APPENDIX 6
Terrestrial Habitat Evaluation Procedures

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A6-1 BACKGROUND AND OBJECTIVES

The U.S. Army Corps of Engineers (USACE) has quantified potential impacts and changes to existing terrestrial habitat resulting from the construction and operation, maintenance and repair of the Work Items, including the selection of borrow sources under Alternatives 2 and 3, and the excavation of the borrow material from selected sites. Data for variables associated with habitat suitability index (HSI) models were collected by the ERDC-EL Wildlife Team during field work in 2018 and 2019, and were used by USACE for Habitat Evaluation Procedures (HEP) (U.S. Fish and Wildlife Service [USFWS] 1980a) analyses. USACE chose the HEP approach to align the current analysis with the one performed by ERDC-EL for the SEIS I (USACE 1998).

Terrestrial habitat types within the Work Item areas primarily include agricultural land, forest, and developed/residential areas. Agricultural lands and developed areas provide limited terrestrial habitat for a small number of species, with the exception of waterfowl (see Appendix 5). Bottomland hardwoods (BLH) are the predominant terrestrial habitat within the Mississippi Alluvial Valley (MAV), and therefore was the habitat most likely to be impacted by the Work Items. The two dominant BLH communities are riverfront BLH and mixed BLH. Dominant species of the riverfront BLH communities include cottonwood *(Populus deltoides),* sycamore *(Platanus occidentalis),* and black willow (*Salix nigra)*, while dominant mixed BLH species include pecan (Carya spp.), green ash *(Fraxinus pennsylvanica),* sugarberry *(Celtis laevigata),* hackberry *(Celtis occidentalis),* oaks *(Quercus* spp.), and elm *(Ulmus* spp.).

Land cover among nine categories were used to describe general habitats for the Work Items using Alternative 3 (Table A6-1a) and Alternative 2 (Table A6-1b).

The USACE objectives for this analysis were to (1) collect data using targeted field sampling to generate inputs for HSI models of four avian and two mammalian species, and (2) use HEP to evaluate potential impacts from the construction and operation, maintenance and repair of the Work Items, including the selection of borrow sources under Alternatives 2 and 3, and the excavation of the borrow material from selected sites. USACE determined the pre-work baseline habitat suitability for target species, used this information to derive estimates of impacts to habitat for “with-project” actions, and then made recommendations for habitat compensation for Work Item impacts.

A6-2 OVERVIEW AND JUSTIFICATION FOR USING HEP/HSI APPROACH

The HEP provides a means to quantify habitat availability for wildlife species under various management alternatives. HSI model input variables are derived from species-specific habitat requirements for specific species in a defined area. HSI models rate the quality of available habitat using a scale of 0 (unsuitable) to 1.0 (optimal). Land cover types in a defined area are mapped, and target species that use specific land cover types are then selected. Target species may include rare or sensitive species, but may also reflect economic, recreational, or ecological considerations (Roberts and O’Neil 1985; O’Neil 1993).

Table A6-1a. Summary of acreages of land cover types for Work Items using Alternative 3 by USACE District and State.

		Land Cover (acres)									
District	State	Cropland	Forested	Levee	Marsh	Non-forested Wetland	Open Water	Pasture, Old Field	Scrub/ Shrub	Urban	Total
MVK	Louisiana	335	262	627	0	7	3	4	87	0	1,324
	Mississippi	114	105	207	0	0	1	32	39	6	505
MVK Total		449	367	834	0	7	3	36	126	6	1,829
MVM	Arkansas	435	159	569	0	2	6	3	1	1	1,175
	Illinois	13	10	42	0	0	0	0	0	47	112
	Kentucky	39	0	7	0	0	0	0	0	1	47
	Missouri	128	69	309	0	5	0	0	0	11	523
	Tennessee	476	65	217	0	0	0	51	0	2	811
MVM Total		1,090	303	1,144	0	8	6	54	1	62	2,668
MVN	Louisiana	230	119	2123	13	0	1	87	5	208	2,786
MVN Total		230	119	2123	13	0	1	87	5	208	2,786
Grand Total		1,770	789	4,102	13	15	10	177	131	275	7,283

Table A6-1b. Summary of acreages of land cover types for Work Items using Alternative 2 by USACE District and State.

		Land Cover									
District	State	Cropland	Forested	Levee	Marsh	Non-forested Wetland	Open Water	Pasture, Old Field	Scrub/Shrub	Urban	Total
MVK	Louisiana	262	328	630	0	9	2	4	73	0	1,309
	Mississippi	51	162	163	0	0	1	19	38	6	440
MVK Total		314	490	793	0	9	4	22	110	6	1,749
MVM	Arkansas	375	195	569	0	2	6	1	8	1	1,156
	Illinois	4	19	42	0	0	0	0	0	47	112
	Kentucky	39	0	7	0	0	0	0	0	1	47
	Mississippi	0	17	0	0	2	0	0	0	0	19
	Missouri	89	104	310	0	4	0	0	0	11	518
	Tennessee	158	388	217	0	0	0	51	0	2	816
MVM Total		665	723	1145	0	9	6	53	8	62	2,669
MVN	Louisiana	136	213	2123	13	0	1	87	5	208	2,786
MVN Total		136	213	2123	13	0	1	87	5	208	2,786
Grand Total		1,114	1,426	4,061	13	18	11	162	123	275	7,203

The HEP approach has historically been the standard procedure to estimate impacts of terrestrial and wetland projects on various species and their habitats (USFWS 1980 a,b,c). The estimated loss or degradation of habitat, as measured by the HEP/HSI approach can be used to provide guidance for State and Federal agencies on the amount of habitat needed to be protected or restored to mitigate for lost habitat, especially for sensitive or rare species (Wakeley 1988; Kellner et al. 1992).

Once target species have been selected, cover types mapped, and habitat variables collected, HSI models are then used to generate indices for each target species in each defined area. An initial number of habitat units (HUs) for each species are based on the amount of cover types available and individual HSI model results for each species. Usually, one HU is equal to 1 acre (0.04 ha) of optimum habitat available for a species. Then, the amount of acreage available for a species is calculated as the number of available acres/hectares times the HSI value (HU = HSI x available acres/hectares) in the study area.

Many other species/habitat evaluation models are available or can be developed, but most other models are too laborious or expensive to implement on a large scale (O'Neil 1993). Moreover, the HEP/HSI approach has been developed by, and is the preferred approach recommended by, the USFWS, the Federal agency responsible for regulating impacts on wildlife species and their habitats (USFWS 1980a,b,c; Wakeley and O'Neil 1988, O'Neil 1993).

In a typical HEP study, a number of evaluation species are chosen for each area that meets a specified standard of homogeneity (i.e., cover type) of interest in the Work Item area. The list of species were chosen because of their presence and dependency on BLH habitat type within the MAV and to be consistent with the same suite of species used in the 1998 SEIS.

There have been numerous critical assessments of the HEP/HSI approach. The most common problem associated with the approach is that the studies are undertaken on a time-scale too short to determine habitat quality (Kellner et al. 1992; Williams 1988). Moreover, the variables used are frequently considered inadequate to correlate with habitat quality and there is usually no insight into whether high quality habitats (e.g., HSI values approximating 1.0) actually contribute to sustainable populations (Kellner et al. 1992). And finally, habitat quality itself is often associated with high density of target species. However, population density often may be due to multiple factors unrelated to habitat quality (e.g., social or seasonal movements by individuals) (Kellner et al. 1992; O'Neil 1993). In addition, there may be bias associated with the planning and implementation of studies that may negatively impact the conclusions or underestimate the amount of compensation needed to offset habitat losses (Williams 1988).

Many of these criticisms are justified, as there can be problems in any study with model development, variables used, and associated analyses and conclusions made from the results. While some HSI models may not have full scientific verification, and some variables may be poorly correlated with habitat quality, the HEP/HSI approach has been developed for rapid assessment associated with estimating potential impacts of proposed projects on wildlife populations. With this purpose in mind, variables with correlation as low as 70 percent to habitat quality may still be reasonable as predictors of Work Item impacts; in fact, reducing time to collect field data for variables, even with reduction of correlations to habitat quality, may still be a viable approach for impact analyses (Wakeley 1988; Wakeley and O'Neil 1988).

Impacts on target species during the construction of the Work Items were estimated by calculating the average number of HUs before the work has begun with the estimated loss of HUs after the work has been completed. This value is referred to as the difference in average annual habitat units (AAHUs). AAHUs reflect the values of habitat quality, acres and time before and after project implementation, and may also estimate HUs gained or lost in comparisons between the Work Item and one or multiple alternative options (Wakeley and O'Neil 1988). The amount of HUs determined to be lost or gained during planning and prior to implementation allows project managers to estimate whether there is a need to mitigate or restore lost habitat. This process also provides an estimate on the amount of habitat that may be required to be restored or protected.

Species Selection

The selected species represent the wildlife community that uses BLH and are those species that are likely to be impacted by loss of such habitats during excavation of borrow pits. These species included the barred owl (BADO; *Strix varia*), fox squirrel (FOSQ; *Sciurus niger*), Carolina chickadee (CACH; *Poecile carolinensis*), pileated woodpecker (PIWO; *Dryocopus pileatus*), wood duck (WODU; *Aix sponsa*), and mink (*Mustela vison*). All HSI models with these representative species are certified by the USACE National Ecosystem Restoration Planning Center of Expertise for use in the project area.

USACE minimized problems associated with the selection of species and associated variables by selecting species common in BLH habitats and species with published HEP models (see Allen 1982, 1986, 1987; Schroeder 1983 a,b; Sousa and Farmer 1984). Often, HSI models may need to be modified to account for application in new localities or to account for application to different, yet similar species (O'Neil 1993). Although USACE does not have specific information on the correlations of the variables and habitat quality for the selected species, it is expected that the published HSI models have at least the minimal correlation required to be effective indicators of Work Item impacts, as described by Wakeley and O'Neil (1988), Wakeley (1988), and O'Neil (1993). USACE collected avian data in the fall of 2019 concurrent with HEP field sampling based on direct observation or by vocalization for the selected bird species: Barred Owl; Carolina Chickadee; Pileated Woodpecker; Wood Duck. Although the data was collected primarily during fall and outside of the breeding season, it is useful for confirming the presence of the bird species in the Work Item areas.

Seasonal changes in habitat use by some species are controlled by the selection of species that are generally non-migratory and remain year-round in BLH in the MAV. Selecting such species also helped minimize bias. Also, since none of the selected species are rare or sensitive, existing populations are likely already self-sustaining. While the impacts to available habitat resulting from the construction and operation, maintenance and repair of the Work Items, including the selection of borrow sources under Alternatives 2 and 3, and the excavation of the borrow material from selected site, will likely negatively affect populations of some of these species, such impacts are unlikely to reduce overall sustainability of the populations. Therefore, whether or not the HSI outputs reflect sustaining populations of the select species is not a factor and does not affect the conclusions or recommendations from the model outputs. Most all potential criticisms in the published literature on planning, implementation and final results and conclusions, as described by Kellner et al. (1992), have been addressed. To supplement the HEP analyses, USACE also addressed potential impacts on waterfowl (Appendix 5), bats (Appendix 7), migratory birds (Appendix 8), and species listed as threatened or endangered under the Endangered Species Act of 1973, proposed for Federal listing, or delisted since the issuance of the Record of Decision for the 1998 SEIS I (Appendix 9).

A6-3 METHODS

Selection of Field Sites

USACE provided ERDC-EL with a list of 143 Work Items as potential sampling units for HEP. A ½-mile buffer from the centerline of the Mississippi River levee (MRL) was established for all Work Items, and major land cover types within those buffers were identified (Table A6-2). USACE used ArcGIS to generate maps of each Work Item. For sampling purposes, potential tracts were defined as blocks of forest comprised of at least 10 acres of habitat. There were two significant constraints on accessing and sampling Work Items. First, a general lack of right-of-entry to many Work Item areas precluded ERDC-EL from generating a random sample from the pool of all Work Items within which to conduct fieldwork. Second, significant Mississippi River flooding during 2018 and 2019 precluded USACE from accessing many Work Item areas until summer 2019. As such, the ERDC-EL Wildlife Team visited as many representative Work Items in each District as was feasible and under the constraint of finishing field sampling before autumn leaf-drop. To help alleviate these constraints, a list of "surrogate" work sites (e.g., State Conservation Areas) with sufficient areas of BLH near the MRL system and as close to actual Work Items as possible was prepared.

Land within a ½ mile of Work Item levee centerlines, and proximal surrogate sites, were collectively termed habitat sampling units (HSUs). The HSUs overlapped MRL-Work Items when feasible. Twenty-nine distinct HSUs were selected for sampling within the project area from Missouri to Louisiana (Figure A6-1).

Field Methods for Quantifying Habitat Characteristics

A HEP team consisting of biologists from the ERDC-EL Wildlife Team, performed all fieldwork and associated analyses. Fifteen HSI model variables were measured on 0.1 acre plots and five variables were calculated remotely using ArcGIS for 253 random sampling locations (173 riverside of the MRL; 80 landside of the MRL; Attachment 1) on 29 HSUs (Figure A6-1) within a 600-mile reach of the lower Mississippi River, near Cairo, IL, to Head of Passes, LA.

USACE did not calculate the percent of year water was present on a plot for the associated variable in the Mink model, but rather observed if permanent water sources occurred within 100 meters of the plot. If permanent water was present, USACE measured other variables within the Mink model to generate a HSI score. This was considered to be more representative of calculating a true HSI score for Mink, as water must be present, and later applied the same methods for assigning HUs to forested areas that contained permanent water sources around the Work Items. A composite of 20 variables (Table A6-3) were generated from HSI models for the six species. References for these models can be found in Allen (1982, 1986, 1987), Schroeder (1983a,b), and Sousa and Farmer (1983). The HSI model for the black-capped chickadee

(*Poecile atricapillus*) (Schroeder 1983a) was modified for the Carolina Chickadee as described in a Memo from U.S. Geological Survey, Biological Resources Division, Fort Collins, CO to USFWS, Vicksburg, MS (Attachment 1).

Table A6-2. Summary of acreages of land cover within a half-mile buffer of levee centerline for Work Items in all Districts using Alternative 3.

Land Cover (CEMVD 2017)	Total Acres	% of Total Land Cover
Bare soil	82	<0.1
Cropland	58,502	28.8
Forested	34,839	17.1
Levee	11,051	5.4
Marsh	1,244	0.6
Non-Forested Wetland	1,361	0.7
Open Water	55,376	27.2
Pasture, Old Field	7,409	3.6
Sandbar	81	<0.1
Scrub/Shrub	4,347	2.1
Tree Plantation	639	0.3
Urban	28,522	14.0
Total	203,454	

USACE assessed access to HSUs along the lower Mississippi River through permission from the various non-Federal sponsors and private landowners, or when possible, permission to access State or Federal lands. Once accessible, USACE identified HSUs and established sampling points using satellite imagery in ArcGIS 10.6. When possible, USACE established initial points in a reach at the northern or western most section, about 100 m from the forest edge. Subsequent sampling points were established systematically approximately every 500 m, and generally parallel with the Mississippi River, until no more points could fit into the MRL reach. On large HSUs (e.g., HSU's > 7 km long), USACE established points 1,000 m apart. Because of access and encroachment concerns, USACE made an effort to establish sampling points within approximately 100 m of the forest edge; however, on flooded sites, or sites with narrow forested tracts, USACE moved points to nearby locations that best represented the targeted sampling habitat (e.g., BLH). Sampling points established in ArcGIS were downloaded to hand-held GPS units to guide sampling teams to exact locations.

USACE used multiple two-person teams to sample all points and reaches during the fall of 2018 and summer and fall of 2019. Field equipment required for this effort included GPS units, clipboards, datasheets, two 50-m tape measures, range finder with built-in clinometer, densitometer, metric tree calipers, and binoculars (for facilitating identification of tree cavities).

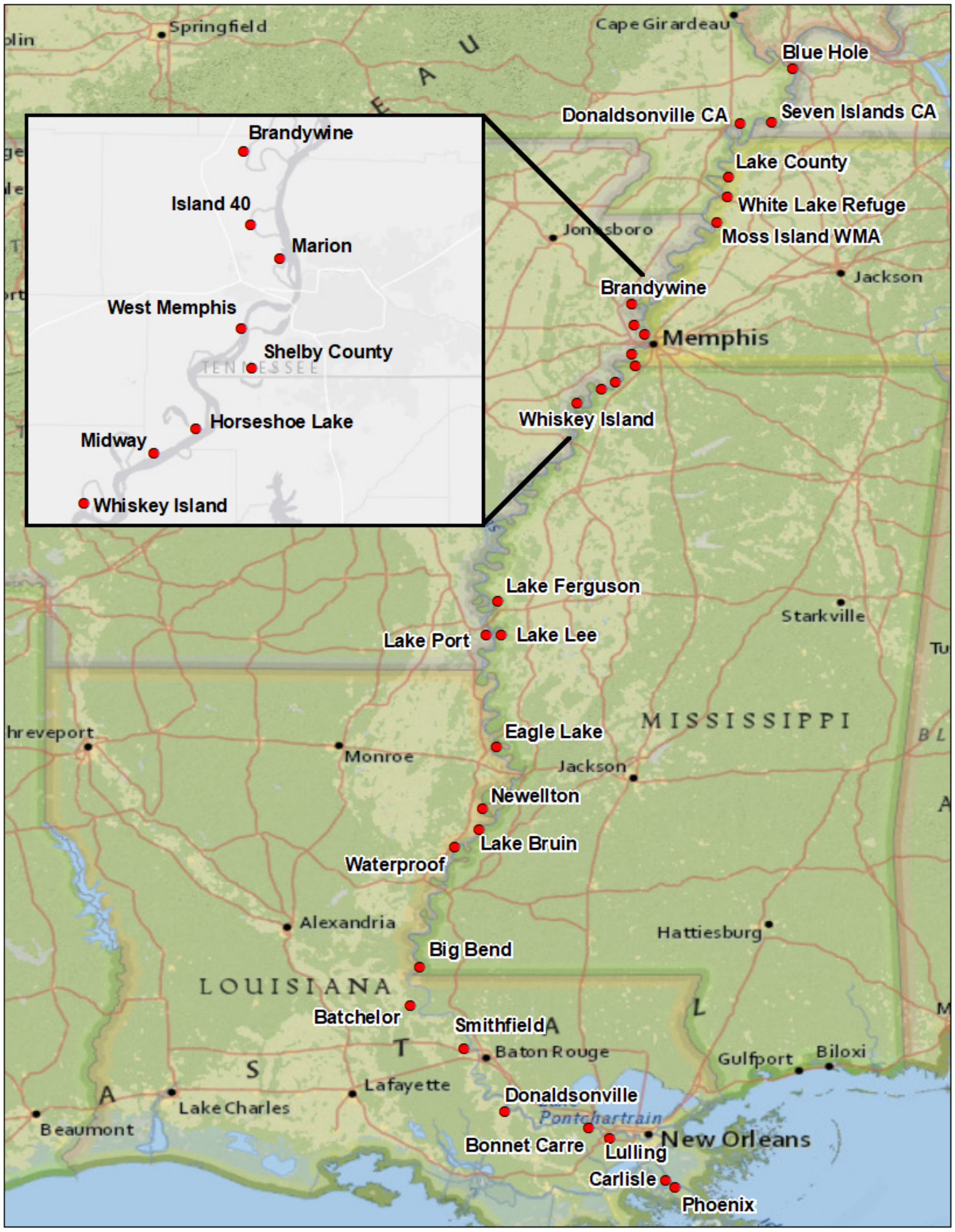

Figure A6-1. The 29 sampling locations where 253 HSI plots were conducted for the HEP analysis between Cairo, IL and Phoenix, LA, during fall 2018 and summer/fall 2019.

Table A6-3. Habitat variables collected and the species for which the data contributed to individual HSI models.

No.	Variables	Species
1	Overall canopy closure (%) for entire plot	Carolina Chickadee, Fox Squirrel, Mink, Pileated Woodpecker
2	Overall midstory canopy closure (%) for entire plot	Fox Squirrel, Mink
3	Overall herbaceous cover for entire plot	Mink
4	Canopy closure (%) of hard mast trees	Fox Squirrel
5	Canopy height (average height of overstory trees, ≥80% of tallest trees)	Carolina Chickadee
6	# of trees with DBH[a] ≥ 51 cm	Barred Owl, Pileated Woodpecker
7	Average DBH of overstory trees (≥80% of tallest trees)	Barred Owl, Fox Squirrel
8	# of snags or dying trees ≥38 cm DBH[a]	Pileated Woodpecker
9	Average DBH of snags ≥38 cm DBH[a]	Pileated Woodpecker
10	Combined # of trees and snags with ≥1 cavity (trees ≥10 cm DBH[a])	Carolina Chickadee
11	# of tree cavities with dimensions of 7.6 x 10.0 cm (in live trees or snags).	Wood Duck
12	# of tree stumps; # of log	Pileated Woodpecker
13	# of artificial nest boxes	Wood Duck
14	% of the terrestrial ground surface within 100 m of a wetland's edge that is shaded by vertical projection of woody vegetation canopy	Mink
15	% of the vegetation/structural complexity at the water/land interface (≤1 m from water's edge)	Mink
16	% water surface covered by brood cover	Wood Duck
17	Distance (m) between nesting and brooding-rearing habitat	Wood Duck
18	% area of optimum nesting habitat	Wood Duck
19	% area of optimum brood-rearing habitat	Wood Duck
20	Distance from plot center to nearest source of grain (m)	Fox Squirrel

[a] Diameter at breast height (DBH) is a standard method of expressing the diameter of the trunk or bole of a standing tree

Using hand-held GPS units, field personnel located a sampling point within an MRL reach. Field personnel had the latitude to move a point away from conditions that were too flooded to sample, or into areas more suitable for forest habitat if conditions were not appropriate (e.g., when tree harvest or other activity had impacted the area). USACE recorded UTM coordinates to ensure that points matched established sampling points, or when an original point was moved.

Plot Sampling

Within each 0.1 acre plot, tree layer consisted of all woody plants >6 m tall, excluding vines, for estimates of canopy cover. The midstory layer consisted of woody plants 1-6 m tall, including vines. Estimates were made of the percent cover of midstory that included trees and shrubs combined. Herbaceous cover was living plants < 1 m tall and was visually estimated within the plot. The diameter at breast height (DBH) of each tree to the nearest centimeter was measured for all living trees and snags, and recorded tree species for all living trees. Snags were defined as standing dead trees > 10 cm in diameter and ≥ 2 m tall, including live trees from which >50 percent of the branches had fallen or were present but no longer produced foliage. A visual determination was made for which trees were representative of the average canopy height and then measured using a clinometer. Oaks (*Quercus* spp.) and hickories (*Carya* spp.) were the only hard-mast genera. The percent hard-mast canopy was calculated as the proportion of these species from all trees and then this percentage was multiplied by the total estimated canopy cover. All trees > 20 cm were considered to contribute toward canopy cover for this variable.

