

THE NORTH CAROLINA
“Affordable and
Reliable Energy Act”

**An Environmental
Assessment**

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Assessing the “Affordable and Reliable Energy Act” (H298/S365)

EXECUTIVE SUMMARY

Since the many House and Senate Committees are concerned with the *environmental* impact of proposed legislation, these comments will emphasize that aspect of [H298](#) / [S365](#).

Even with that limited scope, this is still a complicated situation that requires an in-depth understanding of the electricity business. To simplify this matter somewhat further, my remarks will primarily focus on wind energy.

The reasons for this choice are:

- 1) if [Senate Bill 3](#) (SB3) is left unchanged, wind energy will ultimately most likely provide the majority of the renewables mandate, *and*
- 2) many of the environmental aspects regarding wind energy also apply to other renewables (e.g. solar).

When faced with matters of this complexity, we often want it simplified as a sound bite. For those so inclined, here it is:

Wind energy is a net environmental detriment.

H298/S365 is proposing to remove the renewables mandate of SB3 — which would have ultimately resulted in North Carolina being increasingly burdened by environmental hardships. As such, H298/S365 is beneficial to the vast majority NC businesses and citizens.

For those who are interested in wading through the technical details of why this is so, please see the attached information. [EnergyPresentation.Info](#) can also be very helpful in understanding the electrical energy situation. Let me know any questions about anything in this report.

I am respectfully requesting that all House and Senate Committees give their full support to H298/S365. If needs be, I'd be glad to testify in person.

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[Note: [S365](#) is the identical NC Senate version of this bill.

Since H298 was introduced first, we will exclusively refer to that version.]

Assessing the “Affordable and Reliable Energy Act” (H298/S365)

SOME DETAILED ENVIRONMENTAL INFORMATION

The essence of what H298 does is to remove the renewable energy mandate from [Senate Bill 3](#) (SB3). What are the environmental consequences of this action? The evidence says that H298 **will be a net environmental benefit**.

When we are speaking of “environmental” concerns here, we are referring to impacts on: **a)** human health, **b)** wildlife, **c)** vegetation, and **d)** the eco-system [e.g. air and water resources]. Let’s break it down:

1 - One of the main reasons cited in [Senate Bill 3](#) to justify its passage, is an environmental concern. The question is though, does SB3 actually provide any proven environmental net benefits? *Quoting directly from SB3:*

62-2. (a) (10): To promote the development of renewable energy and energy efficiency through the implementation of a Renewable Energy and Energy Efficiency Portfolio Standard (REPS) that will do all of the following:

- a. Diversify the resources used to reliably meet the energy needs of consumers in the State.
- b. Provide greater energy security through the use of indigenous energy resources available within the State.
- c. Encourage private investment in renewable energy and energy efficiency.
- d. **Provide improved air quality and other benefits to energy consumers and citizens of the State.**

Item “d” sounds good on the surface, but consider these questions:

- 1) Exactly what objective evidence concludes that throughout NC there is a pressing **need** for such improved air quality? **None.**
- 2) Specifically what objective evidence is there to say exactly **how much** improved air quality is needed across the state? **None.**
- 3) What SB3 provisions are there to *quantify* the improved air quality to NC (e.g. what before-and-after measurements are required)? **None.**
- 4) Is it in NC’s interest to improve NC air quality at *any* cost? **No.**
[Nowhere in SB3 is there any real protection for NC ratepayers for excessive costs resulting from this additional improved air quality.]
- 5) Is it in NC’s interest to improve air quality at the expense of reduced reliability to the grid? **No.** [Nowhere in SB3 is grid reliability addressed.]
- 6) Is there a scientific assessment that proves that SB3’s mandate of renewable energy on its citizens will improve air quality? **No.**
- 7) What are the “other benefits” vaguely alluded to in item “d”? **Unknown.**
[If they are important, why are they not specifically itemized in SB3?]

So H298 will not undermine any environmental value here – as there are no proven SB3 net environmental benefits to begin with.

2 - Most people have little understanding of the far-reaching environmental impacts of wind turbines. If they did some objective research, the results would be startling. For example, one place to look would be to check out the conclusions of careful citizens who investigated this matter, *prior* to approving an industrial wind application for their community.

Case in point: look at the excellent [study](#) that citizen volunteers created in the small town of Bethany, NY. This proves that objectivity and competence is possible if people start with an open-mind on this matter. The environmental/health/safety considerations that they researched and dealt with included:

1. Aesthetic / Quality of Life Impact
2. Backup Power Issues
3. Construction Disruption
4. Earthquake / Seismic Effects
5. Electronic & Electromagnetic Interference
6. Fire Risk & Fire Department Needs
7. Ground Water Impact
8. Hazards to Aviation
9. High Wind Failure & Other Breakdowns
10. Ice Throw
11. Lighting
12. Lightning Protection
13. Monitoring
14. Noise, Including Infrasonic
15. Road Upkeep & Repair
16. Security (Vandalism / Terrorism)
17. Shadow & Flicker Effects
18. Siting & Placement Issues
19. Storm Water Runoff, Erosion & Sedimentation
20. Stray Voltage AKA Ground Current

These were identified as *every one* of these can be a problematic matter! It would take too long to go into all of these areas in this report, so we'll just touch on a few of these environmental matters...

3 - A significant environmental consequence of the SB3 renewables mandate is the adverse health effects to citizens living near these industrial developments.

There are a few hundred reports by independent experts on the various issues involved. "[Properly Interpreting the Epidemiologic Evidence About the Health Effects of Industrial Wind Turbines on Nearby Residents](#)" by Dr. Carl Phillips, "[A Summary of New Evidence: Adverse Health Effects and Industrial Wind Turbines](#)" and "[Wind Turbine Noise and Human Perception](#)" are good overviews of the turbine human health situation.

