RED-COCKADED WOODPECKER FIELD SURVEYS

In Support of the DRAFT ENVIRONMENTAL IMPACT STATEMENT(DEIS) FOR CONSTRUCTION AND OPERATION OF AN OUTLYING LANDING FIELD (OLF) ON THE EAST COAST OF THE UNITED STATES

Final Report

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in association with the

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BACKGROUND

This technical report summarizes the results of the Red-cockaded Woodpecker (*Picoides borealis*) field surveys that were completed in support of the *United States Department of the Navy (Navy) Environmental Impact Statement (EIS) for Construction and Operation of an Outlying Landing Field (OLF) on the East Coast of the United States.* The five alternative sites are Mason, Dory, and Cabin Point in Virginia, and Sandbanks and Hale's Lake in North Carolina (Figure 1). Each site is comprised of an approximately 2000 acre core area and a surrounding 25,000 acre buffer area encompassing the airfield noise contours.

Only three of the five sites were surveyed for Red-cockaded Woodpecker (RCW) activity; based on historical presence of the species, and current knowledge of available habitat. Specifically, the Cabin Point site was in an area surveyed in 1996 which yielded no potential habitat for RCWs at that time, or likely within the next two decades (Bradshaw 1999). The Hale's Lake site is comprised almost entirely of agricultural land with no prospects for the target species. The remaining three sites were identified as having historical occurrences of the federally endangered Red-cockaded Woodpecker in their vicinity, as confirmed by the United States Fish and Wildlife Service (USFWS), the Virginia Department of Game and Inland Fisheries (VDGIF), and the North Carolina Wildlife Resources Commission (NCWRC).

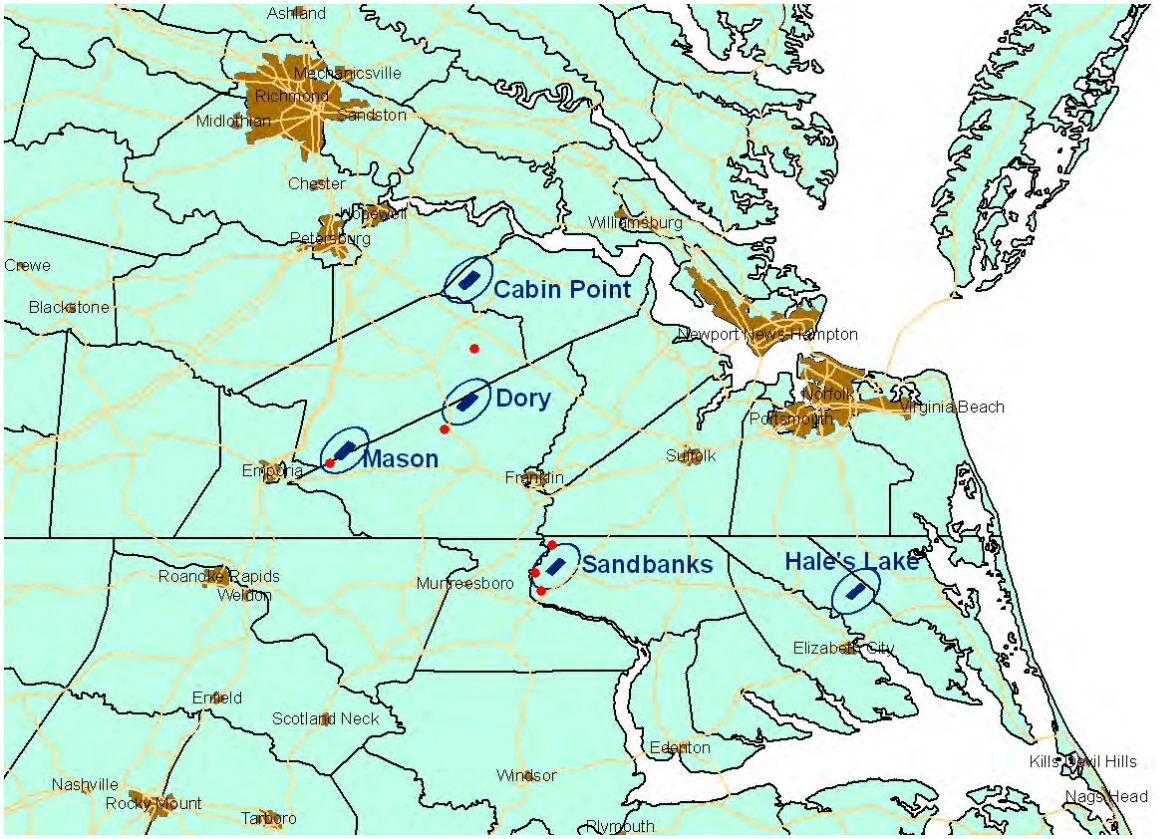


Figure 1. *Map of Proposed OLF Sites, also showing locations of Red-cockaded Woodpecker sites occupied within the last 5 years.*

INTRODUCTION

The Red-cockaded Woodpecker is a small bird, slightly larger than a bluebird. Its diagnostic markings include a black and white ladder-backed appearance with large, white cheek patches. The presence of the red cockade is usually only visible on a male bird in the hand, or at very close range. It exists only as a narrow tuft of red situated on the border between the white cheek patch and black crown, and is usually hidden unless the bird is agitated.

Figure 2: Red-cockaded Woodpecker. Note red cockade barely visible at margins of cheek patch.

A survey for Red-cockaded Woodpeckers demands an understanding of the species specialized ecology and habitat. As a cooperatively breeding species, these woodpeckers have evolved to exploit living pine trees for their cavities. They exist as a social group comprised of a single breeding pair and one or more "helpers" that assist with raising young (Walters 1990). Each bird has its own cavity, which may take from a few months to more than a year to excavate (Hooper et al 1980). This places a premium on cavity protection and retention, to ensure the stability of the group. Excavating a cavity in a living pine is facilitated by the birds being able to detect trees with weakened heartwood, typically from a fungal infection known as red-heart, associated with older pines (Hooper et al 1991). Average tree ages for loblolly pines selected for Red-cockaded Woodpecker cavities range from 70-90 years (Hooper et al 1980). Most cavity trees have visible signs of the red-heart fungus visible on the tree exterior, as a mushroom-like conch.

A Red-cockaded Woodpecker cavity has its own specialized profile which further helps to identify the species. It is normally perfectly round and may range from a few feet to more than 70 feet in the air (Bradshaw, pers. obs.), often correlated with the surrounding height of the mid-story component of the forest (Conner and Rudolph 1989). It almost always faces in a westerly, to southwesterly direction, and is normally located below the level of the lowest branch (Miller 1978). A completed cavity, will also have had all of the bark removed within a few inches of the cavity in all directions, forming a clear, often rounded, plate around the cavity. The exposed sapwood exudes resin, quickly coating the plate with a sticky film. The woodpeckers go on to create breaks in the bark all around the cavity and plate, deep enough to reach the resinous wood beneath, to allow sap to flow from numerous additional "resin wells". These resin wells are usually most dense near the cavity, but may spread around the entire trunk of the tree for several feet above and below the cavity. As the resin emerges, it turns from clear to white as it dries and is often described as giving the tree a candled appearance. Resin flow is likely facilitated by the westerly orientation of the cavity, being exposed to the afternoon sun, and therefore higher temperatures. The resinous coating has been shown to be effective at deterring ground predators from

Figure 3: Well defined" plate", with copious resin flow. (This cavity also shows a metal cavity excluder device to thwart competitors.)

accessing the cavities (Rudolph et al 1990). Red-cockaded Woodpeckers maintain the resin wells on their cavity trees each day to ensure a continuous flow (Dennis 1971).

The historical distribution of the species closely tracks the distribution of longleaf pine (*Pinus palustris*), the primary fire-tolerant pine species of the South (Frost 1993). The species evolved in these natural fire-maintained ecosystems and prefers open, park-like stands of old-growth pine in which to reside (Hooper et al 1980). This type of management was actually still common into the 1970s throughout the Southeast in the form of sawtimber management. Hardwood encroachment was controlled with fire to allow pines to reach the ages required for sawtimber. However, the transition from sawtimber to pulpwood management, and resulting loss of fire, led to the degradation of Red-cockaded Woodpecker habitat. Hardwood encroachment precipitates cavity competition, increases predation risks, hinders flight access within the stand, and may even compromise group cohesion (Jackson 1974; Costa and Escano 1989; Wood 1983).