A visual count was made of the number of trees within a plot that contained cavities suitable for use by Carolina Chickadees, and counted the number of cavities measuring 7.6 x 10 cm for Wood Duck. No Wood Duck nest boxes were observed within any plot, nor were any nest boxes observed while en route to plots. The number of downed logs (> 18 cm diameter) and tree stumps (> 0.3 m; >18 cm diameter) within the plot were also counted.

For plots within 100 m of permanent water (Mink model), two additional variables were collected. The percent of shoreline cover that included the structural complexity consisting of cover provided by overhanging or emergent vegetation, undercut banks, logjams, debris, exposed roots, boulders, or rock crevices within 1 meter from water's edge was estimated. The percent of canopy cover of trees and shrubs within 100 m of the water body was also estimated. To determine areas suitable for mink to be impacted, all Work Items were buffered by 100 m in ArcGIS and permanent water sources within that buffer were identified. The next step involved buffering the adjacent permanent water area by 100 m to determine the area that overlapped with the Work Items. The intersect tool in ArcGIS was used to overlay forest within the Work Item areas with the 100 m buffered area around water to determine the total number of suitable forested acres within each Work Item area (see Supplemental Materials).

Borrow areas will create permanent water sources that will provide suitable habitat for mink within forested areas that previously did not exist. The benefits to mink were calculated from creation of borrow areas by first dissolving each borrow area by district and State so polygons would not overlap with buffers. Each borrow area was buffered by 100 m. To calculate the area of forested habitat within the 100 m buffer, the intersect tool in ArcGIS was used. To determine newly created mink habitat, the union tool in ArcGIS was used between all forest within 100 m of borrow areas with preexisting suitable mink habitats to subtract current suitable areas from future suitable areas to achieve the real acreage of forest that would become suitable with creation of borrow areas (see Supplemental Materials).

Five variables (Variables 16-20; Table A6-2) were calculated within ArcGIS to generate HSI scores for Wood Duck and Fox Squirrel. For Wood Duck, survival is best if ducklings are close to water when they leave the nest, and survival decreases as distance to brood habitat increases. Wood duck habitat was modeled as the 67.5-day duration (25 percent exceedance elevation) elevation during the spring (March-May). The Flood Event Simulation Model (FESM) flood mapping tool was used to determine the areal extent of the 68-day duration elevation.

The percent of water surface covered by brood cover and the optimum percent of nesting or brood-rearing habitat by creating half-mile buffers around each HEP sampling point and dissolving the buffers according to the habitat sampling unit (e.g., Brandywine) was calculated by river or landside. The centerline of the levee was used as the boundary to separate the landside from the riverside of the levee for the buffered area, and areas were extracted to that feature using the clip tool in ArcGIS. The Wood Duck HSI (Sousa and Farmer 1983) described nesting and brood-rearing cover as deciduous forest, deciduous forested wetland, deciduous scrub/shrub wetlands, herbaceous wetlands, or riverine. Forested, marsh, non-forested wetlands, and scrub/shrub cover types were grouped within the USACE MRL 2017 land cover layer as suitable nesting or brood-rearing habitat and clipped those features to the half-mile HSU buffers. The 60-day duration of inundation hydrology layer created was also clipped to the half-mile buffered HSU. All of the land cover types were grouped together and were considered to represent potential nesting habitat as non-forested habitats could be considered suitable if nest boxes were present. The same cover types were considered to be suitable for brood-rearing habitat if these areas were inundated during the brood-rearing period (spring-early summer).

The nearest neighbor tool in ArcGIS was used to determine the distance between nesting and brood-rearing cover types in miles to determine the interspersion component for variable six of the Wood Duck HSI model (variable 17 within Table A6-2). Since all distances between life requisites types (nesting and brood-rearing) were less than 0.5 miles (1.0 HSI), scores were not reduced according to the formula in the Wood Duck's Bluebook HSI Model (Sousa and Farmer 1983).

For Fox Squirrel, the USDA Cropscape layer was used to define areas containing agricultural resources (USDA National Agricultural Statistics Service Cropland Data Layer. 2018). The distance to nearest grain was calculated using the nearest neighbor tool in ArcGIS and determined the distance in meters from the plot center to the nearest agricultural field (e.g. corn or soybean).

Calculating Baseline Habitat Conditions/Habitat Suitability Model Inputs

The "EcoRest package" (McKay and Hernández-Abrams, In Review), an R Statistical Software, was used to generate HSI scores from field data for each of the six species according to formulas and guidelines within each of the target species' respective HEP model. One exception occurred for the Wood Duck, for which the HSI values were manually calculated. This model involves more complex formulas to acquire the final HSI, and correct formulas within the EcoRest package are still being developed for that species. For all field metrics, an average across all plots within a HSU that was directly associated with a Work Item was prepared. In many cases, HSU's were located away from Work Items due to access restraints as previously described. To calculate HSI values for these Work Items, HSI values were calculated and assigned using the guidelines below. These are also further detailed within maps and associated descriptions in Attachment 1.

Riverside HSI values were calculated and assigned to Work Items as follows:

1. For Work Items that were directly sampled (e.g., Brandywine, Figure A6-1), the average of each variable among all plots within the HSU was calculated to develop a HSI score within the EcoRest package.
2. All riverside values for each variable across all HSU within the New Orleans District boundary were averaged, and those values were applied to all Work Items within that district, due to low sample size resulting from accessibility issues (i.e. MVN Complex).
3. For unsampled Work Items within Vicksburg and Memphis Districts, HSI values were calculated and assigned according to geographic location by using values from the most proximal sampling location (e.g., Vicksburg South or Memphis North Complex).

Landside HSI values were calculated and assigned to Work Items as follows:

1. For Work Items that were directly sampled (e.g., Donaldsonville), the average of each variable among all plots within the HSU was calculated to develop a HSI score.
2. All landside values for each variable across all HSU within the New Orleans or Memphis District boundaries were averaged, and those values were applied to all Work Items within each respective district, due to low sample size resulting from accessibility issues (e.g., MVN or MVM complex).
3. For unsampled Work Items within the Vicksburg District, HSI values were calculated and assigned according to geographic location by using values from the most proximal sampling location (e.g., Vicksburg South).
4. All landside sampling locations for mink within the Memphis District did not contain suitable habitat (i.e., no permanent water source within 100 m of plot center) and therefore USACE was unable to assign HSI scores. Therefore, an average HSI score calculated for complexes within Vicksburg and New Orleans Districts was used to assign HSI for Mink in the Memphis District.

Assessing Potential Impacts of 2018 Flooding

The initial survey of HEP plots began during mid-October, 2018 near Marion, Arkansas. Seven Work Items were surveyed during October 2018 before postponing the remainder of sampling to the following spring once leaf-out conditions occurred. Unforeseen circumstances with the extensive flooding of the Mississippi River and the batture persisted throughout the winter of 2018 into early summer, and that precluded any spring 2019 survey efforts. Once flood waters receded, survey crews resumed sampling beginning in the northern reaches of the MRL and proceeding southward. In August 2019, two Work Items sampled in Arkansas a year prior were revisited and 10 HEP plots were re-measured to compare pre- and post-flood canopy cover, midstory cover, and herbaceous layers. A paired t-test was used to analyze data and to compare means of metrics between years.

Calculating Average Annual Habitat Units

The overall effects of each Work Item were estimated by calculating the net change in AAHUs between the No-action Alternative and Alternatives 2 and 3 for each of the six evaluation species. It was assumed that all land proposed for clearing during construction (e.g., borrow pits) would remain in a cleared condition throughout the period of the MR&T Project. For haul roads, even though they eventually may undergo succession back to forest, a conservative approach was used to assume the roads may continue to be used for access purposes. In either event, forested tracks currently within haul roads represent a very small percentage of the overall land clearing (1.2 percent; 94 of 7,283 acres under Alternative 3).

Determining Mitigation Recommendations

AAHUs were calculated by generating spreadsheets in Microsoft Excel based on gains in habitat by reestablishing BLH on a hypothetical 100 acres of existing cleared land under various management scenarios (Table A6-4). The benefits of management plans for selected target years over a 50-year period of analysis were estimated using models developed by consensus of prior HEP Teams in the MAV (i.e., Steele Bayou Project and Upper Yazoo Project HEP Teams (Figure A6-2; Wakeley and Marchi 1991, 1992). In the absence of any other available modeling, annualized benefits of the management plans over 50 years were used since the HSI curves developed for that effort were only projected out for that specific timeframe.

It was assumed that mitigation by direct reforestation of existing cleared land is the preferred means of restoring wildlife habitat impacted by the Work Items. Recommendations were provided together with the means to estimate the benefits of forest reestablishment by planting selected tree species having wildlife benefits. A summary of how habitat benefits of establishing new forest vary with site characteristics is described in Wakeley (2006). The four generalist species – Barred Owl, Fox Squirrel, Carolina Chickadee, and Pileated Woodpecker, will eventually benefit from nearly any forest establishment via succession, if tracts are $\geq$10 acres, and sufficient time is allowed for growth. Mink will use forested wetlands that are flooded >25 percent of the year, and also will benefit from the establishment of forest cover adjacent to streams or lakes, as long as streambank or shoreline vegetation is allowed to develop, or other foraging cover is provided (Wakeley 2006). Wood Ducks require mature trees with large cavities for nesting (which can be offset in mitigation sites with nest boxes), as well as proximal shallow surface water with overhead vegetation cover at least during the brood-rearing period.

Baseline HU's were calculated for each Work Item, by USACE District and by State, and for the entire MRL set of Work Items, from field data collected from 2018-2019. This information was used as the baseline for establishing the minimum amount of mitigation acres (a 1:1 replacement of habitat) needed to compensate for loss that includes both acreage and function.

Table A6-4. From Wakeley (2006), "Estimated Benefits Of Establishment Of Bottomland Hardwood Forest Under Various Management Plans."

	Increase in Average Annual Habitat Units (AAHU) per 100 Acres						
Management Plan[a]	Barred Owl	Gray Squirrel[b]	Carolina Chickadee	Pileated Woodpecker	Wood Duck	Mink	Total
				Natural Succession			
MP 1	34.35	25.95	46.8	27.00	0.00	0.00	134.1
MP 2	34.35	25.95	46.8	27.00	62.7	44.55	241.35
MP 3	34.35	25.95	46.8	27.00	62.7	55.65	252.45
				Reforestation with Hard-Mast Trees			
MP 4	34.35	47.85	46.8	27.00	0.00	0.00	156.00
MP 5	34.35	47.85	46.8	27.00	62.7	44.55	263.25
MP 6	34.35	47.85	46.8	27.00	62.7	55.65	274.35

[a] Mitigation Plan (MP) 1 and MP 4 assume that the mitigation site floods less than 25% of the year, and is not located within 328 ft of a lake or stream that contains water more than 25% of the year. Thus, habitat benefits accrue only to the generalist species.

MP 2 and MP 5 apply to sites entirely within 328 ft of a lake or stream that contains water for 6 months per year, or the site is forested wetland flooded for 6 months per year. The site is shallowly flooded during the March-to-May wood duck brood-rearing period, abundant over-water brood cover is present, and well-maintained nest boxes are provided. If adjacent to a stream or lake, the streambank or shoreline is well vegetated providing ample cover for foraging mink.

MP 3 and MP 6 apply to sites entirely within 328 ft of a lake or stream that contains surface water >9 months per year, or the site is forested wetland shallowly flooded >9 months per year. Other requirements given under MP 2 and MP 5 apply.

[b] Increase in AAHU per 100 acres were generated from Gray Squirrel in Wakeley (2007); it is assumed these values would be similar for both fox and gray squirrels.

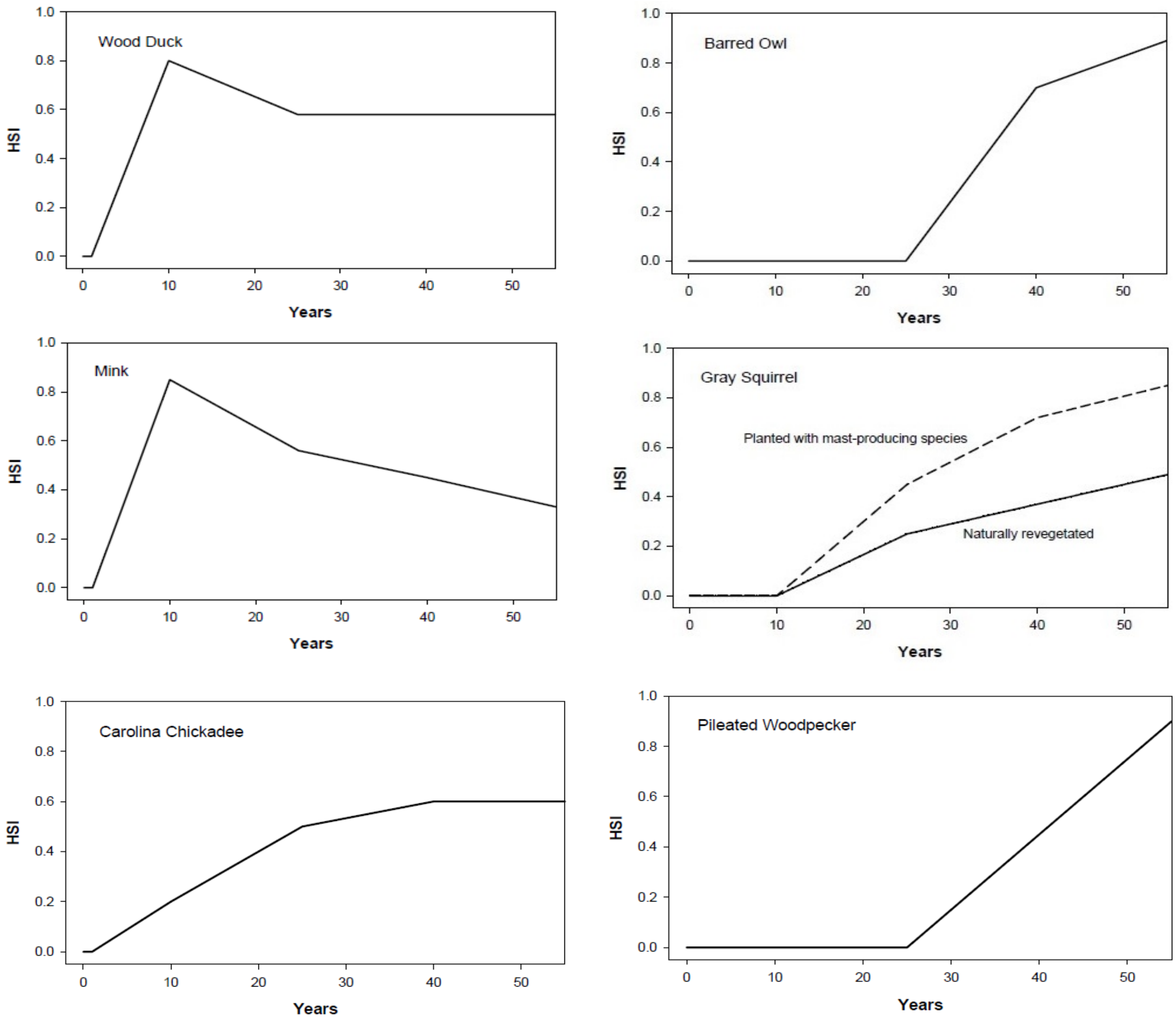

Figure A6-2. Models of habitat development for Wood Duck (upper-left), Barred Owl (upper-right), Mink (middle-left), Gray Squirrel (middle-right), Carolina Chickadee (lower-left) and Pileated Woodpecker (lower-right) following reforestation of existing cleared land (Wakeley and Marchi 1991).

A6-4 RESULTS

No significant differences ($p > 0.05$) between pre-flood and post-flood sampling periods were found for canopy closure, midstory closure, or herbaceous groundcover (Figure A6-3), suggesting no discernable impacts to habitat from extended flood inundation during the study timeframe. Anecdotal observations from HEP sampling post-flood in the Vicksburg and New Orleans Districts suggested rapid regrowth of herbaceous understory after floodwaters receded, especially dense layers of poison-ivy and in the southern-most Work Items, Chinese tallow tree (*Triadica sebifera*) sprouts. No yellowing of leaves was detected in the upper tree canopy and midstory of the forest (which would suggest tree stress and reduction in canopy foliage cover), and did not have any indication that canopy cover was significantly different from what would be expected during an average year without prolonged flooding.

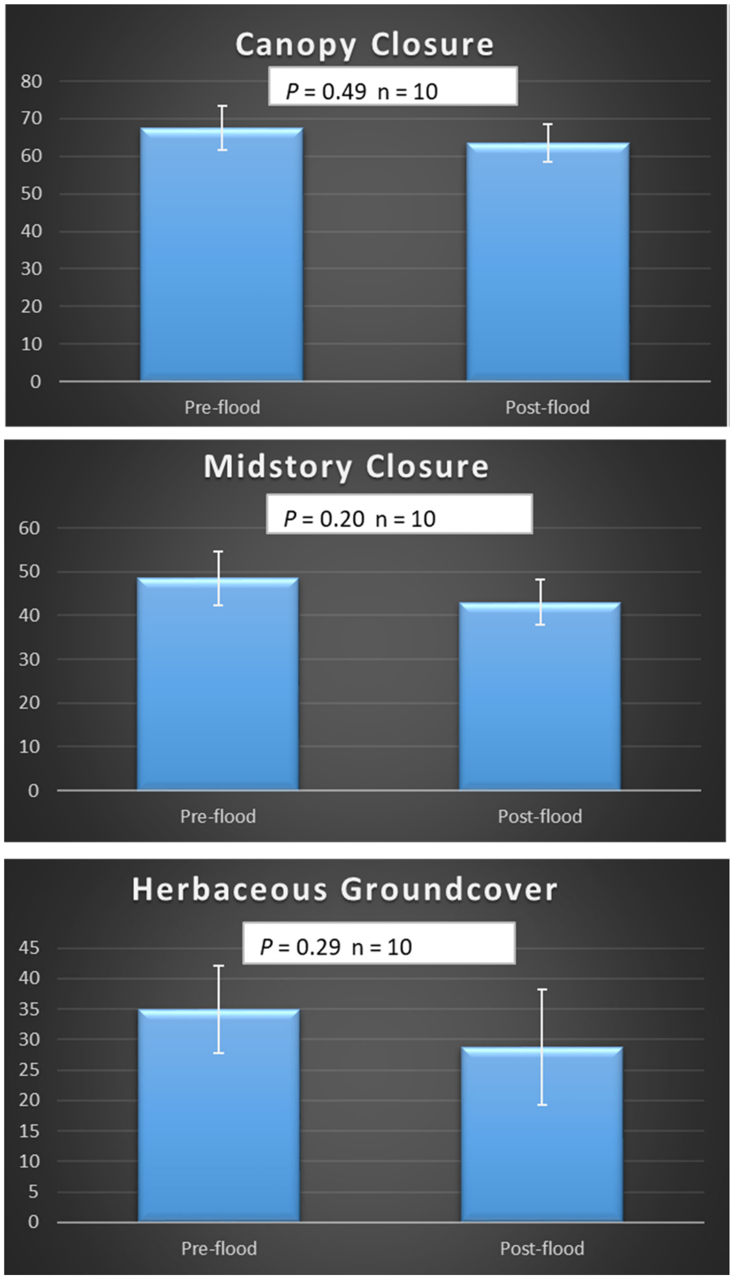

Figure A6-3. Percent canopy closure (top), midstory closure (middle), and herbaceous groundcover (bottom) at sampling plots near Marion, AR during pre-flood (October 2018) and post-flood (August 2019) conditions. Statistical comparisons for mean values of sampled plots using paired t-test.

These observations are consistent with results in Figure A6-3 and those reported for wetlands metrics by Price and Berkowitz (In Press).

This SEIS II addresses the No Action Alternative, Alternative 2 and Alternative 3 as described in greater detail in the main report. Alternative 3 (avoid and minimize) will result in 7,283 acres and Alternative 2 (traditional construction) will result in 7,203 acres impacted by the construction and operation, maintenance and repair of the Work Items, including the selection of borrow sources under the various alternatives, and the excavation of borrow material from the selected sites (Table A6-5). The MRL, cropland, and forested areas will be the primary land cover types impacted during the project. The loss of forested tracts will result in significant habitat loss for numerous BLH and floodplain forest fauna, including all of the targeted species within the HEP analyses except for mink. Of the 143 Work Items, 88 contain 789 acres of forested habitat using Alternative 3, and 107 contain 1,426 acres of forested habitat using Alternative 2 that will be impacted and require mitigation to compensate for these losses.

Riverside HSI values for the pre-project baseline suggested moderate, and in some cases high, habitat value for our focal species (Table A6-6). Riverside HSI values ranged from 0.37-0.81 for CACH, 0.55-0.82 for BADO, 0.26-0.52 for PIWO, 0.27-0.62 for FOSQ, 0.29-0.33 for WODU, and 0.44-0.77 for mink. Our Landside HSI values were lower than Riverside values for all evaluation species except FOSQ and Mink. Values ranged from 0.34-1.0 for CACH, 0.65-0.75 for BADO, 0.15-0.34 for PIWO, 0.64-0.74 for FOSQ, 0.00-0.00 for WODU, and 0.59-0.77 for Mink. Higher HSI values Landside for FOSQ were primarily influenced by proximity to agricultural fields. Available habitat in the New Orleans District differed significantly between landside and riverside as many HSUs have narrow strips of forest within the batture. Landside mink plots in New Orleans also tended to have many water features.

HSI values were higher in the Memphis District and generally decreased for HSUs further south into the New Orleans District (Table A6-6). HSI values were moderate to high for most species, with the exception of Wood Duck receiving lower scores due to low numbers of suitable tree cavities and no observed nest boxes. Wood Duck HSI scores were also low for many HSU's because of the lack of suitable brood-rearing habitat that resulted from insufficient hydrology combined with suitable cover. While the remaining species did generally exhibit higher scores, certain variables most often influenced these lower values. Carolina Chickadee was most limited by canopy height while Barred Owl was limited by average tree size of overstory trees measured at diameter at breast height (DBH). Pileated Woodpecker was most often limited by number of trees greater than 51 cm DBH, except for some HSUs that did not contain snags over 38 cm DBH, which resulted in "0" scores. Fox Squirrel was limited by canopy closure of hard mast trees and mink limited by shoreline complexity within 1 meter of water. The results from the 1998 SEIS I were also consistent with these assessments and HSI scores between the two SEIS's were generally similar (Table A6-7).

