Winter's Landing Mississippi River Pool 7 *Lampsilis higginsii* Secondary Habitat Area Monitoring – 2010

MN DNR Report to the St. Paul District Corps of Engineers

Introduction:

Monitoring of *Lampsilis higginsii* populations within Winters Landing was last accomplished by collecting quantitative data from quadrats in 2005; one hundred randomly selected sites were sampled using a 1/4m^2 quadrat sampling frame. In 2010, we projected one hundred randomly selected sites within the same 50,670 square meter area that encompassed the 2005 effort (Figure 1). However, high flows in the river led us to abandon sixteen sites that were located over two wing dams (Figure 2) due to high velocity currents that prevented us from holding the sampler in place.

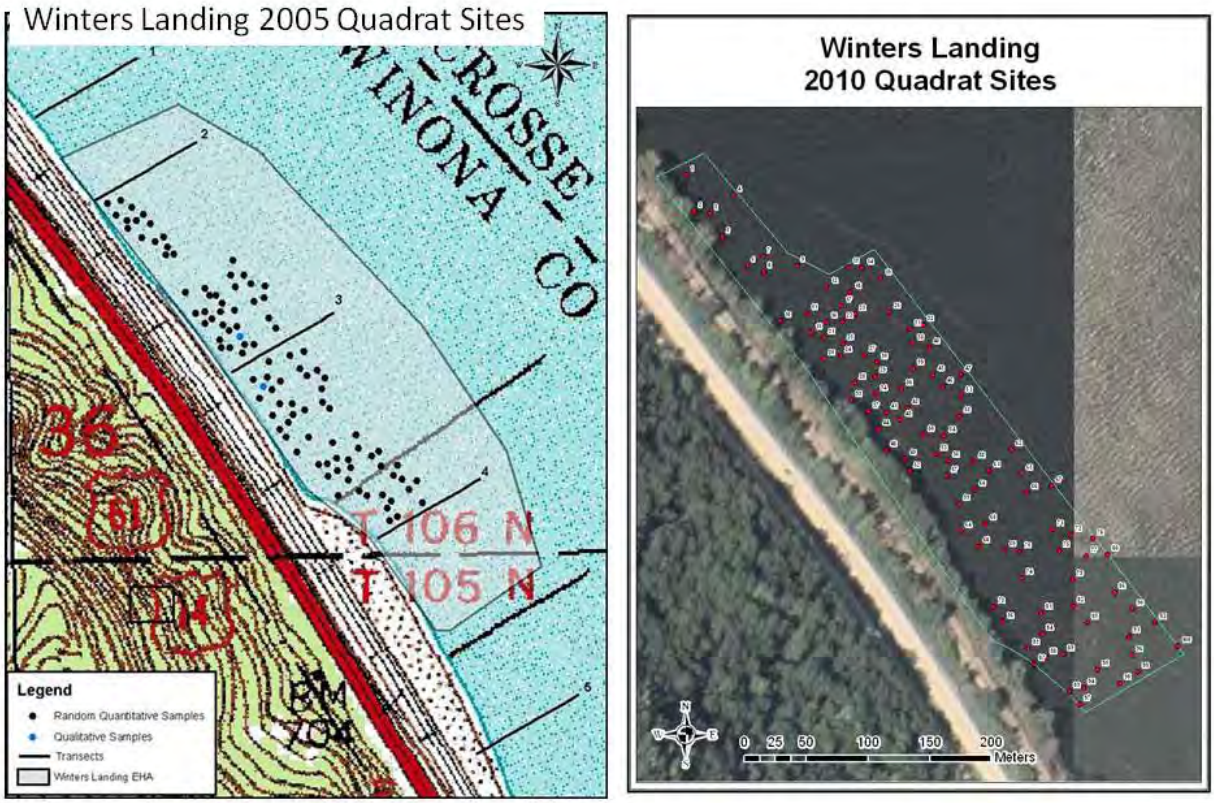

Figure 1. Sites sampled in 2005 and sites targeted for sampling in 2010 at Winters Landing.