This [site](#) has over a hundred studies and reports by medical professionals concerning the human health problems attributed to industrial turbines. And then there's "[Wind Energy: A Review of Human Health & Safety Concerns](#)" which lists sample studies for Acoustical, EMF, Shadow Flicker, Ice Throw and misc (e.g. fires) problems. And health impacts can extend beyond humans, as several studies have concluded (like [this](#)).

H298 avoids the cost, pain and suffering that SB3 would inflict on some NC residents unfortunate enough to live near an industrial wind development.

4 - Many people don't understand is that industrial wind projects can have *significant* impact on a considerable amount of soils and wetlands — **due to their adverse effect on local meteorology.**

This issue has been [assessed](#) by independent scientists who have concluded that such wind projects **can reduce ground level humidity by approximately 30%, and affect an area as much as 15 miles downwind** from the development site.

Some other related studies are: "[Impacts of wind farms on land surface temperature](#)" (2012) and "[Local and Mesoscale Impacts of Wind Farms](#)" (2012) "[Impacts of wind farms on surface air temperatures](#)" (2010).

This means that vegetation *will* change, crops *will* yield less, wetlands *will* dry up, and wildlife *will* be adversely impacted due to the local (*up to 15 miles away!*) meteorological effects caused by industrial wind project. **The economic and environmental implications of such changes are far reaching.** None of these matters has been acknowledged or mitigated in any of the NC wind proposals received to date.

By removing the SB3 renewables mandate, H298 prevents this economic and environmental loss from occurring.

5 - It is well established (through quite a few [studies](#)) that many bats are killed by wind turbines. These deaths can be from direct impact with the blades, or through [pressure differentials](#) that explode their lungs.

The federal government (USGS) in fact [says](#) the wind turbine bat situation is an “**unanticipated and unprecedented problem.**” What’s worse is that at this point there is no known practical and meaningful remediation of this issue (other than shutting down the turbines).

Some studies have been done to assess the economic consequences of such killings. Bats are not only voracious eaters of insects that are harmful to humans (a health matter), but bats are very effective crop [pollinators](#). A well-known 2011 [study](#) (by four independent world-class bat experts) concluded that there would be substantial **annual agricultural losses** due to reduced crop yields, the extra cost of using more pesticides, etc. Of course introducing more pesticides is another adverse environmental effect.

To NC communities this could mean tens of millions of dollars **of annual agriculture losses** — which would far exceed any payoffs received by the wind developer. Appendix A-1 and A-2 show what these experts concluded would be the **annual** agriculture losses for each North Carolina county that takes on wind development. Even a cursory glance at these numbers show that they FAR exceed any annual promised benefits from the wind developer — none of which are guaranteed. H298 avoids these substantial environmental and economic losses to NC coastal communities.

6 - If we look at NC wind maps, the only acceptable inland wind is a few spots on the coast, and a few locations in the mountains. (The NREL/Truewind’s [NC wind map](#) shows wind speed at an 80 meter height. NREL [states](#) “Areas with annual average wind speeds around 6.5 m/s and greater at 80-m height are generally considered to have suitable wind resource for wind development.”) The mountains are out due to the “[Ridge Law](#).” That leaves about **.1%** of NC land — all concentrated on the coast — to be “wind-suitable.” See Appendix B-1 to see the small amount of NC that is wind suitable.

There are many environmentally sensitive (and tourist popular) locations within these areas, like Mattamuskeet National Wildlife Refuge, Pocosin Lakes National Wildlife Refuge, Emily & Richard Preyer Buckridge Coastal Reserve, Swanquarter National Wildlife Refuge, Roanoke River National Wildlife Refuge, Alligator River National Wildlife Refuge, Cedar Island National Wildlife Refuge, Great Dismal Swamp National Wildlife Refuge. Any of these could be severely impacted by a nearby industrial wind project. The USF&W Service has just published NC [maps](#) that show that a **significant** part of the NC coast is unacceptable for industrial wind development. See Appendix B-2 for this information.

Now let's superimpose one more coastal map: the low-level airspace required by Seymour Johnson AFB, Cherry Point MACS and New River MACS (see Appendix B-3 for that map). Once this is combined with the wind-speed and USF&WS maps, it is very clear that there *essentially no land in North Carolina that is acceptable for industrial wind energy.*

Yet SB3 is effectively forcing wind development to be near these pristine protected areas, and in this protected military air space — *which each NC wind proposal put forward to date has been.* H298 is correcting that economic and environmental error and should be supported.

Yes offshore wind is the other option, but that is about twice the cost of the already expensive onshore wind – so that means even further losses to NC businesses at large. Here is a 2012 [study](#) done by independent financial experts, paid for by the state of New Jersey, which is a wind energy promoter.

It concluded that when they looked at the WHOLE jobs picture for the state (not just the small wind segment), that just one offshore project would result in a **net jobs loss** of some **30,000 job-years!** It also concluded that when they looked at the WHOLE economics picture for the state (not just the wind segment), there would be a **net economics loss** to the state of **\$900+ million!** H298 is saving NC from those losses so it should be supported.

Additionally there are several unique environmental problems created with offshore wind energy. Look at this [presentation](#) which enumerates some of those issues.

7 - SB3 made no provisions for environmental rules and regulations necessary for approving industrial wind projects. Subsequent to that legislation passing, a 2009 study was done by the *Environmental Management Commission* (EMC), which [proposed](#) such a permit process for wind developments. Due to political disagreements among the legislators, this was not approved, and nothing else has been legislated since.

Although the EMC proposal had some serious deficiencies, clearly *some* statewide industrial wind energy approval process (including an automatic human health assessment) is needed. The current situation, though, is that there are **zero NC industrial-wind-energy-specific rules and regulations.**

This is a MAJOR environmental omission that requires correction. Another benefit of H298 is that by canceling the renewables mandate, the state can save the time and money for creating these health and other regulations.

8 - Wind energy is promoted as a “green” environmentally friendly alternative to conventional electricity sources — but this is like most of the industry’s other claims: *just marketing*.

