD

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-002.306 **Project Name: Carucci Apartments**

Photo #1:	Front elevation – faces southeast

Photo #2:	Left elevation

Photo #3:	Right and rear elevations

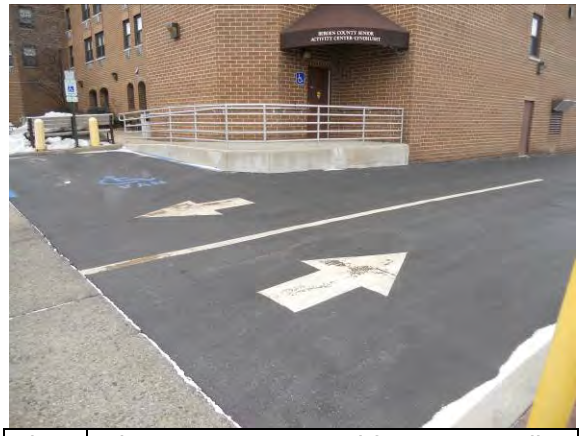


Photo #4:	Driveway entrance and front ADA stall with no access aisle markings

Photo #5:	Parking lot at rear

Photo #6:	Rear entrance with additional ADA stalls and no access aisle markings

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-002.306 **Project Name: Carucci Apartments**

Photo #7:	Rear fencing

Photo #8:	Dumpster, enclosure and bollards with concrete fill pushing up and out of tops

Photo #9:	Roof overview

Photo #10:	Rooftop unit #2 – serves north end of corridors

Photo #11:	Rooftop unit #1 – serves south end of corridors

Photo #12:	Rooftop unit #3 – serves elevator lobbies

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-002.306 **Project Name: Carucci Apartments**

Photo #13:	Elevator machinery

Photo #14:	Main electrical switchgear

Photo #15:	Boilers for domestic water and heat

Photo #16:	Circulation pumps including newly replaced one

Photo #17:	Domestic water storage tanks

Photo #18:	Generator

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-002.306 **Project Name: Carucci Apartments**

Photo #19:	Incoming water main and meter

Photo #20:	Sprinkler main

Photo #21:	Waste line with corrosion in basement

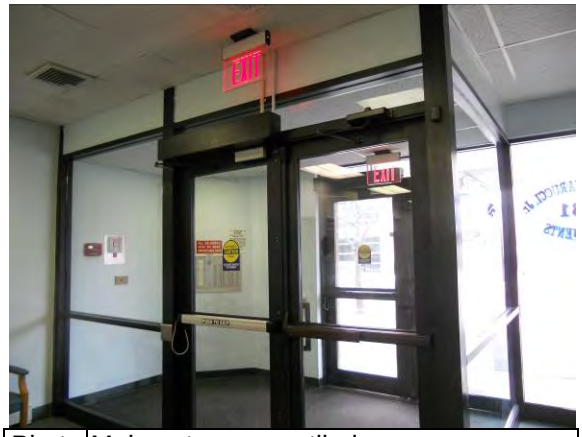


Photo #22:	Main entrance vestibule

Photo #23:	TV room

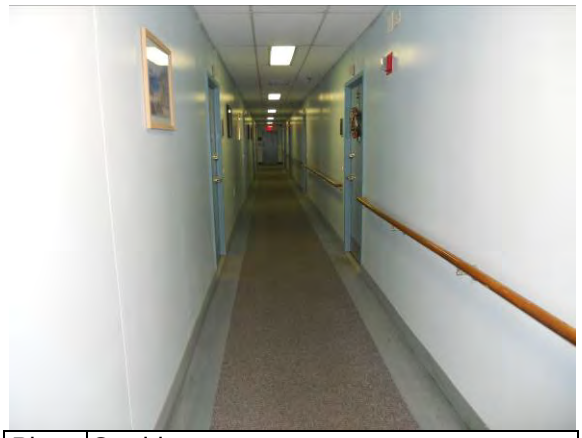


Photo #24:	Corridor

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-002.306 **Project Name: Carucci Apartments**

Photo #25:	Common area restrooms

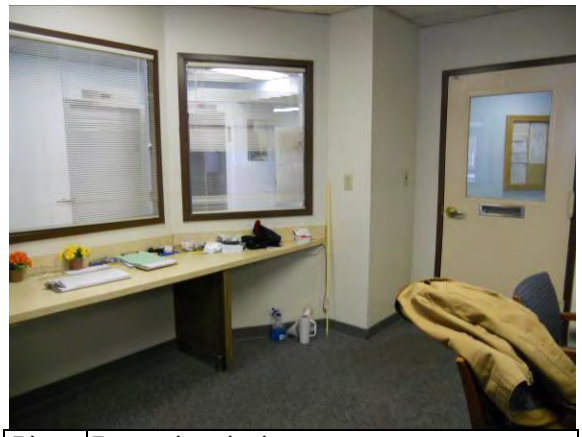


Photo #26:	Reception desk area

Photo #27:	Laundry room with disconnected dryer vent in distance

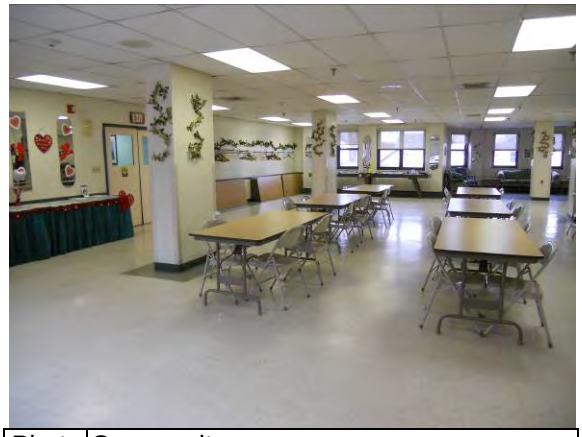


Photo #28:	Community room

Photo #29:	Air handler off community room

Photo #30:	Community room kitchen

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-002.306 **Project Name: Carucci Apartments**

Photo #31:	Non-insulated drainage piping under community room kitchen sink

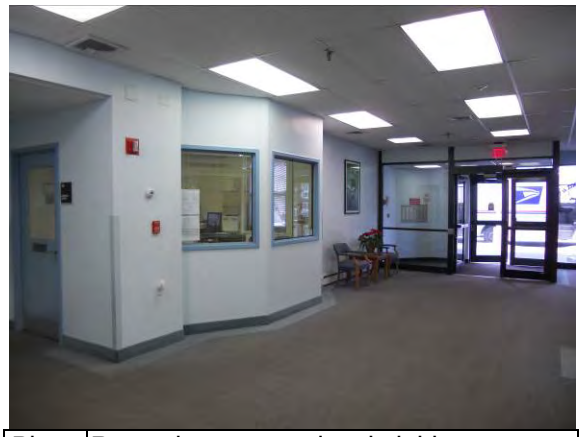


Photo #32:	Reception area and main lobby

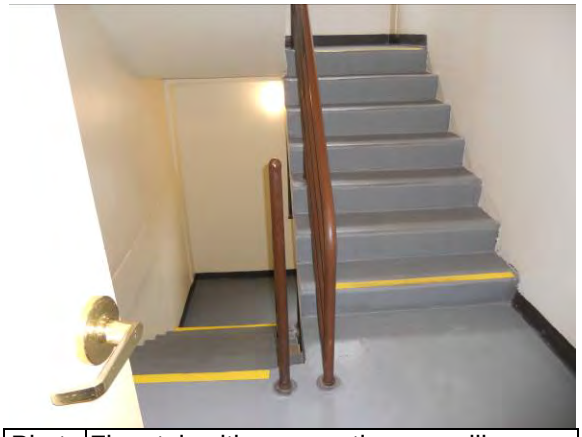


Photo #33:	Fire stair with non-continuous railings

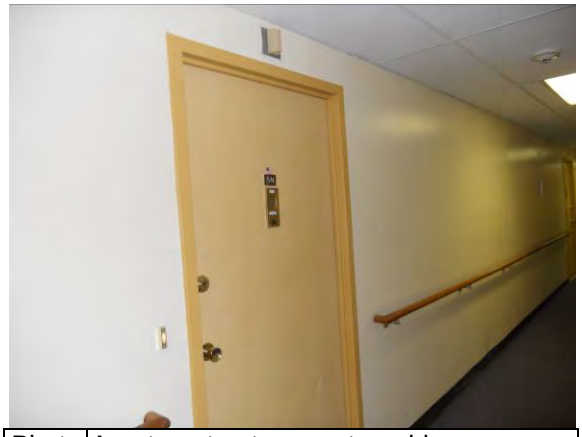


Photo #34:	Apartment entrance at corridor

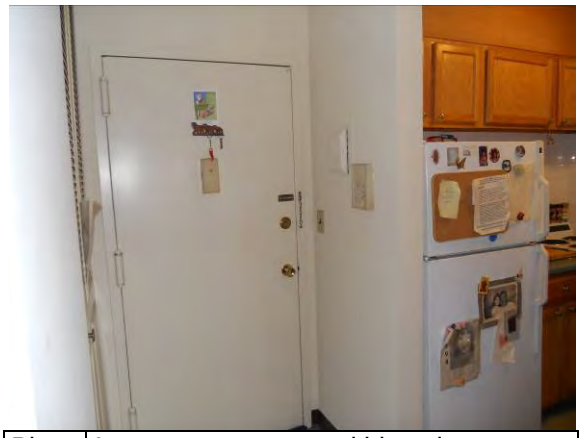


Photo #35:	Apartment entrance within unit

Photo #36:	Living room

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-002.306 **Project Name: Carucci Apartments**

Photo #37:	Apartment unit kitchen

Photo #38:	Apartment unit thermostat

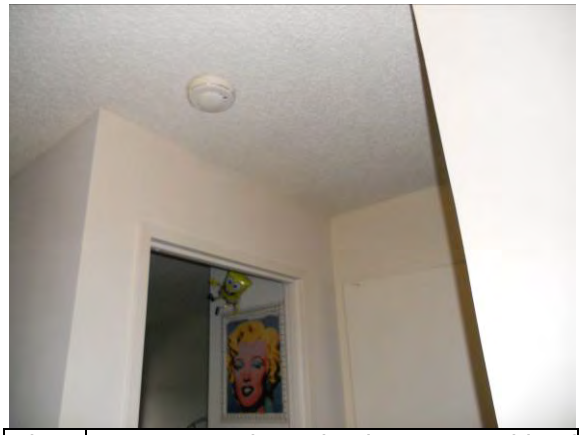


Photo #39:	Apartment unit smoke detector outside of bedroom only

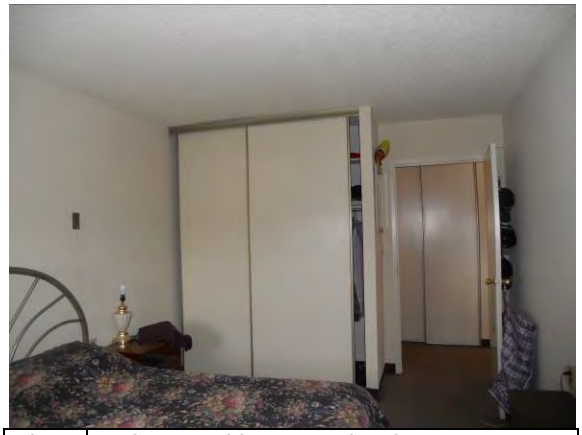


Photo #40:	Bedroom with no smoke detector

Photo #41:	Apartment unit bathroom

Photo #42:	Apartment unit bathtub

EMG

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-002.306 **Project Name: Carucci Apartments**

Photo #43:	Apartment unit hydronic heat baseboard and covered through the wall air condition unit

Photo #44:	Electric resistance heater in apartment unit bathroom – 5th floor only

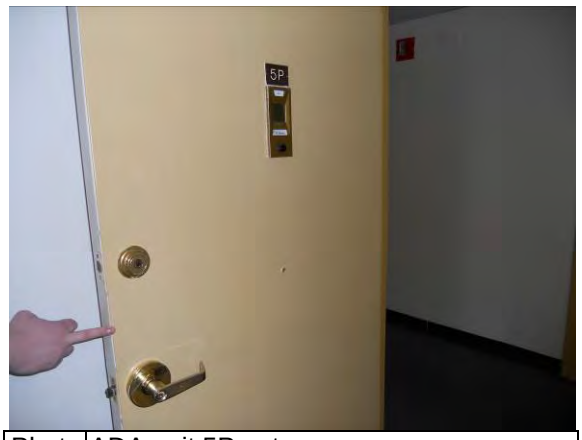


Photo #45:	ADA unit 5P entrance

Photo #46:	ADA unit kitchen

Photo #47:	ADA unit range with front facing controls

Photo #48:	ADA unit refrigerator with reachable side by side

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-002.306 **Project Name: Carucci Apartments**

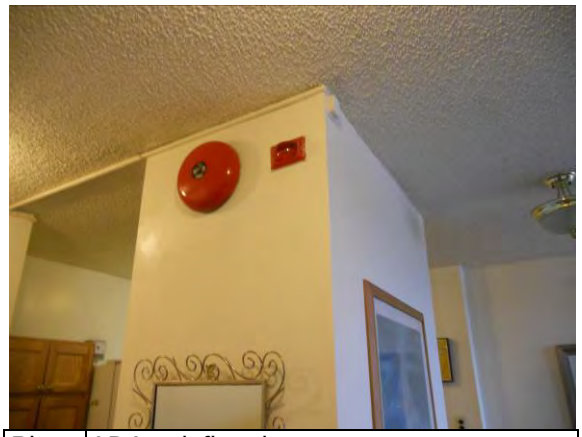


Photo #49:	ADA unit fire alarm system

Photo #50:	ADA unit bathroom

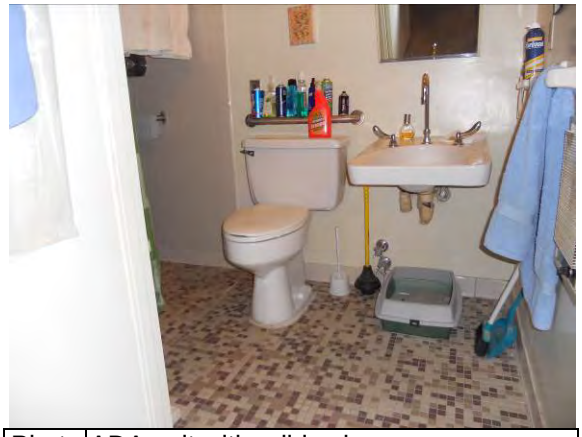


Photo #51:	ADA unit with roll-in shower

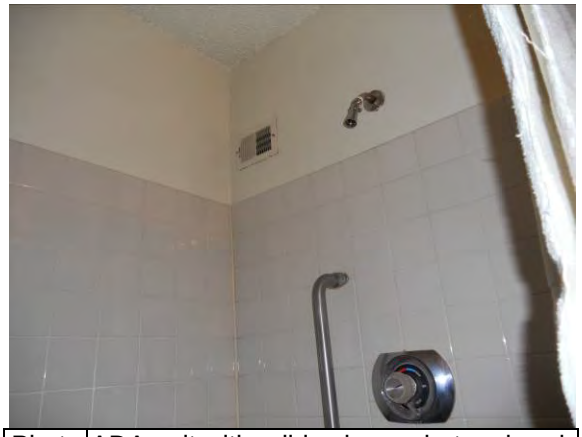


Photo #52:	ADA unit with roll-in shower but no hand-held shower head

Photo #53:	ADA unit sink sloping/not set level

Photo #54:	Suspect mold in supply vent in corridor

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-002.306 **Project Name: Carucci Apartments**

