

THE TENNESSEE VALLEY AUTHORITY



Clinch River Small Modular Reactor and Barge/ Traffic Site

Evaluation of Aquatic Habitats and Protected Aquatic Animals Technical Report

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This report has been prepared as a supporting document for the Clinch River Small Modular Reactor Site (CRSMR) Early Site Permit Application Project and is being distributed for project use. The report provides a summary of documented aquatic habitats and protected aquatic animals potentially present in CRSMR study area including the adjacent barge/ traffic study area and the adjacent Clinch River, Roane County, TN.

INTRODUCTION

TVA is evaluating a site in Roane County, Tennessee along the lower Clinch River (right bank near river miles 15 - 19) to construct and operate up to six small nuclear reactors and barge loading/ unloading area, as well as reconfiguring roads for traffic on an adjacent TVA tract (=Project Site). TVA proposed an environmental evaluation of aquatic habitats at the site and the freshwater mollusk community of the Clinch River adjacent the site (Clinch River miles [CRM] 15 - 19); Figure 1). TVA previously surveyed mussels and habitat near the CSMR site (CRM 14 - 20) in 1982 (Jenkinson 1982), as did others (Ahlstedt 1991, UCC 2005). These studies indicated that the lower Clinch River recently supported a mussel community with relatively low abundance and species richness. Poor mollusk community and habitat status relative to historical conditions are presumed to be the result of impoundment of the Clinch River (Melton Hill Dam in 1963 and Norris Dam in 1936) and mainstem Tennessee River (Watts Bar Dam in 1942). Additionally, the lower Clinch River has also been subject to disposal of contaminants from the Oak Ridge National Laboratory site many decades ago that has contributed to legacy sediment toxicity issues between White Oak Creek (mouth near CRM 21) and Watts Bar Dam (TRM 530) (Interagency Agreement 1991), which also likely contributed to mussel declines in this area. However, in 1991 TVA began a Reservoir Release Improvement program at Melton Hill Dam (CRM 23) and other dam sites to increase dissolved oxygen levels and water flow in the lower Clinch River, which may have improved habitat conditions for mussels since its implementation.

Despite historical habitat and mussel community degradation, evidence of federally listed mussel species has been found near the Project Site over recent decades, including one live individual of the federally endangered pink mucket pearlymussel (*Lampsilis abrupta*) near CRM 19.1 (Ahlstedt 1991) and one live sheepnose mussel (*Plethobasus cyphus*; (endangered) at CRM 21.4 (TWRA and TDEC 1994). Relic shells of other federally listed species have also been found recently in the lower Clinch River, including the spectaclecase (*Cumberlandia monodonta*; endangered) at CRM 10.0 and 15.7 and fanshell (*Cyprogenia stegaria*; endangered) at CRM 21.4 (TWRA and TDEC 1994). Several other federally listed species are historically known from the area (Ahlstedt 1991), but are believed to be extirpated since they have not been found in over fifty years. Since nearly thirty years has passed since TVA surveyed near the Project Site, TVA proposed to update the status of freshwater mussel resources and habitat of the Clinch River near the Project Site in 2011. Since no surveys dedicated to characterizing the snail community near the Project Site have been reported, TVA also proposed evaluating the snail community near the site. Additionally, TVA proposed characterizing the surface waters of waterbodies occurring on the Project Site.

FISHES & MOLLUSKS (CLINCH RIVER) - HISTORIC

Construction of Norris Dam at Clinch River mile (CRM) 80 in 1936, and Melton Hill Dam at CRM 23 in 1963, on the main channel of the Clinch River, dramatically altered the aquatic fauna and likely had the greatest impact on native species (Ahlstedt 1991). Additionally, Watts Bar Reservoir, completed on the Tennessee River mainstem in 1942, impounded the lowermost portion of the Clinch River. Effects of these impoundments on aquatic fauna in the Clinch River

include fragmentation and loss of riverine habitats, disruption of the natural flow regime, altered temperature regimes, extreme water level fluctuations, changes in water quality parameters such as turbidity and oxygen concentrations, as well as increases in concentrations of heavy metals, and impeding host fish migrations (Etnier and Starnes 1993; Parmalee and Bogan 1998).

