2.1 DEVELOPMENT OF ALTERNATIVES

As discussed in Section 1, Oglethorpe needs additional electric capacity and has applied to RUS for financing assistance to construct two 100-MW biomass plants and associated facilities to meet part of its needs. RUS must decide whether or not to provide the financing assistance. This EIS addresses only the Proposal as Oglethorpe has no specific plans to pursue the Alternate at this time.

2.1.1 Evaluation Process and Criteria

Under the CEQ regulations established to implement NEPA,[13] RUS is required to identify and evaluate reasonable alternatives to the Proposal, as well as the no action alternative. Reasonable alternatives are those that are "practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant" (CEQ 1981, Question 1). In determining reasonable alternatives, RUS is required to consider a number of factors that may include, but are not limited to "the proposed action's size and scope, state of the technology, economic considerations, legal considerations, socioeconomic concerns, availability of resources, and the timeframe in which the identified need must be fulfilled."[14]

2.1.2 Previous Studies

As part of the preparation for the NEPA scoping process, RUS requires that applicants for financing assistance for generation projects complete an Alternatives Report and Siting Study.[15] Oglethorpe prepared several studies prior to this EIS, including an Alternatives Report, which incorporated this Siting Study (Oglethorpe Power Corporation 2009a). The Alternatives Report evaluated the following capacity alternatives, most of which are discussed in this final EIS, as noted:

- Renewable energy sources: biomass, geothermal, hydroelectric, solar and wind. See Sections 2.2.1.3, 2.2.1.4, 2.2.1.5, 2.2.1.6 and 2.2.1.7.
- Distributed generation: fuel cells and other resources applicable to distributed generation. See Section 2.2.1.8.
- Load management: Load management is one part of demand side management (DSM). See Section 2.2.1.9.
- Non-renewable central station generation: nuclear, oil, coal and natural gas. While nuclear, coal, and natural gas are energy alternatives that Oglethorpe is investigating and/or developing to meet its energy needs, the purpose of the Proposal and Alternate is to meet part of Oglethorpe's needs with renewable

[13] Title 40 of the Code of Federal Regulations (40 CFR), Parts 1500 - 1508
[14] 7 CFR *1794*.12
[15] 7 CFR 1794.51(c)

energy. Oglethorpe discussed each of these in the Alternatives Report, but since they do not meet Oglethorpe's purpose and need, they were not considered further, and therefore are not evaluated as alternatives in this final EIS.

- Repowering or uprating existing generating units. Oglethorpe currently generates electricity using coal, natural gas, nuclear fuel, oil and hydroelectric pumped storage. Coal, natural gas, nuclear fuel and oil are non-renewable energy sources and therefore adding capacity to these facilities is not evaluated in this EIS. Hydroelectric pumped storage has a negative net energy value because it takes more energy to pump the water to the storage reservoir than it generates as it flows back down. However, it has great value as a peaking resource, because the stored water can be made available for power immediately, whenever it is needed. Hydroelectric pumped storage would also not meet the purpose and need for the Proposal and it is not evaluated as an alternative.

- Participation in another company's generation project. As part of its planning, Oglethorpe is continually on the lookout for opportunities to participate in generation projects. Oglethorpe does not currently have opportunities for participation in any other company's renewable energy generation projects. However, Oglethorpe is one of the founding members of the National Renewables Cooperative Organization, which continually evaluates opportunities for participation in renewable energy projects.

- Purchased power. Oglethorpe and its Members currently purchase hydroelectric power to the extent that it is available. No other large-scale renewable energy is available for sale in Georgia. At present, Oglethorpe Power Corporation is not aware of completed biomass projects for sale. Oglethorpe Power Corporation has been asked to review proposed or potential biomass projects or partnerships. However, the lifecycle cost of each of the potential projects that have been proposed exceeds the estimated cost for the Warren biomass facility. The company has not committed to and is not involved in any other biomass projects other than the subject projects of this EIS. However, certain members of Oglethorpe's EMCs participate in energy purchases from existing biomass facilities either directly or through Green Power EMC, a cooperative formed by EMCs in Georgia.[16]

Section 2.4 summarizes the results of the Siting Study.

2.2 ALTERNATIVES CONSIDERED BUT NOT STUDIED IN DETAIL

2.2.1 Fuel Source/Generation Technology

The Energy Information Administration (EIA), which is the DOE agency that tracks and analyzes energy information, reports "The growing importance of state renewable

[16]The thirty-nine member-owned electric cooperatives in the state participate in Green Power EMC.

portfolio standards and the proposals for a national renewable energy standard. This has sparked an interest in the share of U.S. generation provided by renewable energy. In 2008, renewable energy provided 9.0 percent of total electricity generated in the U.S., up from 8.5 percent in 2007. Nonhydroelectric renewable power provided 3.0 percent in 2008, up from 2.5 percent in the prior year" (EIA 2009b).

What are the sources of renewable energy for electricity in the U.S.?

The EIA recognizes these types of renewable energy for electricity generation:

- **Biomass:** nonfossil biological material.
    - *Wood and derived fuels*: black liquor (a waste product from paper mills), wood/wood waste solids, and wood/wood waste liquids.
    - *Landfill gas.*
    - *Municipal solid waste (MSW) biogenic* is the combustible biogenic (non-fossil) part of ordinary garbage: paper and paper board, wood, food, leather, textiles and yard trimmings.
    - *Other biomass*: agricultural byproducts/crops, sludge waste, and other biomass solids, liquids and gasses.
- **Geothermal**: Hot water or steam extracted from geothermal reservoirs in the earth's crust.
- **Hydroelectric conventional**: flowing water; does not include pumped storage.
- **Solar**:
    - *Thermal*: solar energy converted to heat.
    - *Photovoltaic*: solar energy converted directly to electricity.
- **Wind.**

Figure 2-1 shows the relative uses of these resources for generating electricity in the U.S. in 2009, the latest year for which data are available. The solar energy bar is so small that both types of solar energy are combined. While utility companies that sell electricity to customers generate most of the electricity in the U.S., the bar graph also includes electricity generated by commercial and industrial entities that generate electricity for their own use. If we showed the utility-only graph, the only big difference would be that the "wood and derived fuel" bar would be only a third the size it is in Figure 2-1, and some other items, mostly hydroelectric, would be proportionately larger. This is because the primary current use of wood and derived fuel for generation of electricity is in the wood products industry, where the waste is used to generate electricity on-site (EIA 2009b).

Each of these potential sources is evaluated in the EIS, although not all are currently in use in Georgia for generation of electricity. Distributed power generation and demand side management (DSM) are also evaluated. Distributed power generation may use

renewable energy sources. While DSM is not a renewable energy source, DSM can help postpone the need for non-renewable sources.

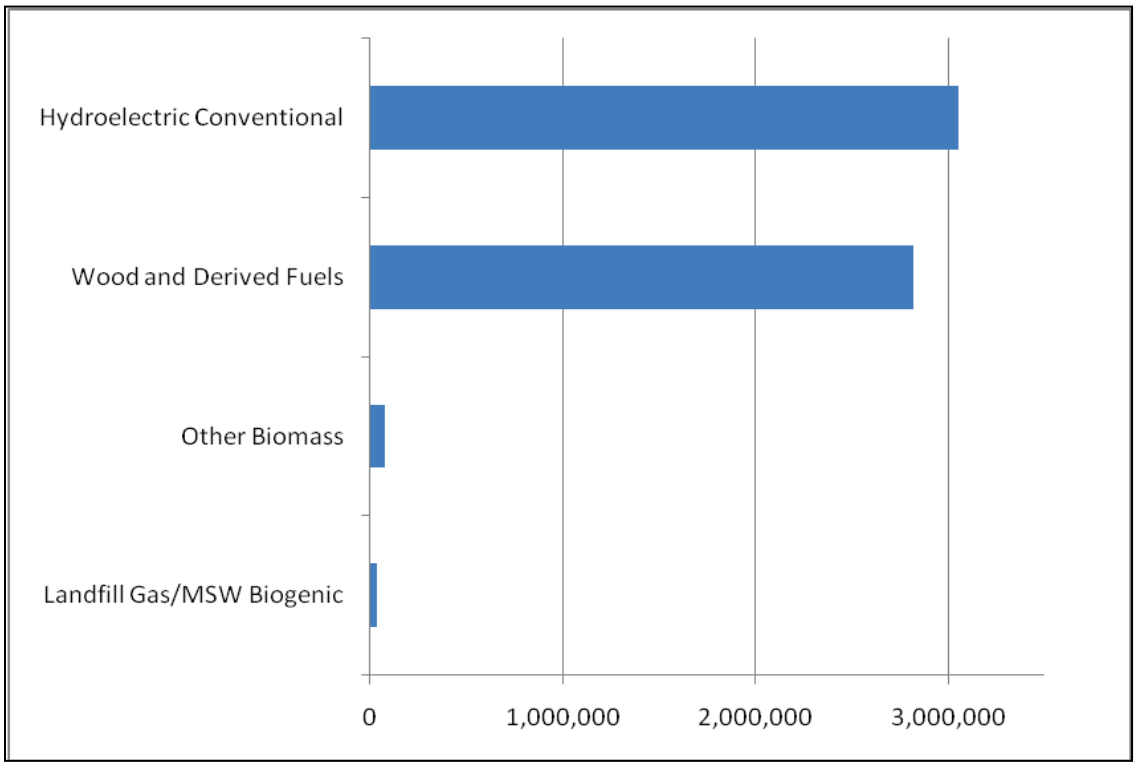

Figure 2-1. U.S. Renewable Electric Power Generation 2009, Thousand MWh
Source: EIA 2010b, Table 3

Which renewable energy resources are used in Georgia?

The chart in Figure 2-2 shows that almost all the electricity generated by renewable sources in Georgia in 2008 was either hydroelectric or from wood and derived fuels. EIA reported no generation from solar, geothermal or wind resources. The solar installations in Georgia are too small to show up in the EIA reporting.[17]

2.2.1.1 Biomass – Landfill Gas

In the U.S., landfill operators must collect the gas, mostly methane and carbon dioxide that is generated as garbage decomposes in a landfill. Within a landfill, the gas is collected in a system of pipes and is then either simply flared, or burned for some useful purpose such as generating electricity.

As Figure 2-1 shows, landfill gas is a notable renewable source for electricity. The U.S. Environmental Protection Agency (EPA) tracks landfill gas projects, and reports that as of December 2009, there are over 500 operational landfill gas projects in the U.S., and

[17] The reference document did not indicate the minimum reporting value; however, the lowest reported value in the reference tables was 18,000 kWh.

more than 500 other landfills that are candidates for landfill gas projects. EPA estimates the untapped capacity of the candidate landfills at 1,700 MW (EPA 2009a). These projects use landfill gas, which is primarily methane, for generating electricity and for other energy uses. Of even more importance to EPA than the renewable energy usage is the reduction in methane emissions. The Intergovernmental Panel on Climate Change (IPCC) estimates that methane has a global warming potential approximately 25 times that of carbon dioxide, when considered over a 100-year period (IPCC 2007a, p. 214).

While the great majority of landfill gas electricity generating projects are in the 1 to 4-MW range, there are some larger projects on very big landfills. The largest of these projects by far is a 50-MW facility on a 53-year old landfill in Los Angeles that is near closure and contains 121 million tons of waste. Two other landfill gas projects, both on landfills with 30 million tons of waste, have capacities of over 20 MW each. There are also thirteen very large landfills that produce between 10 to 20 MW (EPA 2009a).

Georgia has 12 operational landfill gas projects, and 24 additional landfills that the EPA considers candidate sites. Of the 12 projects, five are used to generate electricity, and range in capacity from 1.0 to 6.4 MW. The candidate landfills have waste in place ranging from 0.5 to 9 million tons. Of the five projects, two have been developed by Green Power EMC, a cooperative formed by EMCs in Georgia. All of Oglethorpe's 39 EMCs belong to Green Power EMC.

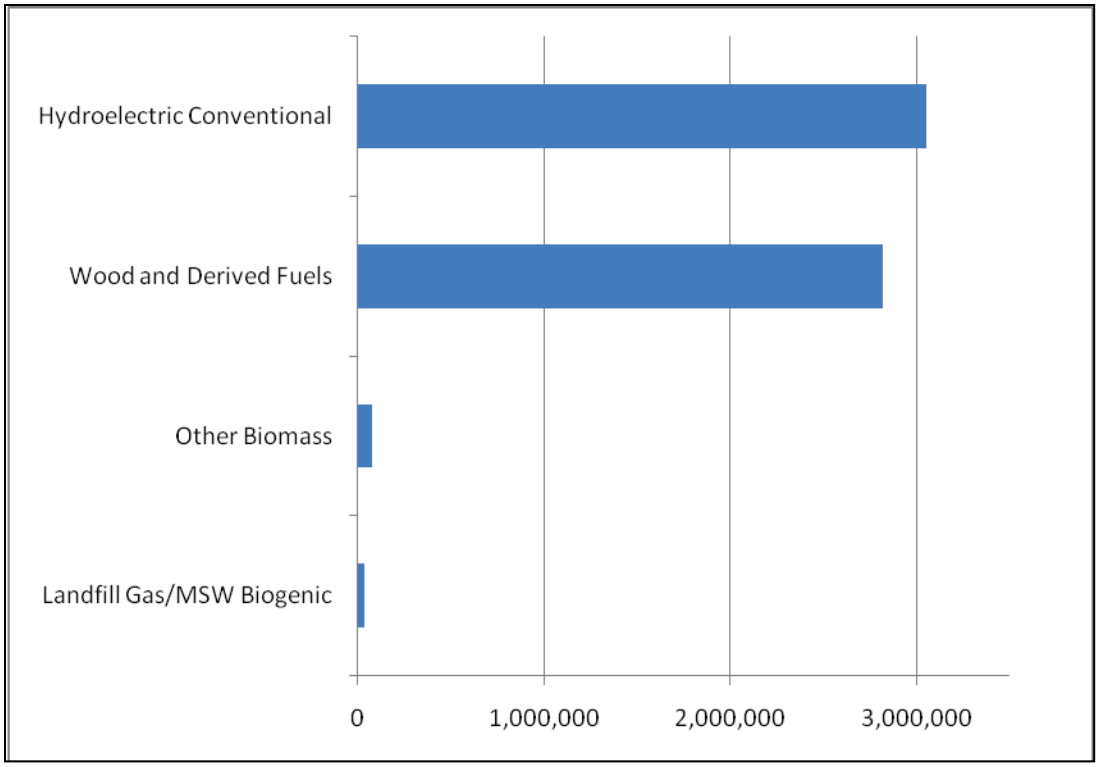

Figure 2-2. Georgia Renewable Electric Power Generation 2008, MWh
Source: EIA 2010b, Table 6

Summary of Reasons for Elimination of Landfill Gas as the Energy Source for the Proposal

Landfill gas has been eliminated as a potential source of energy to meet part of Oglethorpe's needs because Green Power EMC is already developing landfill gas as feasible as a source of electricity for Oglethorpe's Members and it appears there is not enough potential to ever meet 50 MW.

2.2.1.2 Biomass – Municipal Solid Waste (MSW) Biogenic

The major advantage for burning waste is that it reduces the amount of MSW buried in landfills. Since 1995, MSW waste-to-energy (WTE) plants, because they have the potential to release relatively high concentration emissions for some metals such as mercury and cadmium, must comply with EPA's stringent standards, the Maximum Achievable Control Technology (MACT) (Michaels 2007, p. 4; EPA 1997, p. 4.17).[18] Partly because of the high cost of air pollution controls, MSW WTE plants have high capital costs and they need a reliable stream of low-cost fuel to be financially viable. Usually a plant would enter into a "flow contract" with a municipality for its waste. Few new plants have come on line since 1994, when the U.S. Supreme Court upheld a challenge to flow control, finding that it violated the interstate commerce clause of the

[18] These regulations apply to plants with the capacity to combust more than 250 tons per day of MSW; these are the plants that produce the great majority of the energy (EPA 2010b).

Constitution (EIA 2007a, p. 8). In 2007, 87 plants operated in 25 states. Among these plants the most recent startup date was 1996, except for one plant that was retrofitted in 2006 (Michaels 2007). Georgia has one MSW WTE in Savannah with a capacity of 5 MW. The project startup was in 1987 (Michaels 2007, p. 17).

Beginning in 2007, in its tracking of renewable energy, EIA has distinguished between biogenic (non-fossil) and non-biogenic MSW. Based on an analysis of the composition of MSW, EIA estimates that approximately 44 percent of the energy value of MSW is non-biogenic. The primary non-biogenic components are plastics (EIA 2007b, p. 17). Thus, almost half the energy produced from waste-to-energy (WTE) facilities is non-renewable.

Summary of Reasons for Elimination of MSW as the Energy Source for the Proposal

MSW was eliminated as a potential renewable energy source to meet part of Oglethorpe's needs because:

- The potential capacity of MSW WTE plants is small.
- Capital costs are high relative to woody biomass technology.
- Nearly half the energy produced by MSW WTE plants is from fossil fuels, not renewable sources.

2.2.1.3 Biomass – Other

EIA's category of "other biomass" includes agricultural byproducts/crops, sludge waste, and other biomass solids, liquids and gasses. Agricultural byproducts/crops and woody debris may be used as fuel for the Proposal. The remaining "other biomass" sources are small and in the category of sources that Green Power EMC may evaluate; however, they are too small for Oglethorpe's purposes.

2.2.1.4 Geothermal

Geothermal energy is contained in underground reservoirs of steam, hot water, and hot dry rocks. As used at electric generating facilities, hot water or steam extracted from geothermal reservoirs in the Earth's crust is supplied to steam turbines at electric utilities that drive generators to produce electricity. Moderate-to-low temperature geothermal resources are suitable for direct-use applications such as district and space heating. Lower temperature, shallow ground, geothermal resources are used by geothermal heat pumps to heat and cool buildings. Moderate-to-low temperature geothermal resources are not hot enough to produce steam, and are therefore not suitable for generating electricity.

Figure 2-3 generally shows geothermal resources of the U.S., with the highest temperature resources lightest and the lowest, darkest. While the map shows a few small light areas in Arkansas, the western U.S. is where the resources are located that may be used for power generation. Figure 2-4 shows the western U.S. high-temperature geothermal area in more detail, and includes locations of geothermal electric generation plants. As of 2007, the only states with such plants were California, Nevada, Hawaii and Utah (EIA 2009b). Georgia has no high-temperature geothermal resources; the nearest are in New Mexico.

Undeveloped Hydropower Resources in the U.S.

The U.S. Geological Survey (USGS) reports that very few large dams, hydropower or otherwise, have been built in the U.S. since around 1980 (USGS 2010). Many of the environmental and cultural laws of the 1960s and early 1970s made new dam construction much more difficult and expensive due to the environmental effects often associated with dams. These laws include the Wilderness Act (1964), the Wild and Scenic Rivers Act (1968), the National Environmental Policy Act (NEPA) (1969), the National Historic Preservation Act (NHPA) (1966) and the Endangered Species Act (1973). In addition, “most of the good spots to locate hydro plants have already been taken” (USGS 2010).

The U.S. Bureau of Reclamation (BOR) has several dam projects that were authorized in the 1960s and have never been completed, for a number of reasons, including environmental issues, water rights issues, public opposition, cost, safety concerns, and lack of funding. The Auburn Dam in California, for example, was authorized in 1965, and was to provide a 750 MW power plant, flood control, and irrigation. Construction began in 1967, was suspended in 1977, and has not yet resumed (BOR 2009b).[19]

Summary of Reasons for Elimination of Geothermal Energy as the Energy Source for the Proposal

Geothermal energy was eliminated as a potential energy source for the needed renewable energy because there are no resources available near Oglethorpe’s service area.

[19] Other examples are the Narrows Dam in Colorado, the Orme Dam in Arizona, the Garrison Project in North Dakota (BOR-accessed 2008b, BOR-accessed 2008c; Garrison Diversion 2004).