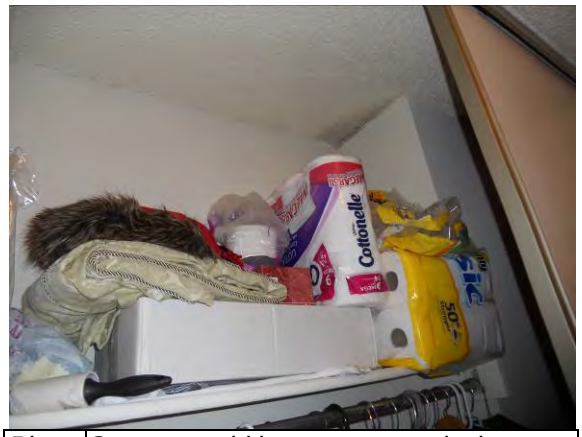


Photo #55:	Suspect mold in apartment unit closet – 5N

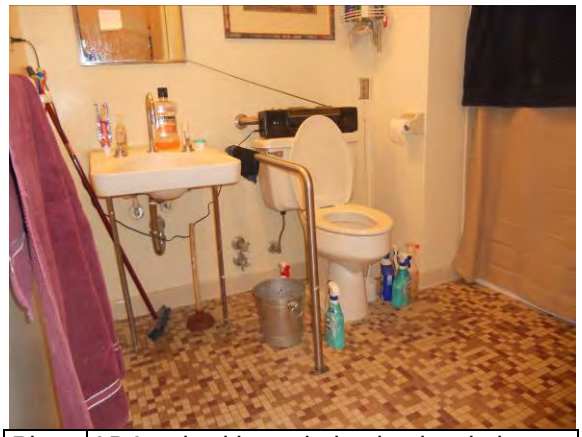


Photo #56:	ADA unit without drain pipe insulation and non-compliant toilet grab bars - 5P

Photo #57:	Elevator lobby

Photo #58:	Suspect mold covering bathroom ceiling in 2B

Photo #59:	Vacant unit kitchen – 2K

Photo #60:	Vacant unit – 2K

EMG PHOTOGRAPHIC RECORD

Project No.: 107534.13R-002.306 **Project Name: Carucci Apartments**

Photo #61:	Vacant apartment bathroom – 2K

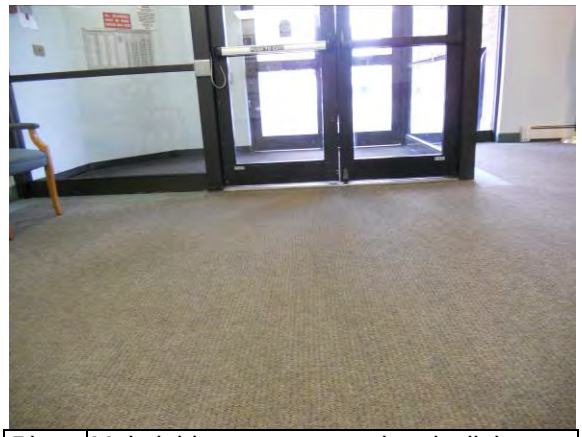


Photo #62:	Main lobby entrance seeing daylight under door frame at both sets

Photo #63:	Dumpster at trash chute

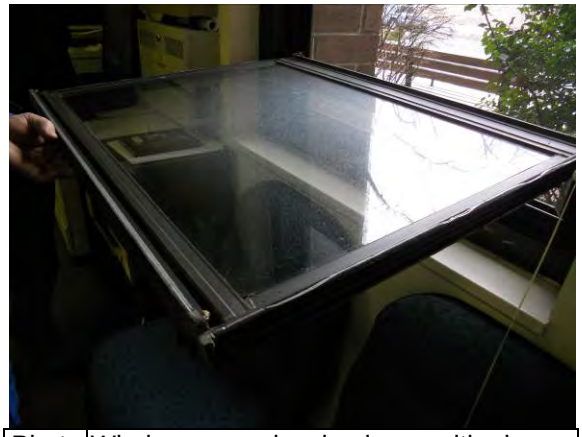


Photo #64:	Window pane showing issue with air infiltration

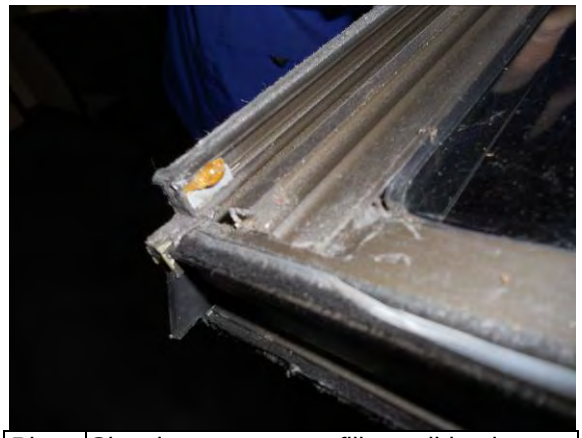
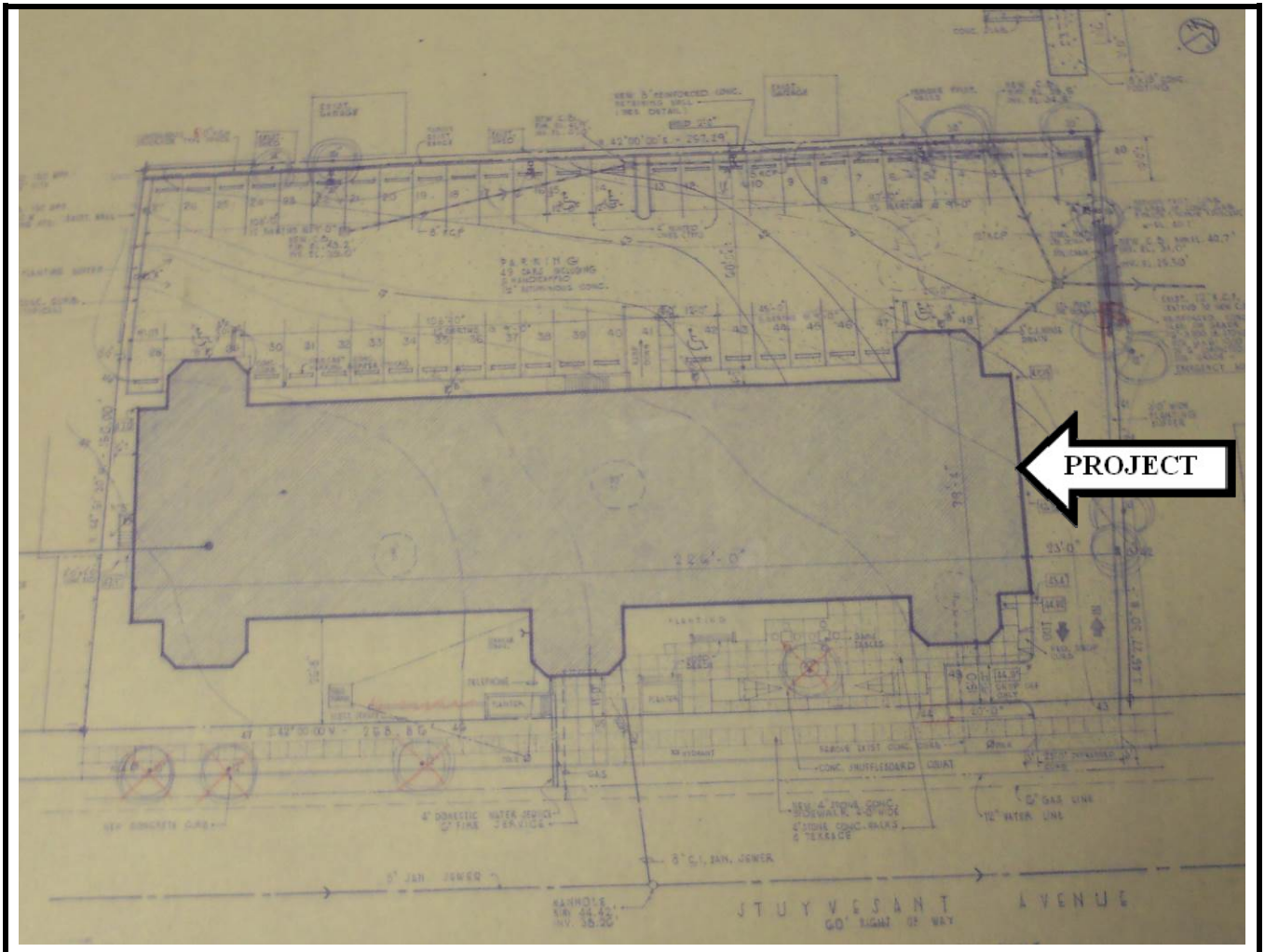


Photo #65:	Showing attempts to fill possible air infiltration areas at window frame

Photo #66:	Exterior of window frame showing cracked window frame sealant at joint

APPENDIX B:
SITE PLAN

Site Plan



EMG	**Source:**	**Project Number:** **107534.13R-002.306**
	The north arrow indicator is an approximation of 0° North.	**Project Name:** **Carucci Apartments**
		On-Site Date: **March 3, 2014**

APPENDIX C:
ENERGY AUDIT CALCULATIONS

UIC	Replace Existing Washing Machines With Energy Star Certified Washing Machines
EAA4	Details:

Total Number of Washers on Site	5				
Number of Washers to be Replaced:	5				
Number of Loads Per Week/Washer:	129	Water Tariff ($/1000 Gal)	$5.70	Cost of Replacing All Machines	$12,250
Are The Machines Rented?	No				

Cost savings per Washer:

	Existing		Recommended		Energy & Water Savings		Cost
Total annual water consumption:	173,042	gal	106,642	gal	66	kGal	$378.48
Select Type of Water Heater Fuel	Natural Gas	(Select)					
Total annual electricity consumption:	3,354	kWh	1,677	kWh	1,677	kWh	$95.41
Total Annual Water Heater Fuel Consumption:	1,213	Therms	747	Therms	465	Therms	$140.11

Total Cost Savings per Washer:	$614.00	Total Cost Savings From All Washers	$3,070
Total Installed Cost For All Machines	$12,250	Simple Pay Back Period:	3.99 Yrs

Type of Recommendation Capital Cost ECM Recommendation

Energy Conservation Measure
Replace Fluorescent Fixtures in Common Areas with T-8 Bulbs & Electronic Ballasts

This analysis is for replacment of the T-12 fluorescent lighting with T-8 Lamps and Electronic Ballasts in the common areas. An average annual usage and standard replacement bulb size are assumed.

Step 1 Cost Information

Cost of Replacing Fixtures w/ T-8 & Electronic Ballast	9828.00	$
Cost of Replacing Fixtures w/ T-12 & Electronic Ballast	8190.00	$

Step 2 Transfer the following information from the Survey:

b	Total number of light fixtures to be replaced:	126	
c	Existing Watts per bulb	40	
d	Number of linear bulbs per fixture	2	
e	Average number of hours/day bulbs are in use:	24	
f	Cost of electricity:	$0.06	$/kWh

Step 3 Lighting Energy Consumption

Traditional Consumption *T-12 Fluorescent - 40 Watt*

0.040	x	252	x	8760	=	88301	kWh/yr
kW/bulb		# of bulbs		hrs/year			

Traditional Consumption *T-12 Fluorescent - 34 Watt*

0.034	x	252	x	8760	=	75056	kWh/yr
kW/bulb		# of bulbs		hrs/year			

Green Consumption *T-8 Fluorescent - 28 Watt*

0.028	x	252	x	8760	=	61811	kWh/yr
kW/bulb		# of bulbs		hrs/year			

Step 4 Estimate annual energy savings vs. Traditional:

2a		3			
75056	-	61811	=	13245	kWh/yr

Step 5 Calcualte annual cost savings vs. Traditional:

	4		2b			
Cost Savings	13245.12	x	0.06	=	753.65	$/yr
Cost Differential	9828.00	-	8190.00	=	1638.00	$/yr

Step 6 Calculate payback period:

	1		5			
Premium Payback	1638.00	/	753.65	=	**2.17**	yrs
Simple Payback Period	9828.00	/	753.65	=	**13.04**	yrs

Energy Conservation Measure
Replace Site Light Fixtures with High Efficacy LED Fixtures

This analysis is for replacement of the HID lighting with LED
in the common areas. An average annual usage and standard replacement bulb size are assumed.

Step 1	Cost Information								
	Cost of Replacing Fixtures w/ LED						12460.00	$	
	Cost of Replacing Fixtures w/ Metal Halide						9100.00	$	
Step 2	Transfer the following information from the Survey:								
	b Total number of light fixtures to be replaced:						14		
	c Existing Watts per bulb						100		
	e Average number of hours/day bulbs are in use:						12		
	f Cost of electricity:						$0.06	$/kWh	
Step 3	Lighting Energy Consumption								
	Traditional Consumption	*Metal Halide, 100 W*							
		0.128	x	14	x	4380	=	7849	kWh/yr
		kW/bulb		# of bulbs		hrs/year			
	Green Consumption	*LED*							
		0.033	x	14	x	4380	=	2024	kWh/yr
		kW/bulb		# of bulbs		hrs/year			
Step 4	Estimate annual energy savings vs. Traditional:								
		2a				3			
		7849		-		2024	=	5825	kWh/yr
Step 5	Calcualte annual cost savings vs. Traditional:								
		4				2b			
	Cost Savings	5825.40		x		0.06	=	331.47	$/yr
	Cost Differential	12460.00		-		9100.00	=	3360.00	$/yr
Step 6	Calculate payback period:								
	Premium Payback	3360.00		/		331.47	=	**10.14**	yrs
	Simple Payback Period	12460.00		/		331.47	=	**37.59**	yrs

Energy Conservation Measure
Replace Site MH Light Fixtures with High Efficacy LED Fixtures

This analysis is for replacement of the Site MH Pole Lights with LED Fixtures
in the common areas. An average annual usage and standard replacement bulb size are assumed.