We already know that wind energy requires a conventional augmenting supply (typically gas), so that means more installed wind will result in more gas facilities. *That also means that CO2 emissions will result from implementing more wind.* Interestingly some studies have concluded that there is more CO2 emitted in a Wind+Gas combination than would be with Gas by itself!

Another major eye-opener is that wind turbine manufacture results in horrific environmental [degradation](#). A lot of this happens in China so it is conveniently out of sight. But the same organizations who are promoting wind energy also strongly push the one-world (“we’re all in this together”) ideology — so they should be very concerned about what happens in China too, right?

Well let’s look at one particular matter: [Rare Earth Elements](#) (REEs). In addition to *significant* air and water pollution, the processing of REEs results in a large amount of **radioactive** waste. Yes, you read that correctly. How much radioactive waste? Consider the following:

Fact 1: Each wind turbine is [reported](#) to have several thousands of pounds of REEs (i.e. typically 2000± pounds per MW).

Fact 2: A US Army analyst [reports](#) (reference page 16) that for every ton of REE there can be about a ton of radioactive waste.

Once we have absorbed the significance of these numbers, an interesting question arises: *how does the quantity of radioactive waste produced by a 1 GW nuclear facility compare to the quantity of radioactive waste produced by the manufacture of wind turbines that would result in an equivalent amount of annual electricity?* Let’s look at it by weight.

The key wind energy assumptions are:

- 1) An optimistic capacity factor of 33% is assumed.
- 2) There are 2000± pounds of REEs per face value wind turbine MW.
- 3) Every ton of REE results in about a ton of radioactive waste.
- 4) Since some of the reported waste includes water, we’ll assume that about 50%± of the weight is due to H2O.

So, the **radioactive waste** for a 3 GW wind facility:

—> 3000 MW x 2000 REE/MW x 1 x .5= **3,000,000± pounds**

How does this compare to a nuclear facility? There are two methods for processing the nuclear fuel (typically uranium). In the US, the fuel is used once (i.e. is a single pass). In some other parts of the world (e.g. France and UK), the fuel is used a second time, which substantially reduces the amount of resulting waste.

The key nuclear assumptions are:

- 1) A 1 GW Nuclear facility has $27\pm$ tonnes/year (about 60,000 pounds/year) of used uranium.
- 2) If **reprocessed**, only 3% of this is radioactive waste ($60,000 \times 3\% = 1,800$). [See [this](#) for a good explanation of radioactive waste, and for items #1 & #2.]
- 3) Twenty years is used as that is the very generous expected life of a wind turbine.
- 4) The reactor is a Light Water Reactor (LWR) [i.e., a Pressurized Water Reactor (PWR), or a Boiling Water Reactor (BWR)].
- 5) The weight is of spent fuel, not other peripheral items (e.g. gloves).
- 6) Spent fuel from the reactor is initially stored at the reactor site, then processed to separate radioactive material from the rest of the material. The radioactive material is then permanently stored at a repository (like Yucca Mountain is intended to be).

The single pass radioactive waste figures for a 1 GW nuclear facility:

—> $60,000\pm$ pounds per year. Therefore the twenty year total of nuclear radioactive waste would be $60,000\pm \times 20 = \mathbf{1,200,000\pm}$ pounds

The double pass radioactive waste figures for a 1 GW nuclear facility:

—> $1,800\pm$ pounds per year. Therefore the twenty year total of nuclear radioactive waste would be $1,800\pm \times 20 = \mathbf{36,000\pm}$ pounds

Compare this to the figure above: $\mathbf{3,000,000\pm}$ pounds of radioactive waste for an equivalent amount of electricity produced by wind energy.

So the amazing conclusion is that the wind energy produces more radioactive waste per MWh than does a nuclear facility!

So we've lifted up another wind energy rock, and have found a very disturbing industry secret. The few others who have looked into this have labeled it as the [800 Pound Gorilla In The Room](#).

The next time that a wind marketer feeds you the “wind is green” sales pitch, say “**Not so fast!**” [See Appendix C for more references about REEs.]

9 - Some wind energy advocates claim that the high cost (and environmental problems) of wind energy are justified once all the **externalities** (meaning the environmental impacts) of our conventional sources of electricity are taken into account. That assertion does not hold water as:

- a) To begin with these proponents never acknowledge the actual grid costs of wind energy. (For example, they do not attribute the cost of special augmentation [typically gas], as a wind energy cost.) If these claims are to be taken seriously we need to start with an **accurate base cost** of industrial wind *before* we proceed into discussing environmental externality costs.
- b) Similarly, wind advocates never acknowledge the full array of actual environmental impacts of industrial wind energy (e.g. REEs, as explained in the prior item). Without starting from an accurate environmental assessment of wind energy, subsequent comparisons to other sources are essentially worthless.
- c) Wind advocates are prone to make specious claims about the supposed health costs of electricity sources like coal. However:
 - 1) The health costs cited are largely speculative, based on many self-serving assumptions.
 - 2) Coal is typically not replaced by wind, so such a comparison is false.
 - 3) Gas is more likely to be replaced by wind, but the health effects of using gas are not significant — so they are not cited.
- d) If fossil fuel health costs are part of the externality equation, then the health costs of the manufacture and operation of renewables must also be fully accounted for. See item #3 for references to a few hundred studies by independent experts (some peer reviewed) that conclude that there are genuine health consequences to renewable energy options.
- e) If the externalities of coal are to be considered, then it is only reasonable that the **benefits** also be put in the equation. A major reason that the US has become the world power it is, is due to the low cost reliable electricity produced by coal. Once the value of these benefits are objectively put on the scale, the **net** picture is very different from what is typically shown.

The bottom line is that if we want to consider externalities, then we **MUST**:

- 1) start with an accurate baseline for all electricity sources,
- 2) do a reasonably objective estimate of all the *benefits* of each electricity source, and
- 3) do a reasonably objective estimate of all the *liabilities* of each electricity source.

