Adults are mostly benthic foragers, and prey items include insect larvae, crustaceans, fishes, and mollusks such as clams and snails.

Freshwater drum are harvested commercially in Lake Erie, although there is not a significant recreational fishery for this species. It is estimated that approximately 2.3 million freshwater drum eggs and larvae were entrained by the Fermi 2 cooling water intake during a study conducted in 2008 and 2009; entrainment was observed only in July 2009 (AECOM 2009b; Table 2-11). Approximately 30 individual freshwater drum were impinged during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009 (AECOM 2009b; Table 2-12).

<u>Gizzard Shad (*Dorosoma cepedianum*)</u>

The gizzard shad is distributed widely in the continental United States from Utah and Arizona eastward to the Atlantic seaboard. This species occurs throughout the Great Lakes region within both the United States and Canada and is common within the western basin of Lake Erie.

As an adult, the gizzard shad can reach 9 to 14 in. in length and can weigh up to 2 lb. This fish can thrive in a wide variety of habitats, including large rivers, reservoirs, lakes, swamps, bays, sloughs, and similar quiet open waters. Young and juveniles live in relatively clear and shallow waters, while adult gizzard shad tend to stay in deeper waters or near the bottom. Although gizzard shad are capable of withstanding temperatures from approximately 43°F to 91°F, they are very sensitive to cold water temperatures, and large numbers are often found dead in the spring when the ice melts off of reservoirs and lakes.

Female gizzard shad can produce as many as 500,000 eggs, which are spawned by scattering them over sandy or rocky substrates. The eggs adhere to objects on the bottom until hatching 2 to 4 days later. Sexual maturity is generally reached in 2 to 3 years. Their lifespan is approximately 4 to 6 years, although a few individuals survive beyond 3 years of age. Because of the large numbers of eggs produced, gizzard shad populations are often capable of rebounding quickly following overwinter die-offs.

Juvenile gizzard shad are planktivores, feeding on both zooplankton and phytoplankton. Adults are primarily bottom filter-feeding detritivores, mostly eating plants and animals that live attached to hard substrates such as sand and rocks.

Gizzard shad often travel in large schools, and young gizzard shad are ecologically significant because they serve as prey for many species of commercially and recreationally important fish. Because of their rapid growth rates, many individuals are too large to be eaten by most other fish by the end of their first year of life. Recreational anglers commonly use gizzard shad as a bait fish, and the species makes up a substantial portion of the commercial harvest in the Michigan waters of Lake Erie.

Gizzard shad was the most commonly entrained species during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, and it is estimated that approximately 30.2 million gizzard shad eggs and larvae were entrained during the 1-year study period (AECOM 2009b; Table 2-11). In addition, gizzard shad was the most commonly impinged species during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, with approximately 1200 individuals impinged during the year (AECOM 2009b; Table 2-12).

Goldfish (*Carrasius auratus*)

Goldfish are native to Eurasia and have been introduced throughout the United States and in parts of southern Canada. They were first introduced in the Great Lakes around 1885 and have since become well established in the region. They are abundant in the shallow bays and marshes of western Lake Erie and can also be found in slow-moving tributaries.

Goldfish can grow to be 12 in. or larger, although most individuals are considerably smaller. Goldfish spawn during the spring and summer in shallow water, and the eggs adhere to vegetation and substrates. A single female can produce several lots of eggs within a season. Hatching occurs in 2 to 14 days, depending on water temperature.

Goldfish feed on a variety of small aquatic invertebrates and vegetation. Because of their abundance within shallow habitats, including marsh habitats, of the western basin and because of their relatively small size, goldfish are a potentially important prey species for fish-eating fish and birds. Goldfish also have some commercial importance within the western basin, making up approximately 4 percent of the commercial harvest in Michigan waters of the basin. Although goldfish were relatively abundant in collections made during fish surveys on and near the Fermi site, no goldfish were identified in impingement or entrainment samples during 2008 and 2009 (AECOM 2009b).

Lake Whitefish (*Coregonus clupeaformis*)

Lake whitefish occur throughout most of Canada and Alaska, south to northern New England, in the Great Lakes region, and in central Minnesota. Lake Erie is considered to be at the southern extent of the range for this species. Lake whitefish have also been introduced as forage and food fish in other areas, including the states of Montana, Idaho, and Washington.

The lake whitefish is a cool water species that has a narrow temperature tolerance and requires cold, well oxygenated bottom waters throughout the summer in order to survive. Optimum temperature for the lake whitefish ranges from 50 to 57°F for adults and 60 to 67°F for juveniles. This species usually spawns during late fall or early winter over rocky or sandy substrates in water less than 25 ft deep. Eggs hatch in the early spring, and sexual maturity is generally reached in 5 to 7 years. Young lake whitefish subsist primarily on zooplankton, while adults usually eat bottom-dwelling invertebrates and small fishes.

Lake whitefish are an indicator of ecosystem health and an important component of the Great Lakes food web. During the late 19th and early 20th centuries, large numbers of lake whitefish entered the Detroit River each year to spawn (EPA 2009d). Reports indicate that the lower Detroit River was a prolific spawning area prior to the construction of the Livingstone Shipping Channel. The timing of this construction coincides with the degradation of whitefish populations in the river and western Lake Erie (EPA 2009d). Recently, populations of lake whitefish were once again discovered in the Detroit River, but further studies are necessary to ascertain their presence in other tributaries of western Lake Erie (EPA 2009d).

Lake whitefish historically made up a large proportion of the commercial fishery in the western basin of Lake Erie. In the late 1800s and early 1900s, more than 500,000 lb of lake whitefish were commercially harvested each year, but catches declined drastically after that period. There have been improvements in the fishery more recently, and the commercial lake whitefish landings in all of Lake Erie exceeded 1 million lb in 2000 (EPA 2009d). In the western basin, the commercial harvest of lake whitefish was only 8800 lb in Michigan waters during 2007, and it was more than 287,000 lb in Ohio waters during 2009 (Tables 2-14 and 2-15). Lake whitefish were not observed in collections made during fish surveys on and near the Fermi site, and no lake whitefish were identified in impingement or entrainment samples during 2008 and 2009 (AECOM 2009b).

Quillback (*Carpiodes cyprinus*)

The quillback has a wide distribution in North America, with inhabited areas encompassing an area with a northward boundary from the Alberta to Quebec Provinces in Canada, southward to the Gulf Slope, and eastward to the Atlantic slope drainages. The species is relatively common in the Great Lakes, including Lake Erie.

These fish are suited to a variety of aquatic habitat conditions, including pools, backwaters, and main channels and clear to turbid waters of creeks, rivers, and lakes. Spawning usually occurs in April through May over sand and mud bottoms in quiet waters of streams, overflow areas in bends of rivers, or the bays of lakes. Quillbacks sometimes migrate up small streams and creeks during the spring and summer in order to find suitable spawning habitat. Both adults and juveniles are omnivorous, feeding on organic matter in bottom sediments, insect larvae, and plant material.

The quillback is a small component of the commercial fisheries in the Michigan and Ohio waters of the western basin (Tables 2-14 and 2-15). In Ohio, commercial harvest of quillback averaged more than 200,000 lb per year from 2000 through 2009 (ODNR 2010). Although small numbers of quillback were collected during fish surveys on and near the Fermi site, no quillback were present in impingement or entrainment samples during 2008 and 2009 (AECOM 2009b).

Walleye (*Sander vitreus*)

The walleye is the largest member of the perch family and can be found in all of the Great Lakes, where it is a native species. Walleye have been introduced and are stocked widely in the United States; the distribution for the species now extends across most of the continental United States and Canada.

The walleye can be found in a variety of large bodies of freshwater, including lakes, pools, backwaters, rivers, and flooded marshes. It prefers deep waters and avoids bright light. This species spawns in late spring or early summer in turbulent rocky areas in rivers, coarse gravel shoals in lakes, or in flooded marshes. Eggs hatch in approximately 26 days. Adults may migrate up to 100 mi between spawning habitat and nonspawning habitat. Sexual maturity is reached in 2 to 4 years for males and in 3 to 8 years for females. Young walleye up to 6 weeks of age primarily eat zooplankton and small fishes, whereas adults feed upon fishes and larger invertebrates. Adults typically range in length from 13 to 25 in. and weigh 1 to 5 lb.

The walleye is considered an extremely important commercial and recreational fishery resource in Lake Erie. Although the commercial fisheries for walleye in the Michigan and Ohio waters of Lake Erie have been closed for many years, commercial fishing for walleye in the western basin waters of Ontario has continued, and the annual harvest since 1976 has averaged approximately 1.5 million fish per year (range is approximately 113,000 to approximately 2.8 million fish) (Lake Erie Walleye Task Group 2010). The western basin also supports a popular recreation fishery, with average harvests of approximately 1.6 million, 293,000, and 39,000 fish in the western basin waters of Ohio, Michigan, and Ontario, respectively, since 1975 (Lake Erie Walleye Task Group 2010).

Because of the importance of walleye to the commercial and recreational fisheries in Lake Erie, the status of walleye populations in the lake are closely monitored by various agencies. The Lake Erie Committee of the Great Lakes Fishery Commission has formed the Walleye Task Group to bring together information from various agencies so that the population status of walleye in Lake Erie can be monitored each year. This task group maintains and updates centralized datasets, improves population models so that scientifically defensible abundance estimates and forecasts can be produced, makes recommendations regarding allowable harvest levels, and helps identify studies that need to be conducted to address data gaps (Lake Erie Walleye Task Group 2010). Modeled abundance estimates of walleye in Lake Erie for the period from 1980 to 2010 indicate that the overall numbers of walleye aged 2 and older have varied considerably, ranging from a low of approximately 15 million individuals in 2004 to a high of approximately 74 million individuals in 1988 (Figure 2-13). Estimated abundance for 2010 was approximately 30 million fish (Lake Erie Walleye Task Group 2010).

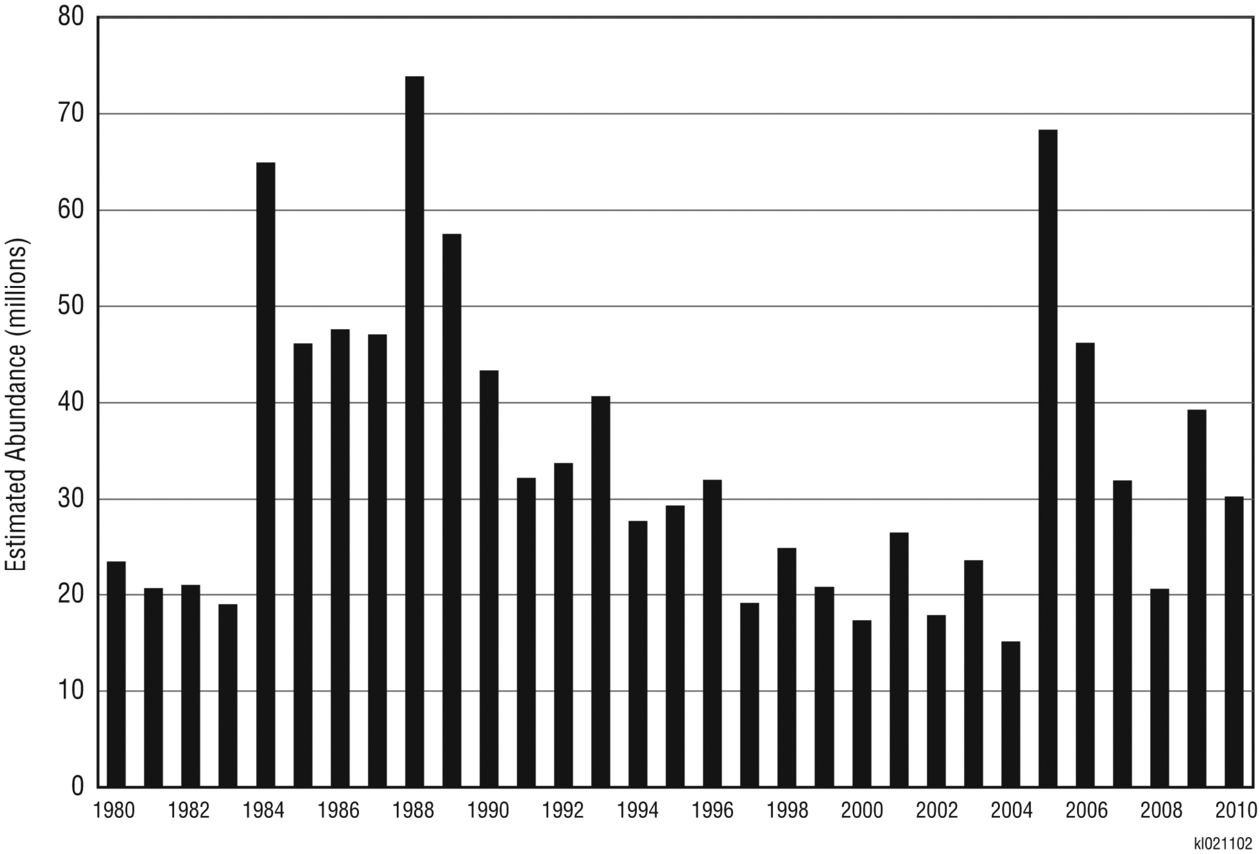

Figure 2-13. Estimated Abundance of Walleye Aged 2 and Older in Lake Erie, 1980–2010 (Lake Erie Walleye Task Group 2010)

No walleye were observed in collections made during fish surveys in aquatic habitats on and near the Fermi site, and no walleye were present in impingement or entrainment samples collected at the Fermi 2 cooling water intake during 2008 and 2009 (AECOM 2009b).

White Bass (*Morone chrysops*)

The white bass is distributed across the United States and eastern Canada. It is a relatively common species in the Great Lakes, including Lake Erie. White bass typically inhabit open waters of large lakes and reservoirs and pools of slow-moving rivers. Often travelling in schools, white bass tend to occur in offshore waters during the day and in inshore waters at night.

Tributary streams appear to be the preferred spawning habitat, but white bass may also spawn along lake shores with high wave action. Spawning occurs during the spring, usually over rock or gravel substrate in water up to 10 ft deep. After hatching, the young fish generally remain in shallow water for a period of time before migrating to deeper areas. White bass become sexually mature at 1 to 3 years of age and usually do not live past 4 years of age. As adults, they can reach up to 16 in. in length and can weigh up to 4 lb. White bass are carnivores, eating zooplankton, insect larvae, and other fish.

White bass is a notable component of the commercial fisheries in the Michigan and Ohio waters of the western basin (Tables 2-14 and 2-15). By weight, white bass accounted for approximately 7 percent of the fish commercially harvested from Michigan waters of Lake Erie in 2007 (Table 2-14) and for 25 percent of the fish commercially harvested from Ohio waters of the western basin in 2009 (Table 2-15).

White bass are also an important recreational fishing species in each of these States. In general, it is reported that very few angler boat trips specifically target white bass, and the majority of white bass are harvested as incidental catch from anglers targeting other species (ODNR 2010). However, when adult fish are moving into major tributaries to spawn during the spring, the aggregations of fish can attract many anglers, especially in major spawning tributaries such as the Maumee River (Bolsenga and Herdendorf 1993). The recreational noncharter boat harvest of white bass from Michigan waters in the western basin during 2007 was estimated to be 7911 individual fish (Thomas and Haas 2008). From 2000 to 2009, the recreational white bass harvest in the Ohio waters of the western basin averaged over 72,000 individual fish per year, with a peak of 121,000 fish caught in 2009 (ODNR 2010).

Although small numbers of white bass were collected on and near the Fermi site, no white bass were present in impingement or entrainment samples during 2008 and 2009 (AECOM 2009b).

White Perch (*Morone americana*)

White perch are native to the east coast of the United States and Canada but can be found in the Great Lakes area, where they are considered an introduced species. This species was first observed in Lake Erie in 1954 and has been abundant in the lake since the 1980s (Bolsenga and Herdendorf 1993). On the Atlantic coast, they are typically found in brackish waters, but they have adapted to inland freshwater lakes and tributaries.

White perch spawn in the spring by releasing their eggs in the shallow waters of tributaries. The eggs sink and stick to the bottom until hatching approximately 4 days later. After hatching, the young feed initially on small planktonic organisms, and, as they grow larger, their diet changes to include aquatic insects, invertebrates, other fishes, and the eggs of other fish species.

