BIOLOGICAL ASSESSMENT

First Marine Properties, LLC
Port of Calvert City
Calvert City, Kentucky

Prepared for:
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-and-
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EXECUTIVE SUMMARY

First Marine Properties, LLC, Paducah, Kentucky, has applied to the Commonwealth of Kentucky, Tennessee Valley Authority (TVA) and U.S. Army Corps of Engineers (USACE) for permits to construct a barge and container vessel port at the proposed project location. The proposed project location is on the left descending bank of the Tennessee River between approximate Tennessee River Mile (TRM) 10.7 and 11.3 in Marshall County near Calvert City, Kentucky. First Marine Properties maintains that the facility would serve as a regional hub for distribution of multi-modal containers and general goods. In addition to eventually being able to handle standard river barge shipments, the proposed port is designed to be able to handle specialty vessels that can carry more than 1,000 containers and off-load them to an on-site storage facility, where these containers will be loaded onto trucks or trains for further distribution. The purpose of this Biological Assessment is to evaluate and determine the effects of the facility's construction and operation on any potentially impacted federally listed species or designated critical habitat.

Based on records from the USFWS, threatened, endangered, proposed, or candidate mussel species that have the potential to occur within this section of the Tennessee River include:

- Fanshell (*Cyprogenia stegaria)* – endangered
- Fat Pocketbook (*Potamilus capax*) – endangered
- Orangefoot Pimpleback (*Plethobasus cooperianus)* – endangered
- Pink Mucket (*Lampsilis abrupta)* – endangered
- Rabbitsfoot (*Quadrula cylindrica)* –threatened
- Ring Pink (*Obovaria retusa*) – endangered
- Rough Pigtoe (*Pleurobema plenum*) – endangered
- Sheepnose (*Plethobasus cyphyus*) – endangered
- Spectaclecase (*Cumberlandia monodonta)* – endangered

In addition to the above listed mussel species, the project site in Marshall County may support or has historically supported numerous additional terrestrial and aquatic species that are federally listed. They include one plant species federally listed as threatened (Price's potato-bean), and two mammal species federally listed as endangered (Indiana bat and gray bat). In March of 2014, Redwing Ecological Services, Inc. (Redwing) performed a terrestrial survey at the current project location. The terrestrial survey performed by Redwing is included at the end of this biological assessment as Appendix A.

The United States Fish and Wildlife Service (USFWS) previously requested a mussel survey for the originally proposed location of the port, between TRM 11.1 to 12.0, to support evaluation of the potential project effects on federally listed species possibly existing in that area. Subsequent to the mussel survey being performed, the proposed location of the port was moved slightly downstream and reduced in size to minimize wetland and aquatic species impacts. The current location of the proposed port overlaps with the previously performed survey by approximately 320 meters, and continues downstream from the previously surveyed area by a distance of

approximately 640 meters. Because the survey location is adjacent to and overlaps the proposed port location being evaluated in this assessment, the USFWS and the USACE have decided that the concentrations and distributions of the mussels encountered in the previous survey can be accurately extrapolated for analysis between TRM 10.7 and 11.3 without the need for an additional survey. The survey, performed in September 2012, found 3,402 live mussels from 22 unionid species, indicating a healthy mussel community. Six individuals of the federally endangered species *Plethobasus cyphyus* (sheepnose mussel) and twenty-six individuals of the federally threatened species *Quadrula cylindrica* (rabbitsfoot mussel) were located during the survey. The survey report is included at the end of this biological assessment as Appendix B.

Based on the analysis of project activities and potential impacts as further described in this biological assessment, it has been determined that the Price's potato-bean, the Indiana bat and gray bat are not likely to be adversely affected by the project.

Based on the analysis of project activities and potential impacts as further described in this biological assessment, it has been determined that the sheepnose mussel, rabbitsfoot mussel and orangefoot pimpleback mussel are likely to be adversely affected by the project.

I. INTRODUCTION

A. *Background*

First Marine Properties, LLC plans to construct a barge and container vessel port along the left descending bank of the Tennessee River between TRM 10.7 and 11.3 in Marshall County, Kentucky. The proposed facilities at the project location would serve as a regional hub for distribution of multimodal containers and general goods, many of which will be shipped inland from New Orleans, Louisiana and Mobile, Alabama, where large increases in trade goods are expected following the opening of the Panama Canal expansion. The port could handle specially designed vessels that can carry more than 1,000 containers and off-load them to waiting barges, trucks and trains approximately once every three days. According to First Marine Properties, this method of trade delivery would remove several thousand trucks a month from the interstate system and allow for much more efficient movement of foreign goods to U.S. consumers while reducing overall congestion and associated air emissions. Currently, the majority of the left descending bank between TRM 10.7 and 11.3 is already used for barge fleeting, and barge scrapping is ongoing at TRM 11.

Because the Tennessee River is known to support a large number of federally listed mussel species, First Marine Properties previously funded a survey of the former proposed project area within the Tennessee River, between TRM 11.1 and 12.0, to help determine if and how the proposed project may affect listed mussel species known to be historically present in the lower Tennessee River. After the survey, the project layout was redesigned, reduced in size, and moved slightly downstream in an effort to decrease the impact to surrounding wetlands and aquatic species. Because the survey location is adjacent to and overlaps the proposed port

location being evaluated in this assessment, the USFWS and the USACE have decided that the concentrations and distributions of the mussels encountered in the previous survey can be accurately extrapolated for analysis between TRM 10.7 and 11.3 without the need for an additional survey. The freshwater mussel survey, performed in September 2012 by Mainstream Commercial Divers, Inc., found 3,402 live mussels from 22 unionid species, indicating a healthy mussel community near the proposed site.

Six individuals of the federally endangered species *Plethobasus cyphyus* (sheepnose mussel) and twenty-six individuals of the federally threatened species *Quadrula cylindrica* (rabbitsfoot mussel) were located during the survey. No other federally or state endangered or threatened mussel species were found during the survey. However, since listed mussels are rare, they are often not detected during general surveys designed to characterize the mussel community. Therefore, the fact that no other listed mussel species were found does not guarantee that they are not present in low densities at the site. In recent biological assessments (TVA 2009, 2010, 2012), TVA has assumed the presence of some listed mussel species using thresholds of community species richness >15 species combined with substrate surface densities >2.5 - 3 mussels/m^2 (equivalent to whole-substrate densities of about 10 mussels/m^2), which were derived from other Tennessee River surveys (Dinkins 2008, Lewis Environmental Consulting 2008, TVA 2009) that collected the federally endangered pink mucket where mussel community parameters were at or higher than these values.

Although the pink mucket mussel is not expected to be present at the proposed project location, given the high densities and species richness found in areas near the proposed project (Mainstream 2012), it is possible that some federally listed mussel species, other than those found, may occur at low densities and could potentially be affected by the First Marine Properties project.

Using historic records for the lower Tennessee River, compiled by Dr. James Sickel and C.E. Lewis for the USACE (2007), in addition to general information provided by the USFWS endangered species website (2013a), threatened, endangered, proposed, or candidate mussel species that have the potential to occur within this section of the Tennessee River include:

- Fanshell (*Cyprogenia stegaria)* – endangered
- Fat Pocketbook (*Potamilus capax*) – endangered
- Orangefoot Pimpleback (*Plethobasus cooperianus)* – endangered
- Pink Mucket (*Lampsilis abrupta)* – endangered
- Rabbitsfoot (*Quadrula cylindrica)* –threatened
- Ring Pink (*Obovaria retusa*) – endangered
- Rough Pigtoe (*Pleurobema plenum*) – endangered
- Sheepnose (*Plethobasus cyphyus*) – endangered
- Spectaclecase (*Cumberlandia monodonta)* – endangered

In addition to the above listed mussel species, the project site in Marshall County, KY may support or has historically supported additional terrestrial and aquatic species that are federally

listed. They include one plant species federally listed as threatened (Price's potato-bean), and two mammal species federally listed as endangered (Indiana bat and gray bat). Species accounts are provided in Section IV.

Finalized critical habitat rules have not currently been published for either the sheepnose mussel or the rabbitsfoot mussel, although critical habitat has been proposed for the rabbitsfoot mussel in several states. In Kentucky, the lower Tennessee River downstream of Kentucky Dam is proposed to be designated as Critical Habitat Unit RF20b (USFWS 2012a). Under the Endangered Species Act, the U.S. Fish and Wildlife Service is required to identify the physical or biological features essential to the conservation of the species, which are termed primary constituent elements (PCEs). When these PCEs are laid out in the appropriate quantity and spatial arrangement to provide for a species' life-history process, they aid in the species' conservation and help in designating areas of critical habitat.

According to the USFWS, as listed in the aforementioned Federal Register (USFWS 2012a), the PCEs for the rabbitsfoot mussel are:

> (1) Geomorphically stable river channels and banks (channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as, stable riffles, sometimes with runs, and mid-channel island habitats that provide flow refuges consisting of gravel and sand substrates with low to moderate amounts of fine sediments and attached filamentous algae); (2) A hydrologic flow regime (the severity, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species are found and to maintain connectivity of rivers with the floodplain, allowing the exchange of nutrients and sediment for maintenance of mussel and fish host habitat, food availability, spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats; (3) Water and sediment quality (including, but not limited to, conductivity, hardness, turbidity, temperature, pH, ammonia, heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages; (4) The presence and abundance (currently unknown) of fish hosts necessary for recruitment of the rabbitsfoot. The occurrence of natural fish assemblages, reflected by fish species richness, relative abundance, and community composition, for each inhabited river or creek will serve as an indication of appropriate presence and abundance of fish hosts until appropriate host fish can be identified; and (5) Either no competitive or predaceous invasive (nonnative) species, or such species in quantities low enough to have minimal effect on survival of freshwater mussels (Federal Register, 2012).

Critical habitat for the rabbitsfoot mussel is present at the proposed First Marine Properties facility, located in Critical Habitat Unit RF20b, based on all or portions of the primary constituent elements being present. However, rabbitsfoot mussels are not distributed evenly throughout the extent of Unit RF20b habitat. Based on recent surveys performed in the lower Tennessee River specifically looking for this species (Mainstream 2012), the rabbitsfoot mussel was found predominantly along the toe of the bank in this section of the Tennessee River downstream of Kentucky Dam. This can be described

as habitat/substrate conditions that this species seems to prefer and this habitat exists as a small portion of the area that may be affected by the proposed First Marine Properties project. Analysis of potential effects of the proposed action on the rabbitsfoot mussel and its proposed critical habitat are presented in Section V: Effects Analysis.

For the other species referenced, critical habitat has only been designated for the Indiana bat, which does not exist at the project site (USFWS 2013). Therefore, critical habitat for the three terrestrial species is not present near the proposed project and will not be considered further in the development of this Biological Assessment.

B. *Purpose*

The purpose of this Biological Assessment is to evaluate First Marine Property's proposed construction, operation, and maintenance of a barge port and storage facility to determine potential effects on any federally listed species and their habitat.

II. DESCRIPTION OF THE PROPOSED PROJECT

A. *Project Conception*

Prior to First Marine Properties' involvement with the proposed project area, several companies performed various operations along the stretch of the Tennessee River between TRM 10 and 12 from the 1950's to the date First Marine Properties took up ownership of the land. Barge fleeting, mooring and scrapping, among other activities, has existed at the site long before First Marine Properties obtained possession of the land, and in 2002, all previous permits granted to all previous entities for the use of the land were consolidated into DA permit 2012-00349 and granted to First Marine Properties. In addition to this, modifications were made to the consolidated permit to allow salt and agricultural products to be handled. The USACE, on October 4, 2006, altered the permit to also allow barge construction operations at the subject location. Tennessee Valley Authority (TVA) followed in February 2006 by issuing a 26a permit to First Marine Properties for a proposed coal handling facility at TRM 11.0, which was never constructed. First Marine Properties currently operates barge scrapping at this location but seeks to cease barge scrapping and change the scope of work to facilitate a commercial goods distribution operation.

With the ongoing upgrades to the Panama Canal, larger vessels will be able to move more containers per vessel through the Canal to the Gulf of Mexico and eastern seaboard ports, including the Ports of New Orleans and Mobile, among others. First Marine Properties, LLC plans to construct a barge port, the Port of Calvert City, along the left descending bank of the Tennessee River between TRM 10.7 and 11.3 in Marshall County, Kentucky (Figures 1 and 2) to take advantage of this increase in trade goods. An innovative container vessel is currently being designed that will be able to maneuver the shallow waters of the inland waterways, especially the Mississippi River and Tennessee-Tombigbee Waterway, to bring containers to the Port of

Calvert City. This vessel will be able to fit into the smallest lock it would encounter on its journey from the Port of Mobile and is projected to be capable of carrying more than 1,000 multi-modal shipping containers.

The container vessel currently in design is unique with a draft of nine feet, dimensions of approximately 600 feet in length and approximately 100 feet in width, and will be rated at approximately 9,000 horsepower with two bow thrusters and a rudderless rear z-drive for maneuverability. In addition to the novel propulsion design, the interior of the vessel will be compartmentalized, allowing the vessel to remain afloat in the occurrence of a hull breach. All operations and mechanical equipment will be confined within the hull rather than situated above deck.

The Port of Calvert City has the necessary land base along with excellent river, highway and rail access, an extraordinary electric power supply and concomitant facilities, and infrastructure already available to meet the increased demand for container shipping in the lower Tennessee River. This combination of features along with adequate water depth makes this location particularly desirable for handling containers and other commodities.

During the preapplication meeting, the USACE requested an alternative analysis of other potential "megasites" within the region. A megasite can easily be defined as a large parcel of land greater than 1,000 acres ready for industrial development. The classification of parcels as megasites has not existed long, and TVA hired McCallum Sweeney Consulting based in Greenville, South Carolina, to analyze the entire TVA Service Area for potential megasites. Three potential megasites were identified by TVA's consultant, one in Hopkinsville, Kentucky, one in Memphis, Tennessee and one in the Western Kentucky Purchase Region Industrial Park between Mayfield and Paducah, Kentucky. These three industrial sites all have the same amenities as the Port of Calvert City, except they do not have direct access to the Inland Waterway System, which is critical to the movement of containerized shipments. As such, there were no other existing viable alternative sites identified in the TVA coverage area.

With the location in the lower Tennessee River chosen as the most ideal area for the proposed facility, various site designs were created. The original site plan (Figure 4) would have impacted one previously man-made intermittent stream and approximately 40 acres of jurisdictional wetlands. In an effort to alleviate environmental impacts, the site layout was redesigned twice. From the original site layout, the current design will reduce wetland impacts by just over 90% to only 3.9 acres, and the intermittent stream would remain untouched. In order to raise the loadout and staging area above the 500-year flood stage, excavated material from the 13 acre borrow site would be used as fill to raise the 19 acre development area to an elevation of 346 feet above mean sea level (Figure 3).

B. *Project Construction*

Upon receiving all necessary permits, First Marine Properties will begin construction on two different sections of the proposed facility area (Figure 3) as listed below. A site layout (Figure 3) and elevation views of the proposed project are included for the project area (Drawings 1-6) and will be referenced below where relevant.

Borrow Area

To obtain the required development area fill, it will be necessary to obtain the volume of fill material from the borrow area. The proposed borrow area for the project consists of the open field area immediately upstream of the development area. The overburden in this area would be excavated and placed in the fill area (development area). Once excavation is completed, the entire borrow area would be seeded and stabilized. The volume of soil excavated from the borrow area will leave a sufficiently deep depression that will collect runoff precipitation. To prevent this collected water from filling the borrow area and spilling over into the adjacent Tennessee River, most likely washing out much of the river bank in the process, an excavated drainage channel would be constructed and stabilized with riprap. This channel would be above the normal pool level of the lower Tennessee River but would allow the pooled water in the borrow area to drain into the river in a controlled fashion that would not threaten the stability of the immediate river bank.

The borrow area exists entirely out of water, and no anticipated risk to freshwater mussels exists during construction. The clearing of forest and individual trees may affect existing Indiana bat summer roosting and foraging habitat and so may pose a risk to Indiana bats (Figure 4). No roosting habitat for gray bats exists in the area and so no adverse risk to gray bats is expected. No habitat for Price's potato-bean exists in the area and so no risk to Price's potato-bean is expected.