Carolina Chickadee, Barred Owl, and Fox Squirrel would be most affected by the construction and operation, maintenance and repair of the Work Items, including the selection of borrow sources under the various alternatives, and the excavation of borrow material from the selected sites, while Pileated Woodpecker and Wood Duck would experience moderate losses (Tables A6-8a-b and A6-9a-b). Mink would be the only species to benefit from the Work Items since the creation of borrow pits within the Work Items would create or enhance habitat resulting in a net gain of AAHUs (Tables A6-8a-b and A6-9a-b).

Overall, the Work Items will result in the loss of 2,280.7 HU and 3,986.5 while gaining 675.6 HU and 911.5 for a net loss of 1,605.1 HU and 3,075.1 HU when considering impacts to all six target species across all USACE districts for Alternatives 3 (avoid and minimize) and Alternative 2 (traditional construction), respectively. The Vicksburg District will experience the greatest habitat losses under Alternative 3 (367 acres, 867.0 HU; Table A6-10a; Attachment 1), followed closely by the Memphis District (303 acres, 540.3 HU; Table A6-10a, Attachment 1). Forested habitat will be impacted less in the New Orleans District (119 acres, 197.8 HU; Table A6-10a, Attachment 1).

Table A6-5. Land cover acreage and percent cover for Alternatives 2 and 3 for the Work Items according to USACE District.

District	Land Cover	**Alt. 3 (Avoid and Minimize)**		**Alt.2 (Traditional Construction)**	
		Total Acres	**Percent Cover**	**Total Acres**	**Percent Cover**
Vicksburg	Cropland	449	24.6	314	17.9
	Forested	367	20.1	490	28.0
	Levee	834	45.6	793	45.3
	Marsh	0	0.0	0	0.0
	Non-forested	7	0.4	9	0.5
	Open Water	3	0.2	4	0.2
	Pasture, Old Field	36	2.0	22	1.3
	Scrub/Shrub	126	6.9	110	6.3
	Urban	6	0.3	6	0.3
Vicksburg Total		1,829	100.0	1,749	100.0
Memphis	Cropland	1,090	40.9	665	24.9
	Forested	303	11.4	723	27.1
	Levee	1,144	42.9	1,145	42.9
	Marsh	0	0.0	0	0.0
	Non-forested	8	0.3	9	0.3
	Open Water	6	0.2	6	0.2
	Pasture, Old Field	54	2.0	53	2.0
	Scrub/Shrub	1	0.0	8	0.3
	Urban	61	2.3	62	2.3
Memphis Total		2,668	100.0	2,669	100.0
New Orleans	Cropland	230	8.3	136	4.9
	Forested	119	4.3	213	7.6
	Levee	2,123	76.2	2,123	76.2
	Marsh	13	0.5	13	0.5
	Open Water	1	0.0	1	0.0

Pasture, Old Field	87	3.1	87	3.1
Scrub/Shrub	5	0.2	5	0.2
Urban	208	7.5	208	7.5
New Orleans Total	2,786	100.0	2,786	100.0
Project Total	7,283		7,204	

Table A6-6. Habitat Suitability Index scores assigned for each target species selected to represent forest characteristics and species guild in BLH with scores assigned to individual Work Items or by complex of Work Items according to location.

	Habitat Suitability Index					
Work Item/ Complex	Carolina Chickadee	Barred Owl	Pileated Woodpecker	Fox Squirrel	Wood Duck	Mink
			Landside			
Carlisle	0.16	0.50	0.00	0.37	0.00	-
Donaldsonville	0.75	0.79	0.00	0.61	0.00	0.77
Eagle Lake	0.47	0.66	0.07	0.69	0.00	0.56
Lulling	0.55	0.94	0.54	0.47	0.00	-
Memphis North	1.00	0.75	0.34	0.64	0.00	-
MVN	0.34	0.65	0.15	0.74	0.00	0.77
Vicksburg North	0.40	0.74	0.44	0.70	0.00	
Vicksburg South	0.67	0.75	0.39	0.81	0.00	0.63
			Riverside			
Brandywine	0.97	1.00	0.88	0.42	0.03	0.83
Carlisle	0.17	0.28	0.00	0.07	0.07	0.79
Donaldson CA	0.74	0.93	0.52	0.47	0.09	0.73
Donaldsonville	0.42	0.63	0.00	0.54	0.37	0.27
Eagle Lake	0.64	0.77	0.48	0.76	0.24	0.73
Horseshoe Lake	0.59	0.70	0.32	0.46	0.50	-
Island 40	0.89	0.76	0.00	0.35	0.08	-
Lake CO	0.48	0.80	0.46	0.43	0.39	0.81
Marion	1.00	1.00	0.81	0.33	0.30	0.72
Memphis North	0.91	0.86	0.55	0.40	0.27	0.79
Midway	0.93	0.96	0.72	0.37	0.48	0.87
MVN	0.37	0.55	0.26	0.27	0.31	0.44
Vicksburg North	0.32	0.63	0.21	0.45	0.27	0.70
Vicksburg South	0.72	0.80	0.47	0.66	0.49	0.65
West Memphis	0.31	0.33	0.27	0.40	0.08	-
Whiskey Island	0.86	0.93	0.64	0.67	0.59	0.66

Table A6-7. Comparison of Baseline Habitat Suitability Index (HSI) Values for Forested Habitats between the 1998 SEIS I and this DSEIS II.

District	Evaluation Species	HSI for Riverside Hardwoods		HSI for Landside Hardwoods	
		MRL-SEIS I (1998)	MRL-SEIS II (2020)[a]	MRL-SEIS I (1998)	MRL-SEIS II (2020)[a]
Memphis	Carolina Chickadee	0.86	0.81	0.84	1.00
	Barred Owl	0.67	0.82	0.46	0.75
	Pileated Woodpecker	0.35	0.52	0.21	0.34
	Fox Squirrel	0.40	0.42	0.64	0.64
	Wood Duck	0.47	0.29	0.00	0.00
	Mink	0.58	0.77	0.00	na
Vicksburg	Carolina Chickadee	0.64	0.56	0.64	0.52
	Barred Owl	0.54	0.73	0.49	0.71
	Pileated Woodpecker	0.28	0.39	0.28	0.30
	Fox Squirrel	0.52	0.62	0.38	0.73
	Wood Duck	0.40	0.33	0.07	0.00
	Mink	0.74	0.69	0.62	0.59
New Orleans	Carolina Chickadee	0.48	0.37	NA	0.34
	Barred Owl	0.36	0.55	NA	0.65
	Pileated Woodpecker	0.00	0.26	NA	0.15
	Fox Squirrel	0.13	0.27	NA	0.74
	Wood Duck	0.00	0.31	NA	0.00
	Mink	0.67	0.44	NA	0.77

[a] Reaches or individual sampling units averaged to determine score for general comparisons between SEIS I & DSEIS II, actual HSI calculations by reach or individual Work Items used in final analyses and are not reflected in this Table. See Table A6-6 for final HSI determination.

Table A6-8a. The number of habitat units (gain/loss)[a] for Alternative 3 within each USACE District for each of the six target species for which HSI analyses were conducted to determine habitat suitability of BLH forest in the MAV.

	District			
Species	Vicksburg	Memphis	New Orleans	All Districts
Carolina Chickadee	-230.9	-282.7	-48.2	-561.8
Barred Owl	-279.6	-256.3	-79.2	-615.0
Pileated Woodpecker	-152.8	-155.1	-25.8	-333.7
Fox Squirrel	-239.3	-150.4	-78.7	-468.4
Wood Duck	-128.0	-58.3	-13.3	-199.6
Mink	+163.5	+362.5	+47.4	+573.4
Overall Change in AAHU	-867.1	-540.3	-197.8	-1,605.2

[a] Minus sign denotes a loss in AAHUs and a plus sign denotes a gain in AAHUs.

Table A6-8b. The number of habitat units (gain/loss)[a] for Alternative 2 within each USACE District for each of the six target species for which HSI analyses were conducted to determine habitat suitability of BLH forest in the MAV.

	District			
Species	Vicksburg	Memphis	New Orleans	All Districts
Carolina Chickadee	-297.2	-697.5	-86.3	-1,081.0
Barred Owl	-368.8	-583.9	-131.9	-1,084.6
Pileated Woodpecker	-196.1	-323.9	-40.6	-560.5
Fox Squirrel	-308.5	-401.3	-103.7	-813.5
Wood Duck	-175.8	-86.0	-55.4	-317.2
Mink	+238.9	+449.8	+93.1	+781.7
Overall Change in AAHU	-1,107.5	-1642.8	-324.8	-3,075.1

[a] Minus sign denotes a loss in AAHUs and a plus sign denotes a gain in AAHUs.

Under Alternative 2, the Memphis District will experience the greatest habitat losses (723 acres, 1,642.7 HU; Table A6-10b; Attachment 1), followed closely by Vicksburg District (490.2 acres, 1,107.5 HU; Table A6-10b, Attachment 1). Forested habitat will be impacted less in the New Orleans District (212.8 acres, 324.8 HU; Table A6-10b, Attachment 1). Forested habitat will be significantly reduced from creation of borrow pits, haul roads, and levee enlargements (Attachment 1). Individual Work Items and associated habitat distribution with loss of HU's are contained in Attachment 1.

By State, the greatest losses of forested habitat will occur in Louisiana as approximately 48 percent and 38 percent (380 and 541 acres) under Alternative 3 and Alternative 2, respectively (Table A6-11a-b). Arkansas, Mississippi, Missouri, and Tennessee will have moderate losses of forested habitat (65-388 acres), while Illinois will have a negligible loss of forested areas (10 and 19 acres; Table A6-11a-b) under Alternatives 3 and 2, respectively.

Mitigation

Due to similarities in the mitigation plan, USACE used the AAHU values from Wakeley (2006) generated from past mitigation planning in the MAV that could be gained by reestablishing BLH forest on a hypothetical 100 acres of existing cleared land under various management plans (Table A6-4). Benefits of different management plans were estimated for selected target years over a 50-year period of analysis using models developed by consensus of the Steele Bayou Project and Upper Yazoo Project HEP Teams (Wakeley and Marchi 1991, 1992) in the MAV. The various management plans were annualized over 50 years to be comparable with estimates of Work Item impacts. In practice, the species composition of reestablished hardwoods will depend on the existing hydrology and soil characteristics of the mitigation tract.

Using Alternative 3, approximately 90 percent of the Work Item acreage (6,494 of 7,283 acres) were not considered suitable habitat for the target species because of a lack of forested area. Using Alternative 2, approximately 80 percent of the Work Item acreage (5,777 of 7,203 acres) were not considered suitable habitat for the target species because of a lack of forested area. However, a total of 585-1,197 acres will require reforestation based on the mitigation plan that is selected using Alternative 3 (Table A6-10a). A total of 1,121-2,294 acres will require reforestation based on Alternative 2 (Table A6-10b). Therefore, the number of acres of BLH forest needed to mitigate losses to the targeted species under Alternative 3 would range between 316-647 acres, 197-403 acres, and 72-148 acres in the Vicksburg, Memphis, and New Orleans Districts, respectively (Table A6-10a). Under Alternative 2, 404-826 acres, 599-1,225 acres, and 118-135 acres in the Vicksburg, Memphis, and New Orleans Districts, respectively (Table A6-10b) would be required for mitigation of BLH. Louisiana and Arkansas would require the largest acreage of reforestation, with moderate reforestation needed for Mississippi, Missouri, and Tennessee under Alternative 3 (Table A6-11a). Louisiana and Tennessee would require the largest acreage of reforestation, with moderate reforestation needed for Arkansas, Mississippi, and Missouri under Alternative 2 (Table A6-11b). Illinois would require less reforestation using either Alternative 2 or Alternative 3 as few forested acres would be impacted in the State. Construction of the Work Items in Kentucky would not affect any of the target species as only cropland, urban areas, and the levee would be impacted.

Table A6-9a. The number of habitat units (gain/loss)[a] within each State for each of the six target species for which HSI analyses were conducted to determine habitat suitability of BLH forest in the MAV for Alternative 3.

	States						
Species	Arkansas	Illinois	Louisiana	Mississippi	Missouri	Tennessee	All States
Carolina Chickadee	-153.7	-9.2	-234.8	-44.3	-61.6	-58.3	-561.8
Barred Owl	-134.1	-8.6	-287.0	-71.8	-60.2	-53.3	-615.0
Pileated Woodpecker	-80.8	-5.5	-145.5	-33.1	-37.6	-31.2	-333.7
Fox Squirrel	-87.7	-4.0	-258.4	-59.6	-28.2	-30.5	-468.4
Wood Duck	-25.1	-2.7	-117.5	-23.8	-17.1	-13.4	-199.6
Mink	+87.1	+28.9	+167.4	+42.7	+123.2	+123.3	+572.5
Overall Change in AAHU	-394.3	-1.1	-875.8	-189.9	-81.5	-63.4	-1,606.0

Table A6-9b. The number of habitat units (gain/loss)[a] within each State for each of the six target species for which HSI analyses were conducted to determine habitat suitability of BLH forest in the MAV for Alternative 2.

	States						
Species	Arkansas	Illinois	Louisiana	Mississippi	Missouri	Tennessee	All States
Carolina Chickadee	-186.5	-17.4	-320.9	-78.1	-93.6	-384.5	-1,081.0
Barred Owl	-168.0	-16.4	-393.1	-123.7	-89.4	-293.9	-1,084.6
Pileated Woodpecker	-105.4	-10.4	-191.7	-56.9	-55.6	-140.4	-560.5
Fox Squirrel	-105.5	-7.6	-327.3	-91.1	-43.1	-239.0	-813.5
Wood Duck	-36.2	-5.2	-192.1	-47.1	-25.3	-11.2	-317.2
Mink	+124.8	+39.5	+275.2	+82.9	+165.4	+92.8	+780.5
Overall Change in AAHU	-476.8	-17.5	-1,149.9	-314	-141.6	-976.2	-3,076.3

[a] Minus sign denotes a loss in AAHUs and a plus sign denotes a gain in AAHUs

Table A6-10a. The overall loss of AAHUs as a result of the Work Items for each target species, included scenarios with/without newly created habitat for mink for Alternative 3. Mitigation acres to reforest the loss of BLH are calculated for six mitigation plans (MP). Unless otherwise denoted by (+), all values express a loss of AAHUs.

		Loss of AAHU from Impacts to Forested Habitat							Acres Needed for Mitigation Under Various Reforestation Plans					
District	Forested Acres	CACH AAHU	BADO AAHU	PIWO AAHU	FOSQ AAHU	WODU AAHU	Mink AAHU[a]	Total Combined Species AAHU	MP 1	MP 2	MP 3	MP 4	MP 5	MP 6
							Without Borrow Area Benefits to Mink							
MVK	366.9	230.9	279.6	152.8	239.3	128.0	53.1	1,083.7	808.2	449.0	429.3	694.7	411.7	395.0
MVM	303.4	282.7	256.3	155.1	150.4	58.3	31.2	934.0	696.5	387.0	370.0	598.7	354.8	340.4
MVN	118.7	48.2	79.2	25.8	78.7	13.3	17.8	262.9	196.1	108.9	104.2	168.5	99.9	95.8
Total	789.0	561.8	615.0	333.7	468.4	199.6	102.1	2,280.7	1,700.7	945.0	903.4	1,462.0	866.4	831.3
							With Borrow Area Benefits to Mink							
MVK	366.9	230.9	279.6	152.8	239.3	128.0	163.5(+)	867.0	646.6	359.3	343.5	555.8	329.4	316.1
MVM	303.4	282.7	256.3	155.1	150.4	58.3	362.5 (+)	540.3	402.9	223.9	214.0	346.3	205.2	196.9
MVN	118.7	48.2	79.2	25.8	78.7	13.3	47.4(+)	197.8	147.5	82.0	78.4	126.8	75.1	72.1
Total	789.0	561.8	615.0	333.7	468.4	199.6	573.4(+)	1,605.1	1,197.0	665.1	635.8	1,029.0	609.8	585.1

[a] Suitable forested areas for mink resulted from creation of borrow pits (i.e., permanent hydrology) that permitted forested tracts within 100 m to contribute towards positive habitat units.

Table A6-10b. The overall loss of AAHUs as result of the Work Items for each target species, included scenarios with/without newly created habitat for mink for Alternative 2. Mitigation acres to reforest the loss of BLH are calculated for six mitigation plans. Unless otherwise denoted by (+), all values express a loss of AAHUs.

		Loss of AAHU from Impacts to Forested Habitat							Acres Needed for Mitigation Under Various Reforestation Plans					
District	Forested Acres	CACH AAHU	BADO AAHU	PIWO AAHU	FOSQ AAHU	WODU AAHU	Mink AAHU[a]	Total Combined Species AAHU	MP 1	MP 2	MP 3	MP 4	MP 5	MP 6
							Without Borrow Area Benefits to Mink							
MVK	490.2	297.2	368.8	196.1	308.5	175.8	69.0	1415.4	1055.5	586.5	560.7	907.3	537.7	515.9
MVM	722.8	697.5	583.9	323.9	401.3	86.0	41.8	2134.3	1591.6	884.3	845.4	1,368.2	810.8	778.0
MVN	212.8	86.3	131.9	40.6	103.7	55.4	18.9	436.8	325.7	181.0	173.0	280.0	165.9	159.2
Total	1,425.9	1,081.0	1,084.6	560.5	813.5	317.2	129.7	3,986.5	2,972.8	1,651.8	1,579.1	2,555.5	1,514.4	1,453.1
							With Borrow Area Benefits to Mink							
MVK	490.2	297.2	368.8	196.1	308.5	175.8	238.9 (+)	1107.5	825.9	458.9	438.7	709.9	420.7	403.7
MVM	722.8	697.5	583.9	323.9	401.3	86.0	449.8 (+)	1642.7	1225.0	680.7	650.7	1,053.0	624.0	598.8
MVN	212.8	86.3	131.9	40.6	103.7	55.4	93.1 (+)	324.8	242.2	134.6	128.7	208.2	123.4	118.4
Total	1,425.9	1,081.0	1,084.6	560.5	813.5	317.2	781.7 (+)	3,075.1	2,293.1	1,274.1	1,218.1	1,971.2	1,168.1	1,120.9

[a] Suitable forested areas for mink resulted from creation of borrow pits (i.e., permanent hydrology) that permitted forested tracts within 100 m to contribute towards positive habitat units.

Table A6-11a. The overall loss of AAHUs by State, including scenarios with/without newly created habitat for mink. Mitigation acres to reforest the loss of BLH are calculated for six mitigation plans for Alternative 3. Unless otherwise denoted by (+), all values express a loss of AAHUs.

			Acres Needed for Mitigation Under Various Reforestation Plans					
State	MRL-SEIS II Forested Acres	Total Species AAHU	MP 1	MP 2	MP 3	MP4	MP 5	MP 6
			Without Borrow Area Benefits to Mink					
Arkansas	159.3	500.0	372.9	207.2	198.1	320.5	189.9	182.2
Illinois	10.0	32.9	24.5	13.6	13.0	21.1	12.5	12.0
Louisiana	380.4	1094.1	815.9	453.3	433.4	701.3	415.6	398.8
Mississippi	105.1	252.6	188.4	104.7	100.1	161.9	96.0	92.1
Missouri	69.2	207.5	154.7	86.0	82.2	133.0	78.8	75.6
Tennessee	64.9	193.5	144.3	80.2	76.6	124.0	73.5	70.5
Total	789.0	2280.7	1700.7	945.0	903.4	1462.0	866.4	831.3
			With Borrow Area Benefits to Mink					
Arkansas	159.3	394.3	294.0	163.4	156.2	252.8	149.8	143.7
Illinois	10.0	1.2	0.9	0.5	0.5	0.8	0.5	0.4
Louisiana	380.4	875.9	653.2	362.9	347.0	561.5	332.7	319.3
Mississippi	105.1	189.7	141.5	78.6	75.1	121.6	72.1	69.1
Missouri	69.2	81.5	60.8	33.8	32.3	52.2	31.0	29.7
Tennessee	64.9	63.4	47.3	26.3	25.1	40.6	24.1	23.1
Total	789.0	1,606.0	1,197.6	665.4	636.2	1029.5	610.1	585.4

Table A6-11b. The overall loss of AAHUs by State, including scenarios with/without newly created habitat for mink. Mitigation acres to reforest the loss of BLH are calculated for six mitigation plans for Alternative 2. Unless otherwise denoted by (+), all values express a loss of AAHUs.

			Acres Needed for Mitigation Under Various Reforestation Plans					
State	MRL-SEIS II Forested Acres	Total Species AAHU	MP 1	MP 2	MP 3	MP4	MP 5	MP 6
			Without Borrow Area Benefits to Mink					
Arkansas	195.2	627.1	467.7	259.9	248.4	402.0	238.2	228.6
Illinois	19.1	59.9	44.7	24.8	23.7	38.4	22.8	21.8
Louisiana	541.0	1,478.0	1,102.2	612.4	585.5	947.5	561.5	538.7
Mississippi	178.8	432.0	322.2	179.0	171.1	276.9	164.1	157.5
Missouri	103.8	319.7	238.4	132.5	126.6	204.9	121.4	116.5
Tennessee	388.0	1,069.7	797.7	443.2	423.7	685.7	406.3	389.9
Total	1,425.9	3,986.5	2,972.8	1,651.8	1,579.1	2,555.5	1,514.4	1,453.1
			With Borrow Area Benefits to Mink					
Arkansas	195.2	476.8	355.6	197.6	188.9	305.6	181.1	173.8
Illinois	19.1	17.5	13.0	7.3	6.9	11.2	6.6	6.4
Louisiana	541.0	1149.9	857.5	476.4	455.5	737.1	436.8	419.1
Mississippi	178.8	314.1	234.2	130.1	124.4	201.3	119.3	114.5
Missouri	103.8	141.6	105.6	58.7	56.1	90.8	53.8	51.6
Tennessee	388.0	976.2	728.0	404.5	386.7	625.8	370.8	355.8
Total	1,425.9	3,076.2	2,294.0	1,274.6	1,218.5	1,971.9	1,168.5	1,121.3

A6-5 DISCUSSION

Access to multiple MRL reaches along the Lower Mississippi River by USACE personnel was very difficult due to the 2019 Mississippi River flood events and also delays in obtaining the right to enter upon Work Item lands. USACE attempted to directly sample Work Item lands when feasible. However, when Work Items could not be directly sampled, USACE sampled a subset of "surrogate" State and Federal protected lands, even though these properties may support older, larger, and higher quality tracts of BLH than inaccessible Work Item reaches. The inclusion of such areas into the USACE sampling design likely influenced the results by ensuring that final estimates and conclusions needed to mitigate or restore lost habitat were conservative and errored on the side of caution. In other words, for data from these sites input into the HSI models, final estimates of areas to be restored or protected are likely to be overestimated rather than underestimated. This final point addresses the potential problems of the HEP approach as described by Williams (1988), and therefore, it was concluded that the approach used, as detailed in this report, is the best available to address potential impacts on BLH habitats and associated wildlife species within the MAV.