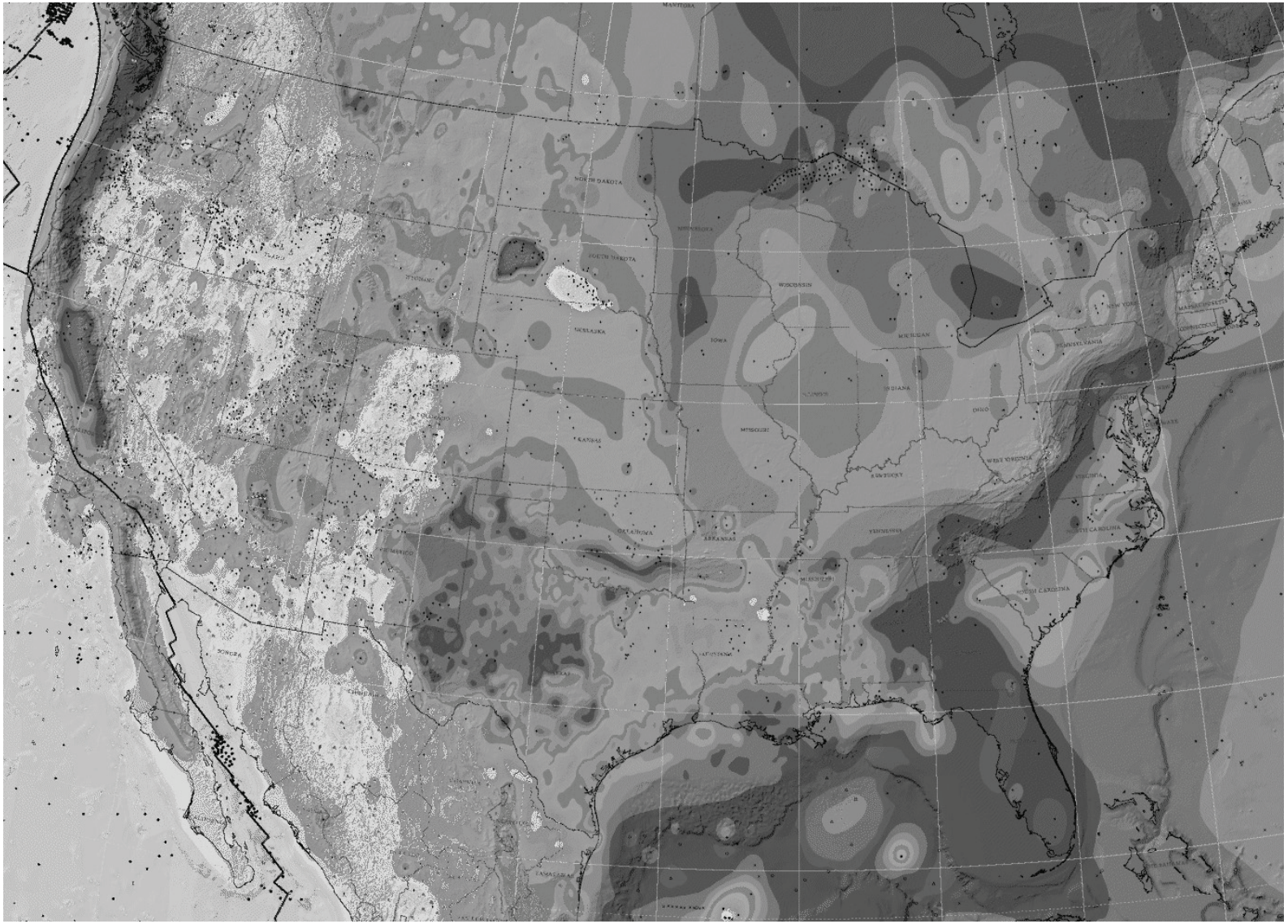

Figure 2-3. Geothermal Resources of the U.S.
Source: AAPG 2004

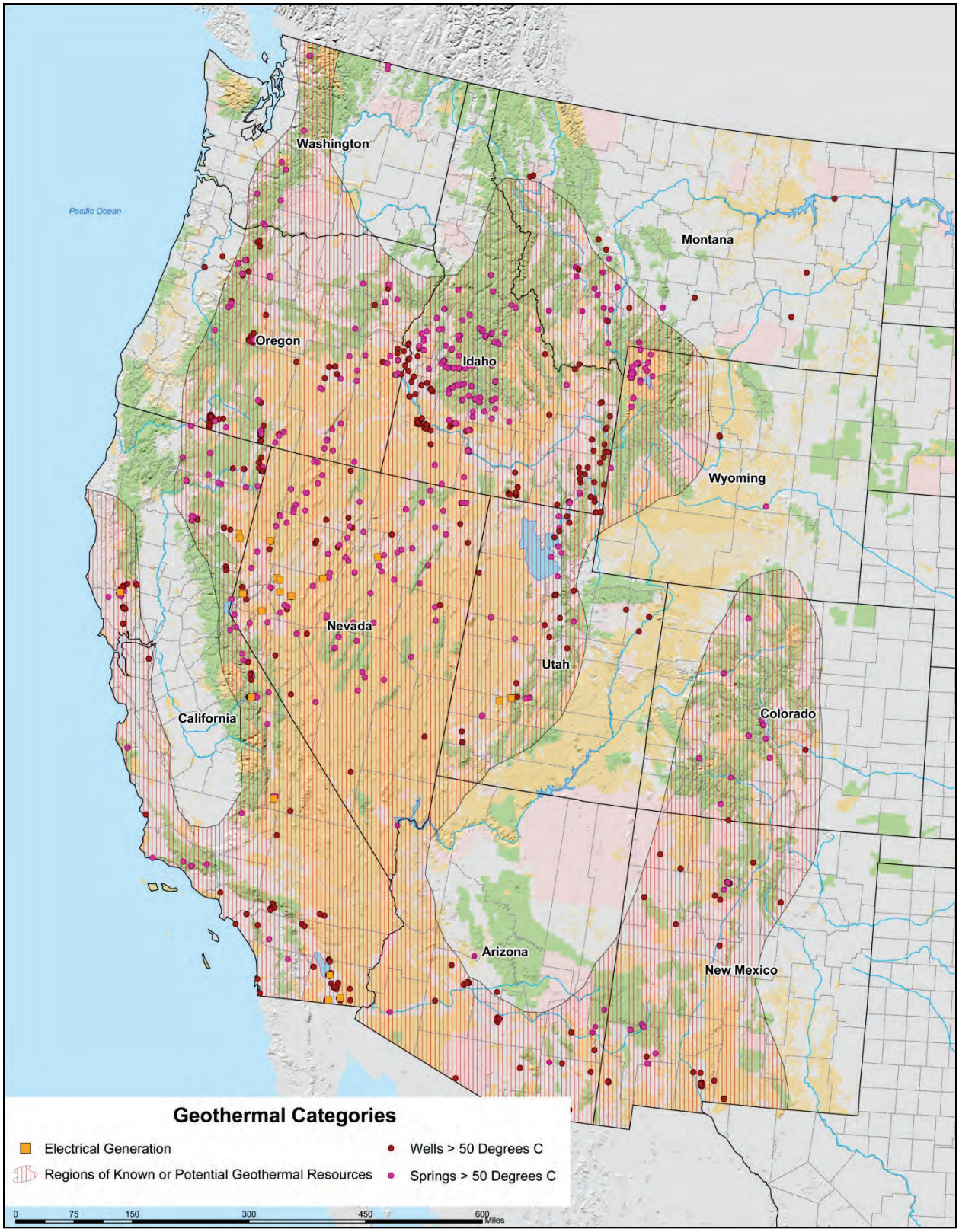

Figure 2-4. Geothermal Features, Western U.S.
Source: INEEL 2003

2.2.1.5 Hydroelectric, Conventional

In the past hydroelectricity met a substantial part of U.S. electrical energy needs, and in some parts of the world it still does. In this section we discuss why hydropower's role has declined in the U.S., why most future U.S. hydropower additions are likely to be small scale, the hydroelectric potential in Georgia, and why hydropower is not feasible as an energy source to meet a part of Oglethorpe's needs. The power source for the hydroelectric turbine is moving water. In some cases, small hydroelectric facilities can operate without damming a stream or with a dam that is not tall (a low head dam). However, to produce utility-scale energy a dam is needed. Tidal power and wave power are potential future sources for coastal areas.

Hydroelectric Energy in the U.S.

In 2008, conventional hydroelectricity in the U.S. accounted for six percent of all net electricity generated (EIA 2010a, p. 28). Fifty years ago, hydroelectricity represented a very large percentage of energy generated in the U.S.; however, hydroelectric generation has been fairly flat since the mid-1970s. As recently as 1980, the U.S. ranked first in the world and accounted for 16 percent of world production (EIA 2007c).

The period from the 1930s to the 1970s, particularly the 1960s, was the peak of the dam-building that created most of the current U.S. hydropower capacity (USGS 2010). Most of these dams were constructed by the federal government. DOE's Idaho National Laboratory (INL) reports that over half the hydroelectric power produced in the U.S. comes from facilities owned by the federal government, and nearly all of that is under the jurisdiction of three agencies: the Corps (largest U.S. hydropower producer), the Bureau of Reclamation (BOR) (second largest), and the Tennessee Valley Authority (INL 2006). The largest hydroelectric facility in the U.S. is the BOR's Grand Coulee facility in the state of Washington, with a capacity of 6,809 MW (BOR 2009a).

A number of studies have assessed the existing undeveloped hydropower resources in the U.S. According to an INL study (Connor et al. 1998), previous studies by the DOE's Hydropower Program[20], the Federal Energy Regulatory Commission (FERC), and the USACE did not account for environmental, legal, and institutional constraints and therefore over-estimated available developable resources. The 1998 INL study estimated a total of 30,000 MW of available undeveloped resources, compared to, for example, the USACE's previous theoretical estimate of 580,000 MW. Most of the INL study's estimated 30,000 MW are from rivers in the northwest U.S., including Alaska.

The DOE later revised their U.S. hydropower estimate to 170,000 MW of undeveloped resources, but much of this would apparently be very small scale (DOE 2004). DOE's

[20] The mission of DOE's Hydropower Program "is to conduct research and development (R&D) that will improve the technical, societal, and environmental benefits of hydropower and provide cost-competitive technologies that enable the development of new and incremental hydropower capacity, adding diversity to the nation's energy supply." The Idaho National Laboratory provides technical support to the Hydropower Program. http://hydropower.inl.gov/ (accessed September 2, 2006).

goals for hydropower are “a 10% growth in generation at existing plants and harnessing undeveloped hydropower capacity without constructing new dams” (DOE 2004, p. 16).

Most recently, the DOE’s Hydropower Program has explicitly acknowledged the unlikelihood of development of large hydropower projects in the U.S. today (INL 2006). DOE concluded “hydroelectric growth is dependent upon the development of distributed generation using low power [less than 1 MW] and small hydro [1 to 30 MW] class plants. For significant growth to occur there will have to be a dramatic increase in the number of these plants and probably an accompanying increase in the number of plant owners” (INL 2006).

Aside from small run-of-the-river hydro projects the most likely sources of additional hydropower capacity are from upgrades to existing facilities or from adding hydropower to existing dams that do not have it. The DOE notes that the National Hydropower Association estimates these activities could achieve more than 4,300 MW of additional power (DOE 2004).[21] Section 1834 of the EPA Act of 2005 requires the U.S. Departments of Interior (DOI) and the Army to assess and report on options to increase hydropower capacity. Adding hydropower to dam facilities that do not currently have it is probably most feasible at lock and dam facilities on major rivers, where it is now being implemented. For example, the USACE is currently partnering with a number of parties to add hydropower facilities to five of its locks and dams systems on the Ohio River, with a total capacity of approximately 350 MW (USACE 2010). Most existing facilities often already have too many competing needs for the limited water supply available.

Potential Hydroelectric Resources in Oglethorpe’s Service Area

Potential Developable Resources. In a nationwide 2006 study of hydropower resources in the U.S., the DOE identified a number of sites in Georgia with small hydro (between 1 and 30 MW average annual power) potential (DOE 2006). The feasibility assessment was based on information available on GIS and did not include cost or other site-specific issues. In any case, constructing many small generating units are not a reasonable alternative for Oglethorpe’s needs. Refer to discussion in Section 2.2.1.8. However, these sites do provide opportunities for development for firms who specialize in small scale hydro projects or potentially for Green Power EMC.

Advantages and Disadvantages of Hydroelectricity

Once the facilities are constructed, hydroelectricity is inexpensive to produce, requires no fuel, and creates negligible emissions or waste. Hydroelectricity is renewable and the technology is well-developed, and it also does not consume water. However, use of the water for hydropower often conflicts with the timing and quantity for other uses.

[21] DOE 2004 did not include a reference.

The construction of large hydropower facilities in the U.S. has created major environmental and social impacts, and costs can vary greatly. Construction of a large hydropower facility in the U.S. is not likely practical in the foreseeable future.

Hydropower development that is likely to occur will be at existing facilities, where the use of water for hydropower would potentially have to compete with other interests including water supply, wildlife, fish, river health, navigation, recreation, fishing, and flood control. In 2007, the most recent year for which EIA has published data, Georgia produced 2,236 thousand MWh of electricity from its hydropower capacity of 2,032 MW, a capacity factor of 12 percent. By comparison, wood/wood waste facilities, Georgia's other major renewable energy source, produced 3,362 thousand MWh from 621 MW capacity (capacity factor 62 percent) (EIA 2009a, p. 30). The nationwide capacity factor for hydropower in 2007 was 36 percent (EIA 2009a, pp. 154-155). While 2007 was a drought year in Georgia, even in a recent year without drought, 2003, the capacity factor for hydropower in George overall was 22 percent, while the capacity factor for wood/wood waste facilities was 88 percent (Rosencrans 2010) (EIA 2009a, pp. 31-32).

Even TVA, the third-largest owner of hydropower facilities in the U.S., with 29 hydroelectric dams, plus additional hydroelectric power from 4 Alcoa dams and 8 USACE dams, uses hydropower as a peaking resource. In 2006, TVA's hydropower system produced 6 percent of its power, with 93 percent from fossil fuel and nuclear power (TVA 2008).

Summary of Reasons for Elimination of Hydroelectric as the Energy Source for the Proposal

Hydroelectric power was eliminated as a potential energy source for the needed renewable energy for the following reasons:

- The history of dam building over the last 40 years in the U.S. indicates large risks related to delays and capital costs. Construction of new facilities is unlikely to be feasible in the foreseeable future.
- Utility-scale hydroelectric projects generally create negative environmental impacts.
- Because of increased demands for water resources aggravated by persistent and long-term drought, even Georgia's current hydropower resources are under-utilized.

2.2.1.6 Solar

Using solar energy for generation of utility-scale electricity is feasible only in areas with intense solar radiation, such as the southwest U.S. For small-scale applications, solar

energy is currently most useful in locations remote from the grid. This section discusses methods and applications for generation of solar energy, and why solar energy is not feasible to meet Oglethorpe's renewable needs.

Two methods are used to convert solar energy to electricity:

- **Thermal -** concentrated solar rays produce heat for conventional steam technologies.
- **Photovoltaics -** semiconductors convert solar energy directly to electricity.

Thermal

In thermal systems, mirrors concentrate solar rays, which transfer heat either to a fluid (oil or salt solution) or directly to water; in either case the heat is used to create steam that powers turbines.

In the U.S., the southwest has the greatest potential for CSP. Even so, the cost of energy from CSP is substantially higher than from other sources (including wind), and is expected to remain so (DOE 2007b, EIA 2010c, p. 68).

Photovoltaics

For generation of electricity, photovoltaic cells are arranged into flat arrays (flat plate collectors). They may be fixed and placed to receive maximum sun at a given latitude. Alternatively, they can be equipped with devices that allow them to track the sun from east to west. Because of their simplicity, flat-plate collectors are often used for residential and commercial building applications. Photovoltaic arrays are economically used at remote locations for lighting, pumping water, etc., but are not currently cost-competitive when conventional electric sources are available (DOE 2007a). Solarbuzz, an international solar energy research and consulting company, estimates the cost of electricity generated from photovoltaics in sunny regions ("US Sunbelt States") at 19 to 35 cents per kWh (Solarbuzz 2010). Oglethorpe's 2008 average power cost to Members, for comparison, was 5.3 cents/kWh (Oglethorpe Power Corporation 2009c, p. 34). In its latest *Annual Energy Outlook* with projections to 2035, the EIA expects solar technology to continue to have a small role in wholesale electricity generation because "solar technologies are too costly for widespread use in wholesale power applications" (EIA 2010c, p. 68).[22]

[22] In *The Recovery Act: Transforming the American Economy Through Innovation*, issued in August 2010 by the Executive Office of the President of the U.S. and the Vice President of the U.S., the authors state "The cost of solar is forecast to reach grid parity over the next five years in many parts of the country" and cite as a reference the U.S. DOE Solar Energy Technologies Program (no specific document was cited). The grid parity (when electricity from solar power will not be costlier than from the grid, allowing for the 30 percent investment tax credit that extends

Summary of Reasons for Elimination of Solar as the Energy Source for the Proposal

Solar thermal was eliminated as a potential energy source for the needed energy for the following reasons:

- Suitable solar resources are not available in Oglethorpe's service.
- The cost would be substantially higher than other available energy sources, including renewable sources.

Photovoltaic power generation was eliminated as a potential source for the needed energy because the cost is substantially higher than other available energy sources, including renewables.

2.2.1.7 Wind

Wind Energy in the U.S.

Wind energy has grown rapidly in the U.S. in the past few years, with over 32 million MWh generated in 2007, more than double the wind energy produced in 2004 (EIA 2008, Tables 2 and 6). Wind accounted for 30 percent of new electric generating capacity additions in 2007. Wind has the potential to make a sizable contribution to U.S. electrical energy needs in some parts of the country.

Wind as a Resource for Generating Electricity

The feasibility of generating electricity from wind is highly dependent on wind speed and constancy. Electricity generated is proportional to the cube of the wind speed: for example, an 18-mph wind generates more than twice the electricity of a 14-mph wind. A given turbine has some minimum wind speed required to turn the blade and generate electricity, an optimal range for wind speed at which the turbine will operate at its maximum capacity, and a maximum wind speed at which the turbine shuts down to avoid being damaged. The ideal site would have constant wind within the optimal range (approximately 8.5 to 11 meters per second), allowing for a high capacity factor (NREL 2008a). An average capacity factor at existing U.S. installations has been reported at approximately 32 percent (IEA 2005, page 55). DOE reports that capacity factors for new wind installations have increased since 1998, with average capacity factors of approximately 36 percent for turbines installed in 2004 and 2005 (DOE 2008a, p. 26 and Figure 2-4).

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through 2016). No forecasts were found in the DOE Solar Energy Technologies Program; however, grid parity was identified as a goal of the program.

Available Wind Energy in Oglethorpe's Service Area

Georgia and surrounding areas are among the least windy places in the U.S. The DOE National Renewable Energy Laboratory (NREL) has prepared wind resources maps and associated potential locations for the U.S., by state. Information from the Georgia map is reproduced in Figure 2-5. Winds below approximately 6 meters per second (m/s) have little potential for utility-scale electricity production (NREL 2008a). Thus, Georgia has only a few isolated areas in the north and along the coast that might have some potential. To put Georgia's wind potential in perspective, Figure 2-6 graphs NREL's wind resource potential for Georgia and Iowa, a similar-sized (though smaller) state with better resources. As explained in the text box in each of the graphs, areas with gross capacity factors greater than 30 percent are considered to have potential for development "with today's advance wind turbine technology." Based on the graphs, the rated capacity above 30 percent gross capacity factor for wind at 80 meters is 130 MW for Georgia and 570,000 MW for Iowa.

While Georgia itself has few wind resources, the area off the coast of Georgia has utility-scale wind resources (estimated at 7.0 to 7.5 m/s; not ideal, but usable). Offshore wind farms are a developed technology widely used in Europe, and the first U.S. offshore wind project has recently been approved (Drye 2010). According to Drye "numerous analyses report" that, "primarily because of the need for more robust turbine parts to withstand tough weather conditions and salty water, offshore wind energy costs are about twice per kilowatt-hour as inland wind power" (Drye 2010). The Southern Company and the Georgia Institute of Technology recently investigated the potential for Georgia offshore wind energy. The study found that among the obstacles to development are cost and the inability of currently available turbines to withstand major hurricanes above a Category 3 or a 1-minute sustained wind of 124 mph (Southern Company 2007, p. 6).

Green Power EMC has investigated wind potential in Georgia. Green Power EMC conducted a wind test at the Rocky Mountain Pump Storage facility in Floyd County, located in northwest Georgia. The test site was located atop Oglethorpe Power Corporation's Rocky Mountain Pumped Storage Hydroelectric Plant. The tower has been removed, following a determination that the site was not suitable for sustained wind.

Summary of Reasons for Elimination of Wind as the Energy Source for the Proposal

Land-based wind was eliminated as a potential source of renewable energy because Oglethorpe's service area does not have adequate wind resources for utility-scale development. Offshore wind was eliminated because of cost and the inability of current turbines to withstand hurricane winds.

2.2.1.8 Distributed Power Generation

Distributed generation is the practice of placing relatively small units capable of providing on-site electricity and heat at the location demanding those needs. The means of providing electricity include reciprocating engines, micro-turbines, fuel cells, photovoltaic, run-of-the-river hydroelectric, waste, and windmills.