White perch make up a component of the commercial fish harvest in the western basin of Lake Erie. In 2007, approximately 36,000 lb (3.4 percent of the commercial harvest) of white perch were reported in Michigan waters of the western basin (Table 2-14). In Ohio waters of the western basin, white perch was the second most dominant species in the commercial catch during 2009, with more than 535,000 lb reported (23.4 percent of the commercial catch by weight) (Table 2-15). Although white perch is generally regarded as an undesirable sport fish in the Great Lakes, it is considered an excellent sport fish in the eastern United States.

White perch was one of the dominant fish species collected during fish surveys on and near the Fermi site during 2008 and 2009. Overall, white perch accounted for more than 12 percent of the individual fish collected during the surveys and more than 33 percent of the individuals collected in areas near the existing Fermi 2 cooling water intake location (Table 2-10). It is estimated that more than 124,000 white perch eggs and larvae were entrained during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009 (AECOM 2009b; Table 2-11). In addition, white perch was the third most commonly impinged species during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, with approximately 305 individuals being impinged during the year (AECOM 2009b; Table 2-12).

Yellow Perch (*Perca flavescens*)

The yellow perch is native to the Great Lakes region but can be found in almost all 50 States as well as most of Canada. This species is one of the most common fish in Michigan waters; is commonly found in Lake Erie; and is assumed to occur throughout the Detroit River, Swan Creek, Stony Creek, and in other surface water habitats on the Fermi site.

Yellow perch usually travel in schools and are generally associated with the clear, shallower waters of lakes or weedy backwaters of creeks and rivers. Yellow perch usually grow to be 6 to 10 in. long and weigh between 6 and 16 oz. Yellow perch spawn in the spring in shallower waters over submerged beds of aquatic vegetation or over sand, gravel, or rubble. The eggs, which are laid in gelatinous strands that can be several feet long, usually hatch in 10 to 20 days. Sexual maturity is reached in 2 to 3 years for males and in 3 to 4 years for females; the maximum lifespan is about 10 years. Larval and young yellow perch feed primarily on zooplankton, whereas adults feed on larger invertebrates and small fish.

Yellow perch is one of the most popular and economically valuable sport and commercial fish in Lake Erie and is considered an indicator of the ecological condition of Lake Erie (EPA 2009f). Because of the importance of yellow perch in Lake Erie, the status of yellow perch populations in the lake is closely monitored by various agencies. The Lake Erie Committee of the Great Lakes Fishery Commission has formed the Yellow Perch Task Group to bring together information from various agencies so that the population status of yellow perch in Lake Erie can be monitored each year. This task group maintains and updates centralized datasets of information needed to evaluate population status and support population and harvest modeling efforts and makes recommendations regarding sustainable harvest levels (Lake Erie Yellow Perch Task Group 2010).

After peaking in the late 1800s, commercial catches of yellow perch in the Detroit River and the western basin of Lake Erie decreased substantially through the 1960s. These decreases are attributed primarily to a combination of high levels of fishing pressure and deteriorating water quality. Improvement in yellow perch population levels occurred during the 1970s as fishing pressure declined and as water quality improved as a result of lakewide pollution control programs that were implemented (EPA 2009f). Numbers of yellow perch in Lake Erie dropped again to very low levels during the early 1990s, possibly because of the combined effects of a lakewide invasion of zebra and quagga mussels, fishing pressure, and unsuitable weather conditions (EPA 2009f). Yellow perch populations increased again beginning in the latter portion of the 1990s, and, while they are not at the levels observed during the 1970s and 1980s, they have remained relatively stable since that time (Figure 2-14) (EPA 2009f; Lake Erie Yellow Perch Task Group 2010). In addition to potentially being affected by water quality, fishing pressure, and invasive species, yellow perch are one of the principal prey items for walleye. As a consequence, as walleye populations increase, there is often a corresponding decrease in yellow perch populations (EPA 2009f).

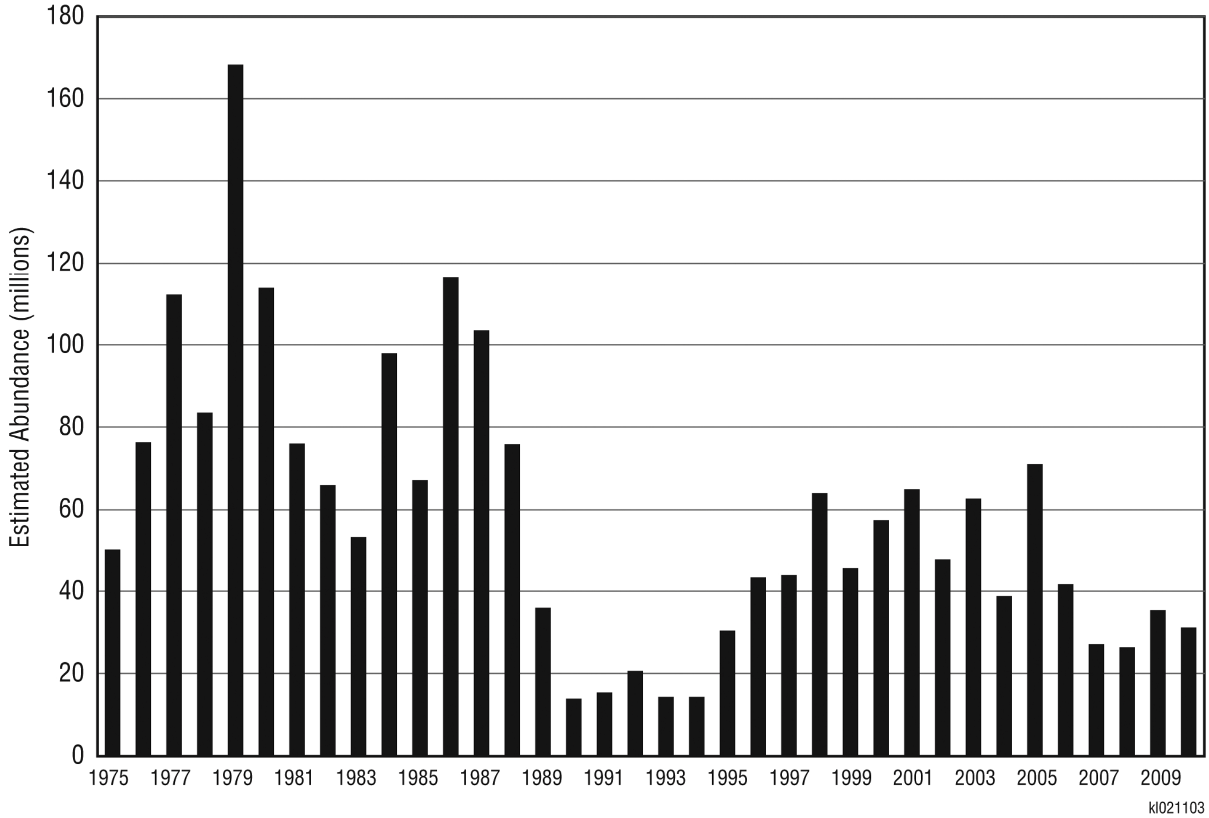

Figure 2-14. Estimated Abundance of Yellow Perch Aged 2 and Older in the Western Basin of Lake Erie, 1975–2010 (Lake Erie Yellow Perch Task Group 2010)

Although yellow perch historically made up a large portion of commercial fishery in the western basin of Lake Erie, the commercial perch fishery in Michigan waters has been closed since 1970, and the commercial perch fishery in the western basin waters of Ohio has been closed since 2008. From 1999 to 2008, the annual commercial harvest of yellow perch in Ohio waters of the western basin ranged from approximately 179,000 lb to 357,000 lb (mean of approximately 255,000 lb). Commercial fishing for yellow perch also occurs in the western basin waters of Ontario, Canada, where it ranged from approximately 534,000 lb to 1.7 million lb (mean of approximately 1.1 million lb) from 1999 to 2009 (Lake Erie Yellow Perch Task Group 2010).

Yellow perch is present in at least low numbers in most of the surface water habitats on the Fermi site, on the basis of fish surveys conducted in 2008 and 2009 (AECOM 2009b). Yellow perch was among the most common species observed during entrainment studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, and it is estimated that more than 4.8 million yellow perch eggs and larvae were entrained during the year-long study (AECOM 2009b; Table 2-11). No yellow perch adults or juveniles were observed during impingement studies conducted at the Fermi 2 cooling water intake during the same period (AECOM 2009b; Table 2-12).

Recreationally Important Species

Lake Erie is the warmest and most biologically productive of the Great Lakes, producing more fish each year than any of the other Great Lakes (Bolsenga and Herdendorf 1993). Walleye and yellow perch are the most popular recreational species in the western basin of Lake Erie.

The total noncharter sport harvest from the Michigan waters of Lake Erie for 2009, based on creel surveys, was estimated at 460,425 fish (Thomas and Haas 2010). Walleye and yellow perch together accounted for 93 percent of the reported recreational fishing harvest. Walleye harvest rates had declined since the previous estimate obtained in 2007, while yellow perch harvest rates were at the highest levels observed since 1998. It is estimated that noncharter boat anglers harvested 85,348 walleye and 344,811 yellow perch during 2009, whereas charter boat anglers harvested 10,258 walleye and 9989 yellow perch (Thomas and Haas 2010). Reported recreational harvests of other species from the Michigan waters of Lake Erie were considerably lower than those of walleye and yellow perch; they included white perch, channel catfish, freshwater drum, largemouth bass, smallmouth bass, and rainbow trout (Thomas and Haas 2010).

In 2009, sport anglers made more than 300,000 trips to fish in the Ohio waters of the western basin of Lake Erie, and the private sport boat fishing effort within the Ohio waters of the basin totaled more than 1.6 million hours (ODNR 2010). Charter boat fishing effort within the Ohio waters of the western basin in 2009 totaled approximately 158,000 hours (ODNR 2010). Estimates of angler hours indicate that most of the private boat angling effort was directed toward walleye (56 percent of angler hours) and yellow perch (35 percent). Smallmouth bass (4 percent), white bass (2 percent), and largemouth bass (2 percent) were less commonly targeted by private boat anglers (ODNR 2010). Charter boat anglers mainly targeted walleye (95 percent of angler hours), followed by yellow perch (4 percent) and smallmouth bass (<1 percent). The total (combined private and charter boat) recreational harvest of fish from the Ohio waters of the western basin in 2009 was estimated at approximately 2.6 million fish, made up primarily of walleye (21 percent of harvest), yellow perch (72 percent of harvest), and white bass (5 percent of harvest). Smallmouth bass, white perch, freshwater drum, channel catfish, and other species accounted for less than 2 percent of the recreational harvest within the Ohio waters of the western basin of Lake Erie (ODNR 2010). On the basis of fish surveys conducted in 2008 and 2009, each of these recreationally important species, with the exception of walleye, is present in Lake Erie adjacent to the Fermi site and/or in onsite surface water habitats (AECOM 2009b).

Sport fish landings are managed by using State-implemented fishing regulations, such as harvest quota systems and requirements for fish to be within certain length limits to be harvested. Typical goals of such regulations are to maintain the numbers of catchable-sized and reproductive-sized individuals at desired levels and to maintain sustainable population levels. For example, walleye fisheries throughout Lake Erie were affected by reduced spawning, which resulted in a lower adult abundance during the 1990s. Harvest quotas and other fishing regulations for walleye became more restrictive because of this reduced adult population, and the result was a rebound in the adult walleye population. Subsequently, less restrictive fishing regulations for the walleye have been implemented in more recent years. Other species-specific fishing regulations have been implemented by the States of Michigan and Ohio.

Recreational angling also occurs in other waters within the vicinity of the Fermi site, such as ponds and tributary drainages of Lake Erie. Swan Creek supports a recreational fishery for common game fish, including largemouth bass and bluegill. Portions of the creek located near recreational areas, such as public parks, receive the largest share of fishing pressure. There are no significant recreational fisheries within the boundaries of Stony Creek, the area managed as part of the DRIWR, or other water bodies located at the Fermi site.

Because many of the recreationally important aquatic species that occur in the vicinity of the Fermi site are also commercially important, the distribution and life history information for those species was summarized above. The distribution and life history information for other recreationally important species that may occur in the vicinity of the site is summarized below.

Bluegill (*Lepomis macrochirus*)

The bluegill is popular with many recreational anglers and is important ecologically because it can affect the composition of aquatic communities by controlling zooplankton populations and by serving as an important prey item for many larger fishes, including largemouth bass and northern pike.

The bluegill is native to the Great Lakes and Mississippi River Basins from Quebec and New York to Minnesota and south to the Gulf of Mexico. It is also native to the Atlantic and Gulf Slope drainages from the Cape Fear River, Virginia, to the Rio Grande, Texas, and New Mexico, and also northern Mexico (Page and Burr 1991). It has been introduced throughout North America and is now found in many other parts of the world. This sunfish species most commonly inhabits shallow lakes, ponds, reservoirs, sloughs, and slow-flowing streams. It is often associated with rooted aquatic vegetation and silt, sand, or gravel substrates.

Bluegills lay eggs in a nest excavated in shallow water by the male on bottoms of gravel, sand, or mud that contain pieces of debris. Adult bluegills can reach sizes of between 10 and 16 in. and may live longer than 10 years. Young bluegill feed primarily on planktonic crustaceans, insects, and worms. Adults eat mainly aquatic insects, small crayfish, and small fishes; in some bodies of water, adults may primarily consume zooplankton.

The bluegill is very common in the immediate vicinity of the Fermi site, according to recent fish surveys. Francis and Boase (2007) found that bluegills made up approximately 9 percent of the individual fish collected during surveys in Swan Creek. Bluegills were also found in most aquatic habitats associated with the Fermi site during surveys conducted in the 2008–2009 period, and, overall, they accounted for 13 percent of the individual fish collected (AECOM 2009b). Impingement rates measured at the cooling water intake indicate that an estimated 214 bluegills were impinged at the Fermi 2 cooling water intake from August 2008 through July 2009 (Table 2-12; AECOM 2009b), accounting for approximately 7 percent of the fishes impinged by Fermi 2 during the sampling period. No bluegill eggs or larvae were specifically identified in entrainment samples collected at the Fermi 2 cooling water intake from August 2008 through July 2009 (AECOM 2009b). However, it was estimated that approximately 70,000 eggs or larval stages of fish in the same fish family (*Centrarchidae*) would be entrained annually on the basis of the presence of eggs and larvae not identifiable to the species level (AECOM 2009b). Some portion or all of these unidentified eggs and larvae could have been those of bluegill.

<u>Largemouth Bass (*Micropterus salmoides*)</u>

The largemouth bass is native to the Great Lakes, Hudson Bay (Red River), and Mississippi River Basins from southern Quebec to Minnesota and south to Texas, throughout the Gulf Coast and southern Florida, and in Atlantic coast drainages from North Carolina to Florida. Because of its popularity as a sport fish, this species has been introduced throughout the United States, southern Canada, and much of world. Largemouth bass occur in a variety of habitats, including clear and turbid waters of lakes, ponds, reservoirs, and swamps and pools or in backwater areas of creeks and rivers. They are often found in areas containing aquatic vegetation.

Largemouth bass spawn primarily in the spring and summer in water temperatures of 60°F or higher. Males excavate nests in shallow water. After a female deposits eggs in the nest, the male guards the eggs, which hatch within a few days. Largemouth bass reach sexual maturity in 2 to 5 years and can attain sizes as large as 38 in., although approximately 28 in. is a typical size for older adult fish. This species feeds mainly upon zooplankton as fry. As the juvenile grows, it begins to prey on larger organisms, including insects, crustaceans, and small fish. Adults prey mainly on fish but are also known to eat other organisms, including crayfish and frogs.

The largemouth bass is a popular sport fish in the Great Lakes region, including Lake Erie and its tributaries. This species is present, at least in low numbers, in most of the surface water habitats on the Fermi site, according to fish surveys conducted in 2008 and 2009 (AECOM 2009b). Largemouth bass was among the species observed during entrainment studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, and it is estimated that approximately 152,000 largemouth bass eggs and larvae were entrained during the year-long study (AECOM 2009b; Table 2-11). On the basis of species-specific impingement rates measured at the Fermi 2 cooling water intake, it is estimated that a total of 31 largemouth bass individuals were impinged at the Fermi 2 cooling water intake during the period from August 2008 through July 2009 (AECOM 2009b; Table 2-12).