Step 1	Cost Information									
		Cost of Replacing Fixtures w/ LED						3560.00	$	
		Cost of Replacing Fixtures w/ Metal Halide						2949.00	$	
Step 2	Transfer the following information from the Survey:									
	a	Number of dwelling units:								
	b	Total number of light fixtures to be replaced:						4		
	c	Existing Watts per bulb						175		
	d	Number of linear bulbs per fixture						1		
	e	Average number of hours/day bulbs are in use:						12		
	f	Cost of electricity:						$0.06	$/kWh	
Step 3	Lighting Energy Consumption									
	Traditional Consumption		*Metal Halide 175 Watt*							
		0.215	x	4	x	4380	=	3767	kWh/yr	
		kW/bulb		# of bulbs		hrs/year				
	Green Consumption		*LED, 70 Watt*							
		0.076	x	4	x	4380	=	1332	kWh/yr	
		kW/bulb		# of bulbs		hrs/year				
Step 4	Estimate annual energy savings vs. Traditional:									
				2a		3				
				3767	-	1332	=	2435	kWh/yr	
Step 5	Calcualte annual cost savings vs. Traditional:									
				4		2b				
		Cost Savings		2435.28	x	0.06	=	138.57	$/yr	
		Cost Differential		3560.00	-	2949.00	=	611.00	$/yr	
Step 6	Calculate payback period:									
		Premium Payback		611.00	/	138.57	=	**4.41**	yrs	
		Simple Payback Period		3560.00	/	138.57	=	**25.69**	yrs	

Energy Conservation Measure
Replace Older Inefficient Air Conditioners - 2 ton units

Step 1	Obtain total cost of replacing existing air conditioners with efficient units:								
	5	Air Conditioners x	$2,925	per unit			$14,625	$	
Step 2	Transfer the following information from the Survey:								
4-55	**a**	SEER rating of existing AC units:					7	SEER	
4-56	**b**	Cooling capacity of existing AC units:					2	Tons	
4-54	**c**	Number of existing AC units:					5		
5-9	**d**	Cost of electricity:					0.122663471	$/kWh	
Step 3									
Table 1	Annual cooling hours						1007		
Step 4	Existing seasonal energy efficiency ratio (SEER):								
							7		
Step 5	Calculate existing energy use per air conditioner:								
		Cooling Hrs		(kBtu)		SEER			
		1007	x	24.00	/	7	=	3452.571429	kWh/yr
Step 6	Calculate new energy use per air conditioner:								
		Cooling Hrs		(kBtu)		SEER			
		1007	x	24.00	/	16	=	1510.5	kWh/yr
Step 7	Estimate annual energy savings:								
		5		6		2c			
		3453	-	1510.50	x	5.00	=	9710.357143	kWh/yr
Step 8	Calculate annual cost savings:								
				7		2d			
				9710	x	0.12	=	1191.106114	$/yr
Step 9	Calculate payback period:								
				1		8			
				14625.00	/	1191.11	=	**12.28**	yrs

Energy Conservation Measure

Replace Older Inefficient Window ACs - 12060 Btuh units

Through Wall Unit

Step 1 Obtain total cost of replacing existing air conditioners with efficient units:

4	Air Conditioners x	$377	per unit	$1,508	$	

Step 2 Transfer the following information from the Survey:

4-55	**a**	EER rating of existing AC units:	7.5	EER
4-56	**b**	Cooling capacity of existing AC units:	12060	Btu/hr
4-54	**c**	Number of existing AC units:	4	
5-9	**d**	Cost of electricity:	0.122663471	$/kWh

Step 3

Table 1	Annual cooling hours	1007

Step 4 Existing energy efficiency ratio (EER):

	7.5

Step 5 Calculate existing energy use per air conditioner:

Cooling Hrs		(kBtu)		EER			
1007	x	12.06	/	7.5	=	1619	kWh/yr

Step 6 Calculate new energy use per air conditioner:

Cooling Hrs		(kBtu)		EER			
1007	x	12.06	/	10.8	=	1124	kWh/yr

Step 7 Estimate annual energy savings:

5		6		2c			
1619	-	1124	x	4.00	=	1979.090667	kWh/yr

Step 8 Calculate annual cost savings:

7		2d			
1979	x	0.12	=	242.7621311	$/yr

Step 9 Calculate payback period:

1		8			
1508.00	/	242.76	=	**6.21**	yrs

Cost/Benefit Worksheet
ECM No. 17: Seal and Insulate Ducts

This worksheet calculates the heating savings from sealing and insulating ducts. If central air conditioning is also provided, the payback can be expected to be quicker.

Step 1 Obtain total cost of sealing and insulating ducts:

	1260	$

Step 2 Transfer the following information from the Survey:

5-14	**a** Annual heating fuel consumption:	Gas:	28117	therms/yr
		Oil:		gal/yr
		Electric:		kWh/yr
		Propane:		gal/yr
5-9	**b** Cost of heating fuel:	Gas:	0.27	$/therm
		Oil:	0	$/gal
		Electric:		$/kWh
		Propane:		$/gal

Step 3 Estimate annual energy savings:

			2a			
Gas:	0.16	x	28117.00	=	4498.72	/yr
Oil:	0.16	x	0.00	=	0	/yr
Electric:	0.16	x	0.00	=	0	/yr
Propane:	0.16	x	0.00	=	0	/yr

Step 4 Calculate annual cost savings:

	3		2b			
Gas:	4498.72	x	0.27	=	1214.6544	$/yr
Oil:	0.00	x	0.00	=	0	$/yr
Electric:	0.00	x	0.00	=	0	$/yr
Propane:	0.00	x	0.00	=	0	$/yr

Step 5 Calculate payback period:

	1		4			
Gas:	1260.00	/	1214.65	=	1.0373321	yrs
Oil:	1260.00	/	0.00	=	0	yrs
Electric:	1260.00	/	0.00	=	0	yrs
Propane:	1260.00	/	0.00	=	0	yrs

Energy Conservation Measure

Replace Older Plumbing Fixtures with Low Flow Devices

Input Data:

Step 1

Number of residents	100
Total annual use days	365

	Water closet		**Sinks**	**Shower**
Existing water controls in gallons per use	3.5		2.2	3
low -flow water controls in gallons per use	1.6		1.5	2
Low-flow replacement cost	$320.00		$4.00	$75.00

Step 2

	Quantity		Daily Usage Assumption	
Total number of old water closets	99		4.0	flushes
Total number of sinks to be upgraded	149		6.0	minutes
Total number of shower heads to be upgraded	99		10.1	minutes
Total Water Rate	$ 0.0058	/gal		

Step 3

Calculations:

Water conservation method	Total to be replaced	Cost of replacement	Total cost
Replace existing with low flow water closets	99	$320	$31,680.00
Install aerators on existing faucet controls	149	$4	$596.00
Replace existing shower heads	99	$75	$7,425.00
		Total	**$39,701.00**

Results

Annual Savings	Annual time used	Gallons saved	Annual cost savings	Payback
Annual water closet flushes (flushes)	143,109	271,907	$1,570.12	20.17680927
Annual sink use (minutes)	326,310	228,417	$1,318.99	0.451861594
Annual shower use (minutes)	365,000	365,000	$2,107.68	3.522825951
	Total	865,324	**$4,996.79**	
	Simple Payback		**7.95**	years

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APPENDIX D:
MANUAL J AND HOT WATER HEATER CALCULATIONS

Apartment Load Sizing: **Carucci Apartments**
Heat Gain Calculations **1-Bedroom**

This analysis is for calculating the heat gain during the cooling season.

Step 1	Calculated total tonnage for cooling equipment:		1.2	Tons
			14379	Btu/hr
Step 2	Heat gain from Windows on North Side			
	a	Height of Window	5.00	ft.
	b	Width of Window	3.30	ft.
	c	Number of windows on north side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	Heat gain, Q = (2a x 2b x 2c) x 2f x (2e- 2d)	0	BTUH
Step 3	Heat gain from Exterior Doors on North Side			
	a	Height of Exterior Door	7	ft.
	b	Width of Exterior Door	3	ft.
	c	Number of exterior doors on north side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Exterior Door	0.10	
	g	Heat gain, Q = (3a x 3b x 3c) x 3f x (3e- 3d)	0	BTUH
Step 4	Heat gain from North Wall			
	a	Length of North wall	23.0	ft.
	b	Height of North wall	9.0	ft.
	c	Indoor Design Temperature	74	F
	d	Outdoor Design Temperature	95	F
	e	U-Value for North wall	0.071	
	f	Heat gain, Q = ((4ax4b)-(2a*2b*2c)-(3a*3b*3c))x 4e x (4d- 4c)	311	BTUH
Step 5	Heat gain from Windows on South Side			
	a	Height of Window	5.00	ft.
	b	Width of Window	3.30	ft.
	c	Number of windows on south side	3	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	SHGC, Solar Heat Gain Coefficient	0.6	
	h	Heat gain, Q = ((5a x 5b x 5c) x 5f x (5e- 5d)) + (5ax5bx5cx5gx125)	4,232	BTUH
Step 6	Heat gain from Exterior Doors on South Side			
	a	Height of Exterior Door	7	ft.
	b	Width of Exterior Door	3	ft.
	c	Number of exterior doors on south side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat gain, Q = (6a x 6b x 6c) x 6f x (6e- 6d+10)	0	BTUH

Apartment Load Sizing: **Carucci Apartments**
Heat Gain Calculations **1-Bedroom**

This analysis is for calculating the heat gain during the cooling season.

Step 7	Heat gain from South Wall			
	a	Length of South wall	23.0	ft.
	b	Height of South wall	9.0	ft.
	c	Indoor Design Temperature	74	F
	d	Outdoor Design Temperature	95	F
	e	U-Value for South wall	0.071	
	f	Heat gain, Q = ((7ax7b)-(5a*5b*5c)-(6a*6b*6c))x 7e x (7d- 7c+10)	349	BTUH
Step 8	Heat gain from Windows on East Side			
	a	Height of Window	5.00	ft.
	b	Width of Window	3.30	ft.
	c	Number of windows on east side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	Heat gain, Q = (8a x 8b x 8c) x 8f x (8e- 8d)	0	BTUH
Step 9	Heat gain from Exterior Doors on East Side			
	a	Height of Exterior Door	7	ft.
	b	Width of Exterior Door	3	ft.
	c	Number of exterior doors on east side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat gain, Q = (9a x 9b x 9c) x 9f x (9e- 9d)	0	BTUH
Step 10	Heat gain from East Wall			
	a	Length of East wall	22.0	ft.
	b	Height of East wall	9.0	ft.
	c	Indoor Design Temperature	74	F
	d	Outdoor Design Temperature	95	F
	e	U-Value for East wall	0.071	
	f	Heat gain, Q = ((10ax10b)-(8a*8b*8c)-(9a*9b*9c))x 10e x (10d- 10c)	297	BTUH
Step 11	Heat gain from Windows on West Side			
	a	Height of Window	5.00	ft.
	b	Width of Window	3.30	ft.
	c	Number of windows on west side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	SHGC, Solar Heat Gain Coefficient	0.0	
	h	Heat gain, Q = ((11a x 11b x 11c)x11f x(11e- 11d))+(11ax11bx11cx11gx125)	0	BTUH

Apartment Load Sizing: **Carucci Apartments**
Heat Gain Calculations **1-Bedroom**

This analysis is for calculating the heat gain during the cooling season.

Step 12	Heat gain from Exterior Doors on West Side			
a	Height of Exterior Door	7	ft.	
b	Width of Exterior Door	3	ft.	
c	Number of exterior doors on west side	0		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	U-Value for Exterior Doors	0.10		
g	Heat gain, Q = (12a x 12b x 12c) x 12f x (12e- 12d+10)	0	BTUH	
Step 13	Heat gain from West Wall			
a	Length of West wall	22.0	ft.	
b	Height of West wall	9.0	ft.	
c	Indoor Design Temperature	74	F	
d	Outdoor Design Temperature	95	F	
e	U-Value for West wall	0.071		
f	Heat gain, Q = ((13ax13b)-(11a*11b*11c)-(12a*12b*12c))x13ex(13d- 13c+10)	297	BTUH	
Step 14	Heat gain from Roof			
a	Length of Roof	23.0	ft.	
b	Width of Roof	22.0	ft.	
c	Slope Factor for Roof (1.0 for flat roofs, 1.20 for sloped roofs)	1.20		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	U-Value for Roof	0.067		
g	Heat gain, Q = (14a x 14b x 14c) x 14f x (14e- 14d + 30)	2,064	BTUH	
Step 15	Heat gain from Ground Floor			
a	Length of ground floor	23.0	ft.	
b	Width of ground floor	22.0	ft.	
c	Indoor Design Temperature	74	F	
d	Outdoor Design Temperature	75	F	
e	U-Value for ground floor	0.000		
f	Heat gain, Q = (15a x 15b) x 15e x (15d- 15c)	0	BTUH	
Step 16	Heat gain from Infiltration			
a	Length of Building or Unit	23.0	ft.	
b	Width of Building or Unit	22.0	ft.	
c	Height of Building or Unit	9.0		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	ACH, Air Change Per Hour	1.0		
g	Enthalpy, H	10.0		
h	Heat gain, Q = ((16a x 16b x 16c) / 60) x 16f x 4.5 * 16g	3,416	BTUH	
Step 17	Heat gain from electrical heat			
a	Kilowatt of continuous power (per hour)	1.0	kW	
b	Heat gain, Q = 3414 x 17a	3,414	BTUH	

Apartment Load Sizing: **Carucci Apartments**
Heat Loss Calculations **1-Bedroom**

This analysis is for calculating the heat loss during the winter heating season.

Step 1	Calculated total BTUH for heating equipment:		15316	BTUH
			4.5	kW
Step 2	Heat loss from Windows on North Side			
	a	Height of Window	5.0	ft.
	b	Width of Window	3.3	ft.
	c	Number of windows on north side	3	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (2a x 2b x 2c) x 2f x (2d- 2e)	1,881	BTUH
Step 3	Heat loss from Exterior Doors on North Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on north side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Door	0.10	
	g	Heat Loss, Q = (3a x 3b x 3c) x 3f x (3d- 3e)	0	BTUH
Step 4	Heat loss from North Wall			
	a	Length of North wall	23.0	ft.
	b	Height of North wall	9.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for North wall	0.071	
	f	Heat Loss, Q = ((4ax4b)-(2a*2b*2c)-(3a*3b*3c))x 4e x (4c- 4d)	855	BTUH
Step 5	Heat loss from Windows on South Side			
	a	Height of Window	5.0	ft.
	b	Width of Window	3.3	ft.
	c	Number of windows on south side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (5a x 5b x 5c) x 5f x (5d- 5e)	0	BTUH
Step 6	Heat loss from Exterior Doors on South Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on south side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat Loss, Q = (6a x 6b x 6c) x 6f x (6d- 6e)	0	BTUH

Apartment Load Sizing: **Carucci Apartments**
Heat Loss Calculations **1-Bedroom**

This analysis is for calculating the heat loss during the winter heating season.

Step 7	Heat loss from South Wall			
	a	Length of South wall	23.0	ft.
	b	Height of South wall	9.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for South wall	0.071	
	f	Heat Loss, Q = ((7ax7b)-(5a*5b*5c)-(6a*6b*6c))x 7e x (7c- 7d)	1,124	BTUH
Step 8	Heat loss from Windows on East Side			
	a	Height of Window	5.0	ft.
	b	Width of Window	3.3	ft.
	c	Number of windows on east side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (8a x 8b x 8c) x 8f x (8d- 8e)	0	BTUH
Step 9	Heat loss from Exterior Doors on East Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on east side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat Loss, Q = (9a x 9b x 9c) x 9f x (9d- 9e)	0	BTUH
Step 10	Heat loss from East Wall			
	a	Length of East wall	22.0	ft.
	b	Height of East wall	9.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for East wall	0.071	
	f	Heat Loss, Q = ((10ax10b)-(8a*8b*8c)-(9a*9b*9c))x 10e x (10c- 10d)	1,075	BTUH
Step 11	Heat loss from Windows on West Side			
	a	Height of Window	5.0	ft.
	b	Width of Window	3.3	ft.
	c	Number of windows on west side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (11a x 11b x 11c) x 11f x (11d- 11e)	0	BTUH

Apartment Load Sizing: **Carucci Apartments**
Heat Loss Calculations **1-Bedroom**

This analysis is for calculating the heat loss during the winter heating season.