There is no scientific evidence that wind energy is advantageous under such a scenario. As such, H298 is doing the right thing by eliminating a forced mandate to use wind energy (and other renewables).

10- RECs are also scheduled to be deleted by H298 (and have been calculated by some to supposedly provide 25% of the SB3's benefits), so we should have some understanding as to what they are all about. A "REC" is a "Renewable Energy Certificate" [also may be known as a "Renewable Energy Credit"]. The impression given is that there are some consequential environmental benefits for buying RECs, but that is very unlikely to be true, as explained below.

In brief, SB3 allowed NC utilities to satisfy some of the renewable energy mandate by buying RECs. These are artificial "credits" supposedly generated by some other utility's portfolio. The basics, using wind as an example:

- a) [The sample situation below is from a utility company perspective, as that is what H298 is about. Note that essentially the same realities exist for RECs sold directly to citizens and businesses. Note also that the example below could use an in-state facility as well, but the out-of-state situation is easier to understand.]
- b) A wind energy facility elsewhere (e.g. Idaho) generates 1MWH of electricity, and sells that to a local utility (e.g. Idaho Power Co.).
- c) There may or may not have been fossil fuel displaced by this wind energy. (For example, the wind energy may replace hydro power in some circumstances.) *No one actually keeps track of what energy source (if anything) is displaced!*
- d) Despite having no actual proof that they replaced **any** fossil fuel, the wind developer is given a REC (piece of paper) saying that they **did** replace a full 1MWH worth of fossil fuel.
- e) That fossil fuel is replaced 1:1 is an additional speculative assumption, which does **not** take into account the fact that wind energy requires essentially full time augmentation by a conventional source of power, which is usually gas (i.e. a fossil fuel). To be even remotely accurate, the amount of fuel used in that augmentation should be subtracted when calculating the REC, *but it is not*.
- f) In the case where hydroelectric is replaced by wind, there is actually a net **increase** of fossil fuel to the system (see prior item). However, a REC is still issued, falsely claiming that fossil fuel use has been offset.
- g) Once the local (e.g. Idaho) wind energy sale is made, the wind developer is already (assuming best case) saving fossil fuel for production of electricity that is consumed in Idaho.
- h) When a NC utility pays for a (wind) REC, the money goes to the wind developer, as additional profit. This is likely to be a foreign owned company, already making an estimated 25%± per year.

- i) When a NC utility buys the REC, they get to claim that this is a “penance” for some fossil fuel source they are currently using. In other words, it supposedly is a type of CO2 *compensation* that offsets the CO2 “pollution” caused by the NC utility using a conventional fossil fuel source.
- j) It is clearly double-dipping (and false), to say that the wind developer saved 1 MWH of fossil fuel in Idaho *and* also saved 1 MWH of fossil fuel in NC. As such, to claim NC “Clean Energy” savings from buying RECs is inaccurate — but this type of misleading claim is often made.
- k) The REC cost is passed onto NC business and residential ratepayers, who pay for the 1 MWH of electricity generated by a conventional NC source *plus* the REC. In other words, this is an additional cost to NC businesses and consumers with zero proven real benefits.
- l) Tracking and dealing with REC issues is another regulatory burden on NC agencies — that are paid for by taxpayers and ratepayers. ([Here](#) is an example where NC RECs were disallowed due to non-compliance.)
- m) Suggested reading: “[RECs are a Feel-good Scam](#)”. This was written by Dr. Daniel Press, chair of the Environmental Studies Department at the University of California, Santa Cruz.
- n) When considering the whole situation, H298’s elimination of the contrived RECs is an **economic benefit to NC businesses, ratepayers and taxpayers**, and should be applauded.

11- The Virginia Attorney General put out a 2012 [study](#) that discussed Virginia’s RES in detail, including its environmental results. NC legislators should consider his conclusions (my emphasis added):

“The Renewable Portfolio Standard (RPS) adder **has not served to advance the environmental concerns** that led to its inclusion in the Act ... The RPS adder has contributed to increases in customer bills and will likely have a significant impact in the future... Any benefits of the RPS adder are outstripped by its cost... **Five years of data and experience strongly suggest that the RPS be eliminated or significantly changed, as it is not meaningfully advancing the goals of** protecting customers from price volatility and unnecessary rate increases, promoting reliable electricity, promoting fuel diversity, **providing environmental benefits**, nor stimulating economic development.”

We couldn't have made the warning more explicit than the Virginia attorney General has. What he says makes perfect sense because:

There are **zero jobs** and **zero economic benefits guaranteed**. Additionally there are no jobs or economic developments *guaranteed to be going to NC citizens*. The net picture is that there will almost certainly be a **net jobs and economic development loss** to the local community, as well as to the state.

Although the environmental rationale sounds good, there is zero scientific evidence that SB3 provides a net environmental benefit to North Carolinians. In fact there are significant environmental **liabilities** from such projects (e.g. human health impacts, bird and bat kills, radioactive waste produced, etc.). And after all that, there are no scientifically proven NET benefits of the SB3 favored renewables, to the public, or to NC businesses at large.

SUMMARY —

It is in North Carolina's interest to support **low cost, reliable** electricity sources, as that will positively result in **more net jobs being created**, and more **net economic development**, throughout the entire state. Senate Bill 3 is contrary to all those traditional, time-tested objectives. (See the [Economic Assessment](#) of H298 for full details.)

This conclusion is born out by some 35 studies that have determined that state RPS's have a net *negative* energy, economic and environmental impact on the states that passed such well-intentioned legislation (see Appendix D).

Every source of electricity has environmental impacts. To portray wind energy as a "green" environmentally benign source of electricity is an inaccurate characterization, as wind energy causes substantial adverse environmental problems — while having no proven net environmental benefits. As such there is no legitimate reason for the state to give wind energy preferential treatment.

