G. IMPACT ON CLIMATE CHANGE

1. Greenhouse Gas Emission

All human activity results in greenhouse gases (GHG) today. In a microscopic sense one residential development has no discernable effect on global warming. In a macroscopic view, all of the small actions across the country may accumulate to produce a measurable effect. There are large overwhelming producers of greenhouse gases such as the industrial sector (28%) and transportation (28%). The direct attribution of GHG to the Residential economic sector is 5% when electric production is excluded. Nevertheless, the extent of greenhouse gas production and the size of an activity's carbon footprint can be lessened. The following sections will provide quantitative and qualitative discussions of the effect of this residential development project and these metrics.

Assessing GHG Emissions during construction

During construction GHG will be produced primarily by construction equipment on the site. Large excavators, pans, and dump trucks consume diesel fuel and produce GHG. In addition there are substantial GHG utilized to produce construction materials and deliver them to the site. Also, employees of the contractors travelling to and from the job produce GHG in their cars and trucks.

The total GHG from construction is estimated to be 0.0418 tonnes CO2-E per square foot ("Comparing High and Low Residential Density: Life-Cycle Analysis of Energy Use and Greenhouse Gas Emissions" by Jonathan Norman1et. al, 2006). On the proposed project, living units average 2,000 SF each for a total of 84 tonnes CO2-E. This figure can be annualized over fifty years to 1.67 tonnes CO2-E per year per year. For the entire development of 396 units the total GHG impact is 662 tonnes CO2-E per year.

Operation and Occupancy

The Energy Information Agency (EIA) of the US Department of Energy reports in its Residential Energy Consumption Survey (RECS) that the average consumption of energy for New York State in 2005 was 118.2 million BTU (34.6MWH) per household. ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy. The "Greenhouse Gas Inventory and Tracking Portfolio Manager, October 21, 2008" is designed to relate building energy consumption to GHGs. For a building in Sullivan County, NY the factor from ENERGY STAR is 93.5360 kg CO-E/MBTU. The estimated annual GHG emissions from a household in the proposed project is 11.1 tonnes CO2-E per year. For the entire development of 396 units the total GHG impact is 4,396 tonnes CO2-E per year.

The other significant source of residential GHG is the use of an automobile. The US EPA (EPAA420-F-05-004 February 2005) calculates the average annual GHG contribution from a single automobile as 5.2 tonnes CO2-E per year. According to the 2002 US census the average household has 1.9 vehicles for personal usage. The

estimated GHG per unit for transportation is 9.9 tonnes CO2-E per year. For the entire development of 396 units the total GHG impact is 3,920 tonnes CO2-E per year.

2. Removal of Carbon Sink

The site build-out will result in a loss of forested area and a net loss of CO2 sequestration capacity. The project evaluated an alternate layout and the preferred layout. The alternate layout resulted in the removal of 22.9 acres of forested resources. The preferred layout substantially avoided the forested areas and resulted in a reduction of forest cover of 5.6 acres.

The loss of forested area was greatly reduced with the preferred layout preserving 17.3 acres of deciduous forest. The preferred plan has set aside the forested land as a permanently reserved open resource. In addition the configuration of the preferred plan allows the forested land to remain substantially contiguous without residential development in the northern section of the site.

3. Energy Usage and Conservation

Energy consumption is associated with all residential construction projects. Short-term energy consumption impacts occur during construction of the proposed residential development, primarily due to the consumption of fossil fuels through the operation of power equipment and construction vehicles. Secondary usages also include fuel utilized by the contractor's employees to commute to the site and the energy for transportation and production of building materials.

After construction the operation of the home consumes energy on a continuous basis. The energy is primarily utilized for heat and air conditioning, hot water production, light and the operation of appliances such as refrigerators, ovens and dehumidifiers. The forms of energy consumed directly are typically electricity, gas, fuels oil. Indirectly coal, hydroelectric power, and nuclear power is used for electric production.

The Energy Information Agency (EIA) of the US Department of Energy reports that New York has the highest production of hydroelectric power east of the Rocky Mountains and that the state has one of the lowest per capita energy consumption rates due to extensive use of mass transportation systems. EIA also reports in its Residential Energy Consumption Survey (RECS) that the average consumption of energy for New York State in 2005 was 118.2 million BTU (34.6MWH) per household.

It is clear that there are distinct advantages of providing highly energy efficient construction, equipment and appliances. The annual savings in energy cost can help pay back the initial higher expense of the purchase and installation of the high performance materials. There are several public programs that address energy efficiency. ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S.