Fitz (1968) published a study on changes in the freshwater fish populations after construction of Melton Hill Dam and documented a reduction in nongame fish species. Rare and uncommon riverine fish species such as the federally threatened sand chub and the state-protected blue sucker have not been documented in the Clinch River since 2002 (TVA, unpublished data). In 1897 the first freshwater mussels were reported from the Clinch River system and 16 species were documented from the lower Clinch River in Roane County (Ahlstedt 1991). Forty-five mussel species were reported from the Clinch River prior to closure of Norris Dam (Cahn 1936). However, by 1975, only 6 species of mussels were found in the lower Clinch River, though surveys were limited in the impounded portions (Bates and Dennis 1978). In the most recent comprehensive survey of the lower Clinch River drainage from 1978-1983, twenty species of freshwater mussels at 63 sites in the lower Clinch River were found, but sites from CRM 15-17 yielded only 7 common and reservoir tolerant mussel species. Species diversity and abundance were low in comparison to pre-impoundment surveys, likely due to construction of impoundments, channelization, and dredging of the river for navigation (Ahlstedt 1991).

FIELD OBSERVATIONS

AQUATIC ECOLOGY

The Project Site is located in the Ridge and Valley ecoregion where large streams and rivers are structurally guided by often parallel ridges and meander along the valley floors. Consequently, rivers in this ecoregion are typically joined on either side by numerous minor tributaries that drain slopes in a trellis drainage pattern. Smaller streams in this region are typically characterized by limestone rubble, bedrock riffles, and silty sand pool areas (Etnier and Starnes 1993). The Project Site lies adjacent the Clinch River, which is affected by releases at Melton Hill Dam and Norris Dam upstream, as well as impoundment of the Tennessee River by Watts Bar Dam downstream. The lower Clinch River is therefore considered part of the Watts Bar Reservoir system.

During several visits in April and May, 2011, and October 2013 and 2014, TVA mapped the location of each waterbody within the Project Site using a global positioning system (GPS). A Tennessee Division of Water Pollution Control, Hydrologic Determination Field Data Sheet was completed for each watercourse (Aquatic Appendix A). A total of 54 waterbodies were characterized at the Project Site, including seven perennial streams, five intermittent streams, 34 ephemerals/wet-weather conveyances (WWCs), and eight ponds (Figure 2). A summary of waterbody characteristics for the CRN site and Barge/ Traffic Area is provided in Table A-1. Sampling with a backpack electrofisher of the identified perennial/ intermittent streams (excluding the Clinch River) within the CRN and Barge/ Traffic Area occurred in March 2015 to determine species as well as the quality of habitat present (Henderson and Phillips, 2015).