My request to the Environmental Committee: ***Please support H298!***

John Droz, jr.

**Appendix A-1: Annual Agriculture Losses
due to Bats Killed by Wind Turbines, in selected NC Counties**

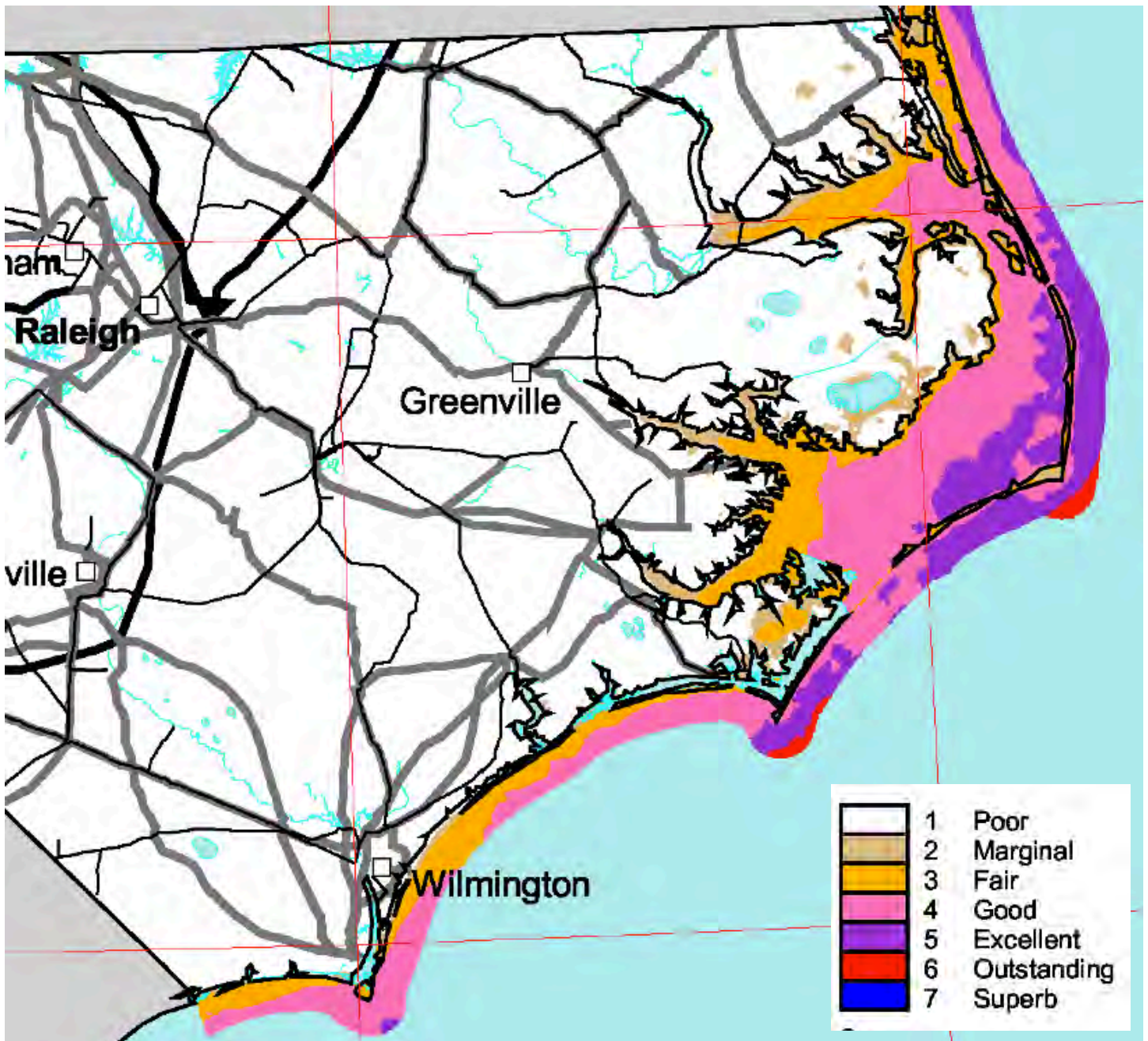
NC County	Harvested Land (acres)	Est Value of Bats Assuming Standard Crop Pest Survival	Est Value of Bats Assuming Low Crop Pest Survival	Est Value of Bats Assuming High Crop Pest Survival
ALAMANCE	26,770	1,983,657	323,917	4,617,825
ALEXANDER	16,444	1,218,500	198,972	2,836,590
ALLEGHANY	22,626	1,676,587	273,775	3,902,985
ANSON	20,065	1,486,817	242,787	3,461,213
ASHE	25,480	1,888,068	308,308	4,395,300
AVERY	10,397	770,418	125,804	1,793,483
BEAUFORT	130,240	9,650,784	1,575,904	22,466,400
BERTIE	90,193	6,683,301	1,091,335	15,558,293
BLADEN	59,896	4,438,294	724,742	10,332,060
BRUNSWICK	24,193	1,792,701	292,735	4,173,293
BUNCOMBE	14,768	1,094,309	178,693	2,547,480
BURKE	10,385	769,529	125,659	1,791,413
CABARRUS	27,912	2,068,279	337,735	4,814,820
CALDWELL	8,477	628,146	102,572	1,462,283
CAMDEN	47,473	3,517,749	574,423	8,189,093
CARTERET	36,336	2,692,498	439,666	6,267,960
CASWELL	18,676	1,383,892	225,980	3,221,610
CATAWBA	28,798	2,133,932	348,456	4,967,655
CHATHAM	22,335	1,655,024	270,254	3,852,788
CHEROKEE	4,663	345,528	56,422	804,368
CHOWAN	51,581	3,822,152	624,130	8,897,723
CLAY	2,597	192,438	31,424	447,983
CLEVELAND	35,365	2,620,547	427,917	6,100,463
COLUMBUS	97,716	7,240,756	1,182,364	16,856,010
CRAVEN	46,315	3,431,942	560,412	7,989,338
CUMBERLAND	37,026	2,743,627	448,015	6,386,985
CURRITUCK	23,350	1,730,235	282,535	4,027,875
DAVIDSON	34,854	2,582,681	421,733	6,012,315
DAVIE	24,681	1,828,862	298,640	4,257,473
DUPLIN	143,030	10,598,523	1,730,663	24,672,675
DURHAM	4,714	349,307	57,039	813,165
EDGECOMBE	94,988	7,038,611	1,149,355	16,385,430
FORSYTH	18,403	1,363,662	222,676	3,174,518
FRANKLIN	34,711	2,572,085	420,003	5,987,648
GASTON	11,218	831,254	135,738	1,935,105
GATES	48,731	3,610,967	589,645	8,406,098
GRANVILLE	18,840	1,396,044	227,964	3,249,900
GREENE	64,760	4,798,716	783,596	11,171,100
GUILFORD	34,986	2,592,463	423,331	6,035,085
HALIFAX	109,806	8,136,625	1,328,653	18,941,535
HARNETT	64,632	4,789,231	782,047	11,149,020
HAYWOOD	9,802	726,328	118,604	1,690,845
HENDERSON	16,546	1,226,059	200,207	2,854,185
HERTFORD	49,727	3,684,771	601,697	8,577,908
HOKE	29,863	2,212,848	361,342	5,151,368
HYDE	59,016	4,373,086	714,094	10,180,260
IREDELL	58,052	4,301,653	702,429	10,013,970
JACKSON	4,440	329,004	53,724	765,900
JOHNSTON	110,772	8,208,205	1,340,341	19,108,170