Step 12	Heat loss from Exterior Doors on West Side			
a	Height of Exterior Door	7.0	ft.	
b	Width of Exterior Door	3.0	ft.	
c	Number of exterior doors on west side	0		
d	Indoor Design Temperature	76	F	
e	Outdoor Design Temperature	0	F	
f	U-Value for Exterior Doors	0.10		
g	Heat Loss, Q = (12a x 12b x 12c) x 12f x (12d- 12e)	0	BTUH	
Step 13	Heat loss from West Wall			
a	Length of West wall	22.0	ft.	
b	Height of West wall	9.0	ft.	
c	Indoor Design Temperature	76	F	
d	Outdoor Design Temperature	0	F	
e	U-Value for West wall	0.071		
f	Heat Loss, Q = ((13ax13b)-(11a*11b*11c)-(12a*12b*12c))x 13e x (13c- 13d)	1,075	BTUH	
Step 14	Heat loss from Roof			
a	Length of Roof	23.0	ft.	
b	Width of Roof	22.0	ft.	
c	Slope Factor for Roof (1.0 for flat roofs, 1.20 for sloped roofs)	1.20		
d	Indoor Design Temperature	76	F	
e	Outdoor Design Temperature	0	F	
f	U-Value for Roof	0.067		
g	Heat Loss, Q = (14a x 14b x 14c) x 14f x (14d- 14e)	3,076	BTUH	
Step 15	Heat loss from Ground Floor			
a	Length of ground floor	23.0	ft.	
b	Width of ground floor	22.0	ft.	
c	Indoor Design Temperature	76	F	
d	Outdoor Design Temperature	68	F	
e	U-Value for ground floor	0.000		
f	Heat Loss, Q = (15a x 15b) x 15e x (15c- 15d)	0	BTUH	
Step 16	Heat loss from Infiltration			
a	Length of Building or Unit	23.0	ft.	
b	Width of Building or Unit	22.0	ft.	
c	Height of Building or Unit	9.0		
d	Indoor Design Temperature	76	F	
e	Outdoor Design Temperature	0	F	
f	ACH, Air Change Per Hour	1.0		
g	Heat Loss, Q = ((16a x 16b x 16c) / 60) x 16f x 1.08 * (16d- 16e)	6,230	BTUH	

Apartment Load Sizing: **Carucci Apartments**
Heat Gain Calculations **2-Bedroom**

This analysis is for calculating the heat gain during the cooling season.

Step 1	Calculated total tonnage for cooling equipment:		1.3	Tons
			15470	Btu/hr
Step 2	Heat gain from Windows on North Side			
	a	Height of Window	5.00	ft.
	b	Width of Window	3.30	ft.
	c	Number of windows on north side	4	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	Heat gain, Q = (2a x 2b x 2c) x 2f x (2e- 2d)	693	BTUH
Step 3	Heat gain from Exterior Doors on North Side			
	a	Height of Exterior Door	7	ft.
	b	Width of Exterior Door	3	ft.
	c	Number of exterior doors on north side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Exterior Door	0.10	
	g	Heat gain, Q = (3a x 3b x 3c) x 3f x (3e- 3d)	0	BTUH
Step 4	Heat gain from North Wall			
	a	Length of North wall	40.0	ft.
	b	Height of North wall	9.0	ft.
	c	Indoor Design Temperature	74	F
	d	Outdoor Design Temperature	95	F
	e	U-Value for North wall	0.071	
	f	Heat gain, Q = ((4ax4b)-(2a*2b*2c)-(3a*3b*3c))x 4e x (4d- 4c)	441	BTUH
Step 5	Heat gain from Windows on South Side			
	a	Height of Window	5.00	ft.
	b	Width of Window	3.30	ft.
	c	Number of windows on south side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	SHGC, Solar Heat Gain Coefficient	0.4	
	h	Heat gain, Q = ((5a x 5b x 5c) x 5f x (5e- 5d)) + (5ax5bx5cx5gx125)	0	BTUH
Step 6	Heat gain from Exterior Doors on South Side			
	a	Height of Exterior Door	7	ft.
	b	Width of Exterior Door	3	ft.
	c	Number of exterior doors on south side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat gain, Q = (6a x 6b x 6c) x 6f x (6e- 6d+10)	0	BTUH

Apartment Load Sizing: **Carucci Apartments**
Heat Gain Calculations **2-Bedroom**

This analysis is for calculating the heat gain during the cooling season.

Step 7	Heat gain from South Wall			
a	Length of South wall	40.0	ft.	
b	Height of South wall	9.0	ft.	
c	Indoor Design Temperature	74	F	
d	Outdoor Design Temperature	95	F	
e	U-Value for South wall	0.071		
f	Heat gain, Q = ((7ax7b)-(5a*5b*5c)-(6a*6b*6c))x 7e x (7d- 7c+10)	797	BTUH	
Step 8	Heat gain from Windows on East Side			
a	Height of Window	5.00	ft.	
b	Width of Window	3.30	ft.	
c	Number of windows on east side (1 window + 1 set of french doors)	0		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	U-Value for Window	0.50		
g	Heat gain, Q = (8a x 8b x 8c) x 8f x (8e- 8d)	0	BTUH	
Step 9	Heat gain from Exterior Doors on East Side			
a	Height of Exterior Door	7	ft.	
b	Width of Exterior Door	3	ft.	
c	Number of exterior doors on east side	0		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	U-Value for Exterior Doors	0.10		
g	Heat gain, Q = (9a x 9b x 9c) x 9f x (9e- 9d)	0	BTUH	
Step 10	Heat gain from East Wall			
a	Length of East wall	22.0	ft.	
b	Height of East wall	9.0	ft.	
c	Indoor Design Temperature	74	F	
d	Outdoor Design Temperature	95	F	
e	U-Value for East wall	0.071		
f	Heat gain, Q = ((10ax10b)-(8a*8b*8c)-(9a*9b*9c))x 10e x (10d- 10c)	297	BTUH	
Step 11	Heat gain from Windows on West Side			
a	Height of Window	5.00	ft.	
b	Width of Window	3.30	ft.	
c	Number of windows on west side	0		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	U-Value for Window	0.50		
g	SHGC, Solar Heat Gain Coefficient	0.4		
h	Heat gain, Q = ((11a x 11b x 11c)x11f x(11e- 11d))+(11ax11bx11cx11gx125)	0	BTUH	

Apartment Load Sizing: **Carucci Apartments**
Heat Gain Calculations **2-Bedroom**

This analysis is for calculating the heat gain during the cooling season.

Step 12	Heat gain from Exterior Doors on West Side			
a	Height of Exterior Door	7	ft.	
b	Width of Exterior Door	3	ft.	
c	Number of exterior doors on west side	0		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	U-Value for Exterior Doors	0.10		
g	Heat gain, Q = (12a x 12b x 12c) x 12f x (12e- 12d+10)	0	BTUH	
Step 13	Heat gain from West Wall			
a	Length of West wall	22.0	ft.	
b	Height of West wall	9.0	ft.	
c	Indoor Design Temperature	74	F	
d	Outdoor Design Temperature	95	F	
e	U-Value for West wall	0.071		
f	Heat gain, Q = ((13ax13b)-(11a*11b*11c)-(12a*12b*12c))x13ex(13d- 13c+10)	297	BTUH	
Step 14	Heat gain from Roof			
a	Length of Roof	40.0	ft.	
b	Width of Roof	22.0	ft.	
c	Slope Factor for Roof (1.0 for flat roofs, 1.20 for sloped roofs)	1.20		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	U-Value for Roof	0.067		
g	Heat gain, Q = (14a x 14b x 14c) x 14f x (14e- 14d + 30)	3,590	BTUH	
Step 15	Heat gain from Ground Floor			
a	Length of ground floor	40.0	ft.	
b	Width of ground floor	22.0	ft.	
c	Indoor Design Temperature	74	F	
d	Outdoor Design Temperature	75	F	
e	U-Value for ground floor	0.000		
f	Heat gain, Q = (15a x 15b) x 15e x (15d- 15c)	0	BTUH	
Step 16	Heat gain from Infiltration			
a	Length of Building or Unit	40.0	ft.	
b	Width of Building or Unit	22.0	ft.	
c	Height of Building or Unit	9.0		
d	Indoor Design Temperature	74	F	
e	Outdoor Design Temperature	95	F	
f	ACH, Air Change Per Hour	1.0		
g	Enthalpy, H	10.0		
h	Heat gain, Q = ((16a x 16b x 16c) / 60) x 16f x 4.5 * 16g	5,940	BTUH	
Step 17	Heat gain from electrical heat			
a	Kilowatt of continuous power (per hour)	1.0	kW	
b	Heat gain, Q = 3414 x 17a	3,414	BTUH	

Apartment Load Sizing: **Carucci Apartments**
Heat Loss Calculations **2-Bedroom**

This analysis is for calculating the heat loss during the winter heating season.

Step 1	Calculated total BTUH for heating equipment:			
			24393	BTUH
			7.1	kW
Step 2	Heat loss from Windows on North Side			
	a	Height of Window	5.0	ft.
	b	Width of Window	3.3	ft.
	c	Number of windows on north side	4	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (2a x 2b x 2c) x 2f x (2d- 2e)	2,508	BTUH
Step 3	Heat loss from Exterior Doors on North Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on north side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Door	0.10	
	g	Heat Loss, Q = (3a x 3b x 3c) x 3f x (3d- 3e)	0	BTUH
Step 4	Heat loss from North Wall			
	a	Length of North wall	40.0	ft.
	b	Height of North wall	9.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for North wall	0.071	
	f	Heat Loss, Q = ((4ax4b)-(2a*2b*2c)-(3a*3b*3c))x 4e x (4c- 4d)	1,596	BTUH
Step 5	Heat loss from Windows on South Side			
	a	Height of Window	5.0	ft.
	b	Width of Window	3.3	ft.
	c	Number of windows on south side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (5a x 5b x 5c) x 5f x (5d- 5e)	0	BTUH
Step 6	Heat loss from Exterior Doors on South Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on south side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat Loss, Q = (6a x 6b x 6c) x 6f x (6d- 6e)	0	BTUH

Apartment Load Sizing: **Carucci Apartments**
Heat Loss Calculations **2-Bedroom**

This analysis is for calculating the heat loss during the winter heating season.

Step 7	Heat loss from South Wall			
	a	Length of South wall	40.0	ft.
	b	Height of South wall	9.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for South wall	0.071	
	f	Heat Loss, Q = ((7ax7b)-(5a*5b*5c)-(6a*6b*6c))x 7e x (7c- 7d)	1,954	BTUH
Step 8	Heat loss from Windows on East Side			
	a	Height of Window	5.0	ft.
	b	Width of Window	3.3	ft.
	c	Number of windows on east side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (8a x 8b x 8c) x 8f x (8d- 8e)	0	BTUH
Step 9	Heat loss from Exterior Doors on East Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on east side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat Loss, Q = (9a x 9b x 9c) x 9f x (9d- 9e)	0	BTUH
Step 10	Heat loss from East Wall			
	a	Length of East wall	22.0	ft.
	b	Height of East wall	9.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for East wall	0.071	
	f	Heat Loss, Q = ((10ax10b)-(8a*8b*8c)-(9a*9b*9c))x 10e x (10c- 10d)	1,075	BTUH
Step 11	Heat loss from Windows on West Side			
	a	Height of Window	5.0	ft.
	b	Width of Window	3.3	ft.
	c	Number of windows on west side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (11a x 11b x 11c) x 11f x (11d- 11e)	0	BTUH

Apartment Load Sizing: **Carucci Apartments**
Heat Loss Calculations **2-Bedroom**

This analysis is for calculating the heat loss during the winter heating season.

Step 12	Heat loss from Exterior Doors on West Side			
a	Height of Exterior Door	7.0	ft.	
b	Width of Exterior Door	3.0	ft.	
c	Number of exterior doors on west side	0		
d	Indoor Design Temperature	76	F	
e	Outdoor Design Temperature	0	F	
f	U-Value for Exterior Doors	0.10		
g	Heat Loss, Q = (12a x 12b x 12c) x 12f x (12d- 12e)	0	BTUH	
Step 13	Heat loss from West Wall			
a	Length of West wall	22.0	ft.	
b	Height of West wall	9.0	ft.	
c	Indoor Design Temperature	76	F	
d	Outdoor Design Temperature	0	F	
e	U-Value for West wall	0.071		
f	Heat Loss, Q = ((13ax13b)-(11a*11b*11c)-(12a*12b*12c))x 13e x (13c- 13d)	1,075	BTUH	
Step 14	Heat loss from Roof			
a	Length of Roof	40.0	ft.	
b	Width of Roof	22.0	ft.	
c	Slope Factor for Roof (1.0 for flat roofs, 1.20 for sloped roofs)	1.20		
d	Indoor Design Temperature	76	F	
e	Outdoor Design Temperature	0	F	
f	U-Value for Roof	0.067		
g	Heat Loss, Q = (14a x 14b x 14c) x 14f x (14d- 14e)	5,350	BTUH	
Step 15	Heat loss from Ground Floor			
a	Length of ground floor	40.0	ft.	
b	Width of ground floor	22.0	ft.	
c	Indoor Design Temperature	76	F	
d	Outdoor Design Temperature	68	F	
e	U-Value for ground floor	0.000		
f	Heat Loss, Q = (15a x 15b) x 15e x (15c- 15d)	0	BTUH	
Step 16	Heat loss from Infiltration			
a	Length of Building or Unit	40.0	ft.	
b	Width of Building or Unit	22.0	ft.	
c	Height of Building or Unit	9.0		
d	Indoor Design Temperature	76	F	
e	Outdoor Design Temperature	0	F	
f	ACH, Air Change Per Hour	1.0		
g	Heat Loss, Q = ((16a x 16b x 16c) / 60) x 16f x 1.08 * (16d- 16e)	10,835	BTUH	

Common Load Sizing: **Carucci Apartments**
Heat Gain Calculations **Rental Office/Community Bldg**

This analysis is for calculating the heat gain during the cooling season.

Step 1	Calculated total tonnage for cooling equipment:		0.8	Tons
			9775	Btu/hr
Step 2	Heat gain from Windows on North Side			
	a	Height of Window	5.00	ft.
	b	Width of Window	3.30	ft.
	c	Number of windows on north side	6	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	Heat gain, Q = (2a x 2b x 2c) x 2f x (2e- 2d)	1,040	BTUH
Step 3	Heat gain from Exterior Doors on North Side			
	a	Height of Exterior Door	7	ft.
	b	Width of Exterior Door	3	ft.
	c	Number of exterior doors on north side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Exterior Door	0.10	
	g	Heat gain, Q = (3a x 3b x 3c) x 3f x (3e- 3d)	0	BTUH
Step 4	Heat gain from North Wall			
	a	Length of North wall	42.0	ft.
	b	Height of North wall	0.0	ft.
	c	Indoor Design Temperature	74	F
	d	Outdoor Design Temperature	95	F
	e	U-Value for North wall	0.071	
	f	Heat gain, Q = ((4ax4b)-(2a*2b*2c)-(3a*3b*3c))x 4e x (4d- 4c)	-149	BTUH
Step 5	Heat gain from Windows on South Side			
	a	Height of Window	5.00	ft.
	b	Width of Window	3.30	ft.
	c	Number of windows on south side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	SHGC, Solar Heat Gain Coefficient	0.6	
	h	Heat gain, Q = ((5a x 5b x 5c) x 5f x (5e- 5d)) + (5ax5bx5cx5gx125)	0	BTUH
Step 6	Heat gain from Exterior Doors on South Side			
	a	Height of Exterior Door	7	ft.
	b	Width of Exterior Door	3	ft.
	c	Number of exterior doors on south side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat gain, Q = (6a x 6b x 6c) x 6f x (6e- 6d+10)	0	BTUH

Common Load Sizing: **Carucci Apartments**
Heat Gain Calculations **Rental Office/Community Bldg**

This analysis is for calculating the heat gain during the cooling season.