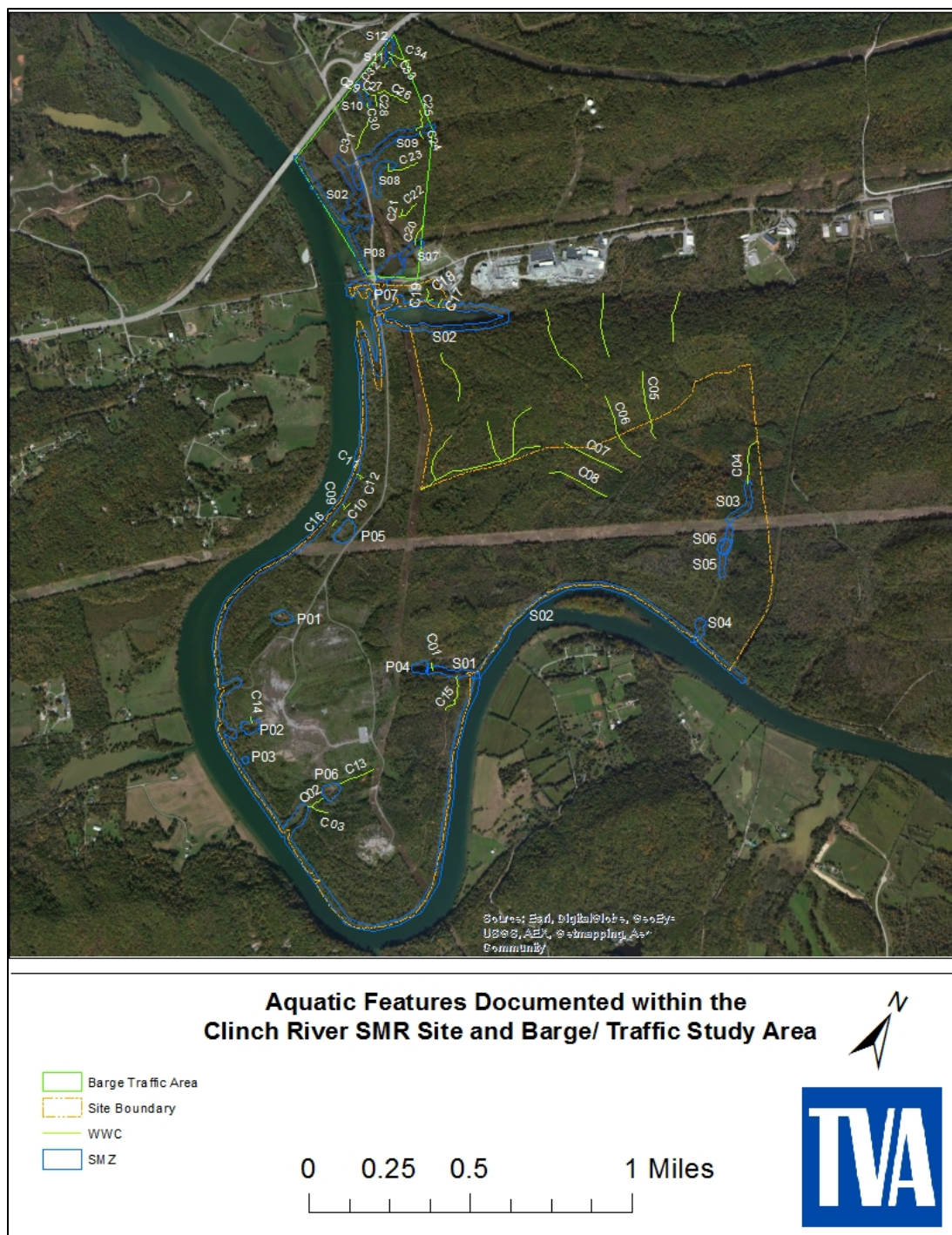


Figure 2: Aquatic Features Documented Within the Clinch River SMR Site and Barge/ Traffic Study Area.

Table A-1. Waterbodies Documented within the Clinch River Property and Barge/Traffic Area in Roane County, Tennessee (2015).

Map ID	Stream Type	Streamside Management Zone Category	Stream Name	Field Notes
CRN Site				
S01	Perennial	Category A (50 ft)	Unnamed Tributary to the Clinch River	Small channel being fed by pond and spring. Flows through a wetland.
S02	Perennial	Category A (50 ft)	Clinch River	Impounded portion of the Clinch River (Watts Bar Reservoir)
S03	Intermittent	Category A (50 ft)	Unnamed Tributary to the Clinch River	2ft wide x 1ft deep channel.
S04	Perennial	Category A (50 ft)	Unnamed Tributary to the Clinch River	Deep channel flowing out from beaver dam to river.
S05	Perennial	Category A (50ft)	Unnamed tributary to Clinch River	Channel with clay substrate. Flows through a wetland to river.
S06	Perennial	Category B (100 ft)	Unnamed tributary to Clinch River	Spring with small spring/run channel.
P01	Other	Category A (50ft)	NA	Storm water retention pond.
P02	Other	Category A (50ft)	NA	Storm water retention pond.
P03	Other	Category A (50ft)	NA	Small dug out pond.
P04	Other	Category A (50ft)	NA	Storm water retention pond.
P05	Other	Category A (50ft)	NA	Storm water retention pond.
P06	Other	Category A (50ft)	NA	Storm water retention pond.