There would be a number of challenges if Oglethorpe were to replace a 100 MW net centralized power generation plant with a distributed generation network. Oglethorpe would have to partner with hundreds of individual power users to co-locate these units at the power users' facilities. Considerable time and effort would need to be taken to find candidate sites and then put into place the legal instruments for implementation. Oglethorpe would have to engineer each site individually to ensure the applied generation technology fits the needs of the facility. Oglethorpe would then have to obtain the necessary environmental and building permits for hundreds of sites, each of which would require its own permits. Ongoing operation and maintenance of these generation units along with meeting monitoring, recordkeeping, and reporting for hundreds of units would be a complex task. Transmission facilities would have to be provided for each unit. The total cost would far exceed the cost of a comparable single unit.

Summary of Reasons for Elimination of Distributed Power Generation as the Energy Source for the Proposal

Because of the loss of economy of scale involved with locating, permitting and constructing a large number of individual units as described above, distributed power generation was not considered a feasible alternative.

2.2.1.9 Demand Side Management (DSM)

The EIA defines the two components of DSM, energy efficiency and load management, and tracks them through detailed annual reports submitted by utilities (EIA 2007d).

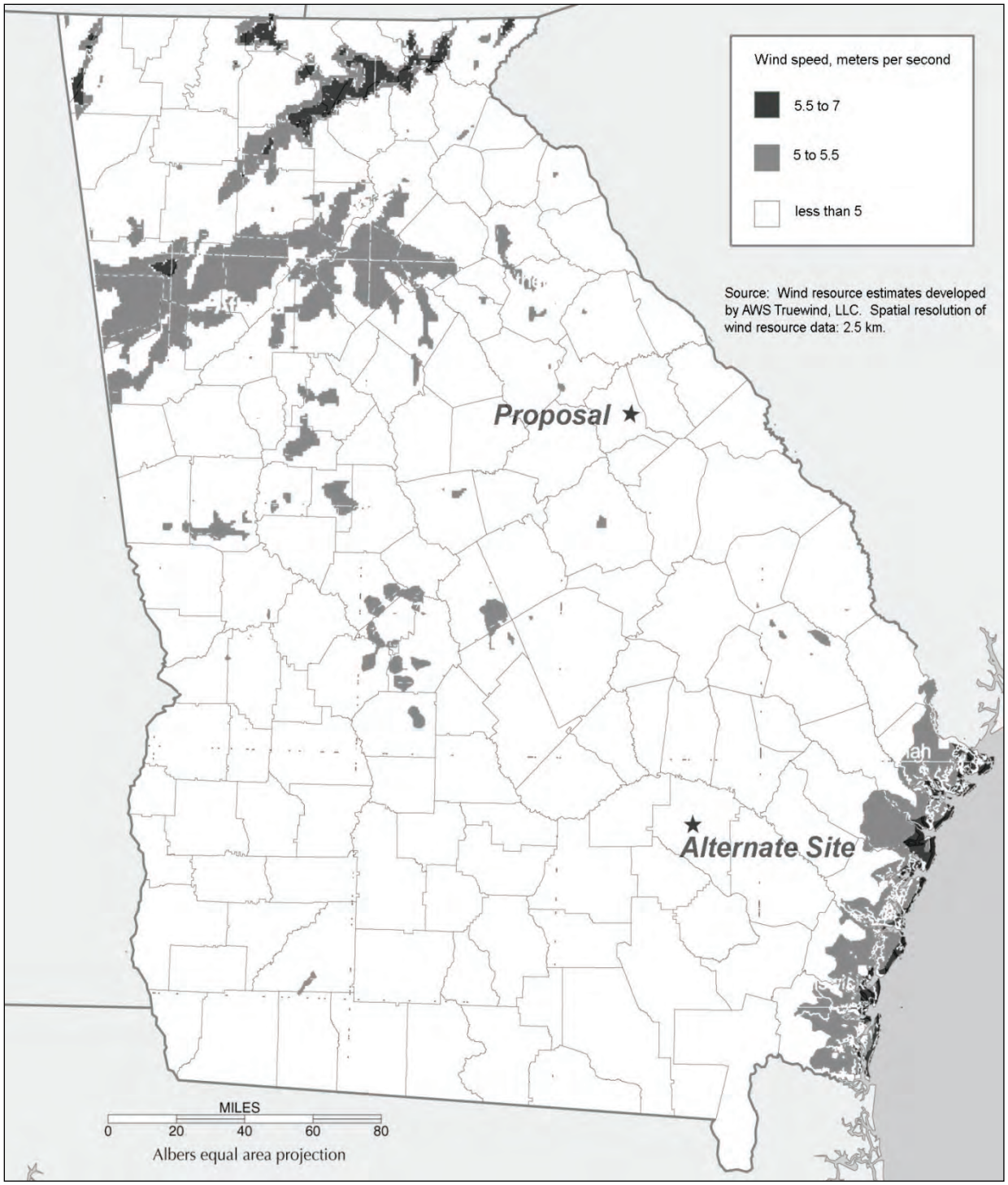

Figure 2-5. Georgia – Average Annual Wind Speeds at 80 Meters.
Source: NREL 2010a

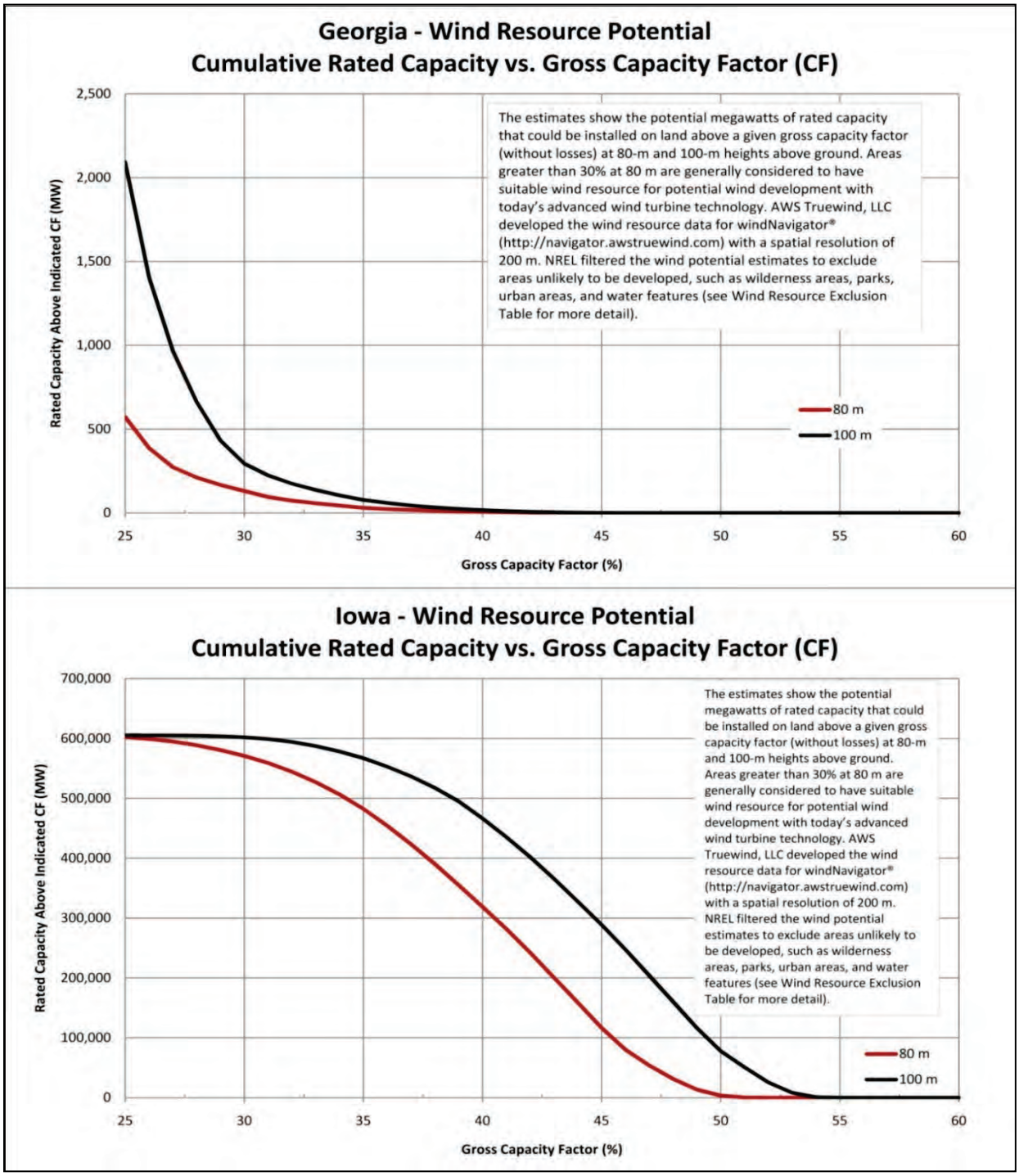

Figure 2-6. State Wind Resource Potential Comparison.
Sources: NREL 2010a, 2010b

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The EIA defines DSM as follows (EIA 2009b):

> The planning, implementation, and monitoring of utility activities designed to encourage consumers to modify patterns of electricity usage, including the timing and level of electricity demand.

The definition goes on to note that DSM refers only to those changes made in response to utility-administered programs, and not changes that would occur from normal market operation or from government-mandated energy efficiency standards.

The "timing and level" of electricity demand define the two categories of DSM:

- **Load management** means shifting the timing of energy use away from peak demand times.
- **Energy efficiency** means reducing the level of energy use.

Only the energy efficiency part of DSM could be an alternative to the Proposal, because load management does not decrease energy requirements, it only shifts the time away from peak demand time. In 2008, Georgia's 42 EMCs spent $17.2 million on DSM programs and saved approximately 34,580,000 kWh of energy. Programs included load management switches, energy audits, heat pump incentives, compact fluorescent bulbs, weatherization, Energy Star appliance promotions, and others (Georgia EMC 2009, pp. 1-2). While many of the energy efficiency improvements have multi-year lives, the investment cost per kWh saved in 2008 was 50 cents, not including the customers' cost (compare with Oglethorpe's average 2008 cost to Members of 5.30 cents per kWh). Presumably the kWh savings also included energy efficiency measures that were paid for and implemented in previous years. Thus, with no allowance for interest, depreciation, or benefits from previously implemented energy efficiency measures, an energy investment would need to have nearly a 10-year life to only justify the EMC's portion of the cost.

Based on this information, it seems likely that additional energy efficiency measures would not be cost-effective. The EMCs would take energy efficiency and conservation programs into account when making their projections for energy needs.

Summary of Reasons for Elimination of DSM as the Energy Source for the Proposal

As discussed above, DSM measures can help reduce future energy needs; however, they fall far short of having the potential to eliminate the need for new generating facilities. Also, the projections that the EMCs make for future power needs have already taken the savings from DSM into account.

2.3 BIOMASS – WOOD AND DERIVED FUEL

Biomass is the renewable resource with the highest potential for power generation in the Oglethorpe service area. Georgia has a wealth of timberland and a long tradition of managing timber to produce a variety of wood products. Of the 24.8 million acres of forestland in Georgia in 2008, 24.4 million acres was timberland available for commercial production (USDA FS 2009).

Oglethorpe identified biomass as the energy source to meet its need to provide renewable energy because the fuel is available in Georgia and biomass is the most cost-effective renewable energy source in Georgia.

2.4 SITING STUDY

After identifying biomass combustion as the renewable technology for its electric generation source, Oglethorpe needed to find suitable candidate sites. Oglethorpe incorporated the requirements discussed in Section 2.1.1 *Evaluation Process and Criteria*.

Siting a biomass plant is different than siting a fossil fuel or nuclear plant. Fossil and nuclear fuels are high-density energy sources and can be economically transported great distances. Biomass is a relatively low-density energy source, and fuel transportation costs can quickly make it uneconomical. This means that biomass plants must be located very close to fuel supplies. Oglethorpe has estimated a maximum feasible distance of 50 to 75 miles. These fuel constraints also require smaller plants than fossil or nuclear fuel plants. If all else is equal, the larger the plant, the greater the radius within which its fuel must be found. Oglethorpe determined that approximately 100 MW is the optimal size, with a trade-off between economy of scale and reasonable availability of fuel.

The relatively small size of the plant affects other siting considerations. While the cost of construction of miles of infrastructure such as roadways, rail lines, water lines, transmission lines, and discharge lines may be a small percentage of the total construction cost for a large generating plant (hundreds or more MW). The same infrastructure is a large percent of the cost for a relatively small biomass facilities. Therefore, proximity of transportation facilities, transmission, water, and wastewater infrastructure is very important.

2.4.1 Selection of a Siting Region

Because Oglethorpe's Members' service areas cover much of the State of Georgia (Figure 1-7), Oglethorpe considered the entire state, plus a 50-mile border into surrounding states, for potential sites.

2.4.2 Identification of Potential Siting Areas

Oglethorpe first determined general requirements for a wood-fueled, fluidized-bed 100-MW plant. Figure 2-7 shows private forestland acreage in Georgia. The first requirement was availability of fuel. Figure 2-8 shows the distribution of woody biomass residue in Georgia by county in 2005. The figure shows only counties with relatively large quantities of residue. At the time of this 2005 study, the authors estimated that roughly half of the woody biomass in the categories shown in Figure 2-8 consisting primarily of unmerchantable timber and harvesting residues was not used for any purpose and therefore would be available for biomass fuel (General*Bioenergy, Inc. 2005, p. 6).

Wood Biomass Residue

Unmerchantable timber *is unsuitable for use in wood products because of size, form, or quality. All unmerchantable timber is available (2005).*

Harvesting residues *are the tops, branches, diseased or otherwise unusable parts of the trees harvested for timber. Most harvesting residues are currently not used for any purpose (2005).*

Mill residues *are sawdust, bark, end pieces, and other leftover parts after processing at sawmills or veneer mills. Almost all mill residues are used. Uses include mulch, fuel, feedstock for particle board and fiber board, animal bedding and composting.*

Urban wood waste *consists of used lumber, pallets, woody yard waste and trees and stumps from land clearing.*

Pecan shells *are the casings that enclose the nut meat. Pecan shells are a relatively small part of the available wood waste in Georgia. Most pecan shells are currently not used.*

Paper mill sludge *is a waste product of paper manufacturing. Oglethorpe does not propose using paper mill sludge.*

Black liquor *is a byproduct of paper manufacturing and consists of wood fibers, lignin and process chemicals. It is the largest contributor to power generation from biomass in the U.S., and is usually used for electricity generation*

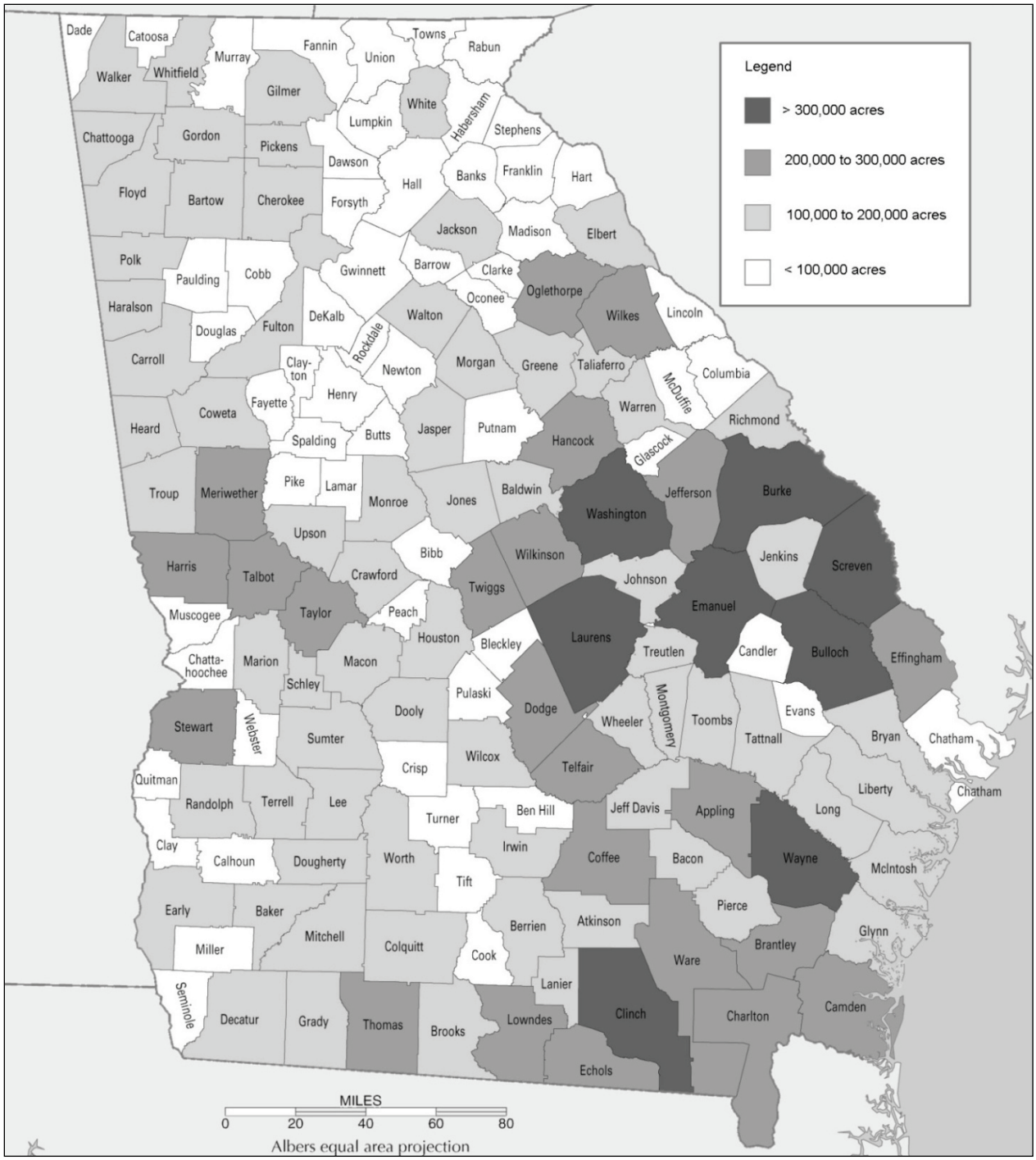


Figure 2-7. Georgia Private Forestland Acreage by County, 2007.
Sources: Miles 2009, USGS 2009a

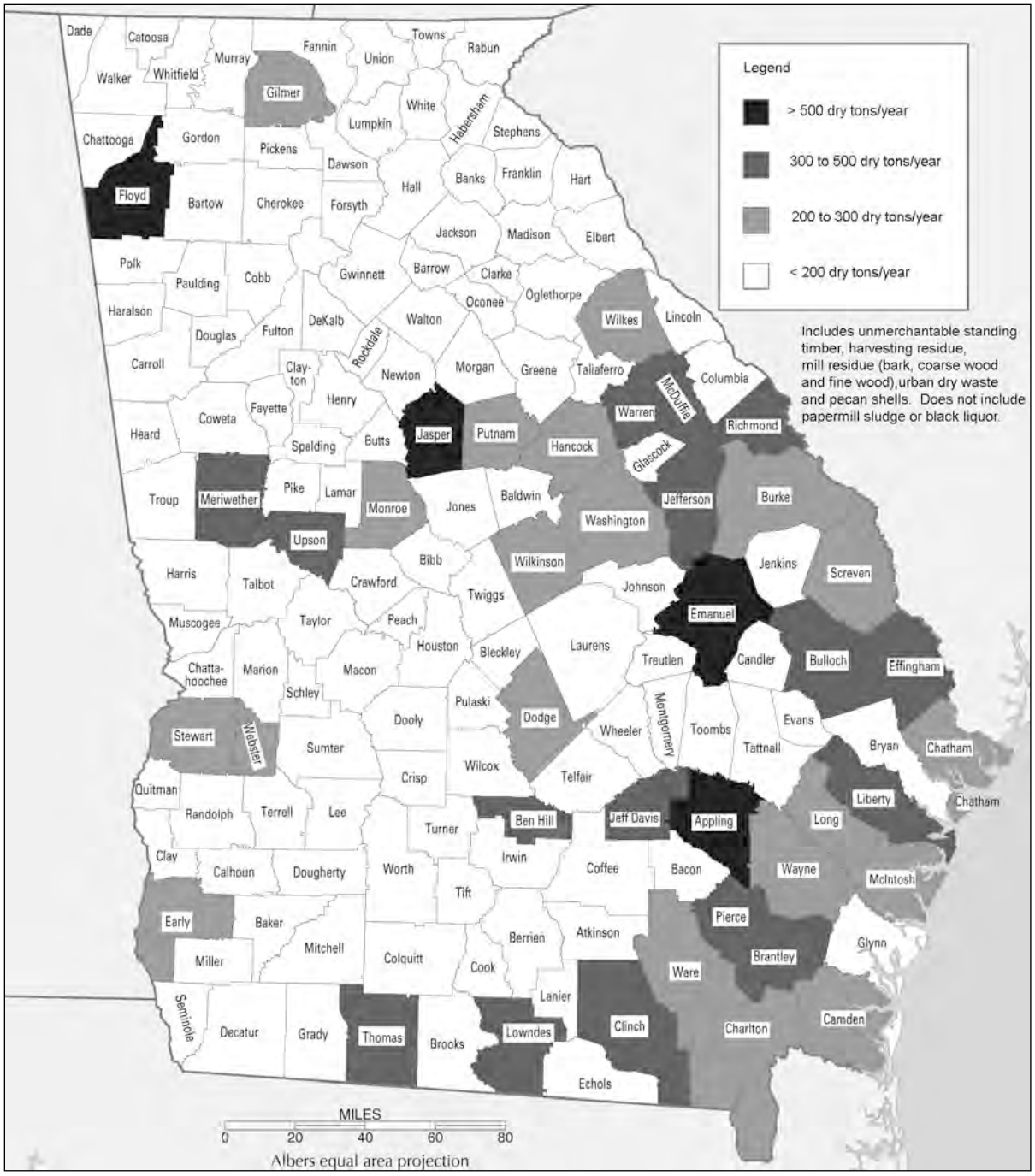


Figure 2-8. Woody Biomass Residue in Georgia (thousands), 2005.
*Sources: General*Bioenergy, Inc. 2005, Table A-8; USGS 2009a*