Development Area

Materials excavated from the borrow area onsite would be utilized to create a landmass that will be approximately 19 acres with final grade above the 500-year flood water surface elevation, where the top elevation of the landmass would be 346 feet above mean sea level. This landmass would serve as the development area for all land-based activities for the port and would include access to Shar-Cal Road. This area would be utilized for the temporary storage and manipulation of containers as well as general goods. A sheet pile breasting wall will be installed to encompass an approximate 0.2 acre (8,712 square feet) area of the Tennessee River. The sheet pile wall will be built approximately 45' from the left descending bank of the river and will surround two existing mooring cells. This 0.2 acre area will be an extension of the development area and is expected to be the location for the installation of a cargo loading crane. Three breasting dolphins will be installed out from the left descending bank and are expected to be built in line with the sheet pile breasting wall. One dolphin will be situated 150 feet upstream of the wall, a second dolphin will be situated 150 feet downstream of the wall and the third dolphin will be situated 300 feet downstream of the wall (Figure 3). Mr. Matt Brawley, engineer with ICA Engineering,

has provided the information that each dolphin will be comprised of three 12-inch diameter pipes, where the entirety of each dolphin is expected to be contained within an area approximately 24 inches in diameter. Using these provided dimensions, each dolphin is expected to directly impact approximately 3.14 square feet and the three dolphins together are expected to directly impact a total approximately 9.42 square feet. Construction barges utilized for the sheet pile breasting wall and dolphin installation may hold themselves in position temporarily by employing spud poles (vertical pipe or square steel sections lowered to the river bottom to hold a barge in position), which may directly impact native mussels when dropped. Most frequently these spud poles would be 18 to 24-inch pipe or square stock, with two spuds dropped to the river bottom on a single pile driving barge for each dolphin installation location. Assuming 24-inch square stock, each work barge location using spud poles would directly affect approximately 8 square feet, yielding a total of 24 square feet of river bottom directly impacted via spud poles during the installation of the three dolphins. When combined with the approximate direct impact of the dolphins (9.42 square feet), the total area of direct impact for all three dolphin installations is expected to be approximately 34 square feet. According to personal communication with Mr. Steve Hawthorn of Southern Marine Construction Company, the sheet pile wall installation is expected to require approximately fifty placements of a pile driving barge. If the work barge is spudded down fifty times, that would yield an approximate area of direct spud pole impact of 400 square feet, which in combination with the direct impact area of the fill material to be placed behind it, would total an area of approximately 9,112 square feet. Because of the relatively high mussel densities near and within the area of sheet pile wall and dolphin installation (Inferred from Mainstream 2012), federally listed mussels could be present near the sheet pile wall and dolphin installation areas may be directly impacted.

The landmass that is created will accommodate truck traffic for the loading and unloading of barges, as well as a 250-ton heavy-lift crane for loading/unloading special cargo. The landmass will be connected to Shar-Cal road at the location of the existing entrance road to the barge maintenance facility. The fill material to create this landmass will be comprised of approximately 700,000 cubic yards of material obtained from within the limits of the project and within the limits of the 100-year floodplain for the Tennessee River. All fill slopes will be constructed at 3H:1V or flatter and suitably stabilized against erosion. Once constructed, the landmass will be covered with gravel for one to two years to allow for settlement, at which time it will then be paved with asphalt and/or concrete. Surface drainage from the site will be provided through shallow inlets and storm sewer piping along with riprap stabilized flumes that drain to the river. The landmass will be constructed to minimize impact to existing jurisdictional wetlands and maintain a 50-foot wide riparian buffer along the bank of the Tennessee River. The total area of wetlands disturbed for the construction of the landmass is expected to be approximately 3.9 acres, reduced from the original design that would have impacted approximately 40 acres of wetlands.

Beginning from the furthest downstream point of the facility, Drawing 1 illustrates the extent to which the development area will be built up in relation to the Tennessee River and its average flood stages for normal pool, five year and one hundred year floods. Moving upstream, Drawings 2 and 3 show elevation views for the two proposed mooring dolphins expected to be

installed downstream of the filled-in sheet pile wall structure encompassing the existing mooring cells. Drawings 4 and 5 illustrate the location of the aforementioned sheet pile wall structure in relation to the Tennessee River while Drawing 6 depicts the most upstream end of the proposed development area.

The presence of large numbers of mussels most likely exist in this area, assuming similar mussel concentrations as were encountered in the survey performed in 2012 (Mainstream 2012). The assumed presence of numerous mussels indicates that the construction of the sheet pile breasting wall and three breasting dolphins may pose a risk to freshwater mussels at and closely around the areas of installation. This includes any effects imposed by construction machinery, such as spud poles placed down to stabilize any work barges and possible wheel wash effects from tow boats moving the work barges into position for driving the sheet piles into the substrate; however, once in place, the sheet pile wall and breasting dolphins would prevent any docking barges or shipping containers from coming into contact with the river bottom.

The clearing of forest and addition of fill material may affect existing Indiana bat summer roosting and foraging habitat and so may pose a risk to Indiana bats (Figure 4). No roosting habitat for gray bats exists in the area and so no adverse risk to gray bats is expected. No habitat for Price's potato-bean exists in the area and so no risk to Price's potato-bean is expected.

C. *Project Operation*

The development area will be utilized primarily for the temporary storage and manipulation of containers. The area will include any machinery required to move containers and large equipment to and from the container vessels and barges. Also included in this area would be any offices/operation facilities necessary for any on-site administrative and coordination tasks.

Proposed initial container vessel traffic rates are expected to be one vessel approximately every three days at the proposed port of Calvert City, where they will dock at the sheet pile breasting wall and await unloading of cargo. The vessels will then be unloaded of shipping containers via overhead crane. The container vessels, being highly maneuverable watercraft, will be operating under their own power and will be docking only at the breasting wall, which is expected to maintain its current adequate water depth. The container vessels' wheel wash may affect the river bottom at and around the breasting wall at low water, but any impact is expected to be minimal and should be less than what already occurs due to currently ongoing permitted activities at the facility.

Proposed barge traffic at the port will be for loading and unloading of large equipment as well as continuing currently permitted fleeting. Small yard tugs, operating at no more than 1,000 horsepower, will maneuver barges into and out of dock at the breasting wall, breasting dolphins as well as the existing fleeting areas alongside the breasting dolphins. Because the small yard tugs will operate at a low horsepower and will endeavor to maintain safe distance from the river bottom while moving barges, no additional impacts to mussels are expected from the tugs' wheel

wash other than what already occurs from deadman barge fleeting and First Marine's other currently ongoing and permitted activities.

D. *Ecological Conservation Measures and Benefits*

First Marine Properties has committed to a variety of design and facility operation features to reduce and minimize impacts of the proposed Port of Calvert City project on terrestrial and aquatic habitat, and federally listed species. These methods can be grouped as short-term (during conception and construction) and long-term (during continued operation of the facility).

Short-term impact conservation measures include:

1. Redesigning the facility layout. The first design would have permanently impacted a man-made intermittent stream and 40 acres of jurisdictional wetlands. The second design would have impacted approximately 100 linear foot of stream, a portion of the river bottom via dredging as well as 4.73 acres of jurisdictional wetlands and significant amounts of archaeological remains. The current design is projected to impact only 3.9 acres of jurisdictional wetlands and minimize impacts to aquatic species.

2. Sheet pile and dolphin installations will be accompanied by a floating turbidity curtain, which will effectively contain and control suspended solids, significantly lessening the impact to listed mussels downstream.

3. Reseeding and stabilization of the borrow area following fill material removal will occur, resulting in positive drainage of runoff water to the Tennessee River.

4. Conducting all tree clearing between October 15 and March 31, during the daytime, in an effort to avoid directly impacting Indiana and gray bats.

Long-term impact conservation measures include:

1. Keeping a minimum of 10 feet of water depth at the barge port near TRM 11.0 through the use of the sheet pile breasting wall and breasting dolphins, significantly reducing impacts to mussels on the bottom of the river.

2. Not dredging at the sheet pile breasting wall or the breasting dolphins to maintain adequate depth. Dredging has never been performed at the proposed project site and the decently swift river current on the left descending side of the river keeps the river bottom reasonably free of sediment. Natural occurrences may occur that necessitate future dredging but First Marine Properties has neither plans nor a desire to dredge at this location.

3. Operating small yard tugs at no more than 1000 horsepower, reducing the effect of wheel wash on mussels while maneuvering barges into and out of dock at the Port.

4. Utilizing either LNG or CNG with diesel to power the container vessel, which would reduce air emissions as opposed to a solely diesel powered vessel.

E. *Action Area*

The action area for the proposed project consists of all areas (directly or indirectly) affected by the project elements (construction and operation) on land and in the water.

Known land-based direct impact areas from construction consist of the borrow area where fill will be extracted, and the development area where that fill will be deposited. The borrow area is anticipated to have an approximate area of 17 acres while the development area is anticipated to have an approximate area of 19 acres. The excavation and fill deposition in these two areas are expected to impact an approximate total area of 3.9 acres of wetlands. In order to construct the sheet pile breasting wall and fill in the 0.2 acre area of the Tennessee River behind it to connect to the development area, an approximate 1,520 linear feet of Tennessee River riparian zone will be cleared. In order to construct the drainage channel to allow the pooled water in the borrow area to drain to the Tennessee River, an approximate 150 linear feet of Tennessee River riparian zone will be cleared.

Aquatic-based construction related direct impact areas include the construction of a sheet pile wall around the two existing cells at approximate TRM 10.9 and 10.95, extending back to the shore and the fill of this then enclosed area with sediment extracted from the borrow area. In addition, three mooring dolphins will be installed in line with the riverward face of the sheet pile wall with one dolphin situated 150 feet upstream of the wall, a second dolphin situated 150 feet downstream of the wall and the third dolphin situated 300 feet downstream of the wall (Figure 3). The area of fill in the Tennessee River behind the existing cells following the construction of the sheet pile wall is expected to be approximately 0.2 acres (8,712 square feet). The area of river bottom directly affected by the installation of the dolphins (34 square feet), the sheet pile wall (400 square feet), and the fill of earth behind it is expected to be approximately 9,146 square feet, or an approximate 850 square meters. The mussel survey evaluated the concentrations of mussels within the previous survey area in units of mussels per square meter, and so to evaluate the approximate number of mussels expected to be impacted from construction activities, it was necessary to change all aquatic areas of impact from imperial units to square meters.

In summation, 3.9 acres (15,782.7 square meters) of wetlands, approximately 850 square meters of river bottom, and approximately 1,670 linear feet (approximately 509 meters) of Tennessee River riparian zone are all expected to be impacted.

Known land-based direct impact areas from operations consist of the area to be used for container storage and manipulation. Since the majority of the land-based activities related to operation of the facility will be performed on the then-filled development area, any terrestrial impact for the entire facility will most likely originate from this area. The potential effects from operation of this area include but may not be limited to runoff from this area into the Tennessee River.

The potential aquatic direct impact area from operations includes the area around the existing cells where the sheet pile breasting wall will be constructed and the fill material will be deposited, in addition to the areas where the dolphins will be constructed.

III. EXISTING ENVIRONMENTAL CONDITIONS NEAR THE PROJECT SITE

A. *Terrestrial Habitat and Ecology*

The terrestrial habitat of the action area is comprised of a combination of former agricultural fields, bottomland/riparian forest and young scrub forest. Former agriculture fields dominate the majority of the site with relatively mature bottomland forest along the southern boundary and along the riparian corridor of the Tennessee River to the north. Scattered young scrub forest is present along the mature forest edge, fencerows and the Tennessee River bank.

B. *Aquatic Habitat and Ecology*

The United States Fish and Wildlife Service (USFWS) previously requested a mussel survey for the site of the original location of the proposed Port of Calvert City, between TRM 11.1 to 12.0, to support evaluation of potential project effects on federally listed species possibly existing in that area by the proposed project. The current action area of the proposed port overlaps with the previously performed survey by approximately 320 meters, and continues downstream from the previously surveyed area by a distance of approximately 640 meters. Due to the previous survey's overlapping and immediately adjacent area with the location being evaluated in this assessment, the USFWS and USACE decided that the concentrations and distributions of the mussels encountered in the previous survey can be accurately extrapolated for analysis between TRM 10.7 and 11.3 without the need for an additional freshwater mussel survey. The surveyed aquatic habitat of the original project action area, as examined by the mussel survey performed by MCDI (Mainstream 2012), includes an area from Tennessee River Mile 11.1 to 12.0 along the left descending bank, extending 100 meters into the river from the bank, perpendicular to the shore. Riverbed substrate composition within the aquatic portion of the action area consisted primary of clay, gravel, and sand, or a combination thereof. The first ten to thirty meters from shore of each transect was comprised of primarily clay or a clay based amalgam, and the remainder of each of the transects, extending to 100 meters from shore, was comprised of primarily gravel and occasionally a mix of mostly gravel and sand. Bottom compaction varied from soft to hard with the majority of the area composed of substrates that had medium to hard

compaction. In most of the transects, a clear transition from a primarily clay based substrate near the shore to a primarily gravel/sand substrate further towards the channel was observed anywhere from 10 to 30 meters from shore. This substrate transition was also accompanied with a sharp drop in elevation to approximately 20 feet in water depth at 30 meters from shore, at which point the slope significantly lessened and the water depth dropped only approximately 10 more feet over the remaining 70 meters of the transects. Water depths at the site (at pool elevation between 302.5 and 302.9 feet at mean sea level) varied from 0 ft at shore to a maximum of approximately 31 feet, which occurred one hundred meters from shore. There was no significant current at the site during the time of the mussel survey (Mainstream 2012).

The freshwater mussel survey performed between TRM 11.1 and 12.0 that included the original project aquatic action area was conducted between the 10th and 14th of September, 2012 (Mainstream 2012). The purpose of the mussel survey was to characterize the mussel community, distribution and habitat suitability near the proposed facility to help determine whether federally listed endangered or threatened mussel species could be affected by the proposed project. The mussel survey used a combination of sampling methods, which included semi-quantitative searches along twelve 100-meter long sampling transects, eleven timed (qualitative) searches in areas with the highest mussel density between each pair of transects, and four timed (qualitative) searches looking specifically for *Quadrula cylindrica* within its preferred habitat. Preferred habitat for *Quadrula cylindrica* has been found to exist at the substrate/slope transition previously described.

During the survey, 3,402 live mussels representing 22 species (Family Unionidae) were encountered, with 29 individual juvenile mussels (< 5 years old) collected for eight of the 22 species. The mussel species located at the site include: threeridge (*Amblema plicata*), purple wartyback (*Cyclonaias tuberculata*), butterfly (*Ellipsaria lineolata*), elephantear (*Elliptio crassidens*), ebonyshell (*Fusconaia ebena*), Wabash pigtoe (*Fusconaia flava*), plain pocketbook (*Lampsilis cardium*), yellow sandshell *(Lampsilis teres),* white heelsplitter (*Lasmigona complanata*), fragile papershell *(Leptodea fragilis),* black sandshell (*Ligumia recta*), washboard *(Megalonaias nervosa),* threehorn wartyback *(Obliquaria reflexa),* bankclimber *(Plectomerus dombeyanus),* sheepnose (*Plethobasus cyphyus*), Ohio pigtoe (*Pleurobema cordatum*), pink heelsplitter *(Potamilus alatus),* rabbitsfoot *(Quadrula cylindrica),* monkeyface *(Quadrula metanevra),* wartyback (*Quadrula nodulata*), pimpleback *(Quadrula pustulosa),* and mapleleaf *(Quadrula quadrula).* Six individuals of the federally endangered species *Plethobasus cyphyus* (sheepnose mussel) and twenty-six individuals of the federally threatened species *Quadrula cylindrica* (rabbitsfoot mussel) were located during the survey. No other federally listed species were encountered. Overall, *Fusconaia ebena* was the dominant species representing 69.96% of the mussel community. *Amblema plicata* and *Quadrula pustulosa* also comprised a significant portion of the mussel community representing 9.79% and 4.79%, respectively. The remaining 19 species each represented less than three percent of the total mussel community. Species diversity (Shannon-Weiner Index) and evenness were determined for the area. Species diversity was based on the following formula: [$H' = -\Sigma\ p_i \log_e p_i$] where p_i is the proportion of the i^{th} species in the sample. Results were based on the natural logarithm. Evenness was based on the

following formula: [Evenness = H'/Hmax = H'/ln (# species)]. The species diversity for the mussel community was 1.2877 and the evenness was 0.4166.

The highest mussel densities recorded in 2012 were found along Transect 3, followed by Transect 1, Transect 11, and Transect 7 (Mainstream 2012). The lowest density of any of the transects was Transect 12, which was located at the farthest downstream site and towards the new proposed site. Based on the age range of the mussels found at the site, and the span of time in which barge fleeting and other previous activities have occurred here, it would appear that successful recruitment has been occurring for many species while such past activities have been operating at the project location.
The Draft Protocol For Mussel Surveys in the Ohio River Where Dredging/ Disposal/ Development Activity Is Proposed, developed by the Ohio River Valley Ecosystem Mollusk Subgroup (April 2004), defines significant mussel concentrations (beds) as areas with densities $\geq 0.5/m^2$. Based on this definition, all twelve of the transect lines searched would be considered above the minimum threshold of containing a mussel concentration or mussel bed (Table 3 in Mainstream 2012). However, the Tennessee River typically supports mussel communities that have greater mussel densities and species richness compared to the nearby Ohio River.

In recent Biological Assessments (TVA 2009, 2010, 2012), TVA has assumed the presence of some listed mussel species using thresholds of community species richness >15 species combined with substrate surface densities >2.5 - 3 mussels/m^2 (equivalent to whole-substrate densities of about 10 mussels/m^2), which were derived from other Tennessee River surveys (Dinkins 2008, Lewis Environmental Consulting 2008, TVA 2009) that collected the federally endangered pink mucket where mussel community parameters were at or higher than these values.

Although the pink mucket mussel is not expected to be present at the proposed project location, given the high densities and species richness found in areas near the proposed project (Mainstream 2012), it is possible that some federally listed mussel species, other than the federally listed individuals of *Plethobasus cyphyus* and *Quadrula cylindrica* that were encountered at the site, may occur at low densities within the proposed First Marine Properties project action area.