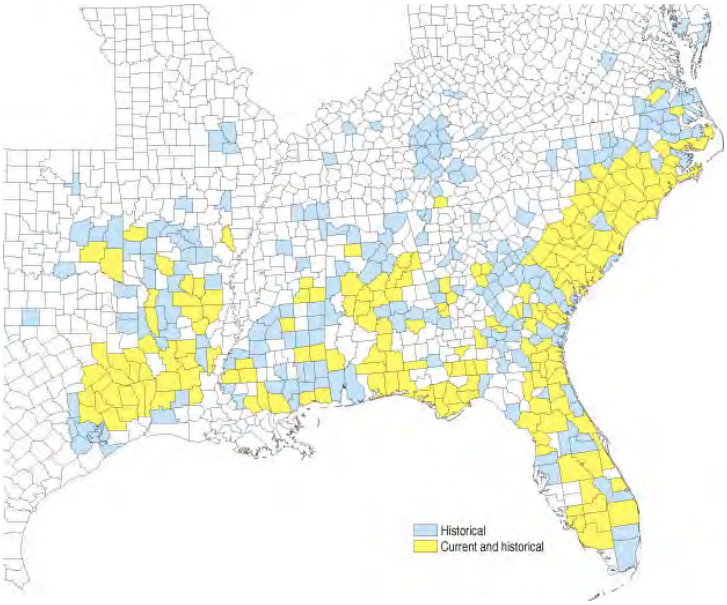


Figure 4: Historic footprint of longleaf pine habitat, which mirrors closely the historic range of Red-cockaded Woodpeckers.

Even though large tracts of typical habitat for this species are quite rare, the species has proven capable of existing in extremely sub-optimal conditions for long periods of time (Bradshaw 1995). Therefore, typical habitat variables should not be used as the model for assigning a habitat signature for this species. The only common denominator for suitable nesting habitat is old-growth pines, typically greater than 70 years. Site viability however must assume that foraging habitat is nearby as well. Evidence still shows that pines are primarily selected as a foraging substrate although age is less important than for nesting habitat (Baker 1971). Foraging primarily consists of prying off bark plates in search of arthropods beneath, although the species occasionally takes berries, and has been observed foraging in corn fields (Murphy 1939; Beal 1911). The Red-cockaded Woodpecker Recovery Plan has suggested that suitable foraging habitat must occur within a half mile of an active cluster (USFWS 2003). So a search image for this species should include some level of mature, or mixed age-class pine habitat within a half mile of each site that contains suitable trees for Red-cockaded Woodpecker cavities. Work on six groups in Virginia showed the minimum amount of pineland used by any group during a year was 115 acres (Bradshaw 1995) so a generic value of 100 acres may be used as a minimum amount of pine adjacent to potentially suitable cavity trees.

With respect to local distribution of the species, Red-cockaded Woodpeckers occurred within, or adjacent to, 4 of the 5 OLF sites in the 1970s, and within two of the sites within the last five years: Mason and Sandbanks. Virginia conducted a region-wide survey of the species in 1977 (Miller 1978) and again in 1996 (Bradshaw 1999). In the latter survey, all of the remaining large blocks of suitable habitat were documented and mapped. At least one of these blocks occurs within, or adjacent to, the Mason Site.

METHODOLOGY

This project used a three-tiered approach to conduct surveys for Red-cockaded Woodpeckers within the target areas. The target areas included only the proposed 2000 acre rectangular "core" area and an adjoining ½ mile buffer around the core area. In the first phase, recent digital aerial imagery (2002 – 2006) was reviewed by multiple parties to evaluate each site for potential RCW habitat. Both color infra-red and true color imagery of 1 meter or greater resolution was used. Imagery was reviewed for evidence of older stands of loblolly pine within the context of each potential site and adjacent buffer. A general assumption was made that older stands are typically characterized by larger canopies and greater spacing between trees. Although the very oldest pine trees often show decreasing canopy biomass, they are often in the company of still old, but more vigorous pines, that typically show a full, robust canopy. As such these areas stand out on aerial imagery and afford a quick reference for potential habitat sites. Areas identified by multiple reviewers were then consolidated to create a comprehensive digital data layer of potential habitat sites to be searched on the ground. This layer was then compared with a "Right-of-Entry" map which showed which land parcels had been granted access for survey visitation. Surveys were then planned for efficiency based on the location of accessible areas.

In the second phase, the digital data layer was uploaded along with the aerial imagery for each site to a portable Trimble XT Global Positioning System (GPS) unit. That unit was taken in the field as each of the potential old-growth sites was visited. The GPS unit was used to identify the boundaries of the selected sites on the ground. This allowed the survey team to compare the initial site selection from the imagery with what existed on the ground, and refine the search image accordingly, if necessary. Once at each designated survey site an initial search was conducted to ascertain whether it contained trees old enough for cavity trees. Seventy years was used as the minimum age requirement for trees before a search for cavity trees would be undertaken. For assessing tree ages, a Haglof increment borer was used to retrieve a core from two or more sample trees of a cohort of the oldest trees. Searches were not limited to the boundaries of the polygons originally identified. If suitable habitat outside of the identified polygons was identified in the field, those areas were exposed to the same survey protocols, as long as they occurred within the core or buffer area, and had received landowner authorization for access.

Finally, if trees old enough to accommodate woodpecker cavities were present, a survey of the old-growth portion of the stand was undertaken to search for evidence of Red-cockaded Woodpecker activity. Searches took the form of either an area search or a transect search. An area search was used if the number of cavity-tree suitable trees was small, and the trees were clustered in groups or in a linear array. In these cases, each tree was visited and examined for evidence of cavities or resin flow. If the old-growth trees were abundant, or scattered randomly through a large stand, transect searches were used to search for woodpecker evidence. Transects were always conducted along a north-south azimuth to coincide with the propensity for Red-cockaded Woodpeckers to install their cavities with some degree of westerly orientation. A surveyor walking north or south would

concentrate his search effort primarily toward the east to maximize the opportunity for seeing westerly oriented RCW evidence on a tree. The evidence in question would be a whole, or partial cavity, or any degree of dried, or fluid, resin flow indicative of bark disturbance that could indicate a resin well.

RESULTS

Dory Site

The aerial imagery review of the Dory Site yielded 12 unique polygons with characteristics indicative of older growth pine habitat (Figure 5), only four of which were contained within the core area. All sites were characterized by a rural matrix of managed pine forests and agricultural lands. Significant to this site was the presence of the Assamoosick Swamp running north-south tangent to the southwestern corner of the core area. This swamp forms an extensive bottomland hardwood corridor and a primary tributary to the Nottoway River. Natural features like this typically form an effective barrier to Red-cockaded Woodpecker movements.