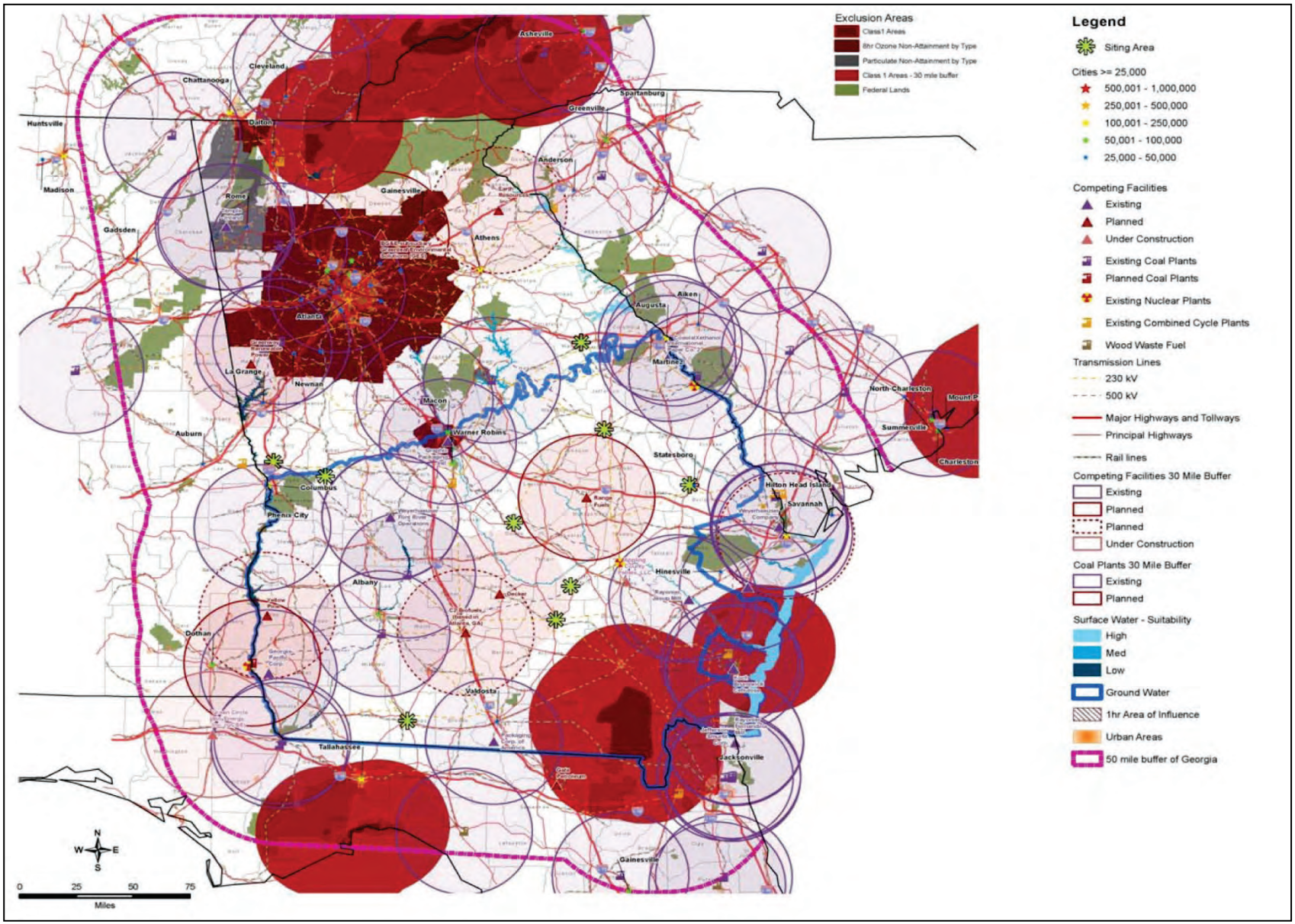


Figure 2-9. Potential Siting Area Considerations.
Source: Oglethorpe Power Corporation 2009a, Figure 6-3

Oglethorpe then collected and mapped relevant siting data (Figure 2-9):

- *Infrastructure/water needs:*
  - Transmission lines.
  - Roads.
  - Rail lines.
  - Surface water suitability
  - Groundwater availability.

- *Exclusion areas:*
  - Areas excluded because of potential air quality impacts: Class I areas with 30-mile buffer and non-attainment areas.[23]
  - Federal lands.

- *Locations of fuel-competing facilities* (existing, planned, and under construction).

Because of the competition for fuel, it is important to maximize the distance from these competing facilities.

2.4.3 Identification/Selection of Candidate Sites

Using the siting information and geographic information system (GIS) mapping tools, Oglethorpe identified and visited potential sites and site areas. Oglethorpe eliminated 16 sites because of fatal flaws such as proximity to schools, residential areas, or retail areas; and the presence of 100-year floodplains over much of the parcel. After eliminating the fatally flawed parcels, 28 candidate sites remained (Oglethorpe Power Corporation 2009a, p. 6.6). A detailed description of the Siting Study is presented in the Alternatives Report (Oglethorpe Power Corporation 2009a).

2.4.4 Evaluation of Candidate Sites

Oglethorpe evaluated the 28 candidate sites using the criteria listed in Figure 2-10. Oglethorpe also created relative site development cost estimates. After this evaluation, Oglethorpe eliminated an additional 13 sites based on either environmental or technical issues. Of the remaining 15 feasible candidate sites, none were available for purchase by Oglethorpe at acceptable terms. Oglethorpe then contacted county economic development groups and forest management organizations seeking sites of suitable size with the needed infrastructure that met the Figure 2-10 criteria. As a result of these inquiries, Oglethorpe identified 11 additional sites potentially available for purchase in the northern, central, and southern parts of the state with the greatest fuel resources (Figures 2-11 and 2-12). Oglethorpe termed these sub-areas “wood baskets” (Oglethorpe Power Corporation 2009a, p. 6.8).

[23]Class I areas receive the highest protection from air quality visibility impacts. Non-attainment areas are those that do not meet EPA’s standards for healthy air, the National Ambient Air Quality Standards (NAAQS). For details see the air resources discussion in Section 3.

2.4.5 Identification and Evaluation of Preliminary Sites

Oglethorpe screened these sites using the criteria shown in Figure 2-10, and evaluated them in more detail based on cost, transportation, and plant layout options. Oglethorpe also considered potential air quality impacts on Class I areas using EPA-approved modeling tools. Two candidate sites closest to Class I areas were modeled. The modeling results showed that both sites had impacts below thresholds for regional haze that would require comprehensive cumulative regional air modeling. Based on these results, Oglethorpe concluded that air quality impacts on Class I areas would not likely be concerns for any of the candidate sites. Oglethorpe also developed comparative cost estimates for transmission line construction, upgrades and interconnection; road and rail access, and land acquisition.

Oglethorpe then eliminated six of the 11 candidate sites. Four were not available at a reasonable price. Two would require substantial road improvements. Oglethorpe then obtained options to purchase the remaining five sites:

- Washington County No. 1 – Northern wood basket.
- Washington County No. 2 – Northern wood basket.
- Warren County – Northern wood basket.
- Appling County – Central wood basket.
- Echols County – Southern wood basket.

Table 2-1 summarizes Oglethorpe's evaluation of the preliminary sites (Oglethorpe Power Corporation 2009a). Note that the information in the table is based on initial screening and does not include detailed site information later obtained for the Warren and Appling sites.

2.4.6 Identification of Sites for Further Study

Because of competition for fuel, sites for detailed analysis should not be located in the same wood basket. Therefore, the next step in the process was to identify sites in different wood baskets to carry forward for detailed study. The comparative analysis of the five remaining sites is summarized in Figure 2-13.

As shown in Figure 2-13, Appling is the only site in the Central wood basket and Echols is the only site in the Southern wood basket. Therefore, the first step was to identify which of the three sites in the Northern wood basket is most suitable for development.

2.4.6.1 Comparison of Northern Wood Basket Sites

Size. All three sites are large enough for the biomass plant; however, the larger site at Warren (110 percent larger than Washington County No. 1 and 62 percent larger than Washington County No. 2) provides more room to avoid on-site impacts and to have a buffer for the surrounding community.

Biomass Fuel Supply. Compared to the other two sites, the Warren site has the advantage of proximity to large sawmills, a potential fuel source.

Water Supply. In the preliminary analysis, the Washington County sites had an advantage for water supply. Both Washington County sites overlie a large regional groundwater supply (aquifer), and the water supply for Warren was uncertain at that time. However, adequate surface water sources have since been identified for the Warren County site.

Transmission. The Washington County sites do not have direct access to 230- or 115-kV transmission lines. Washington County No. 1 has access to a 500-kV line; however, interconnection costs are much higher for 500-kV lines. Warren, on the other hand, has direct access to a 230-kV line and two 115-kV lines.

Air Quality. Within the Northern wood basket, air quality concerns were greater for the Washington County sites. In Washington County, levels of particulate matter less than 2.5 microns are close to the National Ambient Air Quality Standards (NAAQS) (discussed in Section 3).

Wetlands/Waters of the U.S. Potential impacts to wetlands and other Waters of the U.S. did not appear to be a major concern at any of the three sites.

Development Compatibility. Although all three sites are at least partially rural, the Warren site is adjacent to an area of industrial development and the Washington County sites are not. Industrial development is generally considered compatible with a biomass facility.

Environmental Criteria	Technical Criteria
Socioeconomic	**Water Resources**
Noise impacts	Groundwater availability
Impact of Proposal traffic	Wastewater discharge option
Impact to sensitive areas	Availability of gray water for plant water supply
Environmental justice	Availability of sufficient surface water
Land Use	**Transportation/Roadways**
Proximity to residential development	Proximity to Class 1 Road
Impact on agricultural areas	Proximity to railroad
Displacement of residences	**Transmission Lines**
Land use compatibility	Proximity to 230-kilovolt (kV) or 115-kV transmission line
Availability of site - Number of owners	**Site Development**
Land use planning	Site topography
Airports	Stormwater Issues
Floodplain	**Solid Waste Disposal**
Visual Impacts	Solid waste disposal
Visibility from wilderness, scenic, recreational, or cultural areas	
Visibility from urban areas	
Visibility from highways or roads	
Air Quality	
Air permittability	
Adjacent industrial facilities	
Ecology	
Terrestrial – endangered species	
Terrestrial – habitat quality/biological community	
Aquatic – wetlands	
Aquatic – endangered species	
Aquatic – habitat quality	
Cultural Resources	
Archeological or historic resources	
Sensitive buildings or community development	
Environmental Linear Facilities	
Routing of transmission lines	
Routing of railroads	
Upgrades to roads	

Figure 2-10. Candidate Site Evaluation Criteria.
Source: Oglethorpe Power Corporation 2009a, *Table 6-1.*

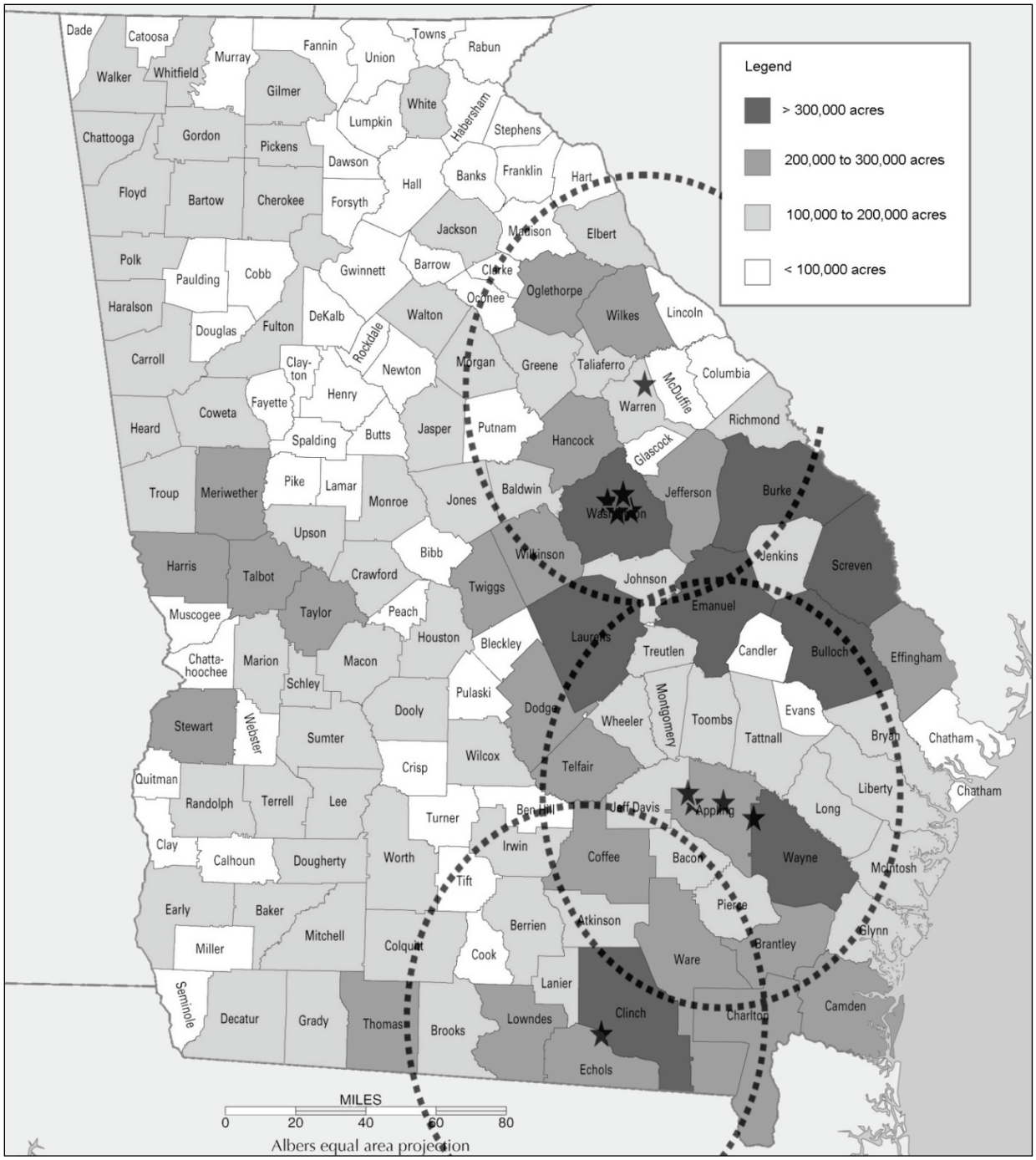


Figure 2-11. Location of Candidate Sites and Subareas with Respect to Private Forestland.

Sources: Miles 2009, USGS 2009a, Oglethorpe Power Corporation 2009a Figure 6-4

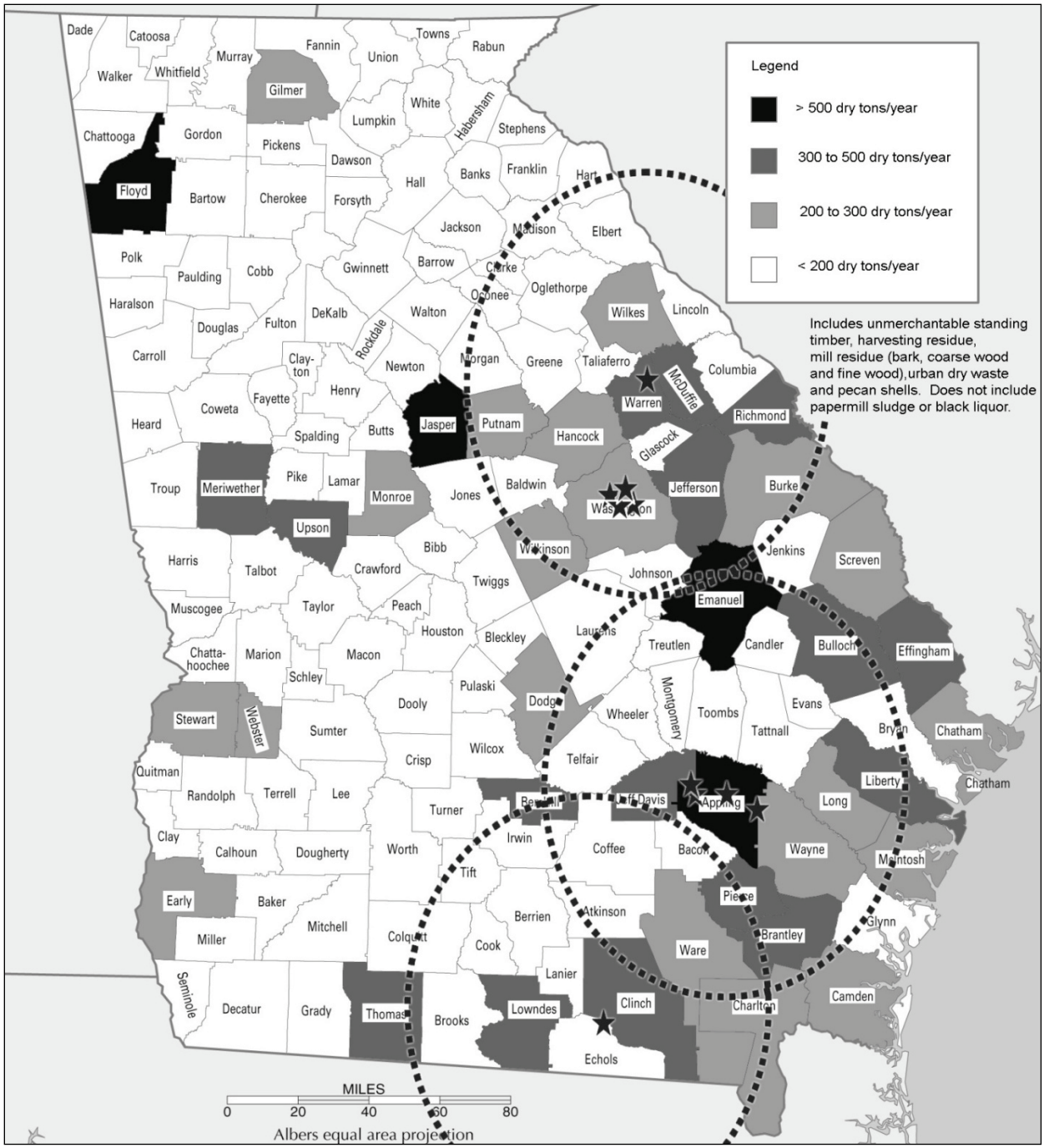


Figure 2-12. Candidate Sites and Subareas with Respect to Woody Residue (thousand tons)

*Sources: General*Bioenergy, Inc. 2005, Table A-8; USGS 2009a;* Oglethorpe Power Corporation 2009a *Figure 6-4.*

Table 2-1. Comparison of Preliminary Sites.