IV. SPECIES ACCOUNTS: Federally Listed and Candidate Species Potentially Present in the Action Area

The evaluation of the plant and mammal species included in this biological assessment was carried out by Redwing Environmental Services, Inc., which prepared a report recording their findings and conclusions regarding the presence of the Price's potato bean, gray bat, and Indiana bat, and their habitat in the proposed facility area (Redwing 2014). The evaluation of the mussel species included in this biological assessment was carried out by Mainstream Commercial Divers, Inc., which prepared a report recording their findings regarding the presence of the

mussel species and their habitat within the proposed facility area (Mainstream 2012). Both reports by Redwing Environmental Services and Mainstream Commercial Divers are included at the end of this biological assessment as Appendix A and Appendix B, respectively.

A. *Plants*

Price's Potato Bean

Price's potato bean (*Apios priceana*) has been listed as federally threatened since January 5th, 1990 (USFWS 1990a) and a recovery plan was approved on February 10th, 1993 (USFWS 1993). Price's potato bean prefers habitat consisting of moderately disturbed open rocky wooded slopes and floodplain edges in well-drained loamy soils (NatureServe 2012). They are capable of tolerating soils with a pH of less than 5 to greater than 8. Price's potato bean thrives in open, wooded areas, often in forest gaps or along forest edges, and seems to prefer open low areas near a stream or along the banks of streams and rivers. Many populations of the species are located in cleared areas associated with powerline or roadside rights-of-way (USFWS 1993).

Reasons for decline are varied and numerous, including aspects of its biology, many differing kinds of human disturbances and interactions with other species. Price's potato bean plants produce very few seeds, which may result in low levels of reproduction and dispersal of the species, as well as a low genetic diversity within populations (USFWS 1993). Logging and regular maintenance of rights-of-way can also negatively affect populations (USFWS 1993). Overshading by canopy trees may result in reduced growth and reproduction, while grazing and trampling of plants by cattle can cause severe damage to a population (USFWS 1993). These factors, in addition to many others, have contributed to a decrease in populations of Price's potato bean.

Based on observations at the projected construction site for the Port of Calvert City, no suitable habitat for the Price's potato bean was found to be present (Redwing 2014). The majority of the wooded habitat on site is characterized by dense midstory and understory dominated by woody species commonly associated with poorly drained, saturated soils such as green ash (*Fraxinus pennsylvanica*), silver maple (*Acer saccharinum*), sugarberry (*Celtis laevigata*), buttonbush (*Cephalanthus occidentalis*), and black willow (*Salix nigra*). Price's potato bean is intolerant of these well-shaded and poorly-drained soil conditions. The required moderate levels of disturbance are also absent. The road corridor (Shar-Cal Road) along the southern property boundary appears to be regularly maintained through herbiciding and mowing, therefore preventing the potential establishment and long-term survival of the Price's potato bean.

Because the site is located within the immediate floodplain of the Tennessee River, it is prone to regular flooding and inundation. This hydrological condition does not represent suitable habitat for Price's potato bean, which prefers moderately to well-drained conditions (Redwing 2014). In addition, there are no current records of existing Price's potato bean populations in Marshall County. Known populations in Kentucky are limited to Calloway, Livingston, Lyon and Trigg Counties. No critical habitat for the species has been identified by the USFWS.

Based on the results of the habitat assessment, the proposed project is not likely to have any adverse effects on the Price's potato bean (Redwing 2014). This species will not be evaluated further in the Biological Assessment.

B. *Mammals*

Gray Bat

The gray bat (*Myotis grisescens*) has been listed as federally endangered since April 28, 1976, and a recovery plan was approved on July 8, 1982 (USFWS 2012a).

The habitat preference for the gray bat includes deep, vertical wintering caves and summering caves located within one to four kilometers of rivers or reservoirs (Tuttle 1976). Summer foraging habitat includes forested areas along the banks of streams and open water features.

Reasons for decline of the gray bat include human disturbance and vandalism of caves near rivers and reservoirs throughout the gray bat's range. Disturbance from late May to mid-July at maternity caves may cause deaths of the flightless young, and disturbance from mid-August to April at hibernating caves may cause stress, depletion of energy reserves, and death due to arousal from hibernation. Routine insecticide use is likely another source of decline, through buildup of toxic levels of PCB, DDD, DDE, heptachlor epoxide, or lead within the insectivorous bats. Impoundments of waterways and cave flooding are two other potential reasons for decline. The gray bat is the largest member of the *Myotis* genus in the eastern United States. It is easily distinguished from all other bats within its range by its unicolored dorsal fur. All other eastern bats have distinctly bi- or tri-colored fur on their backs. The wing membrane connects to the foot at the ankle rather than at the base of the first toe, as in other species of *Myotis*.

Based on data available from the USFWS and KDFWR, there are no known occurrences of gray bats in Marshall County, Kentucky. As no caves, rock shelters, mine portals, highway overpasses, and/or bridges were observed on or near the site, no gray bat winter habitat, or summer roosting habitat, is present within the project site. However, based on the site's location along the banks of the Tennessee River, the mature forested habitat provides potential gray bat foraging habitat. The proposed project will result in the clearing of 3.3 acres, or approximately 38% of the total 9.9 acres of on-site habitat proposed for clearing (Redwing 2014).

Because potential gray bat summer foraging habitat was observed within the survey area, the project has potential to negatively impact this federally-endangered species. Minimal clearing of potential gray bat foraging habitat is expected to occur within the project area but no impacts to winter, or summer roosting, habitat are anticipated. Furthermore, because the species is not known to occur in Marshall County, it is unlikely that the identified potential foraging habitat is regularly used by individuals of the species. As there are no additional developments or habitat impacts planned at this time, Redwing has concluded that indirect and cumulative impacts to the gray bat are not anticipated. All tree clearing activities will be conducted either during the unoccupied time of the year or during daytime to avoid negative impacts to actively foraging

gray bats. Thus, due to the minimization of potential impacts to summer foraging habitat (approximately 38% of on-site habitat proposed for clearing) and the presence of other forested blocks in the vicinity, it appears that the proposed project is not likely to adversely impact the gray bat (Redwing 2014).

Indiana Bat

The Indiana bat (*Myotis sodalis*) has been listed as federally endangered since March 11, 1967, and a draft revised recovery plan was submitted on April 16, 2007 (USFWS 2012a). Historically, the Indiana bat has had a range over most of the eastern half of the United States, but is predominantly known from the Midwest. Almost half of the species hibernate in caves of southern Indiana at some point in their life cycle. Critical habitat for the Indiana bat was designated on September 24, 1976, and consisted of 11 caves and two mines in six states.

The Indiana bat prefers caves and abandoned mines in karst areas of the east-central United States for wintering habitat. In summer, reproductive-age females occupy roost sites under the exfoliating bark of dead trees that retain large, thick slabs of peeling bark. Roost trees are typically within canopy gaps in a forest or fenceline or along the edge of woodlands, and primary roosts usually receive direct sunlight for more than half the day. Forage areas tend to be semi-open to closed forest habitats with open understories or riparian habitats.

Threats to the Indiana bat include human disturbance, modification, and vandalism of caves in the Indiana bat's range. These threats may cause deaths of the flightless young in the nesting season, and may cause stress, depletion of energy reserves, and death due to arousal from hibernation during the dormant season. Loss and degradation of summer habitat due to human land development is also a threat. Disease and infection caused by parasites is also common, and may be related to stresses involved with human disturbance of wintering and summering habitats.

The Indiana bat is a medium-sized bat and closely resembles the little brown bat (*Myotis lucifugus*). The Indiana bat has a distinctly keeled calcar (spur of cartilage on the inner side of the ankle) and tends to have small, delicate hind feet with fewer, shorter hairs than those of the little brown bat (Barbour and Davis 1969). The Indiana bat's coat of fur appears dull and flat compared to that of the little brown bat (Barbour and Davis 1969, Hall 1981).

As no caves, rock shelters, or mine portals were observed, no Indiana bat winter habitat is present within the project site. However, approximately 10.6 acres of potential Indiana bat summer habitat were identified on the site during the field assessment, 4.0 acres of which are proposed to be cleared for project construction (Redwing 2014). Suitability of potential habitat varies across the site, with the majority of the suitable habitat located in the southern portion of the site. Habitat characteristics across the site were documented photographically and with *Indiana Bat Habitat Assessment Worksheets*. Because potential Indiana bat summer habitat was observed within the survey area, the project has potential to negatively impact this federally-endangered species (Redwing 2014). Based on the most recently available data provided by the

USFWS, the project area is not located within an area of known Indiana bat habitat; however, a known swarming habitat around documented hibernacula is located approximately 4.1 miles to the north and a known maternity habitat, around a documented maternity colony, is located approximately 5.0 miles to the northwest.

If habitat clearing can be limited to the "unoccupied" period between October 15 and March 31, any impacts to the species would be indirect, while clearing during the "occupied" period between April 1 and October 14 may be considered a potential direct impact (Redwing 2014). However, due to the minimization of potential impacts (approximately 38% of on-site habitat proposed for clearing) and the presence of other forested blocks in the vicinity, no adverse impacts to the Indiana bat are anticipated (Redwing 2014).

C. *Mussels*

Fanshell

The fanshell (*Cyprogenia stegaria*) has been listed as federally endangered, effective since June 21, 1990 (USFWS 1990b). A recovery plan for the species was approved on July 9, 1991 (USFWS 1991). Historical distribution for the Fanshell has been throughout much of the Ohio, Cumberland and Tennessee River drainages (Simpson 1914).

NatureServe (2012) states:

> This species was historically considered endemic to the eastern highlands east of the Mississippi River. It was historically widely distributed in the Tennessee, Cumberland, and Ohio River systems (Parmalee and Bogan, 1998), although it has become very rare in recent years. In the Ohio drainage it has been recently found in: the deep channel of the Ohio River between Cincinnati and Pittsburgh (Johnson, 1980); the lower Muskingum and Walhonding Rivers, Ohio (Stansbery et al., 1982); the Salt and Licking Rivers, tributaries of the Ohio (Stansbery, pers. comm.); the Green River, Kentucky (USFWS, 1991); the Kanawha River, West Virginia (Stansbery, pers. comm.); the Allegheny River, Pennsylvania (Dennis, 1970); and the lower Clinch River in Scott County (Neves, 1991).

Cummings and Mayer, 1992 describe the exterior of the shell as follows:

> Shell rounded, solid, and moderately inflated. Anterior margin rounded, posterior margin bluntly rounded or truncated. Ventral margin broadly rounded. Umbos not elevated above the hinge line. Beak sculpture, if visible, of a few weak ridges. Growth lines appear as distinct elevated ridges. Numerous pustules usually concentrated in the center but occasionally covering the entire surface of the shell. Periostracum usually greenish yellow, with a pattern of dark green rays made up of numerous smaller broken lines or dots. Length to 3 inches (7.6 cm).

Because of the rarity of the fanshell, little is known of its biology; however, the fanshell, when found, inhabits medium to large rivers and has been reported primarily from relatively deep water in gravel substrate with moderate current (Gordon and Layzer 1989). Ortman (1919) noted that "[i]n the Tennessee-drainage I found it frequently in firmly packed gravel, in strongly flowing water, in rivers of medium size".

Fish hosts for the fanshell remained unknown until relatively recently. Williams, Bogan, and Garner (2008) describe the fish hosts for the fanshell as follows:

> Fishes found to serve as *Cyprogenia stegaria* glochidial hosts in laboratory trials include *Cottus bairdii* (Mottled Sculpin) and *Cottus carolinae* (Banded Sculpin) (Cottidae); and *Etheostoma blenniodes* (Greenside Darter), *Etheostoma simoterum* (Snubnose Darter), *Etheostoma zonale* (Banded Darter), *Percina aurantiaca* (Tangerine Darter), *Percina burtoni* (Blotchside Logperch) and *Percina caprodes* (Logperch) (Percidae) (Jones and Neves, 2002b). One allopatric species, *Percina roanoka* (Roanoke Darter) (Percidae), was reported to serve as a glochidial host under laboratory conditions (Jones and Neves, 2002b).

As with most mussels native or once native to the lower Tennessee River, the most significant impact on its habitat has been activities related to navigation and flood control. This includes impoundment by TVA and USACE navigation dams and channel maintenance dredging operations. Also, pollution from a multitude of sources upstream through the entirety of the Tennessee River watershed may negatively impact this species. These changes not only directly alter the habitat but most likely may also affect fish host distribution. Other threats to this species within the Tennessee River include the introduction of the exotic zebra mussel, *Dreissena polymorpha*. Zebra mussels compete directly with native mussels for food and oxygen as well as attach directly to native mussels via byssal threads and potentially interfere with siphoning and opening/closing of the native mussels shell. In addition, zebra mussels may interfere with reproduction of native mussels by ingesting gametes released by the native mussel (Watters, Hoggarth, Stansbery 2009). Zebra mussels are found sporadically throughout the lower Tennessee River, often on native mussels.

According to a comprehensive USACE funded mussel survey database listing all mussels found by all known historic surveys on the Tennessee River tailwater of Kentucky Dam, *Cyprogenia stegaria* have only been found in two separate surveys: Isom in 1969 and the TVA in 1978 (Sickel and Burnett 2005). Isom did not record how many live fanshell were encountered but TVA recorded only encountering a single live fanshell. In 2012, the Kentucky Department of Fish and Wildlife Resources (KDFWR) Center for Mollusk Conservation stocked a population of *Cyprogenia stegaria* in the lower Tennessee River. The historical records and the lack of more recent encounters of fanshell within the past three decades implies that the species may no longer naturally occur within the lower Tennessee River and that the individuals of the stocked population are likely the only fanshells existing in the river. The stocked individuals of *Cyprogenia stegaria* are within the KDFWR's mussel sanctuary and are located in an area that will not be impacted by construction or operation of the proposed project area.

During the 2012 mussel survey performed at the previously proposed First Marine Properties site (Mainstream 2012), no *Cyprogenia stegaria* were found. Because no live individuals have been found in the lower Tennessee River in the past 35 years, and the stocked population of fanshell will not be impacted by any functions of the proposed project area, it is unlikely that *Cyprogenia stegaria* will be affected by the current proposed project and thus will not be addressed further in this Biological Assessment.

Fat Pocketbook

The fat pocketbook (*Potamilus capax*) has been listed as federally endangered since June 14, 1976 (NatureServe, 2012). A recovery plan for the species was approved November 14, 1989 (USFWS, 1989). Known distribution for the fat pocketbook is primarily based upon museum records (USFWS, 1989). Historically, the species was widely distributed in the Mississippi River drainage from the confluence of the Minnesota and St. Croix Rivers, downstream to the White River of Arkansas, and the bootheel of Missouri, as well as the lower Wabash and Ohio rivers, the lower Cumberland River and the St. Francis system in Arkansas. At the time of listing, the fat pocketbook was only known to occur in the White River and the St. Francis River (USFWS, 1976).
Today, the fat pocketbook is known to be in the lower Wabash River in Indiana, the lower Ohio River (primarily below the mouth of the Wabash River), and the St. Francis River in Arkansas, and is also believed to occur in the Mississippi River in Missouri (NatureServe, 2012). Recent findings indicate that the fat pocketbook may now exist in the lower Tennessee River. During a survey in 2008, Mr. Chad Lewis of Lewis Environmental Consulting encountered a fresh dead *Potamilus capax* shell between Tennessee River Mile 8.3 and 9.0 along the left descending bank in Marshall County, Kentucky (C. Lewis pers. comm.). This survey resulted in the first record of *Potamilus capax* in the Tennessee River. Following the encounter of a freshly dead shell, on May 9th, 2012, a live *Potamilus capax* was observed at Tennessee River Mile 13.0 by Mr. Lewis. It was located near the left descending bank about 70 meters from the shore and it was aged at 5 years (C. Lewis pers. comm.). This survey resulted in the first live record of *Potamilus capax* in the Tennessee River. Although the species was once widely distributed, most of its documented decline occurred historically and it appears stable in the areas where it currently occurs (NatureServe, 2012). Presently, within the lower Ohio River from the mouth of the Wabash River downstream, the species has been found with increasing regularity and with evidence of successful recruitment occurring and may be expected to be found in nearly any area of suitable habitat (Author's personal observations; L. Koch, pers. comm.). The status section of the NatureServe website (2012) states, "Although listed as federally endangered by the USFWS, it should probably be down listed to a lower category". Along the lower Ohio River within Kentucky it is known or believed to occur in at least Livingston, Crittenden, Henderson, Union, and McCracken counties (USFWS, 2011a). The habitat preference for the fat pocketbook is large rivers in slow-moving waters and a sand, sandy silt, or mud (clay) substrate (Watters, Hoggarth, Stansbery, 2009; Cummings, Mayer, 1992). The species has been found to be tolerant of depositional areas not otherwise inhabited by most other mussel species including man-made

ditches, sloughs, and existing bayous (NatureServe, 2012). The freshwater drum (*Aplodinotus grunniens*) is the only known fish host (Watters, Hoggarth, Stansbery 2009).

As with most mussels, the most significant impact on the habitat of the fat pocketbook has been activities related to navigation and flood control (USFWS, 1985). This includes impoundment by TVA and USACE navigation dams and channel maintenance dredging operations. Also, pollution and siltation from a multitude of other sources upstream through the entirety of the Tennessee River watershed may negatively impact this species. These changes not only directly alter the habitat but most likely may also affect fish host distribution. Other potential threats to this species within the project area include the introduction of the exotic zebra mussel, *Dreissena polymorpha*. Zebra mussels compete directly with native mussels for food and oxygen as well as attach directly to native mussels via byssal threads and potentially interfere with siphoning and opening/closing of the native mussel's shell. In addition, zebra mussels may interfere with reproduction of native mussels by ingesting gametes released by the native mussel (Watters, Hoggarth, Stansbery 2009).