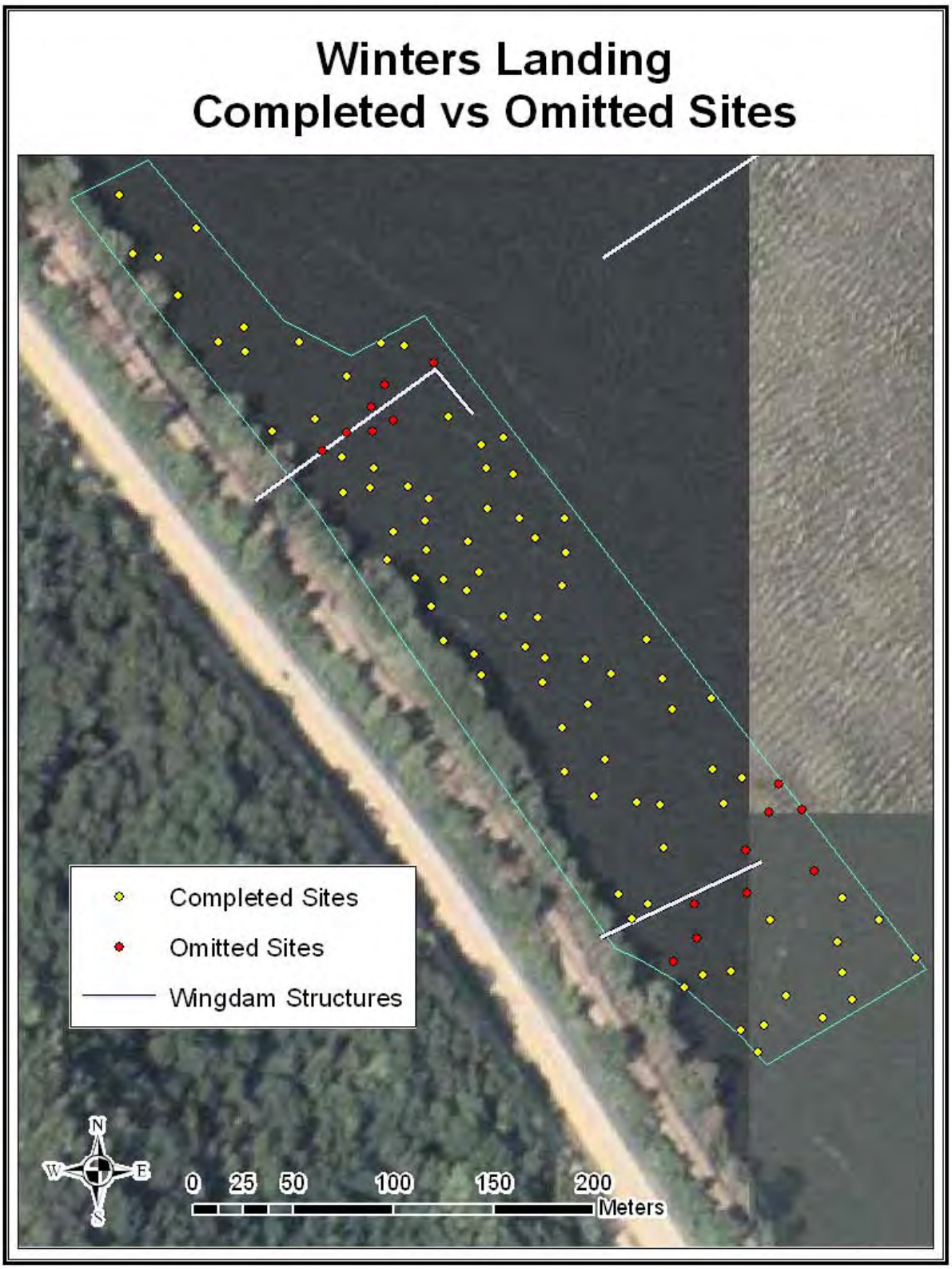

Figure 2. Sites in red were omitted from sampling due to high current velocity over wingdams.

Methods:

Quantitative sampling: Samples were collected using a ¼ m^2 aluminum frame with a 6.35 mm square mesh bag attached (Figure 3). Each quadrat sample site was located by navigating with a GPS unit programmed with the sites to be sampled. Upon reaching the coordinates of a site the sample frame was dropped to the bottom, a diver descends to it and the material within the frame is scooped into the attached bag, excavation within the frame is to a depth of approximately 15 cm. When the excavation of bottom material was complete the frame and bag were raised to the surface and rinsed in the water to remove material smaller than 6.35mm. Any remaining material was placed on a sorting platform where any mussels or shells are removed, species identified, aged by counting growth arrest rings (assumed to be annual), and total length recorded to the nearest millimeter using a caliper.

Figure 3. ¼ meter square quadrat sampler with attached ¼ inch mesh bag.

Mussel bed delineation: Transects were used to delineate the boundary of the mussel bed upstream and downstream of the area sampled. A leaded line marked in 10 meter increments was anchored to the shoreline and run out perpendicular for 100 meters. Beginning at the shore, a diver followed the transect line toward the river searching by sight and feel for live mussels. All live mussels were placed into a mesh bag and at 10 meter or longer intervals the diver ascended to the boat and all mussels collected to that point were enumerated and returned to the water. This was repeated until no mussels were found for at least 10 meters

along the line. A single reference transect was sampled within the already delineated mussel bed area for use in comparing the results from other transects.

<u>Results:</u> Quadrat sampling:

One hundred and sixty nine live mussels representing thirteen species were collected from the sampled sites. Most abundant were *Amblema plicata, Obliquaria reflexa, Fusconaia flava* and the MN Threatened species *Pleurobema sintoxia* (Table 1). Within each quadrat sample the number of species found live ranged from 0 – 8 (Figure 4). Two other MN Threatened species were found, *Quadrula metanevra* and *Ellipsaria lineolata* and two species of Special Concern were found, *Ligumia recta* and *Obovaria olivaria* (Figure 5). No *Lampsilis higginsii* were collected in quadrat samples in 2010.

Species	Common Name	**Total**
Amblema plicata	Threeridge	**62**
Obliquaria reflexa	Threehorn Wartyback	**36**
Fusconaia flava	Wabash Pigtoe	**28**
Pleurobema sintoxia	Round Pigtoe (Threatened)	**14**
Quadrula pustulosa	Pimpleback	**9**
Lampsilis cardium	Plain Pocketbook	**6**
Obovaria olivaria	Hickorynut (Special Concern)	**4**
Ligumia recta	Black Sandshell (Special Concern)	**3**
Leptodea fragilis	Fragile Papershell	**2**
Quadrula metanevra	Monkeyface (Threatened)	**2**
Ellipsaria lineolata	Butterfly (Threatened)	**1**
Lasmigona complanata	White Heelsplitter	**1**
Quadrula quadrula	Mapleleaf	**1**
Grand Total		**169**

Table 1. Relative abundance of species collected live from quadrats.