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C01	Ephemeral/WWC	NA	Unnamed	Natural feature.
C02	Ephemeral/WWC	NA	Unnamed	Constructed.
C03	Ephemeral/WWC	NA	Unnamed	Natural feature.
C04	Ephemeral/WWC	NA	Unnamed	Natural feature.
C05	Ephemeral/WWC	NA	Unnamed	Natural feature.
C06	Ephemeral/WWC	NA	Unnamed	Natural feature.
C07	Ephemeral/WWC	NA	Unnamed	Natural feature.
C08	Ephemeral/WWC	NA	Unnamed	Natural feature.
C09	Ephemeral/WWC	NA	Unnamed	Natural feature.
C10	Ephemeral/WWC	NA	Unnamed	Natural feature.
C11	Ephemeral/WWC	NA	Unnamed	Natural feature.
C12	Ephemeral/WWC	NA	Unnamed	Natural feature.
C13	Ephemeral/WWC	NA	Unnamed	Constructed.
C14	Ephemeral/WWC	NA	Unnamed	Natural feature.
C15	Ephemeral/WWC	NA	Unnamed	Constructed,.
C16	Ephemeral/WWC	NA	Unnamed	Natural feature.
C17	Ephemeral/WWC	NA	Unnamed	Natural feature.
C18	Ephemeral/WWC	NA	Unnamed	Natural feature.
C19	Ephemeral/WWC	NA	Unnamed	Natural feature.
Barge/Traffic Area				

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S07	Perennial	Category A (50 ft)	Unnamed Tributary to the Clinch River	Small channel flooding at time of survey. Gravel/ silt substrate.
S08	Intermittent	Category A (50 ft)	Unnamed tributary to Clinch River	3ft wide x 3ft deep channel with gravel/ silt/ clay substrate. Originates from seep area.
S09	Intermittent	Category A (50ft)	Unnamed tributary to Clinch River	First order stream with 3ft wide x 2ft deep channel. Gravel with some cobble substrate.
S10	Intermittent	Category A (50ft)	Unnamed tributary to Clinch River	Small stream that scored below TDEC threshold but was elevated due to water flow and wetland plants within the channel.
S11	Intermittent	Category A (50ft)	Unnamed tributary to Clinch River	Small channel with bedrock/ silt substrate.
S12	Perennial	Category A (50ft)	Unnamed tributary to Clinch River	Small stream that has been impounded by beaver activity.
P07	Other	Category A (50ft)	NA	Small pond connected to backwater of the Clinch River.
P08	Other	Category A (50ft)	NA	Large pond.
C20	Ephemeral/WWC	NA	Unnamed	Natural feature.
C21	Ephemeral/WWC	NA	Unnamed	Natural feature.
C22	Ephemeral/WWC	NA	Unnamed	Natural feature.
C23	Ephemeral/WWC	NA	Unnamed	Natural feature.
C24	Ephemeral/WWC	NA	Unnamed	Natural feature.
C25	Ephemeral/WWC	NA	Unnamed	Natural feature.
C26	Ephemeral/WWC	NA	Unnamed	Natural feature.

C27	Ephemeral/WWC	NA	Unnamed	Natural feature.
C28	Ephemeral/WWC	NA	Unnamed	Natural feature.
C29	Ephemeral/WWC	NA	Unnamed	Natural feature.
C30	Ephemeral/WWC	NA	Unnamed	Natural feature.
C31	Ephemeral/WWC	NA	Unnamed	Natural feature.
C32	Ephemeral/WWC	NA	Unnamed	Natural feature.
C33	Ephemeral/WWC	NA	Unnamed	Natural feature.
C34	Ephemeral/WWC	NA	Unnamed	Natural feature.