<u>Smallmouth Bass (*Micropterus dolomieu*)</u>

The smallmouth bass is native to the St. Lawrence-Great Lakes, Hudson Bay (Red River), and Mississippi River Basins from southern Quebec to North Dakota and south to northern Alabama and eastern Oklahoma. It has been widely introduced throughout the United States, southern Canada, and other countries. Smallmouth bass prefer large, clear lakes (especially in the northern part of the range) and clear, intermediate-sized streams that contain large pools and abundant cover (rocks, shelves, logs, etc.), and they prefer cool summer temperatures. Adults typically seek the shelter of pools or deep water during the day.

Spawning habitat includes shallow water in lakes or quiet areas of streams, often fairly close to shore. In lakes, spawning adults sometimes move a short distance up a stream to spawn. Spawning generally occurs in late spring or early summer. Females deposit eggs in nests that are constructed by the males; nests usually occur near cover on gravel or sand bottoms. Eggs typically hatch in 2 to 10 days, and males guard eggs and hatchlings for a period of 4 weeks or longer. Individuals usually attain sexual maturity at 2 to 6 years of age, depending on local conditions. Young fish eat primarily small crustaceans and aquatic insects (e.g., midge larvae and pupae) until the fish are about 2 in. in length. After that, smallmouth bass primarily eat fish, although crayfish, amphibians, and larger insects often become dominant foods of local populations or seasonally.

In addition to being a species that has recreational importance, smallmouth bass have ecological importance as being one of the top-level predators in aquatic habitats in the Great Lakes region. Smallmouth bass make up a small component of the aquatic community in the immediate vicinity of the Fermi site, according to recent fish surveys. Francis and Boase (2007) captured low numbers of smallmouth bass in collections from Swan Creek. Smallmouth bass were not found in most aquatic habitats on the Fermi site during surveys conducted in the 2008–2009 period (AECOM 2009b), perhaps because many of these habitats have conditions (e.g., warm summer water temperatures and high turbidity) that are not optimal for smallmouth bass. On the basis of impingement rates measured at the cooling water intake, it is estimated that 62 smallmouth bass were impinged at the Fermi 2 cooling water intake from August 2008 through July 2009 (AECOM 2009b;Table 2-12), accounting for approximately 2 percent of the fishes impinged by Fermi 2. No smallmouth eggs or larvae were identified in entrainment samples collected at the Fermi 2 cooling water intake from August 2008 through July 2009 (AECOM 2009b). However, it was estimated that approximately 70,000 eggs or larval stages of fish in the same fish family (*Centrarchidae*) would be entrained annually, on the basis of the presence of eggs and larvae not identifiable to the species level (AECOM 2009b). Some portion or all of these unidentified eggs and larvae could have been those of smallmouth bass.

Federally and State-Listed Aquatic Species

This section presents information about the Federally and Michigan State-listed threatened and endangered aquatic species in the vicinity of the Fermi site. Federally and State-listed aquatic species that may occur on or near the Fermi site or in the counties through which the proposed transmission line corridor would pass (Monroe, Washtenaw, and Wayne Counties) are indicated in Table 2-16.

Three freshwater mussel species that are Federally listed as endangered could occur within the project area based upon historic records of occurrence. The northern riffleshell (*Epioblasma torulosa rangiana*) could occur in waters of Monroe and Wayne Counties in Michigan. The rayed bean (*Villosa fabalis*) and the snuffbox mussel (*E. triquetra*) have a potential to occur within Monroe, Washtenaw, or Wayne Counties. Another freshwater mussel that is Federally listed as endangered (white catspaw, *E. obliquata perobliqua*), was last reported from Wayne and Monroe Counties in 1930 and is believed to have been extirpated from the State of Michigan. None of these species has been specifically documented to occur either on the Fermi site or along the proposed transmission line route, although they have a potential to occur within one or more of the counties where project activities (including the proposed transmission line ROW) could occur. No Federally designated aquatic critical habitats occur near the Fermi site.

Table 2-16. Federally and State-Listed Aquatic Species That Have Been Observed in Monroe, Washtenaw, and Wayne Counties, Michigan, and the Potential for Their Occurrence on the Fermi Site

Common Name	Scientific Name	Federal Status[(a)]	State Status[(b)]	Monroe County[(c)]	Wayne County[(c)]	Washtenaw County[(c)]	Fermi Site[(d)]
Mollusks							
Elktoe	*Alismidonta marginata*		SC	X		X	U
Ellipse	*Venustaconcha ellipsiformis*		SC			X	U
Gravel pyrg	*Pyrgulopsis letsoni*		SC	X		X	U
Hickorynut	*Obovaria olivaria*		E		X	X	U
Northern riffleshell	*Epioblasma torulosa rangiana*	E	E	X	X		U
Purple lilliput	*Toxolasma lividus*		E	X			U
Purple wartyback	*Cyclonaias tuberculata*		T	X	X	X	U
Rainbow	*Villosa iris*		SC		X	X	U
Rayed bean	*Villosa fabalis*	E	E	X	X		P
Round hickorynut	*Obovaria subrotunda*		E	X	X		U
Round pigtoe	*Pleurobema sintoxia*		SC	X	X	X	U
Salamander mussel	*Simpsonaias ambigua*		E	X	X		P
Slippershell	*Alismidonta viridis*		T	X		X	U
Snuffbox mussel	*Epioblasma triquetra*	E	E	X	X	X	P
Wavyrayed lampmussel	*Lampsilis fasciola*		T	X		X	U
White catspaw	*Epioblasma obliquata perobliqua*	E[(e)]	E[(e)]	X	X		U
Fish							
Brindled madtom	*Noturus miurus*		SC	X	X	X	P
Channel darter	*Percina copelandi*		E	X	X		U
Creek chubsucker	*Erimyzon claviformis*		E	X			U
Eastern sand darter	*Ammocrypta pellucida*		T	X	X		U
Lake sturgeon	*Acipenser fulvescens*		T		X		U
Northern madtom	*Noturus stigmosus*		E		X	X	U
Orangethroat darter	*Etheostoma spectabile*		SC	X		X	U
Pugnose minnow	*Opsopoedus emiliae*		E	X	X		P

Table 2-16. (contd)

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Monroe County[c]	Wayne County[c]	Washtenaw County[c]	Fermi Site[d]
Pugnose shiner	*Notropis anogenus*		E		X	X	U
Redside dace	*Clinostomus elongatus*		E		X	X	U
River darter	*Percina shumardi*		E	X	X		U
River redhorse	*Moxostoma carinatum*		T		X		U
Sauger	*Sander canadensis*		T	X	X		P
Silver chub	*Macrhybopsis storeriana*		SC	X	X		O
Silver shiner	*Notropis photogenis*		E	X		X	U
Southern redbelly dace	*Phoxinus erythrogaster*		E	X		X	U
Spotted gar	*Lepisosteus oculatus*		SC			X	U

(a) Federal status rankings determined by the FWS under the Endangered Species Act: E = endangered.
(b) State species information provided by MNFI (2007g): E = endangered; T = threatened; SC = species of special concern.
(c) County-level occurrence based on information provided by MNFI (2007g): X = the species has been observed within the identified county.
(d) O = species observed on or adjacent to the Fermi site; P = possible occurrence due to presence of potentially suitable habitat and nearby populations, but has not been reported on or adjacent to the Fermi site; U = unlikely to occur due to absence of nearby populations and/or lack of suitable habitat on or adjacent to the Fermi site. Species for which there was no record of occurrence reported by the MNFI (2007g) for Monroe County were considered unlikely to occur on the Fermi site.
(e) The white catspaw is considered extirpated from Michigan (MNFI 2007g).

The State of Michigan has listed 33 aquatic species as endangered (17 species), threatened (7 species), or of special concern (9 species) in Monroe, Wayne, or Washtenaw County (Table 2-16) (MNFI 2007g). Of these, 17 species are fish and 16 species are mollusks (15 freshwater mussels and 1 snail species). Species of special concern are those that are considered to be rare in Michigan or those for which the status of the population is uncertain. Additional information about the distribution, life history, population status, and potential for occurrence of Federally and State-listed threatened and endangered aquatic species that could be present in the vicinity of the Fermi site is provided below. MNFI (2007g) presents additional information about distribution, life history, and ecology of species of special concern to the State of Michigan.

Hickorynut (*Obovaria olivaria*)

The hickorynut is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the hickorynut includes eastern North America, from western Pennsylvania and New York to Missouri, Iowa, and Kansas, and from Michigan and the St. Lawrence drainage southward to Alabama and Arkansas (Badra 2004a). In Michigan, the historic range for this species included the Kalamazoo, Grand, Menominee, Saginaw, and Detroit Rivers, as well as Lake Erie and Lake St. Clair (Badra 2004a). Habitat for the hickorynut consists of sand or mixed sand and gravel substrates in large rivers and lakes (Badra 2004a).

The general life history of unionid mussels is described in Section 2.4.2.1. Gravid individuals of the hickorynut retain larvae internally over the winter and release glochidia in the spring (Badra 2004a). The shovelnose sturgeon (*Scaphirhynchus platorynchus*) and freshwater drum have been shown to be suitable hosts, and it is possible that additional species are used as hosts in natural environments (Badra 2004a). Like all freshwater mussels, the hickorynut is a filter feeder.

Principal threats to the hickorynut include siltation and runoff from human activities, damming and dredging of rivers, and the spread of introduced invasive species. Zebra mussels pose a threat for freshwater mussels because they compete for food and benthic habitat and because they attach to the shells of native mussels, making it difficult for the mussels to move and feed properly. The hickorynut was last observed in Washtenaw County in 1996 and in Wayne County in 2006; the hickorynut has not been reported from Monroe County (MNFI 2007g). Although streams with conditions suitable for the hickorynut are not present on the Fermi site, some nearshore areas in Lake Erie in the vicinity of the site could potentially provide suitable substrate. Since no large rivers will be crossed by the proposed transmission line ROW, it is unlikely that this species would be present in stream areas crossed by the transmission line corridor.

Northern Riffleshell (*Epioblasma torulosa rangiana*)

The northern riffleshell is a freshwater unionid mussel (see Section 2.4.2.1) that was Federally listed as an endangered species in 1993 and is also listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the northern riffleshell includes Illinois, Indiana, Kentucky, Michigan, Ohio, Pennsylvania, West Virginia, and western Ontario (Carman and Goforth 2000b). It was once widespread in the Ohio and Maumee River Basins and in tributaries of western Lake Erie (Carman and Goforth 2000b). In Michigan, the northern riffleshell is known to currently occur only in the Black River in Sanilac County and the Detroit River in Wayne County (Carman and Goforth 2000b). More than 100 individuals from the Detroit River population were relocated to the St. Clair River in 1992 as part of an effort to establish a new population, but the success of that effort is not known (Carman and Goforth 2000b).

The habitat for the northern riffleshell is fine to coarse gravel in riffles and runs of streams with swift currents (MNFI 2007g). The general life history of unionid mussels is described in Section 2.4.2.1. The northern riffleshell holds larvae over the winter and releases glochidia in the spring (Carman and Goforth 2000b). In the laboratory, glochidia developed with brown trout (*Salmo trutta*), bluebreast darter (*Etheostoma camurum*), banded darter (*Etheostoma zonale*), and banded sculpin (*Cottus carolinae*) as hosts; however, these fish species do not occur in the areas of Michigan that could harbor northern riffleshell populations, suggesting that there are also other hosts (Carman and Goforth 2000b). The age at maturity for northern riffleshells is not known, but this species may reach 15 years of age (Carman and Goforth 2000b). Like all freshwater mussels, the northern riffleshell is a filter feeder.

The survival of this species depends on the protection and preservation of suitable habitat and host fish species. Principal threats to survival of the species are similar to those described previously for the hickorynut. The northern riffleshell was last observed in Monroe County in 1977 and in Wayne County in 2006 (MNFI 2007g). The northern riffleshell has not been reported from Washtenaw County (MNFI 2007g). Streams with conditions suitable for the northern riffleshell are not present on the Fermi site; it is currently unknown if appropriate habitats are present in stream areas that are crossed by the proposed transmission line corridor. The portions of Lake Erie adjacent to the Fermi site do not offer suitable habitat for this species.

Purple Lilliput (*Toxolasma lividus*)

The purple lilliput is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the purple lilliput extends from Michigan south to Alabama and from Missouri and Arkansas eastward to Virginia (Carman 2002a). In Michigan, the purple lilliput is generally restricted to the southeastern portion of the State, and spent shells have been found from sites in the River Raisin in Monroe

Country (Carman 2002a). The purple lilliput occurs in small to medium-sized streams and occasionally in large rivers and lakes; the preferred substrate for this species is well-packed sand or gravel and a water depth of less than 1 m (MNFI 2007g).

The general life history of unionid mussels is described in Section 2.4.2.1. Gravid purple lilliputs have been known to retain the larvae internally for about a year, although populations in Michigan reportedly produce multiple broods in a single year (Carman 2002a). Fish hosts for the purple lilliput include green sunfish and longear sunfish (*Lepomis megalotis*) (Carman 2002a), both species that have been observed in aquatic habitats associated with the Fermi site (AECOM 2009b). Like all freshwater mussels, the purple lilliput is a filter feeder.

Principal threats to survival of the species are similar to those described previously for the hickorynut. The purple lilliput was last reported from Monroe County in 1977; it has not been reported from Wayne or Washtenaw County (MNFI 2007g). Streams with conditions suitable for the purple lilliput are not present on the Fermi site; it is currently unknown if appropriate habitats are present in stream areas that are crossed by the proposed transmission line corridor. The portions of Lake Erie adjacent to the Fermi site do not offer suitable habitat for this species.

<u>Purple Wartyback (*Cyclonaias tuberculata*)</u>

The purple wartyback is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as threatened by the State of Michigan (MNFI 2007g). The historic range for the purple wartyback includes eastern North America, from Ontario, Canada, south to Alabama, west to Oklahoma, and east to Pennsylvania (Badra 2004b). It is present in the Mississippi River, Ohio River, Lake Michigan, Lake St. Clair, and Lake Erie drainages (Badra 2004b). The purple wartyback is found in medium to large rivers with gravel or mixed sand and gravel substrates in areas with relatively fast current (Badra 2004b).

The general life history of unionid mussels is described in Section 2.4.2.1. Gravid individuals of the purple wartyback release glochidia during the same summer that they are fertilized (Badra 2004b). The yellow bullhead and channel catfish have been shown to be suitable hosts for the purple wartyback, and it is possible that additional species are used as hosts in natural environments (Badra 2004b). Like all freshwater mussels, the purple wartyback is a filter feeder.

Principal threats to survival of the species are similar to those described previously for the hickorynut. The purple wartyback was last reported from Monroe, Wayne, and Washtenaw Counties in 2000, 2006, and 2005, respectively (MNFI 2007g). Streams with conditions suitable for the purple wartyback are not present on the Fermi site, and Lake Erie adjacent to the Fermi site does not offer suitable habitat for this species. Since no large or medium rivers are crossed by the proposed transmission line corridor, it is unlikely that this species would be present in stream areas associated with the corridor.

Rayed Bean (*Villosa fabalis*)

The rayed bean is a freshwater unionid mussel (see Section 2.4.2.1) that was Federally listed as endangered in 2012 (77 *Federal Register* [FR] 8632). This species is listed as endangered by the State of Michigan and has been recorded in Monroe and Wayne Counties (MNFI 2007g). The rayed bean is patchily distributed in the St. Lawrence, Ohio, and Tennessee River drainages (Carman 2001f). Although it was historically widespread from Ontario to Alabama and Illinois to New York, only a few populations are currently known to exist, and it is assumed to be extirpated throughout much of its former range (Carman 2001f). As of November 2010, extant populations were known from 28 streams in Indiana, Michigan, New York, Ohio, Pennsylvania, West Virginia, and the province of Ontario in Canada. In Michigan, existing rayed bean populations are known from the Black, Pine, Belle, and Clinton River systems.

The rayed bean is generally found in smaller headwater creeks, although it has also been found in larger rivers (FWS 2002). They usually are found in or near shoal or riffle areas; there are also records of rayed bean specimens from shallow, wave-washed areas of Lake Erie, generally associated with islands in the western portion of the lake (FWS 2002). Preferred substrates are gravel and sand, and it is oftentimes found among the roots of vegetation growing in riffles and shoals (FWS 2002).