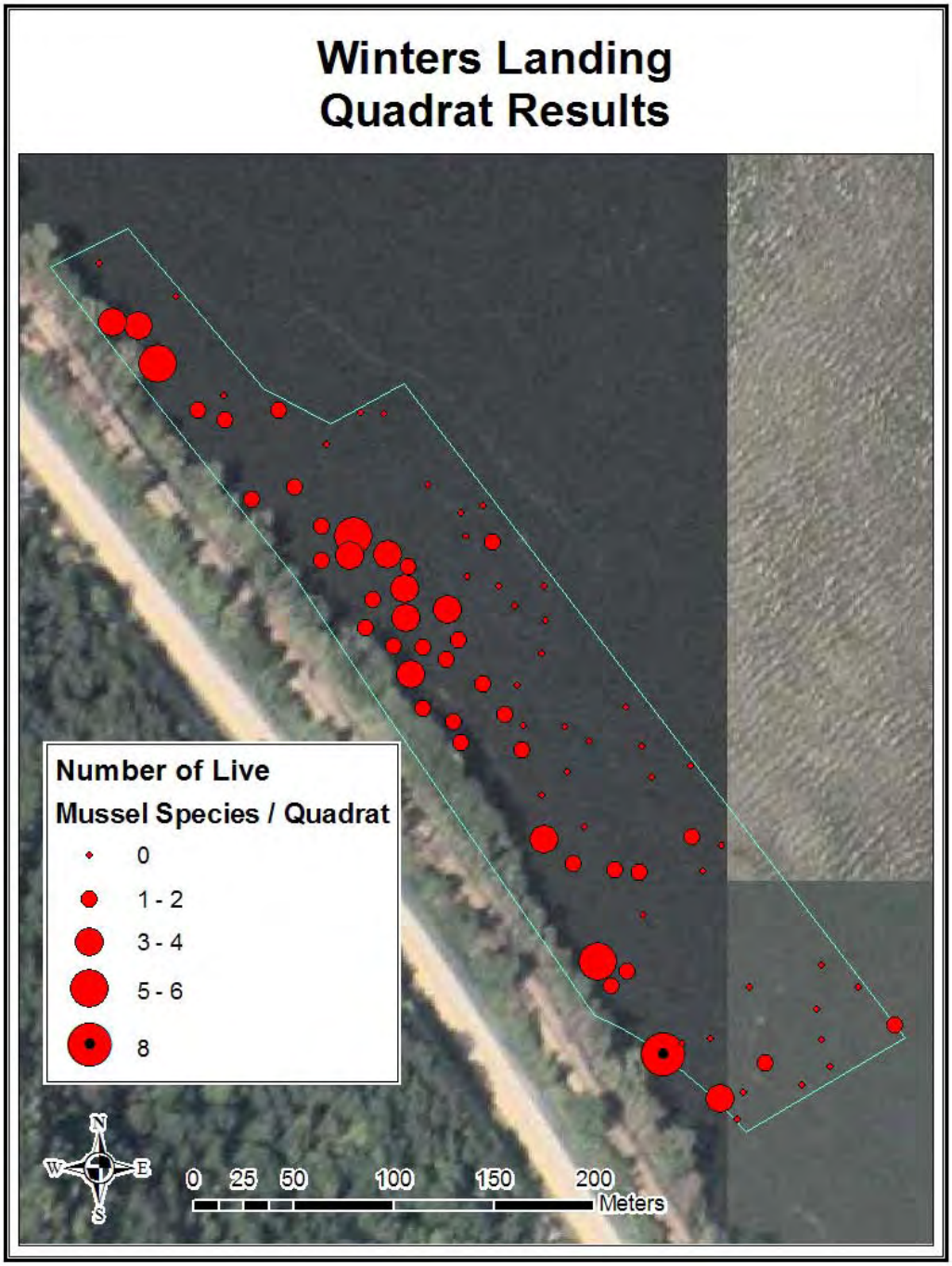

Figure 4. Number of species collected live at each sampling site.