Step 7	Heat gain from South Wall			
	a	Length of South wall	42.0	ft.
	b	Height of South wall	0.0	ft.
	c	Indoor Design Temperature	74	F
	d	Outdoor Design Temperature	95	F
	e	U-Value for South wall	0.071	
	f	Heat gain, Q = ((7ax7b)-(5a*5b*5c)-(6a*6b*6c))x 7e x (7d- 7c+10)	0	BTUH
Step 8	Heat gain from Windows on East Side			
	a	Height of Window	5.00	ft.
	b	Width of Window	3.30	ft.
	c	Number of windows on east side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	Heat gain, Q = (8a x 8b x 8c) x 8f x (8e- 8d)	0	BTUH
Step 9	Heat gain from Exterior Doors on East Side			
	a	Height of Exterior Door	7	ft.
	b	Width of Exterior Door	3	ft.
	c	Number of exterior doors on east side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat gain, Q = (9a x 9b x 9c) x 9f x (9e- 9d)	0	BTUH
Step 10	Heat gain from East Wall			
	a	Length of East wall	12.0	ft.
	b	Height of East wall	0.0	ft.
	c	Indoor Design Temperature	74	F
	d	Outdoor Design Temperature	95	F
	e	U-Value for East wall	0.071	
	f	Heat gain, Q = ((10ax10b)-(8a*8b*8c)-(9a*9b*9c))x 10e x (10d- 10c)	0	BTUH
Step 11	Heat gain from Windows on West Side			
	a	Height of Window	5.00	ft.
	b	Width of Window	3.30	ft.
	c	Number of windows on west side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Window	0.50	
	g	SHGC, Solar Heat Gain Coefficient	0.0	
	h	Heat gain, Q = ((11a x 11b x 11c)x11f x(11e- 11d))+(11ax11bx11cx11gx125)	0	BTUH

Common Load Sizing: **Carucci Apartments**
Heat Gain Calculations **Rental Office/Community Bldg**

This analysis is for calculating the heat gain during the cooling season.

Step 12	Heat gain from Exterior Doors on West Side			
	a	Height of Exterior Door	7	ft.
	b	Width of Exterior Door	3	ft.
	c	Number of exterior doors on west side	0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat gain, Q = (12a x 12b x 12c) x 12f x (12e- 12d+10)	0	BTUH
Step 13	Heat gain from West Wall			
	a	Length of West wall	12.0	ft.
	b	Height of West wall	0.0	ft.
	c	Indoor Design Temperature	74	F
	d	Outdoor Design Temperature	95	F
	e	U-Value for West wall	0.071	
	f	Heat gain, Q = ((13ax13b)-(11a*11b*11c)-(12a*12b*12c))x13ex(13d- 13c+10)	0	BTUH
Step 14	Heat gain from Roof			
	a	Length of Roof	42.0	ft.
	b	Width of Roof	12.0	ft.
	c	Slope Factor for Roof (1.0 for flat roofs, 1.20 for sloped roofs)	1.20	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	U-Value for Roof	0.067	
	g	Heat gain, Q = (14a x 14b x 14c) x 14f x (14e- 14d + 30)	2,056	BTUH
Step 15	Heat gain from Ground Floor			
	a	Length of ground floor	42.0	ft.
	b	Width of ground floor	12.0	ft.
	c	Indoor Design Temperature	74	F
	d	Outdoor Design Temperature	75	F
	e	U-Value for ground floor	0.000	
	f	Heat gain, Q = (15a x 15b) x 15e x (15d- 15c)	0	BTUH
Step 16	Heat gain from Infiltration			
	a	Length of Building or Unit	42.0	ft.
	b	Width of Building or Unit	12.0	ft.
	c	Height of Building or Unit	0.0	
	d	Indoor Design Temperature	74	F
	e	Outdoor Design Temperature	95	F
	f	ACH, Air Change Per Hour	1.0	
	g	Enthalpy, H	10.0	
	h	Heat gain, Q = ((16a x 16b x 16c) / 60) x 16f x 4.5 * 16g	0	BTUH
Step 17	Heat gain from electrical heat			
	a	Kilowatt of continuous power (per hour)	2.0	kW
	b	Heat gain, Q = 3414 x 17a	6,828	BTUH

Common Load Sizing: **Carucci Apartments**
Heat Loss Calculations **Rental Office/Community Bldg**

This analysis is for calculating the heat loss during the winter heating season.

Step 1	Calculated total BTUH for heating equipment:			
			6289	BTUH
			1.8	kW
Step 2	Heat loss from Windows on North Side			
	a	Height of Window	5.0	ft.
	b	Width of Window	3.3	ft.
	c	Number of windows on north side	6	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (2a x 2b x 2c) x 2f x (2d- 2e)	3,762	BTUH
Step 3	Heat loss from Exterior Doors on North Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on north side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Door	0.10	
	g	Heat Loss, Q = (3a x 3b x 3c) x 3f x (3d- 3e)	0	BTUH
Step 4	Heat loss from North Wall			
	a	Length of North wall	42.0	ft.
	b	Height of North wall	0.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for North wall	0.071	
	f	Heat Loss, Q = ((4ax4b)-(2a*2b*2c)-(3a*3b*3c))x 4e x (4c- 4d)	-537	BTUH
Step 5	Heat loss from Windows on South Side			
	a	Height of Window	5.0	ft.
	b	Width of Window	3.3	ft.
	c	Number of windows on south side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (5a x 5b x 5c) x 5f x (5d- 5e)	0	BTUH
Step 6	Heat loss from Exterior Doors on South Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on south side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat Loss, Q = (6a x 6b x 6c) x 6f x (6d- 6e)	0	BTUH

Common Load Sizing: **Carucci Apartments**
Heat Loss Calculations **Rental Office/Community Bldg**

This analysis is for calculating the heat loss during the winter heating season.

Step 7	Heat loss from South Wall			
	a	Length of South wall	42.0	ft.
	b	Height of South wall	0.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for South wall	0.071	
	f	Heat Loss, Q = ((7ax7b)-(5a*5b*5c)-(6a*6b*6c))x 7e x (7c- 7d)	0	BTUH
Step 8	Heat loss from Windows on East Side			
	a	Height of Window	5.0	ft.
	b	Width of Window	3.3	ft.
	c	Number of windows on east side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (8a x 8b x 8c) x 8f x (8d- 8e)	0	BTUH
Step 9	Heat loss from Exterior Doors on East Side			
	a	Height of Exterior Door	7.0	ft.
	b	Width of Exterior Door	3.0	ft.
	c	Number of exterior doors on east side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Exterior Doors	0.10	
	g	Heat Loss, Q = (9a x 9b x 9c) x 9f x (9d- 9e)	0	BTUH
Step 10	Heat loss from East Wall			
	a	Length of East wall	12.0	ft.
	b	Height of East wall	0.0	ft.
	c	Indoor Design Temperature	76	F
	d	Outdoor Design Temperature	0	F
	e	U-Value for East wall	0.071	
	f	Heat Loss, Q = ((10ax10b)-(8a*8b*8c)-(9a*9b*9c))x 10e x (10c- 10d)	0	BTUH
Step 11	Heat loss from Windows on West Side			
	a	Height of Window	5.0	ft.
	b	Width of Window	3.3	ft.
	c	Number of windows on west side	0	
	d	Indoor Design Temperature	76	F
	e	Outdoor Design Temperature	0	F
	f	U-Value for Window	0.50	
	g	Heat Loss, Q = (11a x 11b x 11c) x 11f x (11d- 11e)	0	BTUH

Common Load Sizing: **Carucci Apartments**
Heat Loss Calculations **Rental Office/Community Bldg**

This analysis is for calculating the heat loss during the winter heating season.

Step 12	Heat loss from Exterior Doors on West Side			
a	Height of Exterior Door	7.0	ft.	
b	Width of Exterior Door	3.0	ft.	
c	Number of exterior doors on west side	0		
d	Indoor Design Temperature	76	F	
e	Outdoor Design Temperature	0	F	
f	U-Value for Exterior Doors	0.10		
g	Heat Loss, Q = (12a x 12b x 12c) x 12f x (12d- 12e)	0	BTUH	
Step 13	Heat loss from West Wall			
a	Length of West wall	12.0	ft.	
b	Height of West wall	0.0	ft.	
c	Indoor Design Temperature	76	F	
d	Outdoor Design Temperature	0	F	
e	U-Value for West wall	0.071		
f	Heat Loss, Q = ((13ax13b)-(11a*11b*11c)-(12a*12b*12c))x 13e x (13c- 13d)	0	BTUH	
Step 14	Heat loss from Roof			
a	Length of Roof	42.0	ft.	
b	Width of Roof	12.0	ft.	
c	Slope Factor for Roof (1.0 for flat roofs, 1.20 for sloped roofs)	1.20		
d	Indoor Design Temperature	76	F	
e	Outdoor Design Temperature	0	F	
f	U-Value for Roof	0.067		
g	Heat Loss, Q = (14a x 14b x 14c) x 14f x (14d- 14e)	3,064	BTUH	
Step 15	Heat loss from Ground Floor			
a	Length of ground floor	42.0	ft.	
b	Width of ground floor	12.0	ft.	
c	Indoor Design Temperature	76	F	
d	Outdoor Design Temperature	68	F	
e	U-Value for ground floor	0.000		
f	Heat Loss, Q = (15a x 15b) x 15e x (15c- 15d)	0	BTUH	
Step 16	Heat loss from Infiltration			
a	Length of Building or Unit	42.0	ft.	
b	Width of Building or Unit	12.0	ft.	
c	Height of Building or Unit	0.0		
d	Indoor Design Temperature	76	F	
e	Outdoor Design Temperature	0	F	
f	ACH, Air Change Per Hour	1.0		
g	Heat Loss, Q = ((16a x 16b x 16c) / 60) x 16f x 1.08 * (16d- 16e)	0	BTUH	

APPENDIX E:
SUPPORTING DOCUMENTATION

BUILDING DEPARTMENT FOIA

To:	Phil Fucetola Lyndhurst Building and Planning Department Lyndhurst, New Jersey	Date: Phone #: email:	March 3, 2014 201.804.2490 philf@lyndhurstnj.org
Re:	Carucci Apartments 281 Stuyvesant Avenue Lyndhurst, New Jersey 07071	EMG Project No.:	107534.13R-002.306

Dear Mr. Fucetola:

EMG is an engineering firm currently conducting a property condition survey of the above-referenced property. As part of the due-diligence process, we are submitting this letter through the Freedom of Information Act to obtain information specific to the property. We request your assistance by providing us with the following information concerning the site and buildings:

1. Date of last building department inspection ___/___/___

   mo. day year

2. Are there any OUTSTANDING building code violations? YES / NO

   (circle one)

3. How often is the subject property inspected? annually, biennially, other

   (circle one)

4. Is the original Certificate of Occupancy or Permit on file? YES / NO

If such documents are on file, please fax them to the number noted below.

5. What is the zoning designation for the subject property? _____

   (Residential/Commercial/Industrial/Other)

   (circle one)

6. Are there any OUTSTANDING zoning code violations? YES / NO
   (circle one)
7. Is the subject property, in general, a conforming use? YES / NO

   (circle one)

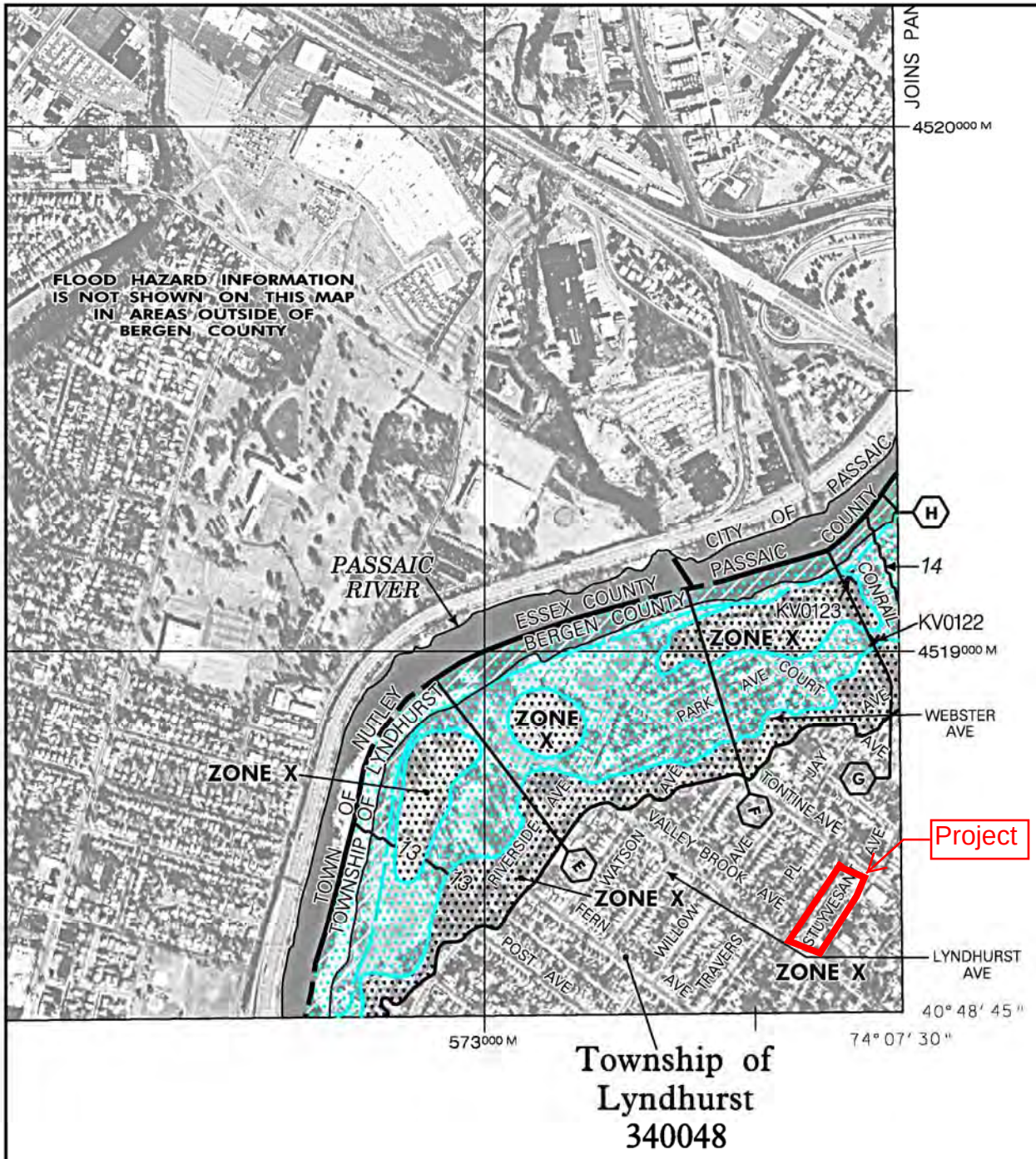
Responses may be faxed directly to our office, at (410) 785-6220, or mailed to our corporate offices:

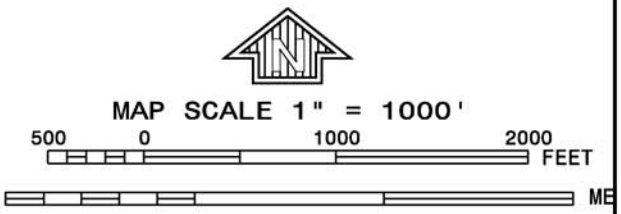
EMG Attn: Senior Engineering Consultant, **Edward Beeghly**
222 Schilling Circle, Suite 275
Hunt Valley, Maryland 21031

If **outstanding** violations are on file, please provide copies of the reports/citations. Please note the EMG Project Number and the Senior Engineering Consultant's name on all correspondence. If you need additional information to complete this request, please contact me at (800) 733-0660. Thank you for your prompt attention to this matter.