The general life history of unionid mussels is described in Section 2.4.2.1. The rayed bean reportedly holds glochidia internally over the winter for release in the spring; female rayed beans bearing eggs have been found in May (Carman 2001f). Fish hosts for the glochidia could include the Tippecanoe darter (*Etheostoma tippecanoe*), greenside darter (*Etheostoma blennioides*), rainbow darter (*Etheostoma caeruleum*), mottled sculpin (*Cottus bairdi*), and largemouth bass (FWS 2002). The limited data available suggest that the lifespan for the rayed bean is less than 20 years (FWS 2002). As are other freshwater mussels, the rayed bean is a filter feeder.

The rayed bean has experienced a significant reduction in range, and most of its populations are isolated and appear to be declining (FWS 2002). The survival of the rayed bean is threatened by a variety of stressors, especially habitat destruction associated with siltation, dredging, and channelization and the introduction of alien species such as the Asian clam and zebra and quagga mussels (FWS 2002). The rayed bean was last observed in Monroe County in 1984 and in Wayne County in 2006 (MNFI 2007g), although these observations were based on the presence of shells, not living specimens (Carman 2001f). The rayed bean has not been reported from Washtenaw County (MNFI 2007g).

There are no streams on the Fermi site with conditions suitable for the rayed bean, and no extant populations are known to occur in the stream drainages that would be crossed by the proposed transmission line route. Although there are records of rayed bean specimens (valves, not live specimens) from shallow, wave-washed areas of western Lake Erie, information supplied by Detroit Edison suggests that it is unlikely that the species occurs in the vicinity of the Fermi site for a number of reasons, as follows. First, approximately 30 years of information on mussels in the western basin of Lake Erie (including in the vicinity of the Fermi site) have been collected and evaluated by the USGS, and no rayed bean specimens have been identified. Second, the USACE conducted mussel surveys in Lake Erie approximately 2 mi south of the Fermi site and found no live specimens or shells of the rayed bean. Third, the rayed bean was not observed in surveys conducted by the MNFI just north of the Fermi site near the mouth of Swan Creek. Fourth, observations made by divers during sediment sampling and buoy maintenance activities within the exclusion zone for the Fermi site indicate that the sediment is predominantly clay hardpan and not suitable for the rayed bean (Detroit Edison 2010c).

Round Hickorynut (*Obovaria subrotunda*)

The round hickorynut is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the round hickorynut includes much of eastern North America, from Ontario and New York southward to Arkansas, Mississippi, Alabama, and Georgia. It has historically been present in the Ohio, Tennessee, Cumberland, and Mississippi River systems, as well as the St. Lawrence and Lake Erie/Lake St. Clair drainages (Carman 2001g). In Michigan, the round hickorynut occurs in the Lake St. Clair and Lake Erie drainages, and it has historically been observed in Sanilac, St. Clair, Macomb, Wayne, Monroe, and Lenawee Counties (Carman 2001g). The round hickorynut is found in sand and gravel substrates of moderately flowing medium to large rivers and along the shores of Lake Erie and Lake St. Clair, near river mouths (Carman 2001g).

The general life history of unionid mussels is described in Section 2.4.2.1. Gravid individuals of the round hickorynut retain fertilized larvae over the winter and release glochidia during the early summer (Carman 2001g). The host fish species for the round hickorynut is unknown (Carman 2001g). Like all freshwater mussels, the round hickorynut is a filter feeder.

Principal threats to survival of the species are similar to those described previously for the hickorynut. The round hickorynut was last reported from Monroe and Wayne Counties in 1977 and 2000, respectively; there are no reports of this species from Washtenaw County (MNFI 2007g). Streams with conditions suitable for the round hickorynut are not present on the Fermi site, although areas in Lake Erie near the mouths of Swan Creek or Stony Creek could contain suitable substrates. Since no large or medium rivers are crossed by the proposed transmission line corridor, it is unlikely that this species would be present in stream areas associated with the corridor.

Salamander Mussel (*Simpsonaias ambigua*)

The salamander mussel is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the salamander mussel includes North America from Ontario southward to Tennessee, where it is found in the Great Lakes Basin in the Lake St. Clair, Lake Huron, and Lake Erie drainages. The salamander mussel is also found in the Ohio River, Cumberland River, and upper Mississippi River drainages (Carman 2002b). The salamander mussel is found in medium to large rivers and in lakes. It is usually found in silt or sand substrates under flat stones (MNFI 2007g).

The general life history of unionid mussels is described in Section 2.4.2.1. The biology of the salamander mussel is poorly understood. Gravid females release glochidia in the spring or summer (Carman 2002b). The host for the salamander mussel is the mudpuppy (*Necturus maculosus*) (Carman 2002b), a large (8 to 15 in. long) salamander species that inhabits many water bodies in Michigan. Like all freshwater mussels, the salamander mussel is a filter feeder.

Principal threats to survival of the salamander mussel are similar to those described previously for the hickorynut. The salamander mussel was last reported from Monroe and Wayne Counties in 1977 and 1998, respectively; there are no reports of this species from Washtenaw County (MNFI 2007g). Streams with conditions suitable for the salamander mussel are not present on the Fermi site. However, areas in Lake Erie near the site could contain suitable substrates as well as the mudpuppy host. Although the exact locations are not known, the nearest reported occurrence of the salamander mussel is from Macon Creek, a medium-sized tributary of Lake Erie, and La Plaisance Bay, located 6 to 9 mi southwest of the Fermi site (Carman 2002b). Since no large or medium rivers are crossed by the proposed transmission line corridor, it is unlikely that this species would be present in stream areas associated with the corridor.

<u>Slippershell (*Alasmidonta viridis*)</u>

The slippershell is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as threatened by the State of Michigan (MNFI 2007g). The historic range for this species extends from southern Ontario south to Alabama and from South Dakota and Kansas east to New York, Virginia, and North Carolina (Carman 2002c). It is found in the Lake Michigan, Lake Huron, Lake St. Clair, and Lake Erie drainages of the Great Lakes Basin and is also present in the Mississippi River system from the Ohio River drainage to the Tennessee River drainage (Carman 2002c). In Michigan, this species has been observed in a number of counties, including Monroe and Washtenaw Counties. The slippershell typically occurs in creeks and headwaters of rivers in sand or gravel substrates, although it can also be present in larger rivers and lakes and has occasionally been found in mud substrates (MNFI 2007g).

The general life history of unionid mussels is described in Section 2.4.2.1. The biology of the slippershell is poorly understood. The slippershell retains larvae internally for about a year. Fish species that are hosts for the slippershell include the johnny darter (*Etheostoma nigrum*) and mottled sculpin (Carman 2002c). Like all freshwater mussels, the slippershell is a filter feeder.

Principal threats to survival of the slippershell are similar to those described previously for the hickorynut (Carman 2002c). The slippershell was last reported from Monroe and Washtenaw Counties in 2000 and 2005, respectively; there are no reports of this species from Wayne County (MNFI 2007g). Streams with conditions suitable for the slippershell are not present on the Fermi site, and Lake Erie adjacent to the Fermi site does not offer suitable habitat for this species. It is currently unknown if appropriate habitats are present in any of the smaller streams that are crossed by the proposed transmission line corridor.

Snuffbox Mussel (*Epioblasma triquetra*)

The snuffbox mussel is a freshwater unionid mussel (see Section 2.4.2.1) that was Federally listed as endangered in 2012 (77 FR 8632). This species is listed as endangered by the State of Michigan and has been recorded in Monroe, Wayne, and Washtenaw Counties (MNFI 2007g). The historic range of the snuffbox mussel extends from Ontario southward to Mississippi and Alabama and eastward to New York and Virginia; extant populations are still present in Wisconsin, Illinois, Indiana, Kentucky, Michigan, Ohio, Pennsylvania, Tennessee, and West Virginia (NatureServe 2009). In Michigan, this species is found primarily in eastern and southeastern rivers, including Otter Creek in Monroe County and the Detroit River in Wayne County (Carman and Goforth 2000c). The snuffbox mussel primarily inhabits small and medium-sized rivers, although specimens have also been collected from Lake Erie and large rivers, such as the St. Clair River. Preferred habitat usually has clear water and sand, gravel, or cobble substrate with a swift current; individuals are often buried deep in the sediment (Carman and Goforth 2000c).

The general life history of unionid mussels is described in Section 2.4.2.1. The snuffbox mussel is a late summer spawner (Carman and Goforth 2000c). Gravid females retain larvae over the winter and release glochidia from May to July (Carman and Goforth 2000c). In Michigan, the only known fish host is the log perch (*Percina caprodes*), although the banded sculpin (*Cottus carolinae*) has been identified as a fish host in other portions of the range (Carman and Goforth 2000c). The snuffbox mussel can live to be approximately 10 years of age (Carman and Goforth 2000c). Like all freshwater mussels, the snuffbox mussel is a filter feeder.

Principal threats to survival of the snuffbox mussel are similar to those described previously for the hickorynut. The snuffbox mussel was last reported from Monroe, Wayne, and Washtenaw Counties in 1933, 2000, and 1977, respectively (MNFI 2007g). Streams with conditions suitable for the snuffbox mussel are not present on the Fermi site, although there is a possibility that shoreline areas of Lake Erie near the site could contain suitable substrates. The snuffbox mussel is unlikely to inhabit any of the smaller streams that are crossed by the proposed transmission line corridor.

Wavyrayed Lampmussel (*Lampsilis fasciola*)

The wavyrayed lampmussel is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as threatened by the State of Michigan (MNFI 2007g). The historic range for this species extended from Ontario to Alabama and Illinois to New York, and it is now discontinuously distributed in the Great Lakes tributaries of Lake Michigan, Lake Erie, Lake Huron, Lake St. Clair, and in the Ohio, Mississippi, and Tennessee River drainages (Stagliano 2001c). Historically, the wavyrayed lampmussel was found throughout the streams and rivers of southeastern Michigan, but the current distribution is more limited (Stagliano 2001c). It is currently known to occur in the Clinton River drainage in Macomb and Oakland Counties, the St. Joseph River in Hillsdale County, the Belle River in St. Clair County, the Huron River drainage in Washtenaw County, and the River Raisin drainage in Jackson, Lenawee, and Washtenaw Counties. It has also been reported in the past from the River Raisin in Monroe County, although the status of populations in that area is not known. The wavyrayed lampmussel occurs in small to medium-sized shallow streams, in and near riffles, with good current; it rarely occurs in medium or larger rivers (Stagliano 2001c). The preferred substrate is sand and gravel (Stagliano 2001c).

The general life history of unionid mussels is described in Section 2.4.2.1. The wavyrayed lampmussel breeding season extends from August of one year through July of the following year (Stagliano 2001c). Following fertilization, gravid females retain larvae over the winter and release glochidia during spring and summer (Stagliano 2001c; Carman and Goforth 2000c). The smallmouth bass is the only known fish host (Stagliano 2001c). After dropping off the fish host, this species reportedly does not move more than approximately 300 yd throughout its life (Stagliano 2001c). The life span of the wavyrayed lampmussel is unknown (Stagliano 2001c). Like all freshwater mussels, the wavyrayed lampmussel is a filter feeder.

Principal threats to survival of this species are similar to those described previously for the hickorynut. The wavyrayed lampmussel was last reported from Monroe, Wayne, and Washtenaw Counties in 2000, 1995, and 2005, respectively (MNFI 2007g). Streams with conditions suitable for the wavyrayed lampmussel are not present on the Fermi site, and Lake Erie adjacent to the Fermi site does not offer suitable habitat for this species. It is currently unknown if appropriate habitats are present in any of the smaller streams that are crossed by the proposed transmission line corridor.

White Catspaw (*Epioblasma obliquata perobliqua*)

The white catspaw is a freshwater unionid mussel (see Section 2.4.2.1) that is Federally listed as endangered and is also listed as endangered by the State of Michigan (MNFI 2007g). This species is considered extirpated from Michigan (MNFI 2007g). Catspaw mussels historically occurred throughout the Midwest and in eastern North America. The white catspaw is believed to have been widely distributed in the Great Lakes drainages; it has been reported from New York to Indiana and is confirmed to have once been present in several rivers in Ohio, Indiana, and southeastern Michigan (Carman 2001h). The white catspaw was also known to have been present in nearshore areas in Lake Erie (Carman 2001h). Currently, the white catspaw is a highly imperiled species, and the only known viable population remaining is in Fish Creek, Ohio (Carman 2001h).

The white catspaw is a medium-sized mussel up to 2 in. long. Little is known of its required habitat because this species is so rare, but it has historically been found in sand and gravel substrates in the riffles and runs of high-gradient streams. In Michigan, the white catspaw also occurred in large rivers (e.g., the Detroit River) and in nearshore areas of Lake Erie (Carman 2001h). The breeding season is unknown, but related mussel species typically release glochidia in late spring or early summer. It is considered likely that the host species for the white catspaw is a riffle-dwelling fish such as a darter or sculpin (FWS 1990). The lifespan is estimated to exceed 15 years (Carman 2001h).

The survival of the white catspaw mussel is currently in severe jeopardy (FWS 1990). Threats to the continued existence of the species include habitat destruction associated with siltation, dredging, and channelization (FWS 1990). The white catspaw was last observed in Monroe and Wayne Counties in 1930 and has not been reported from Washtenaw County (MNFI 2007g). High-gradient streams with conditions suitable for the white catspaw are not present at the Fermi site, although nearshore areas in Lake Erie adjacent to the site could provide suitable substrate. Given the rarity of this species and the absence of reports of individuals or other populations within the region surrounding the Fermi site, it is considered highly unlikely that this species would be present in the project area or in aquatic habitats crossed by the proposed transmission line corridor and, therefore, is not considered further in the environmental impact statement.

<u>Channel Darter (*Percina copelandi*)</u>

The channel darter is a small fish listed as endangered by the State of Michigan (MNFI 2007g). Its distribution extends from the upper St. Lawrence drainages, through the Great Lakes Basin, and into the Ohio River Basin. The darter is found primarily in the Ohio River Basin, but isolated populations occur southward to Louisiana (Carman and Goforth 2000a). In Michigan, the darter's range historically included nearshore areas of Lake Erie and Lake Huron, including some tributaries (Carman and Goforth 2000a). Since 1994, it has been recorded only in the Au Sable, Pine, and St. Clair Rivers in Michigan (Carman and Goforth 2000a). The channel darter's habitat includes rivers and large creeks with moderate current over sand and gravel substrate. It has also been recorded in wave-swept areas of Lake Huron and Lake Erie that have coarse-sand, fine-gravel beach and sandbar substrates (Carman and Goforth 2000a). The darter is usually found in deeper water but will move into shallow water (<3 ft) at night (Carman and Goforth 2000a).

The channel darter spawns in July in Michigan and requires flowing water conditions for successful spawning (Carman and Goforth 2000a). Spawning males maintain a territory with radius of approximately 1.6 ft around a large rock as a spawning female partially buries herself in gravel downstream of the rock and deposits her eggs (Carman and Goforth 2000a). Adults grow to be approximately 2 in. long. Channel darters are benthic feeders whose diet consists of small invertebrates, including mayfly and midge larvae, small crustaceans, and algae and organic debris (Carman and Goforth 2000a).

In Michigan, the range of the channel darter was severely reduced during the past century. Prior to 1957, this species was reported from 11 counties along Lake Huron, Lake St. Clair, the St. Clair River, and Lake Erie (Carman and Goforth 2000a). Declines in abundance and distribution have been attributed primarily to loss of suitable habitat (Carman and Goforth 2000a). The channel darter was last observed in Monroe County in 1941 and in Wayne County in 1952; there are no reports of this species from Washtenaw County (MNFI 2007g). No suitable stream habitat for the channel darter is present on the Fermi site, although there is a potential for this species to inhabit wave-swept shorelines in Lake Erie, such as that located along the eastern edge of the Fermi site. However, no channel darter individuals were collected during recent surveys of aquatic habitats on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No channel darter eggs or larvae were observed during entrainment and impingement studies conducted at the Fermi 2 intake in 2008 and 2009 (AECOM 2009b).