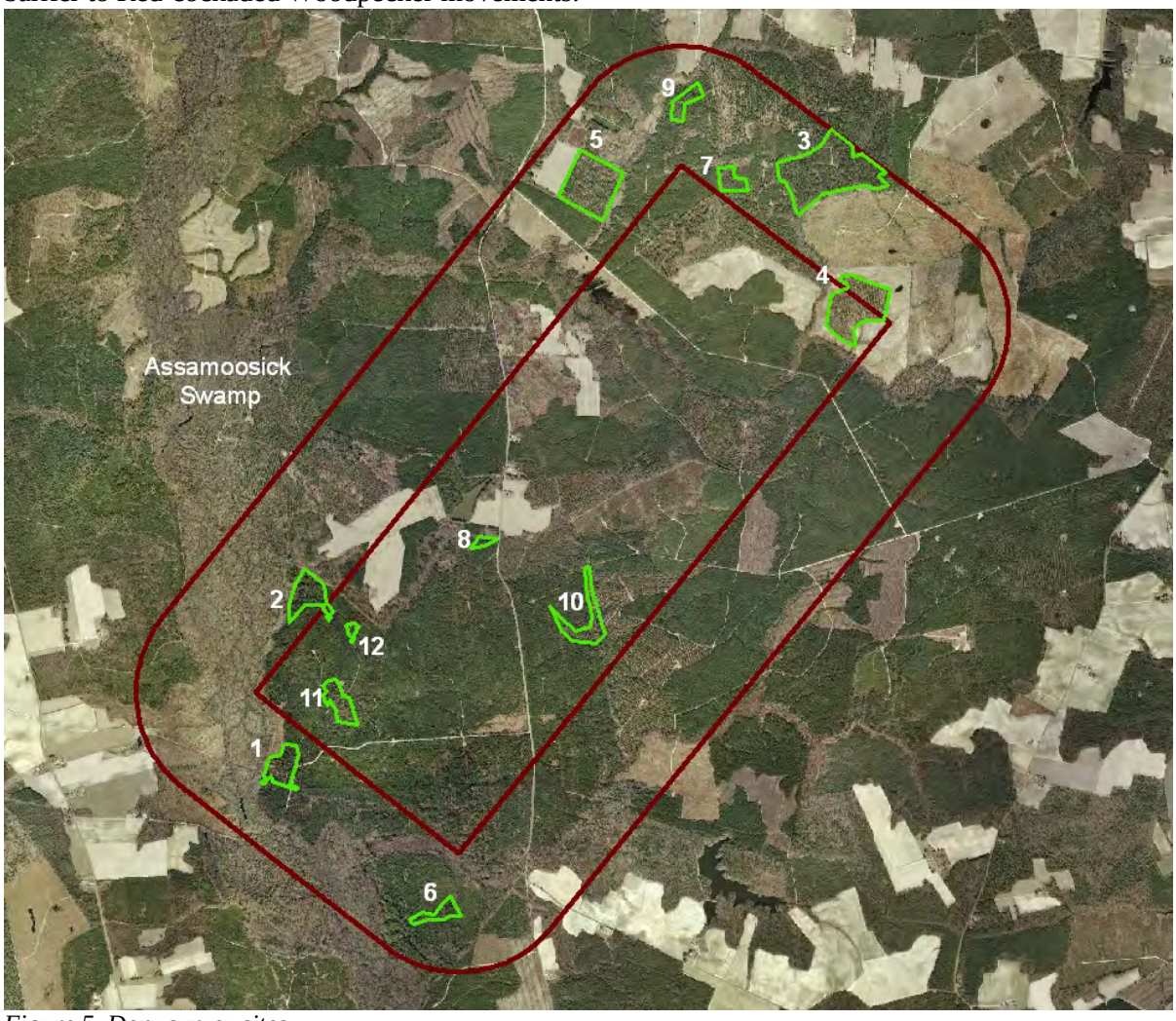


Figure 5. Dory survey sites.

The survey team was granted access to all sites with the exception of the northern section of Polygon 9. Since that area contained what was perceived from the aerial imagery to have been the best habitat within the polygon, it was decided to forego survey of the marginal portion of the polygon.

The best habitat for Red-cockaded Woodpeckers within the Dory Site was located in the southern section of the core and buffer(Figure 6). At least one pocket of old-growth loblolly pine was located (Polygon 2) that was linked by a logging road to two other sections of older habitat (Polygons 11 & 12), all embedded in an extensive forest of 20-30 year old pines. Although the old-growth trees were not abundant in any one area, they were sufficient in age to have supported a cluster of Red-cockaded Woodpeckers and the surrounding forest would have made suitable foraging habitat. The sites would have been extremely marginal in quality, given the high degree of hardwood encroachment and canopy co-dominance, but they are consistent with historical sites in Virginia that have harbored Red-cockaded Woodpeckers in the past.

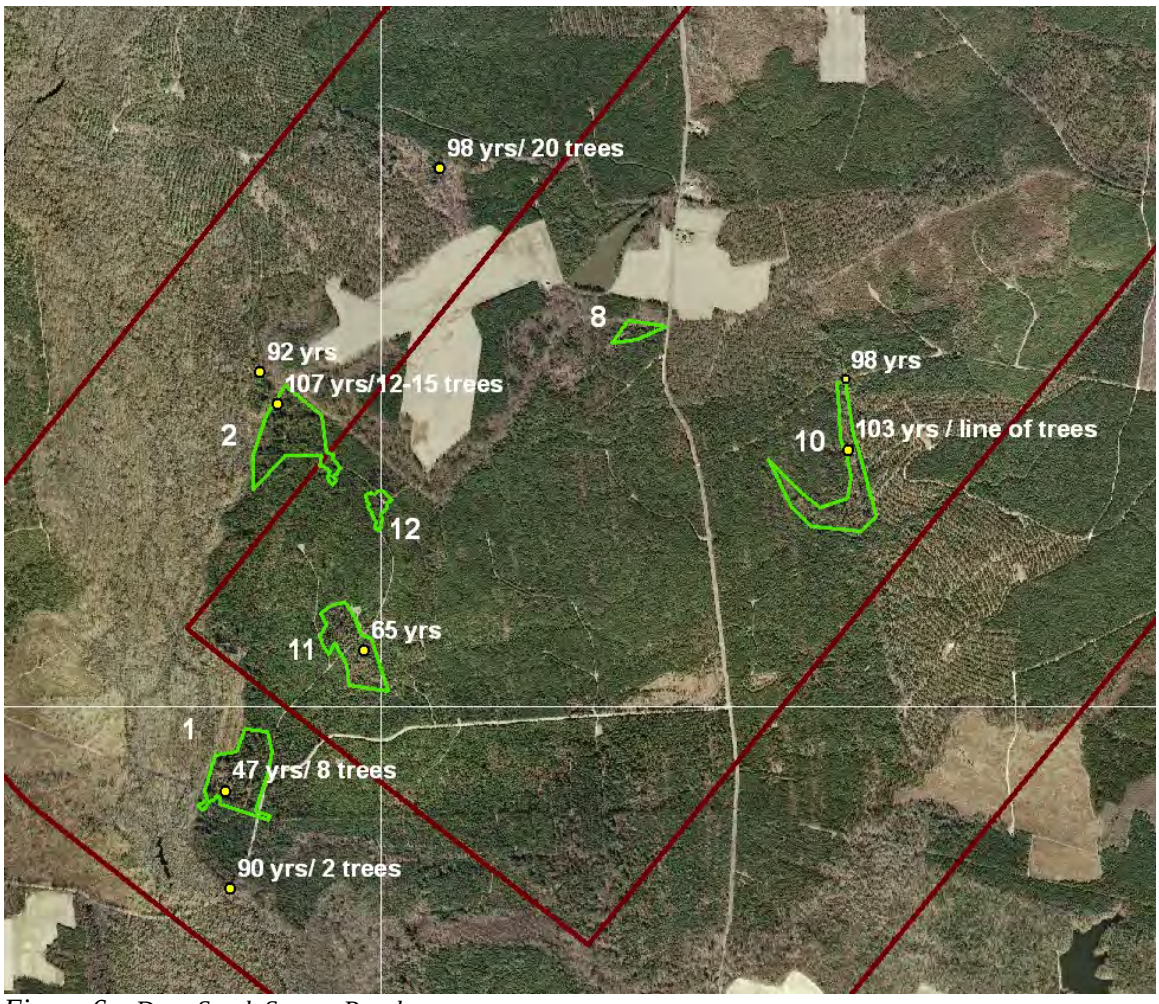


Figure 6. Dory South Survey Results

Given the proximity to the Assamoosick Swamp, it is likely that these old-growth pockets may have been too wet to harvest during previous harvest events, allowing them to persist. Likewise, Polygon 10 yielded a number of old-growth pines oriented along a creek drainage that no doubt were inaccessible to logging equipment due to the topographic relief in that area. These sites are representative of the bulk of all old-growth pine habitat remaining in southeastern Virginia, typically contained within inaccessible areas. All old-growth trees were examined for evidence of RCW activity, but nothing was observed.

Polygons in the northern half of the Dory Site did not meet minimum requirements for Red-cockaded Woodpecker occupation. Oldest stand ages did not exceed 40 years (Figure 7). Unlike the southern sites, these areas were all managed pine plantations, having undergone relatively recent thinnings. The "release" resulting from reduced density, had resulted in larger crown diameters than would have been suspected for the normal age structure, thereby biasing the aerial photo interpretation.