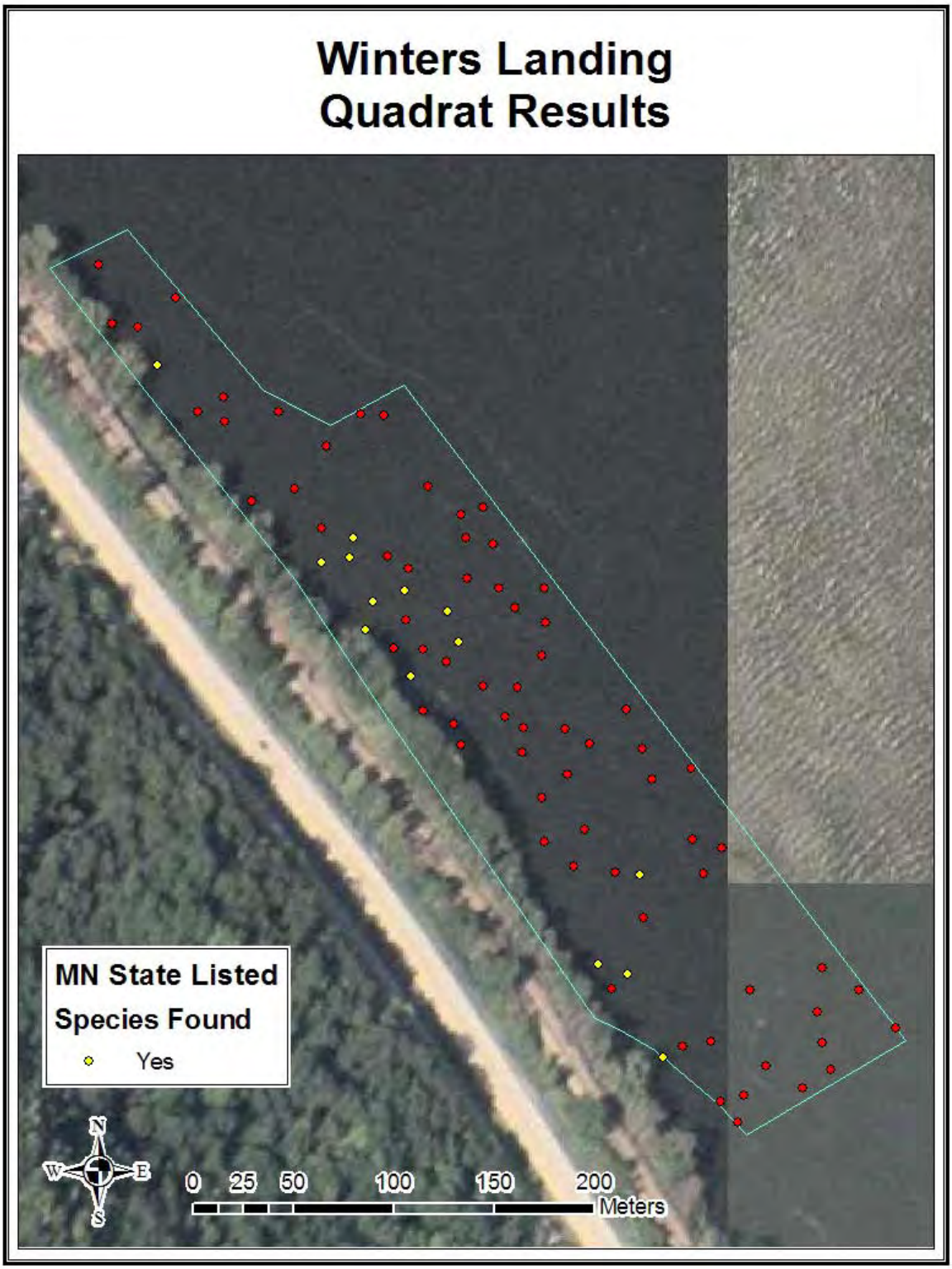

Figure 5. Sites where MN state listed species were found.

Forty one quadrat samples had no mussels present, the number of live mussels ranged from 1-17 (Table 2 & Figure 6). Density in live mussels/M^2 is estimated by dividing the number of live mussels by the number of samples and dividing the result by the fraction of a square meter sampled (¼ $M^{2)}$. In this case (169 live mussels/84 samples)/(1/4 M^2 /sample) = 8.05 live mussels/M^2. Using the estimated area of the sampled river reach the mussel population can be estimated by multiplying the density by the area; in this case (8.0 live mussels/M^2) (52,031 M^2 impact area) = 418,725 live mussels . Table 3 shows the Xcel function TINV use in calculating 95% Upper and Lower Confidence Limits (UCL and UCL) for this population estimate.

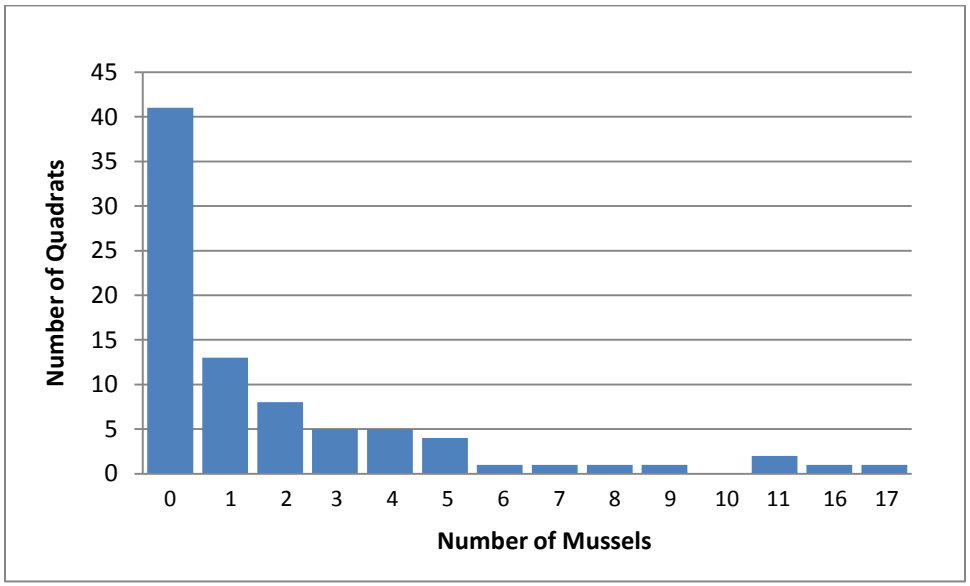

Table 2. Range of quadrat sample results.

Winter's Landing - All Mussels		
		Population Est
Sample size	84	
Mean of n	2.011904762	**407772.9**
Area (m²)	50670 m²	
SD	3.377794417	
SE	0.368547586	
TINV	1.988959743	
95%UCL	2.744931073	**556342.6**
95%LCL	1.278878451	**259203.1**

Table 3. Population estimate for Winter's Landing mussel bed 2010.