Creek Chubsucker (*Erimyzon oblongus claviformis*)

The creek chubsucker is listed as endangered by the State of Michigan and has been reported from Monroe County (MNFI 2007g). This fish occurs throughout most of the eastern United States but is becoming increasingly rare at the edges of its historic distribution. The northern extent of the range for the creek chubsucker terminates in Michigan, where it has been found in the Kalamazoo River, St. Joseph River, and River Raisin, and their tributaries. For the last two decades, it has been reported only in the Kalamazoo River, located west of Monroe County. The creek chubsucker inhabits headwaters and clear creeks with moderate currents over sand-gravel substrate. In Michigan, the creek chubsucker has been reported primarily from streams that are 3 to 5 ft deep with moderately swift currents and muddy bottoms (Carman 2001a).

The creek chubsucker migrates upstream to spawn in early spring. Eggs are usually scattered over substrates, although males have been observed building nests. Adults may produce up to 9000 eggs per year. Juveniles of this species often form schools in vegetated headwater areas with less current but migrate to deeper downstream areas as they become adults. Life expectancy of the creek chubsucker is approximately 5 years. The diet of the creek chubsucker is mostly small benthic invertebrates (Carman 2001a).

The preferred habitat type for this species (clear creeks with sandy substrates and moderate current) does not occur on the Fermi site. No creek chubsuckers were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) in the vicinity of the Fermi site.

Eastern Sand Darter (*Ammocrypta pellucida*)

The eastern sand darter is listed as threatened by the State of Michigan (MNFI 2007g). This fish occurs in the St. Lawrence River drainage, the Lake Champlain drainage in Vermont, south to West Virginia and Kentucky, and west through Ontario and Michigan (Derosier 2004a). Within Michigan, this darter was found historically in the Huron, Detroit, St. Joseph, Raisin, and Rouge Rivers, as well as Lake St. Clair. However, in the past two decades it has been recorded in the Lake St. Clair and Huron River drainages (Derosier 2004a). The preferred habitats of the eastern sand darter are streams and rivers with sandy substrates and lakes with sandy shoals. They frequently occur in slow-moving streams with deposits of fine sand, often just downstream of a bend (Derosier 2004a).

The spawning period for the eastern sand darter occurs from April through June. Eggs are buried singly in sandy sediments. These darters reach sexual maturity at age one and have a life expectancy of 2 to 3 years The eastern sand darter feeds mostly on chironomid larvae but will also prey upon aquatic worms and small crustaceans (Derosier 2004a).

Declines in Michigan populations of eastern sand darters have been attributed to siltation, modification of riparian areas, channel and flow alterations, and nutrient enrichment (Derosier 2004a). In the vicinity of the Fermi project, the eastern sand darter was last observed in Monroe County in 1929 and in Wayne County in 1936; it has not been reported from Washtenaw County (MNFI 2007g). Although suitable habitat for this species could be present in Stony Creek, no eastern sand darters were collected during recent surveys of aquatic habitats on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No eastern sand darter eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b).

Lake Sturgeon (*Acipenser fulvescens*)

The lake sturgeon is listed as threatened by the State of Michigan for Wayne County, although it is not listed for Monroe County (MNFI 2007g). This fish is also listed as endangered by the State of Ohio (ODNR 2009b). Historically, this species has been found in the Hudson Bay watershed, St. Lawrence estuary, and upper and middle Mississippi River and Great Lakes Basins, and scattered throughout Tennessee, Ohio, and lower Mississippi drainages (Goforth 2000a). It has become rare throughout its historic range, and population estimates indicate that about 1 percent of their original numbers remain. Michigan populations are among the largest at the current time and are scattered throughout most counties bordering the Great Lakes, as well as in some inland lakes and rivers (Goforth 2000a). The lake sturgeon is a benthic organism that occurs in large rivers and the shallow areas of large lakes (Goforth 2000a). Lake sturgeon tend to avoid aquatic vegetation and prefer deep run and pool habitats of rivers, although habitat use varies among lakes, depending on what conditions are available (Goforth 2000a).

Lake sturgeon begin spawning migrations in May when the water temperature reaches 10–12°C, but they do not actually begin spawning until the water is between 13 and 18°C. Spawning occurs in areas with swift currents and clean rocky substrates and at depths of 2 to 15 ft. Large females lay hundreds of thousands of adhesive eggs but may spawn only once every 3 to 7 years. The eggs are fertilized as they are laid and hatch in approximately 5 days. Juveniles grow relatively quickly for the first 10 years, but growth slows considerably after that. Males become sexually mature at about 15 years of age, while females reach maturity at about 25 years of age. The lake sturgeon has the greatest life expectancy of any freshwater fish, with some individuals reaching 80 years old. Although a lake sturgeon spawning area was historically recorded along Michigan's Lake Erie shoreline near Stony Point in Monroe County, activity has diminished or ceased in this area since the 1970s. The lake sturgeon forages over gravel, sand, and mud substrates. The lake sturgeon feeds on snails, clams, crustaceans, fish, and aquatic insect larvae and may also prey on eggs of other species of fish during foraging (Goforth 2000a).

Lake Erie was formerly one of the most productive waters for lake sturgeon in North America (EPA 2009e). In the 1860s, the lake sturgeon population was greatly reduced in Lake Erie as a bycatch of the gill net fishery. In subsequent decades, overharvesting, limited reproduction, and destruction of spawning habitats nearly eliminated the lake sturgeon population in the lake (EPA 2009e). Threats to lake sturgeon populations include physical barriers to migration (e.g., construction of dams), loss of spawning and nursery areas, impacts on water quality, parasitism by sea lamprey, colonization of spawning habitats by zebra and quagga mussels, predation of eggs by round gobies, and the introduction of contaminants (Goforth 2000a). In addition, life history attributes, such as the late age at which sexual maturity is attained, infrequent reproduction, and lack of parental care for eggs or young, contribute to the decline of this species by offering a very low potential for population growth (Goforth 2000a).

Given the proximity of a previously documented spawning area for lake sturgeon in the vicinity of Lake Erie near Stony Point (Goforth 2000a), which is located approximately 1 mi south of the southern boundary for the Fermi site, there is a potential for lake sturgeon to occur in waters near the Fermi site. Although this species does not occur in Washtenaw County, it was last reported from Wayne County in 2006 (MNFI 2007g). No lake sturgeon individuals were collected during recent surveys of aquatic habitats in the vicinity of the Fermi site

(AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No lake sturgeon eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b).

Northern Madtom (*Noturus stigmosus*)

The northern madtom is listed as endangered by the State of Michigan for Wayne County and Washtenaw County; it is not listed for Monroe County (MNFI 2007g). This fish species is found in Lake Erie and Ohio River Basins from western Pennsylvania, southern Ontario, and West Virginia, to the Ohio River in southern Illinois (Carman 2001b). The species is uncommon and is disappearing on the edges of its range. It is also protected in Canada as an endangered species. The northern madtom historically occurred in several large rivers in southeastern Michigan. Surveys in the late 1970s found the species to be present in the Detroit and Huron Rivers, although a survey conducted in the Huron River in 1983 found no northern madtom individuals; the species was observed in the St. Clair River as recently as 1995 (Carman 2001b).

The northern madtom inhabits riffles with sand and gravel substrates in swiftly flowing small to large rivers (Carman 2001b). This species is tolerant of elevated turbidity, although it apparently avoids heavily silted areas (Carman 2001b). Although knowledge of the life history characteristic of this species is limited, the northern madtom is probably sexually mature after 2 to 3 years. It spawns in small cavities in the substrate (Carman 2001b) from June to August (MNFI 2007g). It is believed to feed primarily on aquatic insect larvae and other small invertebrates (Carman 2001b).

The northern madtom is not known to occur in Monroe County, although it could be present in appropriate habitats in Wayne County and Washtenaw County (MNFI 2007g). No northern madtoms were collected during recent surveys on the Fermi site, although another madtom species (tadpole madtom, *Noturus gyrinus*) was observed in surveys conducted near the South Lagoon (AECOM 2009b). Similarly, no northern madtoms were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No northern madtom eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b).

Pugnose Minnow (*Opsopoeodus emiliae*)

The pugnose minnow is listed as endangered by the State of Michigan (MNFI 2007g). This fish species has been documented from the southern Great Lakes Basin, through the Mississippi River valley, to the Gulf of Mexico (Carman 2001c). Although common in the southeastern portion of its range, it is becoming rare at the northern edge of its range (Carman 2001c). Historically, the pugnose minnow occurred in Michigan tributaries and nearshore areas of Lake

Erie and Lake St. Clair, located approximately 15 mi northeast of the Fermi site, although there is no recent record of occurrence (Carman 2001c). The pugnose minnow inhabits slow, clear waters of rivers and shallow regions of lakes and is found in greatest abundance in weedy areas over sand or organic substrate (Carman 2001c). Historically, it occurred in turbid areas of the Huron River that lacked aquatic vegetation, although it is believed that such conditions are not preferred (Carman 2001c).

The life history of the pugnose minnow is not well documented. Spawning occurs in June and July (MNFI 2007g). After hatching, the adult length of 2 in. is reached within 2 years (Carman 2001c). The pugnose minnow feeds on small crustaceans, fly larvae, and other aquatic invertebrates, as well as algae and plants (Carman 2001c).

In Michigan, the pugnose minnow has been observed in Monroe and Wayne Counties within the past 15 years (MNFI 2007g). Declines in Michigan populations have been attributed primarily to increased siltation and loss of weedy aquatic habitats (Carman 2001c). Although there is a potential for suitable habitat for the pugnose minnow to be present in the vicinity of the Fermi site, no individuals were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No pugnose minnow eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b).

Pugnose Shiner (*Notropis anogenus*)

The pugnose shiner is listed as endangered by the State of Michigan (MNFI 2007g). The distribution of this fish species historically ranged from the Lake Ontario drainage of eastern Ontario and western New York to southeastern North Dakota and central Illinois (Derosier 2004b). The species is rare and declining in much of its former range (Derosier 2004b). Within Michigan, the pugnose shiner was historically found within at least 18 watersheds, including some within Wayne and Washtenaw Counties (MNFI 2007g). The pugnose shiner usually inhabits clear, vegetated lakes and vegetated pools and runs of low-gradient streams and rivers and appears to be extremely intolerant of increased levels of turbidity (MNFI 2007g). The species feeds on filamentous green algae, plant material, and small crustaceans (Derosier 2004b). There is little other information available about the life history of this species.

In Michigan, the pugnose shiner was last reported from Washtenaw County in 1938 and from Wayne County in 1894; it has not been reported from Monroe County (MNFI 2007g). No individuals were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No pugnose shiner eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b). Suitable habitat for this species does not occur on the Fermi site.

Redside Dace (*Clinostomus elongatus*)

The redside dace is listed as endangered by the State of Michigan (MNFI 2007g). This fish species was historically distributed in the Lake Erie and Lake Ontario drainages in southeastern Michigan, Ontario, Ohio, Pennsylvania, and New York; the upper Mississippi River Basin of Wisconsin and southeastern Minnesota; the upper Susquehanna River drainage of New York and Pennsylvania, and the upper Ohio River Basin (Goforth 2000b). In Michigan, the redside dace occurs in the River Rouge drainage of Oakland and Wayne Counties and in the Huron River drainage in Washtenaw County (Goforth 2000b). Redside dace occur in small headwater streams with moderate to high gradients, overhanging vegetation that provides shade, coarse woody structures, and clean rocky substrates (Goforth 2000b).

The redside dace spawns during late May in clean rocky riffles, and it inhabits pools during other periods of the year (MNFI 2007g). Redside dace generally mature at about 2 or 3 years of age and reach a length of about 3 in. (Goforth 2000b). This species feeds primarily on insects (Goforth 2000b).

The redside dace has not been reported to occur in Monroe County (MNFI 2007g). No individuals were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No redside dace eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b). Suitable habitat for this species does not occur on the Fermi site.

River Darter (*Percina shumardi*)

The river darter is listed as endangered by the State of Michigan (MNFI 2007g). The distribution of this fish species ranges from southern Canada to the Gulf of Mexico, including the Great Lakes Basin (Carman 2001d). The river darter is found in rivers and large streams with deep, fast-flowing riffles and cobble and boulder substrate. This species has also been observed at depths below 15 ft in nearshore areas of the Great Lakes and is tolerant of elevated levels of turbidity (Carman 2001d).

The river darter is believed to move upstream to spawn. Spawning occurs in late winter to early spring in southern areas, from April through May in the Midwest, and as late as June or July in Canada. The female river darter buries eggs in loose gravel or sand substrates during spawning, and neither males nor females provide parental care to the young. River darters grow to be 3 in. long, mostly within the first year of development, and sexual maturity is usually reached after 1 year. As juveniles, river darters primarily feed on small zooplankton; adults prey upon midge and caddisfly larvae, as well as some snail species (Carman 2001d).

Even though the river darter is relatively tolerant of elevated turbidity and other water quality changes, the species generally requires deep and swiftly flowing waters as habitat. Such habitats are becoming more limited as a result of flood control efforts and riverine impoundments. Within the project area, the river darter was last observed in Monroe and Wayne Counties in 1941; there are no reports of this species from Washtenaw County (MNFI 2007g). No suitable stream habitat for the river darter is present on the Fermi site. No river darters were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No river darter eggs or larvae were collected during entrainment and impingement studies in 2008 and 2009 (AECOM 2009b).

<u>River Redhorse (*Moxostoma carinatum*)</u>

The river redhorse is listed as threatened by the State of Michigan (MNFI 2007g). This fish species was historically distributed in rivers of the upper St. Lawrence River to the upper Mississippi River drainages, west to Nebraska, and south to Florida (west of the Appalachians); it is widespread in the central Mississippi Basin, including Missouri, Arkansas, Kentucky, Tennessee, and Alabama (Stagliano 2001a). The species reaches the northern extent of its historic range in Michigan, and few specimens have been documented in the State (Stagliano 2001a). In the vicinity of the Fermi site, the river redhorse has been documented only from the Detroit River in Wayne County. The species prefers medium to large rocky rivers with moderate to strong currents and is most often associated with long, deep run habitats up to 3 m deep (MNFI 2007g). This species is generally considered intolerant of increased levels of silt deposition and turbidity (MNFI 2007g).

Although most individuals average 10 to 20 in. in length, this species can be 30 in. long and weigh more than 10 lb. In Michigan, the river redhorse normally spawns in July or August, with adults often migrating upstream to medium-sized sections of rivers and tributary streams. Spawning occurs over gravel or rubble in nests constructed by males. After hatching, young fish generally remain in the spawning reaches until they are subadults. Sexual maturity is reached at approximately 3 years of age, and adults can live to be approximately 12 years old. River redhorse consume primarily benthic invertebrates, such as clams, crayfish, and aquatic stages of insects (Stagliano 2001a).

In Michigan, the river redhorse was last observed in Wayne County in 1984 and has not been reported from Monroe or Washtenaw Counties (MNFI 2007g). No river redhorse were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No river redhorse eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b). Suitable habitat for river redhorse is not present on the Fermi site.

Sauger (*Sander canadensis*)

The sauger is listed as threatened by the State of Michigan (MNFI 2007g). The native range for this fish species includes the St. Lawrence, Great Lakes, Hudson Bay, and Mississippi River Basins, as well as the Tennessee River in Alabama and Louisiana; the sauger has also been introduced into the Atlantic, Gulf, and southern Mississippi River drainages (Derosier 2004c). This species was historically abundant in Lake Erie.

The sauger, which is closely related to the walleye, prefers turbid areas of lakes, reservoirs, and large rivers (MNFI 2007g). This species spawns over shallow areas with gravel and rubble substrates in May or June, when temperatures range from 4 to 6°C (Derosier 2004c). The sauger broadcasts demersal, adhesive eggs over shoals during the night. After hatching, young sauger spend up to 9 days on the bottom, absorbing yolk from their egg sacs. Males reach sexual maturity within 3 years, while females take 4 to 6 years to mature (Derosier 2004c). The life expectancy for the sauger is up to 13 years (Derosier 2004c), and it can attain lengths up to approximately 18 in. (NatureServe 2009). Saugers have a specialized structure in their eyes that makes them very sensitive to light, and they prefer to feed at night in clearer waters or during the day in turbid areas (Derosier 2004c). Juvenile sauger prey on zooplankton and aquatic insect larvae, whereas adults feed on fish and larger invertebrates, including gizzard shad, emerald shiner, crappie, bass, freshwater drum, leeches, crayfish, and insects (Derosier 2004c).