Appendix A-2: Annual Agriculture Losses

due to Bats Killed by Wind Turbines, in selected NC Counties

NC County	Harvested Land (acres)	Est Value of Bats Assuming Standard Crop Pest Survival	Est Value of Bats Assuming Low Crop Pest Survival	Est Value of Bats Assuming High Crop Pest Survival
JONES	46,309	3,431,497	560,339	7,988,303
LEE	14,544	1,077,710	175,982	2,508,840
LENOIR	104,573	7,748,859	1,265,333	18,038,843
LINCOLN	25,545	1,892,885	309,095	4,406,513
MACON	4,350	322,335	52,635	750,375
MADISON	8,956	663,640	108,368	1,544,910
MARTIN	69,271	5,132,981	838,179	11,949,248
MCDOWELL	4,553	337,377	55,091	785,393
MECKLENBURG	6,377	472,536	77,162	1,100,033
MITCHELL	3,612	267,649	43,705	623,070
MONTGOMERY	6,421	475,796	77,694	1,107,623
MOORE	15,401	\$1,141,214	\$186,352	\$2,656,673
NASH	79,703	\$5,905,992	\$964,406	\$13,748,768
NEW HANOVER	2,593	\$192,141	\$31,375	\$447,293
NORTHAMPTON	100,954	\$7,480,691	\$1,221,543	\$17,414,565
ONSLow	34,078	\$2,525,180	\$412,344	\$5,878,455
ORANGE	18,447	\$1,366,923	\$223,209	\$3,182,108
PAMLICO	39,113	\$2,898,273	\$473,267	\$6,746,993
PASQUOTANK	78,934	\$5,849,009	\$955,101	\$13,616,115
PENDER	31,911	\$2,364,605	\$386,123	\$5,504,648
PERQUIMANS	62,845	\$4,656,815	\$760,425	\$10,840,763
PERSON	30,696	\$2,274,574	\$371,422	\$5,295,060
PITT	125,102	\$9,270,058	\$1,513,734	\$21,580,095
POLK	4,386	\$325,003	\$53,071	\$756,585
RANDOLPH	43,460	\$3,220,386	\$525,866	\$7,496,850
RICHMOND	10,766	\$797,761	\$130,269	\$1,857,135
ROBESON	196,678	\$14,573,840	\$2,379,804	\$33,926,955
ROCKINGHAM	29,200	\$2,163,720	\$353,320	\$5,037,000
ROWAN	55,560	\$4,116,996	\$672,276	\$9,584,100
RUTHERFORD	13,180	\$976,638	\$159,478	\$2,273,550
SAMPSON	187,087	\$13,863,147	\$2,263,753	\$32,272,508
SCOTLAND	27,775	\$2,058,128	\$336,078	\$4,791,188
STANLY	49,631	\$3,677,657	\$600,535	\$8,561,348
STOKES	23,137	\$1,714,452	\$279,958	\$3,991,133
SURRY	39,712	\$2,942,659	\$480,515	\$6,850,320
SWAIN	715	\$52,982	\$8,652	\$123,338
TRANSYLVANIA	5,282	\$391,396	\$63,912	\$911,145
TYRRELL	50,610	\$3,750,201	\$612,381	\$8,730,225
UNION	109,598	\$8,121,212	\$1,326,136	\$18,905,655
VANCE	12,738	\$943,886	\$154,130	\$2,197,305
WAKE	35,610	\$2,638,701	\$430,881	\$6,142,725
WARREN	17,470	\$1,294,527	\$211,387	\$3,013,575
WASHINGTON	80,128	\$5,937,485	\$969,549	\$13,822,080
WATAUGA	8,535	\$632,444	\$103,274	\$1,472,288
WAYNE	126,158	\$9,348,308	\$1,526,512	\$21,762,255
WILKES	26,599	\$1,970,986	\$321,848	\$4,588,328
WILSON	77,780	\$5,763,498	\$941,138	\$13,417,050
YADKIN	47,735	\$3,537,164	\$577,594	\$8,234,288
YANCEY	4,875	\$361,238	\$58,988	\$840,938
TOTALS	4,185,342	\$310,133,842	\$50,642,638	\$721,971,495