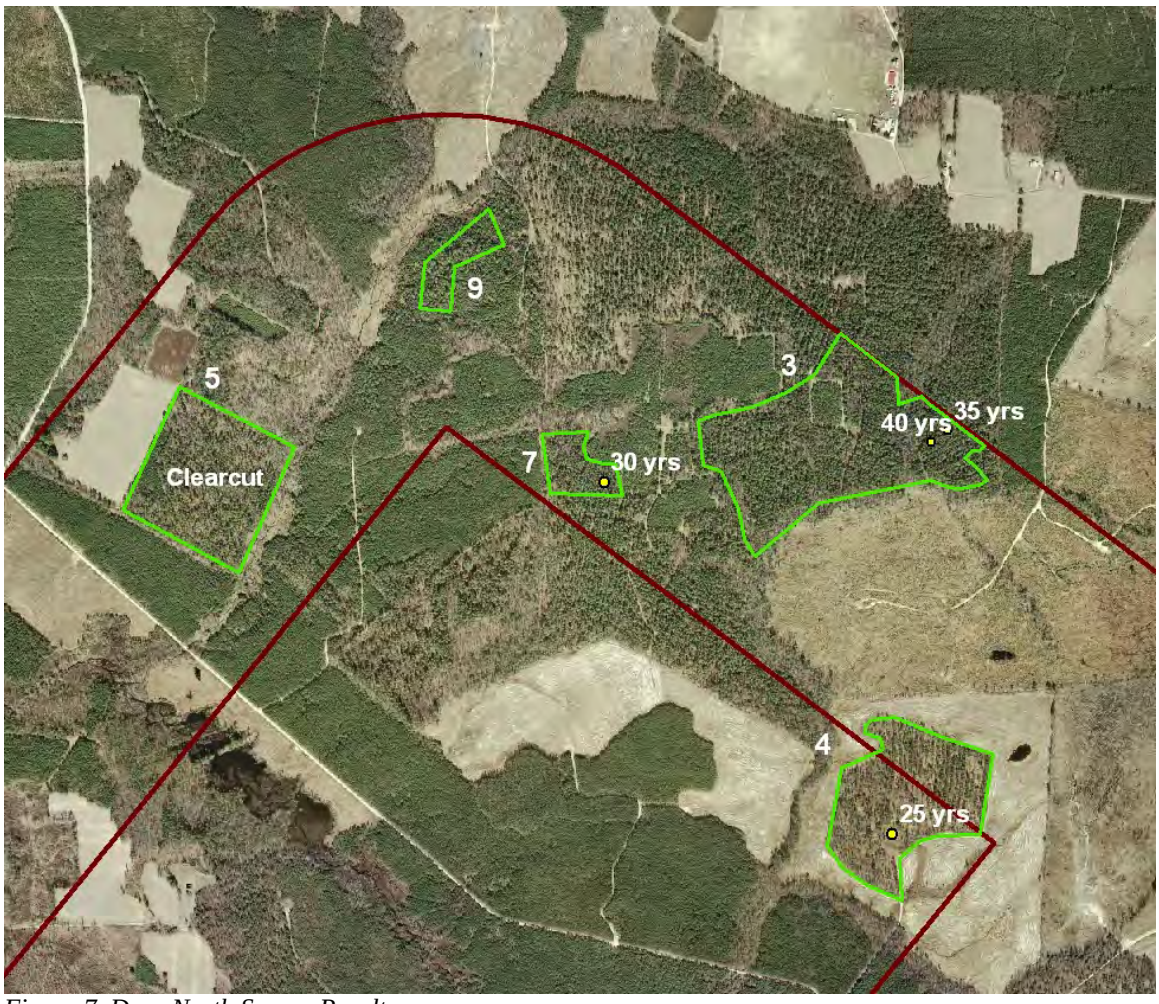


Figure 7. Dory North Survey Results

Mason Site

The Mason Site yielded 24 polygons of potential habitat suitable for Red-cockaded Woodpeckers, approximately equally distributed between the core area and the buffer (Figure 8). This site also contains the location of the last occupied RCW site in Southampton County (shown as red dot in Figure 8) where a single male was trapped and translocated in late 2004. Right of entry was granted for all but three polygons:13, 19, and 21.

Two areas of very good Red-cockaded Woodpecker habitat occurred in the Mason Site. In the northernmost corner of the buffer area, Polygons 8 and 9 combined to form the southern end of an extensive old-growth natural pine stand (Figure 9). Only the part of the stand that fell within the buffer area was surveyed, but it contained suitable habitat for Red-cockaded Woodpeckers. Numerous old-growth trees were observed, and although hardwoods were co-dominant in most of the area, midstory encroachment was not severe, and the site was adequate to contain one or more clusters of woodpeckers. Transect surveys were undertaken in this area, in addition to audio playbacks of recorded Red-cockaded Woodpecker vocalizations. This area was part of a very large forest stand extending to the north outside the buffer, all of which is suitable for Red-cockaded Woodpeckers.

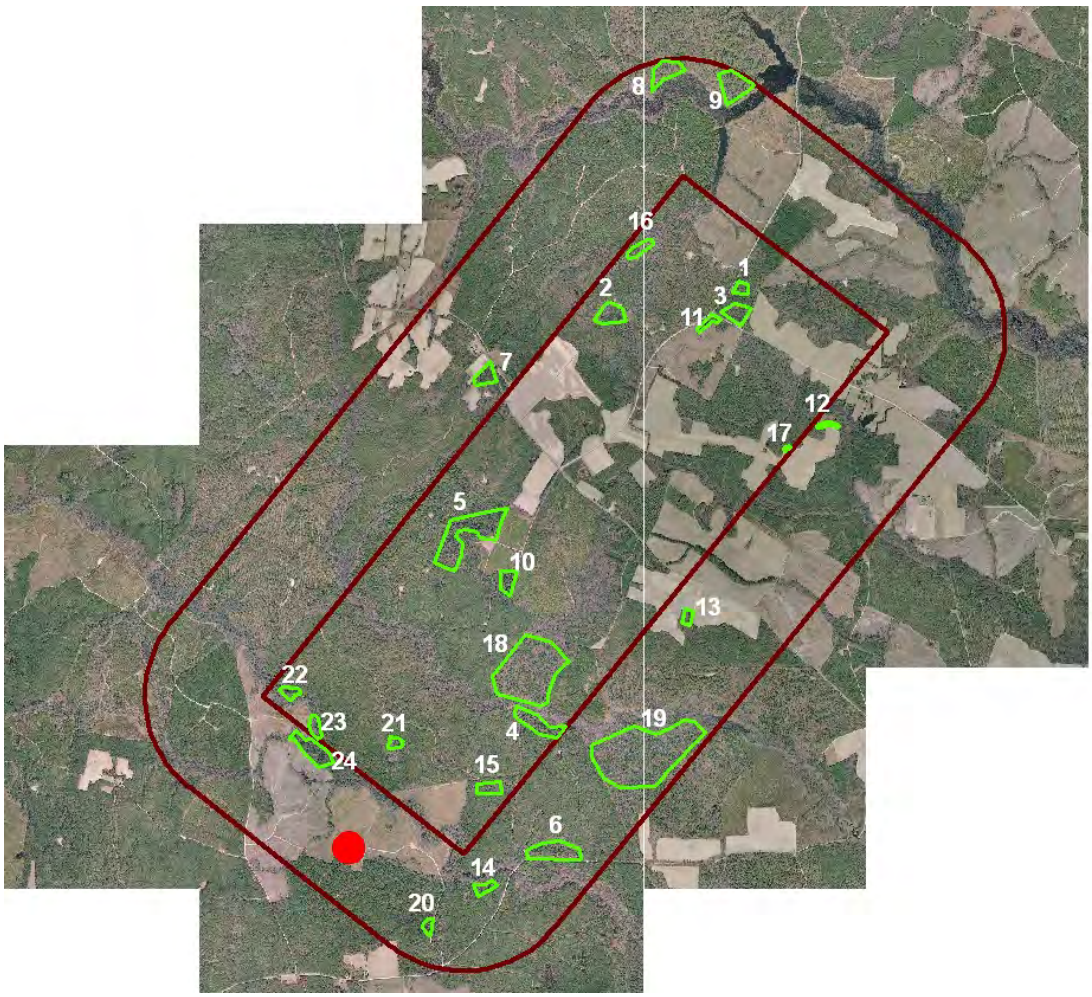


Figure 8. Mason Survey Map. Red dot indicates historic RCW site from 2004.