Within the project area, the sauger was last reported from Monroe County in 1996 and from Wayne County in 1993; there are no reports of this species from Washtenaw County (MNFI 2007g). Although there is no riverine habitat suitable for sauger on or adjacent to the Fermi site, suitable habitat could be present in Lake Erie near the Fermi site. However, no sauger individuals were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No sauger eggs or larvae were collected during entrainment and impingement studies in 2008 and 2009 (AECOM 2009b).

Silver Shiner (*Notropis photogenis*)

The silver shiner is listed as endangered by the State of Michigan (MNFI 2007g). The distribution for this fish species ranges from the Great Lakes and their tributaries, through the Ohio River Basin and Tennessee drainage, to northern Alabama and Georgia. This shiner is fairly common within most of the Ohio River Basin but occurs more rarely in tributaries of the Great Lakes. Within Michigan, it is locally abundant in the St. Joseph River (Hillsdale County) and in the River Raisin (Washtenaw County). Historically, the silver shiner was also found in the River Raisin in Monroe County (Carman 2001e).

Preferred habitat for the silver shiner is medium to large streams with moderate to high gradients. This species is usually found in deeper water, such as pools or eddies directly below riffles. The species has been documented to prefer a variety of substrates, including gravel and boulder, pebble and cobble, and sand, mud, and clay, and is believed to avoid areas with dense vegetation and substantial siltation. In Michigan, the shiner has been found to inhabit areas of strong current with wooded banks (Carman 2001e).

Reproduction of the silver shiners is not well documented, but it is believed to spawn in June. Juvenile silver shiners exhibit rapid growth, reaching sexual maturity at age 2 and maximum size by age 3. Although the silver shiner primarily feeds at the surface, it will take mid-water prey as well. The majority of the silver shiner's prey are aquatic stages of insects, especially flies (Carman 2001e).

The silver shiner is relatively rare in Michigan, but populations appear to be stable (Carman 2001e). The species is fairly tolerant of human impact and poor water quality (Carman 2001e). The silver shiner prefers stream habitats with moderate to high gradient, and such habitat is not present on the Fermi site. No silver shiners were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) in the vicinity of the Fermi site. No silver shiner eggs or larvae were observed during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b). Suitable habitat for this species does not occur on the Fermi site.

Southern Redbelly Dace (*Phoxinus erythrogaster*)

The southern redbelly dace is listed as endangered by the State of Michigan (MNFI 2007g). The distribution for this fish species ranges from the Lake Erie and Lake Michigan drainages, through the Mississippi River Basin south to Alabama, Arkansas, and Oklahoma. The northern limit of this species' range is in southeastern Michigan in the Huron River and River Raisin drainages that feed Lake Erie (Stagliano 2001b). The southern redbelly dace generally occurs in the clear and cool permanent headwaters of river systems, especially small moderate-gradient spring-fed and wooded streams that contain pools and are shaded (Stagliano 2001b). Preferred substrates include mud bottoms of pools and clean gravel of riffles (Stagliano 2001b).

In the northern portion of its range, the southern redbelly dace usually spawns in May and June. Spawning fish migrate from pools to riffles, where they use nests built by other fishes in the same family (*Cyprinidae*). Females generally release 700 to 1000 eggs during each spawning event. Southern redbelly dace reach sexual maturity within 1 year at a length of less than 2 in. This species is generally herbivorous, feeding on filamentous algae, diatoms, and drifting or benthic detritus; larger fish reportedly feed on chironomid and mayfly larvae, as well as other small invertebrates (Stagliano 2001b).

Within the project area, the southern redbelly dace was last reported from Monroe County in 1930 and from Washtenaw County in 1973; there are no reports of this species from Wayne County (MNFI 2007g). Although there is a potential for suitable habitat to be present in some of the small streams adjacent to the Fermi site or within the ROW for the proposed transmission line, the areas of Lake Erie near the Fermi site are not suitable habitat for this species. No southern redbelly dace were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No southern redbelly dace eggs or larvae were collected during entrainment and impingement studies in 2008 and 2009 (AECOM 2009b).

Critical Habitats

No critical habitat for aquatic species has been designated by the FWS in the vicinity of the Fermi site.

Non-Native and Nuisance Species

Aquatic nuisance species have the ability to cause large-scale ecological and economic problems when they have been introduced into an ecosystem that does not have the natural controls to keep them in check, such as pathogens, predators, and parasites. When new species are introduced into an area, the lack of natural controls may cause the populations to grow at or near maximum exponential rates. If a nuisance species becomes established, it may disrupt the balance of the existing ecosystem. As a nuisance species proliferates, it may prey upon, out-compete, or cause disease in the existing inhabitants. Aquatic nuisance species that are known to occur on or near the Fermi site are discussed below.

Asian Clam (*Corbicula fluminea*)

The Asian clam was imported in the northwestern United States in 1938 as a food source and subsequently released to the environment. The species has since become widely distributed throughout the United States (Foster et al. 2011). Native to Asia and Africa, the first report of this species from Lake Erie was in 1981, and it has now become established in the Great Lakes. Cold water temperatures limit the potential for survival and reproduction of this species in the Great Lakes Region, where it is often found in areas influenced by the heated water discharged from power plants (French and Schloesser 1991). Asian clams can attach to intake pipes and other man-made structures, causing problems related to the operation and maintenance of power plants and industrial water systems. The cost of removing them from intake systems is estimated at about a billion dollars each year (Foster et al. 2011). Asian clams compete with other species, especially native freshwater mussels, by occupying benthic habitat and filtering phytoplankton and suspended matter from the water column. This species is also eaten by some aquatic species, such as fish and crayfish (Foster et al. 2011).

Fishhook Water Flea (*Cercopagis pengoi*)

The fishhook water flea is an invasive planktonic crustacean that is native to the Caspian Basin in southwest Asia. It is believed to have been introduced to the Great Lakes from the ballast water of a transoceanic ship in the late 1990s. It is now considered established in Lake Ontario and has substantial populations in all of the Great Lakes except Lake Superior and Lake Huron. The fishhook water flea consumes zooplankton and competes with other planktivores for food. Similar to the spiny water flea (described below), this species has a long spine that makes it less palatable to planktivorous fish, and it has a high reproductive rate. As a consequence, it is feared that the establishment of this species could result in substantial changes to plankton communities and could affect survival of planktivorous fish in affected lakes. The current distribution of this species in the vicinity of the Fermi site is unknown, although it was found in Lake Erie in 2002 (Benson et al. 2010a).

Lyngbya (*Lyngbya wollei*)

Lyngbya is an invasive filamentous cyanobacterial (blue-green algae) species that has become established in some areas of the western basin of Lake Erie. Lyngbya, which is common in some areas of the southeastern United States, was first observed in Maumee Bay (approximately 18 mi south-southwest of the Fermi site) in 2006. This species has been observed to form dense benthic and floating mats that can interfere with boating and other lake activities and may negatively affect other aquatic organisms. In addition, when the algal mats wash ashore, they can blanket extensive shoreline areas and become a nuisance as they decompose.

Bridgeman and Penamon (2010) conducted surveys of the western basin in 2008 and found that lyngbya was most prevalent along shorelines in the vicinity of Maumee Bay, becoming less prevalent with increasing distance from Maumee Bay. In addition, the biomass of benthic mats of lyngbya was found to be greatest in Maumee Bay and Bolles Harbor at water depths of 5 to 11 ft on substrates that contained mixtures of sand and fragmented shells from dreissenid mussels (i.e., zebra and quagga mussels). The closest record of occurrence of lyngbya is in the vicinity of Sterling State Park, approximately 5 mi south-southwest of the Fermi site (Bridgeman and Penamon 2010). Bridgeman and Penamon (2010) found no lyngbya in samples collected at Stony Point (approximately 2 mi southwest of the Fermi site) in 2008, and lyngbya has not been documented at the Fermi site. Overall, it appears that the potential for excessive growth of lyngbya is related to the amount of light penetration into the water column (a function of water turbidity), water depth, nutrient availability, and the type of substrate that is present (Bridgeman and Penamon 2010; LaMP Work Group 2008). Bridgeman and Penamon (2010) found that lyngbya in the vicinity of Maumee Bay usually occurred at depths between 6.6 and 9.2 ft. Nutrient concentrations of nitrate, orthophosphate, and total phosphorus reported from Maumee Bay (Moorhead et al. 2008) were higher than those reported by the applicant in Lake Erie near the Fermi site (AECOM 2009a).

A report prepared by Detroit Edison (2012a) documented visual inspections for algae recorded in ship and dive logs during surveys conducted as part of the Fermi 2 Radiological Environmental Monitoring Program. Detroit Edison (2012a) also performed microscopic analyses of algal samples collected near the existing Fermi 2 discharge and the proposed location for the Fermi 3 discharge in 2011. Information from the logs indicated that no mats or stands of algae were observed in the vicinity of the Fermi site. The microscopic analyses confirmed that *Lyngbya wollei* was not present in samples from the Fermi site.

<u>Quagga Mussel (*Dreissena rostriformis bugensis*)</u>

The quagga mussel is a nuisance species believed to have been introduced to the United States through the ballast water discharge of transatlantic shipping vessels. Native to Ukraine, this species was first discovered in the Great Lakes region in 1989 and has now become well-established in Lake Erie. It has been reported in Lake Erie near the mouths of Swan and Stony Creeks (near the Fermi site), and is most likely present in parts of the Detroit River as well. Very similar to the zebra mussel (described below), the quagga mussel attaches to a wide variety of living and nonliving things, including intake pipes and structures, causing problems related to the operation and maintenance of these structures. By filtering phytoplankton and suspended matter from the water column, the quagga mussel consumes a large portion of the zooplankton food source, thus affecting the entire food chain. By clarifying the water, the species augments the natural success of aquatic vegetation and, in turn, alters the entire lake ecosystem (Benson et al. 2010b).

<u>Round Goby (*Neogobius melanostomus*)</u>

The round goby is an invasive species abundant throughout the Great Lakes region, with origins in the Black and Caspian Seas. It is commonly believed that the round goby was introduced to the Great Lakes through ballast water. First encountered in the vicinity of the St. Clair River in 1990, the round goby has now spread to all of the Great Lakes. The largest populations are believed to be in Lake Erie and Lake Ontario. This small fish feeds primarily on bivalves (including zebra mussels), amphipods, small fish, and fish eggs. Thermal tolerance for this species ranges from 39 to 68°F. Known to compete with other fish for food and consume eggs and juvenile fish, the round goby is seen as a detriment to the Lake Erie ecosystem (Fuller et al. 2010a).

The round goby is present in habitats near the Fermi site and is likely present in Swan Creek and Stony Creek. During aquatic surveys conducted at the Fermi site in 2008 and 2009, a total of 22 round gobys were collected along the Lake Erie shoreline near the South Lagoon (AECOM 2009b). Round gobys were also observed in samples collected during impingement and entrainment studies during 2008 and 2009; it was estimated that 123 individuals would be impinged and that more than 1.7 million eggs and larvae would be entrained annually during normal operations of the water intake (AECOM 2009b).

Sea Lamprey (*Petromyzon marinus*)

The sea lamprey is a primitive jawless fish originating in the Atlantic Ocean. The sea lamprey is an invasive species and is larger and far more predacious than the lamprey species that are native to Lake Erie. During the adult stage, sea lampreys parasitize other fish by attaching to them with their suckerlike mouth and penetrate the body wall with sharp teeth in order to feed on body fluids; this often results in the death of the host fish (Great Lakes Fishery Commission 2000). A single sea lamprey can kill as much as 40 lb of fish in its lifetime, and it is estimated that only one in seven fish survive an attack by a sea lamprey (Great Lakes Fishery Commission 2000). They have a strong advantage over the many species of fish native to Lake Erie because they have no natural predators in the lake. The sea lamprey has no economic value, and during its peak abundance, it is estimated that 85 percent of lake trout encountered that have not been killed by the lamprey will have scarring from their attacks (Great Lakes Fishery Commission 2000). Sea lampreys were first observed in Lake Erie (Fuller et al. 2010b). This species typically moves into tributaries to spawn, and many tributaries of Lake Erie are treated with chemicals, called lampricides, that kill the larval stages of sea lampreys in order to prevent further expansion of the species. Although Lake Erie and Swan Creek are the only waterways in the vicinity of the Fermi site where sea lampreys have been found, Stony Creek and the Detroit River could have individuals present during spawning runs.

Spiny Water Flea (*Bythotrephes longimanus*)

The spiny water flea is an invasive planktonic crustacean (cladoceran) that is native to Europe and northern Asia and believed to have arrived in the Great Lakes region via ballast water in the mid 1980s. Because of a preference for cooler waters, the spiny water flea is more abundant in the central basin of Lake Erie than in the western basin; however, it can be found throughout the lake (Berg 1992). There are populations found in inland lakes of the Great Lakes region, and it is presumed that the spiny water flea could also occur in tributaries of Lake Erie, such as Swan Creek, Stony Creek, and the Detroit River as well.

This is a large plankton species, about 0.5 in. long, that has a very high reproductive rate. The spiny water flea consumes small zooplankton, such as small cladocerans, copepods, and rotifers, and it is feared that the introduction of this species could result in changes to the zooplankton community structure in affected lakes. The spiny water flea also competes with juvenile fish, since they share many similar food sources, such as zooplankton, fish larvae, and eggs. This species is not an attractive prey to the native inhabitants of Lake Erie because of the sharp spines located on its tail. It is assumed that there will be few deterrents to the success of its rapidly growing population (Liebig and Benson 2010).

Tubenose Goby (*Proterorhinus semilunaris*)

The tubenose goby is a small fish that was introduced into the St. Clair River, in Michigan, in 1990, and probably originated in ballast water discharged from a foreign tanker that took on water somewhere in the Black Sea (Jude et al. 1992). This species is believed to be established, but rare in the St. Clair River and in Lake St. Clair, in Michigan (Fuller et al. 2012). Since establishment, the distribution of the species has expanded and it now also occurs in the Detroit River and the western basin of Lake Erie (Kocovsky et al. 2011). This species was also found to be present in Swan Creek in 2001, within approximately 2.5 mi of Lake Erie and the Fermi site (Fuller et al. 2012).

In the western basin of Lake Erie, maximum densities of tubenose gobies occurred in sheltered areas with abundant growth of aquatic vegetation, which also is the preferred habitat for the native northern Black Sea populations (Kocovsky et al. 2011). Tubenose gobies were generally absent from sampled areas of the western basin that were dominated by cobble, along windswept shores, or that lacked vegetation (Kocovsky et al. 2011). The diet of tubenose gobies in the western basin consisted almost exclusively of invertebrates, especially midge larvae and amphipods, suggesting that it may compete for food with other bottom-dwelling fishes, such as darters (*Etheostoma* spp. and *Percina* sp.), madtoms (*Noturus* spp.), and sculpins (*Cottus* spp.), and could displace some of these native species (Kocovsky et al. 2011).

Zebra Mussel (*Dreissena polymorpha*)

The zebra mussel is considered a nuisance species throughout the entire Great Lakes region and is known to inhabit the western basin of Lake Erie, near the Fermi site. Zebra mussels have been reported in Swan Creek, Stony Creek, and the Detroit River. Originally found primarily in Russia, it is believed that this species was transported to the Great Lakes region in the ballast water of a transatlantic freighter in 1988. Since that time, it has spread to more than 100 lakes and several major river systems, including the Mississippi River (USGS 2008).

Zebra mussels are very successful invaders because they live and feed in many different aquatic habitats, breed prolifically, and have both a planktonic larval stage and an attached adult stage. Adult zebra mussels attach to a wide variety of living and nonliving things, from boats, docks, piers, and water intake pipes to plants and even slow-moving animals. They can also attach to each other, creating dense blankets of mussels up to 1-ft thick. In 1989, the city of Monroe lost its water supply for 3 days when large amounts of zebra mussels clogged the city’s water intake pipeline. The FWS estimates the economic impact of zebra mussels to be in the billions of dollars (over the next 10 years) in the Great Lakes region alone (USGS 2008).