	Washington County No. 1	Washington County No. 2	Warren County	Appling County	Echols County
Location	60 miles SW Augusta	60 miles SW Augusta	40 miles west of Augusta	90 miles SW Savannah	180 miles SW Savannah
Size, acres	169	219	355 (later reduced to 343 with Warrenton wastewater treatment plant)	345	535
Terrain	Relatively flat	Relatively flat	Relatively flat	Relatively flat	Relatively flat
Land cover	Managed forest	Managed forest/pasture	Managed forest/pasture/ Cleared forest	Managed forest/cropland	Managed pine plantation
Proximity to sustainable fuel supply	Good	Good	Good. Close to large sawmill. Less overlap with Central wood basket compared to Washington Co.	Good. Close to large sawmill.	Good
Transmission	500 kV adjacent; two 230-kV and one 115-kV one mile away	Two 230-kV and one 115-kV one mile away	One 230-kV and two 115-kV cross site	One 230-kV crosses site	115-kV on site; possible 40 miles reconductoring
Roadways	On Georgia Hwy 24 (GA 24)	On GA 231	On East Warrenton Road, half-mile from US 278	0.1 mile from US 341	2 miles from GA 187; 6 miles from GA 94
Rail	0.25 mile away; on other side GA 24	2 miles away	Adjacent	Adjacent	2 miles away
Water supply	Major Coastal Plain aquifer	Major Coastal Plain aquifer	Possible groundwater; possible surface water from local water and wastewater sources	Major aquifer; also potential water and/or gray water from City of Baxley.	Major aquifer.
NAAQS	Attainment and not adjacent to non-attainment counties; however, $PM_{2.5}$ levels are very close to NAAQS.	Attainment and not adjacent to non-attainment counties; however, $PM_{2.5}$ levels are very close to NAAQS.	Attainment and not adjacent to non-attainment counties; air quality not close to any NAAQS.	Attainment and not adjacent to non-attainment counties; air quality not close to any NAAQS.	Attainment and not adjacent to non-attainment counties; air quality not close to any NAAQS.

Table 2-1. Comparison of Preliminary Sites.

	Washington County No. 1	Washington County No. 2	Warren County	Appling County	Echols County
Nearest Class I area	Wolf Island Wilderness, 140 miles	Wolf Island Wilderness, 140 miles	Shining Rock Wilderness Area, 135 miles	Okefenokee Wilderness Area, 40 miles	Okefenokee Wilderness Area, 20 miles
Waters of the U.S.	Likely low impact	Likely low impact	Likely low impact.	Likely low impact.	Potentially substantial impacts.
Floodplains	None mapped on site	None mapped on site	None mapped on site	None mapped on site	None mapped on site
Threatened and Endangered Species	Moderate probability (forested site)	Moderate probability (some forest)	Moderate probability (some forest)	Moderate probability (some forest)	Moderate probability (some forest)
Cultural Resources	No sites listed on Nat'l Reg. of Historic Places (NRHP)	No sites listed NRHP	No sites listed NRHP	No sites listed NRHP	No sites listed NRHP
Prime farmland	86 percent of site	84 percent of site	80 percent of site	None	None
Setting/adjacent land uses	Rural: forestry, agricultural. Some residences on GA 24.	Rural: forestry, agricultural. Several residences within one mile.	Rural (forestry/agricultural) /light industrial. ¾ mile from City of Warrenton. Several residences within one mile.	Rural (forestry/agricultural) /light industrial/residential; however, just outside City of Baxley. Several residences within one mile.	Rural (forestry/agricultural). Very few residences within one mile.

Assessment Category	Wood Baskets				
	Northern			Central	Southern
	Washington County No. 1	Washington County No. 2	Warren County	Appling County	Echols County
Size	●	●	●	●	●
Biomass Fuel Supply	●	●	●	●	●
Water Supply	●	●	●	●	●
Transmission	●	●	●	●	●
Air Quality	●	●	●	●	●
Wetlands	●	●	●	●	●
Development Compatibility	●	●	●	●	●
Overall Assessment	●	●	●	●	●

Legend: ● Acceptable Choice ● Better Choice

Figure 2-13. Comparative Assessment Results
Source: Oglethorpe Power Corporation 2009a, *Table 6-8*

In the overall assessment in the above seven categories, Warren had more favorable attributes than the other two sites in five categories, and equal attributes in one category. Only in the water supply category were the Washington County sites judged to be superior. Therefore, in the Northern wood basket, the Washington County sites were eliminated and Warren was retained for further study.

2.4.6.2 Comparison of Warren, Appling, and Echols

Size. Echols, at 535 acres, is approximately 55 percent larger than either Appling or Warren, which are similar in size (345 and 343 acres, respectively).

Biomass Fuel Supply. Both Warren and Appling have the advantage of proximity to large sawmills; Echols does not. Also, Echols is furthest removed from the major fuel areas (Figures 2-11 and 2-12).

Water Supply. In the preliminary analysis, Appling and Echols had an advantage for water supply. They both overlie a large aquifer, and the water supply for Warren was uncertain at that time. However, adequate surface water sources have since been identified for the Warren County site. Appling had the added advantage of potential gray water (treated water from a wastewater treatment plant) from Baxley; Warren also has that advantage.

Transmission. All three sites had access to suitable transmission lines; however, Echols had a small disadvantage of potentially needing upgrading (reconductoring) of 40 miles of line. Appling and Warren, it was found later, also would need reconductoring. Appling would need nearly as much as Echols, approximately 38 miles, and Warren would need approximately 16.8 miles, less than half the length of reconductoring the other two would need.

Air Quality. None of the sites had concerns with attainment of NAAQS. Of the three sites, the Echols County site is considerably closer to a Class I area (the Okefenokee Wilderness Area), which has more stringent air quality requirements.

Wetlands/Waters of the U.S. While the Echols site is the largest of the three, because of its lowland setting, unavoidable impacts to wetlands and other Waters of the U.S. would likely be greater than with either Appling or Warren. During field investigations for potential wetlands areas, 16 Waters of the U.S. were identified; these included one open water pond and 15 wetlands totaling 259 acres.

Development Compatibility. Although all three sites are at least partially rural, both the Warren and Appling sites are adjacent to or near areas of industrial development and the Echols County site is not. Industrial development is generally considered compatible with a biomass facility. However, the Echols site has little nearby residential development, and there are a number of residences within a mile of the both the Appling and Warren sites.

In the seven categories above, Echols had a disadvantage over the other two in three categories, and Warren had a disadvantage over the other two in one category (Figure 2-13). Appling had no disadvantages over the other two in these seven categories. Two of the Echols site disadvantages, in addition, are substantial: with an estimated 259 acres of wetlands on site, Echols has a greater potential for impacts to wetlands and other Waters of the U.S.; and the distance from fuel supplies. For these reasons, the Echols County site was eliminated from further consideration and the Warren and Appling sites were retained for detailed analysis.

2.4.6.3 Comparison of Warren and Appling Sites

Oglethorpe's initial intention, as identified in the NOIs and scoping, was to construct both the Warren and Appling facilities. Based on the preliminary analysis, both sites appear to be acceptable for development. However, Oglethorpe later decided to proceed with plans for only one facility. Therefore, further preliminary analysis was undertaken to identify a proposed site.

As discussed above, preliminarily Warren had a disadvantage of uncertain water supply. However, Oglethorpe has since identified an adequate water supply, including use of gray water from the City of Warrenton.

Both sites are large enough that impacts to wetlands and Waters of the U.S. can be avoided or minimized; however, the Appling site is slightly smaller and has potentially four times the wetland area of the Warren site. Therefore, while the impacts could be avoided or minimized, it would place more constraints on design than at the Warren site.

Warren has a transportation advantage. While both sites have access to a good roadway system, Warren has a more extensive transportation network near the site, and is much closer to an Interstate route (Figures 1-1 and 1-2). Also, the Warren site can be accessed from all major roadways without passing through the City of Warrenton. Traffic from southbound GA 80 and westbound US 278 access the site without entering Warrenton. Traffic on southbound US 278/GA 12 and northbound GA 16, GA 171 and GA 80 can reach the site by bypassing Warrenton on the south (the bypass is within city limits, but borders the edge of the city) (Figures 1-1 and 1-2). At Appling, on the other hand, only traffic from the east (US 341 and GA 144) would access the plant without passing through the City of Baxley (Figures 1-1 and 1-2).

Also, while both sites are adjacent to or near industrial areas, there is more residential development close to Appling than to Warren, thereby increasing the number of people subject to visual intrusion and increased noise levels.

For these reasons, Oglethorpe identified Warren as its preferred site and Appling as the alternate.

2.4.7 Facility-Related Alternatives

2.4.7.1 Alternative Cooling Methods

Most of the electricity generated in the U.S. is from thermoelectric plants, where steam is used to drive a turbine-generator (coal, nuclear, and combined-cycle natural gas). In this process, the water/steam goes through a cycle: the water is heated to steam in a boiler, the steam is used to drive a turbine-generator, the steam is condensed through a cooling process, and the resulting water returns to the boiler. The design of the cooling system is critical to the overall power generation efficiency; inadequate cooling greatly reduces efficiency (NETL 2009b, pp. 11-12).

There are four general types of cooling systems for thermoelectric power plants (NETL 2009b, p. 12):

- Once-through.
- Wet recirculating.
- Direct dry.
- Indirect dry.

With a once-through system, cooling water is withdrawn from a surface water or groundwater body and the warm water is returned to a surface water body. With a wet recirculating system, the cooling water is re-used and cooled by evaporation in a tower or pond. Because of the large evaporative losses from the cooling water, the naturally-occurring dissolved metals in the water become more concentrated over time. To prevent this buildup, some of the cooling water is periodically released as “blowdown” that is discharged as wastewater. With the wet recirculating system, water is withdrawn only to make up for losses from evaporation and blowdown. Compared with a once-through system, a recirculating system has low water withdrawals (because the water is re-used) and high water consumption (because the re-used water is cooled by evaporation) (NETL 2009b, p. 12). Direct dry cooling uses large fans and does not use water. Indirect dry cooling uses a closed system where water is the coolant; large fans (rather than evaporation) in a cooling tower are used to transfer the heat from the water, which is enclosed in tubes, to the ambient air. In the U.S., estimates indicate that 42.7 percent of thermoelectric generating capacity uses once-through cooling, 56.4 percent uses wet recirculating cooling, and 0.9 percent uses either direct or indirect dry cooling (Platts 2005, as referenced in NETL 2009b, p. 13).

Once-through systems are most efficient (NETL 2009a) and in the past were feasible for new facilities where a very large surface water or groundwater source was available for withdrawals, and a very large surface water source was available for discharge, that can reduce the impact of the warm water. No such sources are available in the vicinity of the Proposal or the Alternate site. In addition, since 2001, once-through cooling has generally not been an option for new plants because of the larger environmental impact on aquatic resources. In 2001, EPA promulgated regulations under Section 316(b) of the Clean Water Act that require cooling water intake structures for facilities that withdraw more than 2 million gallons per day to reflect the best technology available for minimizing adverse environmental impact. These regulations limit flow for new facilities to that needed for a wet recirculating system.[24]

Dry cooling is “much more expensive than wet circulating technology due to higher capital and operating costs as well as an energy output penalty” (NETL 2009a). The

[24] 40 CFR Parts 9, 122, 123, 124, and 125.

“energy output penalty” or energy penalty, is the loss in plant electricity output resulting from the reduced ability of dry cooling methods to decrease cooling water temperature compared with wet cooling methods. The energy penalty can be expressed as a percent of plant capacity and is lowest when ambient air temperatures are low. NETL has estimated an energy penalty for dry cooling ranging from approximately 9 to 16 percent, with the highest losses associated with higher ambient temperatures. During the hottest days of the summer in most of the U.S., when demand is high, dry cooling is the least efficient, and output may also need to be reduced to safely operate the turbines (NETL 2002, pp. 2-3). This loss of efficiency translates to greater fuel use and greater emissions for the same energy output. NETL has estimated the cost of dry cooling as more than twice the cost of wet cooling, based on its reference case (NETL 2009a). Moreover, after consideration of these and other factors, EPA rejected dry cooling as the basis for establishing requirements under Section 316(b) for new sources.

Because of the infeasibility of both once-through and dry cooling systems for both the Proposal and the Alternate, neither is evaluated in detail. A wet-recirculating system is evaluated in detail.

2.4.7.2 Alternative Cooling Water Sources - Proposal

The water needs of proposed biomass plant at either site would be approximately 2 MGD. Potential sources are surface water, groundwater and/or gray water.

There is insufficient gray water available as a sole source for the Proposal, and therefore Oglethorpe evaluated groundwater and surface water sources.

Oglethorpe conducted a pumping test to evaluate groundwater as a potential water source. The estimated total sustainable yield from the test well was 0.09 to 0.15 MGD, well below the estimated total need for the Proposal (Golder Associates Inc. 2009a, p. 9). While additional wells may have increased the total yield, the results from the pumping test were not encouraging and Oglethorpe did not investigate groundwater further. A well may be used for water supply during construction.

Surface water was therefore the remaining alternative; however, there are no suitable surface water sources near the Proposal site. Therefore, Oglethorpe plans to purchase water from several available sources, as discussed in Section 2.5.2.6.

2.4.7.3 Alternative Cooling Water Sources – Alternate

There are no large surface water sources available near the Alternate site. However, there is a very large groundwater source, the Floridian aquifer, that could meet the needs of the biomass plant. Oglethorpe has also identified additional water resource

availability, including gray water, from the City of Baxley (Oglethorpe Power Corporation 2009a, p. 6~24). The probable major water source would be groundwater.

2.5 DESCRIPTION OF ALTERNATIVES

2.5.1 No Action Alternative

The no action alternative would result in no impacts to the environment at the Warren County and Appling County site or their surroundings. The Proposal and Alternate site would not be constructed or operated, and therefore, there would be no effects on environmental resources such as air quality, geology and soils, groundwater, surface water, floodplains, farmland, etc.

However, because the Proposal and Alternate site would not be constructed, the power demand would likely be met by construction of some other non-renewable power generation facility, such as coal, nuclear or natural gas.

2.5.2 Proposal

An overview of the Proposal is described in this section. Proposal specifics are subject to change during final design and construction. However, no environmental impacts beyond those assessed in this document are anticipated. If future substantial changes to the design of the proposed power plant constitute a federal action that create the potential for impacts not assessed in this EIS, additional environmental reviews will be conducted pursuant to NEPA.

2.5.2.1 Typical Biomass Facility Layout

In the Figure 2-14 rendering of a typical biomass plant (the layout is not exactly like the Proposal), the fuel arrives by truck mainly as chipped wood. Any long wood (logs) needs to be chipped on site. The chipped wood is then ground to a finer size and conveyed to the boiler building where it is burned to heat water to produce steam. The steam is used to drive a turbine (located in the turbine building), which is connected to a generator. The electricity produced by the generator is sent to the transformers where the voltage is “transformed” to a level suitable for transmission. The boiler water is highly purified and re-used and replenished with additional highly purified water as needed: it is heated to steam, condensed, heated back to steam, and so on. Large quantities of cooling water are needed for the condensation phase of the cycle. Although the cooling water is recycled, substantial quantities are lost to evaporation. The heated cooling water is sent to cooling towers, where it is cooled primarily by evaporation of a portion of the water (Cooling Technology Institute, undated). The remainder is replenished with fresh water and continues through the cycle. Ash is temporarily stored in a silo awaiting offsite use or disposal. Storm water runoff from the plant area is diverted to a storm water runoff pond. Water released from the storm water runoff pond is subject to permitting, as discussed in Sections 2.5.2.8 and 2.5.2.9.

2.5.2.2 Proposal Site Plan

Figure 2-15 is a preliminary site plan for the Proposal. Site features are numbered, with a description for each numbered feature included in the box in the lower left of the figure. The upper case letters in hexagonal boxes indicate interface points, where there is a physical connection to some feature (usually a utility) that is not part of the Proposal. The largest part of the fenced area is the wood yard, used for fuel unloading, processing, storage, and conveyance. The largest of the three storm water ponds serves the wood lot. The “power block” includes the boiler, turbine, cooling towers and associated facilities. Transmission lines connect the transformers in the power block to the substation at the existing 115-kV line at the west side of the site (Interface Point G in Figure 2-15).

2.5.2.3 Fuel Supply

The Proposal will burn a woody biomass fuel blend. Biomass, discussed in more detail in Section 2.2.1, is non-fossil organic fuel. The facility will be designed to accept 100 percent chipped biomass (predominantly chipped wood) or up to ten percent long wood processed on site. The biomass used will meet the following definition (EPD 2010d, p. 7):

> Organic matter, excluding fossil fuels, including agricultural crops, plants, trees, wood, wood residues, sawmill residue, sawdust, wood chips, bark chips, and forest thinning, harvesting , or clearing residues; wood residue from pallets or other wood demolition debris; peanut shells; pecan shells; cotton plants; corn stalks, and plant matter, including aquatic plants, grasses, stalks, vegetation, and residues, including hulls, shells, or cellulose containing fibers.

The Proposal is expected to consume approximately 3,100 tons per day (wet weight) of biomass fuel (Oglethorpe Power Corporation 2008e). This equates to approximately 150 truckloads per day. Oglethorpe will obtain the majority of the fuel directly from privately-owned, actively managed timberland that currently provides wood supplies to the pulp and paper and wood products industries, from unmerchantable timber and from sawmill and other wood waste. The fuel is expected to come primarily from sources within 50 to 75 miles of the plant. Fuel will arrive primarily in the form of chips by truck (Oglethorpe Power Corporation 2009a, p. 7-4).