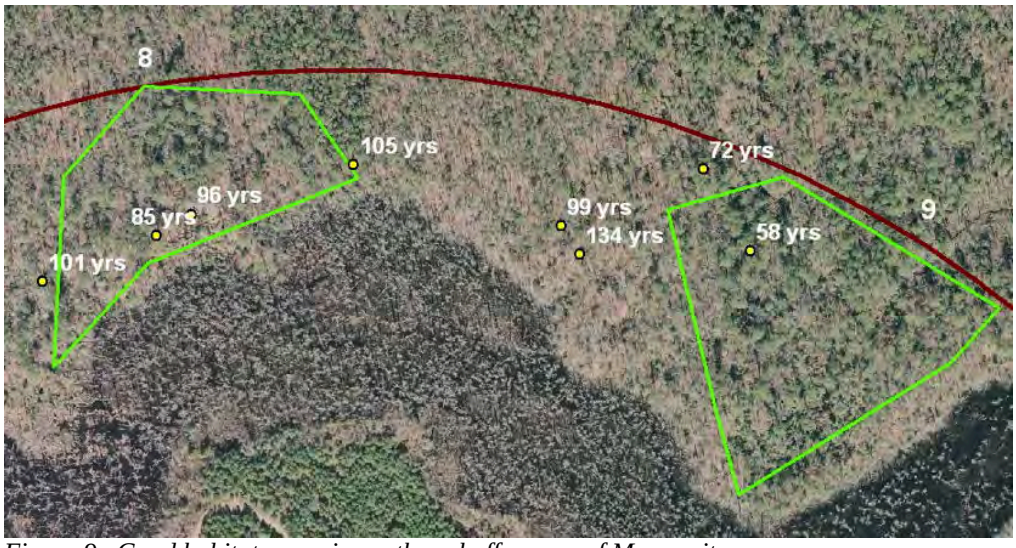
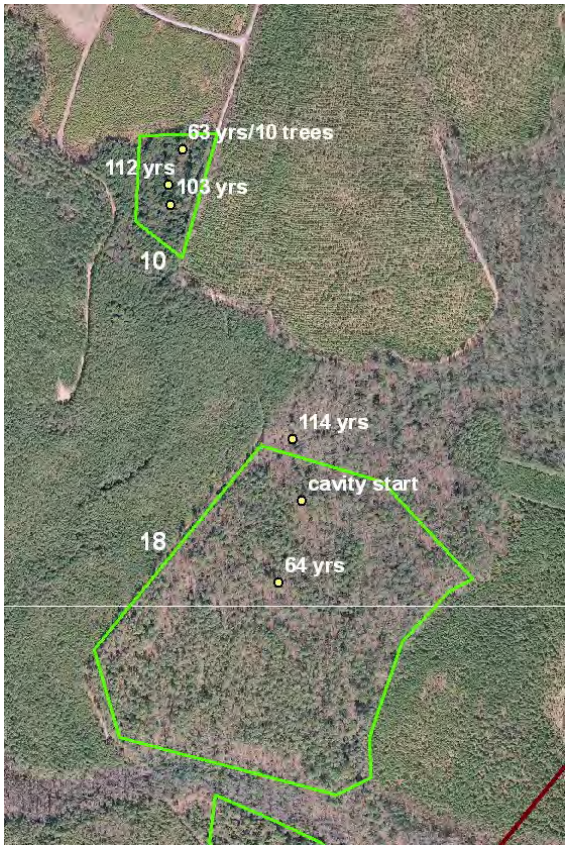


Figure 9. Good habitat areas in northern buffer zone of Mason site.



The other area of very suitable habitat occurred in the southern portion of the core area. Polygons 10 and 18 were embedded in a mosaic of mixed-age class pine regeneration and natural pine stands (Figure 10). The availability of older, cavity tree-suitable trees, within this substantial acreage of suitable foraging habitat elevated this site to a high priority. Transect surveys were used to survey Polygon 18 although no evidence of Red-cockaded Woodpeckers was found. The reference to a cavity start in Figure 10 was actually an old wound, where a limb had broken off, and the exposed base had been hollowed out and enlarged by another species. The work was characteristic of activity associated with Pileated Woodpeckers (*Dryocopus pileatus*).

Figure 10. Polygons 10 and 18 in Mason core area.

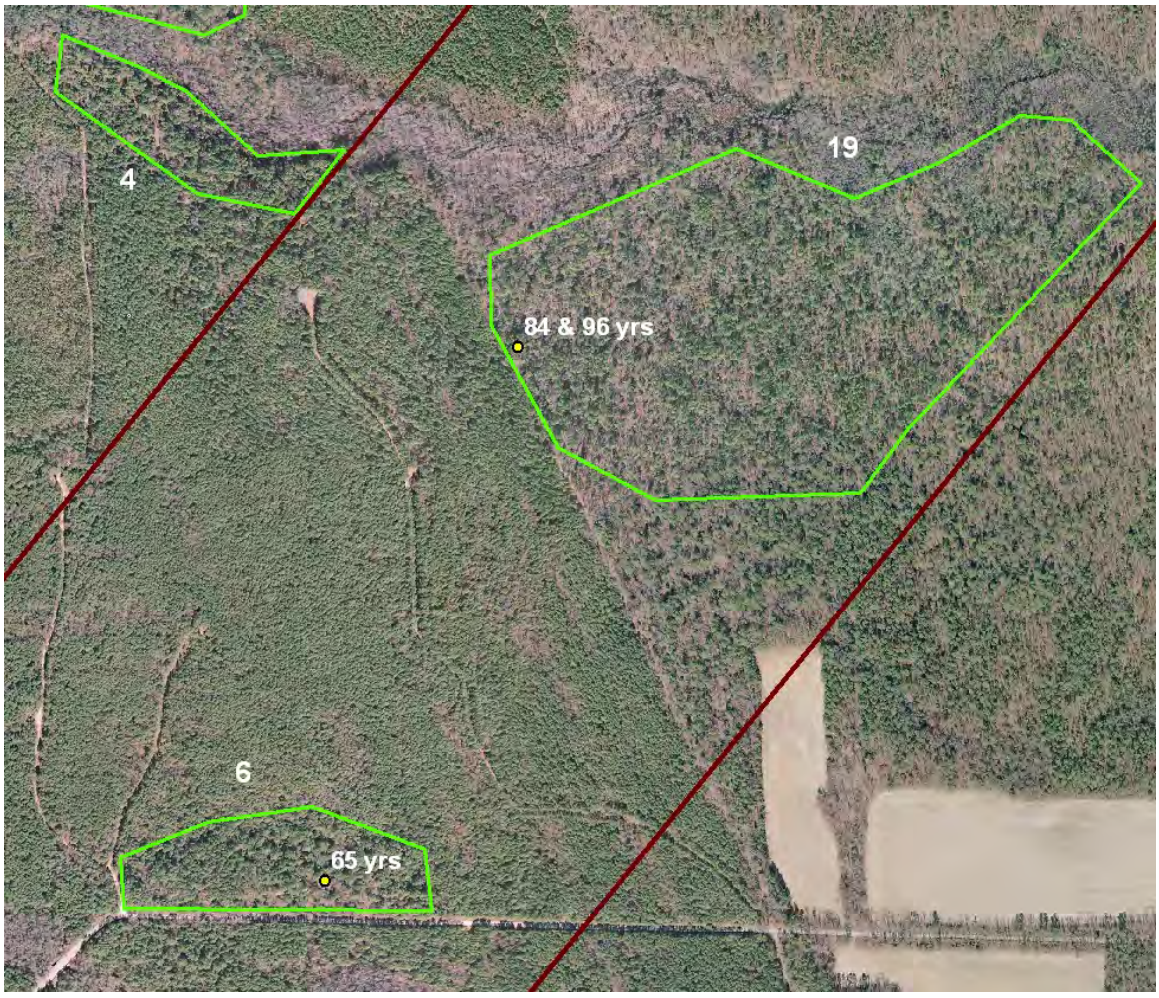


Figure 11. Polygon 19 was inaccessible, but suggested good habitat in east buffer of Mason site.