Fisheries

TVA has systematically monitored the ecological conditions of its reservoirs since 1990 as part of the Vital Signs Monitoring Program (<http://www.tva.gov/environment/ecohealth/index.htm>). Vital signs monitoring activities focus on (1) physical/chemical characteristics of water; (2) physical/chemical characteristic of sediments; (3) benthic macroinvertebrate community sampling; and (4) fish assemblage sampling.

Several reservoir monitoring and evaluation tools were developed in the initial phase of the Vital Signs Monitoring Program, and those tools are often used in other TVA studies. Such is the case for the Project Site, where TVA's fisheries monitoring tool (Reservoir Fish Assemblage Index) has been used in recent years to characterize the fish community at CRM 22 (Inflow site to Watts Bar Reservoir). The fish assemblage at this site has consistently rated "Good" to "Fair". Watts Bar Reservoir, in general, has rated at or below the valley-wide average in the quality of its sport fishery with the exception of black crappie, largemouth bass, and spotted bass, which were slightly above the average (<http://www.tva.gov/environment/water/sportfish.htm#29>).

All streams with the exception of the Clinch River documented within the Project Site are first order unnamed tributaries.

Mollusks (Clinch River)

TVA developed a mussel survey plan using methods and locations similar to that used by Jenkinson (1982) to provide a level of comparability between studies at the Project Site, but also included a focused effort to collect data near anticipated impact areas such as anticipated locations of a water intake and outfall. Additionally, effort was included to collect representatives of aquatic snails, water quality conditions, and habitat (i.e., depth, substrate composition, and zebra mussel infestation) throughout the study reach. A combination of semi-quantitative and qualitative sampling methods was used to characterize mollusk species composition, density, and distribution between Clinch River miles 15.0 and 19.0. Although quantitative sampling can provide a more accurate estimate of mollusk density and improve detection of small or buried individuals, this method was omitted due to potential legacy issues with contaminated sediments in this reach of the Clinch River (Interagency Agreement 1991).

Similar to the 1982 study, bank-to-bank survey transects (lines weighted to the riverbed) spaced about 1000 feet (or 300 meters) apart were used to guide divers. Additional sampling transects were placed approximately 50 meters upstream and downstream of both the discharge and intake sites, anticipated to occur near CRM 16.0 and 17.9, respectively. Thus, a total of 25 transects were sampled using semi-quantitative methods. Qualitative sampling consisting of one-hour timed searches occurred at each of five sites. Two of the five sites were located at the anticipated discharge and intake sites, respectively. Currently, a barge dock site has not been included in the project description. The remaining qualitative searches occurred in areas with the most suitable mollusk habitat, based on semi-quantitative sampling data.

The mollusk and habitat survey was conducted on September 21 - 26, 2011 (Third Rock 2011 - Appendix B). A total of 74 live mussels representing six species were collected. No live federally threatened or endangered mollusk species were found, but relic specimens of the following federally listed mussel species were found - dromedary pearlymussel (*Dromus dromas*; endangered), fanshell (*Cyprogenia stegaria*; endangered), and spectaclecase (*Cumberlandia monodonta*; endangered). Pimpleback (*Quadrula pustulosa*) was the most abundant mussel species (71.6% of total), fragile papershell *Leptodea fragilis* was second most abundant (17.6% of total), and the remaining live species (purple wartyback [*Cyclonaias tuberculata*], pink heelsplitter [*Potamilus alatus*], giant floater [*Pyganodon grandis*], and elephant ear [*Elliptio crassidens*]) were all present at frequencies less than five percent of the total. Additional species found only as relic shells included black sandshell (*Ligumia recta*), butterfly (*Ellipsaria lineolata*), fluted kidneyshell (*Ptychobranhus fasciolaris*), longsolid (*Fusconaia subrotunda*), mucket (*Actinonaias ligamentina*), Ohio pigtoe (*Pleurobema cordatum*), pocketbook (*Lampsilis ovata*), pyramid pigtoe (*Pleurobema rubrum*), rabbitsfoot (*Quadrula cylindrica*), and round hickorynut (*Obovaria subrotunda*). Only one snail species was collected live in the study area was the silty hornsnail (*Pleurocera canaliculata*), which is common within the Tennessee River basin.