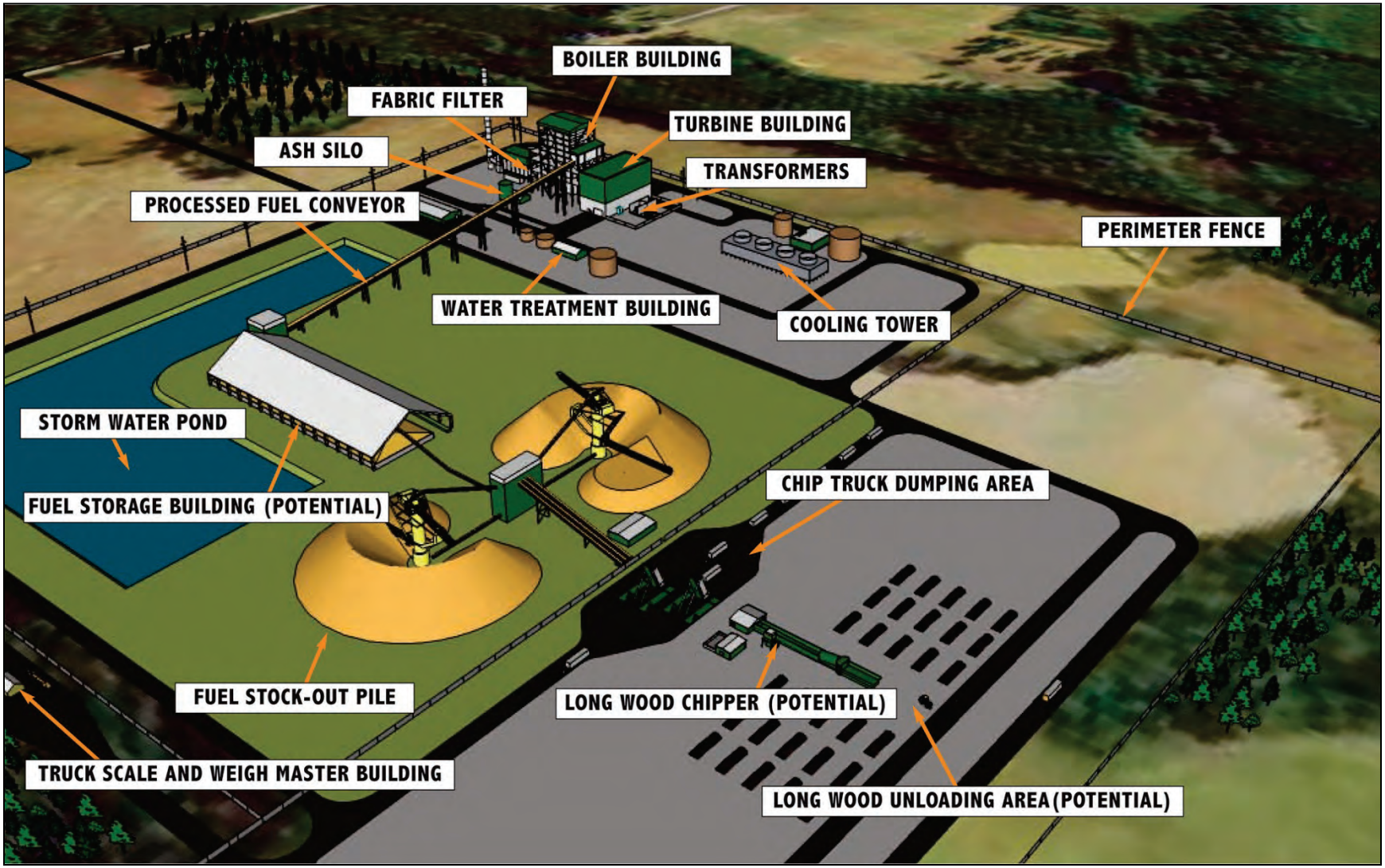
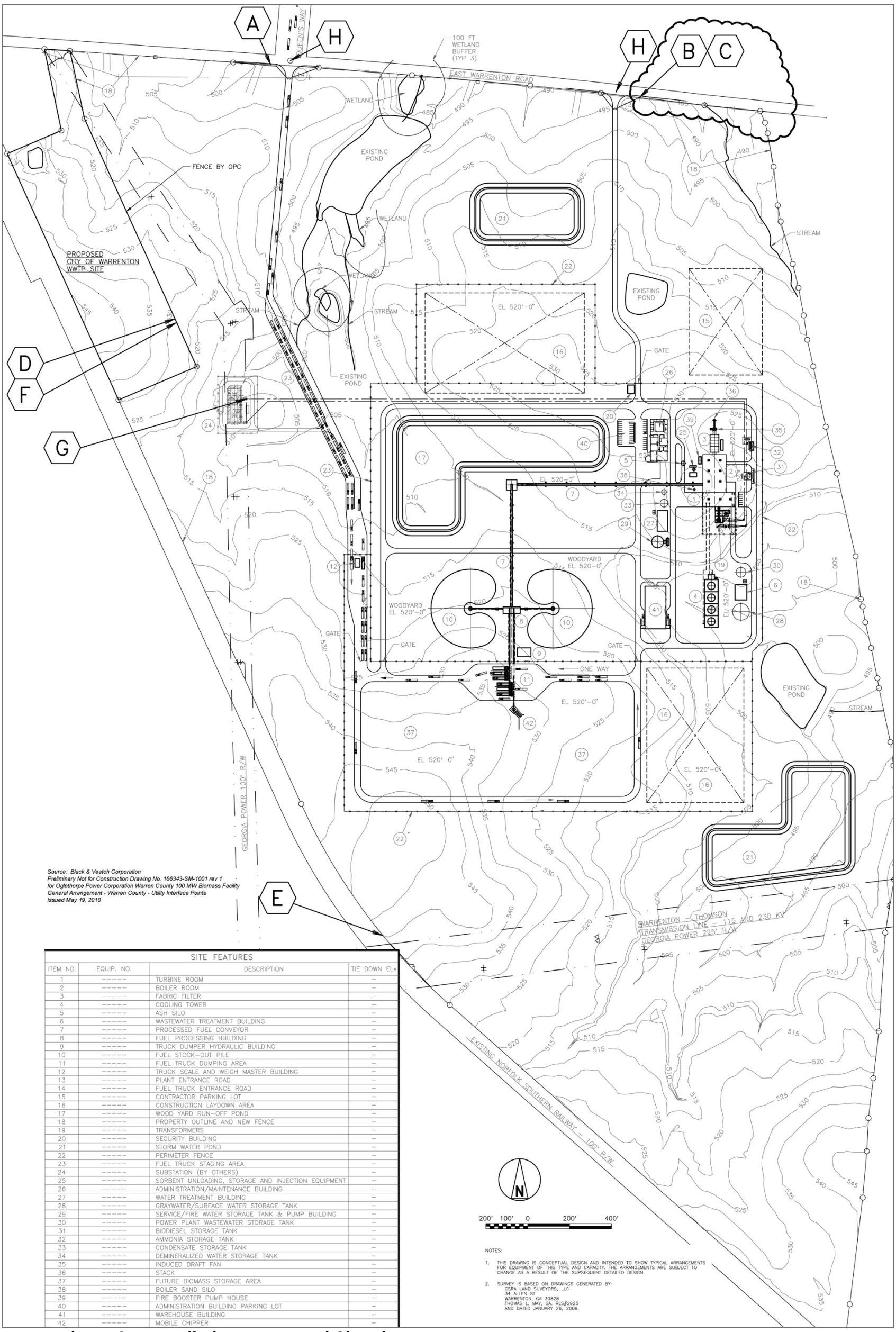


Figure 2-14. Rendering of Typical Biomass Plant.
Source: Boards from Scoping Meeting, June 2009



Source: Black & Veatch Corporation
Preliminary Not for Construction Drawing No. 166343-SM-1001 rev 1
for Oglethorpe Power Corporation Warren County 100 MW Biomass Facility
General Arrangement - Warren County - Utility Interface Points
Issued May 19, 2010

SITE FEATURES

ITEM NO.	EQUIP. NO.	DESCRIPTION	TIE DOWN EL.
1	-----	TURBINE ROOM	–
2	-----	BOILER ROOM	–
3	-----	FABRIC FILTER	–
4	-----	COOLING TOWER	–
5	-----	ASH SILO	–
6	-----	WASTEWATER TREATMENT BUILDING	–
7	-----	PROCESSED FUEL CONVEYOR	–
8	-----	FUEL PROCESSING BUILDING	–
9	-----	TRUCK DUMPER HYDRAULIC BUILDING	–
10	-----	FUEL STOCK-OUT PILE	–
11	-----	FUEL TRUCK DUMPING AREA	–
12	-----	TRUCK SCALE AND WEIGH MASTER BUILDING	–
13	-----	PLANT ENTRANCE ROAD	–
14	-----	FUEL TRUCK ENTRANCE ROAD	–
15	-----	CONTRACTOR PARKING LOT	–
16	-----	CONSTRUCTION LAYDOWN AREA	–
17	-----	WOOD YARD RUN-OFF POND	–
18	-----	PROPERTY OUTLINE AND NEW FENCE	–
19	-----	TRANSFORMERS	–
20	-----	SECURITY BUILDING	–
21	-----	STORM WATER POND	–
22	-----	PERIMETER FENCE	–
23	-----	FUEL TRUCK STAGING AREA	–
24	-----	SUBSTATION (BY OTHERS)	–
25	-----	SORBENT UNLOADING, STORAGE AND INJECTION EQUIPMENT	–
26	-----	ADMINISTRATION/MAINTENANCE BUILDING	–
27	-----	WATER TREATMENT BUILDING	–
28	-----	GRAYWATER/SURFACE WATER STORAGE TANK	–
29	-----	SERVICE/FIRE WATER STORAGE TANK & PUMP BUILDING	–
30	-----	POWER PLANT WASTEWATER STORAGE TANK	–
31	-----	BIODIESEL STORAGE TANK	–
32	-----	AMMONIA STORAGE TANK	–
33	-----	CONDENSATE STORAGE TANK	–
34	-----	DEMINERALIZED WATER STORAGE TANK	–
35	-----	INDUCED DRAFT FAN	–
36	-----	STACK	–
37	-----	FUTURE BIOMASS STORAGE AREA	–
38	-----	BOILER SAND SILO	–
39	-----	FIRE BOOSTER PUMP HOUSE	–
40	-----	ADMINISTRATION BUILDING PARKING LOT	–
41	-----	WAREHOUSE BUILDING	–
42	-----	MOBILE CHIPPER	–

Figure 2-15. Preliminary Proposal Site Plan.

All fuel trucks will enter and leave at the fuel truck entrance road (Item 14 on Figure 2-15) on East Warrenton Road opposite Queen's Way. Unloaded longwood, if used, would be stored in the south biomass storage area (Item 37) and would be chipped using a mobile chipper (Item 42). Chipped longwood and chipped wood delivered by truck (Item 11) will be further processed and conveyed to the fuel stock-out piles (Item 10), then conveyed to the boiler room (Item 2).

2.5.2.4 Boiler

The Proposal will use a technology called bubbling fluidized bed (BFB). In a conventional biomass-fired boiler, the biomass is burned on a grate. With the more recently developed BFB technology the biomass fuel is burned in a suspended bed of hot, moving (bubbling) granular material such as sand. Air is injected into the bed creating turbulence and "fluidizing" the mix. Compared with a conventional boiler, the fluidized bed design increases heat transfer, which allows for lower operating temperatures, resulting in reduced nitrogen oxide (NOx) emissions (State of Oregon 2010).

2.5.2.5 Ash Handling

The Proposal is expected to generate a maximum of 40 tons per day of ash, which will be disposed of in a permitted landfill, if it cannot be beneficially re-used as a soil amendment. Fly ash (the fine ash that goes up the flue) will be collected and stored in a silo (Item 5) awaiting disposal. Bottom ash (the coarse ash that falls to the bottom of the boiler) will be conveyed to a covered concrete storage structure, awaiting disposal or re-use (Oglethorpe Power Corporation 2009b, Volume I, p. 2-6). Oglethorpe is researching use of ash as a soil amendment.

2.5.2.6 Water Supply

At the time the *Alternatives Report* was completed, only one potential water source was identified, an existing pipeline north of the site. A macro-corridor one mile long and 0.5 mile wide was identified for that source (Oglethorpe Power Corporation 2009a, p. 8-15). Additional sources have since been identified and are summarized below.

Oglethorpe estimates that the Proposal will require approximately 2.0 million gallons of water per day (MGD), mostly for cooling. Oglethorpe plans to use several types of water, including potable (treated for use as drinking water), reclaimed gray water (treated wastewater), and untreated surface water (Black & Veatch 2010):

- Potable water from Thomson- McDuffie County (0.5 MGD maximum flow; Interface Point B on Figure 2-15). Thomson-McDuffie County will construct a new 10-mile long, approximately 8-inch diameter water line from the Thomson

McDuffie County wastewater treatment plant to the Proposal site, as shown in Figure 2-16. The line will be constructed entirely within existing roadway right-of-way.

- Reclaimed gray water from Thomson-McDuffie County (0.7 MGD maximum flow; Interface Point C on Figure 2-15) Thomson-McDuffie will construct a new, approximately 12-inch diameter line from the Thomson-McDuffie wastewater treatment plant, following the same route as the water line (Figure 2-16).
- Untreated surface water from Warren County (0.3 MDG maximum flow; Interface Point E on Figure 2-15). Warren County will construct approximately four miles of new approximately 10-inch diameter line. This line would use existing railroad, roadway, and water pipeline corridors to the extent practicable. The proposed line is shown in Figure 2-17.
- Potable water from the City of Warrenton (0.5 MGD maximum flow; Interface Point A on Figure 2-15); Oglethorpe will need to construct approximately one-half mile of new approximately 10-inch diameter line (Oglethorpe Power Corporation 2009a, p. 7-6). The proposed location along VFW Road is shown in Figure 2-17.
- Reclaimed gray water from the City of Warrenton (0.2 MGD[25] maximum flow; Interface Point D on Figure 2-15). This line, which Oglethorpe will install, will be located within the Proposal site.

2.5.2.7 Wastewater to Treatment Plant

At the time the Alternatives Report was completed, the City of Warrenton planned to construct its treatment facility at a location approximately 5 miles southwest of the Proposal site. The Alternatives Report included an assessment of three macro-corridors for gray water lines to the treatment facility (Oglethorpe Power Corporation 2009a, pp. 8-15 to 8-19). The planned location for the City of Warrenton treatment facility is now adjacent to the northwest corner of the Warren site (Figure 2-15), and a corridor study is not needed.

The maximum expected wastewater flow from the Proposal operations (excluding sanitary wastewater) is 0.309 MGD (Black & Veatch 2010). The primary wastewater source would be cooling tower blowdown (Oglethorpe Power Corporation 2010f). This wastewater, along with sanitary wastewater, would be discharged to the collection system at the City of Warrenton's planned treatment facility (Black & Veatch 2010). The connections to and from the Warrenton wastewater treatment plant will be entirely on the Proposal site.

[25] Reported as 0.5 MGD on Black & Veatch 2010; in September 2010, Oglethorpe reported the revised value of 0.2 MGD.

2.5.2.8 Storm Water and Wastewater to Woodyard Runoff Pond

Storm water runoff from the woodyard and the power block area (Figure 2-15) would be collected in a newly constructed pond (Item 17 in Figure 2-15). The wood yard runoff pond would also receive approximately 14,400 gallons per day (gpd) (10 gallons per minute [gpm]) of water from floor drains. The area floor drains will collect all miscellaneous washings, flushings, and minor leakage/spills within the power block building area (Oglethorpe Power Corporation 2010f). Any wastewater which could potentially contain oil would be routed to an oil/water separator prior to introduction into the wood yard runoff pond (Black & Veatch 2009). Pond effluent would be pumped through a back-washable pressure filter system for suspended solids reduction, and the capability would be provided to feed a coagulant chemical ahead of the filters to enhance filtration of suspended solids (Black & Veatch 2009). Treated water from the woodyard runoff pond would be reused as a small part of the makeup water for the cooling tower.

2.5.2.9 Storm Water to Storm Water Runoff Ponds

Water from those parts of the fenced plant site outside the woodyard and the power block area would be collected in two newly constructed ponds (Items 21 in Figure 2-15). Overflow from these ponds would be released into on-site drainageways and would be permitted under the National Pollution Discharge Elimination System (NPDES), as required by Georgia regulations for storm water discharges associated with industrial activity.[26]

2.5.2.10 Transmission

An approximately 3,000-foot long 115-kV transmission line will be built from the transformers (Item 19) outside the turbine room (Item 1) to a new substation (Item 24) located within the existing north-south transmission line right-of-way on the west side of the site. The structures will likely be concrete and/or steel, single pole design, 80 to 100 feet out of ground, constructed to support 115 kV circuits (Oglethorpe Power Corporation 2010i).

[26] 391-3-6.16(3)(b)

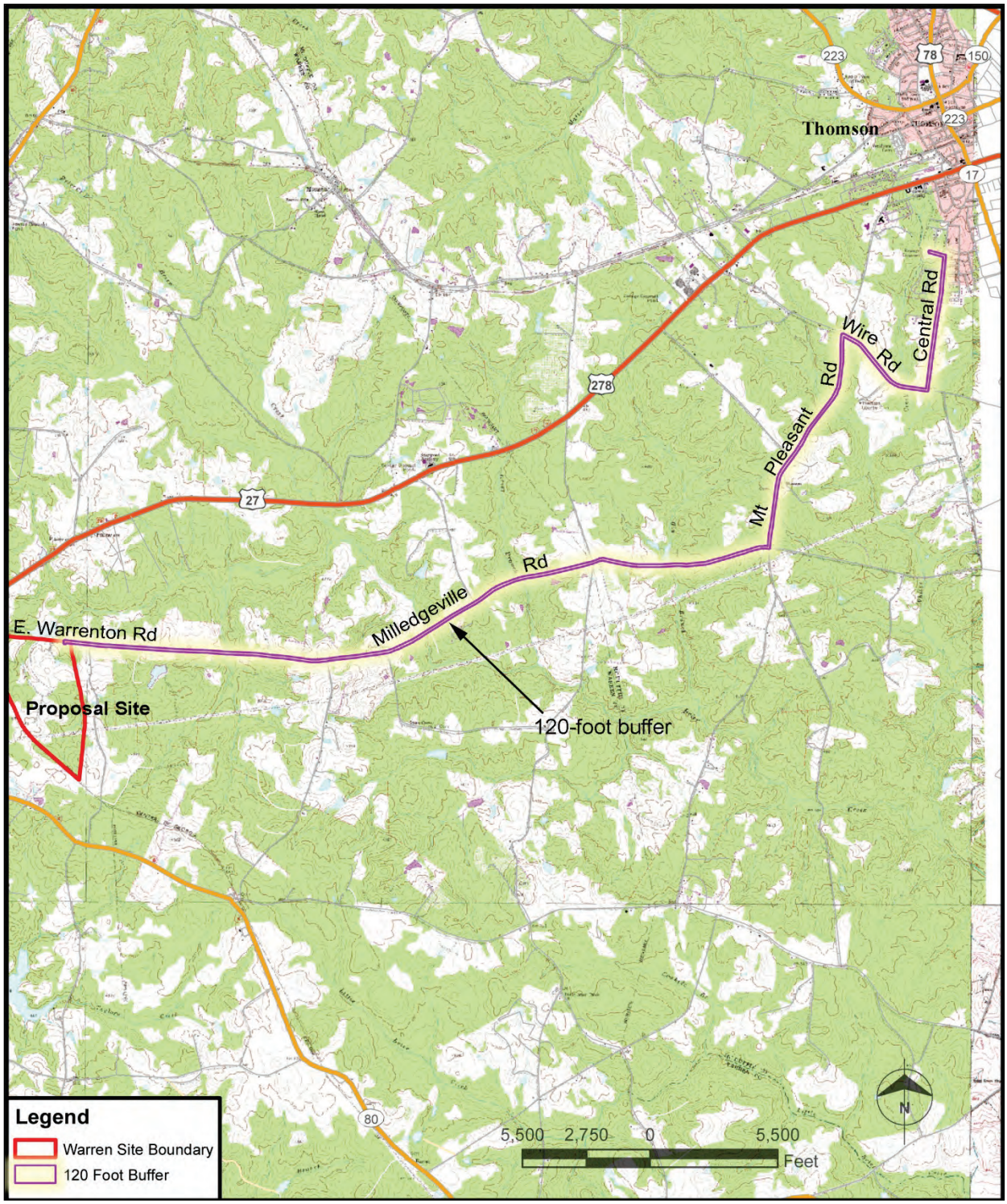


Figure 2-16. Proposed Thomson-McDuffie Gray and Potable Water Lines.
Source: Oglethorpe Power Corporation 2010g, Figure 1-3.

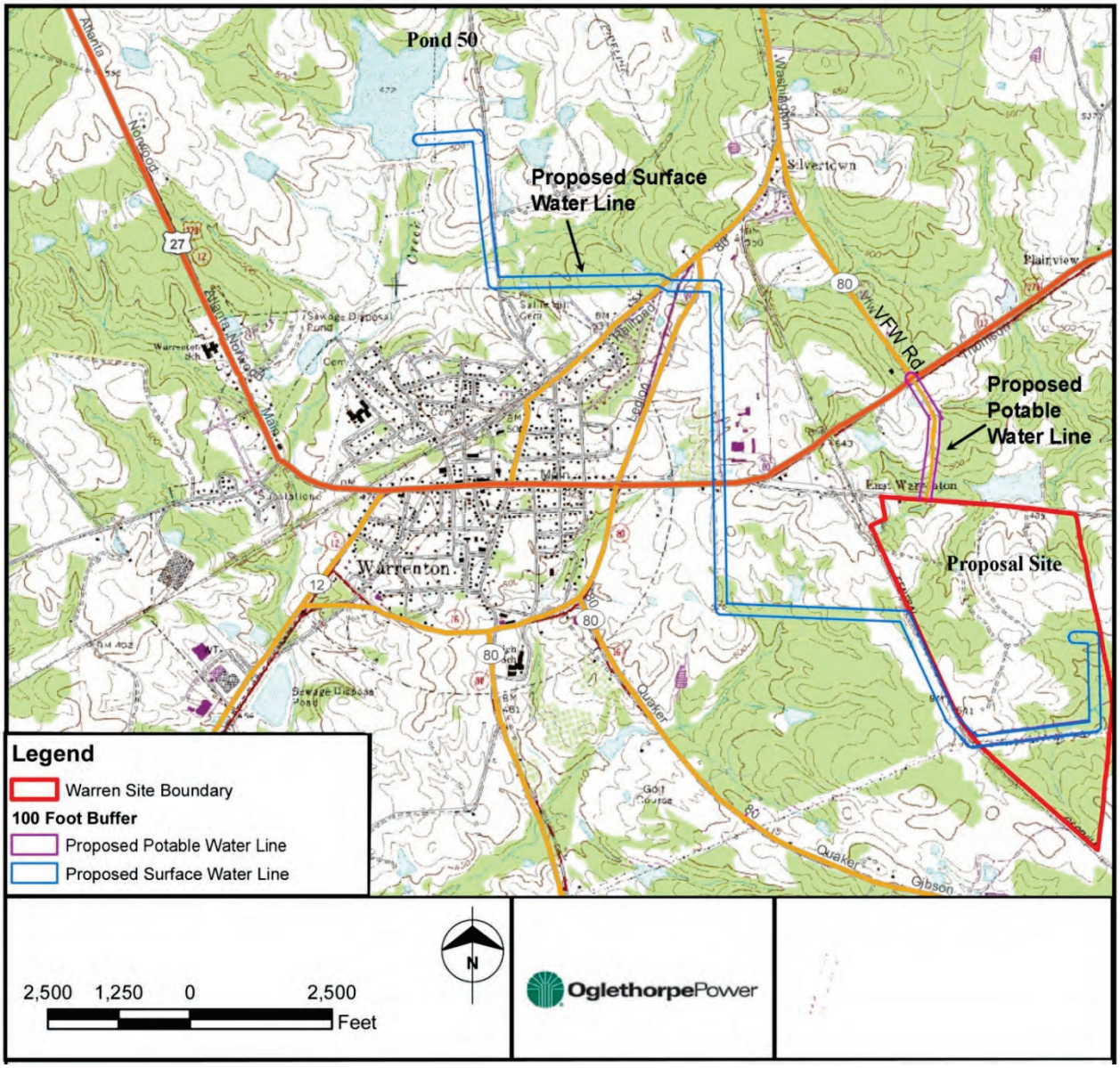


Figure 2-17. Proposed Warrenton Surface Water and Potable Water Lines.
Sources: Oglethorpe Power Corporation 2010g, 2009a.