In addition to the economic damage caused by this species, the invasion of the Great Lakes and other areas by this species has had important ecological effects. As identified in previous sections, zebra mussels have contributed to the decline of native freshwater mussels by competing for food and space and by preventing burrowing and other activities when they attach to the shells of freshwater mussels. In addition, the collective water-filtering ability of quagga and zebra mussels is believed to have had lakewide effects on nutrient levels, the abundance and composition of phytoplankton and zooplankton communities, and water clarity, resulting in large-scale ecological changes (USGS 2008).

2.4.2.4 Important Aquatic Species and Habitats – Transmission Lines

As identified in Section 2.4.2.2, aquatic habitats within or adjacent to the new transmission line corridor include several small streams and numerous small drainage ditches. The new transmission line corridor does not cross any lakes, ponds, or reservoirs. Stony Creek, which is located in the developed eastern portion of the assumed route, is the largest stream crossed by the transmission line route and is discussed in Section 2.4.2.1.

There are no known commercial fisheries occurring within surface water habitats that occur within the proposed transmission line corridor. While some species that support fisheries (e.g., largemouth or smallmouth bass, bluegill, or yellow perch) could be present in these habitats in low numbers, there are no important commercial or recreational fisheries present within the assumed 300-ft-wide ROW because of the small sizes of the drainages present.

Federally and State-listed species that have a potential to occur along the new transmission line route, on the basis of county-level records for Monroe, Wayne, and Washtenaw Counties, are identified in Table 2-16. The majority of the transmission line route falls within the Ottawa-Stony Watershed (Hydrologic Unit Code 04100001). However, it is not known whether suitable habitat or populations of species identified in Table 2-16 occur in portions of the drainage that would be crossed by the proposed transmission route. The MDEQ and/or USACE may require surveys of the proposed transmission line corridor to evaluate the presence of important species and habitat.

2.4.2.5 Aquatic Monitoring

No formal monitoring of the aquatic environment on the Fermi site has been conducted or is planned. The current NPDES permit for the Fermi site does not require monitoring of aquatic ecological resources, and there are no requirements in the license for Fermi 2 to conduct monitoring of aquatic resources, including specific aquatic ecological monitoring of the algal community, benthic invertebrates, or fish.

2.5 Socioeconomics

This section describes the socioeconomic baseline of the regional and local area around the Fermi plant site. The proposed Fermi 3 would be built at the site of the existing Fermi 1 and 2 that are owned and operated by Detroit Edison, located in Monroe County, Michigan, on the shore of Lake Erie. Section 2.5.1 describes the regional and local population, and Section 2.5.2 describes community characteristics of the population.

The review team considered the regional area to be the area within a 50-mi radius of Fermi 3, including portions of the metropolitan statistical areas that encompass the Cities of Detroit and Toledo and their surrounding metropolitan areas. Within a 50-mi radius of Fermi 3 are all or a portion of eight counties in Michigan (Jackson, Lenawee, Livingston, Macomb, Monroe, Oakland, Washtenaw, and Wayne); eight counties in Ohio (Erie, Fulton, Henry, Lucas, Ottawa, Sandusky, Seneca, and Wood); and three Canadian census divisions (Essex, Chatham-Kent, and Lamberton). The 2000 and 2010 Census populations of counties and selected municipalities located within or partially within the 50-mi radius are shown in Table 2-17.[(a)]

Also within a 50-mi radius of Fermi 3 are the Cities of Detroit and Toledo and portions of their surrounding metropolitan statistical areas. The City of Detroit is part of the Detroit-Warren-Livonia Metropolitan Statistical Area (MSA), which encompasses 10 principal cities over a six-county area. The City of Toledo is part of an MSA that includes Lucas, Fulton, Ottawa, and Wood Counties. The 2000 and 2010 Census populations of the Detroit-Warren-Livonia MSA and the Toledo MSA are shown in Table 2-18.

The review team expects most socioeconomic impacts to occur within a local area where most of the building and operations workforces for Fermi 3 are expected to reside. This local area would be Monroe and Wayne Counties in Michigan and Lucas County in Ohio, which the review team considers the economic impact area. The review team expects community services there to receive the majority of any benefits and stresses associated with building, maintenance, and operation of Fermi 3.

Table 2-19 shows the county of residence for the 2008 Detroit Edison workforce at the Fermi site. Approximately 57.5 percent of the plant's workforce resides in Monroe County, Michigan, where the plant is located. Approximately 23.1 percent reside within the Detroit-Warren-Livonia MSA, principally in Wayne County (19.0 percent of the workforce). Approximately 12.9 percent reside within the Toledo MSA, principally in Lucas County (10.7 percent of the workforce). The remaining 6.5 percent of the workers is distributed across 13 other counties in Michigan, Ohio,

(a) This section has been updated for the Final EIS to include the results of the mandated U.S. decadal census for 2010 for the data sets that have been released by the U.S. Census Bureau as of May 2012. For the data sets that have not yet been released, the review team has presented the results of the five-year estimates from the American Community Survey (i.e., 2006–2010).

Table 2-17. Total Population of U.S. Counties and Municipalities and Canadian Census Divisions within or Partially within a 50-mi Radius of the Fermi Site in 2000 and 2010

County or Municipality	2000	2010	Change in Population (percent)
Michigan			
Jackson County	158,422	160,248	1.2
Lenawee County	98,890	99,892	1.0
Livingston County	156,951	180,967	15.3
Macomb County	788,149	840,978	6.7
Monroe County[(a)]	145,945	152,021	4.2
City of Monroe	22,076	20,733	–6.1
Oakland County	1,194,156	1,202,362	0.7
Washtenaw County	322,895	344,791	6.8
Wayne County[(a)]	2,061,162	1,820,584	–11.7
City of Detroit	951,270	713,777	–25.0
Ohio			
Erie County	79,551	77,079	–3.1
Fulton County	42,084	42,698	1.5
Henry County	29,210	28,215	–3.4
Lucas County[(a)]	455,054	441,815	–2.9
City of Toledo	313,619	287,208	–8.4
Ottawa County	40,985	41,428	1.1
Sandusky County	61,792	60,944	–1.4
Seneca County	58,683	56,745	–3.3
Wood County	121,065	125,488	3.7
Ontario, Canada[(b)(c)]			
Essex City	374,975[(d)]	388,782[(e)]	3.7
City of Windsor	209,218[(d)]	319,246[(e)]	52.6
City of Chatham-Kent	107,709[(d)]	104,075[(e)]	–3.4

Sources: USCB 2000a, b, 2010a, b, c; Statistics Canada 2007, 2011a, b, c

(a) Counties that make up the three-county economic impact area.

(b) Canadian census divisions are counties or other legislated areas that are identified by provinces for the planning or provision of community services. Population data from 2000 and 2010 for Canadian census divisions are unavailable. Canadian 2001 and 2011 Census data are provided instead.

(c) The 50-mi radius around Fermi 3 encompasses a small portion of Lamberton County in Ontario; however, because of the small amount of land impacted, population statistics for Lamberton County have not been included in the analysis of the 50-mi radius area.

(d) 2001 data.

(e) 2011 data.

Table 2-18. Total Population of Detroit-Warren-Livonia MSA and Toledo MSA in 2000 and 2010

Metropolitan Statistical Area	2000	2010	Change in Population (percent)
Detroit-Warren-Livonia[(a)]	4,452,557	4,296,250	–3.5
Toledo[(b)]	659,188	651,429	–1.2

Source: USCB 2008, 2010d

(a) The Detroit-Warren-Livonia MSA encompasses the principal cities of Detroit, Warren, Livonia, Dearborn, Troy, Farmington Hills, Southfield, Pontiac, Taylor, and Novi. It encompasses Wayne, Lapeer, Livingston, Macomb, Oakland, and St. Clair Counties.

(b) The Toledo MSA encompasses the principal city of Toledo and Lucas, Fulton, Ottawa, and Wood Counties.

and Ontario. No more than 23 employees (3.2 percent of the total workforce) reside in any one county outside Monroe, Wayne, and Lucas Counties. Current employees at the Fermi site represent less than 1 percent of the total population in any of the counties or locations where these employees reside.

The review team determined that, on the basis of the analysis of the residential distribution of the Fermi site workforce, the economic impact area for analysis of the construction and operation of Fermi 3 would include Monroe and Wayne Counties in Michigan and Lucas County in Ohio. These three counties are where more than 87 percent of the current Fermi site workforce resides; therefore, the review team expects that most of the building and operations workforces for Fermi 3 would similarly reside in these three counties. Given the commute distance beyond this three-county area and the residential distribution pattern of the current Fermi site workforce, the review team expects few in-migrating workers to choose to reside outside these three counties, and the impact on any one community is not likely to be noticeable. The review team expects workers already residing in the 50-mi region will have no marginal impact on their communities due to Fermi 3 building or operations.

The scope of the review of demographic and community characteristics is guided by the magnitude and nature of the expected impacts that may result from the building, maintenance, and operation of Fermi 3.

2.5.1 Demographics

This section provides population data within a 50-mi radius of Fermi 3 for two major groups: residents, who live permanently in the area, and transients, who may temporarily work or visit in the area but have a permanent residence elsewhere. Population data for residents are based on the 2000 and 2010 U.S. Census and the 2001 and 2011 Canada Census. Transient populations are not fully characterized by the U.S. Census Bureau (USCB), which generally

Table 2-19. Distribution of Fermi Site Employees in 2008 by County of Residence

County	Workforce in 2008	Percent of Workforce		Percent of 2010 County Population[a]
		by County	Cumulative	
Monroe	418	57.5	57.5	0.3
Wayne	138	19.0	76.5	<0.1
Lucas	78	10.7	87.2	<0.1
Economic Impact Area	**634**		**87.2**	**0.03**
Washtenaw	23	3.2	90.4	<0.1
Oakland	21	2.9	93.3	<0.1
Lenawee	10	1.4	94.7	<0.1
Wood	8	1.1	95.8	<0.1
Macomb	6	0.8	96.6	<0.1
Ottawa	6	0.8	97.4	<0.1
Sandusky	3	0.4	97.8	<0.1
Livingston	2	0.3	98.1	<0.1
Fulton	2	0.3	98.4	<0.1
Windsor (Ontario)	2	0.3	98.7	<0.1
Jackson	1	0.1	98.8	<0.1
Branch[b]	1	0.1	98.9	<0.1
Berrien[b]	1	0.1	99.0	<0.1
Saint Clair[b]	1	0.1	99.1	<0.1
Van Buren[b]	1	0.1	99.2	<0.1
Presque Isle[b]	1	0.1	99.3	<0.1
Erie	1	0.1	99.4	<0.1
Seneca	1	0.1	99.5	<0.1
Stark[b]	1	0.1	99.6	<0.1
Clare	1	0.1	99.7	<0.1
Total	**727**			

Source: Detroit Edison 2008a
(a) County population data were from USCB 2010a, b; Statistics Canada 2011a.
(b) Outside the 50-mi radius around Fermi 3.

documents only resident populations. Therefore, the transient population within a 50-mi radius of Fermi 3 is estimated as described in Section 2.5.1.2. Regional population projections in 10-year increments are provided through 2060 for the combined resident and transient populations within a 50-mi radius.

Data on the resident population, population change, and selected demographic characteristics also are provided for the local population (i.e., the population within the three-county economic impact area, including Monroe and Wayne Counties, Michigan, and Lucas County, Ohio). Included in this section is information on migrant workers (i.e., workers who reside in an area for a period of time to work and then leave after their jobs are done).

2.5.1.1 Resident Population

The following resident population data is based in part on the sector analysis performed in the FSAR for the Fermi 3 COL application (Detroit Edison 2012b). Following the discussion of the sector analysis, resident population is provided at a county level based on U.S. Census Bureau data.

Data for the resident population within a 50-mi radius of Fermi 3 were estimated by Detroit Edison using LandView® 6 software, developed by the USCB in collaboration with other Federal agencies as a tool to estimate 2000 Census populations at prescribed distances within a specific geographic area. Detroit Edison used ArcGIS software, which can estimate the percentage of a population within a specified geographic area, to estimate the population in Canada.

On the basis of 2000 Census data, approximately 5.4 million persons reside within a 50-mi radius of Fermi 3. Table 2-20 provides the 2000 population as distributed among 10-mi circular segments within a 50-mi radius.

Table 2-20. Resident Population within a 50-mi Radius of Fermi 3 in 2000

0–10 mi	10–20 mi	20–30 mi	30–40 mi	40–50 mi	1–50 mi
89,198	336,170	1,725,503	1,939,797	1,287,597	5,378,266

Source: Detroit Edison 2011a

Figure 2-15 shows the distribution of this population in further detail, as each 10-mi circular segment within a 50-mi radius is subdivided into sectors to show the population distribution by radial direction.

The largest population center within a 50-mi radius of Fermi 3 is the portion of the Detroit-Warren-Livonia MSA within the 50-mi radius. This MSA had a population of more than 4 million persons in 2000. The Detroit-Warren-Livonia MSA encompasses 10 principal cities over a six-county area, the core of which is the City of Detroit, which is located approximately 30 mi northeast of the Fermi site. Toledo, which is approximately 24 mi southwest of the Fermi site, is part of an MSA that includes Lucas, Fulton, Ottawa, and Wood Counties, portions of which are within a 50-mi radius of the site. In 2000, the population of the Toledo MSA was 659,188 persons. To the northeast, approximately 251,563 persons in Canada are within a 50-mi radius of Fermi 3.

An estimated 89,198 permanent residents are located within the emergency evacuation zone, which lies within a 10-mi radius around Fermi 3. The City of Monroe accounts for a large portion of this population. It is the largest city within a 10-mi radius of Fermi 3, with a population of 22,076 persons in 2000. Other population centers (and their corresponding 2000 Census

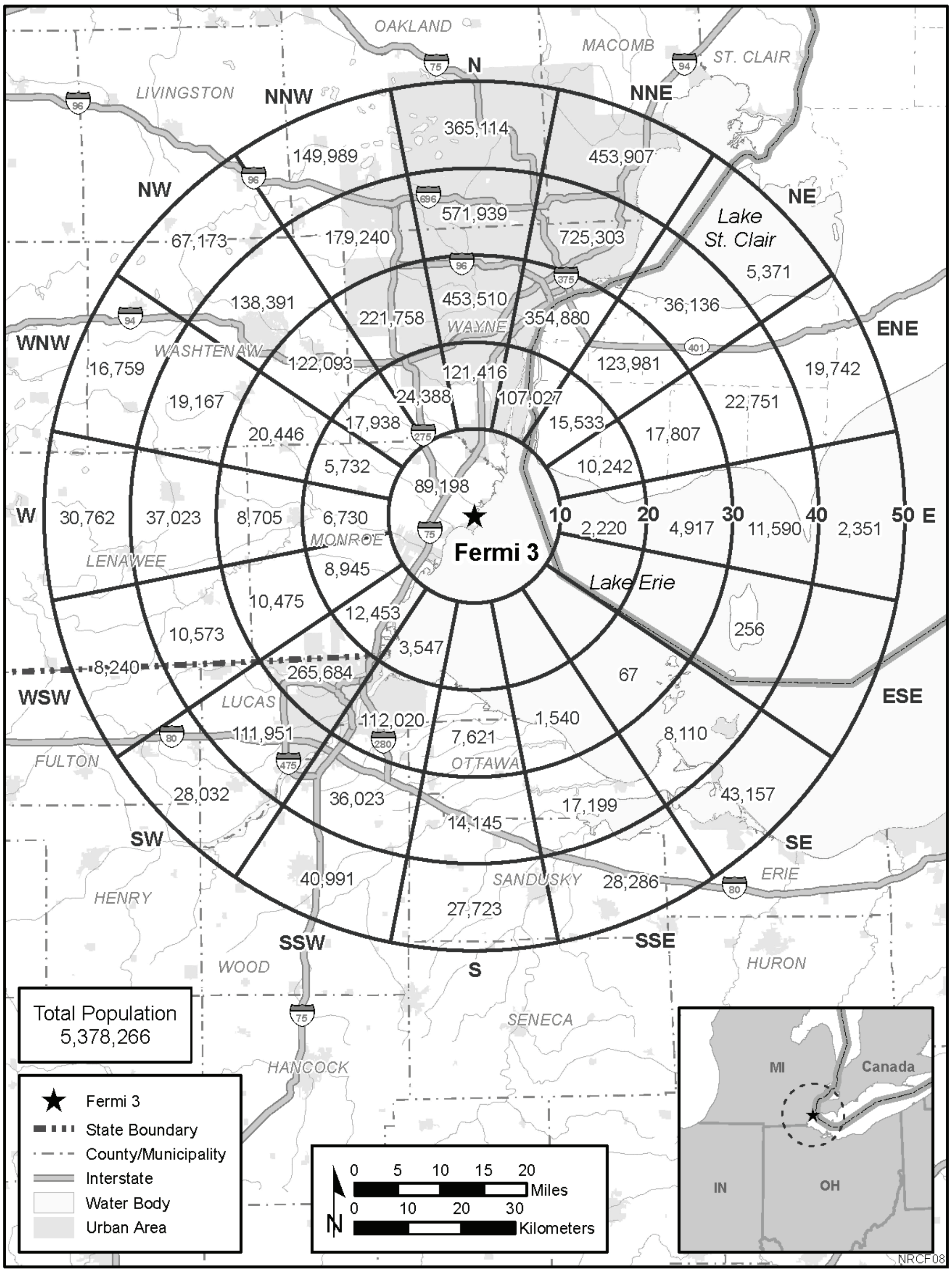

Figure 2-15. Resident Population Distribution in 2000 Located 0 to 50 mi from Fermi 3 as Shown by Segmented Concentric Circles (Detroit Edison 2011a)

populations) within the 10-mi radius include Woodland Beach (2179 persons), Carleton (2561 persons), Detroit Beach (2289 persons), Flat Rock (8488 persons), Gibraltar (4264 persons), Rockwood (4726 persons), and Stony Point (1175 persons). Much of the surrounding land use beyond the population centers is agricultural. Open water also accounts for a large portion of the area within the emergency evacuation zone because of the presence of Lake Erie directly east of the Fermi site.