Another site that looked suitable was Polygon 19, however the survey team only had access to the western edge of the polygon (Figure 11). The accessible portion was confined to only a 20-30 year old pine plantation. Just across a red-painted boundary marker however, the stand opened up to a natural mixed pine-hardwood stand, with a significant number of what appeared to be old-growth trees. Two trees right on the boundary line were cored, yielding ages of 84 and 96 years. The condition of this polygon in conjunction with mature trees in Polygon 6 to the south, and good foraging habitat in Polygon 4 to the west, as well as nearby, suggest a mandatory re-survey of this area if the Mason site is selected for the OLF. However, at the time of the survey, no RCWs or cavities were observed at any of the surveyed sites at the proposed Mason OLF site.

Sandbanks Site

Figure 12. Sandbanks Survey Sites

The Sandbanks Site yielded 14 polygons, largely polarized to the northern and southern ends of the site (Figure 12). At the north end, Polygon 8 contained some mature habitat, but not old enough for cavity trees (Figure 13). Polygon 9 had no right of entry from the property owner during the time of the field survey, but the polygon was relatively narrow and could be surveyed from the shoulder of the road. It yielded only trees suspected to be less than 50 years old. Just to the west, Polygon 11 contained some old seed tree pines, suitable for cavity trees, but they were also closely associated with a creek drainage and the concomitant problems of hardwood encroachment and small stand size. It would be possible for Red-cockaded Woodpeckers to occupy this polygon, but very unlikely. All of the other polygons in the northern half of the core and buffer were either extremely young habitat, or clearcut.

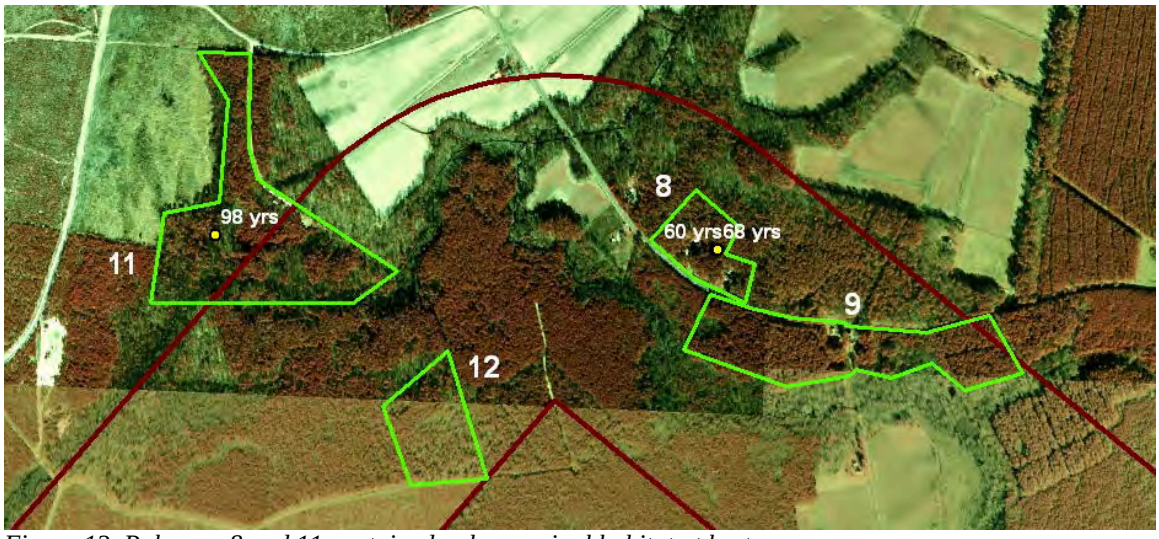


Figure 13. Polgyons 8 and 11 contained only marginal habitat at best.

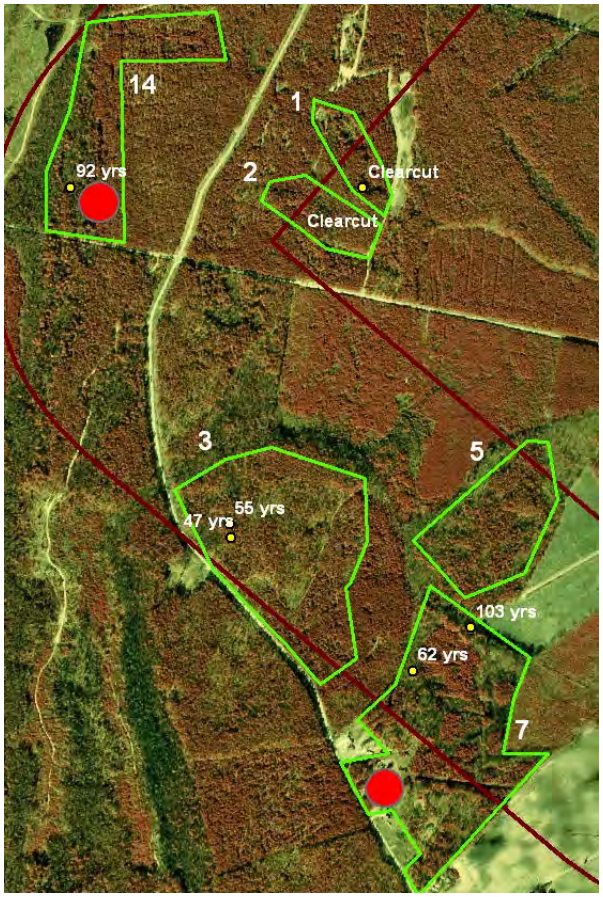


Figure 14 Locations of historical RCW sites and surrounding habitat.

Along the southern end of the core and buffer two polygons (Polygons 14 and 7) contained historical Red-cockaded Woodpecker locations as shown by the red dots. Polygon 14, an historical site, yielded very little in terms of cavity tree suitability. The survey team estimated 4-5 old trees in the 80-100 year old range, 4-5 trees in the 60-80 year old range, and the balance of the pine component was mostly 20-30 years old (Figure 13). All of the old trees were investigated, but the site was extremely marginal. Hardwood encroachment was severe, and much of the conifer component was Atlantic white cedar (*Chamaecyparis thyoides*), not very useful to Red-cockaded Woodpeckers. Polygons 3, 5, and 7, along the southern buffer area, formed a mosaic of mixed-age class pine intertwined with a creek drainage. There were sporadic old-growth trees embedded in this matrix, but no areas were really conducive to a cluster of cavity trees. Polygon 5 was not granted right of entry.

CONCLUSIONS

Of the three OLF sites surveyed, they all contained some degree of suitable habitat, and each have significant links to Red-cockaded Woodpeckers. The Dory site is closest to an existing Red-cockaded Woodpecker population at The Nature Conservancy's Piney Grove Preserve in Virginia, six miles to the north. This population is part of a 3000 acre preserve that continues to expand as new land is acquired. With the advent of "Safe Harbor" agreements, it is plausible that this population could continue to grow and spread outward through cooperative landowner agreements (USFWS 2003). The Dory site has at least one complex of habitat in the southwest corner that could easily contain Red-cockaded Woodpeckers (Polygon 2), although they were not present during this survey. However, given the nomadic nature of displaced birds, and the travel corridor between North Carolina and Piney Grove, within which the Dory site lies, this site could easily harbor Red-cockaded Woodpeckers at any time. Toward that end, if the Dory site is selected for development it is recommended to conduct a follow-up survey of at least the priority sites identified in the southern section. Approximately half of that area is within the buffer, and half within the core area. In addition, there would need to be close coordination with the US Fish and Wildlife Service, the Virginia Department of Game and Inland Fisheries, The Nature Conservancy and the Center for Conservation Biology regarding the potential impacts of OLF activity on the Piney Grove population. That population is in an extremely precarious position and is susceptible to extinction with only minor population impacts.

The Mason site held the last recorded Red-cockaded Woodpecker for Southampton County, a single male which was translocated to Piney Grove, and lost from there, 4 years ago. The Mason site also contains one of the last remaining historical blocks of habitat from the 1970s, that was identified again in the 1996 region-wide survey report. Within this block are two, and possibly three, complexes of habitat that could easily contain Red-cockaded Woodpeckers. They will remain priority sites as long as they are standing, and should be considered mandatory re-survey areas if the Mason site is selected for use. The best (Polygons 8 and 9) and worst (Polygon 19)of the three sites are within the buffer area , while the moderately suitable site (Polygon 18) is centrally located in the core area.