Sincerely,

Jill Orlov
Project Manager





NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0235G

FIRM

FLOOD INSURANCE RATE MAP

BERGEN COUNTY,
NEW JERSEY
(ALL JURISDICTIONS)

PANEL 235 OF 332

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LYNDHURST, TWP OF	340048	0235	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
34003C0235G

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

RightSpec® Commercial Water Heater Sizing Recommendations

Job Specifications

Date:	5/29/2014
Application:	Apartments/Condominiums
Installation Type:	Indoor
Fuel:	Natural Gas
VentType:	Standard Atmospheric
Ultra Low NOx:	No
Altitude:	Less than 2000 ft.
Shower Heads:	2.5 GPM
Inlet Temp:	50°F
Stored Temp:	140°F
Pre-Existing Storage:	720 Gallons
General Requirements:	99 Units with 1 Bath
Laundry Requirements:	5 Washers (16 Pound Capacity)

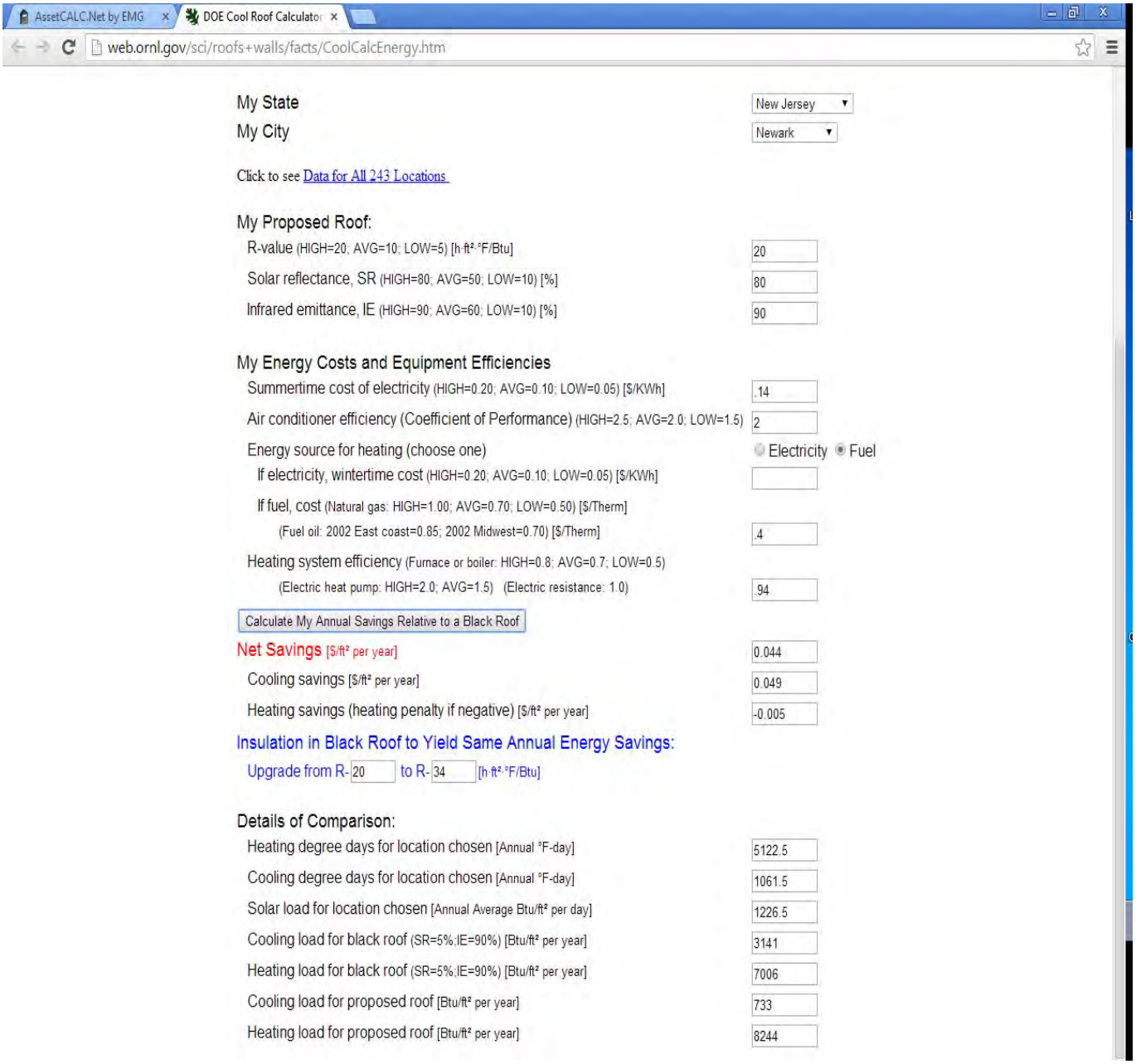
	Energy Saver Recommendation # 1	Energy Saver Recommendation # 2	Ultra High Efficiency Recommendation
Heaters Required:	1	2	3
Heater Model No.:	D-80T-725-3N(A)	D-65T-370-3N(A)	EF-60T-199E-3N(A)
Vent Type:	Std	Std	Std/PDV/PV/DV
Heater Capacity:	80 Gallons	65 Gallons Each	60 Gallons Each
Input per Hour:	725,000 BTU	370,000 BTU Each	199,999 BTU Each
Storage Tanks Required:	None	None	None
Storage Tank Model No.:			
Storage Tank Capacity:			
Usable Storage:	56 Gallons	92 Gallons	126 Gallons
Recovery:	781 GPH @ 90°F Rise	797 GPH @ 90°F Rise	743 GPH @ 90°F Rise
1st Hour Delivery:	837 Gallons	889 Gallons	869 Gallons
3 Hour Average Delivery:	799 GPH	828 GPH	785 GPH
Approx. Storage Recovery:	6 Minutes	10 Minutes	15 Minutes
% of Demand Satisfied:	106%	110%	105%
Heater Top Vent Height:	79 5/8"	73 1/4"	57"
Heater Diameter:	28 1/4"	28 1/4"	28 1/4"
Heater Vent Diameter:	8"	8"	3 or 4"

	Volume Water Heater Recommendation	Brute Elite Volume Water Heater Recommendation	Brute Magnum Volume Water Heater Recommendation
Heaters Required:	1		
Heater Model No.:	BWCV0750NAC		
Heater Capacity:	0 Gallons	Coming Soon	Coming Soon
Input per Hour:	750,000 BTU		
Output per Hour:			
Storage Tanks Required:	None		
Storage Tank Model No.:			
Storage Tank Capacity:			
Usable Storage:	576 Gallons		

Recovery:	850 GPH @ 90°F Rise
1st Hour Delivery:	1426 Gallons
3 Hour Average Delivery:	1042 GPH
Approx. Storage Recovery:	51 Minutes
% of Demand Satisfied:	115%
Heater Height:	41 1/2"
Heater Width:	58"
Heater Depth:	31 5/16"
Heater Vent Diameter:	8"

(A) - ASME Available - Check Local Codes
A - ASME Standard

725 Talamore Drive, Ambler, PA 19002-1815
Email: info@bradfordwhite.com or Phone: 800.523.2931


AssetCALC.Net by EMG
DOE Cool Roof Calculator
web.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm
My State
New Jersey
My City
Newark
Click to see Data for All 243 Locations
My Proposed Roof:
R-value (HIGH=20; AVG=10; LOW=5) [h·ft²·°F/Btu]
20
Solar reflectance, SR (HIGH=80; AVG=50; LOW=10) [%]
80
Infrared emittance, IE (HIGH=90; AVG=60; LOW=10) [%]
90
My Energy Costs and Equipment Efficiencies
Summertime cost of electricity (HIGH=0.20; AVG=0.10; LOW=0.05) [$/KWh]
.14
Air conditioner efficiency (Coefficient of Performance) (HIGH=2.5; AVG=2.0; LOW=1.5)
2
Energy source for heating (choose one)
Electricity
Fuel
If electricity, wintertime cost (HIGH=0.20; AVG=0.10; LOW=0.05) [$/KWh]
If fuel, cost (Natural gas: HIGH=1.00; AVG=0.70; LOW=0.50) [$/Therm]
(Fuel oil: 2002 East coast=0.85; 2002 Midwest=0.70) [$/Therm]
.4
Heating system efficiency (Furnace or boiler: HIGH=0.8; AVG=0.7; LOW=0.5)
(Electric heat pump: HIGH=2.0; AVG=1.5) (Electric resistance: 1.0)
.94
Calculate My Annual Savings Relative to a Black Roof
Net Savings [$/ft² per year]
0.044
Cooling savings [$/ft² per year]
0.049
Heating savings (heating penalty if negative) [$/ft² per year]
-0.005
Insulation in Black Roof to Yield Same Annual Energy Savings:
Upgrade from R-20 to R-34 [h·ft²·°F/Btu]
Details of Comparison:
Heating degree days for location chosen [Annual °F-day]
5122.5
Cooling degree days for location chosen [Annual °F-day]
1061.5
Solar load for location chosen [Annual Average Btu/ft² per day]
1226.5
Cooling load for black roof (SR=5%;IE=90%) [Btu/ft² per year]
3141
Heating load for black roof (SR=5%;IE=90%) [Btu/ft² per year]
7006
Cooling load for proposed roof [Btu/ft² per year]
733
Heating load for proposed roof [Btu/ft² per year]
8244

APPENDIX F:
EMG ACCESSIBILITY CHECKLIST

EMG ACCESSIBIILITY CHECKLIST

Property Name: Carucci Apartments
Date: March 3, 2014
Project Number: 107534.13R-002.306

EMG Accessibility Checklist						
UFAS/ADA Accessibility						
	Building History	**Yes**	**No**	**N/A**	**Unk**	**Comments**
1.	Has the management previously completed an accessibility review?	√				
2.	Does an accessibility compliance plan exist for the property?	√				
3.	Has the plan been reviewed/approved by outside agencies (engineering firms, building department, other agencies)?	√				
4.	Have any accessibility related complaints been received in the past?	√				Occupancy sensor for entrances – close to fast. Want to change apartments to VCT from carpet
5.	Is the property Section 504 compliant?	√				

	Building Access	**Yes**	**No**	**N/A**	**Comments**
1.	Are there an adequate number (per regulation) of wheelchair accessible parking spaces available at the rental office (96" wide/ 60" aisle)		√		No access aisles
2.	Is there at least one wheelchair accessible van parking space (96" wide/ 96" aisle) for every 8 standard accessible spaces?		√		No access aisles
3.	Are accessible parking spaces located on the shortest accessible route of travel from an accessible building entrance?	√			
4.	Does signage exist directing you to wheelchair accessible parking and an accessible building entrance?		√		Not needed

EMG Accessibility Checklist					
	Building Access (cont.)	**Yes**	**No**	**N/A**	**Comments**
5.	Is there a ramp from the parking to an accessible building entrance (1:12 slope or less)		√		
6.	If the main entrance is inaccessible, are there alternate accessible entrances?			√	
7.	Is the accessible entrance doorway at least 32" wide?	√			
8.	Is the door handle easy to open? (lever/push type knob, no twisting required, no higher than 48" above floor)	√			
9.	Are entry doors other than revolving doors available?	√			
	Rental office	**Yes**	**No**	**N/A**	**Comments**
1.	Is the entry door to the rental office 3'wide with no step or threshold over ½" tall?	√			
2.	Is there a counter or table at 30" high for wheelchair access to fill out a rental application?	√			
3.	Is there clearance behind the counter for an employee in a wheelchair?	√			
	Building Corridors and Elevators	**Yes**	**No**	**N/A**	**Comments**
1.	Is the path of travel free of obstructions and wide enough for a wheelchair (at least 60" wide)?	√			
2.	Are floor surfaces firm, stable and slip resistant (carpets wheelchair friendly)?	√			
3.	Do obstacles (phones, fountains, etc.) protrude no more than 4" into walkways or corridor?	√			
4.	Are elevators controls low enough to be reached from a wheelchair (48" front approach/54" side approach)?	√			
5.	Are there raised elevator markings in Braille and standard alphabet for the blind?	√			
6.	Are there audible signals inside cars indicating floor changes?	√			
7.	Do elevator lobbies have visual and audible indicators of the cars arrival?	√			

EMG Accessibility Checklist					
	Building Corridors and Elevators (cont.)	**Yes**	**No**	**N/A**	**Comments**
8.	Does the elevator interior provide sufficient wheelchair turning area (51" x 68" minimum)?		√		50.5"x68"
9.	Is at least one wheelchair accessible public phone available?			√	
10	Are wheelchair accessible facilities (restrooms, exits, etc.) identified with signage?		√		No accessibility signage
	Common Area Restrooms	**Yes**	**No**	**N/A**	**Comments**
1.	Are common area public restrooms located on an accessible route?	√			
2.	Are pull handles push/pull or lever type?	√			
3.	Are access doors wheelchair accessible (at least 32" wide)?	√			
4.	Are public restrooms large enough for wheelchair turnaround (60" turning diameter)?	√			
5.	Are stall doors wheelchair accessible (at least 32" wide)?	√			
6.	If stalls are too narrow can the toilet room be converted to a single occupant toilet room?			√	
7.	Are grab bars provided in toilet stalls (33"-36" above floor)?	√			
8.	Do sinks provide clearance for a wheelchair to roll under (29" clearance)?	√			
9.	Are sink handles operable with one hand without grasping, pinching or twisting?	√			
10.	Are exposed pipes under sink sufficiently insulated against contact?	√			
11.	Are soap dispensers, towel, etc. reachable (48" from floor for frontal approach, 54" for side approach)?	√			
12.	Is the base of the mirror no more than 40" off floor?	√			
	Common Area Kitchen	**Yes**	**No**	**N/A**	**Comments**
1.	In a "U"-shaped kitchen is there 60" clear floor space width?	√			

EMG Accessibility Checklist					
	Common Area Kitchen (cont.)	**Yes**	**No**	**N/A**	**Comments**
2.	In a “U”-shaped kitchen with base cabinet removed from beneath sink, is there a minimum of 40” width?	√			
3.	In an “L”-shaped kitchen, is there a 40” width minimum maintained?			√	
4.	Are countertops a maximum of 24” deep and 36” high?	√			
5.	Knee space beneath cabinetry is 30” wide and 27” high.		√		
6.	Is insulation installed below sinks on piping?		√		
7.	Are adaptable units equipped with removable or retractable cabinetry fronts beneath sink or stove?			√	
	Common Area Laundry rooms	**Yes**	**No**	**N/A**	**Comments**
1.	Are the laundry rooms located on an accessible route?	√			
2.	Are the door handles push/pull or lever type?	√			
3.	Are the access doors wheelchair accessible (at least 32” clear width)?	√			
4.	Are laundry rooms large enough for wheelchair turnaround (60” turning diameter)?	√			
5.	Is there a front load washing machine	√			
6.	If clothes folding tables are provided is one section at 32” high with a clear area below the table?	√			
Fair Housing Accessibility / Section 504					
	Access to Unit	**Yes**	**No**	**N/A**	**Comments**
1.	Property management reports that the number of units currently accessible and those adaptable meet FHA requirements of all ground floor units or 100% for a high rise.	√			
2.	Are 5% of the units fully accessible to those individuals with mobility impairments and 2% of units accessible to those individuals with audio / visual impairments?	√			