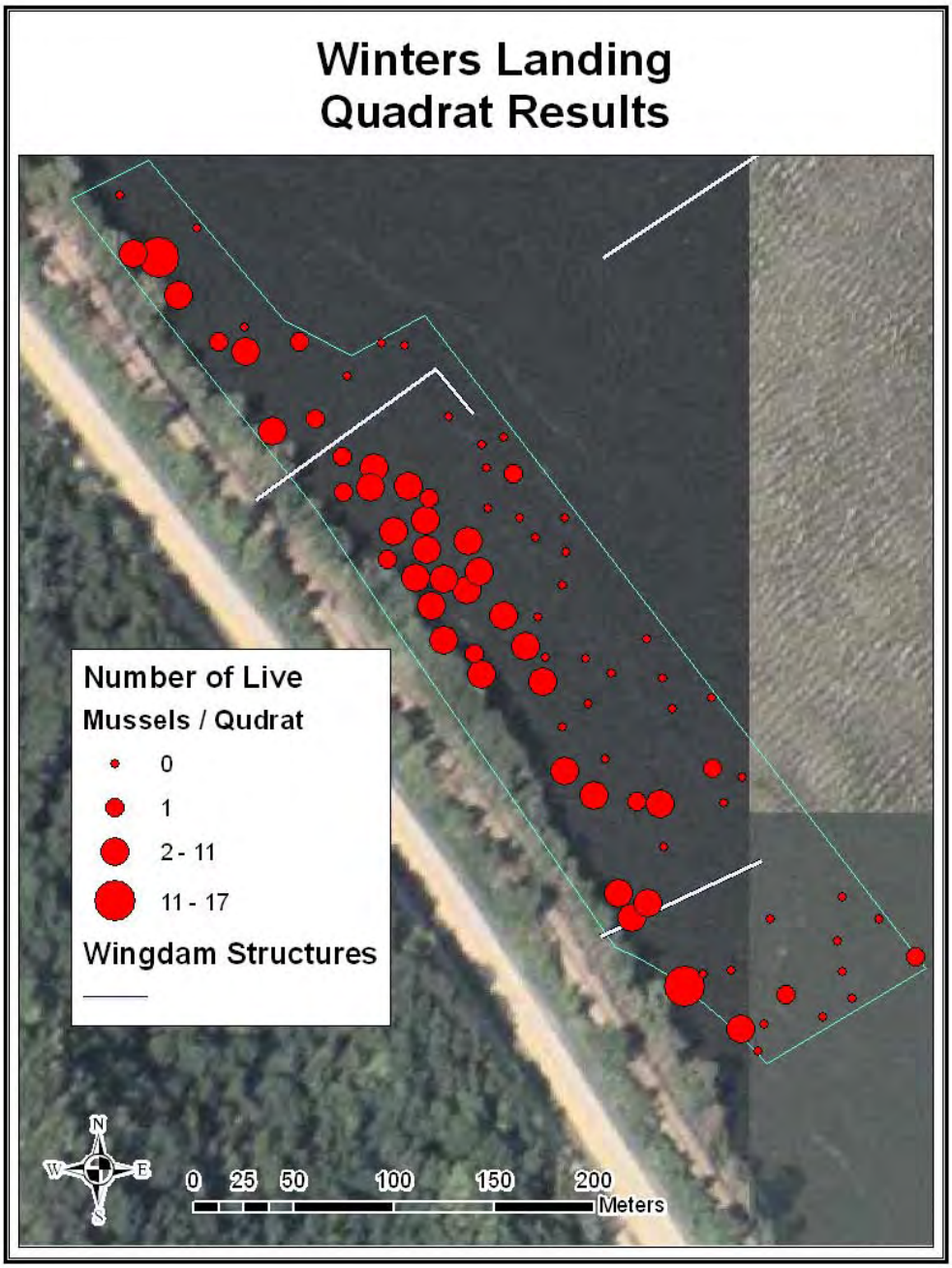

Figure 6. Number of live mussels found in each quadrat.

Age structure of mussel populations representing the four most abundant species is presented in Figure 7 along with the overall age structure of the entire sample of mussels. Evidence of

recruitment was lacking for the past two to four years in the Winters Landing EHA