Flooding of the MAV in 2018 and 2019 inundated the majority of the Riverside HSUs and delayed fieldwork into the summer of 2019. Although there were some concerns about the effects of persistent floodwaters on vegetation (and hence, habitat for our evaluation species), the repeated measures of sampling at a subset of points indicated no impact on overstory canopy closure or midstory cover. In addition, it was anticipated that the persistent river flooding would significantly reduce understory cover, however vegetation responded quickly once floodwaters receded and there was no significant differences between years for this variable. This data is consistent with wetland metrics also measured during the same timeframe in the MAV by Price and Berkowitz (2020).

All of the target species will experience a loss of suitable habitat within forested areas following Work Item completion, except for Mink. Suitable forested areas for Mink were projected to increase in all districts because of the creation of borrow pits (i.e., water features that eventually will have complex shorelines) that permitted forested tracts within 100 m of the shoreline to contribute towards a total of 688 positive HUs that gives a net gain of 664.4 HUs within the Work Item areas (Table A6-6 and A6-7). The edges of borrow pits were not considered to contribute to a significant number of HUs for Wood Duck, if current construction measures maintain traditional deep-pit designs and do not incorporate shallow-water edges.

To properly mitigate for the loss of BLH, it is recommended that there be a focus on Mitigation Plan (MP) 4, 5, and/or 6 within Table A6-10 to obtain the necessary number of AAHUs to be applied for determining the acres of reforestation. Mitigation Plan 4 includes active replanting of non-forested land with mast-producing species, to include oaks and hickories, with Mitigation Plan 5 and 6 adding a component for hydrology that also benefits mink and Wood Duck. Specific tree species to be planted will depend on locations and site conditions of mitigation lands. If mitigation sites selected for reforestation are within areas projected to flood during the winter, it is recommended that tree planting follow the recommendations within Appendix 5 (Waterfowl). If areas are not expected to flood, as likely will occur for mitigation sites selected on the landside of the MRL, it is recommended that planting a diversity of tree species that are known to be beneficial to wildlife. A mixture of red and white oaks, as well as several species of hickories, will provide food resources for Fox Squirrel and many other fauna that rely on hard mast. Louisiana will lose the greatest acreage of BLH, and reforestation that continues to support other species, such as the Louisiana black bear population, will be highly beneficial. In addition to hard-mast trees, other species of trees that are prone to form cavities, such as sycamore, should be planted to benefit Wood Duck, Pileated Woodpecker, Carolina Chickadee, Barred Owls, and other cavity-nesting species. All tree plantings should include species that are native to the MAV. By incorporating a diversity of tree species into the landscape during reforestation, the long-range benefits and habitat value of this forest community will likely exceed those of the current floodplain and riverfront forest that will be impacted by construction activities within the Work Item areas.

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A6-7 ATTACHMENT 1

ATTACHMENT 1 - APPENDIX 6 (HEP)

Coordinates of plots sampled during MRL-SEIS HEP analysis

Site	Plot Number	Levee Side	Observer	Latitude	Longitude	State	USACE District
Batchelor	1	Landside	Jung/Guilfoyle	30.803483	-91.641256	Louisiana	New Orleans
Big Bend	1	Landside	Jung/Guilfoyle	31.055508	-91.583619	Louisiana	New Orleans
Big Bend	2	Landside	Jung/Guilfoyle	31.053492	-91.579531	Louisiana	New Orleans
Big Bend	3	Landside	Jung/Guilfoyle	31.049888	-91.581028	Louisiana	New Orleans
Big Bend	4	Riverside	Jung/Guilfoyle	31.048299	-91.577663	Louisiana	New Orleans
Big Bend	5	Landside	Jung/Guilfoyle	31.047078	-91.583833	Louisiana	New Orleans
Big Bend	6	Riverside	Jung/Guilfoyle	31.045523	-91.581976	Louisiana	New Orleans
Big Bend	7	Landside	Jung/Guilfoyle	31.044674	-91.586599	Louisiana	New Orleans
Big Bend	8	Riverside	Jung/Guilfoyle	31.042139	-91.585573	Louisiana	New Orleans
Big Bend	9	Landside	Jung/Guilfoyle	31.041741	-91.589499	Louisiana	New Orleans
Big Bend	10	Riverside	Jung/Guilfoyle	31.037514	-91.589964	Louisiana	New Orleans
Big Bend	11	Landside	Jung/Guilfoyle	31.038850	-91.593112	Louisiana	New Orleans
Blue Hole	1	Riverside	Fischer	36.956712	-89.121379	Missouri	Memphis
Blue Hole	2	Riverside	Fischer	36.960134	-89.123541	Missouri	Memphis
Blue Hole	3	Riverside	Fischer	36.961478	-89.124488	Missouri	Memphis
Blue Hole	4	Riverside	Fischer	36.960223	-89.126126	Missouri	Memphis
Blue Hole	5	Riverside	Fischer	36.960346	-89.129342	Missouri	Memphis
Bonnet Carre	1	Riverside	Jung/Guilfoyle	30.014224	-90.470500	Louisiana	New Orleans

Bonnet Carre	2	Riverside	Jung/Guilfoyle	30.012155	-90.470611	Louisiana	New Orleans
Bonnet Carre	3	Riverside	Jung/Guilfoyle	30.011739	-90.468303	Louisiana	New Orleans
Bonnet Carre	4	Riverside	Jung/Guilfoyle	30.005123	-90.468469	Louisiana	New Orleans
Brandywine	1	Riverside	Fischer/Jung	35.379745	-90.177415	Arkansas	Memphis
Brandywine	2	Riverside	Fischer/Jung	35.382912	-90.181301	Arkansas	Memphis
Brandywine	3	Riverside	Fischer/Jung	35.386360	-90.184912	Arkansas	Memphis
Brandywine	4	Riverside	Fischer/Jung	35.390102	-90.187757	Arkansas	Memphis
Brandywine	5	Riverside	Fischer/Jung	35.394228	-90.189779	Arkansas	Memphis
Brandywine	6	Riverside	Fischer/Jung	35.398651	-90.190407	Arkansas	Memphis
Brandywine	7	Riverside	Fischer/Jung	35.403033	-90.189338	Arkansas	Memphis
Brandywine	8	Riverside	Fischer/Jung	35.411227	-90.184844	Arkansas	Memphis
Brandywine	9	Riverside	Fischer/Jung	35.414962	-90.181721	Arkansas	Memphis
Brandywine	10	Riverside	Fischer/Jung	35.418032	-90.177769	Arkansas	Memphis
Brandywine	11	Riverside	Fischer/Jung	35.420661	-90.173322	Arkansas	Memphis
Brandywine	12	Riverside	Fischer/Jung	35.423411	-90.168885	Arkansas	Memphis
Carlisle	1	Landside	Jung/Guilfoyle	29.663270	-89.964646	Louisiana	New Orleans
Carlisle	2	Landside	Jung/Guilfoyle	29.659492	-89.964469	Louisiana	New Orleans
Carlisle	3	Riverside	Jung/Guilfoyle	29.659774	-89.962500	Louisiana	New Orleans
Carlisle	4	Landside	Jung/Guilfoyle	29.655772	-89.964844	Louisiana	New Orleans
Carlisle	5	Riverside	Jung/Guilfoyle	29.656614	-89.962357	Louisiana	New Orleans
Carlisle	6	Landside	Jung/Guilfoyle	29.651744	-89.964227	Louisiana	New Orleans
Carlisle	7	Riverside	Jung/Guilfoyle	29.652487	-89.961872	Louisiana	New Orleans
Donaldson CA	1	Riverside	Fischer	36.593511	-89.495972	Missouri	Memphis

Donaldson CA	2	Riverside	Fischer	36.595605	-89.486316	Missouri	Memphis
Donaldson CA	3	Riverside	Fischer	36.598408	-89.475933	Missouri	Memphis
Donaldson CA	4	Riverside	Jung/Thomas	36.600696	-89.465428	Missouri	Memphis
Donaldson CA	5	Riverside	Jung/Thomas	36.602140	-89.460456	Missouri	Memphis
Donaldson CA	6	Riverside	Jung/Thomas	36.603327	-89.455708	Missouri	Memphis
Donaldson CA	7	Riverside	Jung/Thomas	36.604693	-89.448721	Missouri	Memphis
Donaldsonville	1	Riverside	Jung/Guilfoyle	30.145105	-91.019227	Louisiana	New Orleans
Donaldsonville	2	Riverside	Jung/Guilfoyle	30.142801	-91.022785	Louisiana	New Orleans
Donaldsonville	3	Riverside	Jung/Guilfoyle	30.140591	-91.024735	Louisiana	New Orleans
Donaldsonville	4	Riverside	Jung/Guilfoyle	30.137617	-91.027805	Louisiana	New Orleans
Donaldsonville	5	Riverside	Jung/Guilfoyle	30.134305	-91.030274	Louisiana	New Orleans
Donaldsonville	6	Riverside	Jung/Guilfoyle	30.131389	-91.032796	Louisiana	New Orleans
Donaldsonville	7	Riverside	Jung/Guilfoyle	30.127737	-91.034611	Louisiana	New Orleans
Donaldsonville	8	Riverside	Jung/Guilfoyle	30.122381	-91.036370	Louisiana	New Orleans
Donaldsonville	9	Riverside	Jung/Guilfoyle	30.118594	-91.035550	Louisiana	New Orleans
Donaldsonville	10	Riverside	Jung/Guilfoyle	30.112868	-91.029821	Louisiana	New Orleans
Donaldsonville	11	Riverside	Jung/Guilfoyle	30.111638	-91.025420	Louisiana	New Orleans
Donaldsonville	12	Riverside	Jung/Guilfoyle	30.110553	-91.020157	Louisiana	New Orleans
Donaldsonville	13	Landside	Jung/Guilfoyle	30.107320	-91.020685	Louisiana	New Orleans
Donaldsonville	14	Landside	Jung/Guilfoyle	30.106185	-91.016222	Louisiana	New Orleans
Eagle Lake	1	Landside	Jung/Guilfoyle	32.519475	-91.071552	Mississippi	Vicksburg
Eagle Lake	2	Riverside	Jung/Guilfoyle	32.518837	-91.074174	Mississippi	Vicksburg
Eagle Lake	3	Landside	Jung/Guilfoyle	32.515849	-91.070613	Mississippi	Vicksburg

Eagle Lake	4	Landside	Jung/Guilfoyle	32.512349	-91.071503	Mississippi	Vicksburg
Eagle Lake	5	Riverside	Jung/Guilfoyle	32.511385	-91.074393	Mississippi	Vicksburg
Eagle Lake	6	Landside	Jung/Guilfoyle	32.508640	-91.072293	Mississippi	Vicksburg
Eagle Lake	7	Riverside	Jung/Guilfoyle	32.502763	-91.076005	Mississippi	Vicksburg
Eagle Lake	8	Riverside	Jung/Guilfoyle	32.495149	-91.079822	Mississippi	Vicksburg
Eagle Lake	9	Riverside	Jung/Guilfoyle	32.486963	-91.080112	Mississippi	Vicksburg
Eagle Lake	10	Landside	Jung/Guilfoyle	32.474439	-91.053094	Mississippi	Vicksburg
Eagle Lake	11	Riverside	Jung/Guilfoyle	32.467467	-91.041210	Mississippi	Vicksburg
Eagle Lake	12	Landside	Jung/Guilfoyle	32.466814	-91.025887	Mississippi	Vicksburg
Eagle Lake	13	Landside	Jung/Guilfoyle	32.467094	-91.021639	Mississippi	Vicksburg
Eagle Lake	14	Riverside	Jung/Guilfoyle	32.465540	-91.020793	Mississippi	Vicksburg
Horseshoe Lake	1	Riverside	Fischer/Jung	34.894441	-90.304081	Arkansas	Memphis
Horseshoe Lake	2	Riverside	Fischer/Jung	34.896997	-90.299539	Arkansas	Memphis
Horseshoe Lake	3	Riverside	Fischer/Jung	34.899430	-90.294943	Arkansas	Memphis
Horseshoe Lake	4	Riverside	Fischer/Jung	34.901498	-90.292020	Arkansas	Memphis
Horseshoe Lake	5	Riverside	Fischer/Jung	34.903590	-90.287213	Arkansas	Memphis
Horseshoe Lake	6	Riverside	Fischer/Jung	34.906873	-90.283508	Arkansas	Memphis
Horseshoe Lake	7	Riverside	Fischer/Jung	34.910028	-90.279628	Arkansas	Memphis
Island 40	1	Riverside	Fischer/Jung	35.267985	-90.166152	Arkansas	Memphis
Island 40	2	Riverside	Fischer/Jung	35.272342	-90.167597	Arkansas	Memphis
Island 40	3	Riverside	Fischer/Jung	35.276542	-90.169374	Arkansas	Memphis
Island 40	4	Riverside	Fischer/Jung	35.281022	-90.170203	Arkansas	Memphis
Island 40	5	Riverside	Fischer/Jung	35.285363	-90.168817	Arkansas	Memphis

Island 40	6	Riverside	Fischer/Jung	35.289800	-90.169526	Arkansas	Memphis
Island 40	7	Riverside	Fischer/Jung	35.294174	-90.168357	Arkansas	Memphis
Lake Bruin	1	Landside	Guilfoyle/Sekoni	32.006326	-91.180467	Louisiana	Vicksburg
Lake Bruin	2	Landside	Guilfoyle/Sekoni	32.005039	-91.186436	Louisiana	Vicksburg
Lake Bruin	3	Riverside	Guilfoyle/Sekoni	31.984405	-91.182653	Louisiana	Vicksburg
Lake Bruin	4	Landside	Guilfoyle/Sekoni	31.979627	-91.185554	Louisiana	Vicksburg
Lake Bruin	5	Riverside	Guilfoyle/Sekoni	31.976770	-91.184292	Louisiana	Vicksburg
Lake Bruin	6	Landside	Guilfoyle/Sekoni	31.976196	-91.188680	Louisiana	Vicksburg
Lake Bruin	7	Riverside	Guilfoyle/Sekoni	31.972373	-91.191281	Louisiana	Vicksburg
Lake Bruin	8	Riverside	Guilfoyle/Sekoni	31.964015	-91.192985	Louisiana	Vicksburg
Lake Bruin	9	Riverside	Guilfoyle/Sekoni	31.956786	-91.195168	Louisiana	Vicksburg
Lake Bruin	10	Riverside	Guilfoyle/Sekoni	31.949818	-91.198299	Louisiana	Vicksburg
Lake Bruin	11	Landside	Guilfoyle/Sekoni	31.946424	-91.203701	Louisiana	Vicksburg
Lake County	1	Riverside	Jung/Thomas	36.246465	-89.558673	Tennessee	Memphis
Lake County	2	Riverside	Jung/Thomas	36.246351	-89.554110	Tennessee	Memphis
Lake County	3	Riverside	Jung/Thomas	36.245964	-89.550685	Tennessee	Memphis
Lake County	4	Riverside	Jung/Thomas	36.244239	-89.543485	Tennessee	Memphis
Lake County	5	Riverside	Jung/Thomas	36.243822	-89.540741	Tennessee	Memphis
Lake County	6	Riverside	Jung/Thomas	36.244326	-89.537784	Tennessee	Memphis
Lake Ferguson	1	Riverside	Jung/Thomas	33.479988	-91.110122	Mississippi	Vicksburg
Lake Ferguson	2	Landside	Jung/Thomas	33.477660	-91.098502	Mississippi	Vicksburg
Lake Ferguson	3	Landside	Jung/Thomas	33.470520	-91.078720	Mississippi	Vicksburg
Lake Ferguson	4	Landside	Jung/Thomas	33.468878	-91.074370	Mississippi	Vicksburg

Lake Ferguson	5	Riverside	Jung/Thomas	33.465385	-91.073617	Mississippi	Vicksburg
Lake Ferguson	6	Landside	Jung/Thomas	33.467320	-91.070263	Mississippi	Vicksburg
Lake Ferguson	7	Riverside	Jung/Thomas	33.463445	-91.068842	Mississippi	Vicksburg
Lake Ferguson	8	Landside	Jung/Thomas	33.465880	-91.065985	Mississippi	Vicksburg
Lake Ferguson	9	Riverside	Jung/Thomas	33.453417	-91.052295	Mississippi	Vicksburg
Lake Ferguson	10	Riverside	Jung/Thomas	33.447783	-91.050129	Mississippi	Vicksburg
Lake Ferguson	11	Riverside	Jung/Thomas	33.445177	-91.050561	Mississippi	Vicksburg
Lake Lee	1	Riverside	Jung/Thomas	33.267472	-91.039357	Mississippi	Vicksburg
Lake Lee	2	Riverside	Jung/Thomas	33.264658	-91.040213	Mississippi	Vicksburg
Lake Lee	3	Riverside	Jung/Thomas	33.260543	-91.040601	Mississippi	Vicksburg
Lake Lee	4	Landside	Jung/Thomas	33.259947	-91.037798	Mississippi	Vicksburg
Lake Lee	5	Riverside	Jung/Thomas	33.257361	-91.042133	Mississippi	Vicksburg
Lake Lee	6	Riverside	Jung/Thomas	33.244202	-91.045259	Mississippi	Vicksburg
Lake Lee	7	Riverside	Jung/Thomas	33.241474	-91.048158	Mississippi	Vicksburg
Lake Lee	8	Riverside	Jung/Thomas	33.237629	-91.050990	Mississippi	Vicksburg
Lake Lee	9	Riverside	Jung/Thomas	33.237194	-91.053927	Mississippi	Vicksburg
Lake Port	1	Riverside	Jung/Thomas	33.268582	-91.153209	Arkansas	Vicksburg
Lake Port	2	Riverside	Jung/Thomas	33.257534	-91.151705	Arkansas	Vicksburg
Lake Port	3	Riverside	Jung/Thomas	33.249803	-91.148985	Arkansas	Vicksburg
Lake Port	4	Riverside	Jung/Thomas	33.242748	-91.145987	Arkansas	Vicksburg
Lake Port	5	Riverside	Jung/Thomas	33.236757	-91.141194	Arkansas	Vicksburg
Lake Port	6	Landside	Jung/Thomas	33.233106	-91.138779	Arkansas	Vicksburg
Lake Port	7	Landside	Jung/Thomas	33.230105	-91.136121	Arkansas	Vicksburg

Lake Port	8	Landside	Jung/Thomas	33.227298	-91.130392	Arkansas	Vicksburg
Lake Port	9	Riverside	Jung/Thomas	33.223683	-91.120677	Arkansas	Vicksburg
Lake Port	10	Riverside	Jung/Thomas	33.216875	-91.117325	Arkansas	Vicksburg
Lake Port	11	Landside	Jung/Thomas	33.204131	-91.109579	Arkansas	Vicksburg
Lake Port	12	Riverside	Jung/Thomas	33.197083	-91.101958	Arkansas	Vicksburg
Lake Port	13	Landside	Jung/Thomas	33.191991	-91.104495	Arkansas	Vicksburg
Lake Port	14	Landside	Jung/Thomas	33.189578	-91.104652	Arkansas	Vicksburg
Lulling	1	Landside	Jung/Guilfoyle	29.929523	-90.334775	Louisiana	New Orleans
Lulling	2	Landside	Jung/Guilfoyle	29.929542	-90.330482	Louisiana	New Orleans
Marion	1	Riverside	Fischer/Jung	35.230886	-90.102532	Arkansas	Memphis
Marion	2	Riverside	Fischer/Jung	35.226580	-90.100985	Arkansas	Memphis
Marion	3	Riverside	Fischer/Jung	35.222218	-90.099804	Arkansas	Memphis
Marion	4	Riverside	Fischer/Jung	35.217846	-90.101009	Arkansas	Memphis
Marion	5	Riverside	Fischer/Jung	35.213569	-90.102708	Arkansas	Memphis
Marion	6	Riverside	Fischer/Jung	35.209937	-90.105912	Arkansas	Memphis
Marion	7	Riverside	Fischer/Jung	35.206831	-90.109954	Arkansas	Memphis
Midway	1	Riverside	Fischer/Jung	34.859323	-90.362280	Arkansas	Memphis
Midway	2	Riverside	Fischer/Jung	34.859754	-90.364488	Arkansas	Memphis
Midway	3	Riverside	Fischer/Jung	34.858381	-90.369738	Arkansas	Memphis
Midway	4	Riverside	Fischer/Jung	34.857260	-90.374734	Arkansas	Memphis
Midway	5	Riverside	Fischer/Jung	34.856431	-90.380197	Arkansas	Memphis
Midway	6	Riverside	Fischer/Jung	34.855559	-90.385622	Arkansas	Memphis
Midway	7	Riverside	Fischer/Jung	34.854169	-90.390874	Arkansas	Memphis