A system impact study performed by Georgia Transmission Corporation (GTC) determined the need to upgrade two 115kV transmission lines within the current system. These upgrades would better facilitate the addition of the Proposal to the Georgia Integrated Transmission System (GA ITS). The two lines that would require upgrades are the Evans Primary – Fury's Ferry Road 115kV transmission line owned by Georgia Power Company (GPC) (Figure 2-18), and Union Point-Maxeys 115kV transmission line owned by the Municipal Electric Authority of Georgia Power (MEAG) (Figure 2-19).

The Evans Primary – Fury's Ferry 115kV transmission line would require approximately 3.5 miles of line to be reconductored. Reconductoring involves replacing the transmission cable with a larger-diameter line. Currently, the transmission line is built using wooden "H" frame structures. It is not anticipated that any structures would be replaced during the upgrade. All upgrades would occur within the existing 100 foot wide right-of-way and no new right-of-way would need to be acquired.

Approximately 13.3 miles of the Union Point – Maxeys line also requires reconductoring. Currently, the line uses wooden "H" frame structures within a 125 foot-wide right-of-way. In addition to reconductoring, the existing "H" frame structures would be replaced with new single pole structures. All upgrades would occur within the existing right-of-way and no new right-of-way would need to be acquired.

2.5.2.11 Emissions Control Systems

Nitrogen Oxides (NO_X)

NO_x will be controlled by a process called selective non-catalytic reduction (SNCR) (Oglethorpe Power Corporation 2009b, Volume I, Table 1-2). Air is made up of approximately 78 percent nitrogen (N_2). When fuels are burned, nitrogen in the fuel and nitrogen in the air react with oxygen to form primarily nitric oxide (NO), plus small amounts of nitrogen dioxide (NO_2). When the NO enters the air outside the flue, a portion it is converted to NO_2. The objective in the control system is to reduce (remove oxygen from) the NO_x to produce N_2. This is accomplished by injecting either ammonia (NH_3) or urea ($CO(NH_2)_2$) into the flue gas stream in the stack (Item 36). The simplified reaction using ammonia is shown below; the urea reaction is similar.

$$4\ NO + 4\ NH_3 + O_2 \rightarrow 4\ N_2 + 6\ H_2O$$

This process is called selective non-catalytic reduction (SNCR), to distinguish it from a similar process that uses a catalyst.

Sulfur Dioxide (SO_2)

Sulfur dioxide (SO_2) emissions will be controlled by a process called duct sorbent injection (Oglethorpe Power Corporation 2009b, Volume I, Table 1-2). SO_2 emissions result from oxidation of sulfur contained in the fuel when it is burned. The SO_2 in the flue gas will be controlled by injection of alkaline sorbent, which reacts with the SO_2 to form solids, which are collected with a fabric filter (Item 3).

Carbon monoxide (CO)

Carbon monoxide results from incomplete combustion and will be controlled by implementing good combustion practices (Oglethorpe Power Corporation 2009b, Volume I, p. 2-2). Good combustion practices are measures to ensure that the boiler is operating as designed with respect to such variables as temperature and fuel/air ratio at high combustion efficiency, thus reducing products of incomplete combustion. Good combustion practices are implemented through routine and periodic adjustments and checks by trained personnel using the operation and maintenance manuals provided by the boiler manufacturer. On a BFB boiler, good combustion is accomplished through the following (Oglethorpe Power Corporation 2010j, p. 2):

- Maintaining the proper boiler bed inventory through the fuel feed, ash removal, and bed makeup systems.
- Monitoring oxygen and CO concentrations at the boiler exit, and making adjustments at the air feed to ensure sufficient excess oxygen for complete combustion.
- Monitoring and adjusting the exhaust gas recirculation flow rate to ensure proper fluidization and temperature of the boiler bed, which in turn promotes complete combustion.

Particulate Matter (PM)

Filterable PM emissions will be controlled by the use of a filter fabric (baghouse) (Item 3).

2.5.2.12 Other Chemicals and Fuels

A tank (Item 32) will be used for aqueous ammonia, which will be used in the SNCR system. Biodiesel, which will be used as a starting fuel, will be stored in a tank on-site (Item 31).

2.5.2.13 Improvements to East Warrenton Road

Warren County plans to widen East Warrenton Road between the two plant entrance roads shown in Figure 2-15. The roadway right-of-way will increase from 50 to 65 feet, with all new right-of-way on the south, on the current Proposal site. Shoulder widths will

be increased from three to eight feet and lane widths will be increased from 10 to 12 feet. The area affected will extend just west of the west entrance road and just east of the east entrance road, to allow a gradual tie-in to the existing roadway (Civil Design Solutions, LLC 2010).

2.5.2.14 Construction Timetable

The EIS process culminates in the publication of a Record of Decision (ROD) that states RUS' position based on the environmental review. The ROD is projected to be available in 2011. Major contracts cannot be signed and construction could not begin until the ROD is signed and published. While there is currently no definite schedule for project completion, pending its approval, the biomass plant would be constructed and operational within four years of project commencement. The estimated cost of the plant is $477 million (Oglethorpe Power Corporation 2010c, p. 9).

2.5.2.15 Plant Operations

The plant will operate unrestricted for approximately 8,255 hours per year with a staff of approximately 40 (Oglethorpe Power Corporation 2009a, p. 7~6).

2.5.3 Biomass Facility at Alternate Site

The Alternate site regional setting is shown in Figure 1-2 and the site is shown in Figures 1-4 and 1-6. The general site arrangement is shown in Figure 2-20. The plant would be very similar to the Proposal as described above, except that groundwater would likely be the primary water source. Groundwater wells would be installed on-site and there would be no need for the off-site water pipelines needed for the Proposal. Also, approximately 38 miles of an existing 230-kV transmission line (Hatch-Offerman) requires reconductoring; however, unlike the Proposal reconductoring, this work would require a new line in an approximately 125-foot right-of-way adjacent to the existing line and would require the clearing of this additional right-of-way. The location of the line is shown in Figures 2-21a, -b, and –c.

2.6 COMPARISON OF ALTERNATIVES

The alternatives assessed in detail are summarized in Table 2-2. Primarily because the Alternate has greater potential for impacts to residential areas, wetlands and other Waters of the U.S. and because the Proposal has superior roadway access, Oglethorpe has identified the Proposal as its preferred alternative. Based on the analysis detailed in this final EIS, RUS concurs and has identified the Proposal as described in this final EIS with proposed measures to minimize impacts as its preferred alternative.

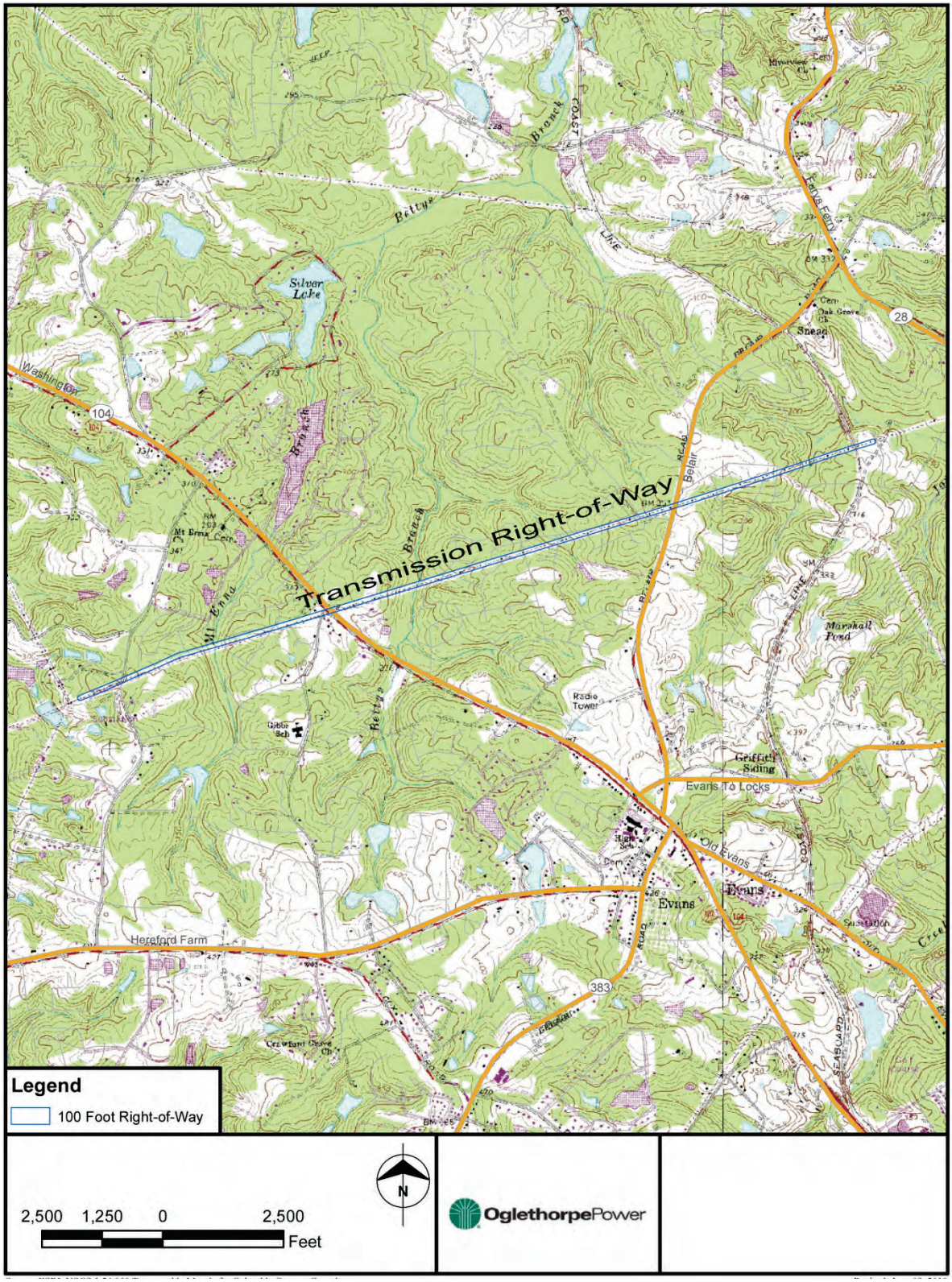


Figure 2-18. Evans Primary – Fury's Ferry 115-kV Line Upgrade.
Source: Oglethorpe Power Corporation 2010g, Figure 1-1

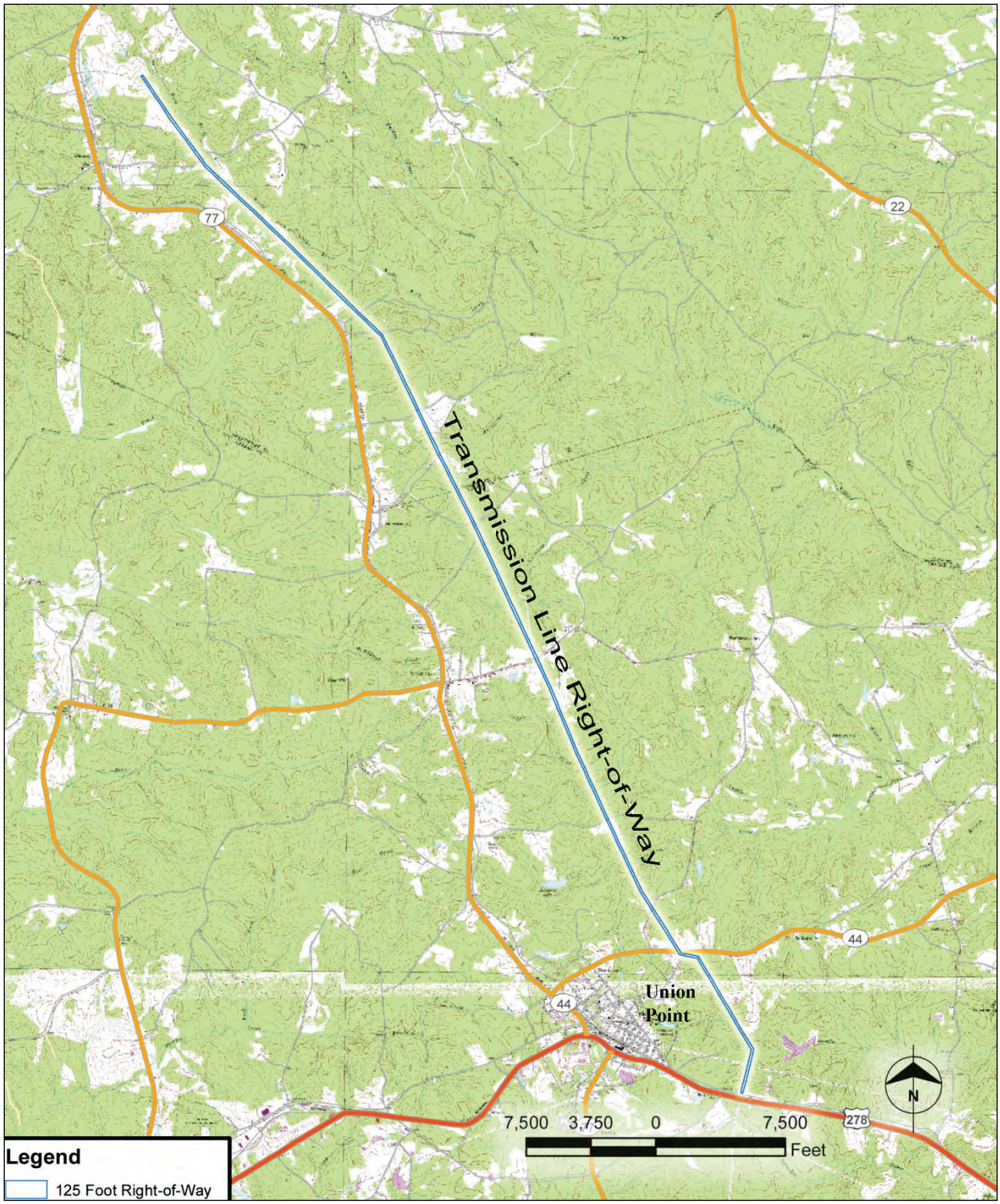


Figure 2-19. Union Point – Maxeys 115-kV Line Upgrade.
Source: Oglethorpe Power Corporation 2010g, Figure 1-2

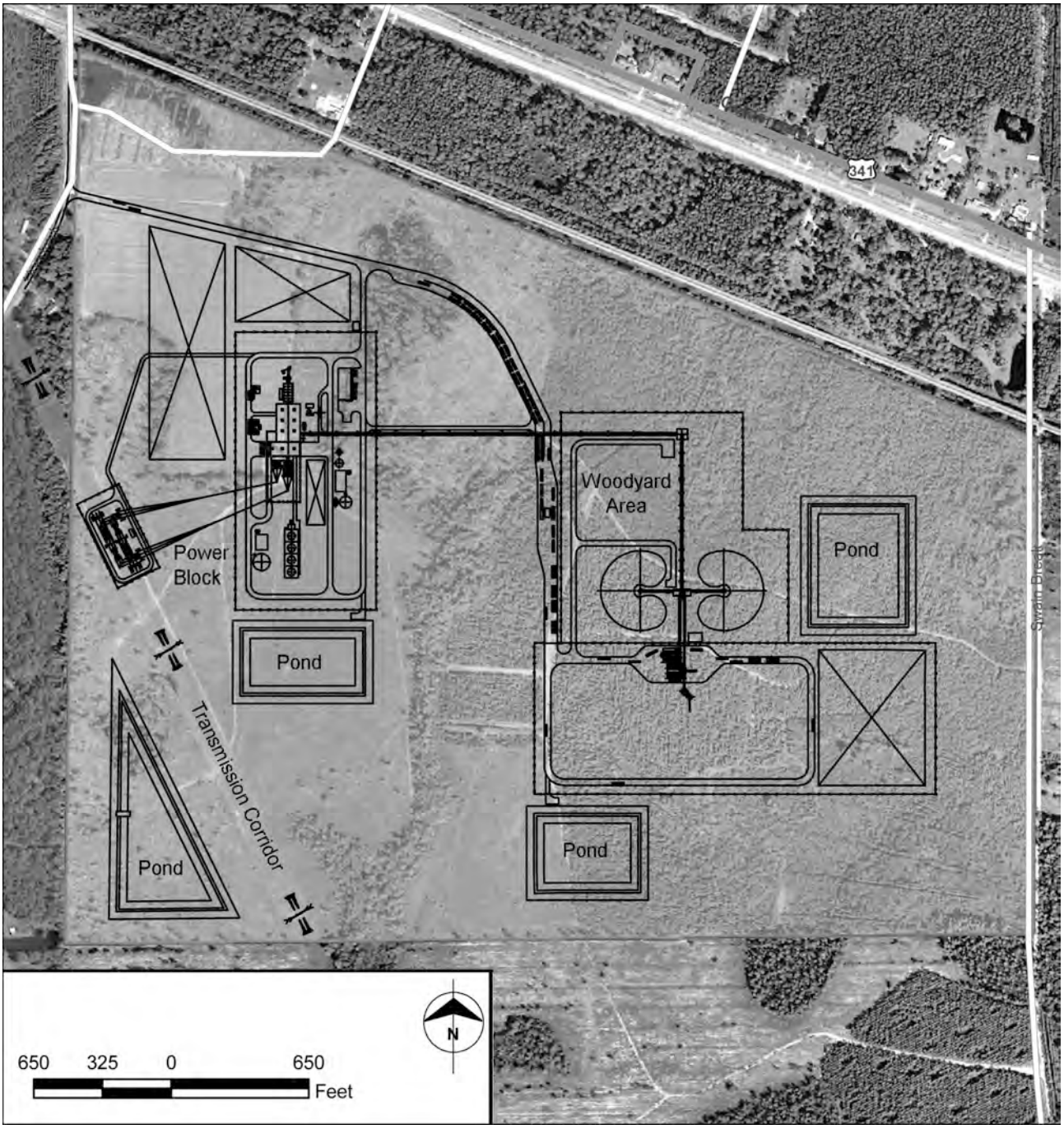


Figure 2-20. Alternate Site Layout.
Source: Oglethorpe Power Corporation 2010

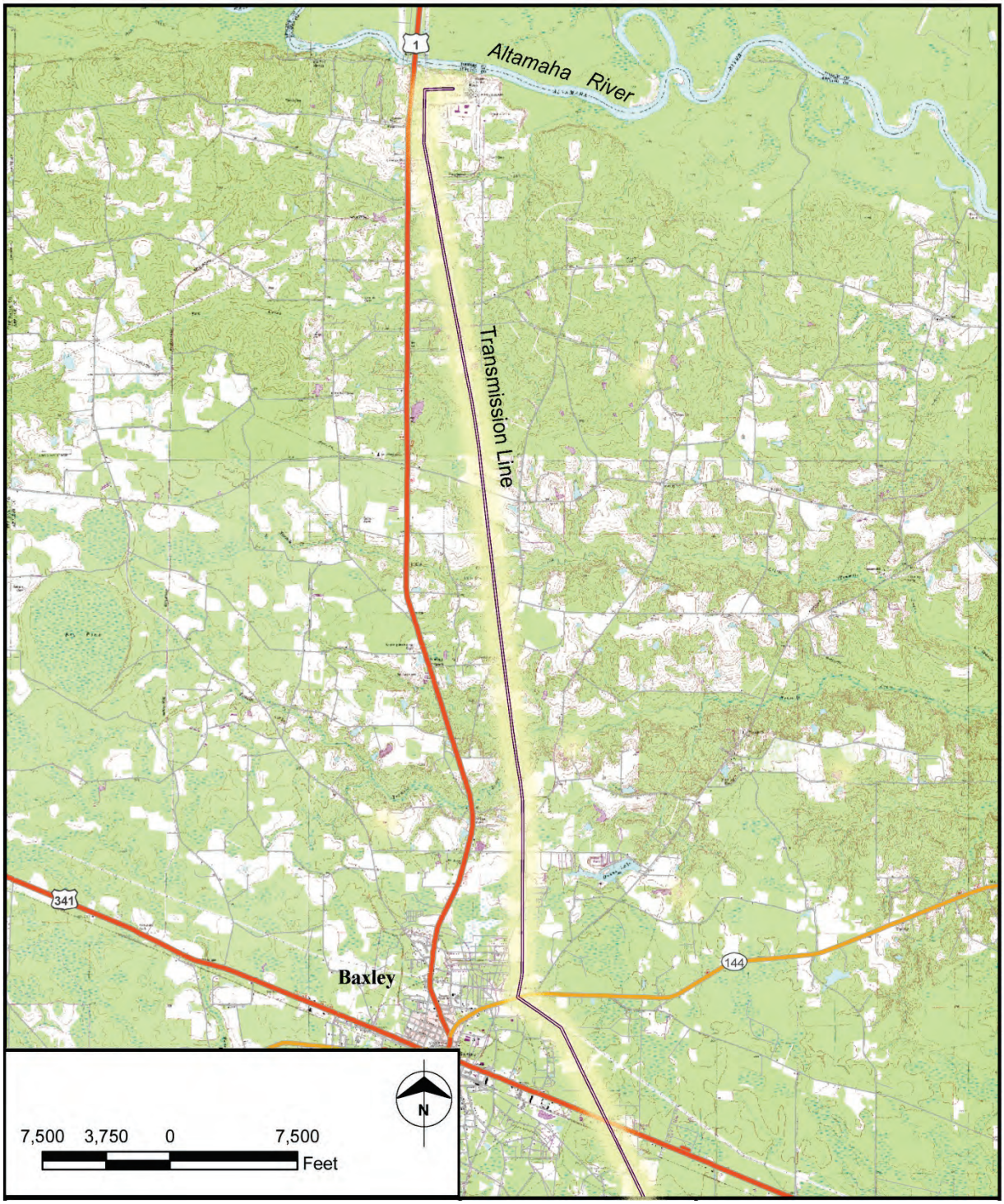


Figure 2- 21a. Location Map: Hatch – Offerman 230-kV Line, North Section.
Source: Oglethorpe