The Sandbanks site yielded the least amount of suitable habitat. If selected, at least the two historical areas should be re-surveyed (Polygons 7 and 14) along with any appropriate habitat within the same polygons. There were no other areas within the Sandbanks site that appeared promising for Red-cockaded Woodpecker occupation.

If either of the Dory, Mason, or Sandbanks sites is selected as the preferred alternative for the OLF, there should be immediate collaboration on conducting follow-up Red-cockaded Woodpecker surveys. This is so adequate time is made available in order to plan the survey. Ideally, if there is at least a year between site designation and development, a survey should be timed to coincide with the onset of the breeding season, between mid-March and mid-April. This would allow for audio playback surveys to be most effective and increase the survey efficacy through tape playbacks simultaneous with habitat searches. There would only be a need to survey the most promising areas as identified in this report, but surveys should be required to ensure that birds have not moved into these sites in the intervening period between the initial survey and the site development.

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APPENDICES

Appendix A. SURVEY POLYGONS, SIZES, AND ORIGIN

Site	Map ID	Acres	Hectares	Source
Mason	1	1.57	0.63	Chris Petersen
Mason	2	5.33	2.16	Chris Petersen
Mason	3	4.18	1.69	Chris Petersen
Mason	4	6.73	2.72	Chris Petersen
Mason	5	20.58	8.33	Chris Petersen
Mason	6	9.11	3.69	Chris Petersen
Mason	7	3.45	1.40	Chris Petersen
Mason	8	5.59	2.26	Chris Petersen
Mason	9	7.87	3.18	Chris Petersen
Mason	10	3.34	1.35	Chris Petersen
Mason	11	1.59	0.64	Chris Petersen
Mason	12	0.84	0.34	Chris Petersen
Mason	13	1.62	0.65	Chris Petersen
Mason	14	2.13	0.86	Chris Petersen
Mason	15	2.95	1.20	Chris Petersen
Mason	16	2.70	1.09	Sergio Harding
Mason	17	0.23	0.09	Sergio Harding
Mason	18	39.02	15.79	Sergio Harding
Mason	19	54.97	22.24	Sergio Harding
Mason	20	1.32	0.53	Sergio Harding
Mason	21	1.50	0.61	Sergio Harding
Mason	22	2.02	0.82	Sergio Harding
Mason	23	2.15	0.87	Sergio Harding
Mason	24	7.15	2.89	Sergio Harding
Dory	1	10.99	4.45	Chris Petersen
Dory	2	12.50	5.06	Chris Petersen
Dory	3	49.43	20.00	Chris Petersen
Dory	4	29.39	11.89	Chris Petersen
Dory	5	29.09	11.77	Chris Petersen
Dory	6	5.78	2.34	Chris Petersen
Dory	7	5.67	2.29	Chris Petersen
Dory	8	1.69	0.68	Chris Petersen
Dory	9	5.56	2.25	Chris Petersen
Dory	10	11.52	4.66	Dana Bradshaw
Dory	11	8.83	3.57	Chris Petersen
Dory	12	1.46	0.59	Dana Bradshaw
Sandbanks	1	8.39	3.40	Chris Petersen
Sandbanks	2	10.43	4.22	Chris Petersen

Appendix A. *cont*.

Sandbanks	3	55.87	22.61	Jenna Begier
Sandbanks	4	13.31	5.38	Chris Petersen
Sandbanks	5	25.09	10.15	Chris Petersen
Sandbanks	6	25.83	10.45	Chris Petersen
Sandbanks	7	62.08	25.12	Jenna Begier
Sandbanks	8	8.81	3.57	Jenna Begier
Sandbanks	9	26.85	10.87	Chris Petersen
Sandbanks	10	12.16	4.92	Chris Petersen
Sandbanks	11	37.46	15.16	Jenna Begier
Sandbanks	12	12.60	5.10	Jenna Begier
Sandbanks	13	6.07	2.45	Jenna Begier
Sandbanks	14	35.08	14.20	Chris Petersen

Appendix B. SURVEY TEAM AND AFFILIATIONS

Dana Bradshaw, Center for Conservation Biology (CCB)
Sergio Harding, Virginia Department of Game and Inland Fisheries (VDGIF)
Jenna Begier, North Carolina Wildife Resources Agency (NCWRA)
Chris Petersen, Department of the Navy (Navy)
Paul Block, Department of the Navy (Navy)
Meghan Byrne, Department of the Navy (Navy)

Appendix C. DORY FIELD NOTES

Polygons 12, 11, 1 and 2 were visited first, arriving on-site at approximately 0830 on December 2. The survey team met the landowner at the site and discussed the project and where we intended to search. Present were Chris Petersen (Navy), Sergio Harding (VDGIF), and Dana Bradshaw (CCB). The landowner suggested another area as well to the west of his pond where some old pines were located.

Parking just south of a farm field we walked a logging road through a forest of 20-30 year old plantation pine. We passed through Polygon 12 first, where we encountered a small stand of older trees embedded in the young pine. None of the trees appeared to be of cavity tree age and so we continued south to Polygon 11. We cored one tree there, which was 65 years old. We searched the area to identify the extent of the old-growth, investigating each of the older trees as we went. Proceeding south we encountered Polygon 1 which yielded another stand of 8-10 mature trees, approximately 45-55 years of age. We cored one tree, aged 47. Just beyond Polygon 1 to the south we encountered a creek crossing and cored one of two old boundary trees there. It was 90. Since these were lone boundary trees, embedded in a hardwood corridor, no additional searching was conducted here.

Working our way back to the trucks we detoured to the west to check Polygon 2. Here we encountered a stand of 12-15 large diameter old trees. We tapped three trees, yielding ages of 87, 107 and 92 years. This was the best looking habitat of all four areas. Hardwood encroachment was high but not extreme, and the site was typical of historical RCW sites in Virginia. As with the other areas, the stand was searched for evidence of cavities, or resin flow, but nothing suggesting RCW activity was observed.

From here we drove back through the farm field and west to investigate the landowners suggestion. We discovered a small one to two acre pine stand of about 20-30 trees embedded in bottomland hardwood forest. All of the pines were old, suggesting a natural stand that had been in an area too wet to harvest. We tapped one tree to confirm our estimates of the stand age. It was 98 years old. All of the older pines were investigated for RCW evidence.

Polygon 6 was visited next. It constituted a 20-25 year old pine regeneration stand with one or two mature 40-50 year old seed trees embedded in it. There was no reason to conduct additional searching.

Polygon 7 was a similarly young regeneration stand, slightly more diverse in age structure than Polygon 6, but without any significantly older trees. The stand appeared to range from approx. 20-35 years of age. We cored one tree that appeared to be among the oldest. It was 30 years old.

Polygon 3 was a mixed age class pine stand ranging from about 30-50 years. Embedded within it were occasional older trees, but nothing that looked suitable for RCW cavity use. We cored what we perceived to be one of the oldest trees, which was 66 years old. The stand was investigated for any additional evidence of older trees, but nothing else was discovered. Two additional trees were cored to get an estimate of the overall stand age. Those trees were aged at 35 and 40 years.

Polygon 4 was another young stand, 20-30 years old, in a mosaic of relatively open trees interspersed with some dense hardwood pockets.

Polygon 9 was not surveyed. The bulk of this polygon was outside of the area of authorized access, so it was left unvisited.

Polygon 5 was clearcut.

Polygon 8 was a small stand of timber with no trees appearing older than 40 years.

On December 21, we returned to the Dory site to complete the survey work after having worked on the Mason site that morning. We started with Polygon 5 which we found to have been clearcut.

We ended with Polygon 10 which we found to be an old creek drainage, with sporadic old-growth pines extending in a line along the length of it. We tapped one tree next to the road, and it was 98 years old. Given the loss of daylight, it was decided that the principle investigator would survey the remainder of the drainage at a later date.

Polygon 10 was completed on December 28 by Dana Bradshaw (CCB). The length of the drainage was walked and it was confirmed that old-growth pines were present along its entirety. One other tree was tapped for confirmation. It was 103 years old. No trees showed any evidence of RCW activity, old or new. Activity would be unlikely here anyway, as the old-growth pines were a minority in the landscape. They were overshadowed by bottomland hardwoods, and surrounded by 15-20 year old plantation pines.