Cummings and Mayer, 1992 describe the exterior of the shell as follows:

> "Shell round to somewhat oblong, greatly inflated, and thin (young) to moderately thick (adults). Anterior and posterior ends rounded. Umbos greatly inflated, elevated, and turned inward. Beak sculpture of a few faint ridges, visible only in young shells. Small posterior wing present in young mussels. Surface usually smooth and very shiny. Periostracum rayless, yellow, yellowish tan, or olive, becoming dark brown in older individuals. Length to 5 inches (12.7 cm)."

During the 2012 mussel survey performed at the previously proposed First Marine Properties site (Mainstream 2012), no *Potamilus capax* were found. Based on the recent discovery of *Potamilus capax* in the lower Tennessee River, evidenced by the five year old individual found at TRM 13 in 2012, it is possible, though unlikely due the lack of their preferred substrate, that the fat pocketbook could have begun to inhabit the current action area in very low numbers. It is more likely, however, that the individual located at TRM 13 is an anomaly that fell from its fish host at that location. Additionally, there have been no other recorded live encounters of *Potamilus capax* in the lower Tennessee River. A final conclusion on this species can be found below in Effects Analysis.

Orangefoot Pimpleback

The orangefoot pimpleback or orange-footed pearly mussel (*Plethobasus cooperianus*) has been listed as federally endangered since June 14, 1976 (NatureServe 2012). A recovery plan for the species was approved on September 30, 1984 (USFWS 1984a). The species is considered to be an Ohioan or Interior Basin species only (Ortmann 1919 in USFWS 1984a). Historical distribution includes the Ohio River from western Pennsylvania to southern Indiana; the Wabash River downstream of Mt. Carmel, Illinois; the Cumberland River between Cumberland County

Kentucky and Nashville, Tennessee; the lower Clinch River in Anderson County, Tennessee, and the Tennessee River from near Knoxville to Kentucky Lake, Benton County, Tennessee; and the Caney Fork, Holston, and French Broad Rivers in Tennessee and the Green and Rough Rivers in Kentucky (NatureServe 2012). According to the USFWS, "Orangefoot Pimpleback Mussel Recovery Action Plan", the best known population of the species occurs in the lower portion of the Ohio River near Paducah, Kentucky. Other known populations include downstream of Pickwick Dam and Kentucky Dam on the Tennessee River (USFWS 2009b). In the lower Ohio River near Paducah, Mainstream Commercial Divers, Inc. crews have found the species at two different sites with some regularity. One site is upstream of Lock and Dam 53 at the Brookport Bed at ORM 938 and the other site is downstream near Olmsted, Illinois. In 2007 while working for the USFWS, Mainstream found 23 live individuals at the Brookport bed in substrate consisting of a mixture of sand, gravel, and cobble (Lewis 2007). While working for Murray State University in 1999, Mr. Chad Lewis collected one live *Plethobasus cooperianus* from the lower Tennessee River at TRM 20.8 (C. Lewis pers. comm.) and in 2008, Mr. Lewis collected one live *Plethobasus cooperianus* between TRM 18.9 and 19.8 along the right descending bank in Livingston County, Kentucky (C. Lewis pers. comm.).

In 2010 TVA prepared a Biological Assessment for dike stabilization of the Johnsonville ash storage pond located at approximate TRM 99. In the Biological Assessment TVA addressed the orangefoot pimpleback and stated:

> This species is restricted to the Tennessee River, Cumberland River and lower Ohio River where it is considered very rare. The USFWS has proposed a rule to reintroduce this species into historical habitat in the free-flowing portion of the French Broad River below Douglas Dam to its confluence with the Holston River near Knoxville, TN (USFWS, Federal Register, 12 September 2007). This species has not been recently collected from this reach of the Tennessee River and is believed to be either extirpated from the area or occur at such low densities that the likelihood of being affected by the proposed project is discountable. (TVA 2010)

The habitat preference for the orangefoot pimpleback is flowing waters of medium to large-sized rivers in substrates composed of a mixture of gravel and sand (Williams, Bogan, and Garner 2008; Cicerello and Schuster 2003). NatureServe (2011) states, "This species is found in medium to large rivers in sand, gravel and cobble substrates in riffles and shoals in deep water and steady currents as well as some shallower shoals and riffles". The host fish for the species is unknown (Parmalee and Bogan 1998; Williams, Bogan, and Garner 2008).

As with most mussels native or once native to the lower Tennessee River, the most significant impact on its habitat has been activities related to navigation and flood control. This includes impoundment by TVA and USACE navigation dams and maintenance dredging operations. Also, pollution and siltation from a multitude of other sources upstream through the entirety of the Tennessee River watershed may negatively impact this species. These changes not only directly alter the habitat but most likely may also affect fish host distribution. Other threats to this species within the Tennessee River include the introduction of the exotic zebra mussel, *Dreissena polymorpha*. Zebra mussels compete directly with native mussels for food and

oxygen as well as attach directly to native mussels via byssal threads and potentially interfere with siphoning and opening/closing of the native mussels shell. In addition, zebra mussels may interfere with reproduction of native mussels by ingesting gametes released by the native mussel (Watters, Hoggarth, Stansbery 2009). Zebra mussels are found sporadically throughout the middle and lower Tennessee River, often on native mussels.

Cummings and Mayer, 1992 describe the exterior of the shell as follows:

> Shell thick, solid, round or slightly elongate, and moderately inflated to compressed. Anterior end rounded, posterior end rounded to bluntly pointed. Dorsal margin straight or slightly curved, ventral margin curved. Umbos low, directed forward, and only slightly elevated above the hinge line. Anterior fourth of the shell smooth, numerous pustules present on the posterior three-fourths. Periostracum rayless, light brown in small shells, becoming chestnut or dark brown color in larger individuals. Length to 4 inches (10.2 cm). Foot of this species is characteristically orange-colored.

During the 2012 mussel survey performed at the previously proposed First Marine Properties site (Mainstream 2012), no *Plethobasus cooperianus* were found. Based on the historical and recent distribution records of the orangefoot pimpleback, both in the Ohio River downstream of the project site and several miles upstream of the project site on the Tennessee River, it is possible that this species could occur within the current action area in very low numbers. Further review of potential project impacts on this species is provided in the Effects Analysis section below.

Pink Mucket

The pink mucket (*Lampsilis abrupt*a) has been listed as federally endangered since June 14, 1976 (NatureServe 2012). A recovery plan for the species was approved January 24, 1985 (USFWS 1985). Historical distribution for the pink mucket includes at least 25 river systems with widespread distribution but it has never been reported in large numbers from any one site (NatureServe 2012).

NatureServe (2012) states:

> In Alabama, it currently is rare in riverine reaches downstream of Wilson and Guntersville Dams (rare) and single gravid female from Bear Creek, Colbert County (Mirarchi et al., 2004; Williams et al., 2008). In Louisiana, Vidrine (1993) reports it from only Bayou Bartholemew. In Missouri it is found in the St. Francis River and the Sac River; with specimens from the mouth of the Bourbeuse River to the mouth of the Meramec River with other populations (possibly historical) in the lower Big River, lower Meramec River, Little Black and lower Osage Rivers (Oesch, 1995). In Tennessee, this species has been found living in the tailwaters of several dams, and there is a localized relict population in the Cumberland River, Smith Co., but all individuals appear very old. It is nearly gone from the upper and middle stretches of the Tennessee River with a stable population below Pickwick

> Landing Dam in Hardin Co. and populations in the Cumberland River are also localized while occasional individuals can be found in several small to medium-sized tributaries of large rivers including the Holston, French Broad, and upper Clinch Rivers (Parmalee and Bogan, 1998). In Ohio it is in the Ohio River mainstem in very few sites bordering West Virginia (Watters et al., 2009) and in Greenup dam pool in Ohio/Kentucky (Watters and Flaute, 2010). Tolin et al. (1987) report the upper free-flowing 3.5 miles of the Kanawha River and the mainstem of the Ohio River (at depth) at the West Virginia border. Taylor and Horn (1983) also included the Kanawha and Elk Rivers in West Virginia. In Arkansas, it is known from between river miles 50.5 and 161.5 of the Black River, the Ouachita River (Posey et al., 1996), White River (Gordon, 1982- upper White; Christian, 1995), and 18 km of the Spring River (Harris et al., 1997; Harris and Gordon, 1987) In Kentucky, it is sporadic in the lower Ohio River to the Licking River (Cicerello and Schuster, 2003). (NatureServe 2012)

In 2010 TVA prepared a Biological Assessment for dike stabilization of the Johnsonville ash storage pond located at approximate TRM 99. In the Biological Assessment TVA addressed the pink mucket and stated:

> Within the last 30 years, the pink mucket has been encountered in nearly all tailwaters of the mainstem Tennessee River dams and in parts of Bear Creek and the Clinch, French Broad, and Holston rivers (USFWS 1985; TVA Natural Heritage Database). The pink mucket is known from eight mainstem tailwaters (downstream from Kentucky, Pickwick, Wilson, Guntersville, Nickajack, Chickamauga, Watts Bar, and Fort Loudoun dams), four tributary tailwaters (downstream from Bear Creek, Norris, Cherokee, and Douglas dams), and two mainstem reservoirs (Kentucky and Wheeler). Although always uncommon or rare, this species is encountered most often in the Tennessee River within the flowing mainstem areas downstream from Pickwick Dam (= upstream end of Kentucky Reservoir). Its continued presence in mainstem reservoirs and in tributary dam tailwaters is often limited to sightings of single, often old, individuals.
>
> An extensive survey near TRM 391-392 (Guntersville Reservoir) in 2007 found a mussel community with 12 species and density of 0.81 mussels/m^2, but no pink mucket were found; however, a during a snail survey of the same location in 2009 (Dinkins, 2009), one pink mucket was found inadvertently during the survey. A 2008 survey in the Nickajack Dam tailwater (TRM 424; LEC 2008) found one live pink mucket, which comprised 0.11% of the mussel community at that site. TWRA (D. Hubbs pers. comm., 2008) reported finding pink mucket at a rate of 1.5 individuals/hr in the Pickwick Dam tailwater in 2008, while ADCNR (J. Garner, pers. comm., 2008) reported great difficulty in finding pink mucket downstream of Wilson and Guntersville dams; only 0.03 individuals/m^2 were found in Guntersville tailwater in 2008. Mean catch per hour of pink mucket at commercial mussel assessment sites between TRM 141.5 and TRM 202 in Kentucky Reservoir (Pickwick Dam tailwater) was 3.5 pink mucket/hr in 2008 and 2.8 pink mucket/hr in 2009 (D. Hubbs, pers. comm., 2009). In 2009 TWRA (D. Hubbs pers. comm., 2009) reported collecting pink mucket (all

≥12 yr old) in the Cumberland River (downstream of Cordell Hull Dam) at a mean rate of 2.7 individuals/hr in 2008 and 0.92 individuals/hr in 2009.

A 2009 survey in Kentucky Reservoir at TRM 94 (Mainstream Commercial Diving, 2009) found 1,454 mussels representing 20 species, but no pink mucket were collected. A 2008 survey in Kentucky Reservoir at TRM 160.7 (Dinkins 2008) found 10 individuals of pink mucket in 11,090 mussels collected (= 0.1% frequency), which included an assemblage of 17 species. The pink mucket at this site were all found near the slope or toe of the old river channel, and none were found on the overbank. As reported above (Section 3.1.3 and presented in Appendix A), a 2009 survey of the proposed JOF project site at TRM 99-100 found a relic shell of pink mucket, although no live individuals were found live within a collection of 1,951 mussels representing 16 species (Third Rock Consulting, 2009).

According to Cicerello and Schuster (2003), the habitat preference for the pink mucket is medium-size to large rivers in sand and gravel. Williams, Bogan, and Garner (2008) state, "Its preferred substrates appear to be gravel with interstitial sand, kept free of silt by current". Gordon and Layzer (1989) in NatureServe (2012) state that the pink mucket is "found in waters with strong currents, rocky or boulder substrates, with depths up to about 1 m, but is also found in deeper waters with slower currents and sand and gravel substrates". According to Watters, Hoggarth, and Stansbery (2009), suitable habitat for the pink mucket also includes "sandy mud and gravel of large rivers". Potential fish hosts include Smallmouth Bass (*Micropterus dolomieu*), Spotted Bass (*Micropterus punctulatus*), Largemouth bass (*Micropterus salmoides*), White Crappie (*Pomoxis annularis*), Sauger (*Sander canadensis*), and Walleye (*Sander vitreus*) (Williams, Bogan, and Garner 2008).

As with most mussels native or once native to the lower Tennessee River, the most significant impact on its habitat has been activities related to navigation and flood control. This includes impoundment by TVA and USACE navigation dams and maintenance dredging operations. Also, pollution and siltation from a multitude of other sources upstream through the entirety of the Tennessee River watershed may negatively impact this species. These changes not only directly alter the habitat but most likely may also affect fish host distribution. Other threats to this species within the Tennessee River include the introduction of the exotic zebra mussel, *Dreissena polymorpha*. Zebra mussels compete directly with native mussels for food and oxygen as well as attach directly to native mussels via byssal threads and potentially interfere with siphoning and opening/closing of the native mussels shell. In addition, zebra mussels may interfere with reproduction of native mussels by ingesting gametes released by the native mussel (Watters, Hoggarth, Stansbery 2009). Zebra mussels are found sporadically throughout the middle and lower Tennessee River, often on native mussels.

Cummings and Mayer, 1992 describe the exterior of the shell as follows: "Shell round to elliptical, solid, and inflated. Anterior end rounded, posterior end bluntly pointed in males, truncated in females. Dorsal margin straight, ventral margin straight to slightly curved. Umbos turned forward and elevated above the hinge line. Beak sculpture, if visible, of three or four

double looped ridges. Shell smooth, yellow or yellowish green and rayless or with faint green rays. Length to 4 inches (10.2 cm)."

The last known pink mucket on the lower Tennessee River was encountered by Dr. James Sickel between TRM 15.8 and 20.1 in 1991. During that survey, three live *Lampsilis abrupta* were found. There have been no known recorded encounters of live pink mucket in the lower Tennessee River since. During the 2012 mussel survey performed at the previously proposed First Marine Properties site (Mainstream 2012), no *Lampsilis abrupta* were found. Due to the lack of live *Lampsilis abrupta* encountered in the lower Tennessee River within the past 22 years, it is unlikely that this species will be affected by the current proposed project action. A final conclusion on this species is provided in the Effects Analysis section below.

Rabbitsfoot

The rabbitsfoot (*Quadrula cylindrica*) has been a candidate species for federal listing under the Endangered Species Act since November 9, 2009 (USFWS 2011b). In the September 17, 2013 release of *Federal Register*, the United States Fish and Wildlife Service listed the rabbitsfoot mussel as threatened under the Endangered Species Act (USFWS 2013).

Historically the rabbitsfoot was known from 139 streams in 15 states including Alabama, Arkansas, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, Tennessee, and West Virginia and is now considered to be extant in 49 streams in 13 states (USFWS 2009a). According to the USFWS (2009a), extant populations occur in the following states and streams:

> **Alabama** (Paint Rock River, Bear Creek), **Arkansas** (White River, War Eagle Creek, Buffalo River, Black River, Current River, Spring River, South Fork Spring River, Strawberry River, Middle Fork Little Red River, Illinois River, Cossatot River, Little River, Ouachita River, Little Missouri River, Saline River), **Illinois** (Ohio River, North Fork Vermilion River, Middle Branch North Fork Vermilion River), **Indiana** (Ohio River, Eel River, Tippecanoe River), **Kansas** (Neosho River, Spring River), **Kentucky** (Ohio River, South Fork Kentucky River, Green River, Barren River, Rough River, Red River, Tennessee River), **Louisiana** (Bayou Bartholomew), **Mississippi** (Bear Creek, Big Sunflower River, Big Black River), **Missouri** (St. Francis River, Spring River [Arkansas River system]), **Ohio** (Fish Creek, Walhonding River, Killbuck Creek, Big Darby Creek, Little Darby Creek), **Oklahoma** (Illinois River, Little River, Glover River, Verdigris River), **Pennsylvania** (Allegheny River, French Creek, Muddy Creek, LeBoeuf Creek, Conneautee Creek), and **Tennessee** (East Fork Stones River, Red River, Tennessee River, Elk River, Duck River).

Historically *Quadrula cylindrica* occurred throughout most of the Tennessee River, however the extant populations are restricted to the two lower most tailwaters (approximately 25 river miles) below Pickwick Landing Dam and Kentucky Dam (USFWS 2009a). It has been found in the lower Tennessee River (below Kentucky Dam) at the project site as recent as September, 2012

by Mainstream Commercial Divers (MCDI 2012). Its preferred habitat in that area appears to be at the toe of the initial drop off from shore toward the channel. According to USFWS (2009a), "the rabbitsfoot is unable to survive in impounded areas due to sedimentation and loss of host fish necessary to complete its life cycle".

The habitat preference for the rabbitsfoot is sand and gravel substrates in small to medium sized streams and some larger rivers, usually occurring in shallow areas along the bank, but sometimes may be in deeper water (USFWS 2009a). Reported potential fish hosts include the Rainbow darter (*Etheostoma caeruleum*) and the Striped shiner (*Luxilus chrysocephalus*) (Watters, Hoggarth, Stansbery 2009).