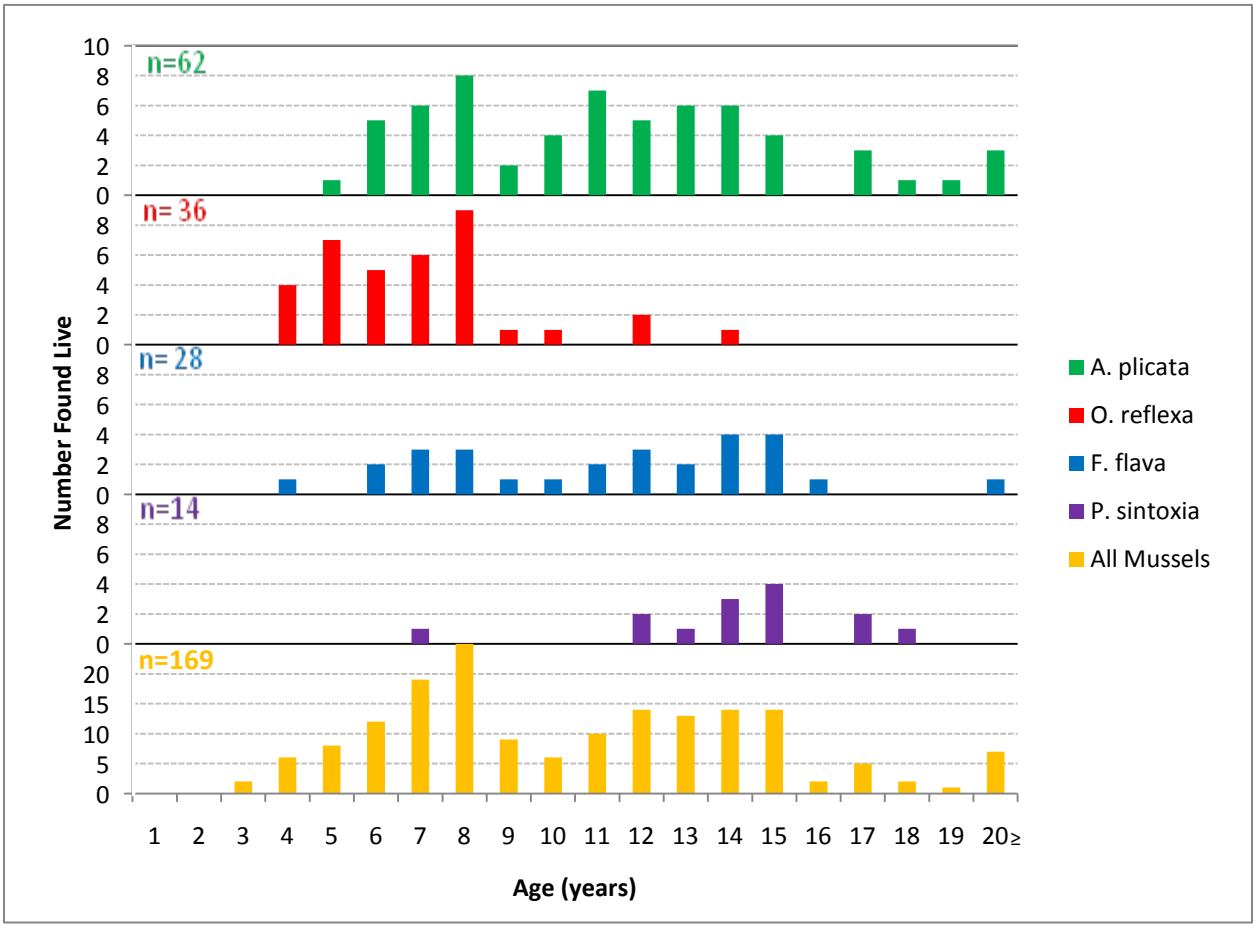

Figure 7. Age distribution of the four most abundant mussel species and all mussels at Winter's Landing.

Results - Mussel bed delineation: Two upstream, one reference and four downstream transects were sampled (Figure 8.) Mussels were still quite abundant 50m upstream of the previously delineated boundary of the mussel bed with most found from the shoreline out 20m, however, relatively few were collected 100m upstream. At a reference transect within the bed mussels were found from about 10m offshore to a distance of 35m. Abundance and distribution downstream of the previously delineated bed appeared to diminish with distance downstream and out into the river

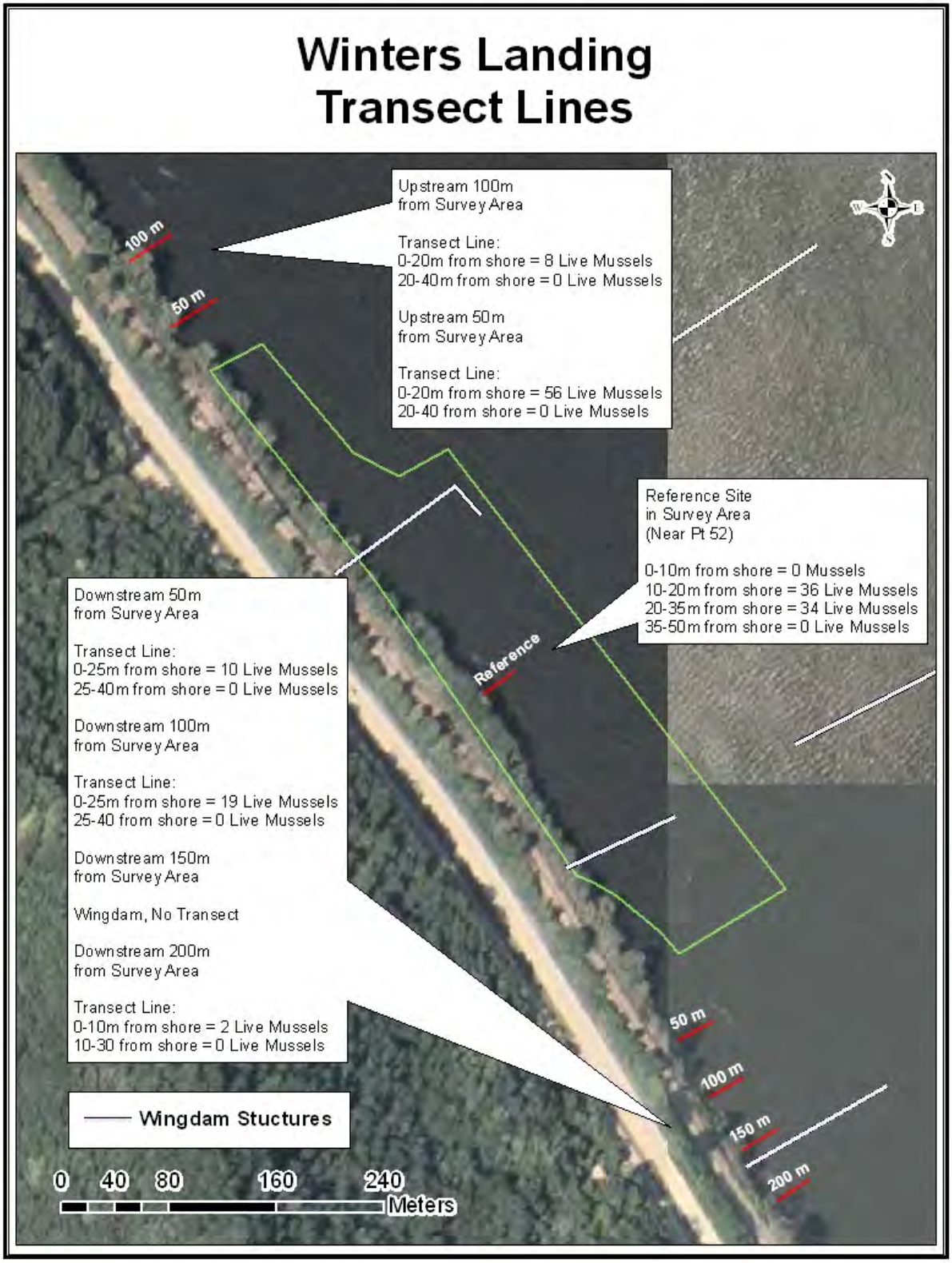

Figure 8. Mussel bed delineation transect locations and resulting information.