EMG Accessibility Checklist					
	Access to Unit (cont.)	**Yes**	**No**	**N/A**	**Comments**
3.	Are there any barriers or structural restrictions preventing access to the building?		√		
4.	Are the accessible units on an accessible route?	√			
5.	Is the apartment entry corridor 36” wide, door 32” wide (frame to frame), threshold height less than ½”, and appropriate door hardware present?	√			
	Unit Living Space	**Yes**	**No**	**N/A**	**Comments**
1.	Is there access throughout unit?		√		Kitchen is only 2’11” between refrigerator and counter
2.	Are electrical outlets 15” minimum above floor minimum?	√			
3.	Are environmental controls and switches 48” maximum above floor or lower?	√			
	Unit Bathroom	**Yes**	**No**	**N/A**	**Comments**
1.	Is entry door at least 32” wide frame-to-frame?	√			
2.	Are switches & outlets in accessible locations?	√	√		Intercom at 58”
3.	Are bathroom walls around the toilet and tub/shower reinforced?	√			
4.	Is there a 30” x 48” clear floor space outside of door swing area?	√			
5.	Is there a 56” x 48” clear floor space in front of toilet (48” out from wall toilet is hung against)?	√			
6.	Is there a 30” x 48” clear floor space in front of lavatories (30” deep from front of counter)?	√			
7.	Is there a 30” x 48” clear floor space in front of tub/shower (30” out from tub/shower)?	√			
8.	Is vanity a maximum of 24” deep and 36” high?			√	
9.	Knee space beneath sink is 30” wide and 27” high.	√			
10.	Is shower stall 36”x 42” minimum with small lip?	√			

EMG Accessibility Checklist					
	Unit Bathroom (cont.)	**Yes**	**No**	**N/A**	**Comments**
11.	Is insulation installed below sinks on piping?	√	√		Unit 5P, 3P, 2R - no
	Unit Kitchen	**Yes**	**No**	**N/A**	**Comments**
1.	In a "U"-shaped kitchen is there 60" clear floor space width?		√		
2.	In a "U"-shaped kitchen with base cabinet removed from beneath sink, is there a minimum of 40" width?	√			
3.	In an "L"-shaped kitchen, is there a 40" width minimum maintained?		√		
4.	Are countertops a maximum of 24" deep and 36" high?	√			
5.	Knee space beneath cabinetry is 30" wide and 27" high.	√			
6.	Is insulation installed below sinks on piping?		√		Required in adaptable unit regardless of occupancy.
7.	Are adaptable units equipped with removable or retractable cabinetry fronts beneath sink or stove?			√	

It is understood by the Client that the limited observation described herein does not comprise a full ADA Compliance Survey, and that such a survey is beyond the scope of EMG's Physical Condition Assessment. Only a representative sample of areas was observed and, other than as shown on the accessibility checklist, actual measurements were not taken to verify compliance.

ADAAG CRITERIA

Total Parking in Lot	Required Minimum Number of Accessible Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6

Total Parking in Lot	Required Minimum Number of Accessible Spaces
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2% of total
1001 and over	20 plus 1 for each 100 over 1000

For further information or a copy of the Americans with Disabilities Act Accessibility Guidelines contact 1-800-949-4ADA

107534.13R-002.306

APPENDIX G:
PRE-SURVEY QUESTIONNAIRES

PROPERTY CONDITION ASSESSMENT: PRE-SURVEY QUESTIONNAIRE

This questionnaire must be completed by the property owner, the owner's designated representative, or someone knowledgeable about the subject property. ***The completed form must be presented to EMG's Field Observer on the day of the site visit***. If the form is not completed, EMG's Project Manager will require ***additional time*** during the on-site visit with such a knowledgeable person in order to complete the questionnaire. During the site visit, EMG's Field Observer may ask for details associated with selected questions. This questionnaire will be utilized as an exhibit in EMG's final Property Condition Report.

Name of person completing questionnaire: Robert Moore

Association with property: Property Manager

Length of association with property: 2 years

Date Completed: 2/19/14

Phone Number: 201-935-0790

Property Name: Carmel Apartments

EMG Project Number:

Directions: Please answer all questions to the best of your knowledge and in good faith. Please provide additional details in the Comments column, of add backup documentation for any *Yes* responses.

	INSPECTIONS	DATE LAST INSPECTED	LIST ANY OUTSTANDING REPAIRS REQUIRED
1	Elevators	12/9/13	None
2	HVAC, Mechanical, Electric, Plumbing	In house every month	None
3	Life-Safety/Fire	5/1/13	None
4	Roofs	1/1/14	Not currently but roof is approx 20+ yrs old.

	QUESTION	RESPONSE
5	List any major capital improvement within the last three years.	Boiler replacement, DHW, + Heat. Weatherization of entire building.
6	List any major capital expenditures planned for the next year.	Carpet all common area + roof if funding is available.
7	What is the age of the roof(s)?	23 years.
8	What building systems (HVAC, roof, interior/exterior finishes, paving, etc.) are the responsibilities of the tenant to maintain and replace?	None

Mark the column corresponding to the appropriate response. Please provide additional details in the Comments column, or backup documentation for any *Yes* responses. (**NA** indicates *"Not Applicable"*, **Unk** indicates *"Unknown"*)

	QUESTION	RESPONSE				COMMENTS
		Y	N	Unk	NA	
9	Are there any unresolved building, fire, or zoning code issues?		√			
10	Are there any "down" or unusable units?		√			
11	Are there any problems with erosion, stormwater drainage or areas of paving that do not drain?		√			
12	Is the property served by a private water well?		√			
13	Is the property served by a private septic system or other waste treatment systems?		√			
14	Are there any problems with foundations or structures?		√			
15	Is there any water infiltration in basements or crawl spaces?		√			
16	Are there any wall, or window leaks?		√			
17	Are there any roof leaks?		√			
18	Is the roofing covered by a warranty or bond?		√			
19	Are there any poorly insulated areas?	√				Roof + windows.
20	Is Fire Retardant Treated (FRT) plywood used?		√			
21	Is exterior insulation and finish system (EIFS) or a synthetic stucco finish used?		√			
22	Are there any problems with the utilities, such as inadequate capacities?		√			
23	Are there any problems with the landscape irrigation systems?		√			
24	Has a termite/wood boring insect inspection been performed within the last year?	√				
25	Do any of the HVAC systems use R-11, 12, or 22 refrigerants?			√		

Mark the column corresponding to the appropriate response. Please provide additional details in the Comments column, or backup documentation for any *Yes* responses. (**NA** indicates *"Not Applicable"*, **Unk** indicates *"Unknown"*)

	QUESTION	RESPONSE				COMMENTS
		Y	N	Unk	NA	
26	Has any part of the property ever contained visible suspect mold growth?	✓				Mis-labeled duct work
27	Is there a mold Operations and Maintenance Plan?	✓				
28	Have there been indoor air quality or mold related complaints from tenants?		✓			
29	Is polybutylene piping used?		✓			
30	Are there any plumbing leaks or water pressure problems?		✓			
31	Are there any leaks or pressure problems with natural gas service?		✓			
32	Does any part of the electrical system use aluminum wiring?		✓			
33	Do Residential units have a less than 60-Amp service?	✓				
34	Do Commercial units have less than 200-Amp service?				✓	
35	Are there any recalled fire sprinkler heads (Star, GEM, Central, Omega)?		✓			
36	Is there any pending litigation concerning the property?		✓			
37	Has the management previously completed an ADA review?	✓				EMG
38	Have any ADA improvements been made to the property?	✓				Shower head replacements.
39	Does a Barrier Removal Plan exist for the property?				✓	
40	Has the Barrier Removal Plan been approved by an arms-length third party?				✓	
41	Has building ownership or management received any ADA related complaints?	✓				Occupancy surveys needed on main doors + VCT + shower stalls.
42	Does elevator equipment require upgrades to meet ADA standards?		✓			

Mark the column corresponding to the appropriate response. Please provide additional details in the Comments column, or backup documentation for any *Yes* responses. (**NA** indicates *"Not Applicable"*, **Unk** indicates *"Unknown"*)						
QUESTION		**RESPONSE**				**COMMENTS**
		Y	N	Unk	NA	
43	Are there any problems with exterior lighting?		√			
44	Are there any other significant issues/hazards with the property?		√			
45	Are there any unresolved construction defects at the property?		√			

Signature of person Interviewed or completing form

2/19/14
Date

ENERGY AUDIT : PRE-SURVEY QUESTIONNAIRE

This questionnaire must be completed by the property owner, management point of contact or other person knowledgeable about the subject property.

The completed form must be presented to EMG's Field Observer on or before the site visit.

If the form is not completed, EMG's Project Manager will require additional time during the on-site visit in order to complete the questionnaire. During the site visit, EMG's Field Observer may ask for details associated with selected questions. This questionnaire will be utilized as an exhibit in EMG's final report.

Housing Authority: Bergen County	Address: One Bergen County Plaza, 2nd Fl
Owner, if other than Authority:	Address: Hackensack, NJ 07601
Name of Subject Site: Carucci Apts.	Residential Buildings: Common Buildings: Other Buildings:
Address 281 Stuyvesant Ave,	City, State, Zip Lyndhurst, NJ 07071
Building Manager Robert Moore	Phone 201-935-0790
Maintenance Manager	Phone
Energy Management Coordinator	Phone

Building Description (circle all that apply)

Masonry - Wood framed – Steel framed – Curtain wall
Detached – Townhouse – Low-rise – Mid-rise – High-rise
Basement – Crawl Space – Attic - Flat Roof -- Slope Roof

Number of:
0 Efficiencies 98 One BR 1 Two BR 6 Three BR 6 Four BR 0 Five BR 6 Six BR 6 SRO

Date of original completion 1982
Dates of significant renovations _____
Describe:

Other uses on this site

- √ Rental Office
- √ Community Service Offices
- √ Common Laundry
- √ Common Meeting-Activity
- √ Common Kitchen
  - (Residential or Commercial)
- ___ Daycare
- ___ Training Education
- √ Gym Fitness Recreation
- √ Maintenance Storage
- ___ Other, Specify:

Anticipated Modifications or Changes In Use in the next 15 yrs: Roof, carpet, generator, hot water tanks, windows replacement, parking lot, fence

Have there been previous Energy Audits or Retrofit Programs? √ Yes __ No
Date _____
Agency EMG + BCCAP/CHIP
Scope _____
Are related Energy Audit or Retrofit documents available? Yes
Any additional Energy Investment Programs? No

Does the Institution Have an ongoing energy management program? ✓ Yes ___ No

Utilities			
	Utility Supplier to the Site	Master Metered	Tenant Metered
Electric	PSEG	✓	✓
Natural/LP Gas	PSEG	✓	
Fuel Oil	None		
Other _____	None		
Domestic Water	United Water	✓	
Sewer	None		

- Utility data is required for the most recent available 12 month period. EMG can provide you with Excel form to assist you in supplying this data. Request this form from your Program Manager.
- Tenant paid data is required for best evaluation results. At minimum a representative sample of actual tenant consumption and cost is required for the 12 month period.

Tenant Utility Cost Paid By		
	Landlord or Housing Authority	Tenant
Heating	✓	✓
Cooling		✓
Domestic Hot Water	✓	
Water Supply	✓	
Sewer	✓	

Unk = Unknown, NA = Not Applicable	Yes	No	Unk	NA	Comments
1. Does the boiler or furnaces seem to be oversized for the property (i.e. – cycles on and off often)?	✓	✓			DHW is oversized
2. Do any of the gas fired boilers, furnaces, or water heaters have vent or flue dampers?	✓				Vents
3. Does the boiler have outdoor reset controls?		✓			
4. Does the County pay for the tenant gas or oil consumption?		✓			
5. Are low-flow faucet aerators and shower heads installed on all or most faucets and showers?	✓				
6. Are the water closets low-flow (1.6 gpf)?	✓				
7. Are the motors used for the elevators	✓				

Unk = Unknown, NA = Not Applicable	Yes	No	Unk	NA	Comments
high-efficiency motors?	✓				
8. Are the motors used for the ventilation systems (i.e. - air handlers, fan coils, etc.) high-efficiency motors?	✓				
9. Are the motors used for the hydronic heating system (i.e. – pumps) high-efficiency motors?	✓				
10. Are the motors used for the hydronic cooling system (i.e. – pumps, chillers, cooling tower fan) high-efficiency motors?	✓				
11. Is there any uninsulated heating water, chilled water, or domestic hot water piping in unconditioned spaces such as mechanical rooms, basements, or storage areas?		✓			
12. Is a booster pump required to maintain water pressure at the property?	✓				
13. Are laundry room washing machines fixed to cold rinse only?		✓			
14. Are there any wall or window leaks?		✓			
15. Are there any poorly insulated areas?	✓				Windows + A/C sleeves
16. Do the utilities (electric, gas, sewer, water) provide adequate service?	✓				
17. Are HVAC systems at the property inspected and maintained, at a minimum, annually?	✓				
18. Is the HVAC equipment more than ten years old?	✓				
19. Are the water heaters/boilers more than ten years old?		✓			
20. Are the any leaks or pressure problems with natural gas service?		✓			
21. Is the electrical service adequate?	✓				
22. Are there any emergency electrical generators?	✓				
23. Are there any large UPS battery systems?		✓			
24. Are there any vacant buildings or significant building areas?		✓			
25. Is there anything else that EMG should know about when assessing this property? If so, what?			✓		

APPENDIX H:
RESUMES

EDWARD BEEGHLY

Quality Assurance Manager

Education

- Pursuing Masters of Engineering in Project Management – UMD College Park
- Ohio Northern University; Bachelor of Science, Civil Engineering, May 1995
- Valley Forge Military College; Associate Degree in Business, May 1991

Project Experience

- ***Charlottesville Department of Public Works, Charlottesville, NC –*** Mr. Beeghly, as the Program Manager on this project, which includes the assessment of eight sites encompassing over 161,000 SF. Projects under this contract include office buildings, a county health center, a fire station, an historic center and an opera house. EMG was responsible for assisting the DPW in developing their capital facilities plan for major rehabilitation projects at these buildings. EMG performed ADA assessments, facility assessments, and completed cost estimates per the RS Means model, adjusted to the location of the projects. Mr. Beeghly was responsible for management of the assessment teams and technical review of deliverables.
- ***Atlanta Housing Authority, Atlanta, GA –*** Mr. Beeghly is serving as the Program Manager for this ADA and Section 504 Assessment. He is responsible for managing the EMG team, as well as technical oversight and facilitating communication between EMG and AHA. Mr. Beeghly's knowledge of multifamily housing will lead the team to provide ADA assessments. EMG will provide AHA with design solutions to bring each facility in compliance with UFAS, and HUD Section 504 standards.
- ***MDSHA District 3, Greenbelt, MD (Chief of Engineering Systems) –*** Mr. Beeghly served as the Chief of Engineering. During this time he managed a staff of seven, including four project managers, two engineering technicians, and one administrative assistant. Their projects included 10 consulting contracts valued at $12 million dollars. Additionally, he served as Program Manager for District 3's (Suburban Washington D.C.) system preservation programs. He was fiscally responsible for multiple programs valued upwards to $90 million dollars. He tracked asset management performance goals, program budget, network condition, and public commitments in determining individual project scope and program priority.