Mean mussel density (semi-quantitative sampling) in the study area was 0.02 mussels/m², and mean catch per hour (qualitative sampling) was 4.2 mussels/hr. Mussels did not appear to be distributed in any discernable pattern, but were most abundant near Transects 2 and 3 (upstream), and around Transect 21 (near CRM 16). Snails were most abundant near

Transects 3 and 9 (Third Rock 2011, Exhibits 1 - 8). Substrate at these locations contained mixtures of cobble, gravel, and sand, which is suitable for mussels, however this substrate type was found in numerous other locations where mussels were less abundant or absent. Substrate along some transects consisted mostly of bedrock, and most transects had heavy concentrations of silt along the banks (e.g., within 50 feet or 20 meters of the banks) (see Exhibits 1 - 8 in Third Rock 2011).

The river channel ranged between about 300 and 600 feet (or 100 - 200 meters) wide, and maximum depth along transects were about 20 - 27 feet (or 6 - 8 meters) deep. Water temperature and water quality variables were very consistent between surface and bottom depths, as well as from upstream to downstream. The range of water quality variables were as follows: temperature = 19.9 - 20.8 °C, dissolved oxygen = 6.57 - 7.3 mg/L, pH = 7.3 - 7.6, conductivity = 263 - 267.7 µS, and turbidity = 13.1 - 23.8 NTU. Water velocity ranged from 0 - 0.3 feet/sec in the mornings, but reached 2.23 feet/sec in the afternoon when Melton Hill Dam increased discharge. Zebra mussels (*Dreissena polymorpha*) were abundant within the study area, where they infested 96% of the live mussels collected (Third Rock 2011).

Findings from this study (Third Rock, 2011) indicated that the mussel community between CRM 15 and 19 remains poor and may be declining further relative to past studies. A total of six common species were collected live during this study, while ten species were found in this reach by Jenkinson (1982). Ahlstedt (1991) found 12 species at river mile 10 and three species at river mile 30, Ortmann (1918) reported 16 species at river mile 10, but he did not sample river mile 30. In 1994, (TWRA and TDEC) fourteen individuals representing six species were collected at CRM 21.4, 22 individuals representing six species at CRM 15.7, one individual was found at CRM 11.2, nine individuals representing two species were found at CRM 10, and no live individuals were observed at CRM 5.7.

Despite efforts to design the 2011 study (Third Rock 2011) similarly to the Jenkinson (1982) study, specific comparison of results were hindered by a lack of specific quantifiable survey effort (i.e., transect lengths) in the 1982 report. However, if we assume effort spent along transects (semi-quantitative samples) were similar between the 2011 and 1982 studies, we find that 52 mussels were collected in 2011 (Third Rock 2011) compared to 132 mussels collected in 1982 (Jenkinson), which equates to a decline of nearly 60% over time. Additionally, there was no evidence of recent mussel reproduction during the 2011 survey, as no juvenile mussels were found and individuals 15 years or older were common (Third Rock 2011).

LISTED AQUATIC ANIMALS

A review of the TVA Natural Heritage Database indicated records of 23 state and/or federally listed aquatic animal species (seven fish, 13 mussels, and three snails) within Roane County and/or ten miles of the Project Site (Table A-2).