Midway	8	Riverside	Fischer/Jung	34.852657	-90.396311	Arkansas	Memphis
Midway	9	Riverside	Fischer/Jung	34.851330	-90.401512	Arkansas	Memphis
Midway	10	Riverside	Fischer/Jung	34.850696	-90.406998	Arkansas	Memphis
Midway	11	Riverside	Fischer/Jung	34.849810	-90.412178	Arkansas	Memphis
Midway	12	Riverside	Fischer/Jung	34.850891	-90.417238	Arkansas	Memphis
Midway	13	Riverside	Fischer/Jung	34.878230	-90.432835	Arkansas	Memphis
Midway	14	Riverside	Fischer/Jung	34.882345	-90.435128	Arkansas	Memphis
Moss Island WMA	1	Landside	Guilfoyle/Sekoni	35.938919	-89.622016	Tennessee	Memphis
Moss Island WMA	2	Landside	Guilfoyle/Sekoni	35.941937	-89.624558	Tennessee	Memphis
Moss Island WMA	3	Landside	Guilfoyle/Sekoni	35.945334	-89.627231	Tennessee	Memphis
Moss Island WMA	4	Landside	Guilfoyle/Sekoni	35.948514	-89.630161	Tennessee	Memphis
Moss Island WMA	5	Landside	Guilfoyle/Sekoni	35.959592	-89.628612	Tennessee	Memphis
Moss Island WMA	6	Landside	Guilfoyle/Sekoni	35.960639	-89.627363	Tennessee	Memphis
Moss Island WMA	7	Landside	Guilfoyle/Sekoni	35.962024	-89.624131	Tennessee	Memphis
Moss Island WMA	8	Landside	Guilfoyle/Sekoni	35.963642	-89.620341	Tennessee	Memphis
Newellton	1	Riverside	Guilfoyle/Sekoni	32.138565	-91.173717	Louisiana	Vicksburg
Newellton	2	Riverside	Guilfoyle/Sekoni	32.128867	-91.172976	Louisiana	Vicksburg
Newellton	3	Landside	Guilfoyle/Sekoni	32.124566	-91.178688	Louisiana	Vicksburg
Newellton	4	Riverside	Guilfoyle/Sekoni	32.122243	-91.174503	Louisiana	Vicksburg
Newellton	5	Landside	Guilfoyle/Sekoni	32.119481	-91.175594	Louisiana	Vicksburg
Newellton	6	Landside	Guilfoyle/Sekoni	32.100396	-91.168266	Louisiana	Vicksburg
Newellton	7	Riverside	Guilfoyle/Sekoni	32.099202	-91.167257	Louisiana	Vicksburg
Newellton	8	Riverside	Guilfoyle/Sekoni	32.076415	-91.177525	Louisiana	Vicksburg

Newellton	9	Landside	Guilfoyle/Sekoni	32.051971	-91.179964	Louisiana	Vicksburg
Newellton	10	Landside	Guilfoyle/Sekoni	32.045089	-91.179163	Louisiana	Vicksburg
Newellton	11	Landside	Guilfoyle/Sekoni	32.042823	-91.176608	Louisiana	Vicksburg
Newellton	12	Riverside	Guilfoyle/Sekoni	32.043335	-91.175179	Louisiana	Vicksburg
Newellton	13	Landside	Guilfoyle/Sekoni	32.038345	-91.174663	Louisiana	Vicksburg
Newellton	14	Riverside	Guilfoyle/Sekoni	32.037545	-91.160312	Louisiana	Vicksburg
Phoenix	1	Landside	Jung/Guilfoyle	29.617330	-89.910419	Louisiana	New Orleans
Phoenix	2	Riverside	Jung/Guilfoyle	29.618384	-89.909088	Louisiana	New Orleans
Phoenix	3	Landside	Jung/Guilfoyle	29.615391	-89.906675	Louisiana	New Orleans
Phoenix	4	Riverside	Jung/Guilfoyle	29.616522	-89.905704	Louisiana	New Orleans
Phoenix	5	Landside	Jung/Guilfoyle	29.613488	-89.902670	Louisiana	New Orleans
Phoenix	6	Riverside	Jung/Guilfoyle	29.614810	-89.902007	Louisiana	New Orleans
Phoenix	7	Landside	Jung/Guilfoyle	29.611848	-89.898606	Louisiana	New Orleans
Phoenix	8	Landside	Jung/Guilfoyle	29.610038	-89.894560	Louisiana	New Orleans
Phoenix	9	Landside	Jung/Guilfoyle	29.608227	-89.890514	Louisiana	New Orleans
Phoenix	10	Riverside	Jung/Guilfoyle	29.609496	-89.889724	Louisiana	New Orleans
Phoenix	11	Landside	Jung/Guilfoyle	29.606582	-89.886350	Louisiana	New Orleans
Phoenix	12	Riverside	Jung/Guilfoyle	29.607845	-89.885381	Louisiana	New Orleans
Seven Island CA	1	Riverside	Fischer	36.613848	-89.286067	Missouri	Memphis
Seven Island CA	2	Riverside	Fischer	36.611618	-89.282502	Missouri	Memphis
Seven Island CA	3	Riverside	Fischer	36.609496	-89.278940	Missouri	Memphis
Seven Island CA	4	Riverside	Fischer	36.607440	-89.275257	Missouri	Memphis
Seven Island CA	5	Riverside	Fischer	36.605375	-89.27153	Missouri	Memphis

Seven Island CA	6	Riverside	Jung/Thomas	36.596999	-89.257365	Missouri	Memphis
Seven Island CA	7	Riverside	Jung/Thomas	36.593836	-89.260430	Missouri	Memphis
Seven Island CA	8	Riverside	Jung/Thomas	36.590855	-89.264493	Missouri	Memphis
Seven Island CA	9	Riverside	Jung/Thomas	36.589468	-89.260282	Missouri	Memphis
Seven Island CA	10	Riverside	Jung/Thomas	36.589379	-89.256214	Missouri	Memphis
Seven Island CA	11	Riverside	Jung/Thomas	36.587225	-89.253440	Missouri	Memphis
Shelby County	1	Landside	Guilfoyle/Sekoni	35.029716	-90.174616	Tennessee	Memphis
Shelby County	2	Landside	Guilfoyle/Sekoni	35.020714	-90.178340	Tennessee	Memphis
Shelby County	3	Landside	Guilfoyle/Sekoni	35.013881	-90.181599	Tennessee	Memphis
Shelby County	4	Riverside	Guilfoyle/Sekoni	35.011268	-90.166904	Tennessee	Memphis
Shelby County	5	Landside	Guilfoyle/Sekoni	35.014098	-90.149571	Tennessee	Memphis
Shelby County	6	Riverside	Guilfoyle/Sekoni	35.011570	-90.144946	Tennessee	Memphis
Shelby County	7	Riverside	Guilfoyle/Sekoni	35.012738	-90.138614	Tennessee	Memphis
Smithfield	1	Riverside	Jung/Guilfoyle	30.554966	-91.285382	Louisiana	New Orleans
Smithfield	2	Riverside	Jung/Guilfoyle	30.545244	-91.290214	Louisiana	New Orleans
Smithfield	3	Riverside	Jung/Guilfoyle	30.541992	-91.290551	Louisiana	New Orleans
Smithfield	4	Riverside	Jung/Guilfoyle	30.524883	-91.293264	Louisiana	New Orleans
Smithfield	5	Riverside	Jung/Guilfoyle	30.523301	-91.292964	Louisiana	New Orleans
Waterproof	1	Riverside	Guilfoyle/Sekoni	31.880726	-91.266225	Louisiana	Vicksburg
Waterproof	2	Landside	Guilfoyle/Sekoni	31.882807	-91.276471	Louisiana	Vicksburg
Waterproof	3	Landside	Guilfoyle/Sekoni	31.884151	-91.285027	Louisiana	Vicksburg
Waterproof	4	Riverside	Guilfoyle/Sekoni	31.883981	-91.293132	Louisiana	Vicksburg
Waterproof	5	Landside	Guilfoyle/Sekoni	31.885678	-91.29423	Louisiana	Vicksburg

Waterproof	6	Landside	Guilfoyle/Sekoni	31.885762	-91.303353	Louisiana	Vicksburg
Waterproof	7	Riverside	Guilfoyle/Sekoni	31.882117	-91.321483	Louisiana	Vicksburg
Waterproof	8	Riverside	Guilfoyle/Sekoni	31.868139	-91.343285	Louisiana	Vicksburg
Waterproof	9	Riverside	Guilfoyle/Sekoni	31.843902	-91.351448	Louisiana	Vicksburg
Waterproof	10	Landside	Guilfoyle/Sekoni	31.831545	-91.358351	Louisiana	Vicksburg
Waterproof	11	Landside	Guilfoyle/Sekoni	31.828444	-91.359757	Louisiana	Vicksburg
West Memphis	1	Riverside	Fischer/Jung	35.097146	-90.188433	Arkansas	Memphis
West Memphis	2	Riverside	Fischer/Jung	35.092945	-90.189492	Arkansas	Memphis
West Memphis	3	Riverside	Fischer/Jung	35.088484	-90.190183	Arkansas	Memphis
West Memphis	4	Riverside	Fischer/Jung	35.084384	-90.190708	Arkansas	Memphis
West Memphis	5	Riverside	Fischer/Jung	35.080019	-90.192066	Arkansas	Memphis
West Memphis	6	Riverside	Fischer/Jung	35.076058	-90.194558	Arkansas	Memphis
Whiskey Island	1	Riverside	Fischer/Jung	34.780451	-90.549744	Arkansas	Memphis
Whiskey Island	2	Riverside	Fischer/Jung	34.776112	-90.548918	Arkansas	Memphis
Whiskey Island	3	Riverside	Fischer/Jung	34.771698	-90.547981	Arkansas	Memphis
Whiskey Island	4	Riverside	Fischer/Jung	34.767655	-90.545581	Arkansas	Memphis
Whiskey Island	5	Riverside	Fischer/Jung	34.763788	-90.543393	Arkansas	Memphis
Whiskey Island	6	Riverside	Fischer/Jung	34.759460	-90.544654	Arkansas	Memphis
Whiskey Island	7	Riverside	Fischer/Jung	34.755278	-90.550320	Arkansas	Memphis
Whiskey Island	8	Riverside	Fischer/Jung	34.747411	-90.563752	Arkansas	Memphis
White Lake Refuge	1	Landside	Guilfoyle/Sekoni	36.111714	-89.572118	Tennessee	Memphis
White Lake Refuge	2	Landside	Guilfoyle/Sekoni	36.115110	-89.569760	Tennessee	Memphis
White Lake Refuge	3	Landside	Guilfoyle/Sekoni	36.117867	-89.564672	Tennessee	Memphis

White Lake Refuge	4	Landside	Guilfoyle/Sekoni	36.116032	-89.562642	Tennessee	Memphis
White Lake Refuge	5	Landside	Guilfoyle/Sekoni	36.120677	-89.538537	Tennessee	Memphis
White Lake Refuge	6	Landside	Guilfoyle/Sekoni	36.118938	-89.534728	Tennessee	Memphis
White Lake Refuge	7	Landside	Jung/Thomas	36.117230	-89.531308	Tennessee	Memphis
White Lake Refuge	8	Landside	Jung/Thomas	36.115822	-89.527897	Tennessee	Memphis

U.S. Fish and Wildlife memo for modification of Black-capped Chickadee HSI model for the Carolina Chickadee

SEP-30-1997 16:55 Geo-Marine, Inc. 504 926 1040 P.02/05

United States Department of the Interior
FISH AND WILDLIFE SERVICE
NATIONAL ECOLOGY RESEARCH CENTER
4512 McMurray Avenue
Fort Collins, Colorado 80525-3500

TAKE PRIDE IN AMERICA

In Reply Refer To:
FWS/Region 8/NERC

October 29, 1989

REMS: 120.1

Memorandum

To: Robert Barkley, Fish and Wildlife Enhancement, Vicksburg, MS

From: Bubba Farmer, Resource Evaluation and Modeling Section, National Ecology Research Center, Fort Collins, CO.

Subject: Application Guidance and Modifications of HSI Models for the Yazoo River Project

The following guidance for modification of the mink, Carolina chickadee, and pileated woodpecker Habitat Suitability Index (HSI) models were provided by Art Allen and Rick Schroeder.

Two problems were identified in relation to the mink HSI model: 1) the distance in which the model is applied around palustrine or lacustrine cover types subject to water level fluctuations; and 2) the distance that shoreline cover is measured adjacent to riverine and lacustrine cover types.

Sampling to determine vegetative canopy cover adjacent to palustrine cover types should be initiated at the interface of the wetland cover type and the vegetative type (non-wetland) bordering the wetland. In situations where water defines the edge of the wetland and no palustrine emergent, shrub or forested cover types are present measurements should be initiated at the water's edge. Depending upon the season, water levels may be low resulting in exposed mud flats within palustrine cover types. Assuming that such low water periods are normal seasonal fluctuations, measurements still should be made outward from the edge of the wetland, not at the edge of the water.

The habitat variable "Percent shoreline cover" is intended to characterize cover quality within what would typically be considered the shoreline zone. The mink model was developed based on studies from relatively small streams/rivers and palustrine cover types. For much larger rivers (e.g., Mississippi, Yazoo) a larger shoreline zone is appropriate. I suggest that you modify the variable definition and sampling scheme to reflect conditions in unchannelized segments of larger, local rivers (e.g., 5 m). Measurements to define the shoreline zone should be started at the water's edge and extend only to the top of the bank margin of the cover type immediately adjacent to the river.

Rick Schroeder reviewed the Carolina chickadee model and recommends that be used in its present form. Rick has been involved in a test of the capped chickadee HSI model, and believes that what he has learned could to modify the Carolina chickadee model. Suggested variables and model structure are as follows:

Food SI - food is provided by arthropods whose abundance and biomass are correlated to the volume of foliage in the tree canopy. Tree foliage volume can be assessed by a combined measure of tree canopy cover and tree height.

SIV1 - % Tree canopy cover - begin at 0,0 and linear to 70% (or greater) for a 1.0 SI.

SIV2 - Average height of trees - begin at 5 meters and 0.0 SI, and linear to 25 meters (or greater) for a 1.0 SI.

Food SI = (SIV1 * SIV2) (no mean, just multiply the two)

Nest SI - nest sites are provided by both snags and cavities on limbs of live trees. Minimum diameters are 10 cm.

SIV3 - Combined number of trees with ≥ 1 cavity (>10 cm dia.) and number of snags > 10 cm dbh, per hectare - begin at 0,0 and linear to 5 per ha for an SI of 1.0.

HSI = lower of food or nest SI values.

In reference to the pileated woodpecker model, there was concern related to whether an SI of 1.0 at 30 large trees (≥51 cm) per ha was reasonable. Rick Schroeder investigated the data set from the White River NWR and found that this range does appear reasonable. For example, mature stands of sugarberry, elm, and ash contained 33.4 such trees per ha, and stands of oak-hickory contained 27 per ha.

Please contact me, or my staff, if we can be of further assistance.

Library: C:YAZOO.HLB
7-2-1990

Single covertype model.

Model # 7
Model name: CAROLINA CHICKADEE (MODIFIED2)
Verification level: None
Creation/modification date: 7-2-1990

Schroeder, Rick. 1989. In letter from Bubba Farmer to Robert Barkley.
Letter developed for Yazoo River Study.

Covertypes:
PFO : Palustrine forested wetland
UFOD : Deciduous Forest
UTSD : Deciduous tree savanna

```
Lev 4     Lev 3    Lev 2    Lev 1
 VCVTR01--grf------usf------min--HSI
 JHTAL01--grf-------^        |
 JDNSN02--usf------grf-------^
 J150V1----^
```

Habitat variables:
J150V1 :Density of trees with >=1 cavity with diam. of hole or branch >3.94in
JDNSN02 : Density of snags that >3.94in. DBH (#/ac)
JHTAL01 : The average height of all trees (ft)
VCVTR01 : Percent canopy cover of trees (%)

GRAPH FUNCTION at level 3, position 1
Title: % TREE CANOPY COVER
X: 0.000, Y: 0.000
X: 70.000, Y: 1.000
X: 100.000, Y: 1.000

GRAPH FUNCTION at level 3, position 2
Title: AVERAGE TREE HEIGHT (FT)
X: 0.000, Y: 0.000
X: 16.250, Y: 0.000
X: 81.250, Y: 1.000
X: 162.500, Y: 1.000

USER-SPECIFIED FUNCTION at level 3, position 3
USUB = X(1) + X(2)

USER-SPECIFIED FUNCTION at level 2, position 1
USUB = X(1) * X(2)

GRAPH FUNCTION at level 2, position 2
Title: COMBINED SNAGS & TREES WITH CAVITIES/AC

X:	0.000,	Y:	0.000
X:	2.020,	Y:	1.000
X:	5.000,	Y:	1.000

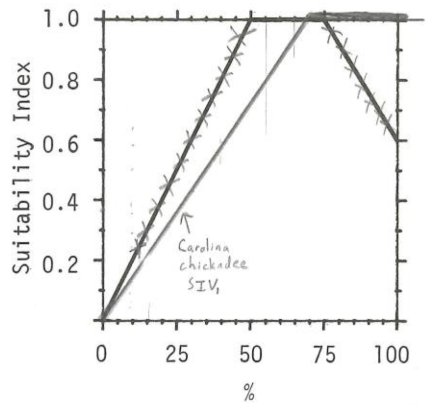
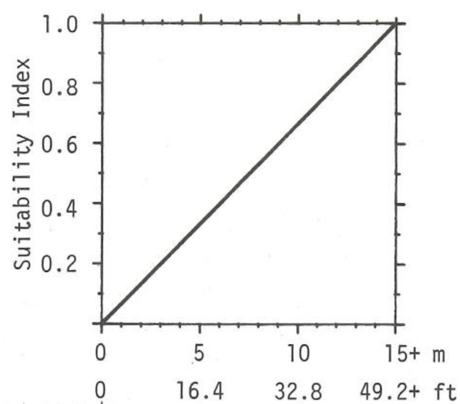
Comments:
USF AT LEVEL 3, POSITION 3:
ALLOWS FOR THE COMBINATION OF SNAGS/ac AND CAVITIES/ac, WHICH YIELDS THE NUMBER OF NEST SITES.
USF AT LEVEL 2, PSOTION 1:
ALLOWS FOR THE COMBINATION OF % TREE CANOPY COVER AND AVG. TREE HT, WHICH YEILDS THE VOLUME OF TREE FOLIAGE.

TOTAL P.05

Note the annotated Carolina chickadee revisions per USFWS 1989 Memo.

Model Relationships

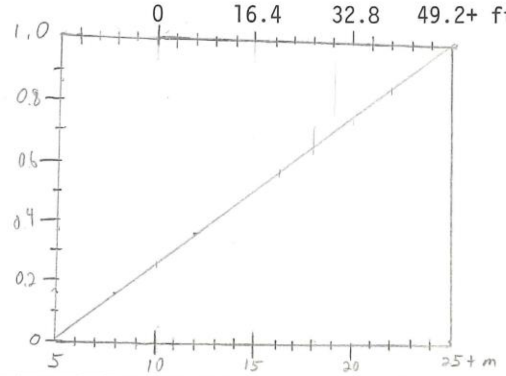
Suitability Index (SI) graphs for habitat variables. This section contains SI graphs that illustrate the habitat relationships described in the previous section.

Cover type	Variable		Suitability graph
DF, EF, DFW, EFW	V_1	Percent tree canopy closure.	
DF, EF, DFW, EFW	~~V_2~~	Average height of overstory trees.	

SIV_1 = Carolina Chickadee modified model is in pencil.

From: Schroeder, R. 1989. In Letter from Bubba Farmer to Robert Barkley. Letter developed for Yazoo River Study.

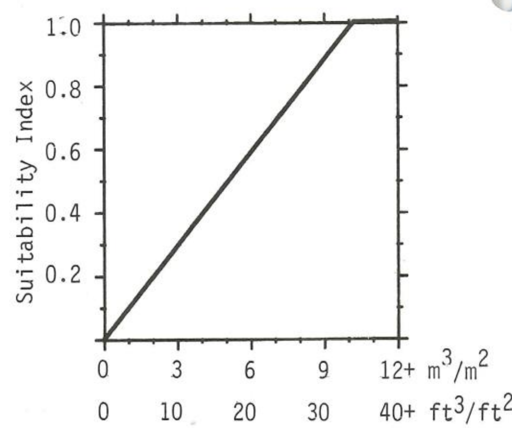
SIV_2 = Carolina Chickadee →



7

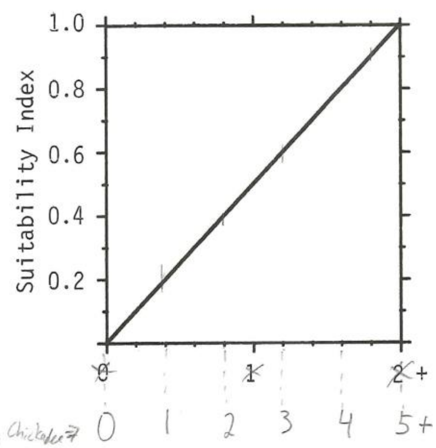
Not used for Carolina Chickadee

DF,EF, DFW,EFW — V_3 — Tree canopy volume/area of ground surface.



DF,EF, DFW,EFW — ~~V_4~~ — ~~Number of snags 10 to 25 cm dbh/0.4 ha (4 to 10 inches dbh/1.0 acre).~~

SIV3 = Carolina Chickadee Variable V_3 = Combined # of trees with ≥ 1 cavity (>10cm dbh) & # of snags >10cm dbh/ha → Carolina Chickadee #



Equations. In order to determine life requisite values for the black-capped chickadee, the SI values for appropriate variables must be combined through the use of equations. A discussion and explanation of the assumed relationships between variables was included under Model Description, and the specific equations in this model were chosen to mimic these perceived biological relationships as closely as possible. The suggested equations for obtaining food and reproduction values are presented below.

Carolina chickadee ⇒

Life Requisite	Cover Type	Equation
Food	"	$(V_1 \times V_2)$ ---> No square root, just multiply the two
Reproduction	"	V_3

Life requisite	Cover type	Equation
Food	DF,EF,DFW,EFW	$(V_1 \times V_2)^{1/2}$ or V_3 (See page 5 for discussion on which to use)
Reproduction	DF,EF,DFW,EFW	V_4

Carolina chickadee ⇒ HSI determination. The HSI for the black-capped chickadee is equal to the lowest life requisite value. → Same for Carolina chickadee (lower life requisite value)

Application of the Model

Definitions of variables and suggested field measurement techniques (from Hays et al. 1981, unless otherwise noted) are provided in Figure 3.

Variable (definition)		Cover types	Suggested technique
V_1	Percent tree canopy closure [the percent of the ground surface that is shaded by a vertical projection of the canopies of all woody vegetation taller than 5.0 m (16.5 ft)].	DF,EF,DFW,EFW	Line intercept
V_2	Average height of overstory trees (the average height from the ground surface to the top of those trees which are ≥ 80 percent of the height of the tallest tree in the stand).	DF,EF,DFW,EFW	Graduated rod, trigonometric hypsometry
V_3	Tree canopy volume/area of ground surface (the sum of the volume of the canopies of each tree sampled divided by the total area sampled).	DF,EF,DFW,EFW	Quadrat and refer to Figure 2 on page 6

Figure 3. Definitions of variables and suggested measurement techniques.

Maps and descriptions for assignment of individual HSU's or sampling complexes to determine HSI scores applied to MRL Work Items.