As with most mussels native or once native to the lower Tennessee River, the most significant impact on its habitat has been activities related to navigation and flood control. This includes impoundment by TVA and USACE navigation dams and maintenance dredging operations. Also, pollution and siltation from a multitude of other sources may negatively impact this species. These changes not only directly alter the habitat but most likely may also affect fish host distribution. Other threats to this species within the Tennessee River include the introduction of the exotic zebra mussel, *Dreissena polymorpha*. Zebra mussels compete directly with native mussels for food and oxygen as well as attach directly to native mussels via byssal threads and potentially interfere with siphoning and opening/closing of the native mussels shell. In addition, zebra mussels may interfere with reproduction of native mussels by ingesting gametes released by the native mussel (Watters, Hoggarth, Stansbery 2009). Zebra mussels are found throughout the middle and lower Tennessee River, often on native mussels.

Cummings and Mayer, 1992 describe the exterior of the shell as follows:

> Shell rectangular, elongate (about three times as long as high), thick, and compressed to moderately inflated. Anterior end rounded, posterior end squared or truncated. Dorsal and ventral margins parallel. Umbos low, only slightly elevated above the hinge line. Beak sculpture consists of two rows of knobs or ridges that continue down the lateral surface of the shell. Surface of the shell usually rough, with numerous tubercles on the anterior end and a series of large pustules or knobs along the posterior ridge. Periostracum green or light brown (darker in older shells) with yellow zigzag or chevron-shaped markings on the shell. Length to 5 inches (12.7 cm).

During the 2012 mussel survey performed at the previously proposed First Marine Properties site, 26 individuals of *Quadrula cylindrica* were found (Mainstream 2012). Assuming that mussel concentrations remain consistent, rabbitsfoot mussels definitively exists at the current proposed project area. Potential project impacts on *Quadrula cylindrica* are discussed below in Section V – Effects Analysis.

Ring Pink

The ring pink (*Obovaria retusa*) has been listed as federally endangered since September 29, 1989 (NatureServe 2012), and a recovery plan was approved on March 25, 1991 (USFWS 2011c). Their historical range was throughout the Ohio, Wabash, Tennessee, and Cumberland River systems including many of their major tributaries (Mirarchi et al. 2004 and Parmalee and Bogan 1998 in NatureServe 2012). Most populations are relict populations and it is unknown if there are any viable reproducing populations (NatureServe 2012). Known populations that may be viable include the Tennessee River below Pickwick dam (Stansbery, pers. comm. in NatureServe 2012), the upper Green river in Kentucky (Cicerello and Schuster 2003), and potentially portions of the middle Cumberland river and Wilson Dam tailwaters (Garner and McGregor 2001 and Mirarchi et al. 2004 in NatureServe, 2011). It has also been found in the Ohio River south of Gallipolis and the Muskingum River (Stansbery, pers. comm. in NatureServe 2012). Cicerello and Schuster (2003) report its Kentucky distribution as, "sporadic in the upper Green river".

The habitat preference for the ring pink is medium to large rivers in sand and gravel/cobble substrates and flowing water (Williams, Bogan, and Garner 2008; Watters, Hoggarth, Stansbery 2009). No fish hosts are known (Watters, Hoggarth, Stansbery 2009).

As with most mussels native or once native to the lower Tennessee River, the most significant impact on its habitat has been activities related to navigation and flood control. This includes impoundment by TVA and USACE navigation dams and channel maintenance dredging operations. Also, pollution and siltation from a multitude of other sources upstream through the entirety of the Tennessee River watershed may negatively impact this species. These changes not only directly alter the habitat but most likely may also affect fish host distribution. Other threats to this species within the Tennessee River include the introduction of the exotic zebra mussel, *Dreissena polymorpha*. Zebra mussels compete directly with native mussels for food and oxygen as well as attach directly to native mussels via byssal threads and potentially interfere with siphoning and opening/closing of the native mussels shell. In addition, zebra mussels may interfere with reproduction of native mussels by ingesting gametes released by the native mussel (Watters, Hoggarth, Stansbery 2009). Zebra mussels are found sporadically throughout the middle and lower Tennessee River, often on native mussels.

Cummings and Mayer, 1992 describe the exterior of the shell as follows:

> Shell thick, solid, and somewhat inflated, with an unusual dorso-ventrally elongated recurved shape. Anterior, ventral, and posterior margins rounded. Umbos high, full, swollen, and directed forward. Shell surface smooth or clothlike. The female has a distinct groove on the posterior ridge. Periostracum reddish brown, occasionally dark brown or blackish. Length to 3 inches (7.6 cm).

In 2010 TVA prepared a Biological Assessment for dike stabilization of the Johnsonville ash storage pond located at approximate TRM 99. In the Biological Assessment TVA addressed the

ring pink mussel and stated, "this species has not been collected from this reach of the Tennessee River since at least 1978 and is believed to be either extirpated from the area or occur at such low densities that the likelihood of being affected by the proposed project is discountable" (TVA 2010).

The ring pink was last encountered on the lower Tennessee River by Dr. James Sickel in a survey of the Kentucky Dam tailwaters in 1985. During that survey, only two live *Obovaria retusa* were found. There have been no known encounters of live ring pink in the lower Tennessee River since. During the 2012 mussel survey performed at the previously proposed First Marine Properties site (Mainstream 2012), no *Obovaria retusa* were found. Based on the lack of recent records for this species in the lower Tennessee River, it is unlikely that the ring pink would be affected by the current proposed project and will not be addressed further in this Biological Assessment.

Rough Pigtoe

The rough pigtoe (*Pleurobema plenum*) has been listed as federally endangered since June 14, 1976 (USFWS 1976), and a recovery plan was approved on August 6, 1984 (USFWS 1984b).

NatureServe, 2012 states:

> Historically, this species was widely distributed in the Ohio, Cumberland, and Tennessee River drainages (USFWS, 1984). Currently, it is present in an undetermined number of miles below three Tennessee River mainstem dams (Pickwick, Wilson, and Guntersville) and the upper Clinch River between river miles 323 and 154 (likely only extant and viable between rm 189 and 154) primarily on the Tennessee side at the Virginia border. Although reported by Parmalee et al. (1980) from the middle Cumberland River between 1977 and 1979, it was not found in recent surveys by Tennessee Valley Authority (1976) or Sickel and Chandler (1996). It is present on the Green River, Kentucky between locks 4 and 5 and in the Barren River (Green River tributary in Kentucky) below Lock and Dam 1 (USFWS, 1984). Clarke (1983) found a single living specimen in the Green River near Glenmore, Kentucky. Historical populations are gone in the upper Ohio River drainage and western parts of its range (Arkansas, Missouri, and Kansas) if in fact it ever occurred there. In Alabama, extant populations are in the Tennessee River tailwaters of Wilson Dam (very rare) and possibly Guntersville Dam (Mirarchi et al., 2004) but historically it is known from the following counties: Colbert, Lauderdale, Madison, Morgan, Marshall, Lawrence, Limestone.

In 2010 TVA prepared a Biological Assessment for dike stabilization of the Johnsonville ash storage pond located at approximate TRM 99. In the Biological Assessment TVA addressed the rough pigtoe mussel and stated:

> The increasing scarcity of encounters with this species (at least in the Tennessee River system) supports the conclusion that it is declining overall (USFWS, 2003). In recent years, the rough pigtoe has been found in the mainstem Tennessee River downstream from

> Pickwick, Wilson, Guntersville, and Watts Bar dams, as well as in Pickwick and Wheeler Reservoirs. Both of the reservoir records came from the upstream ends, very close to the identified extent of the lotic habitat provided by the dam tailwaters. This species has not been reported near the project site since 1920 and is considered extirpated from the area. (TVA 2010)

The habitat preference for the rough pigtoe is large rivers in firmly packed gravel and sand (Parmalee and Bogan 1998). No fish hosts are known (Parmalee and Bogan 1998).

As with most mussels native or once native to the lower Tennessee River, the most significant impact on its habitat has been activities related to navigation and flood control. This includes impoundment by TVA and USACE navigation dams and channel maintenance dredging operations. Also, pollution and siltation from a multitude of other sources upstream through the entirety of the Tennessee River watershed may negatively impact this species. These changes not only directly alter the habitat but most likely may also affect fish host distribution. Other threats to this species within the Tennessee River include the introduction of the exotic zebra mussel, *Dreissena polymorpha*. Zebra mussels compete directly with native mussels for food and oxygen as well as attach directly to native mussels via byssal threads and potentially interfere with siphoning and opening/closing of the native mussels shell. In addition, zebra mussels may interfere with reproduction of native mussels by ingesting gametes released by the native mussel (Watters, Hoggarth, Stansbery 2009). Zebra mussels are found sporadically throughout the middle and lower Tennessee River, often on native mussels.

Cicerello and Schuster, 2003 describe the exterior of the shell as follows:

> Shell triangular, inflated, and thick. Anterior margin rounded; posterior margin rounded or bluntly pointed. Ventral margin curved. Umbos inflated and extend above hinge line. Shell smooth with a shallow depression extending from the umbos to the ventral margin. Shell light to dark brown, sometimes with faint rays. Cardinal teeth large and serrated; lateral teeth thick and short. Nacre white or pinkish, iridescent posteriorly. Length: 3-4 inches.

According to the USACE lower Tennessee River mussel report database, there have been no known encounters of live *Pleurobema plenum* in the lower Tennessee River. During the 2012 mussel survey performed at the previously proposed First Marine Properties site (Mainstream 2012), no *Pleurobema plenum* were found. Based on the lack of recent records for this species in the lower Tennessee River, it is unlikely that the rough pigtoe would be affected by the current proposed project and will not be addressed further in this Biological Assessment.

Sheepnose

The sheepnose mussel (*Plethobasus cyphyus*) has been listed as federally endangered since April 12, 2012 (USFWS 2012b). It had previously been a federally listed candidate species under the Endangered Species Act since May 4, 2004 (USFWS 2007). Historically, the

sheepnose was known from 77 streams in 15 states. The streams included the main stem Mississippi River, Ohio River, Cumberland River, and Tennessee River, as well as many of their tributaries. According to the U.S. Fish and Wildlife Service, current known distribution consists of the following extant populations from twenty-six streams in fourteen states:

> Alabama (Tennessee River), Illinois (Mississippi, Kankakee, Ohio [*contra* Cummings and Mayer 1997], Wabash Rivers), Indiana (Ohio, Wabash, Tippecanoe, Eel Rivers), Iowa (Mississippi River), Kentucky (Ohio, Licking, Kentucky, Green, Cumberland Rivers), Minnesota (Mississippi, St. Croix Rivers), Mississippi (Big Sunflower River), Missouri (Mississippi, Meramec, Bourbeuse, Osage Fork Gasconade Rivers), Ohio (Ohio, Muskingum Rivers), Pennsylvania (Allegheny River, Tionesta Creek), Tennessee (Duck, Tennessee, Holston, Clinch, Powell Rivers), Virginia (Clinch, Powell Rivers), West Virginia (Ohio, Kanawha Rivers), and Wisconsin (Mississippi, St. Croix, Chippewa, Flambeau, Wisconsin Rivers). (USFWS 2007)

In addition to the rivers listed for the state of Kentucky, it has also been recently collected by Mainstream Commercial Divers' crews numerous times in the lower Tennessee River (below Kentucky Dam) including multiple individuals found between TRM 13.5 and 19.2 between 2003 and 2007 (Lewis and Sickel 2003; Sickel and Lewis 2005; Lewis and Sickel 2005; Lewis 2006; Lewis and Sickel 2007). The author also found one live individual in 2008 during a survey between TRM 2.8 and 3.2 (Fortenbery 2008), and Third Rock Consultants found three live individuals during a mussel relocation at TRM 5.8 in 2005 (Third Rock Consultants 2005). On the lower Ohio River, Mainstream Commercial Divers found one live individual in 2007 at the Brookport bed at ORM 938 and one in the Little Chain bed at approximate ORM 948 (Lewis 2007). Parmalee and Bogan (1998) feel that in Tennessee the most stable and viable populations of this mussel "occur in the upper Clinch River, Hancock County, and in the Tennessee River below Pickwick Landing Dam, Hardin County". According to the Federal Register report for the sheepnose (USFWS 2012c):

> The sheepnose persists in the tailwaters of Guntersville, Wilson, Pickwick Landing, and Kentucky Dams on the mainstem Tennessee River, where it is considered uncommon (Garner and McGregor 2001, p. 165; Gooch et al. 1979, p. 9). These populations are considered stable overall but with very limited.

The habitat preference for the sheepnose is larger streams where it is frequently found in shallow shoal habitats that have moderate to swift currents and coarse sand and gravel (Oesch 1984, as cited in USFWS 2007). The only confirmed host fish is the central stoneroller (*Campostoma anomalum*) (Watters, Hoggarth, and Stansbery 2009), although Parmalee and Bogan, 1998 state, "based on data from Surber (1913) and Wilson (1916), Fuller (1974) lists the Sauger (*Stizostedion canadense)* as the fish host for glochidia of the sheepnose".

As with most mussels native or once native to the lower Tennessee River, the most significant impact on its habitat has been activities related to navigation and flood control. This includes impoundment by TVA and USACE navigation dams and maintenance dredging operations.

Also, pollution and siltation from a multitude of other sources upstream through the entirety of the Tennessee River watershed may negatively impact this species. These changes not only directly alter the habitat but most likely may also affect fish host distribution. Other threats to this species within the Tennessee River include the introduction of the exotic zebra mussel, (*Dreissena polymorpha*). Zebra mussels compete directly with native mussels for food and oxygen as well as attach directly to native mussels via byssal threads and potentially interfere with siphoning and opening/closing of the native mussels shell. In addition, zebra mussels may interfere with reproduction of native mussels by ingesting gametes released by the native mussel (Watters, Hoggarth, Stansbery 2009). Zebra mussels are found sporadically throughout the middle and lower Tennessee River, often on native mussels.

Cummings and Mayer, 1992 describe the exterior of the shell as follows:

> Shell thick, oval, or oblong, somewhat elongate, and slightly inflated. Anterior end rounded, posterior end bluntly pointed. Dorsal margin straight, ventral margin curved anteriorly, straight posteriorly. Umbos slightly elevated above the hinge line. Beak sculpture of two heavy ridges, visible only in young shells. Shell smooth, except for a row of knobs or tubercles on the center of the valve, running from the umbo to the ventral margin (sometimes obscure). A shallow sulcus or furrow present between the row of tubercles and the posterior ridge. Periostracum yellow or light brown in juveniles, becoming chestnut to dark brown in adults. Length to 5 inches (12.7 cm).

During the 2012 mussel survey performed at the previously proposed First Marine Properties site (Mainstream 2012), six individuals of *Plethobasus cyphyus* were found. Assuming that mussel concentrations remain consistent, sheepnose definitively exists at the current proposed project area. Potential project impacts on *Plethobasus cyphyus* are discussed below in Section V – Effects Analysis.

Spectaclecase

The spectaclecase mussel (*Cumberlandia monodonta*) has been listed as a federally endangered species since April 12, 2012 (USFWS 2012b). It had previously been a federally listed candidate species under the Endangered Species Act since 2004 (USFWS 2011a). Their historical range was throughout much of the Mississippi River system, the upper Ohio River system, the Cumberland and Tennessee River systems and, in some tributaries of the lower Mississippi in Arkansas (NatureServe 2012). According to Parmalee and Bogan (1998), within Tennessee, the spectaclecase has historically been reported from the Tennessee River, the Clinch River, the Powell River, the Holston River, and the Nolichucky River. It has also been reported recently (2004) from the Duck River (NatureServe 2012). According to NatureServe (2012), extant populations are known from 20 streams in 10 states.

The habitat preference for the spectaclecase is large rivers in areas sheltered from the main current. They are often found in clusters in firm mud substrate, and most frequently in sheltered

areas such as beneath boulders and rock, or even under tree roots (USFWS 2011a). No fish hosts are known (Watters 1994 in Parmalee and Bogan, 1998).

As with most mussels native or once native to the lower Tennessee River, the most significant impact on its habitat has been activities related to navigation and flood control. This includes impoundment by TVA and USACE navigation dams and channel maintenance dredging operations. Also, pollution and siltation from a multitude of other sources upstream through the entirety of the Tennessee River watershed may negatively impact this species. These changes not only directly alter the habitat but most likely may also affect fish host distribution. Other threats to this species within the Tennessee River include the introduction of the exotic zebra mussel, *Dreissena polymorpha*. Zebra mussels compete directly with native mussels for food and oxygen as well as attach directly to native mussels via byssal threads and potentially interfere with siphoning and opening/closing of the native mussels shell. In addition, zebra mussels may interfere with reproduction of native mussels by ingesting gametes released by the native mussel (Watters, Hoggarth, Stansbery 2009). Zebra mussels are found sporadically throughout the middle and lower Tennessee River, often on native mussels.

Cummings and Mayer, 1992 describe the exterior of the shell as follows:

> Shell oblong, elongate, and compressed. Anterior and posterior ends rounded. Ventral margin usually arched or pinched, occasionally straight. Shell thin in young, becoming thicker in older individuals. Umbos only slightly elevated above the hinge line. Beak sculpture, when visible, of three or four heavy ridges. Surface of shell smooth to somewhat rough, brown in young shells, becoming dark brown to black and rayless with age. Length to 8" (20.3 cm).