Table A-2. Records of federal and state-listed aquatic animal species known from Roan County, and/or within ten miles of the Project Site (Clinch River miles 14 - 19).¹

Common Name	Scientific Name	Element Rank ²	Federal Status ³	State Status ³	State Rank ⁴
FISHES					
Blue Sucker	<i>Cycleptus elongatus</i>	E		THR	S2
Flame Chub	<i>Hemitremia flammea</i>	E		NMGT	S3
Highfin Carpsucker	<i>Carpionodes velifer</i>	E		NMGT	S2S3
Snail Darter	<i>Percina tanasi</i>	E	THR	THR	S2S3
Spotfin Chub	<i>Erimonax monachus</i>	E	THR	THR	S2
Tangerine Darter	<i>Percina aurantiaca</i>	E		NMGT	S3
Tennessee Dace	<i>Chrosomus tennesseensis</i>	E		NMGT	S3
MUSSELS					
Alabama Lampmussel	<i>Lampsilis virescens</i>	H	END	END	S1
Fanshell	<i>Cyprogenia stegaria</i>	H	END	END	S1
Fine-rayed Pigtoe	<i>Fusconaia cuneolus</i>	H	END	END	S1
Orangefoot Pimpleback	<i>Plethobasus cooperianus</i>	H	END	END	S1
Pink Mucket	<i>Lampsilis abrupta</i>	E	END	END	S2
Purple Bean	<i>Villosa perpurpurea</i>	H	END	END	S1
Pyramid Pigtoe	<i>Pleurobema rubrum</i>	E		TRKD	S2S3
Ring Pink	<i>Obovaria retusa</i>	H	END	END	S1
Sheepnose	<i>Plethobasus cyphus</i>	E	END	TRKD	S2S3
Shiny Pigtoe	<i>Fusconaia cor</i>	X	END	END	S1
Spectaclecase	<i>Cumberlandia monodonta</i>	H	END	TRKD	S2S3
Tennessee Clubshell	<i>Pleurobema oviforme</i>	H		TRKD	S2S3
Turgid Blossom	<i>Epioblasma turgidula</i>	X	END	EXTI	SX
SNAILS					
Anthony's Riversnail	<i>Athearnia anthonyi</i>	X?	END	END	S1
Ornate Rocksnail	<i>Lithasia geniculata</i>	H		TRKD	S3
Spiny Riversnail	<i>Io fluviialis</i>	E		TRKD	S2

¹ Source: TVA Natural Heritage Database queried on 10/23/2013; federal status updates were made on 12/18/2015.

² Heritage Element Occurrence Rank; E = extant record ≤25 years old; H = historical record >25 years old; X = considered extirpated; ? = status uncertainty

³ Status Codes: END = Endangered; THR = Threatened; EXTI = Extirpated from state or region; NMGT = In Need of Management;; TRKD = Tracked by state natural heritage program (no legal status)

⁴ State Ranks: S1 = Critically Imperiled; S2 = Imperiled; S3 = Vulnerable; SX = Presumed Extirpated; ? = Inexact or uncertain

Of these aquatic animal species, 12 are federally listed as endangered (11 mussels and one snail), two are federally listed as threatened (two fishes) (Table A-2). Many (12) of the 23 aquatic species records are considered either historical (records >25 years old) or extirpated (no longer occur in this portion of their former range). Given the lack of detecting these species in many decades (including the 2011 survey) and apparent continuation of unsuitable habitat conditions for mollusks, TVA has determined that these 12 species (Alabama lampmussel, fanshell, fine-rayed pigtoe, orangefoot pimpleback, purple bean, ring pink, shiny pigtoe, spectaclecase, Tennessee clubshell, and turgid blossom) either do not occur or occur at extremely low (undetectable) levels near the proposed project site. Therefore, they will not be addressed further in this report.

A brief description of state and federally listed aquatic animal species (including those only tracked as a species of conservation concern by Tennessee) potentially occurring within the project area are presented below. These descriptions and additional information about species' habitat and ecology can be found in Etnier and Starnes (1993) for fish, in Parmalee and Bogan (1998) for mussels, and NatureServe (2011) for snails and other aquatic species.

Fishes

The blue sucker is found in deep pools of large, free-flowing rivers with swift currents. Once common throughout its range, populations of blue suckers have drastically declined due to impoundments and increasing siltation of big rivers.

The flame chub is an inhabitant of springs/spring runs. Spawning occurs from late January through May. Populations have declined with the continued alteration of spring habitats.