New Orleans District-Individual Sampling Locations

Levee Side: Landside

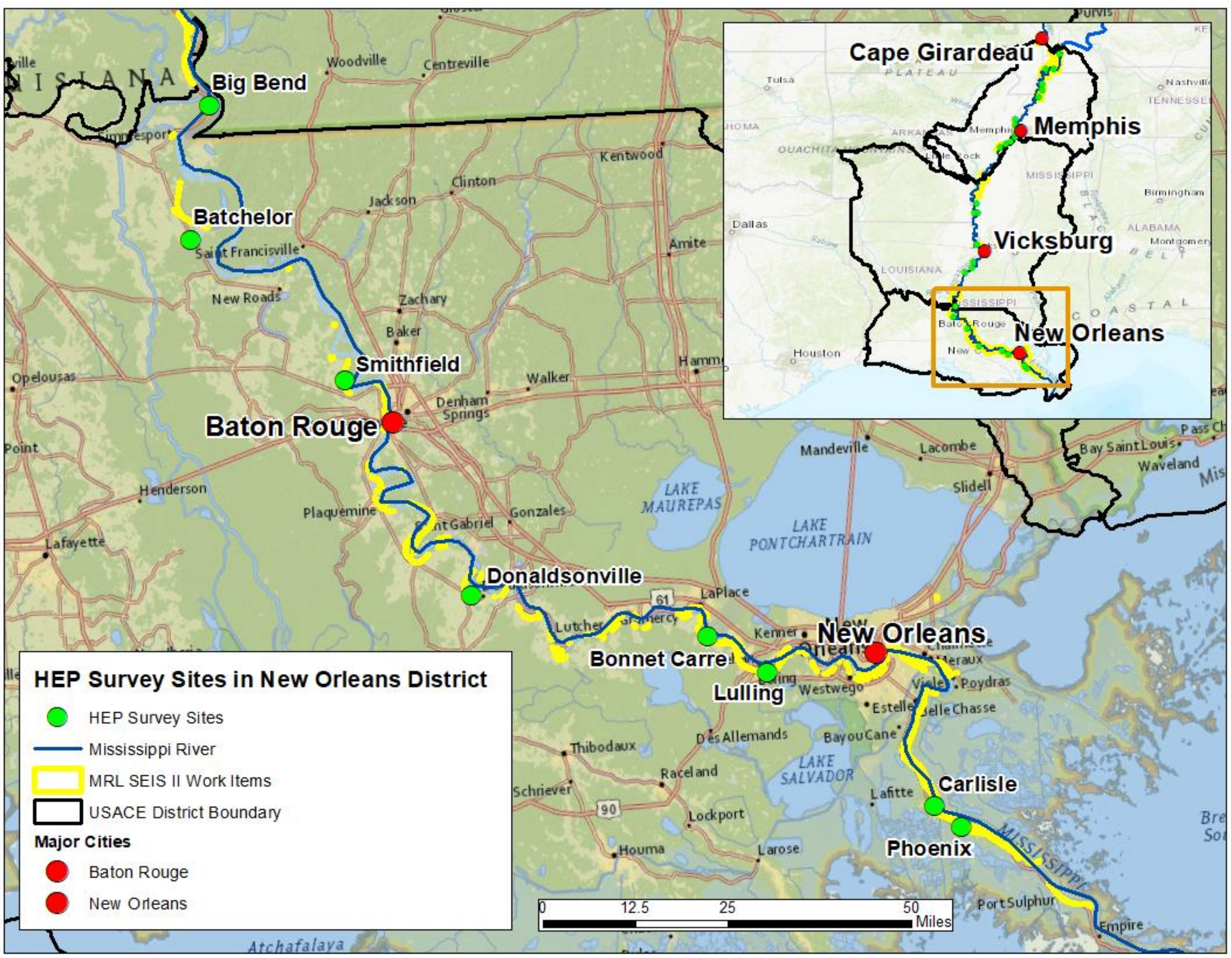
Sampling Locations and Work Items (WI): Carlisle (WI 61.5-R); Donaldsonville (WI 180-R); Lulling (WI 119.2-R)

New Orleans District-MVN Complex

Levee Side: Landside and Riverside

Sampling Locations: Big Bend, Batchelor, Smithfield, Donaldsonville, Bonnet Carre, Lulling, Carlisle, Phoenix

Work Items: 47.5-R, 51-L, 52.5-R, 58-R, 67-L, 67-R, 84.3-R, 86.1-L, 88.5-L, 88-R, 90-L, 90.8-L, 91-L, 91.2-L, 98.7-L, 109.6-R, 113.5-R, 115-L, 117.3-R, 124.3-R, 131.7-R, 135.7-R, 136-L, 142-R, 143.7-R, 149-R, 152-L, 154-L, 156-R, 156.8-L, 158-R, 159.7-R, 163.5-R, 173.9-R, 199-L, 208-L, 231-R, 242.5-R, 246-R, 253-R, 268-R, 293.5-R

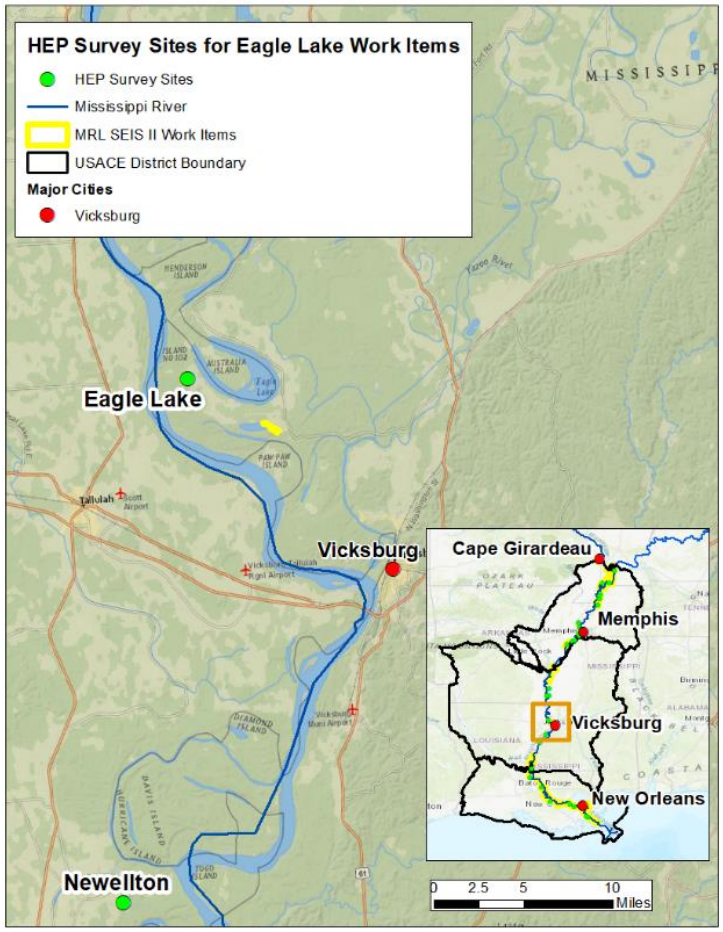


Vicksburg District- Individual Sampling Locations

Levee Side: Landside and Riverside

Sampling Locations: Eagle Lake

Work Items: 443-L

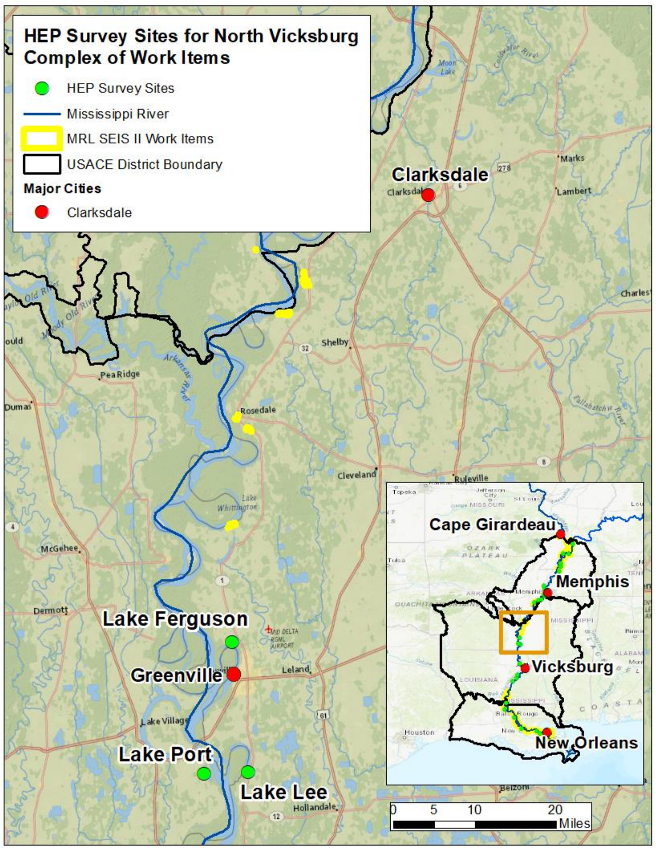


Vicksburg District- Vicksburg South Complex

Levee Side: Landside and Riverside

Sampling Locations: Newellton, Lake Bruin, Waterproof, Big Bend

Work Items: 304-R, 312.5-R, 320-R, 326-R, 330-R, 333-R, 337-R, 340-R, 341-R, 345-R, 348-R, 351-R

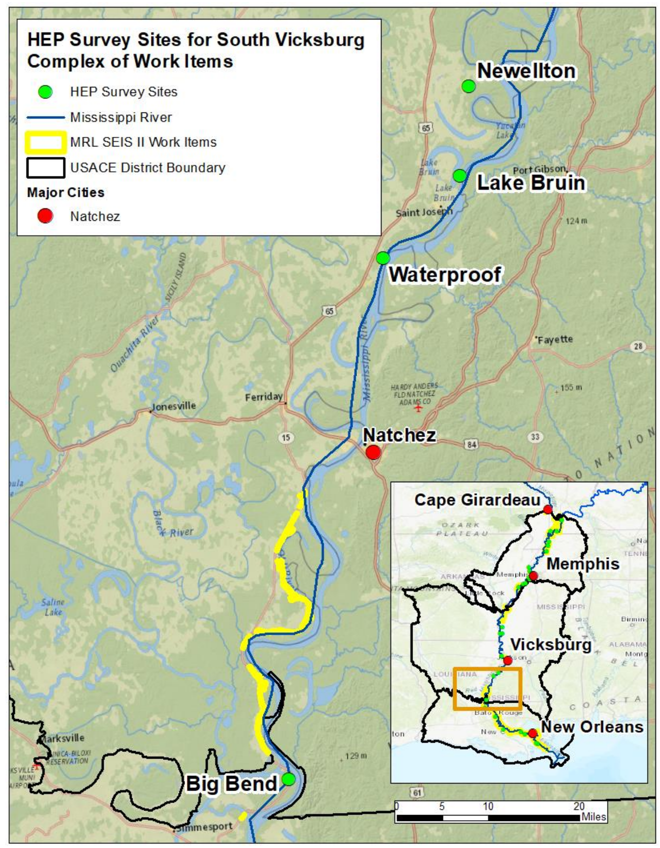


Vicksburg District-Vicksburg North Complex

Levee Side: Landside and Riverside

Sampling Locations: Lake Ferguson, Lake Port, Lake Lee

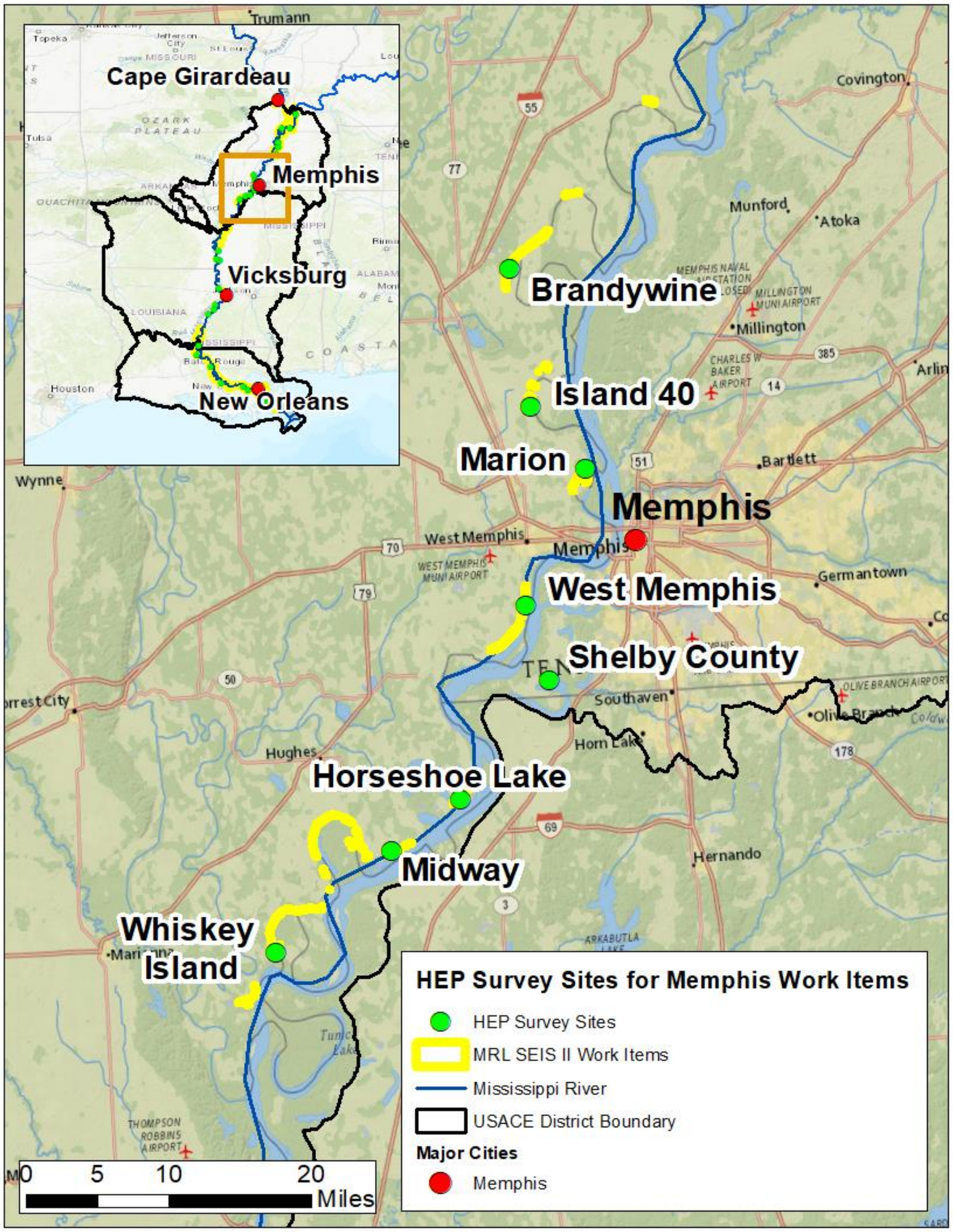
Work Items: 577-L, 587-L, 611-L



Memphis District- Individual Sampling Locations

Levee Side: Riverside

Sampling Locations and Work Items (WI): Whiskey Island (WI 682-R); Midway (693-R, 697-R); Marion (WI 741-R); Island 40 (WI 747-R); Brandywine (WI 762-R, 766-R); Donaldsonville CA (WI 915-R); Lake County (WI 848-L)



Memphis District- Memphis North Landside Complex

Levee Side: Landside

Sampling Locations: Moss Island WMA, Shelby County, White Lake Refuge

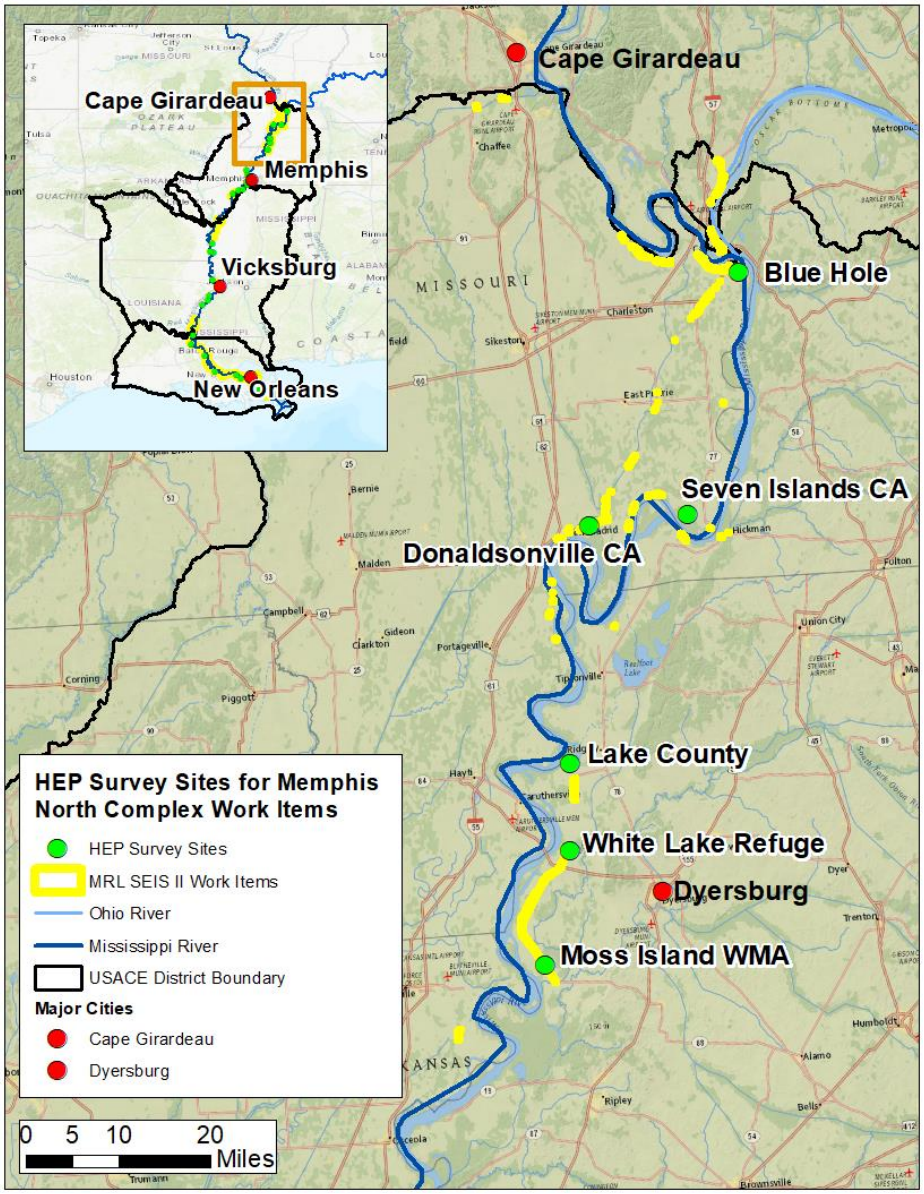
Work Items: 723-R, 726-R, 754-R, 832-L

Memphis District-Memphis North Riverside Complex

Levee Side: Riverside

Sampling Locations: Lake County, Blue Hole, Donaldsonville Conservation Area (CA) Seven Islands CA

Work Items: 22-R, 29-R, 49-R, 807-R, 832-L, 877-R, 882-R, 882-R, 915-R, 920-R, 947-R, 955-R, 956-R, 958-R, 961-R, 962.5-R, 965-R



Impacts to acreage and total AAHU's for all target species of BLH by MRL-Work Item ID within the Vicksburg District.