Discussion:

Winter's Landing still supports a large and diverse aggregation of native mussel species. Density at this bed in 2000 was reported to be 11.7 mussels/M^2 (Miller & Payne, 2001) and in 2005 was reported to be 9.4 mussels/M^2 (ERDC, 2005). We measured density to be 8.0 mussels/M^2.

Our efforts to better define the boundary of the mussel bed showed that mussels were concentrated along the shoreline, usually within 35 meters of shore and in an area that contained gravel and cobble substrate mixed with sand (Figure 9). Transect results suggest an extension of the Winter's Landing mussel bed area upstream and a retreat towards shore for future monitoring (Figure 10). In the area proposed for elimination, density was only 0.6 mussels/m^2 while within the new mussel bed boundary density is 13.9 mussels/m^2. This greatly affects accuracy in detecting change in the population of mussels at Winter's Landing over time. Table 4 compares mussel densities and population estimates among the original, suggested new area, and the eliminated portion of the original area along with the estimated number of samples needed within each to detect various levels of population change. To detect a 20% change in the mussel population within the area we sampled (original area) would require 282 quadrat samples while detecting 20% change within the suggested new area would require only 129 quadrat samples, a much easier task to accomplish.

It is difficult to compare recruitment or the presence of "juvenile" mussels in these data with those reported in 2005 since the criteria used then to define juvenile mussels was those individuals that measured ≤ 40mm in length while our data is based on age derived by counting annual growth arrest lines on the shells. However, we did collect length data; in 2005 25% of the mussels collected in quadrats were ≤40mm, in 2010 we found that19.5% of the mussels were ≤40mm in length. This discrepancy could be the result of a change in the number of juvenile mussels present or it could be the result of a change in the abundance of a small mussel species such as *Obliquaria reflexa*.

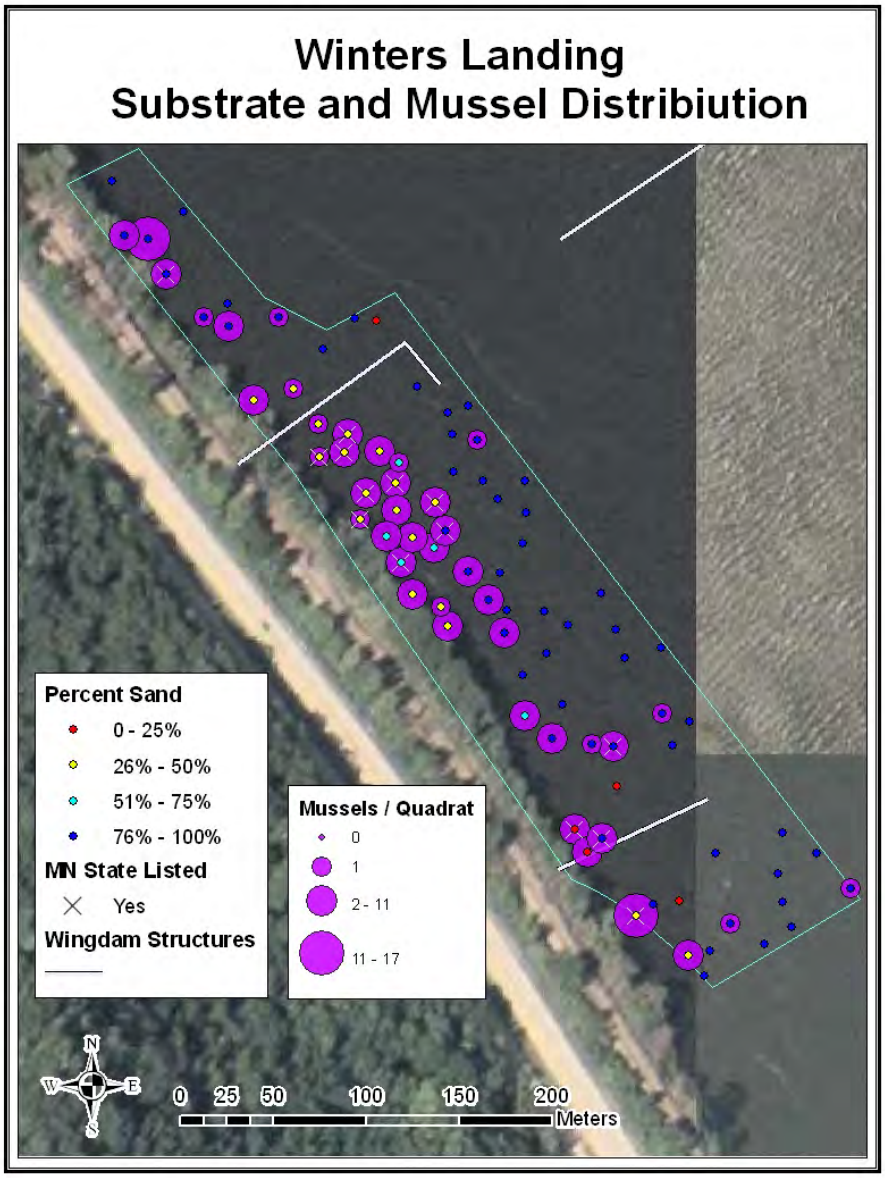

Figure 9. Mussel density in relation to substrate type and distance from shore.