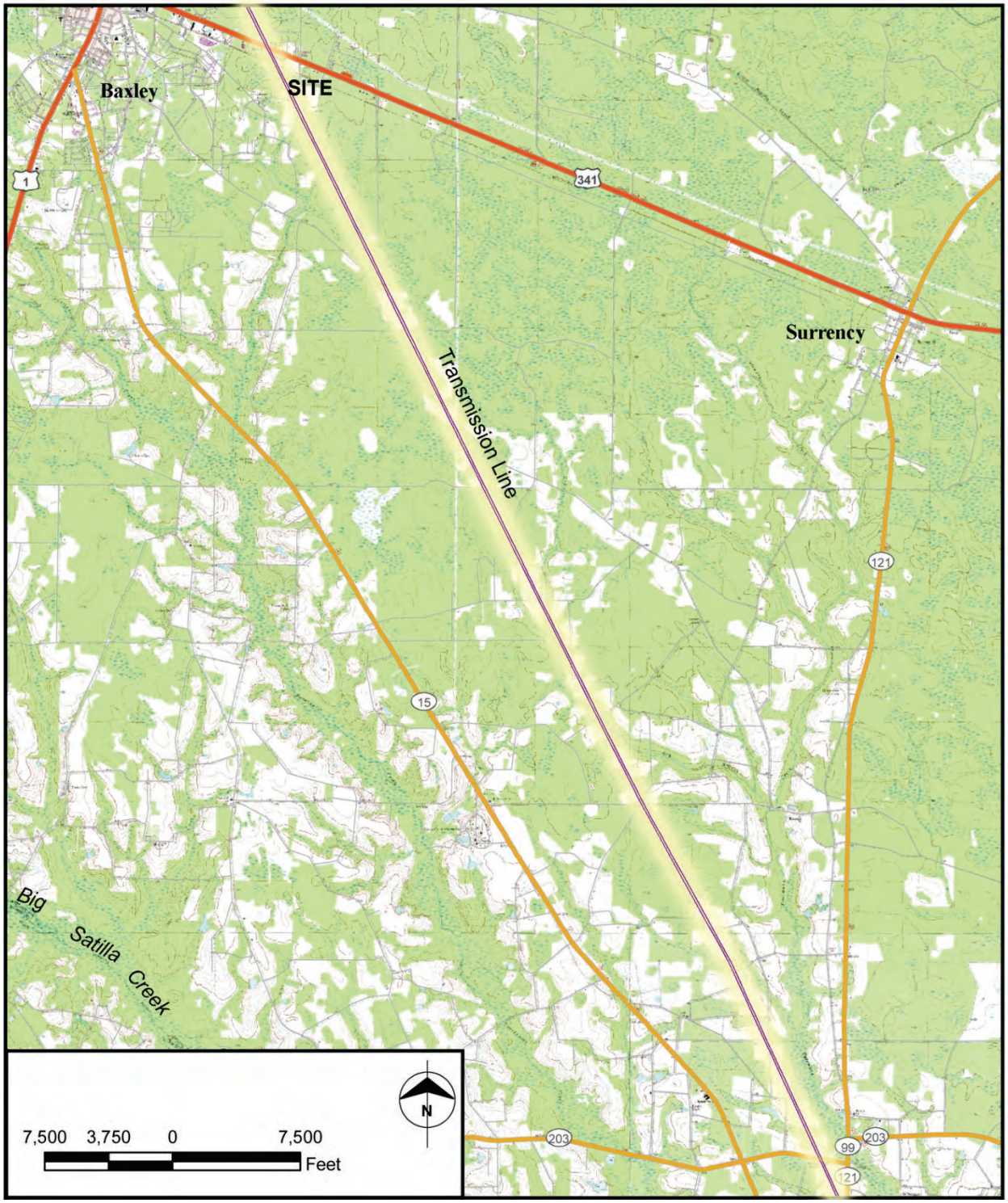


Figure 2- 21b. Location Map: Hatch – Offerman 230-kV Line, Middle Section.
Source: Oglethorpe

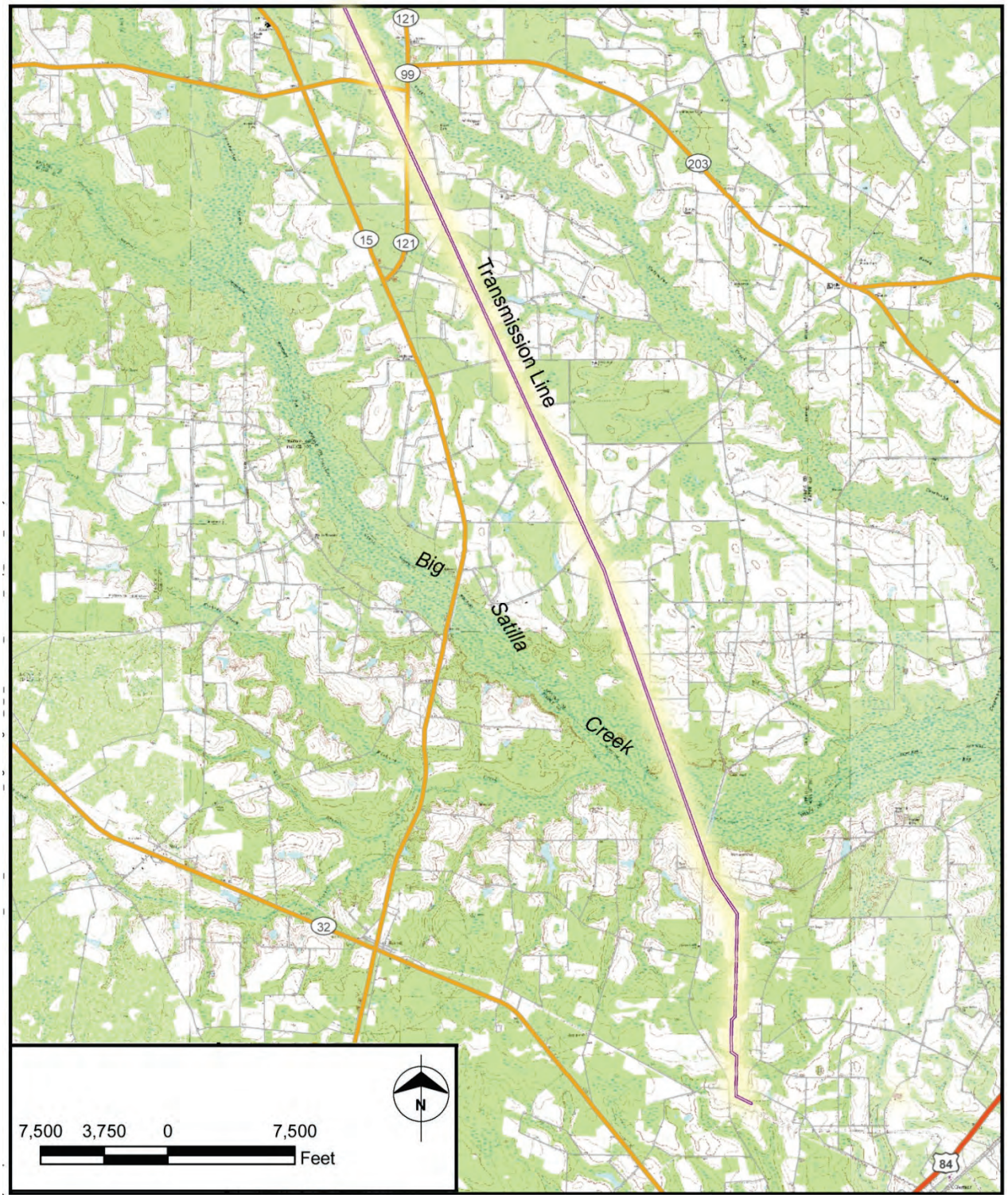


Figure 2- 21c. Location Map: Hatch – Offerman 230-kV Line, South Section.
Source: Oglethorpe

Table 2-2: Summary of Impacts by Alternative

<table>
<tr><th>Proposal</th><th>Alternate</th><th>No-Action</th></tr>
<tr><td colspan="3">Air</td></tr>
<tr><td colspan="2">• Proposed plant would operate under an air emission permit from the Georgia Environmental Protection Division (EPD) and would comply with NAAQS and prevention of significant deterioration (PSD) increments.
• Short-term construction impacts from increased vehicle emissions and dust would be localized.
• Estimated maximum mercury emissions would be approximately 0.3 percent (11 lb/yr) of the 2008 Georgia utility mercury air releases.
• Local mercury deposition is expected to be less than 1 lb/yr within a 75-mile radius of the area surrounding the site.
• Yearly maximum emissions from idling trucks on site and truck deliveries are low compared to overall emissions from operation of the plant.
• Compared to other combustion options, greenhouse gas (GHG) emissions are minimized by selection of biomass as the fuel.</td><td>Power would likely be generated from non-renewable sources, with potentially higher mercury and GHG emissions.</td></tr>
<tr><td colspan="3">Surface Water</td></tr>
<tr><td colspan="2">• Short-term impacts to water quality could result from spills, leaks, or improper disposal of construction materials or sediment and other contaminants carried in downstream runoff, but would be avoided by implementation of spill prevention, control and countermeasure (SPCC) Plan.
• Potential sedimentation impacts during construction from erosion, would be avoided through storm water controls, best management practices, and required storm water permit.
• Minimize wastewater discharge through maximum reuse of plant wastewater.
• Reuse stormwater runoff from wood pile and wastewater from plant drains as makeup water for cooling tower.</td><td rowspan="2">Power would likely be generated from non-renewable sources, with similar impacts.</td></tr>
<tr><td>• Surface water withdrawals will reduce flows in Rocky Comfort Creek system.
• Will require EPD approval of additional withdrawals by the City of Warrenton (permit pending).</td><td>• Use of reclaimed wastewater from Baxley wastewater treatment plant would reduce pollutant load in Altamaha River.</td></tr>
</table>

Table 2-2: Summary of Impacts by Alternative

Proposal	Alternate	No-Action
• Use of reclaimed wastewater will reduce pollutant loading to Whites Creek and Rocky Comfort Creek. • Reduce surface water withdrawal by 0.9 million gallons per day (MGD) through use of reclaimed water from Thomson-McDuffie and City of Warrenton • Use of surface water from multiple watersheds will reduce the impact on any given watershed.	• Use of reclaimed wastewater from Baxley wastewater treatment plant would reduce pollutant load in Altamaha River.	Power would likely be generated from non-renewable sources, with similar impacts.
Geology and Soils		
• No unique geologic features.		Power would likely be generated from non-renewable sources, with similar impacts.
Land Use		
• Permanent prime farmland impacts of 94 acres and 12 acres of farmland of statewide importance.	• No prime farmland impacts and permanent impacts of 80.4 acres of farmland of statewide importance.	Power would likely be generated from non-renewable sources, with similar impacts.
Groundwater		
• Construction dewatering of deep excavation for truck unloading system may result in short-term, highly localized depression of groundwater levels at the proposed site.		Power would likely be generated from non-renewable sources, with potentially similar impacts.
No long-term groundwater impacts expected.	• Withdrawal of approximately 0.8 MGD from Floridan aquifer, which has abundant supply – requires GAEPD permit with potential special conditions.	

Table 2-2: Summary of Impacts by Alternative

Proposal	Alternate	No-Action
Noise		
• Noise levels would increase during construction; short term steam blow event. • Oglethorpe will analyze and implement noise mitigation to ensure that noise levels will be below 65 dBA at the nearest residential receptor.		Power would likely be generated from non-renewable sources, with similar impacts.
• Predicted day night noise levels are expected to be approximately 50-60 A-weighted decibels (dBA) at the property boundary during operations, and within a range that is consistent with 65 dBA during operations near a small area along eastern property boundary only during the limited hours of intermittent use of the mobile chipper, however no residences are near this area.	• Numerous residences to the north, northeast, southwest, and west could be impacted by the increased noise levels.	Power would likely be generated from non-renewable sources, with similar impacts.
Forests and Forest Industry		
• Permanent removal of 0.7 acres bottomland forest.	• Permanent removal of 61.7 acres upland forest and 39.2 acres of harvested forest.	Probable similar impacts.
Biological		
Vegetation		
• Existing site is pasture, upland forest and recently harvested pine forests. • Permanent vegetation removal from 105.6 acres; short term impacts to 144.9 acres. • Permanent impact to 0.7 acres bottomland forest for road construction.	• Existing site is pasture and recently harvested pine forests. • Permanent vegetation removal from 105 acres; short term impacts to 154.4 acres. • Permanent impact to 61.7 acres upland forest and 39.2 acres of harvested forest.	Power would likely be generated from non-renewable sources, with similar impacts.

Table 2-2: Summary of Impacts by Alternative

Proposal	Alternate	No-Action
Wetlands, Riparian Areas, and Waters of the U.S.		
• Implementation of BMPs would minimize impacts to wetlands or riparian areas resulting from construction and operation activities		Power would likely be generated from non-renewable sources, with potentially similar impacts.
• Based on wetland delineation, 0.02 acre impact to one open water pond; no loss of riparian areas, 0.3 acre wetland impact from widening East Warrenton Road. • Impacts from water line installation not yet determined; total estimated area from National Wetland Inventory (NWI) maps is 1.6 acres.	• Based on wetland delineation, 640 linear feet of stream impact; no loss of riparian areas, no degradation or loss of any Federal- or State-protected wetlands as defined by Section 404 of the CWA or other applicable regulations. • The replacement Hatch – Offerman transmission line would cross approximately 65 acres of wooded wetland, which would need to be cleared.	
Floodplains		
• No floodplains on proposed sites.	• Very small floodplain area at edge of site; will not be impacted.	Impacts not known.
Wildlife		
• Habitat loss at site for common species. • Recent removal by previous owner of portions of forested areas by clear-cut logging previously decreased the available wildlife habitat on the proposed site.	• Habitat loss at site for common species.	Power would likely be generated from non-renewable sources, with similar impacts.
Sensitive Species and Areas		
• No known or expected state- or federally-listed species or critical habitat on sites.		Power would likely be generated from non-

Table 2-2: Summary of Impacts by Alternative

Proposal	Alternate	No-Action
• Reconductoring of Evans Primary-Fury's Ferry could potentially impact the state-listed Georgia aster or relict trillium, and installation of the Thomson-McDuffie water line could potentially impact the Georgia aster. Field studies may be needed when the responsible party does the work.	• Potential for impact to protected species has not been assessed for the Hatch – Offerman transmission line.	renewable sources, with potentially similar impacts.
Land Resources		
• Conversion of pastureland and recently harvested forestland to industrial land use. • Proposed site is consistent with existing land use and development goals of Joint Warren County Comprehensive Plan. • Property will be annexed by the City of Warrenton. • Property site would require a land use district map change from forestry-agriculture to industrial.	• Conversion of pastureland and forestland to industrial land use. • Proposed site is consistent with existing land use and development goals of the Appling County Comprehensive Plan. • Property site would be annexed by the City of Baxley. • Impacts to adjacent and nearby residential areas along Hundreds Rd west of project site from increase in industrial land use and traffic.	Power would likely be generated from non-renewable sources, with potentially similar impacts.
• No impacts to federal, state, or local recreational facilities.		Potential impact not known.
Visual		
• Landscape buffer would be planted along property boundary to provide additional screening to lessen visual impact on residences.		Power would likely be generated from non-renewable sources, with similar impacts.
• Project has limited visibility and would mix in with other industrial lands uses nearby. • Few residents with visual impacts; only stack visible from nearby golf course.	• Project has limited ground level visibility, but the stack and taller structures may be visible above the tree line. • Multiple residences to the north, northeast, southwest, and one residence to the west would have visual impacts.	

Table 2-2: Summary of Impacts by Alternative

Proposal	Alternate	No-Action
Transportation		
• Level of service on GA12 and at GA12 and VFW road intersection would worsen during peak hour traffic period at peak construction (2012) to level of service (LOS) of D. • Proposed installation of temporary traffic signal at SR12 and VFW road intersection during construction to lessen peak hour traffic impacts. • Safety improvements to East Warrenton Road, including widening and repaving of existing roadway. • Traffic to plant has many options, and no need to pass directly through Warrenton.	• Level of service at U.S. 341 and Industrial Park Drive intersection would drop to LOS of F during peak morning hour traffic period at peak construction (2012). • Staggered start times would be implemented to evenly distribute arriving vehicles over a period of 2 hours. • Recommended construction of northbound right-turn lane on the Hundreds Road approach to allow for heavy volume of right turning vehicles to exit the site during peak evening hour. • Recommended widening of Hundreds Road to handle large volume of vehicles during construction and deliveries of biomass products. • Traffic to plant has fewer options and most routes pass through the middle of Baxley.	Power would likely be generated from non-renewable sources, with similar impacts.
Cultural		
• No impacts to National Register of Historic Places (NRHP) eligible properties.		No impact
Public Health and Safety		
• Ash would be stored in enclosed silos and disposed in an off-site permitted landfill.		Power would likely be generated from non-renewable sources, with similar impacts.

Table 2-2: Summary of Impacts by Alternative

<table>
<tr><th>Proposal</th><th>Alternate</th><th>No-Action</th></tr>
<tr><td colspan="3">Socioeconomic Resources</td></tr>
<tr><td colspan="2">• Direct and indirect economic benefits would occur from construction-related expenditures to the surrounding region.
• Creation of a maximum of 600 temporary construction and 44 permanent jobs would be a beneficial impact.
• Local government services are adequate for worker influx.
• Positive benefits from property taxes and fees.
• No residential displacements.</td><td>Power would likely be generated from non-renewable sources, with similar impacts.</td></tr>
<tr><td colspan="3">Environmental Justice</td></tr>
<tr><td colspan="2">• No environmental justice impact (no high adverse impacts) as defined by Executive Order 12898.</td><td rowspan="2">Power would likely be generated from non-renewable sources, with potentially similar impacts.</td></tr>
<tr><td>• The percent of minority population in the census blocks at and immediately adjacent to the site are all 0 to 20 percent, except for one at 40 to 60 percent (Figure 3-43); however, this block has more residents than the other adjacent blocks. By comparison, the minority population of the State of Georgia is 28.7%, Warren County is 59.5% and the City of Warrenton is 69.4%.
• Poverty rate for the affected area is also higher than the State of Georgia (13%), but lower than Warren County (27%) and the City of Warrenton (36%).</td><td>• The percent of minority population in the census blocks at and immediately adjacent to the site are mostly 0 to 10 percent, however one is 10-20 percent and one is 40-100 percent. By comparison, the minority population of the State of Georgia is 28.7%, Appling County is 19.6% and the City of Baxley is 37.9%.
• Poverty rate for the affected area is also higher than the State of Georgia (13%) and Appling County (18.6%), but comparable to the City of Baxley (24.4%).</td></tr>
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