The spectaclecase was last encountered on the lower Tennessee River by Dr. James Sickel between TRM 15.8 and 20.1 in 1991. During that survey, only one live *Cumberlandia monodonta* was found. There have been no known recorded encounters of live spectaclecase in the lower Tennessee River since. During the 2012 mussel survey performed at the previously proposed First Marine Properties site, no *Cumberlandia monodonta* were found. Based on the lack of recent records for this species in the lower Tennessee River, it is unlikely that the spectaclecase would be affected by the current proposed project and will not be addressed further in this Biological Assessment.

V. EFFECTS ANALYSIS

The only federally listed species that are thought to occur in any significant concentrations in the First Marine Properties action area would be the federally endangered sheepnose mussel and the federally threatened rabbitsfoot mussel. However, it cannot be ruled out that the federally endangered orangefoot pimpleback mussel may exist in the action area in small numbers. The federally endangered fat pocketbook mussel and pink mucket mussel may possibly occur at the proposed action area, but the lack of preferred habitat of the fat pocketbook mussel, and the

significant length of time since the last sighting of a pink mucket in this area of the lower Tennessee River would seem to indicate that neither of the two species are likely to be present in any significant concentrations. Additionally, the fat pocketbook mussel is found relatively often downstream in the Ohio River near the mouth of the Tennessee River, but only one recorded live individual has been located in the lower Tennessee River. This variance in species presence in such a short distance seems to imply that the fat pocketbook mussel finds the habitat in the lower Tennessee River unsuitable, leading to the possible conclusion that the one live fat pocketbook found at TRM 13 is an anomaly that fell from a fish host at that particular location and has been able to persist for the past five years. An analysis of potential project effect for the federally endangered Indiana bat, the federally endangered orangefoot pimpleback mussel, the federally endangered sheepnose mussel and the federally threatened rabbitsfoot mussel, and their habitat, is listed below.

A. *Project Construction*

Development Area

The construction of the development area will include the installation of a sheet pile breasting wall around the existing cells at approximate TRM 10.9 and 10.95 extending to the shore, the deposit of fill material to an elevation of 346 feet above mean sea level behind the breasting wall and for the entirety of the proposed 19 acre plot, as well as tree clearing within wetlands existing within the proposed development area. In addition, three breasting dolphins are proposed to be installed offshore of the development area, 150 feet on center from the two existing cells with two being located downstream of the sheet pile breasting wall and one located upstream of the wall (Figure 3). All dolphins will be in-line with the channel side of the breasting wall.

Terrestrial construction will include the placement of fill material for the development area. A total of 10.6 acres of potential Indiana bat summer habitat were identified by Redwing Consulting within the area of proposed tree clearing. If habitat clearing can be limited to the "unoccupied" period of the year between October 15 and March 31, any impacts to the Indiana bat would be indirect, while clearing during the "occupied" period between April 1 and October 14 may be considered a potential direct impact (Redwing 2014). As stated in Section IV under "Species Accounts", the 4.0 acres proposed for clearing only constitute approximately 38% of the 10.6 acres of on-site habitat and because there exists numerous other forested blocks in the vicinity, no adverse impacts to the Indiana bat are anticipated (Redwing 2014).

Aquatic construction includes the installation of the sheet pile breasting wall around the existing cells extending back to the shore and the three breasting dolphins, where the construction of the wall and consequent fill of the area behind it would directly impact approximately 0.2 acres (8,712 square feet) while the dolphins would directly impact approximately 9.42 square feet. As described previously, construction barges utilized for the sheet pile breasting wall and dolphin installation may hold themselves in position temporarily by employing spud poles (vertical pipe or square steel sections lowered to the river bottom to hold a barge in position), which could

impact native mussels when dropped. Most frequently these spud poles would be 18 to 24-inch pipe or square stock, with two spuds dropped to the river bottom on a pile driving barge for each dolphin installation location. Assuming 24-inch square stock, each work barge using spud poles would directly affect approximately 8 square feet, yielding a total of 24 square feet of river bottom directly impacted via spud poles during the installation of the dolphins. When combined with the approximate direct impact of the dolphins (9.42 square feet), the total area of direct impact for all three dolphin installations is expected to be approximately 34 square feet. According to personal communication with Mr. Steve Hawthorn of Southern Marine Construction Company, the sheet pile wall installation is expected to require approximately fifty placements of a pile driving barge, which will employ two spud poles to hold itself in place. If the work barge is spudded down fifty times, that would yield an approximate area of direct impact of 400 square feet, which in combination with the direct impact area of the fill material to be placed behind it (8,712 square feet) as well as the approximate area of direct impact from the installation of the dolphins (34 square feet), would total an area of approximately 9,146 square feet, or an approximate 850 square meters. Because of the relatively high mussel densities in the area of sheet pile wall and dolphin installation (inferred from Mainstream 2012), federally listed mussels could be expected to be present near the sheet pile wall and dolphin installation areas and, if present, may be directly impacted.

During the 2012 survey, an area of preferred *Quadrula cylindrica* habitat approximately 300 meters long by 1 meter wide was searched parallel to the left descending bank. This search covered the entirety, as well as contiguous areas upstream and downstream, of the previously proposed harbor portal width for the previous site plan of the facility. The area that was surveyed in 2012 is analogous to the area currently being assessed, where the areas of dolphin and sheet pile installation are expected to occur within or close to *Quadrula cylindrica* preferred habitat in this section of the Tennessee River. The total search area in 2012 was approximately 300 square meters and in that area 12 individuals of *Quadrula cylindrica* were encountered, yielding an approximate density of 0.04 individuals of *Quadrula cylindrica* for every square meter within and immediately adjacent to their preferred habitat. When this approximate density is applied to the 0.2 acre fill area and 400 square foot area impacted by spud poles for the sheet pile wall installation, as well as the 34 total square feet of direct impact from the dolphin installations, it yields a total area of 9,146 square feet or an approximate 850 square meters. An estimated 34 individuals of *Quadrula cylindrica* are expected to be impacted in or near the area of their preferred habitat by the construction activities.

In the 12 semi-quantitative transect searches, all totaling 1,200 square meters of searched river bottom, only three individuals of *Plethobasus cyphyus* were encountered, yielding an approximate density of 0.0025 individuals of *Plethobasus cyphyus* for every square meter of the entire search area from TRM 11.1 to 11.8. When this approximate density is applied to the total expected direct impact area of approximately 850 square meters, an estimated 2 individuals of *Plethobasus cyphyus* are expected to be impacted by the construction activities. However, preferred *Plethobasus cyphyus* habitat is often shown to be in areas of predominantly gravel, which does not occur near to the proposed facility construction but is found further out in the river. It is possible, however, that some few individuals of *Plethobasus cyphyus*, and even

Plethobasus cooperianus, could reside in areas of construction and those that do may be affected by the construction activities.

Borrow Area

To obtain the required development area fill, it will be necessary to obtain the volume of fill material from the borrow area. The proposed borrow area for the project consists of the open field area immediately upstream of the development area. The overburden in this area would be excavated and placed in the fill area (development area). Once excavation is completed, the entire borrow area would be seeded and stabilized.

The removal of the necessary volume of fill material from the borrow area will require tree clearing. The trees projected to be cleared in the borrow area are free standing trees that are not clustered into what can be classified as a forest block (Figure 5). Because only seven trees and a nearby small copse of trees within the borrow area were identified as possible Indiana bat summer habitat, and due to the presence of other individual trees and forested blocks in the vicinity, it is unlikely that the Indiana bat will be significantly impacted within the borrow area.

B. *Project Operation*

First Marine Properties, LLC plans to construct a barge and container vessel port along the left descending bank of the Tennessee River between TRM 10.7 and 11.3. Prior to First Marine Properties' involvement with the proposed project area, several companies performed various operations, including barge fleeting, mooring and scrapping, among other activities, at this particular area of the Tennessee River from the 1950's to the date First Marine Properties took over ownership of the land. The site of proposed barge and container vessel breasting along the proposed sheet pile wall has long been a location for breasting by barges and boasts a depth of between 10 and 15 feet at normal pool, which is not expected to decrease following the installation of the sheet pile wall (Drawings 4 and 5). Possible effects that might occur with the planned usage of the sheet pile breasting wall include suspension of sediment from towboat or container vessel propeller wash during periods of low water. However, given the historical use of the area and currently ongoing similar use by First Marine Properties, potential impacts to nearby mussels and habitat would likely not be any greater than existing conditions at the site of the proposed sheet pile breasting wall.

Conditions at the two downstream breasting dolphins may yield potential direct impact to the river bottom, as the depth at normal pool for both dolphins is expected to be between approximately 10 and 15 feet (Drawings 2 and 3). Because the river bed slope is assumed to be composed primarily of clay (Table 4 in Mainstream 2012) and is not expected to provide suitable mussel habitat as evidenced by the general absence or low concentrations of mussels between shore and 20 meters from shore (Table 3 in Mainstream 2012), the location of the two downstream dolphins farther up the slope of the river bottom is not expected to affect many mussels. If empty barges were moored at the dolphins, no direct impacts to the river bottom are

typically expected, but during very low water conditions, loaded moored barges could possibly come into contact with the river bottom. Effects from the rare occasion where barges may come into contact with the river bottom are not expected to be any greater than ongoing effects from currently permitted deadman barge fleeting and other permitted activities that have long occurred at the site. Therefore, it is unlikely that mussels will be significantly adversely affected by the mooring of vessels at the proposed dolphins during normal facility activities.

Listed mussels, such as the federally threatened *Quadrula cylindrica* and the federally endangered *Plethobasus cyphyus* and *Plethobasus cooperianus* mussels, are expected to exist in the project area in low numbers and in particular areas of the river. The majority of the rabbitsfoot mussels were located in the transition area at the toe of the river bottom slope where the substrate transitions from a predominantly clay soil to a predominantly gravel composite. Previous surveys on the Tennessee River seem to indicate that the rabbitsfoot mussels prefer this very specific habitat, while the sheepnose and orangefoot pimpleback mussels generally prefer more gravel-based substrates and are thus found farther out in the river, away from shore. The sheet pile cell wall is located closer to the toe of the slope where rabbitsfoot mussels prefer to reside and closer to the predominantly gravel-comprised river bottom where the sheepnose and orangefoot pimpleback mussels may be. However, due to the approximately 10-15 feet of water depth during normal pool at that location, it is unlikely that any barge or container vessel will connect with the river bottom at that location unless very low water conditions exist. As such, and because current permitted fleeting and scrapping activity has been long ongoing in this area, it is unlikely that either the rabbitsfoot mussel, sheepnose mussel or orangefoot pimpleback mussel will be adversely affected by the mooring of vessels at the proposed sheet pile wall during normal facility activities.

C. *Cumulative Effects*

Because the lower Tennessee River is regarded as an OSRW, there is generally little activity which occurs in this area that is not closely evaluated for its effects on native federally listed flora and fauna. The lower Tennessee River supports recreational fishing but very little if any commercial fishing, and no commercial mussel harvesting. The fishing is not anticipated to significantly affect listed species of mussels. Maintenance dredging for the navigational channel is generally not performed and so is not anticipated to significantly affect listed species of mussels. No other state or private actions are known or expected to occur within or near close proximity to the action area.

VI. PROJECT EFFECT DETERMINATIONS

A. *Gray Bat*

It has been determined that the gray bat is not likely to be adversely affected by the First Marine Properties proposed facility.

B. ***Indiana Bat***
It has been determined that the Indiana bat is not likely to be adversely affected by the First Marine Properties proposed facility.

C. ***Fat Pocketbook***
It has been determined that the fat pocketbook is not likely to be adversely affected by the First Marine Properties proposed facility.

D. ***Orangefoot Pimpleback***
Although the orangefoot pimpleback has not been found recently or in large numbers within the lower Tennessee River, it most likely resides there in very low concentrations and thus often goes undetected during mussel surveys. Based on information presented in this BA, primary effects from the project would impact areas near or within high-quality mussel assemblages where orangefoot pimpleback could reasonably be expected to occur. Given some level of uncertainty with estimates of impact area and assumptions of orangefoot pimpleback distribution, it is possible that a small number of orangefoot pimpleback and its suitable habitat may be adversely affected by the First Marine Properties proposed facility.

E. ***Pink Mucket***
It has been determined that the pink mucket is not likely to be affected by the First Marine Properties proposed facility.

F. ***Rabbitsfoot***
It has determined that the rabbitsfoot will be adversely affected by the proposed First Marine Properties' facility.

G. ***Sheepnose***
It has been determined that the sheepnose may be adversely affected by the First Marine Properties proposed facility.

VII. CONCLUSIONS

First Marine Properties' proposed barge and container port facility is likely to adversely affect a small number of federally endangered sheepnose mussels, federally endangered orangefoot pimpleback mussels and federally threatened rabbitsfoot mussels, primarily as a result of material fill behind a sheet pile wall built around two existing cells, in addition to the installation of three breasting dolphins. The federally endangered fat pocketbook mussel and pink mucket mussel species' extremely low observed abundance in the lower Tennessee River indicates that these species are very unlikely to inhabit areas of the river that could be impacted by the facility's construction or operation. Therefore, the fat pocketbook, and pink mucket are not likely to be adversely affected by the First Marine Properties' project. The federally listed as endangered gray bat and Indiana bat may also be affected by the project, but Redwing Ecological Consulting (2014) has concluded based on their survey of the project area that due to the relatively small area of habitat expected to be cleared as well as the presence of other forested blocks in the vicinity, it is unlikely that the gray and Indiana bats will be significantly impacted by the facility's construction or operation.

FIGURES:
First Marine Properties, LLC
Biological Assessment

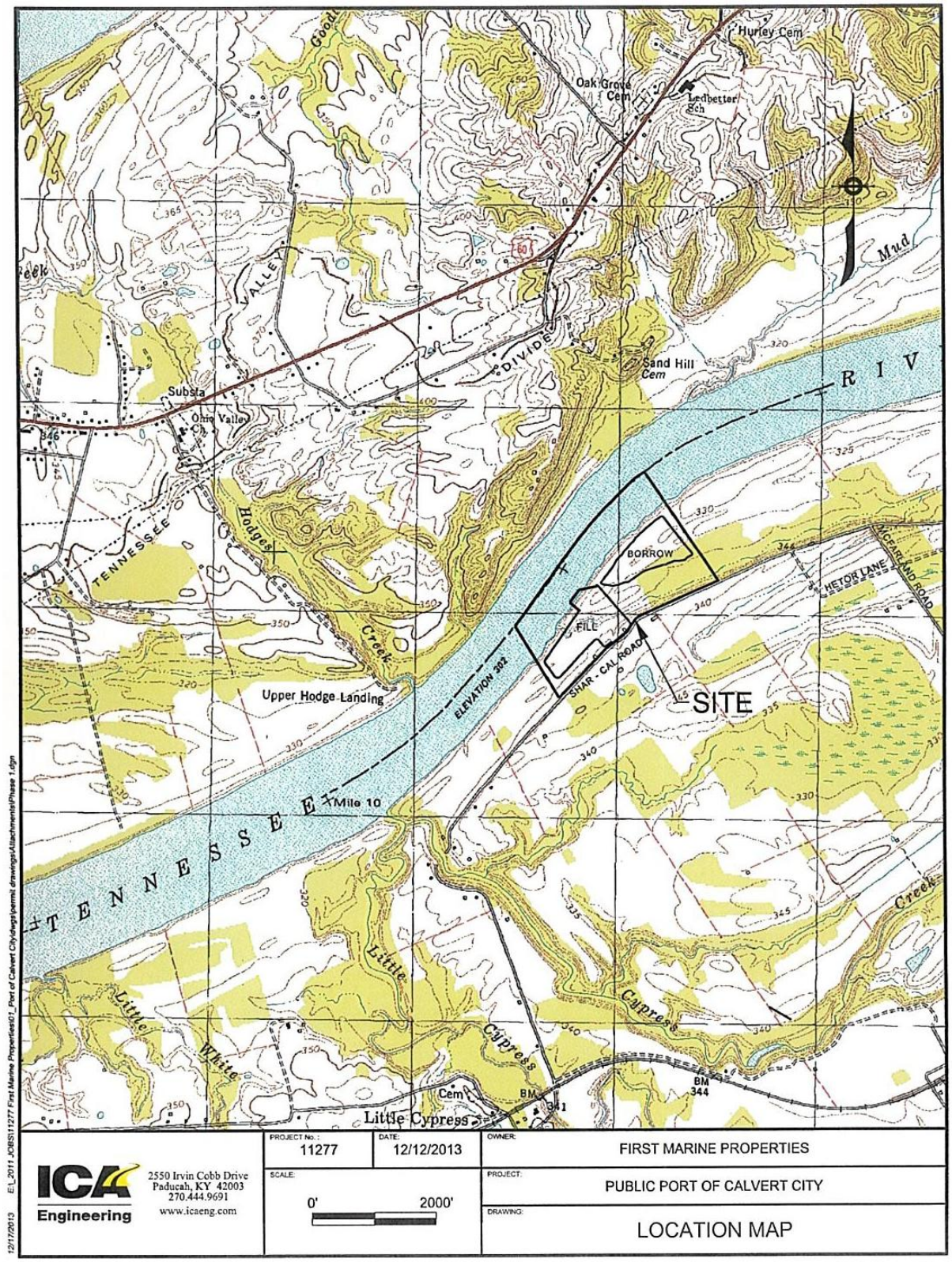


Figure 1. Proposed facility overview.

Figure 2. Elevation contours of proposed facility.