Industry Tenure

- A/E: 1995
- EMG: October, 2006

Related Experience

Industry Experience

- Government
- Office
- Industrial
- Affordable/Multi-family Housing
- Healthcare
- Retail
- Hospitality

Active Licenses/Registration

- Engineer in Training – Maryland

Special Skills & Training

- Dean L. H Archer Senior Design Award (Ohio Northern University)
- Geometric Design
- Highway Materials
- Pavement Design
- Project Management

Memberships

- Association of State Highway Engineers

BRETT BYERS

Lead Technical Review, Project Manager, Senior Engineering Consultant

Education

- Associate of Science, Electrical Engineering, Tidewater Community College, 2003

Project Experience

HOUSING

- ***Massachusetts Department of Housing and Community Development*** – Capital Needs Assessment for MDHCD, which consists of 252 local housing authorities and more than 3,300 housing units.
- ***Brandywine Apartments, Tullahoma, TN –*** Capital needs assessment of this multifamily housing facility located in southern Tennessee in accordance with HUD requirements and protocols.
- ***Morristown Housing Authority, Morristown, TN –*** Senior Engineering Consultant for HUD Green Physical Needs Assessments of public housing authority managed multi-family properties.
- ***Scottsboro Housing Authority, Scottsboro, AL –*** Senior Engineering Consultant for HUD Rental Assistance Demonstration program conversion of multi-family properties managed by the housing authority.
- ***Winn Development, PA –*** Senior Engineering Consultant on several Capital Needs Assessment projects to meet Pennsylvania Housing Finance Administration requirements for Low Income Housing Tax Credit financing.
- ***Stone Gate Apartments, Maynardville, TN*** – Project Manager for Physical Needs Assessment of apartment community.

COMMERCIAL

- ***Citibank, New York City, NY*** – Senior Engineering Consultant for Facility Condition Assessments of 16 bank branches in the greater NYC area.
- ***Opryland Hotel, Nashville, TN*** – Property Condition Assessment of the four-million square foot premiere showcase property in the clients' resort hotel portfolio.
- ***Nursing Homes, Various Locations Nationwide and Canada*** – Senior Engineering Consultant on portfolios of Senior

Industry Tenure

- A/E: 1992
- EMG: 2006

Related Experience

- Educational Facility Condition Assessment reports
- Utility System Infrastructure Condition Assessment Reports
- Historical Structure Condition Assessments
- Retail and Restaurant
- Office Portfolios
- Acute Care Hospitals

Industry Experience

- Government Facilities
- Hospitals and Health Care Facilities
- Office
- Housing/Multi-family
- K-12
- Hospitality
- Infrastructure
- Retail/Wholesale
- Commercial Garage
- Universities

Active Licenses/Registration

- EPA Transitional Refrigerant Recovery Certification, 1994

Special Skills & Training

- Water Treatment Plant Operation
- Wastewater Treatment Plant Operation
- ANSI 3.1 Senior Health Physics Technician

Regional Location

- Knoxville, TN

- ***Shady Grove and Washington Adventist Hospitals, Behavioral Health Hospitals –*** Senior Engineering Consultant for Facility Condition Assessments of Acute Care Hospitals, Behavioral Health Hospitals, and Physical Plants.
- ***Hendrick Automotive Properties Nationwide –*** Senior Engineering Consultant and Project manager for Physical Needs Assessments of properties owned or being purchased; including retail auto sales outlets, office buildings, and retail sales stores leased by other companies.

FEDERAL GOVERNMENT

- ***Bureau of Indian Affairs, Various Locations in Arizona, Oregon, and Washington States –*** FCAs at schools, offices, housing quarters, maintenance garages, and utility systems.
- ***Bureau of Indian Affairs, Muckleshoot Tribal School, Auburn, WA –*** FCA at 140,000 SF K-12 tribal school.
- ***Bureau of Indian Affairs, Cherokee Indian School, Cherokee, NC –*** FCA and Space Utilization Analysis at 400,000 SF high school.
- ***Bureau of Indian Affairs, Chemawa Indian School, Salem, OR –*** FCA and Space Utilization Analysis at 230,000 SF high school.
- ***Bureau of Indian Affairs, Nazlini Community School, Nazlini, AZ –*** FCA and Space Utilization Analysis at 57,000 SF middle school. FCA of fire station and quarters buildings.
- ***Bureau of Indian Affairs, Chinle Boarding School, Chinle, AZ –*** FCA and Space Utilization Analysis at 85,000 SF boarding school including FCA of 95 quarters buildings.
- ***Bureau of Indian Affairs, Laguna Elementary School, Laguna, New Mexico –*** FCA and Space Analysis at 80,000 SF elementary school along with administrative office buildings.
- ***Bureau of Indian Affairs, Tesuque Day School, Tesuque Pueblo, New Mexico –*** FCA and Space Analysis at 30,000 SF elementary school including administrative office buildings and classrooms.
- ***Bureau of Indian Affairs, Cheyenne River Agency, Marty, SD –*** client specified equipment inventory and condition assessment of office buildings, fire station, maintenance facilities, and a 40,000 square foot adult and juvenile detention center***.***
- ***Bureau of Indian Affairs, Cheyenne River Agency, Eagle Butte, SD –*** client specified equipment inventory and condition assessment of school buildings, dormitories, office buildings, and physical plant/ maintenance facilities***.***
- ***US Department of Interior*** - Bureau of Land Management and the National Park Service. Field inspections and assessment reports for utility infrastructures (potable water treatment and distribution; wastewater collection, treatment, and discharge; medium and low voltage electrical supply and distribution) at The Presidio, Yosemite National Park, Grand Canyon National Park, Gateway National Recreation Area, Yellowstone National Park, Sequoia and Kings Canyon National Park, Big Bend National Park, and Lake Meredith National Recreation Area

EDUCATION

- ***University of New Mexico, Albuquerque, NM*** – Facility Condition Assessment of University campus buildings.
- ***Columbia State Community College, Columbia, TN*** – Senior Engineering Consultant for Facility Condition Assessment of the college campus.
- ***Texas Southern University, Houston, TX*** – Senior Engineering Consultant and lead reviewer for Facility Condition Assessments of the University campus buildings including dormitories and apartments.

- ***University of the District of Columbia, Washington, D.C.*** – Senior Engineering Consultant for Physical Needs Assessment of campus buildings and infrastructure, an in-depth roof survey, and a Phase I Environmental Site Assessment.
- ***Alexandria City Public Schools, Alexandria, VA*** – Senior Engineering Consultant for Physical Needs Assessment of the schools and support facilities for Alexandria City Public Schools.
- ***Stafford County Public Schools, Stafford County, VA*** – Physical Needs Assessment of 25 buildings, consisting of 2.9 million square feet of educational facilities.
- ***Board of Education of Carroll County, MD; –*** Facility Condition Assessment of 41 school buildings.

STATE GOVERNMENTS AND MUNICIPALITIES

- ***Pennsylvania National Guard, Multiple PA Sites –*** Lead reviewer and project manager on FCAs of 41 National Guard and Army Reserve Centers across the state.
- ***City of Dallas, Dallas, TX*** – FCA of over 700 City-owned buildings within the incorporated boundaries of the city. Building types included water treatment, waste water treatment, offices, city maintenance, stormwater pumping stations, fair grounds, and the city zoo.
- ***County of San Diego, San Diego, CA*** – Lead reviewer of FCAs for more than 800 County-owned buildings including offices, road maintenance stations, parks, housing, museums, and vehicle and equipment maintenance facilities.
- ***Town of West Tisbury, MA*** – Senior Engineering Consultant and Project Manager for Facility Condition Assessments of town-owned buildings.

PARKS

- ***National Park Service, Washington, D.C –*** Comprehensive condition assessment of the monuments, memorials, maintenance support facilities, park police substations, and historical structures in the National Capital Region Parks. The assessment included national icons such as the Washington Monument, Jefferson Memorial, Lincoln Memorial, FDR Memorial, and Ford's Theatre.
- ***National Park Service, Death Valley, CA –*** Comprehensive condition survey of single and multi family housing, park visitor centers, park maintenance and support facilities, utility infrastructure systems, and historical museum facilities such as Scotty's Castle.

ENERGY

- ***Unicor – Federal Prison Industries, Northeast Locations –*** ASHRAE Level I & II energy assessments of US Army Reserve Centers in NY, MD, VA, and other locations.
- ***Housing Authority of Baltimore City, Baltimore, MD*** – ASHRAE Level I and III energy assessments of high-rise, low-rise, and scattered site multi-family housing buildings.
- ***Village of Winnetka, Winnetka, IL*** – ASHRAE Level II energy assessments of the Villages' municipal buildings. Included a power generating station and water treatment/distribution facilities.
- ***Oak Ridge National Laboratories, Oak Ridge, TN*** – Level II energy assessment of office buildings and laboratories (second year of a 5-year rotating assessment schedule).
- ***County of Sandoval, Bernalillo, NM*** – Combined Level II energy and Facility Condition assessments of County-owned buildings.
- ***City of Needham, Needham, MA*** – Level II energy assessment of select facilities.

- ***Bristol Housing and Redevelopment Administration, Bristol, VA*** – Level I energy assessment and Physical Needs Assessment.
- ***Schuylkill County Housing Authority, Schuylkill County, PA*** – Level II energy assessment of multi-family buildings.
- Multiple other portfolios across a broad spectrum of client and building types.

JILL E. ORLOV

Technical Report Reviewer

Education

- Master of Architecture - University of Pennsylvania
- Bachelor of Science, Architecture - University of Virginia

Project Experience

- ***Hotel Property; Pittsburgh, PA –*** As Project Manager, Ms. Orlov performed a Property Condition Assessment of this 132 unit, six-story hotel property. She reviewed the condition of the building structure and systems and developed a thorough report, delivered on time and on budget.
- ***Nursing Home; Charleston, SC –*** Ms. Orlov completed a Property Condition Assessment of this 89,900 square feet building consisting of 148 units. Her findings included information on existing building conditions, site improvements, mechanical and electrical systems and code accessibility information.
- ***Office Building; Richmond, VA –*** Ms. Orlov completed a Property Condition Assessment on this 31,000 square feet, two and three story office building located in Richmond. She conducted interviews with the property manager and maintenance staff. Findings included information on existing building conditions, site improvements, mechanical and electrical systems and code and accessibility information.
- ***Higher Education Stadium; Fairfax, VA –*** Ms. Orlov completed a Property Condition Assessment on this 162,221 square feet, three story sports arena building located in Fairfax. Findings included information on existing building conditions, site improvements, mechanical and electrical systems and code and accessibility information. The client found her structural and roof observations critical to their final business decision. This project was a part of a large portfolio of projects EMG completed for our client.
- ***Accessibility Study of Office Building –*** New Orleans, Louisiana – Ms. Orlov completed a detailed handicapped accessibility study of a large hotel conference center.
- ***Multi-Family; Northeast –*** Ms. Orlov performed Property Condition Assessments on a large scale multi-family property converted from an historic mill complex. The site comprised a variety of past use buildings which had undergone major gut renovations.

Industry Tenure

- A/E: 1991 - 2004
- EMG: July, 2004 to present
- Commercial Real Estate Due Diligence: 2004

Industry Experience

- Government Facilities; 2004
- Office; 2004
- Industrial/Warehouse Facilities; 2004
- Housing/Multi-family; 2004
- Affordable Housing/HUD; 2004
- K-12; 2004
- Higher Education; 2004
- Hospitality; 2004
- Healthcare/Senior Living; 2004
- Retail; 2004
- Level 1 Energy Audit; 2004
- Level 3 ADA Audit; 2013

Active Licenses/Registration

- Architectural, Maryland
- Architectural, Pennsylvania - pending

Special Skills & Training

- AUTOCAD, 2000

Regional Location

- Baltimore, Maryland

KEVIN M. LANTRY, CEM

Lead Project Manager

Education

- Bachelor of Science, Mechanical Engineering - Purdue University School of Mechanical Engineering, 2003.

Project Experience

- ***Indianapolis Housing Agency, Indianapolis, IN –*** Lead Project Manager. Completed Physical Needs Assessments and Energy Assessments at 11 multifamily and senior living properties in the City of Indianapolis. Provided subsequent comprehensive update assessments for Tax Credit Rehabilitation purposes. Reports included life/safety concerns, deferred maintenance, capital planning, and ADA issues. Compiled capital plan into EMG's AssetCALC database software for client use.
- ***Ann Arbor Housing Commission, Ann Arbor, MI –*** Lead Project Manager. Completed Physical Needs Assessments and Energy Audits at 17 multifamily and senior living properties in the City of Ann Arbor. Compiled PNA Reports along with energy benchmarking, conservation measures, and financial calculations.
- ***Housing Authority of the City of Paterson; Paterson, NJ –*** Project Manager. Completed Energy Audits at office, residential, and recreational properties owned and operated by the Housing Authority of Paterson. Energy Audits included physical assessment, plan review, utility consumption analysis, and energy conservation recommendations.
- ***Mark to Market Green PCAs; Various Locations –*** Project Manager. Completed multiple Mark to Market Green PCAs per Housing and Urban Development (HUD) protocol. Reports included standard mark to market assessments with energy audits including ECMs and recommendations for sustainability.
- ***Alan Bible Federal Building; Las Vegas, NV –*** Project Manager. Completed a Level IV Building Engineering Report (BER) for the US Government General Services Administration. Evaluated the mechanical, plumbing, and elevator systems as part of the assessment team sent by EMG to analyze all building components.
- ***First Energy Facility Assessments; Multiple Sites, PA -*** Project Manager. Performed facility assessments on over forty sites in central and eastern Pennsylvania. Evaluated district offices, regional headquarters and maintenance facilities. Compiled results into Facility Condition Reports and AssetCALC software.

Industry Tenure

- A/E: 2001
- EMG: 2004

Related Experience

- GSA Assessment Team

Industry Experience

- Industrial
- Commercial
- Multi-family Residential
- Affordable Housing
- Condition Assessment
- Energy Auditing

Active Licenses/Registration

- Engineer in Training (EIT)
  Indiana ET 31011662
- Association of Energy Engineers
  Certified Energy Manager
  CEM #16678

Special Skills & Training

- Certified Multifamily Building Analyst by Building Performance Institute (BPI)
- Training Program for Energy Managers by the Association of Energy Engineers (AEE)
- AutoCAD
- VFA.Facility Certified
- Cross Trained for Environmental Assessments

Memberships

- ASHRAE
- U.S. Green Building Council

Regional Location

- Indianapolis, Indiana

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The Association of Energy Engineers

certifies that

Kevin M. Lantry

has completed the prescribed standards for certification,
has demonstrated a high level of competence and ethical fitness
for energy management, and is hereby granted the title of

CERTIFIED ENERGY MANAGER

Expiration Date:

December 31, 2014

CEM

16678

ASSOCIATION OF ENERGY ENGINEERS CORPORATE SEAL GEORGIA

CEM Board Chairman

CEM Director