	Traditional			Avoid-Minimize		
MRL Levee Work Item	Land Cover	Total Acres	Total AAHU of Combined Target Species	Land Cover	Total Acres	Total AAHU of Combined Target Species
320-R	Cropland	6.3	0.0	Cropland	6.3	0.0
	Forested	71.2	223.2	Forested	71.2	223.2
	Levee	80.5	0.0	Levee	80.5	0.0
	Open Water	1.6	0.0	Open Water	1.6	0.0
	Scrub/Shrub	0.2	0.0	Scrub/Shrub	0.2	0.0
320-R Total		159.8	223.2		159.8	223.2
326-R	Cropland	11.3	0.0	Cropland	11.3	0.0
	Forested	97.6	304.4	Forested	97.6	304.4
	Levee	117.3	0.0	Levee	117.3	0.0
	Non-forested Wetland	0.2	0.0	Non-forested Wetland	0.2	0.0
	Open Water	0.5	0.0	Open Water	0.5	0.0
	Pasture, Old Field	3.8	0.0	Pasture, Old Field	3.8	0.0
326-R Total		230.7	304.4		230.7	304.4
330-R	Forested	37.6	137.5	Forested	37.6	137.5
	Levee	42.3	0.0	Levee	42.3	0.0
	Non-forested Wetland	0.3	0.0	Non-forested Wetland	0.3	0.0
	Open Water	0.0	0.0	Open Water	0.0	0.0
330-R Total		80.1	137.5		80.1	137.5
333-R	Cropland	23.2	0.0	Cropland	52.2	0.0
	Forested	41.9	133.6	Forested	14.6	47.4
	Levee	75.7	0.0	Levee	76.2	0.0
	Marsh	0.0	0.0	Marsh	0.0	0.0
	Open Water	0.1	0.0	Open Water	0.3	0.0
	Pasture, Old Field	0.1	0.0	Pasture, Old Field	0.4	0.0
333-R Total		141.0	133.6		143.6	47.4
337-R	Cropland	3.5	0.0	Cropland	3.5	0.0
	Forested	1.2	3.2	Forested	1.2	3.2
	Levee	14.9	0.0	Levee	14.9	0.0
337-R Total		19.6	3.2		19.6	3.2
340-R	Cropland	25.2	0.0	Cropland	27.6	0.0
	Forested	35.4	109.1	Forested	8.0	22.1
	Levee	20.3	0.0	Levee	18.7	0.0
	Scrub/Shrub	1.7	0.0	Scrub/Shrub	20.0	0.0
340-R Total		82.6	109.1		74.3	22.1
341-R	Cropland	4.6	0.0	Cropland	4.6	0.0
	Forested	3.8	9.9	Forested	3.8	9.9
	Levee	5.9	0.0	Levee	5.9	0.0
341-R Total		14.4	9.9		14.4	9.9

345-R	Cropland	134.4	0.0	Cropland	156.0	0.0
	Forested	20.3	56.5	Forested	20.3	56.6
	Levee	159.3	0.0	Levee	159.5	0.0
	Non-forested Wetland	3.8	0.0	Non-forested Wetland	3.8	0.0
	Open Water	0.1	0.0	Open Water	0.1	0.0
345-R Total		317.9	56.5		339.7	56.6
348-R	Cropland	25.4	0.0	Cropland	25.4	0.0
	Forested	5.3	20.0	Forested	5.3	20.0
	Levee	3.6	0.0	Levee	3.6	0.0
	Non-forested Wetland	0.0	0.0	Non-forested Wetland	0.0	0.0
348-R Total		34.4	20.0		34.4	20.0
351-R	Forested	2.2	6.9	Forested	2.2	6.9
	Levee	100.6	0.0	Levee	100.6	0.0
	Non-forested Wetland	3.1	0.0	Non-forested Wetland	3.1	0.0
	Open Water	0.0	0.0	Open Water	0.0	0.0
	Scrub/Shrub	66.6	0.0	Scrub/Shrub	66.6	0.0
351-R Total		172.5	6.9		172.5	6.9
355-R	Cropland	28.5	0.0	Cropland	48.0	0.0
	Forested	11.8	37.0	Levee	7.3	0.0
	Levee	9.4	0.0		55.3	0.0
	Non-forested Wetland	2.0	0.0			
	Scrub/Shrub	4.2	0.0			
355-R Total		56.0	37.0			
443-L	Cropland	0.2	0.0	Cropland	0.2	0.0
	Forested	29.3	94.6	Forested	29.3	94.6
	Levee	21.1	0.0	Levee	21.1	0.0
	Open Water	0.2	0.0	Open Water	0.2	0.0
443-L Total		50.8	94.6		50.8	94.6
577-L	Cropland	3.9	0.0	Cropland	3.9	0.0
	Forested	32.7	63.7	Forested	32.7	63.7
	Levee	49.4	0.0	Levee	49.4	0.0
	Urban	1.5	0.0	Urban	1.5	0.0
577-L Total		87.5	63.7		87.5	63.7
587-L	Cropland	21.7	0.0	Cropland	21.7	0.0
	Forested	29.1	65.8	Forested	29.1	65.8
	Levee	10.0	0.0	Levee	10.0	0.0
	Open Water	0.3	0.0	Open Water	0.3	0.0
	Pasture, Old Field	3.3	0.0	Pasture, Old Field	3.3	0.0
	Urban	4.5	0.0	Urban	4.5	0.0
587-L Total		69.1	65.8		69.1	65.8
611-L	Cropland	17.0	0.0	Cropland	20.1	0.0
	Forested	15.2	30.5	Forested	14.0	28.5

	Levee	20.7	0.0	Levee	66.4	0.0
	Pasture, Old Field	15.3	0.0	Pasture, Old Field	29.0	0.0
611-L Total		68.1	30.5		129.5	28.5
615-L	Cropland	8.5	0.0	Cropland	68.5	0.0
	Forested	55.7	119.5	Levee	60.6	0.0
	Levee	61.6	0.0	Scrub/Shrub	38.8	0.0
	Non-forested Wetland	0.0	0.0		167.9	0.0
	Open Water	0.9	0.0			
	Scrub/Shrub	37.6	0.0			
615-L Total		164.3	119.5			
Total Vicksburg District		1748.7	1415.4		1829.1	1083.7

Impacts to acreage and total AAHU's for all target species of BLH by MRL-Work Item ID within the Memphis District.

	Traditional			Avoid-Minimize		
MRL Levee Work Item	Land Cover	Total Acres	Total AAHU of Combined Target Species	Land Cover	Total Acres	Total AAHU of Combined Target Species
22-R	Cropland	46.0	0.0	Cropland	54.0	0.0
	Forested	39.4	120.1	Forested	31.3	95.6
	Levee	90.2	0.0	Levee	90.2	0.0
	Open Water	0.4	0.0	Open Water	0.4	0.0
22-R Total		176.0	120.1		175.9	95.6
29-R	Cropland	2.6	0.0	Cropland	2.6	0.0
	Forested	1.1	3.4	Forested	1.2	3.5
	Levee	4.9	0.0	Levee	4.9	0.0
29-R Total		8.7	3.4		8.7	3.5
49-R	Forested	12.2	46.0	Cropland	12.3	0.0
	Levee	14.7	0.0	Forested	0.2	0.7
	Open Water	0.0	0.0	Levee	14.1	0.0
	Urban	6.1	0.0	Open Water	0.0	0.0
49-R Total		32.9	46.0	Urban	6.1	0.0
					32.7	0.7
620-R	Forested	0.3	0.7	Cropland	0.3	0.0
	Levee	1.5	0.0	Levee	1.5	0.0
620-R Total		1.9	0.7		1.9	0.0
682-R	Cropland	7.0	0.0	Cropland	18.6	0.0
	Forested	31.7	117.6	Forested	17.9	67.0
	Levee	109.5	0.0	Levee	109.5	0.0
	Pasture, Old Field	0.3	0.0	Pasture, Old Field	2.3	0.0
682-R Total		148.5	117.6		148.3	67.0
693-R	Cropland	0.0	0.0	Cropland	13.5	0.0
	Forested	20.1	75.4	Forested	8.7	36.0
	Levee	80.0	0.0	Levee	80.0	0.0
	Non-forested Wetland	2.1	0.0	Scrub/Shrub	0.0	0.0
	Scrub/Shrub	0.0	0.0	Urban	0.9	0.0
	Urban	0.9	0.0		103.1	36.0
693-R Total		103.1	75.4			
697-R	Cropland	0.0	0.0	Cropland	8.6	0.0
	Forested	21.6	78.8	Forested	13.3	50.2
	Levee	40.9	0.0	Levee	40.9	0.0
	Non-forested Wetland	2.6	0.0	Non-forested Wetland	2.2	0.0
	Open Water	0.0	0.0	Open Water	0.0	0.0
	Scrub/Shrub	0.6	0.0	Scrub/Shrub	0.6	0.0
697-R Total		65.7	78.8		65.7	50.2

705-R	Cropland	19.0	0.0	Cropland	19.0	0.0
	Levee	33.2	0.0	Levee	33.2	0.0
705-R Total		52.2	0.0		52.2	0.0
723-R	Cropland	164.0	0.0	Cropland	164.0	0.0
	Forested	5.7	15.5	Forested	5.7	15.5
	Levee	4.9	0.0	Levee	4.9	0.0
	Open Water	3.2	0.0	Open Water	3.2	0.0
723-R Total		177.9	15.5		177.9	15.5
726-R	Cropland	100.1	0.0	Cropland	100.1	0.0
	Forested	6.5	17.8	Forested	6.5	17.8
	Levee	66.4	0.0	Levee	66.4	0.0
	Open Water	2.4	0.0	Open Water	2.4	0.0
726-R Total		175.4	17.8		175.4	17.8
741-R	Cropland	1.6	0.0	Cropland	4.6	0.0
	Forested	10.3	37.6	Forested	7.2	27.2
	Levee	29.6	0.0	Levee	29.6	0.0
741-R Total		41.5	37.6		41.5	27.2
747-R	Cropland	0.3	0.0	Cropland	3.5	0.0
	Forested	8.6	18.9	Forested	5.3	12.1
	Levee	18.5	0.0	Levee	18.5	0.0
747-R Total		27.3	18.9		27.3	12.1
754-R	Cropland	63.4	0.0	Cropland	63.4	0.0
	Forested	71.6	199.2	Forested	71.6	199.2
	Levee	154.2	0.0	Levee	154.2	0.0
	Open Water	0.0	0.0	Open Water	0.0	0.0
754-R Total		289.2	199.2		289.2	199.2
762-R	Cropland	9.1	0.0	Cropland	17.9	0.0
	Forested	24.4	87.4	Forested	15.7	52.0
	Levee	10.4	0.0	Levee	10.4	0.0
762-R Total		43.8	87.4		43.9	52.0
766-R	Cropland	8.7	0.0	Cropland	13.0	0.0
	Forested	8.4	27.5	Forested	4.4	14.4
	Levee	11.0	0.0	Levee	11.0	0.0
	Pasture, Old Field	0.8	0.0	Pasture, Old Field	0.4	0.0
766-R Total		28.9	27.5		28.7	14.4
807-R	Cropland	1.5	0.0	Cropland	8.5	0.0
	Forested	2.9	8.6	Forested	2.9	8.6
	Levee	8.6	0.0	Levee	8.6	0.0
	Scrub/Shrub	7.0	0.0		20.0	8.6
807-R Total		20.0	8.6			
832-L	Cropland	122.8	0.0	Cropland	405.6	0.0

	Forested	346.8	946.3	Forested	58.8	177.9
	Levee	202.2	0.0	Levee	202.2	0.0
	Pasture, Old Field	51.3	0.0	Pasture, Old Field	51.3	0.0
	Urban	1.8	0.0	Urban	1.8	0.0
832-L Total		724.8	946.3		719.5	177.9
848-L	Cropland	34.1	0.0	Cropland	69.4	0.0
	Forested	41.2	123.4	Forested	6.1	15.6
	Levee	14.9	0.0	Levee	14.9	0.0
848-L Total		90.2	123.4		90.5	15.6
877-R	Forested	0.8	2.3	Cropland	0.5	0.0
	Levee	2.5	0.0	Forested	0.3	0.8
877-R Total		3.3	2.3	Levee	2.5	0.0
					3.3	0.8
882-R	Cropland	0.1	0.0	Cropland	0.6	0.0
	Forested	7.8	23.3	Forested	7.3	21.7
	Levee	9.0	0.0	Levee	9.0	0.0
	Urban	4.7	0.0	Urban	4.7	0.0
882-R Total		21.6	23.3		21.6	21.7
889-R	Cropland	11.1	0.0	Cropland	11.9	0.0
	Levee	6.4	0.0	Levee	6.4	0.0
	Urban	0.0	0.0	Urban	0.0	0.0
889-R Total		17.5	0.0		18.4	0.0
902-L	Cropland	0.7	0.0	Cropland	0.7	0.0
	Levee	0.4	0.0	Levee	0.4	0.0
	Marsh	0.2	0.0	Marsh	0.2	0.0
902-L Total		1.3	0.0		1.3	0.0
915-R	Cropland	14.4	0.0	Cropland	17.4	0.0
	Forested	20.3	58.1	Forested	17.2	49.5
	Levee	98.5	0.0	Levee	98.5	0.0
	Non-forested Wetland	0.3	0.0	Non-forested Wetland	0.3	0.0
915-R Total		133.5	58.1		133.3	49.5
918-L	Cropland	39.3	0.0	Cropland	39.3	0.0
	Levee	5.5	0.0	Levee	5.5	0.0
918-L Total		44.8	0.0		44.8	0.0
920-R	Forested	20.3	61.0	Cropland	9.1	0.0
	Levee	38.7	0.0	Forested	11.2	33.8
920-R Total		59.0	61.0	Levee	38.7	0.0
					59.0	33.8
921-L	Levee	1.2	0.0	Levee	1.2	0.0
	Urban	1.2	0.0	Urban	1.2	0.0
921-L Total		2.4	0.0		2.4	0.0

922-L	Urban	0.1	0.0	Urban	0.1	0.0
922-L Total		0.1	0.0		0.1	0.0
947-R	Cropland	15.0	0.0	Cropland	19.1	0.0
	Forested	1.9	5.5	Forested	0.5	1.8
	Levee	44.9	0.0	Levee	44.9	0.0
	Non-forested Wetland	3.5	0.0	Non-forested Wetland	5.0	0.0
947-R Total		65.4	5.5		69.6	1.8
955-R	Forested	3.4	10.1	Cropland	1.8	0.0
	Levee	6.6	0.0	Forested	1.5	4.4
955-R Total		9.9	10.1	Levee	6.6	0.0
					9.8	4.4
956-R	Forested	2.6	10.0	Forested	2.6	10.0
	Levee	0.4	0.0	Levee	0.4	0.0
	Urban	32.8	0.0	Urban	32.8	0.0
956-R Total		35.8	10.0		35.8	10.0
958-R	Levee	0.4	0.0	Cropland	0.1	0.0
	Pasture, Old Field	0.1	0.0	Forested	0.0	0.1
958-R Total		0.5	0.0	Levee	0.4	0.0
					0.5	0.1
961-R	Forested	1.1	3.4	Cropland	0.6	0.0
	Levee	4.5	0.0	Forested	0.5	1.5
961-R Total		5.5	3.4	Levee	4.5	0.0
					5.5	1.5
962.3-R	Levee	0.8	0.0	Levee	0.8	0.0
	Urban	2.4	0.0	Urban	2.4	0.0
962.3-R Total		3.2	0.0		3.2	0.0
962.5-R	Forested	5.3	16.4	Cropland	3.7	0.0
	Levee	14.3	0.0	Forested	1.5	5.2
	Urban	11.6	0.0	Levee	14.3	0.0
962.5-R Total		31.2	16.4	Urban	11.6	0.0
					31.2	5.2
965-R	Cropland	4.0	0.0	Cropland	6.7	0.0
	Forested	6.7	20.1	Forested	3.9	11.7
	Levee	15.2	0.0	Levee	15.2	0.0
965-R Total		25.9	20.1		25.8	11.7
Total Memphis District		2,668.8	2,134.3		2,668.0	934.0

Impacts to acreage and total AAHU's for all target species of BLH by MRL-Work Item ID within the New Orleans District.

	Traditional			Avoid-Minimize		
MRL Levee Work Item	Land Cover	Total Acres	Total AAHU of Combined Target Species	Land Cover	Total Acres	Total AAHU of Combined Target Species
100.4-R	Cropland	4.4	0.0	Cropland	4.4	0.0
	Levee	15.1	0.0	Levee	15.1	0.0
	Urban	20.6	0.0	Urban	20.6	0.0
100.4-R Total		40.1	0.0		40.1	0.0
100-L	Levee	0.2	0.0	Levee	0.2	0.0
	Urban	17.1	0.0	Urban	17.1	0.0
100-L Total		17.3	0.0		17.3	0.0
102.1-R	Levee	5.8	0.0	Levee	5.8	0.0
	Urban	0.1	0.0	Urban	0.1	0.0
102.1-R Total		5.9	0.0		5.9	0.0
107-R	Cropland	1.3	0.0	Cropland	1.3	0.0
	Levee	5.5	0.0	Levee	5.5	0.0
	Urban	1.2	0.0	Urban	1.2	0.0
107-R Total		7.9	0.0		7.9	0.0
108.3-R	Cropland	1.4	0.0	Cropland	1.4	0.0
	Levee	8.7	0.0	Levee	8.7	0.0
	Urban	1.2	0.0	Urban	1.2	0.0
108.3-R Total		11.3	0.0		11.3	0.0
109.6-R	Forested	0.2	0.5	Forested	0.2	0.5
	Levee	2.8	0.0	Levee	2.8	0.0
109.6-R Total		3.0	0.5		3.0	0.5
110.4-R	Cropland	1.7	0.0	Cropland	1.7	0.0
	Levee	8.8	0.0	Levee	8.8	0.0
	Urban	1.1	0.0	Urban	1.1	0.0
110.4-R Total		11.7	0.0		11.7	0.0
113.5-R	Cropland	2.3	0.0	Cropland	2.3	0.0
	Forested	0.3	0.9	Forested	0.3	0.9
	Levee	14.0	0.0	Levee	14.0	0.0
	Urban	1.5	0.0	Urban	1.5	0.0
113.5-R Total		18.1	0.9		18.1	0.9
115.5-R	Cropland	1.0	0.0	Cropland	1.0	0.0
	Levee	9.4	0.0	Levee	9.4	0.0
	Pasture, Old Field	0.0	0.0	Pasture, Old Field	0.0	0.0
	Urban	0.0	0.0	Urban	0.0	0.0
115.5-R Total		10.4	0.0		10.4	0.0

115-L	Forested	3.5	6.8	Cropland	3.2	0.0
	Levee	24.5	0.0	Forested	0.3	0.5
	Urban	0.9	0.0	Levee	24.5	0.0
115-L Total		28.9	6.8	Urban	0.9	0.0
					28.9	0.5
117.3-R	Cropland	0.3	0.0	Cropland	0.3	0.0
	Forested	0.8	1.8	Forested	0.8	1.8
	Levee	16.1	0.0	Levee	16.1	0.0
117.3-R Total		17.2	1.8		17.2	1.8
118.5-R	Levee	0.6	0.0	Levee	0.6	0.0
118.5-R Total		0.6	0.0		0.6	0.0
119.2-R	Cropland	2.0	0.0	Cropland	2.0	0.0
	Forested	1.1	3.7	Forested	1.1	3.7
	Levee	14.7	0.0	Levee	14.7	0.0
	Urban	1.3	0.0	Urban	1.3	0.0
119.2-R Total		19.1	3.7		19.1	3.7
124.3-R	Cropland	0.9	0.0	Cropland	0.9	0.0
	Forested	1.6	3.6	Forested	1.6	3.6
	Levee	106.4	0.0	Levee	106.4	0.0
	Open Water	0.1	0.0	Open Water	0.1	0.0
	Pasture, Old Field	0.1	0.0	Pasture, Old Field	0.1	0.0
	Urban	12.1	0.0	Urban	12.1	0.0
124.3-R Total		121.2	3.6		121.2	3.6
124-L	Forested	4.2	8.2	Cropland	4.2	0.0
	Levee	45.3	0.0	Levee	45.3	0.0
	Urban	3.6	0.0	Urban	3.6	0.0
124-L Total		53.1	8.2		53.1	0.0
130-L	Forested	1.9	3.9	Cropland	1.9	0.0
	Levee	10.0	0.0	Levee	10.0	0.0
130-L Total		11.9	3.9		11.9	0.0
131.7-R	Cropland	1.8	0.0	Cropland	1.8	0.0
	Forested	1.8	4.1	Forested	1.8	4.1
	Levee	11.6	0.0	Levee	11.6	0.0
131.7-R Total		15.2	4.1		15.2	4.1
133-L	Forested	0.9	1.8	Cropland	0.9	0.0
	Levee	6.4	0.0	Levee	6.4	0.0
	Urban	0.3	0.0	Urban	0.3	0.0
133-L Total		7.6	1.8		7.6	0.0
135.7-R	Cropland	2.4	0.0	Cropland	2.4	0.0
	Forested	0.7	1.5	Forested	0.7	1.5
	Levee	11.9	0.0	Levee	11.9	0.0

	Scrub/Shrub	0.0	0.0	Scrub/Shrub	0.0	0.0
	Urban	1.9	0.0	Urban	1.9	0.0
135.7-R Total		16.8	1.5		16.8	1.5
136-L	Cropland	1.7	0.0	Cropland	5.0	0.0
	Forested	3.5	6.9	Forested	0.3	0.6
	Levee	28.5	0.0	Levee	28.5	0.0
	Urban	7.1	0.0	Urban	7.1	0.0
136-L Total		40.9	6.9		40.9	0.6
142-R	Cropland	0.6	0.0	Cropland	0.6	0.0
	Forested	0.6	1.4	Forested	0.6	1.4
	Levee	12.0	0.0	Levee	12.0	0.0
	Pasture, Old Field	0.4	0.0	Pasture, Old Field	0.4	0.0
	Scrub/Shrub	0.0	0.0	Scrub/Shrub	0.0	0.0
142-R Total		13.7	1.4		13.7	1.4
143.7-R	Cropland	1.6	0.0	Cropland	1.6	0.0
	Forested	0.7	1.5	Forested	0.7	1.5
	Levee	3.6	0.0	Levee	3.6	0.0
143.7-R Total		5.8	1.5		5.8	1.5
144-L	Forested	1.0	2.0	Cropland	1.0	0.0
	Levee	6.9	0.0	Levee	6.9	0.0
144-L Total		7.8	2.0		7.8	0.0
147.3-R	Cropland	1.7	0.0	Cropland	1.7	0.0
	Levee	11.9	0.0	Levee	11.9	0.0
	Urban	0.8	0.0	Urban	0.8	0.0
147.3-R Total		14.4	0.0		14.4	0.0
148-L	Forested	10.2	20.0	Cropland	10.2	0.0
	Levee	47.5	0.0	Levee	47.5	0.0
	Scrub/Shrub	0.0	0.0	Scrub/Shrub	0.0	0.0
	Urban	9.1	0.0	Urban	9.1	0.0
148-L Total		66.9	20.0		66.9	0.0
149-R	Cropland	0.3	0.0	Cropland	0.3	0.0
	Forested	0.6	1.3	Forested	0.6	1.3
	Levee	2.7	0.0	Levee	2.7	0.0
	Urban	0.1	0.0	Urban	0.1	0.0
149-R Total		3.7	1.3		3.7	1.3
152-L	Cropland	0.0	0.0	Cropland	1.0	0.0
	Forested	1.4	2.7	Forested	0.4	0.7
	Levee	13.1	0.0	Levee	13.1	0.0
	Urban	0.0	0.0	Urban	0.0	0.0
152-L Total		14.5	2.7		14.5	0.7
154-L	Forested	1.4	2.8	Cropland	1.0	0.0

	Levee	1.8	0.0	Forested	0.5	0.9
	Urban	0.1	0.0	Levee	1.8	0.0
154-L Total		3.3	2.8	Urban	0.1	0.0
					3.3	0.9
156.8-L	Cropland	0.6	0.0	Cropland	1.7	0.0
	Forested	1.3	2.6	Forested	0.2	0.5
	Levee	10.6	0.0	Levee	10.6	0.0
	Urban	0.3	0.0	Urban	0.3	0.0
156.8-L Total		12.8	2.6		12.8	0.5
156-R	Cropland	5.8	0.0	Cropland	5.8	0.0
	Forested	0.2	0.4	Forested	0.2	0.4
	Levee	31.4	0.0	Levee	31.4	0.0
	Urban	1.0	0.0	Urban	1.0	0.0
156-R Total		38.4	0.4		38.4	0.4
158-R	Cropland	0.5	0.0	Cropland	0.5	0.0
	Forested	0.5	1.2	Forested	0.5	1.2
	Levee	2.5	0.0	Levee	2.5	0.0
	Urban	0.3	0.0	Urban	0.3	0.0
158-R Total		3.8	1.2		3.8	1.2
159.7-R	Cropland	0.3	0.0	Cropland	0.3	0.0
	Forested	0.4	0.9	Forested	0.4	0.9
	Levee	13.0	0.0	Levee	13.0	0.0
	Pasture, Old Field	2.8	0.0	Pasture, Old Field	2.8	0.0
	Urban	1.4	0.0	Urban	1.4	0.0
159.7-R Total		18.0	0.9		18.0	0.9
163.5-R	Cropland	10.2	0.0	Cropland	10.2	0.0
	Forested	1.0	2.3	Forested	1.0	2.3
	Levee	39.7	0.0	Levee	39.7	0.0
	Scrub/Shrub	0.0	0.0	Scrub/Shrub	0.0	0.0
	Urban	2.7	0.0	Urban	2.7	0.0
163.5-R Total		53.6	2.3		53.6	2.3
163-L	Cropland	0.3	0.0	Cropland	1.3	0.0
	Forested	1.0	2.0	Levee	1.7	0.0
	Levee	1.7	0.0	Urban	0.1	0.0
	Urban	0.1	0.0		3.1	0.0
163-L Total		3.1	2.0			
165-R	Cropland	2.1	0.0	Cropland	2.1	0.0
	Levee	7.9	0.0	Levee	7.9	0.0
165-R Total		10.0	0.0		10.0	0.0
172.6-R	Cropland	3.7	0.0	Cropland	3.7	0.0
	Levee	22.5	0.0	Levee	22.5	0.0
	Urban	0.3	0.0	Urban	0.3	0.0