The Highfin Carpsucker inhabits areas of gravel substrate in relatively clear medium to large rivers. It is more susceptible to change by siltation and impoundments than other Carpsucker species.

The snail darter is known to occur in larger creeks/ rivers where it frequents sand and gravel shoal areas. It can also occur in deeper portions of rivers and reservoirs where current is present. Although this species has been collected in Roane County downstream of the Project Site within ten miles of the project, it is extremely unlikely that this species would still occur in the project area (Clinch River) due to lack of available shoal habitats with gravel and cobble substrates.

The spotfin chub inhabits clear upland rivers in swift currents over boulder substrates. Spawning occurs May through August. Although this species has been collected in Roane County within ten miles of the project, it is extremely unlikely that this species would still occur in the project area (Clinch River) due to lack of available bedrock shoals and shallow riverine habitats.

The tangerine darter inhabits clearer portions of large to moderate sized headwater tributaries of the Tennessee River. It frequents deeper riffles and runs with boulders, large rubble, and

bedrock most of the year but moves into deeper pools in winter. It is confined to the upper Tennessee River drainage, and reaches maximum abundance in smaller tributaries such as the Emory, Little, Little Pigeon, Tellico, and Hiwassee Rivers.

The Tennessee dace can be found inhabiting shallow pools in association with undercut banks and debris in small low gradient woodland tributaries in the upper Tennessee River drainage. Spawning occurs from April through July.

Mussels

The pink mucket is typically a big river species but occasionally individuals become established in small to medium sized tributaries of large rivers. It inhabits rocky bottoms with swift current usually in less than three feet of water but appears to be tolerant of reservoir conditions with some measure of flow. Fish hosts for the larval stage include largemouth bass, smallmouth bass, spotted bass, and walleye. This species spawns August - September and releases larvae the following year between May and July.

The pyramid pigtoe prefers rivers with strong current and substrate composed of firm sand and gravel. It is believed to be long-term brooder, but the fish host for the larval stage is unknown.

The sheepsnose can be found in the Ohio, Cumberland, and Tennessee River systems; upper Mississippi River north to Minnesota. The species prefers substrate of mixed coarse sand and gravel. It is tachytictic with most reproductive activity occurring in the summer. The larval host fish has been identified as sauger.

Snails

The spiny riversnail is found in shallow waters of shoals that are rapid to moderate and well-oxygenated. This species may occur in surrounding headwater habitats but is not likely to occur in the Clinch River near the project due to impoundment and other unsuitable habitat conditions.

CONCLUSION

The Clinch River Property and the Barge/Traffic Area currently contains 54 waterbodies, including seven perennial streams, five intermittent streams, 34 ephemeral/WWCs, and eight ponds. Any development of the site should consider protection of these waterbodies as directed by state and industry guidelines, as well as TVA best management practices, as appropriate.

The Clinch River adjacent the proposed SMR site (CRM 15.0 - 19.0) and Barge/ Traffic study area (CRM 14.0) appears to support a fair to good fish assemblage and a poor mussel and snail community. A review of the 2011 mollusk and habitat survey, as well as recent surveys near the site in 1982 (Jenkinson), 1991 (Ahlfstedt), and 1994 (TWRA and TDEC) all indicated that habitat conditions to support mussels and snails is generally inadequate, despite reservoir release improvements to Melton Hill Dam and Watts Bar Dam that began in 1991. Although this reach of the Clinch River historically supported several federally listed aquatic mollusks, a lack of recent records for live endangered species in combination with a depauperate mussel and

snail community indicates that developmental activities in or adjacent this reach of the Clinch River would not affect rare or listed aquatic animal species.

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APPENDICES

**APPENDIX AQUATICS A:
HABITAT ASSESSMENT FORMS FOR WATERBODIES
AT THE CSMR SITE.**

APPENDIX AQUATICS B:

**REPORT: EVALUATION OF FRESHWATER MOLLUSKS AND HABITAT,
CLINCH RIVER, CRM 15.0 - 19.0, ROANE COUNTY, TENNESSEE.**