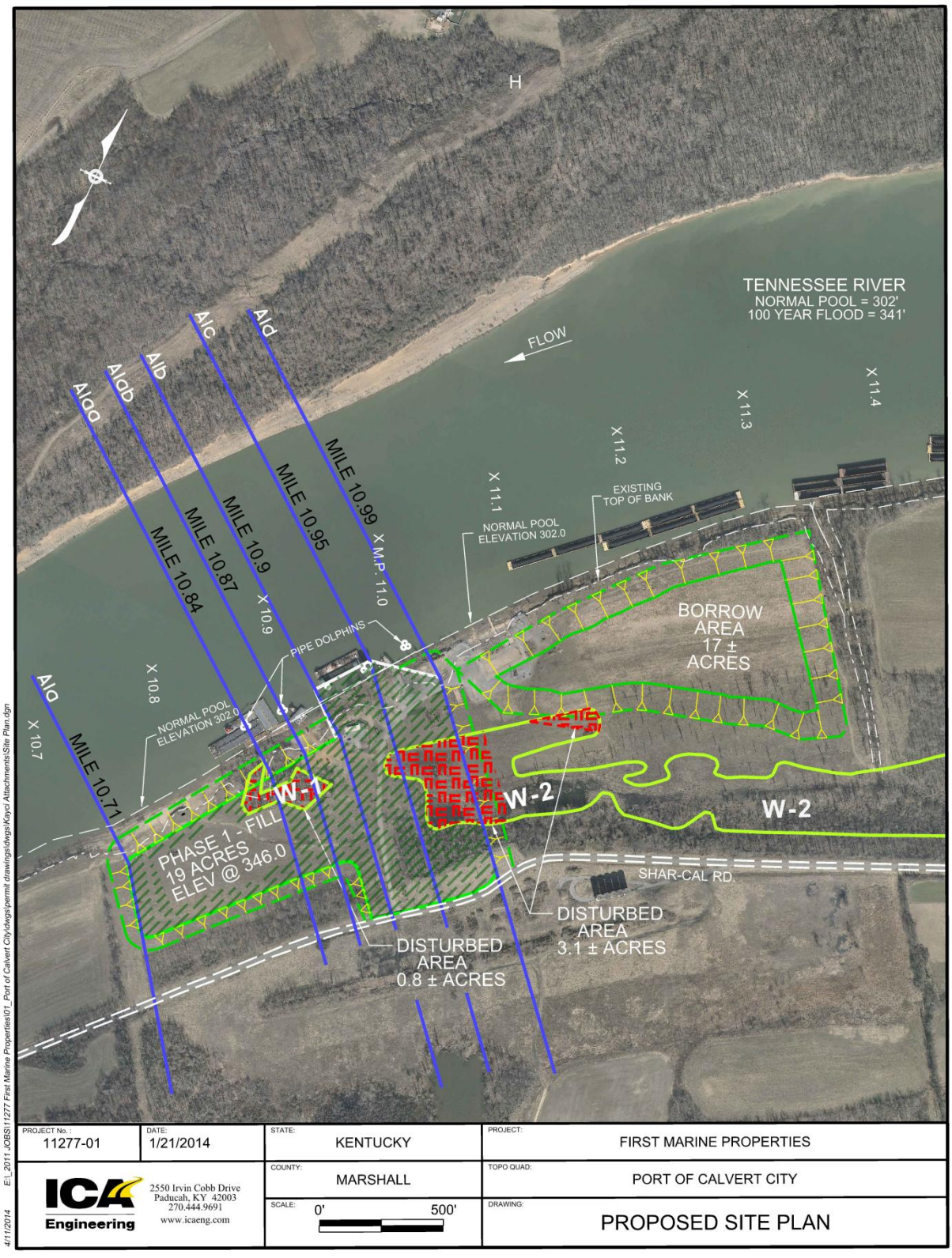


Figure 3. Site plan of proposed facility including wetland areas expected to be disturbed.

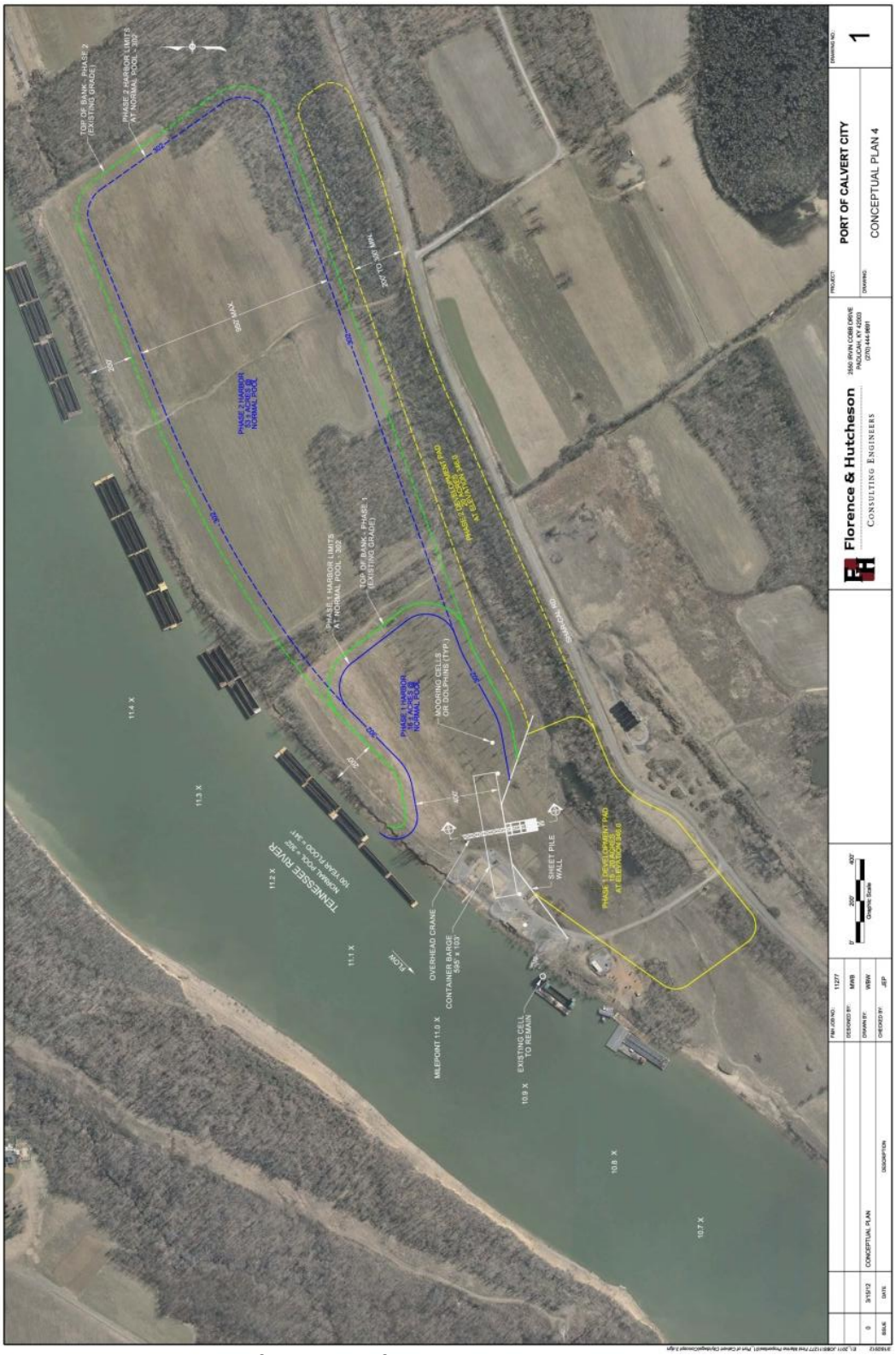


Figure 4. Previous site design of proposed facility.

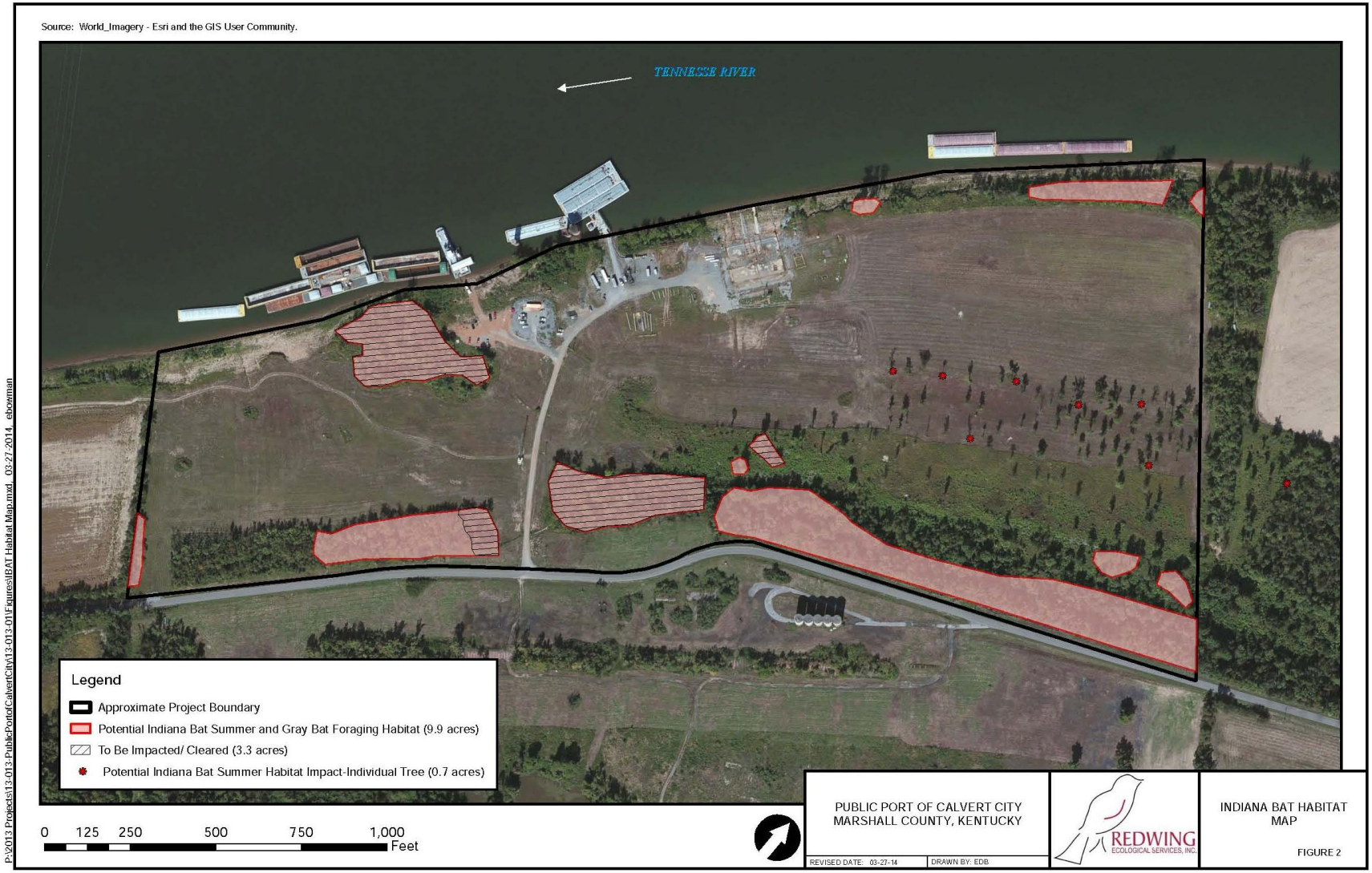
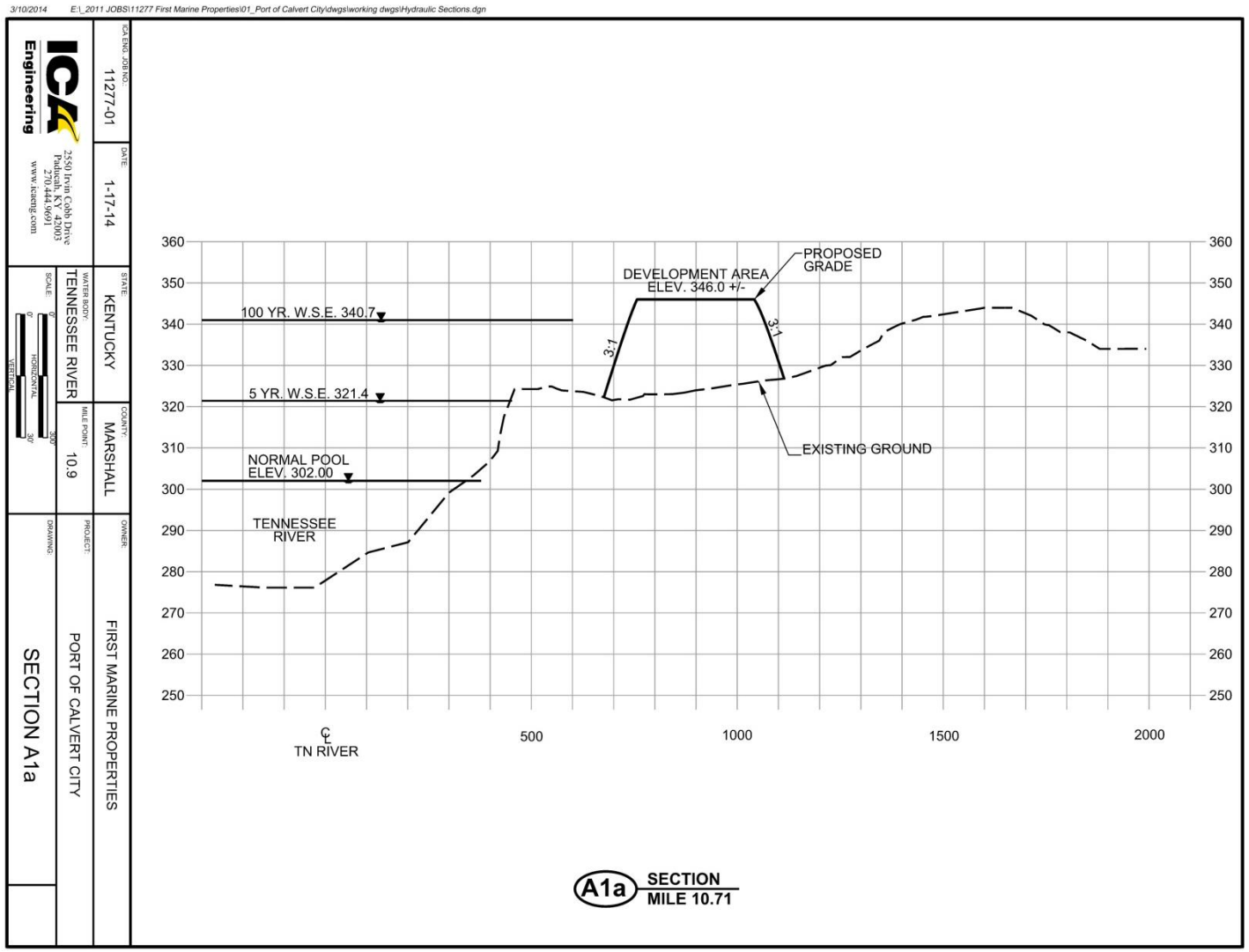
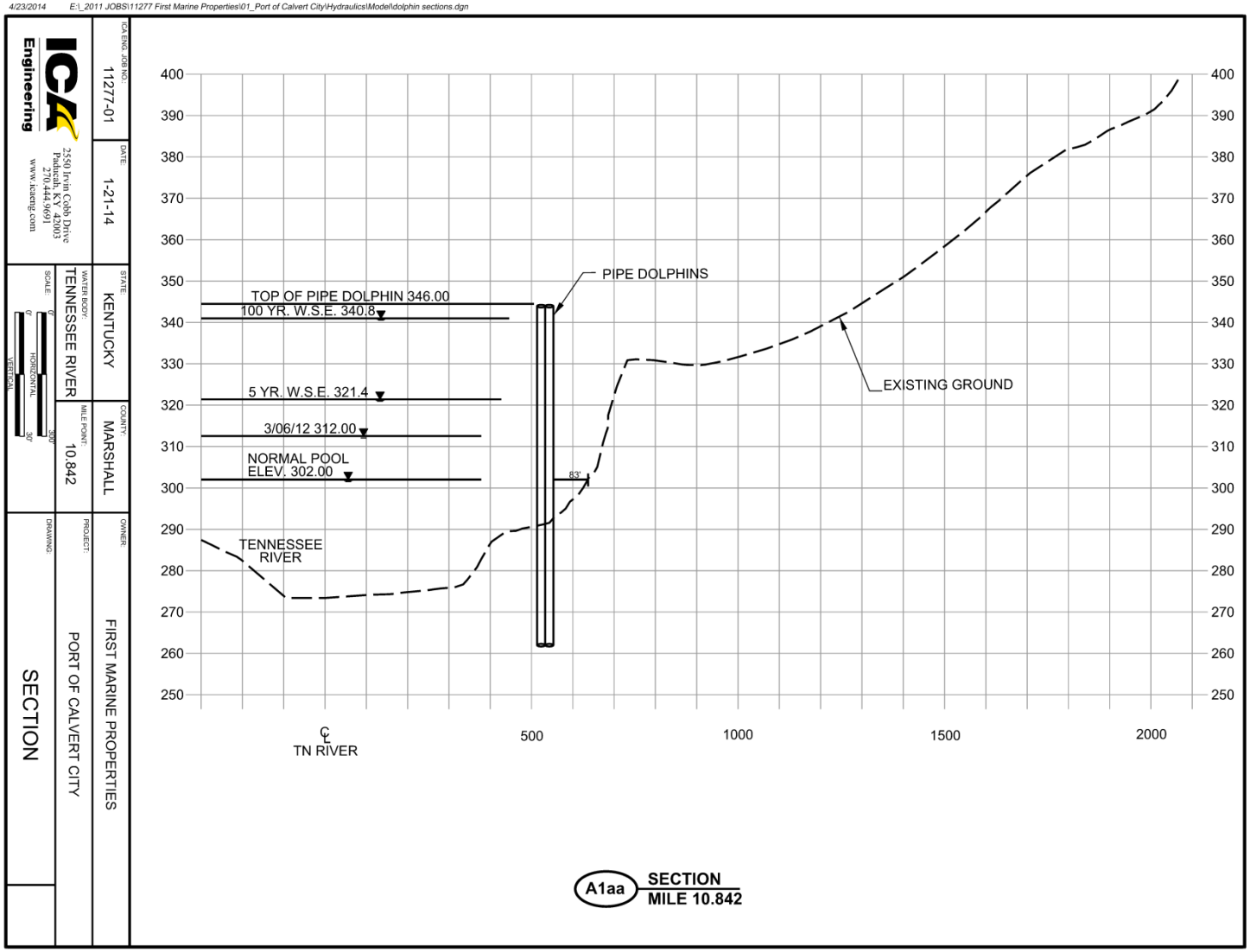


Figure 5. Indiana bat habitat impacts of proposed facility.