Appendix D. MASON FIELD NOTES

Present on December 3 to begin the Mason site were Chris Petersen (Navy), Paul Block (Navy), and Dana Bradshaw (CCB). Polygons 13, 21, and a large portion of 19 had not yet been granted access authorization and so were not surveyed.

Polygon 10 was an approximately 2 acre stand of old pines embedded in an extensive forest of young pine. On one side was pine saplings, and the other was 20-25 year old plantation pine. Within Polygon 10 was a mosaic of old-growth pines interspersed with younger, but still mature trees. We tapped three trees: 63, 103, and 112 years. All older trees were searched for RCW evidence.

Just to the south of Polygon 10, Polygon 18 comprised 15-20 acres of mostly old-growth mixed pine/hardwood. This stand was surveyed extensively, employing line transects to cover the bulk of the old-growth sections. One false cavity start was discovered, but it turned out to reflect the work of Pileated Woodpeckers at the site of a limb bud, where an old branch had broken off, leaving a false cavity. Five trees were tapped to yield ages of 63, 83, 99, 102, and 114 years. Stand conditions similar to these extended for another half mile to the north, and this area was in proximity to older stands of plantation pine, which would be suitable for foraging habitat soon. Given the acreage involved, the number of cavity suitable trees, and the suitability of foraging habitat, this stand will need to be re-surveyed prior to development, if selected.

Polygon 4 was just across a creek drainage from Polygon 18, but was not authorized for access. From the other side of the creek however, the stand appeared to be very young, 10-15 years, with what looked like some 25-30 year old canopy trees interspersed.

Polygon 5 was found to have been clearcut.

Polygon 7 was a small mixed pine/hardwood stand adjacent to the road. Hardwoods were at least co-dominant, with an extensive mid-story component. We tapped what appeared to be two of the oldest trees present, at 49 and 57 years. No extensive survey work was undertaken here.

Polygon 11 was found to have been clearcut.

Polygons 1 and 3 were very similar stands of mixed pine hardwood. Although some of the trees seemed to show full canopies on the imagery, these stands were approximately 30-40 years old with sporadic trees nearing 50 years. We tapped what looked to be the one of the oldest trees in each polygon, which turned out to be in 47 years in Polygon 1 and 49 years in Polygon 3. Polygon 11 which was adjacent to these two areas appeared even younger in age, and was a narrow, linear stand affording little in potential habitat. No trees were cored there.

Polygon 2 was a mixed age-class pine/harwood floodplain forest stand between two young pine regeneration stands. The entire stand was surveyed but we never located any truly old trees. We tapped three of the oldest trees to yield 46, 52, and 75 years.

Moving north to Polygon 16 we walked in to what appeared to be the terminal end of an extensive creek drainage that harbored a number of old pines along its route. Two trees were cored, yielding ages of 90 and 76 years. We investigated all of the trees for RCW evidence but found nothing. We noticed that the floodplain extended beyond Polygon 16 to the west and south, and we continued to

find old-growth pines along it. We tapped one more tree for confirmation to the south, and found it to be 98 years old. Although the trees here were very suitable for RCWs, the possibility for occupation would still be very low due to the heavy hardwood encroachment, and hardwood domination of the canopy.

Polygons 17 and 12 were very narrow adjacent polygons on the northeast side of the core area. Polygon 17 was a 15-25 year old stand, with a few older trees along the northern edge. The oldest we cored at 36 years. Polygon 12 was a very similar 20-25 year old stand, with a few older trees along the edge of an adjacent soybean field. None exceeded 40 years of age.

Polygon 7 was a small mixed pine/hardwood stand adjacent to a road. It was walked, and the two oldest trees were cored, yielding ages of 49 and 57 years.

On December 21, Chris Petersen (Navy) and Dana Bradshaw (CCB) returned to complete field surveys at the Mason site.

Polygon 6 was a 20-30 year old relatively homogeneous pine stand along a road. We found a couple of old seed trees along a drainage in the interior. We cored one, at 65 years.

Polygon 15 was a 15-25 year old pine plantation. The oldest tree we could find was 26 years old.

Polygon 19 offered only partial access to the south end. The accessible portion was confined to only a 20-30 year old pine plantation. Just across a red-painted boundary marker however, the stand opened up to a natural mixed pine hardwood stand, with a significant number of what appeared to be old-growth trees. Two trees right on the boundary line were tapped, yielded ages of 84 and 98. This area will need to be surveyed completely if the Mason site is selected.

Polygon 14 was a dense 15-25 year old stand along a creek drainage. No trees were cored.

Polygon 20 was essentially the same, a 20 year old stand along a logging road. No ages collected.

Polygons 22, 23, and 24 were old-growth pine/hardwood corridors that defined a creek drainage. All had been harvested within a few months of the survey. One old pine was still present in a narrow corridor remaining to the east. It was 106 years old. These sites were within a half mile of the historic RCW site in this tract.

Polygons 8 and 9 were visited by Dana Bradshaw (CCB) in a follow-up survey on December 28. These sites yielded some of the best habitat in the Mason site. The habitat is a mosaic of mixed-age class pines ranging from 40 to 140 years, with a hardwood component ranging from a moderate midstory to a co-dominant canopy competitor. Eight trees were cored within, or between the target polygons. They yielded the following ages: 58, 72, 85, 96, 99, 101, 105, and 134 years. North-south transects were walked to canvas this area moving from the creek drainage out to the buffer boundary, as well as that point could be determined. Tape-recorded playbacks of RCW vocalizations were played at multiple points as well. This site marks the southern boundary of an extensive old-growth forest block that held Red-cockaded Woodpeckers some 25 years ago, and is still intact.

Appendix C. SANDBANKS FIELD NOTES

Present on site to begin the Sandbanks Area on 5 January were Chris Petersen (Navy), Paul Block (Navy), Jenna Begier (NCWRA), Meghan Byrne (NAVY), and Dana Bradshaw (CCB).

Polygons 1, 2, 4, 6 and 12 were determined to have been clearcut.

Polygon 5 had no right of entry. Standing on the adjacent logging road, this area appeared to harbor some large trees, with only moderate hardwood encroachment, although the trees appeared to be less than 50 years old.

Polygon 14 was a mixed stand of pine, hardwood, and Atlantic white cedar, and an historical RCW site. It had an extremely dense understory of cane and greenbriar, and a heavy mid-story component in the wetter areas. The survey team located about 4-5 trees in the 80-100 year old age class. One was cored to be 92. Another half dozen or so trees appeared to be in the 60-80 year range. One was cored to be 63. The remainder of the conifer component was either 20-30 year old loblolly pine or older white cedar. All of the older trees were investigated for evidence of RCW activity, but nothing was observed. There appeared to be no remaining evidence of past RCW occupation of this site.

Polygon 3 was a block of older trees along a drainage, but not old enough. Two of the oldest trees were tapped, and yielded ages of 47 and 55.

Polygon 7, another historical RCW site, was characterized by a young 20-30 year old stand with two distinct corridors of older pines embedded in the stand. The first line of older trees yielded just mature trees of middle age. Two trees were cored yielding ages of 53 and 62. The second tier of older trees was associated more with a drainage, and yielded distinctly old-growth trees of very large diameter. One tree was cored, at 103 years. All of the trees in this area were investigated for signs of RCW evidence but nothing was observed. The portion of Polygon 7 that was identified as having harbored RCWs in the past was not accessible to the survey team.

Polygon 8 was a pine dominated woodlot between two homes. Although the stand was relatively open, with mature trees, it was very small, and only marginal in age structure. Two trees were cored, yielding ages of 60 and 68. The entire stand was surveyed however, but no RCW evidence was unearthed.

Just across the road, Polygon 9 was comprised of two narrow forest blocks adjacent to a state road. Although no right of entry was granted for this area, these blocks were visually scanned from the shoulder of the road They were observed to be relatively homogeneous stands of what appeared to be 30-40 year old pines. There were sporadic trees that may have reached 50 years but nothing of cavity tree age present.

Polygon 11 was a mixed age-class pine stand located along a drainage. It harbored a number of old-growth trees suitable for use. Two trees were cored, yielding ages of 91 and 98 years. All of the older growth trees were investigated for RCW evidence, but yielded nothing.

Polygon 10 was young, 20-30 years, with no evidence of significantly older seed trees. Polygon 13 appeared younger, probably 15-25 years, with no evidence of significantly older trees.