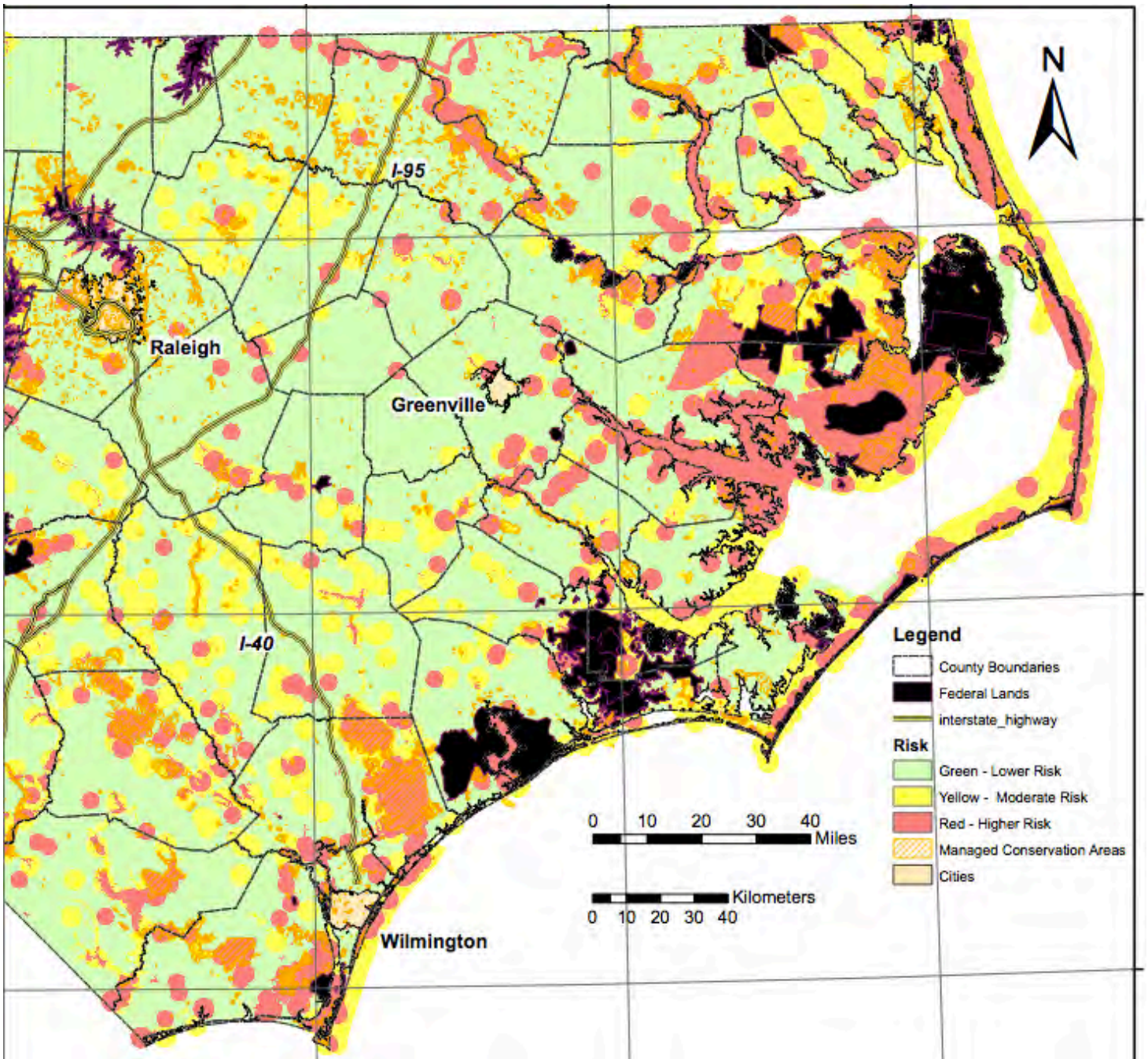
**Appendix B-1: US Department of Energy —
NC Average Annual Wind Speed at 50 Meters**



Note: Per the US DOE, suitable areas are those with wind speeds of 6.5+ m/s at 80 M. As the government maps make clear (this is a sample), there is almost no NC land that has even “Marginal” or “Fair” wind speeds.