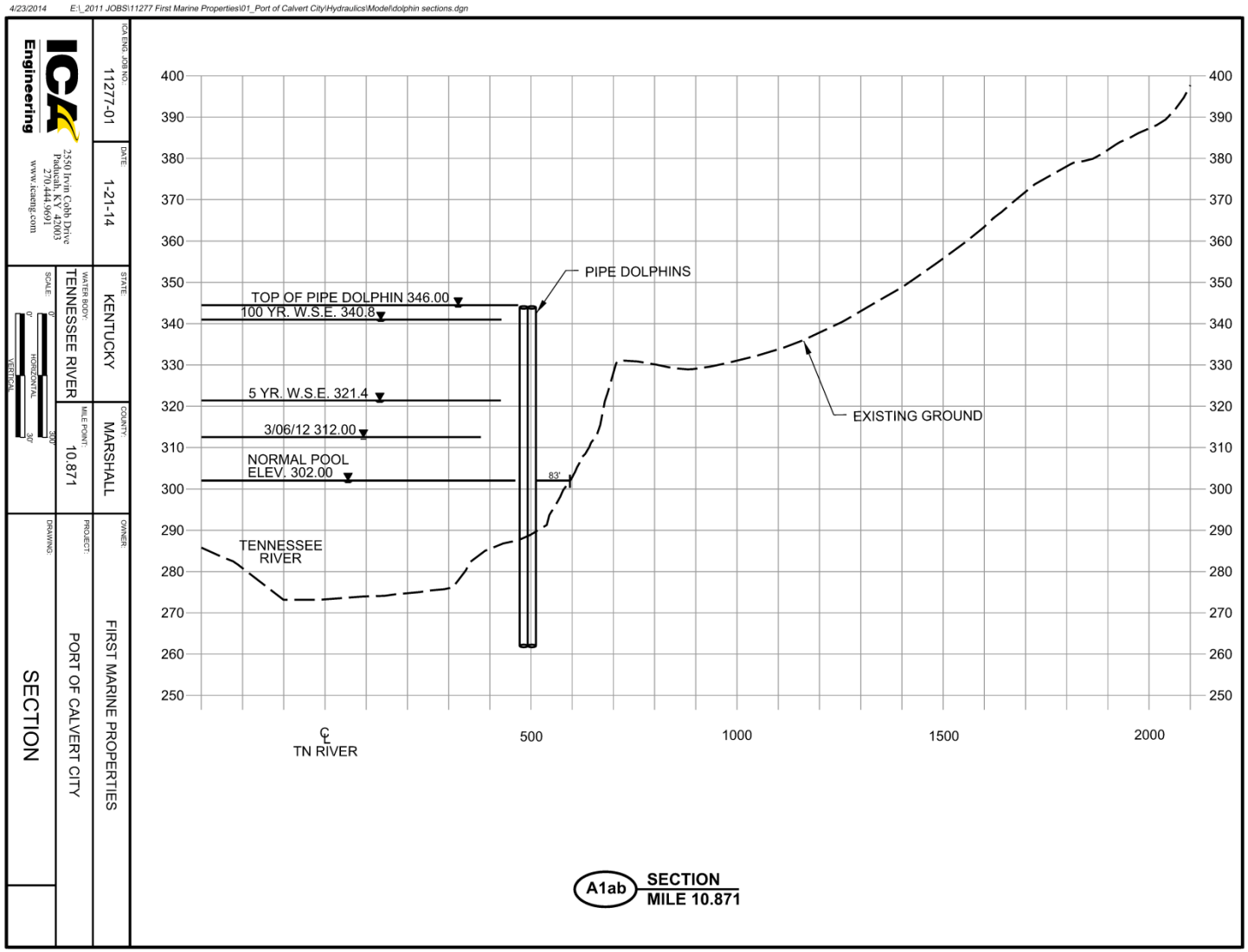
DRAWINGS:
First Marine Properties, LLC
Biological Assessment



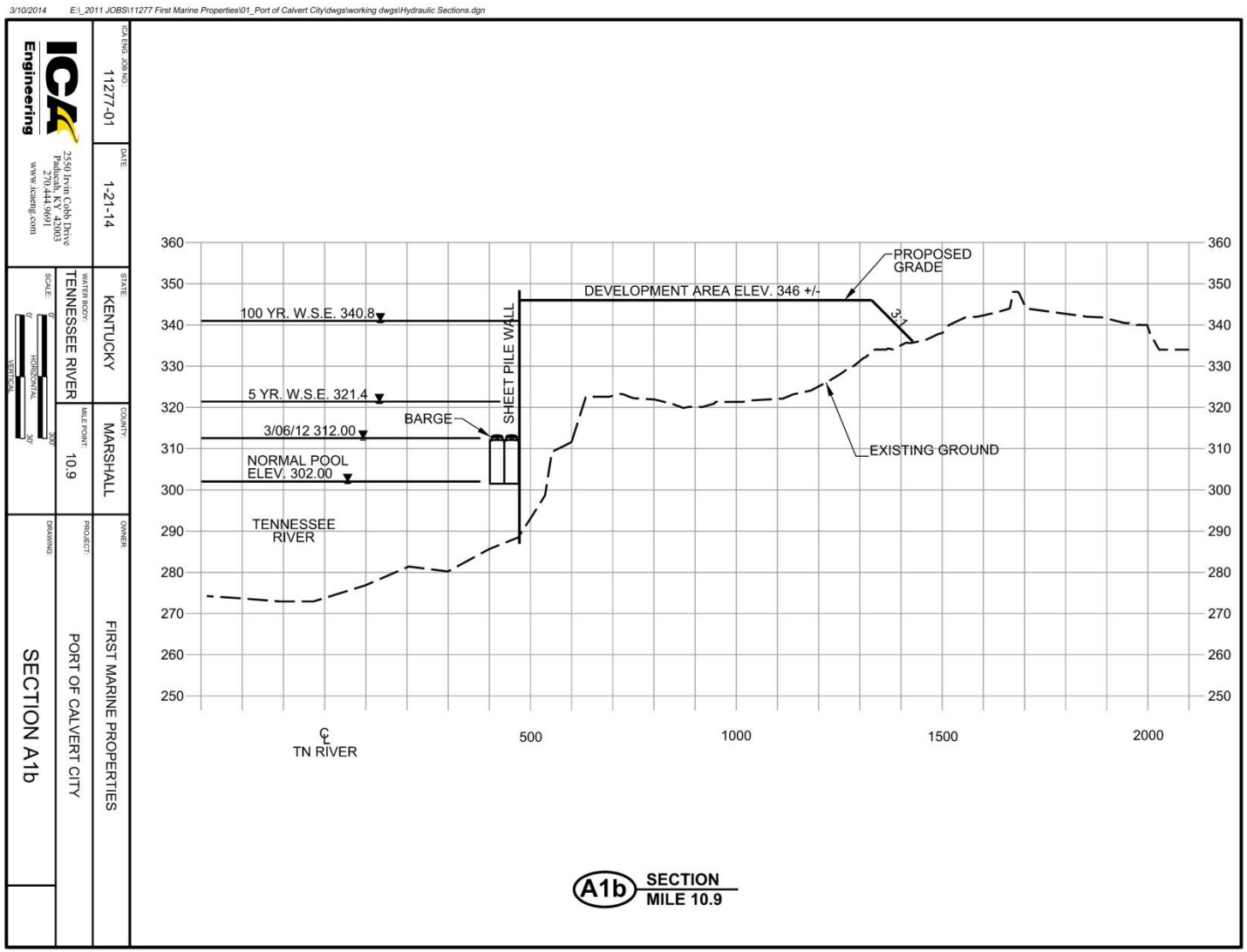
Drawing 1. Elevation view of the development area at TRM 10.71.



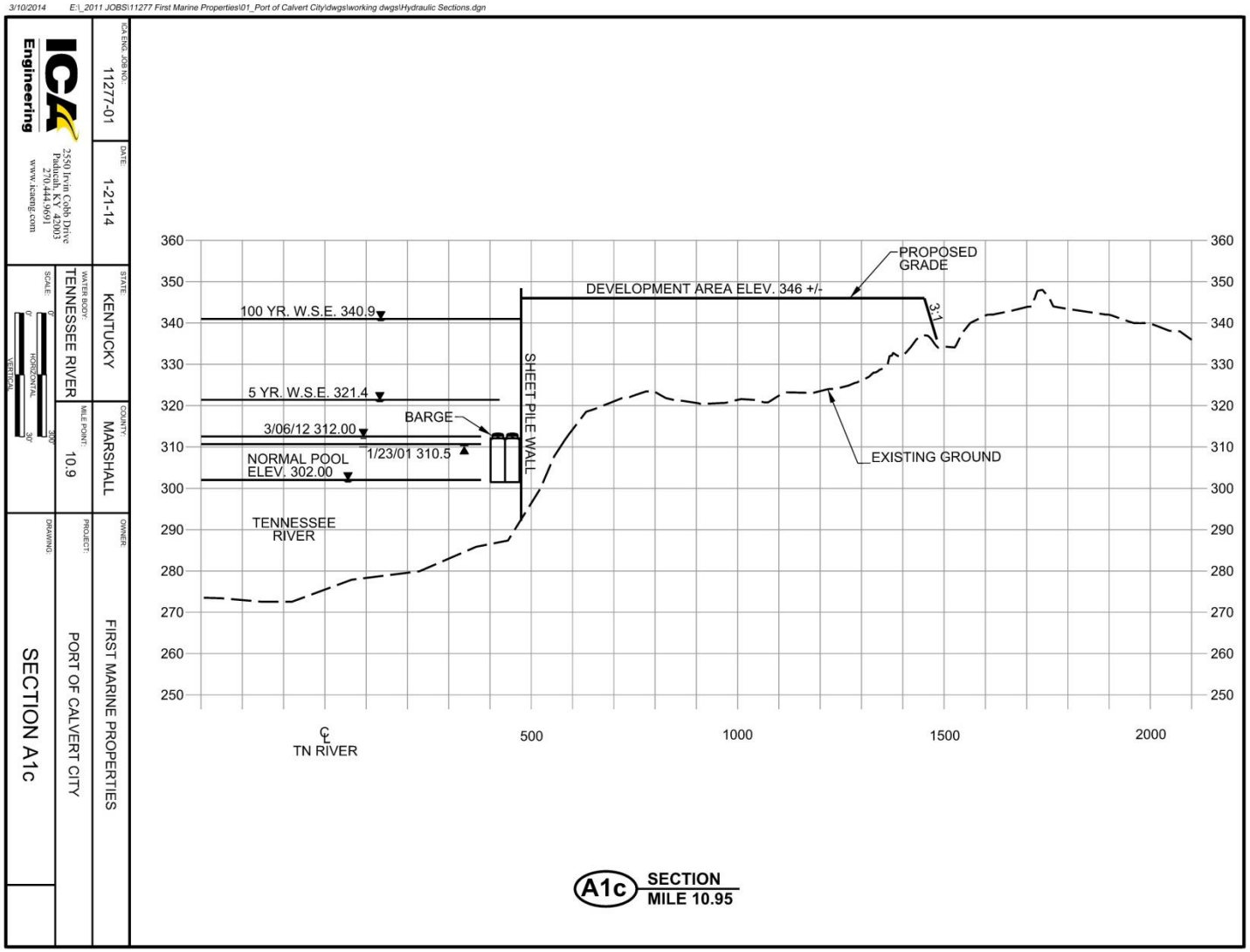
Drawing 2. Elevation view of the breasting dolphin at TRM 10.842.



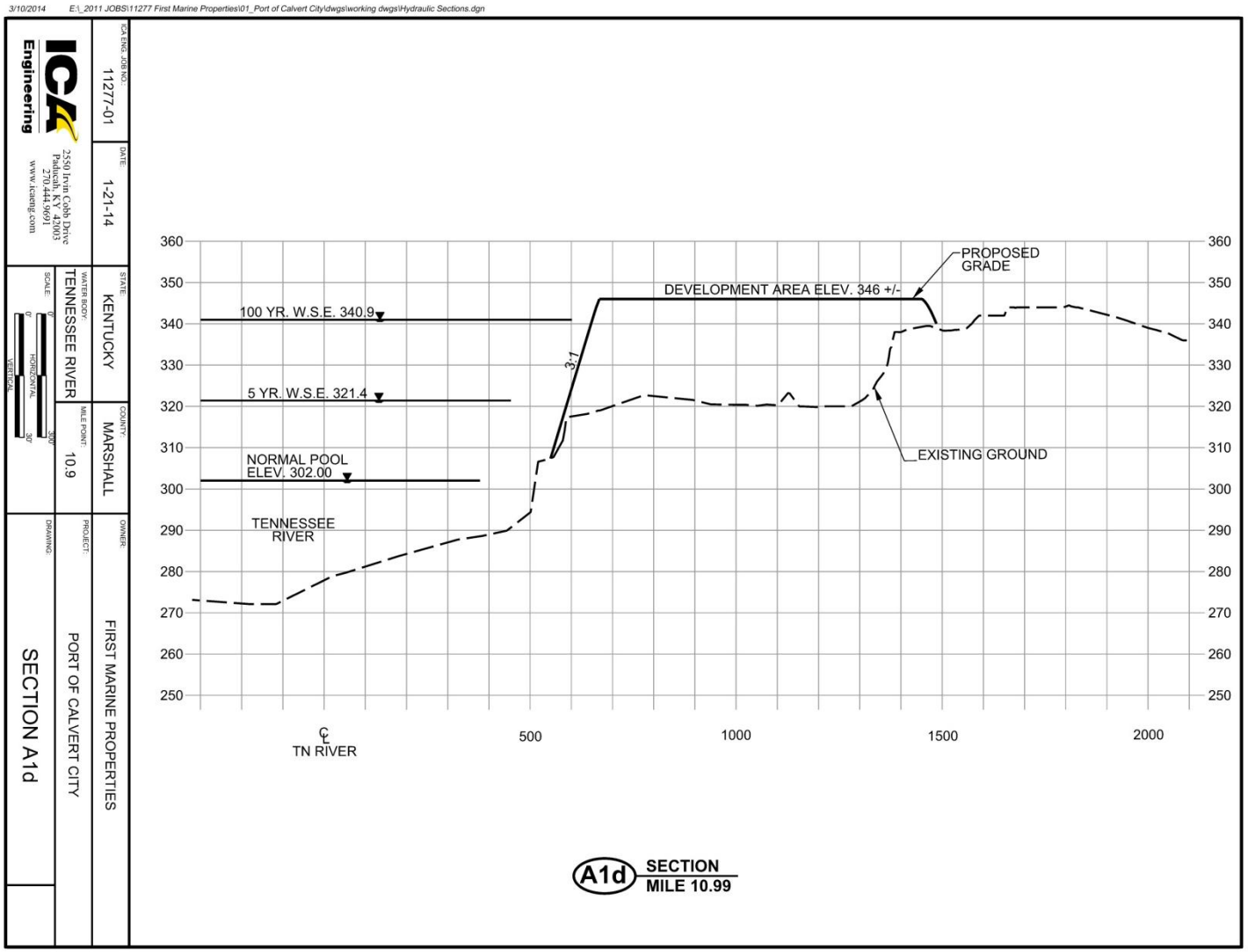
Drawing 3. Elevation view of the breasting dolphin at TRM 10.871.



Drawing 4. Elevation view of the sheet pile wall and development area at TRM 10.9.



Drawing 5. Elevation view of the sheet pile wall and development area at TRM 10.95.



Drawing 6. Elevation view of the development area at TRM 10.99.

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APPENDIX A – PROTECTED SPECIES HABITAT ASSESSMENT REPORT:
First Marine Properties, LLC
Biological Assessment

APPENDIX B – MUSSEL SURVEY:
First Marine Properties, LLC
Biological Assessment