Department of Energy which helps save money and protect the environment through energy efficient products and practices. In the state, the New York State Energy Research and Development Authority supports the **New York Energy $mart**[SM] program. The highest rated Energy Star buildings can be 40% more energy efficient a conventional building. NYSERDA states that multi-family construction in accordance with the **New York Energy $mart**[SM] program will be 20% more efficient than an ASHRAE compliant design. Compliance with provisions of these energy conservation programs would reduce the overall long-term energy consumption of the project.

The Energy Conservation Construction Code of New York (ECCCNYS 2007) addresses the design of energy-efficient building envelopes and the installation of energy-efficient mechanical, lighting and power systems through requirements emphasizing performance. This comprehensive code establishes minimum regulations for energy-efficient buildings using prescriptive and performance-related provisions. It makes possible the use of new materials and innovative techniques that conserve energy. The ECCCNYS 2007 has an effective date of January 1, 2008. Compliance with provisions of this energy code will reduce the overall long-term energy consumption of the project.

The Villages of Chestnut Ridge will utilize highly efficient energy devices for heating and air conditioning. Insulation with high R-values will be provided to obtain more efficient levels of thermal protection. Other equipment and appliances such as, hot water systems, and electrical systems will be highly rated for energy efficiency.

Based on the selection of materials and equipment the energy efficiency of the townhomes will be improved. An energy savings from these types of measures could be 10% of the annual usage. Based on the annual estimated usage of 34.6MWH per household the savings could be 3.5 MWH per household. Based on the average local rate of $0.17/KWH for electric usage the savings would be $595 per year.

The project, with 396 new residences, is not expected to have any effect on local or County wide energy distribution systems.

4. Alternatives

The GHG associated with building construction were estimated in the section above. Mitigation measures which reduce the activities related to GHG production during construction are listed below. If some of these measures are adopted which can result in approximately a 10% drop then the reduction in GHG impact for the entire development would be 66 tonnes CO2-E per year over the life of the project.

The GHG associated with transportation are significant. Mitigation measures which reduce the activities related to travel would directly reduce GHG production. If a some of these measures are adopted which can result in approximately a 10% drop in total

annual miles traveled then the reduction in GHG impact for the entire development would be 392 tonnes CO2-E per year.

The following mitigation measures during detailed design, construction and operation may be considered. These measures would reduce energy consumption and thus lower GHGs.

Building Construction Measures

- Provide for storage and collection of recyclables (including paper, corrugated cardboard, glass, plastic and metals) and construction materials during construction
- Re-use building materials and products
- Use building materials with recycled content
- Use building materials that are extracted and/or manufactured within the region
- Pursue carbon collection, capture, and reuse or sequestration
- Provide open space on the project site
- Provide forested areas and trees for carbon sequestration
- Conserve natural areas on-site
- Minimize building footprint
- Incorporate idling reduction policies during construction
- Support temporary parking at Park-n-Ride Lots and/or transit stations during construction
- Reduce energy demand using peak shaving or load shifting strategies as applicable during construction
- Provide access to and encourage use of public transportation for construction workers
- Provide use of transportation sharing/pooling for construction workers

Building Operation Measures

- Energy efficient building design to reduce cooling/heating requirements
- Install high-efficiency HVAC systems
- Reduce use of refrigerants in HVAC systems
- Maximize interior daylighting
- Reduce energy demand using peak shaving or load shifting strategies
- Incorporate window glazing to optimize daylighting, heat loss and solar heat gain
- Incorporate super insulation to minimize heat loss
- Incorporate motion sensors into lighting and climate control
- Use efficient, directed exterior lighting
- Use water conserving fixtures that exceed building code requirements
- Provide for storage and collection of recyclables (including paper, corrugated cardboard, glass, plastic and metals) in building design
- Use energy efficient boilers, heaters, furnaces
- Incorporate combined heat and power (CHP) technologies
- Design project to support alternative transportation (walking and bicycling)
- Design and maintain water efficient landscaping

- Support expansion of regional parking at Park-n-Ride Lots and/or transit stations
- Reduce energy demand using peak shaving or load shifting strategies
- Incorporate motion sensors into lighting and climate control
- Use rapidly renewable building materials for repairs
- Maintain open space on the project site
- Manage forested areas for carbon sequestration
- Use natural areas on-site

Transportation Measures

- Support expansion of regional parking at Park-n-Ride Lots and/or transit stations
- Develop and implement an information program that includes posting and distribution of ride sharing /pooling information
- Provide access to and encourage use of public transportation
- Support alternative transportation (walking and bicycling)
- Incorporate idling reduction policies into HOA policies