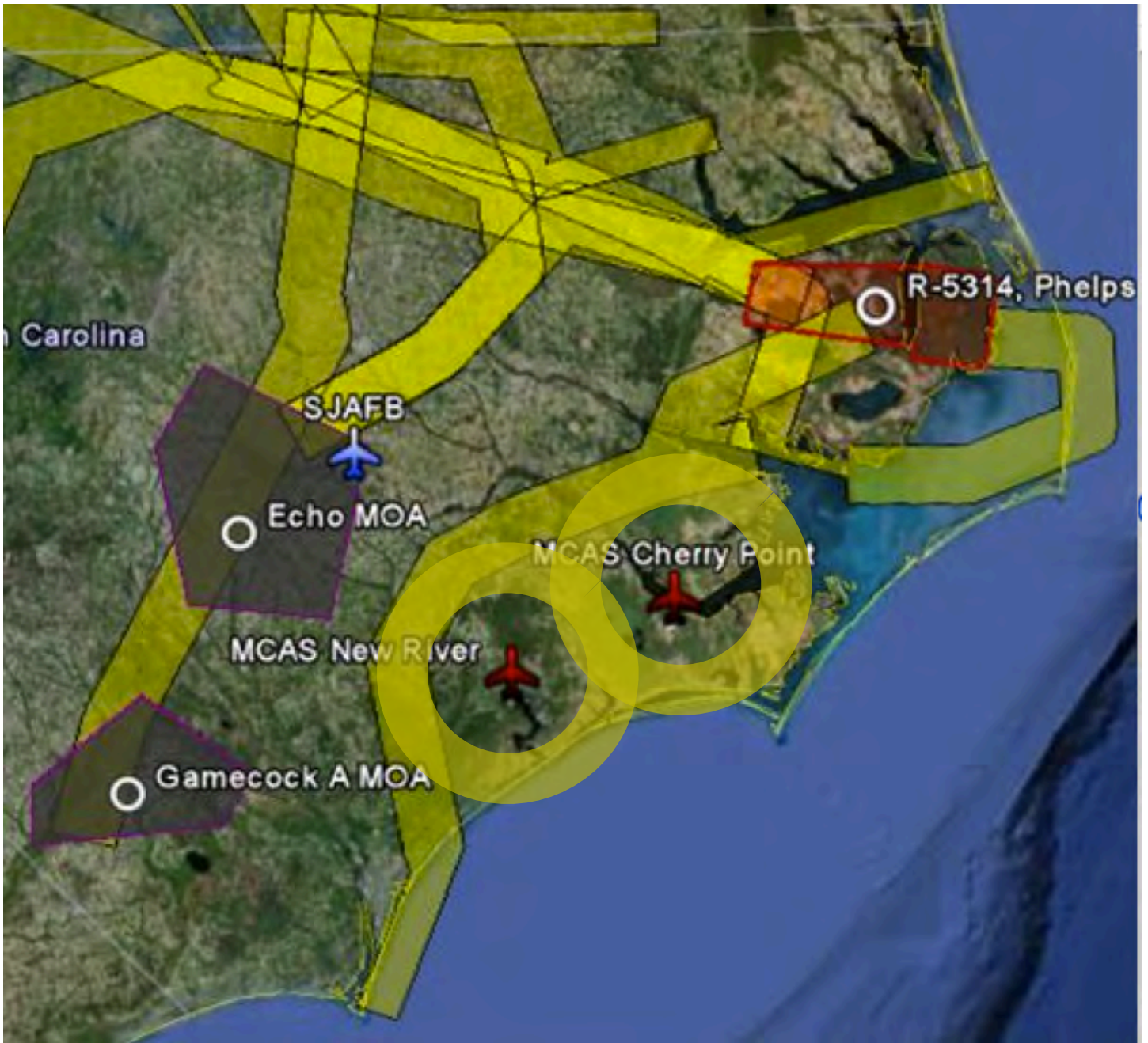
Appendix B-2: US Fish & Wildlife Services —

Wildlife and Habitat Risk Map for NC Land - Based Wind Energy Projects



Note: Per the US Fish and Wildlife Services, the Red and Black areas are problematic to wildlife, and unlikely to be approved.

Appendix B-3: US Air Force —
Assessment of Wind Turbine Impacts on SJ AFB Training



Note: Seymour Johnson's 13 low-altitude Training Routes (in yellow) + 4 medium-altitude training Military Operations Areas (in purple). Circles for Cherry Point MCAS & New River MCAS are added.

Combine the prior three maps, and there is essentially no acceptable land left.

Appendix C: Additional References about Rare Earth Elements

[Environmentalism's Dirty Little Secret: Rare Earth Elements](#) (a very good video)

[The Rare Earth Dilemma: A Safety Nightmare](#)

[Will Rare Earths Cripple the Green Economy](#) (3 parts)

[The REE Crisis](#)

[Investigating a Rare Earth Development Mine](#) (EPA)

[Why REEs Matter](#)

[REES: More Precious Than Gold](#)

[China's Rare Earth Strategy](#)

How China has no qualms about [restricting REEs](#)
(check good references at end of article)

China-Japanese [dispute](#) over Rare Earths

[China Ups Ante on REEs](#)

[The US Government's Role in Managing REE supply](#)

[Can the Environment Sustain the Quest for REEs?](#)

[New REE Deposit Discoveries: a Game Changer?](#)

[Malaysia tries to enter the REE market](#)

[Malaysian Environmentalists Lead Opposition to REE Facility](#)

[Rare Earth Elements and Thorium Power](#)

Some background about REEs: [here](#), [here](#), and [here](#).

Appendix D: Sample Studies About the Merits of State RES's

1. & 2. [North Carolina \(2009\) & North Carolina \(2013\)](#)
3. [Pennsylvania \(2012\)](#)
4. [Wisconsin \(2013\)](#)
5. [Maryland \(2011\)](#)
6. & 7. [Maine \(2012\) & Governor's Letter \(2013\)](#)
8. [Michigan \(2012\)](#)
9. [Delaware \(2011\)](#)
10. [Kansas \(2012\)](#)
11. [Montana \(2011\)](#)
12. [Illinois \(2012\)](#)
13. & 14. [Oregon \(2011\) \[also a video \(2013\)\]](#)
15. [New York \(2012\)](#)
16. [Missouri \(2012\)](#)
17. [New Mexico \(2011\)](#)
18. [Colorado \(2011\)](#)
19. [Ohio \(2011\)](#)
20. [California \(2013\)](#)
21. [Arizona \(2013\)](#)
22. & 23. [Minnesota \(2007\) & Minnesota \(2011\)](#)
24. [RES Consequences in Washington state \(2012\)](#)
25. [RES Trouble in Texas \(2012\)](#)
26. [The High Cost of RES Mandates \(2012\)](#)
27. [The Status of RES's in the States \(2011\)](#)
28. [Energy Regulation in the States: A Wake-up Call \(2011\)](#)
29. [Do Renewable Energy Targets Make Sense? \(2011\)](#)
30. [The Green Energy Fantasy \(2009\)](#)
31. [Rethink Renewable Energy Mandates \(2011\)](#)
32. [The Great Renewable Energy Rort \(2012\)](#)
33. [Renewable Energies Not A Solution – They Increase Foreign Dependency\(2010\)](#)
34. [A Sensible Strategy for Renewable Electrical Energy in North America \(2012\)](#)
35. [Impact of Tax Policy on the Commercial Application of Renewable Energy\(2012\)](#)