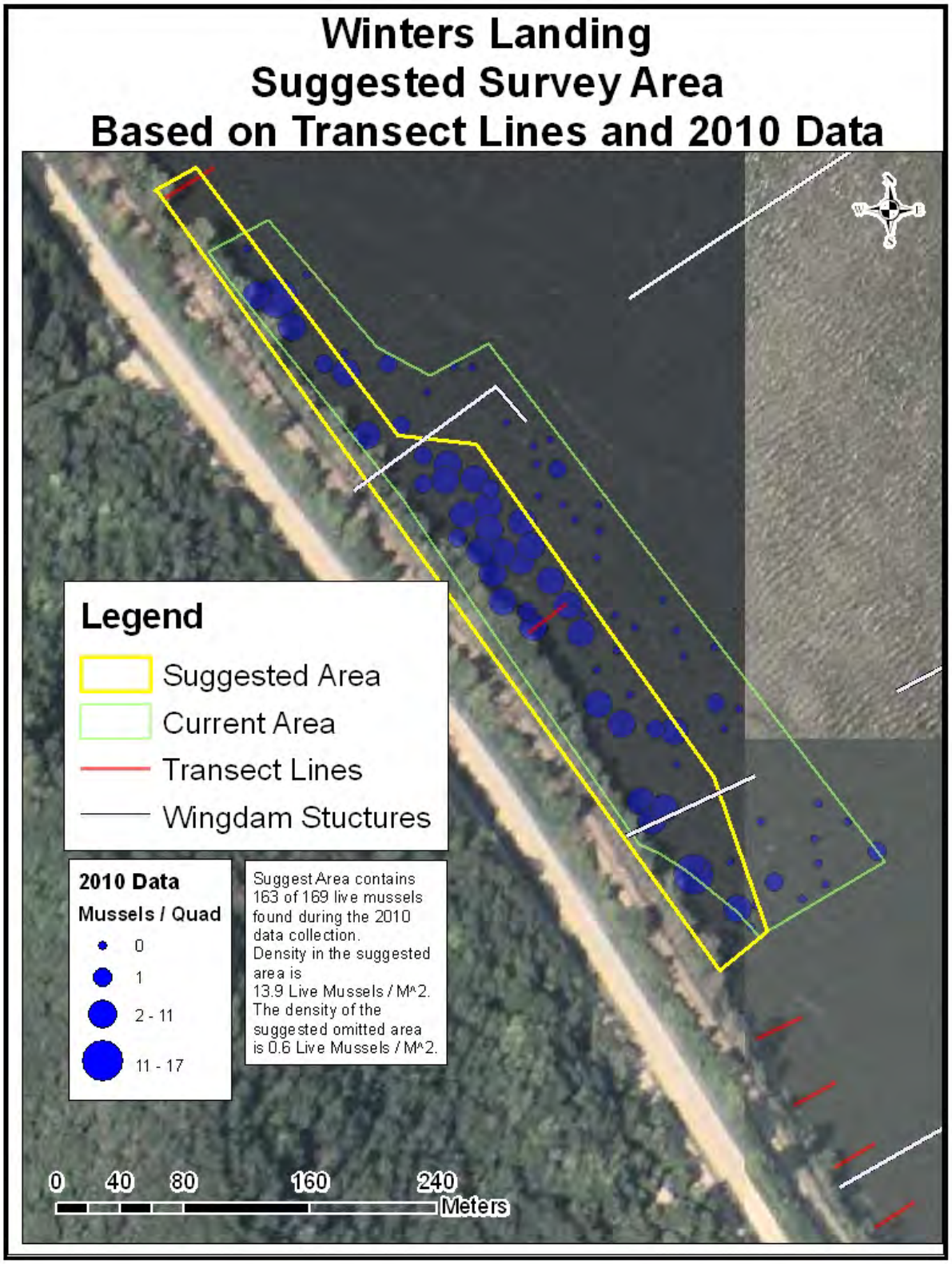

Figure 10. Suggested change in mussel bed boundary.

Further rationale for this suggestion can be found in Table 4 below.

Sample Size Estimate Based on the Percent Variance Among Samples					
Statistical Analysis					
Original Area		Suggested Area		Eliminated Area	
Mean Population Est.	407,773	Mean Population Est.	438,727	Mean Population Est.	16,282
95% UCL	556,343	95% UCL	585,236	95% UCL	27,371
95% LCL	259,203	95% LCL	292,218	95% LCL	5,193
Density	8.0 / M^2	Density	13.9 / M^2	Density	0.6 / M^2
Change in Population	Required Sample Size to Detect Change	Change in Population	Required Sample Size to Detect Change	Change in Population	Required Sample Size to Detect Change
10%	1,127	10%	517	10%	2,124
20%	282	20%	129	20%	531
25%	180	25%	83	25%	340
30%	125	30%	57	30%	236
35%	92	35%	42	35%	173
40%	70	40%	32	40%	133
50%	45	50%	21	50%	85

Table 4. Comparisons of mussel densities and population estimates among the original, suggested new area and the eliminated portion of the original area along with the estimated number of samples within each to detect various levels of population change.

References

Miller and Payne, 2001. Effects of Zebra Mussels (*Dreissena polymorpha*) at Essential Habitats for *Lampsilis higginsi* in the Upper Mississippi River System, 2000. Aquatic Ecology Branch, Engineering Research and Development Center, Visckburg, MS 39180.