172.6-R Total		26.6	0.0		26.6	0.0
173.9-R	Cropland	0.8	0.0	Cropland	0.8	0.0
	Forested	0.1	0.3	Forested	0.1	0.3
	Levee	1.6	0.0	Levee	1.6	0.0
	Urban	0.0	0.0	Urban	0.0	0.0
173.9-R Total		2.5	0.3		2.5	0.3
178-R	Cropland	5.2	0.0	Cropland	15.2	0.0
	Forested	10.0	17.7	Levee	40.3	0.0
	Levee	40.3	0.0	Urban	7.4	0.0
	Urban	7.4	0.0		62.9	0.0
178-R Total		62.9	17.7			
180-R	Cropland	5.0	0.0	Cropland	6.9	0.0
	Forested	2.7	5.5	Forested	0.7	2.1
	Levee	17.1	0.0	Levee	17.1	0.0
	Urban	0.2	0.0	Urban	0.2	0.0
180-R Total		24.9	5.5		24.9	2.1
181-L	Forested	1.0	1.9	Cropland	1.0	0.0
	Levee	15.2	0.0	Levee	15.2	0.0
	Pasture, Old Field	0.0	0.0	Pasture, Old Field	0.0	0.0
181-L Total		16.2	1.9		16.2	0.0
189-L	Forested	1.4	2.8	Cropland	1.4	0.0
	Levee	22.8	0.0	Levee	22.8	0.0
189-L Total		24.1	2.8		24.1	0.0
189-R	Cropland	15.4	0.0	Cropland	18.2	0.0
	Forested	2.8	4.9	Levee	11.7	0.0
	Levee	11.7	0.0	Pasture, Old Field	9.8	0.0
	Pasture, Old Field	9.8	0.0		39.7	0.0
189-R Total		39.7	4.9			
194.5-R	Cropland	0.0	0.0	Cropland	1.9	0.0
	Forested	1.9	3.4	Levee	85.9	0.0
	Levee	85.9	0.0	Urban	0.2	0.0
	Urban	0.2	0.0		88.0	0.0
194.5-R Total		88.0	3.4			
199-L	Cropland	2.2	0.0	Cropland	16.0	0.0
	Forested	14.4	28.7	Forested	0.5	1.0
	Levee	149.4	0.0	Levee	149.4	0.0
	Pasture, Old Field	12.2	0.0	Pasture, Old Field	12.2	0.0
	Urban	1.7	0.0	Urban	1.7	0.0
199-L Total		179.8	28.7		179.8	1.0
206.7-R	Forested	3.5	6.2	Cropland	3.5	0.0
	Levee	39.0	0.0	Levee	39.0	0.0

	Urban	2.0	0.0	Urban	2.0	0.0
206.7-R Total		44.5	6.2		44.5	0.0
208-L	Forested	5.7	11.2	Cropland	4.9	0.0
	Levee	11.7	0.0	Forested	0.8	1.5
	Pasture, Old Field	9.2	0.0	Levee	11.7	0.0
	Urban	7.4	0.0	Pasture, Old Field	9.2	0.0
208-L Total		34.2	11.2	Urban	7.4	0.0
					34.2	1.5
216-R	Forested	9.1	16.0	Cropland	9.1	0.0
	Levee	41.5	0.0	Levee	41.5	0.0
	Pasture, Old Field	0.0	0.0	Pasture, Old Field	0.0	0.0
216-R Total		50.6	16.0		50.6	0.0
217.6-L	Forested	1.0	1.9	Cropland	1.0	0.0
	Levee	1.3	0.0	Levee	1.3	0.0
217.6-L Total		2.3	1.9		2.3	0.0
223-R	Forested	0.9	1.6	Cropland	0.9	0.0
	Levee	15.9	0.0	Levee	15.9	0.0
223-R Total		16.8	1.6		16.8	0.0
228-R	Cropland	4.5	0.0	Cropland	5.4	0.0
	Forested	0.9	1.6	Levee	14.6	0.0
	Levee	14.6	0.0	Open Water	0.8	0.0
	Open Water	0.8	0.0	Urban	7.5	0.0
	Urban	7.5	0.0		28.3	0.0
228-R Total		28.3	1.6			
231-R	Cropland	0.5	0.0	Cropland	9.1	0.0
	Forested	10.3	18.4	Forested	1.6	3.1
	Levee	91.2	0.0	Levee	91.2	0.0
	Urban	3.7	0.0	Urban	3.7	0.0
231-R Total		105.6	18.4		105.6	3.1
240.3-R	Forested	1.6	2.8	Cropland	1.6	0.0
	Levee	14.4	0.0	Levee	14.4	0.0
240.3-R Total		15.9	2.8		15.9	0.0
242.5-R	Cropland	3.9	0.0	Cropland	5.2	0.0
	Forested	10.6	18.7	Forested	9.2	17.3
	Levee	50.2	0.0	Levee	50.2	0.0
	Pasture, Old Field	0.8	0.0	Pasture, Old Field	0.8	0.0
	Urban	1.9	0.0	Urban	1.9	0.0
242.5-R Total		67.4	18.7		67.4	17.3
246-R	Cropland	0.4	0.0	Cropland	0.4	0.0
	Forested	0.8	1.5	Forested	0.8	1.6
	Levee	15.4	0.0	Levee	15.4	0.0

246-R Total		16.6	1.5		16.6	1.6
253-R	Forested	0.9	1.6	Forested	0.9	1.7
	Levee	0.8	0.0	Levee	0.8	0.0
253-R Total		1.6	1.6		1.6	1.7
268-R	Forested	0.9	1.6	Cropland	0.8	0.0
	Levee	2.8	0.0	Forested	0.1	0.3
268-R Total		3.7	1.6	Levee	2.8	0.0
					3.7	0.3
293.5-R	Cropland	21.2	0.0	Cropland	21.2	0.0
	Forested	20.2	35.7	Forested	20.2	38.1
	Levee	133.0	0.0	Levee	133.0	0.0
	Pasture, Old Field	1.9	0.0	Pasture, Old Field	1.9	0.0
	Urban	2.7	0.0	Urban	2.7	0.0
293.5-R Total		178.9	35.7		178.9	38.1
304-R	Forested	2.0	6.9	Forested	2.0	6.9
	Levee	3.1	0.0	Levee	3.1	0.0
304-R Total		5.1	6.9		5.1	6.9
312.5-R	Cropland	0.4	0.0	Cropland	0.4	0.0
	Forested	15.9	52.7	Forested	15.9	52.7
	Levee	63.8	0.0	Levee	63.8	0.0
	Pasture, Old Field	0.1	0.0	Pasture, Old Field	0.1	0.0
312.5-R Total		80.2	52.7		80.2	52.7
37-R	Levee	62.2	0.0	Levee	62.2	0.0
	Pasture, Old Field	3.4	0.0	Pasture, Old Field	3.4	0.0
37-R Total		65.6	0.0		65.6	0.0
47.5-R	Forested	2.6	5.9	Forested	2.6	5.9
	Levee	18.3	0.0	Levee	18.3	0.0
	Pasture, Old Field	5.2	0.0	Pasture, Old Field	5.2	0.0
47.5-R Total		26.1	5.9		26.1	5.9
51-L	Cropland	0.4	0.0	Cropland	0.4	0.0
	Forested	25.4	50.3	Forested	25.4	50.3
	Levee	127.3	0.0	Levee	127.3	0.0
	Pasture, Old Field	4.1	0.0	Pasture, Old Field	4.1	0.0
	Scrub/Shrub	0.9	0.0	Scrub/Shrub	0.9	0.0
	Urban	4.1	0.0	Urban	4.1	0.0
51-L Total		162.2	50.3		162.2	50.3
52.5-R	Forested	0.3	0.8	Forested	0.3	0.8
	Levee	64.3	0.0	Levee	64.3	0.0
	Pasture, Old Field	11.7	0.0	Pasture, Old Field	11.7	0.0
	Scrub/Shrub	2.0	0.0	Scrub/Shrub	2.0	0.0
	Urban	3.4	0.0	Urban	3.4	0.0

52.5-R Total		81.7	0.8		81.7	0.8
58-R	Forested	3.7	8.9	Forested	3.7	8.9
	Levee	28.2	0.0	Levee	28.2	0.0
	Pasture, Old Field	6.8	0.0	Pasture, Old Field	6.8	0.0
	Urban	0.5	0.0	Urban	0.5	0.0
58-R Total		39.1	8.9		39.1	8.9
61.5-R	Forested	0.7	0.9	Forested	0.7	0.9
	Levee	31.4	0.0	Levee	31.4	0.0
	Pasture, Old Field	6.4	0.0	Pasture, Old Field	6.4	0.0
	Urban	0.3	0.0	Urban	0.3	0.0
61.5-R Total		38.8	0.9		38.8	0.9
67-L	Cropland	10.5	0.0	Cropland	10.5	0.0
	Forested	11.4	21.2	Forested	11.4	21.2
	Levee	154.8	0.0	Levee	154.8	0.0
	Marsh	4.8	0.0	Marsh	4.8	0.0
	Pasture, Old Field	1.1	0.0	Pasture, Old Field	1.1	0.0
	Scrub/Shrub	0.6	0.0	Scrub/Shrub	0.6	0.0
	Urban	3.6	0.0	Urban	3.6	0.0
67-L Total		186.9	21.2		186.9	21.2
67-R	Cropland	1.3	0.0	Cropland	1.3	0.0
	Forested	1.1	2.3	Forested	1.1	2.3
	Levee	50.9	0.0	Levee	50.9	0.0
	Pasture, Old Field	10.5	0.0	Pasture, Old Field	10.5	0.0
	Scrub/Shrub	1.5	0.0	Scrub/Shrub	1.5	0.0
	Urban	8.6	0.0	Urban	8.6	0.0
67-R Total		73.8	2.3		73.8	2.3
84.3-R	Cropland	1.1	0.0	Cropland	1.1	0.0
	Forested	0.1	0.2	Forested	0.1	0.2
	Levee	5.3	0.0	Levee	5.3	0.0
	Pasture, Old Field	0.0	0.0	Pasture, Old Field	0.0	0.0
84.3-R Total		6.6	0.2		6.6	0.2
86.1-L	Cropland	0.9	0.0	Cropland	0.9	0.0
	Forested	1.0	1.9	Forested	1.0	1.9
	Levee	21.6	0.0	Levee	21.6	0.0
	Urban	2.5	0.0	Urban	2.5	0.0
86.1-L Total		26.0	1.9		26.0	1.9
88.5-L	Forested	2.6	5.0	Forested	2.6	5.0
	Levee	20.9	0.0	Levee	20.9	0.0
	Urban	4.1	0.0	Urban	4.1	0.0
88.5-L Total		27.6	5.0		27.6	5.0
88-R	Cropland	2.0	0.0	Cropland	2.0	0.0
	Forested	1.6	4.1	Forested	1.6	4.1

	Levee	7.5	0.0	Levee	7.5	0.0
	Urban	0.1	0.0	Urban	0.1	0.0
88-R Total		11.2	4.1		11.2	4.1
90.6-R	Cropland	6.6	0.0	Cropland	6.6	0.0
	Levee	29.5	0.0	Levee	29.5	0.0
	Urban	3.9	0.0	Urban	3.9	0.0
90.6-R Total		40.0	0.0		40.0	0.0
90.8-L	Forested	0.0	0.1	Forested	0.0	0.1
	Levee	2.8	0.0	Levee	2.8	0.0
	Scrub/Shrub	0.0	0.0	Scrub/Shrub	0.0	0.0
	Urban	0.1	0.0	Urban	0.1	0.0
90.8-L Total		3.0	0.1		3.0	0.1
90-L	Forested	1.1	2.1	Forested	1.1	2.1
	Levee	5.0	0.0	Levee	5.0	0.0
	Urban	1.3	0.0	Urban	1.3	0.0
90-L Total		7.4	2.1		7.4	2.1
91.2-L	Forested	0.3	0.8	Forested	0.3	0.8
	Levee	6.4	0.0	Levee	6.4	0.0
	Open Water	0.0	0.0	Open Water	0.0	0.0
	Urban	0.1	0.0	Urban	0.1	0.0
91.2-L Total		6.8	0.8		6.8	0.8
91-L	Forested	0.0	0.0	Forested	0.0	0.0
	Levee	2.4	0.0	Levee	2.4	0.0
91-L Total		2.4	0.0		2.4	0.0
92.6-L	Levee	8.2	0.0	Levee	8.2	0.0
	Marsh	7.0	0.0	Marsh	7.0	0.0
	Urban	3.2	0.0	Urban	3.2	0.0
92.6-L Total		18.4	0.0		18.4	0.0
92-L	Levee	10.9	0.0	Levee	10.9	0.0
	Marsh	1.3	0.0	Marsh	1.3	0.0
	Urban	1.3	0.0	Urban	1.3	0.0
92-L Total		13.5	0.0		13.5	0.0
93.6-L	Levee	0.4	0.0	Levee	0.4	0.0
	Urban	5.7	0.0	Urban	5.7	0.0
93.6-L Total		6.1	0.0		6.1	0.0
93-L	Levee	1.4	0.0	Levee	1.4	0.0
	Urban	6.4	0.0	Urban	6.4	0.0
93-L Total		7.8	0.0		7.8	0.0
94.1-L	Urban	7.4	0.0	Urban	7.4	0.0
94.1-L Total		7.4	0.0		7.4	0.0

94.5-L	Urban	5.8	0.0	Urban	5.8	0.0
94.5-L Total		5.8	0.0		5.8	0.0
94.6-R	Cropland	1.2	0.0	Cropland	1.2	0.0
	Levee	17.5	0.0	Levee	17.5	0.0
	Urban	1.9	0.0	Urban	1.9	0.0
94.6-R Total		20.6	0.0		20.6	0.0
94.8-L	Levee	2.7	0.0	Levee	2.7	0.0
	Urban	3.1	0.0	Urban	3.1	0.0
94.8-L Total		5.7	0.0		5.7	0.0
95.3-L	Levee	5.1	0.0	Levee	5.1	0.0
	Urban	3.2	0.0	Urban	3.2	0.0
95.3-L Total		8.3	0.0		8.3	0.0
95-L	Levee	0.4	0.0	Levee	0.4	0.0
	Urban	0.6	0.0	Urban	0.6	0.0
95-L Total		1.0	0.0		1.0	0.0
96.5-L	Levee	5.5	0.0	Levee	5.5	0.0
	Urban	9.9	0.0	Urban	9.9	0.0
96.5-L Total		15.4	0.0		15.4	0.0
97.4-R	Cropland	1.2	0.0	Cropland	1.2	0.0
	Levee	9.9	0.0	Levee	9.9	0.0
	Urban	1.7	0.0	Urban	1.7	0.0
97.4-R Total		12.8	0.0		12.8	0.0
98.1-L	Levee	1.7	0.0	Levee	1.7	0.0
	Urban	2.3	0.0	Urban	2.3	0.0
98.1-L Total		4.0	0.0		4.0	0.0
98.3-R	Cropland	1.2	0.0	Cropland	1.2	0.0
	Levee	1.3	0.0	Levee	1.3	0.0
	Open Water	0.2	0.0	Open Water	0.2	0.0
	Urban	1.7	0.0	Urban	1.7	0.0
98.3-R Total		4.5	0.0		4.5	0.0
98.7-L	Forested	1.5	4.0	Forested	1.5	4.0
	Urban	0.1	0.0	Urban	0.1	0.0
98.7-L Total		1.6	4.0		1.6	4.0
99.5-R	Cropland	1.4	0.0	Cropland	1.4	0.0
	Levee	1.6	0.0	Levee	1.6	0.0
	Urban	0.1	0.0	Urban	0.1	0.0
99.5-R Total		3.1	0.0		3.1	0.0
Total New Orleans District		2,785.6	436.8		2,785.6	262.9

Forested acres impacted by MRL-SEIS II according to project work type for the avoid/minimize alternative

District	MRL Work Type	Total Acres	Total Habitat Units for Species Occupying Bottomland Hardwood Forest							
			Carolina Chickadee	Barred Owl	Pileated Woodpecker	Fox Squirrel	Wood Duck	Mink (Loss)	Mink (Gain)	All Target Species
MVK	Landside Borrow Area	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5 (+)	6.5 (+)
	Riverside Borrow Area	222.9	138.5	169.5	92.1	138.5	91.7	29.4	210.2 (+)	449.5
	Drainage Ditch	6.7	4.3	5.0	2.6	5.3	0.0	0.0		17.2
	Landside Haul Roads	9.1	5.1	6.6	3.3	6.0	1.7	1.7		24.4
	Riverside Haul Roads	84.9	56.9	66.2	37.4	55.8	34.6	21.5		272.4
	Levee Enlargement	0.2	0.1	0.1	0.1	0.1	0.0	0.1		0.5
	Relief Wells	3.9	2.5	2.9	1.5	3.1	0.0	0.0		10
	Seepage Berm	39.2	23.5	29.2	15.7	30.4	0.0	0.5		99.3
MVK Total		366.9	230.9	279.6	152.8	239.3	128.0	53.1	216.7 (+)	866.8
MVM	Landside Borrow Area	0.1	0.1	0.1	0.0	0.0	0.0	0.0	7.6 (+)	7.4 (+)
	Riverside Borrow Area	57.8	50.3	49.7	32.0	23.2	16.1	6.8	386.1 (+)	208 (+)
	Floodwall Replacement	2.6	2.4	2.3	1.4	1.1	0.7	2.1		10
	Levee Enlargement	119.5	107.3	107.3	69.4	51.7	40.2	17.5		393.4
	Relief Wells	83.9	83.9	62.5	28.5	53.8	0.0	3.9		232.6
	Slope Flattening	39.6	38.7	34.4	23.8	20.6	1.3	0.9		119.7
MVM Total		303.4	282.7	256.3	155.1	150.4	58.3	31.2	393.7 (+)	540.3
MVN	Landside Borrow Area	72.0	31.4	49.8	16.8	51.6	8.7	3.1	42.7 (+)	118.8
	Riverside Borrow Area	14.5	5.4	8.0	3.8	4.0	4.5	3.3	22.5 (+)	6.4
	Floodwall Replacement	2.3	0.8	1.5	0.4	1.7	0.0	1.6		5.9
	Levee Enlargement	29.1	10.4	19.3	4.7	20.8	0.0	9.9		65.0
	Relief Wells	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
	Seepage Berm	0.8	0.3	0.5	0.1	0.6	0.0	0.0		1.5
MVN Total		118.7	48.2	79.2	25.8	78.7	13.3	17.8	65.2 (+)	197.7
Grand Total		789.0	561.8	615.0	333.7	468.4	199.6	23.6	102.1 (+)	1,605

Forested acres impacted by MRL-SEIS II according to project work type for the traditional alternative

District	MRL Work Type	Total Habitat Units for Species Occupying Bottomland Hardwood Forest								
		Total Acres	Carolina Chickadee	Barred Owl	Pileated Woodpecker	Fox Squirrel	Wood Duck	Mink (Loss)	Mink (Gain)	All Target Species
MVK	Landside Borrow Area	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5 (+)	6.5 (+)
	Riverside Borrow Area	346.0	201.9	257.5	133.6	206.3	137.6	45.2	301.4 (+)	680.7
	Drainage Ditch	6.7	4.3	5.0	2.6	5.3	0.0	0.0		17.2
	Landside Haul Roads	7.1	3.6	5.0	2.3	4.7	0.7	1.7		18.0
	Riverside Haul Roads	87.1	61.2	69.1	40.2	58.6	37.4	21.7		288.2
	Levee Enlargement	0.2	0.1	0.1	0.1	0.1	0.0	0.1		0.5
	Relief Wells	3.9	2.5	2.9	1.5	3.1	0.0	0.0		10.0
	Seepage Berm	39.2	23.5	29.2	15.7	30.4	0.0	0.5		99.3
MVK Total		490.2	297.2	368.8	196.1	308.5	175.8	69.0	307.9 (+)	1,107.5
MVM	Landside Borrow Area	329.7	329.7	245.7	112.0	211.6	0.0	0.0	76.0 (+)	823.0
	Riverside Borrow Area	147.6	135.5	131.7	88.8	62.6	43.8	17.4	415.5 (+)	64.3
	Floodwall Replacement	2.6	2.4	2.3	1.4	1.1	0.7	2.1		10.0
	Levee Enlargement	119.5	107.3	107.3	69.4	51.7	40.2	17.5		393.4
	Relief Wells	83.9	83.9	62.5	28.5	53.8	0.0	3.9		232.6
	Slope Flattening	39.6	38.7	34.4	23.8	20.6	1.3	0.9		119.7
MVM Total		722.8	697.5	583.9	323.9	401.3	86.0	41.8	491.6 (+)	1,642.8
MVN	Landside Borrow Area	82.3	36.1	52.4	22.9	40.2	21.6	3.1	40.9 (+)	135.4
	Riverside Borrow Area	98.3	38.8	58.1	12.5	40.5	33.8	4.3	71.1 (+)	116.9
	Floodwall Replacement	2.3	0.8	1.5	0.4	1.7	0.0	1.6		6.0
	Levee Enlargement	29.1	10.4	19.3	4.7	20.8	0.0	9.9		65.1
	Relief Wells	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
	Seepage Berm	0.8	0.3	0.5	0.1	0.6	0.0	0.0		1.5
MVN Total		212.8	86.3	131.9	40.6	103.7	55.4	18.9	112.0 (+)	324.8
Grand Total		1,425.9	1,081.0	1,084.6	560.5	813.5	317.2	129.7	911.5 (+)	3,075