Tables 2-21 and 2-22 present the historic and projected populations for Monroe, Wayne, and Lucas Counties compared with the respective State totals. In addition to the 1990, 2000, and 2010 Census populations, the USCB provides Statewide population projections. Projections at the county level are provided by SEMCOG for Monroe and Wayne Counties, Michigan, and by the Ohio Department of Development for Lucas County, Ohio.

Monroe County has 24 municipal jurisdictions, including 15 townships, 4 cities, and 5 villages. The county had modest growth between the 1990 and 2010 Census, and the population is expected to continue to grow through 2030, although at a slower rate than has occurred historically (SEMCOG 2008a). Most of the population growth has occurred around the City of Monroe, along the northern boundary toward Detroit and along the southern boundary toward Toledo (Monroe County Planning Department and Commission 2010). Wayne County has 38 municipal jurisdictions. The population in Wayne County has declined between the 1990 and

Table 2-21. Historic and Projected Population Change in Monroe and Wayne Counties, Michigan, 1990–2030

	Michigan					
	Monroe County		Wayne County		State of Michigan	
Year	Population	Average Annual Growth (percent)	Population	Average Annual Growth (percent)	Population	Average Annual Growth (percent)
1990	133,600	–[a]	2,111,687	–	9,295,297	–
2000	145,945	0.9	2,061,162	–0.2	9,938,492	0.7
2010	152,021	0.4	1,820,584	–1.2	9,883,640	<–0.1
2020 projected	159,461	0.5	1,812,593	<–0.1	10,695,993	0.8
2030 projected	167,588	0.5	1,824,113	0.1	10,694,172	0.0

Sources: Monroe and Wayne Counties 2020 and 2030 projections are provided by SEMCOG (2008a). 1990, 2000, and 2010 data for all areas are from the 1990, 2000, and 2010 Census of Population and Housing (USCB 1990a, 2000a, 2010a). State projections for 2020 and 2030 are also provided by the USCB via its 2004 Interim Projections (USCB 2004).

(a) – = The average annual growth rate was calculated from 1990 through 2030 and is not presented for 1990 or any years prior to 1990.

Table 2-22. Historic and Projected Population Change in Lucas County, Ohio, 1990–2030

	Lucas County		State of Ohio	
Year	**Population**	**Average Annual Growth (percent)**	**Population**	**Average Annual Growth (percent)**
1990	462,361	–[(a)]	10,847,115	–
2000	455,054	–0.2	11,353,140	0.5
2010	441,815	–0.4	11,536,504	0.2
2020 projected	434,650	–0.2	11,644,058	0.1
2030 projected	417,870	–0.4	11,550,528	–0.1

Sources: For Lucas County, projections are provided by the Ohio Department of Development (2003). 1990 and 2000 data for all areas are from the 1990, 2000, and 2010 Census of Population and Housing (USCB 1990b, 2000b, 2012b). State projections for 2020 and 2030 are also provided by the USCB via its 2004 Interim Projections (USCB 2004).

(a) – = The average annual growth rate was calculated from 1990 through 2030 and is not presented for 1990 or any years prior to 1990.

2010 Census and is expected to continue to decline through 2020. Some of the population loss in Wayne County has been due to residents moving out of the City of Detroit into suburban communities in adjoining counties. However, SEMCOG forecasts modest growth in Wayne County between 2020 and 2030 (SEMCOG 2008a).

Lucas County has nine municipal jurisdictions, including three townships, three cities, and three villages. The county has experienced, and is projected to continue to experience, modest population loss through 2030 (Ohio Department of Development 2003).

Tables 2-23 and 2-24 present selected demographic characteristics for the resident population within Monroe, Wayne, and Lucas Counties.

2.5.1.2 Transient Population

Transient populations include people who do not reside permanently in the area but work in or visit schools, hospitals and nursing homes, correctional facilities, hotels and motels, and recreational areas or special events on a temporary basis. The transient population within a 50-mi radius of Fermi 3 was estimated by Detroit Edison on the basis of data on the following groups:

- workers who live permanently outside of the 50-mi radius and commute to a worksite within the 50-mi radius, an assumption based on 2000 Census commuter data for each county
- visitors who live outside of the 50-mi radius and travel to destinations within the 50-mi radius (e.g., campers, users of recreational facilities), an assumption based on 2000 Census data on recreational, seasonal, and occasional housing units

Table 2-23. Selected Demographic Characteristics of the Resident Population in Monroe and Wayne Counties, Michigan

Demographic Characteristic	Monroe County	Wayne County	State of Michigan	United States
Population Density				
Population, 2010	152,021	1,820,584	9,883,640	308,745,538
Land area (square miles)	551	614	56,804	3,537,438
Population per square mile, 2010	276	2965	174	87
Ethnic Composition, 2010 (percent of total)				
Caucasians	94.4	52.3	78.9	72.4
African-American	2.4	41.3	14.3	12.8
Hispanic	2.6	4.9	4.0	15.1
Other[(a)]	1.0	2.8	3.0	5.6
Two or more races	1.2	1.5	1.5	1.6
Income Characteristics, 2010				
Median household income	$55,366	$42,241	$48,432	$51,914
Persons below poverty (percent of total)	9.0	21.4	14.8	13.8

Sources: USCB 2000a, 2009, 2010c, e, f, g

(a) Includes American Indian and Alaska Native persons, Asian persons, and Native Hawaiian and Other Pacific Islanders.

Table 2-24. Selected Demographic Characteristics of the Resident Population in Lucas County, Ohio

Demographic Characteristic	Lucas County	State of Ohio	United States
Population Density			
Population, 2010	441,815	11,485,910	308,745,538
Land area	340	40,948	3,537,438
Population per square mile, 2010	1300	277	87
Ethnic Composition, 2010 (percent of total)			
Caucasians	74.0	82.7	72.4
African-American	19.0	12.2	12.6
Hispanic	6.1	3.1	16.3
Other[(a)]	3.8	3.0	12.1
Two or more races	3.1	2.1	2.9
Income Characteristics, 2010			
Median household income	$42,072	$47,358	$51,914
Persons below poverty (percent)	18.0	14.2	13.8

Sources: USCB 2000b, 2009, 2010c, e, f, g

(a) Includes American Indian and Alaska Native persons, Asian persons, and Native Hawaiian and Other Pacific Islanders.

- residents of special facilities (correctional facilities, college dormitories, nursing homes, hospitals, religious group quarters, and others).

Detroit Edison estimated the transient population for the FSAR by using LandView® 6 software based on the 2000 Census population. Table 2-25 provides the estimated total transient population within a 50-mi radius of Fermi 3. An estimated 200,656 transient persons lived or visited within a 50-mi radius of Fermi 3 as of the 2000 Census.

Table 2-25. Transient Population within a 50-mi Radius of Fermi 3 in 2000

0–10 mi[(a)]	10–20 mi	20–30 mi	30–40 mi	40–50 mi	1–50 mi
17,538	10,906	44,433	70,601	57,178	200,656

Source: Detroit Edison 2011a
(a) Transient population within the emergency evacuation zone (e.g., 0–10 mi radius) was derived from KLD Associates, Inc. 2008.

2.5.1.3 Regional Population Projections

Table 2-26 shows the population growth projections for the region in 2020 and for four subsequent decades through the year 2060 by 10-mi increments. Detroit Edison based these projections on the average annual growth rate between the 1990 Census population and the estimated 2005 population of each of the counties within the region and the average annual growth rate for populations in the Canadian census subdivisions between the Canadian 1996 Census and 2006 Census. Average annual growth rates were applied to the 2000 (United States) and 2001 (Canada) resident census population and the estimated transient population to project the growth through 2060. These growth rates were weighted by the applicant for the percentage of the county population within each 10-mi segment around Fermi 3. The review team reviewed the growth rates and concurred with this approach.

2.5.1.4 Agricultural, Seasonal, and Migrant Labor

Agricultural, seasonal, or migrant labor within Monroe, Wayne, and Lucas Counties includes:

- Contract labor employed during outages at Fermi 2 and
- Migrant labor on farms in Monroe, Wayne, and Lucas Counties.

During Fermi 2 scheduled refueling outages, contract labor is hired by Detroit Edison to carry out fuel reloading activities, equipment maintenance, and other projects associated with the outage. Detroit Edison employs approximately 1200 to 1500 workers for 30 days during every refueling outage, which occurs every 18 months for Fermi 2.

Table 2-26. Resident and Transient Population Projections within a 50-mi Radius of Fermi 3 by 10-mi Increments, 2000-2060

	Distance					
Year	**0–10 mi**	**10–20 mi**	**20–30 mi**	**30–40 mi**	**40–50 mi**	**Total**
2000	106,736	347,077	1,769,937	2,010,398	1,344,775	5,578,923
2008	112,665	348,369	1,791,988	2,081,615	1,449,117	5,783,754
2020	123,378	351,302	1,831,686	2,198,894	1,624,796	6,130,056
2030	133,239	354,711	1,871,367	2,307,607	1,791,234	6,458,158
2040	144,031	359,060	1,917,634	2,427,916	1,978,702	6,827,343
2050	155,853	364,415	1,971,113	2,561,627	2,190,275	7,243,283
2060	168,849	370,858	2,032,503	2,810,898	2,429,542	7,812,650

Source: Detroit Edison 2011a

A migrant worker is defined by the U.S. Department of Agriculture (USDA) as “a farm worker whose employment required travel that prevented the migrant worker from returning to his/place of residence the same day.” In the 2007 Census of Agriculture (USDA 2007), the USDA reports the number of farms with hired labor by county and State as well as the total number of hired workers. Migrant workers are a subset of total hired workers, but the number of migrant workers is not reported.

The review team concluded that the number of migrant workers within Monroe, Wayne, and Lucas Counties is low because the total number of hired workers in the 2007 Census was 3592, and between 7 percent to 15 percent of the farms in Monroe, Wayne, and Lucas Counties reported that migrant workers were employed there (Table 2-27).

Table 2-27. Migrant Labor within the Regional Area of Fermi 3 in 2007

County	Farms with Hired Labor (no. of farms)	Farms with Hired Labor (no. of workers)	Migrant Labor on Farms with Hired Labor (no. of farms)	Percentage of Farms with Migrant Labor
Monroe	222	1854	27	12
Wayne	86	894	6	7
Lucas	91	844	14	15

Source: USDA 2007

2.5.2 Community Characteristics

This section characterizes the communities that may be affected by the building, maintenance, and operation of Fermi 3. As noted in Section 2.5.1, most socioeconomic impacts are expected to occur within a three-county economic impact area, which includes Monroe and Wayne Counties in Michigan and Lucas County in Ohio. These three counties are where more than 87 percent of the current Fermi site workforce resides; therefore, the review team expects that most of the building and operations workforces for Fermi 3 would similarly reside in these three counties.

Since no more than 3.2 percent of the current workforce resides in any one county outside the local area of Monroe, Wayne, and Lucas Counties and since current employees at the Fermi site represent less than 1 percent of the total population in any of the counties or locations where these employees reside, the review team expects impacts beyond the three-county area to be minimal. Therefore, the following discussion focuses on the three-county economic impact area. Community characteristics evaluated in this section include the economy, taxes, transportation, aesthetics and recreation, housing, public services, and education, focusing on the three-county economic impact area of Monroe and Wayne Counties, Michigan, and Lucas County, Ohio.

2.5.2.1 Economy

An overview of the economy of Monroe, Wayne, and Lucas Counties is provided below. Tables 2-28 and 2-29 show employment by industry for 2000 and 2010 within each of the three counties, and Table 2-30 shows the labor force statistics.

Manufacturing, specifically automobile manufacturing, has been the major sector of the economy in southeast Michigan throughout most of the 20th century. This manufacturing base has affected the economies of Wayne and Monroe Counties in Michigan as well as Lucas County, Ohio. Southeast Michigan is 680 percent more concentrated in automobile manufacturing employment than the national economy overall (SEMCOG 2007). Since the 1940s, Lucas County has also supported the automotive industry, primarily as a supplier of automotive glass and automotive parts (Lucas County 2010).

Job growth in manufacturing was strong through the 1990s but has been in decline since 2000. Between 1999 and 2006, the State of Michigan lost 274,000 manufacturing jobs, primarily in the automobile and automobile parts manufacturing industries (Ivacko 2007). SEMCOG estimates that between 2000 and 2009, southeast Michigan lost 210,000 manufacturing jobs (SEMCOG 2009a). Domestic automobile manufacturers, heavily reliant on light trucks and sport utility vehicles (SUVs), were particularly hit by the increase in gasoline prices and loss of market share in light vehicles during this decade. Job losses in auto manufacturing have had a ripple effect in other industries statewide, estimated as a loss of between one to three jobs in other sectors for every job lost in manufacturing (Ivacko 2007; SEMCOG 2009a).

Job losses accelerated with the automobile industry restructuring and the economic downturn of 2009, which affected the construction sector and consumer spending (Michigan Department of Energy, Labor, and Economic Growth 2010a). As the manufacturing sector has declined, the economy of southeast Michigan, including the Fermi 3 economic impact area, has moved

Table 2-28. Area Employment by Industry – Monroe and Wayne Counties, Michigan, in 2000 and 2010

	Monroe County					Wayne County				
	2000		2010			2000		2010		
Occupation	**Persons**	**%**	**Persons**	**%**	**Net Change**	**Persons**	**%**	**Persons**	**%**	**Net Change**
Agriculture; forestry; fishing and hunting; mining	894	1	589	<1	–305	1044	<1	2357	<1	+1313
Construction	5370	7.6	4316	6.2	–1054	39,296	14.6	29,005	4.0	–10,060
Manufacturing	18,120	25.8	14,185	20.4	–3935	185,856	21.8	121,536	16.7	–64,320
Wholesale trade	2307	3.3	2349	3.4	+42	26,904	3.2	19,286	2.7	–7618
Retail trade	8430	12	8006	11.5	–124	90,905	10.7	80,492	11.1	–10,413
Transportation and warehousing; utilities	5112	7.3	4982	7.1	–130	54,387	6.4	42,616	5.9	–11,771
Information	973	1.4	736	1.1	–237	21,231	2.5	15,606	2.1	–5625
Finance and insurance; real estate and rental and leasing	2669	3.8	3102	4.5	+433	50,591	5.9	43,826	6.0	–6765
Professional, scientific, and management; administrative and waste management services	4012	5.7	5024	7.2	+1012	77,890	9.2	71277	9.8	+6613
Educational services; healthcare; social assistance	12,891	18.3	15,139	21.7	+2248	158,342	18.6	162,976	22.4	+4634
Arts, entertainment, and recreation; accommodation and food services	4894	7.0	5749	8.2	+855	68,026	8.0	74,630	10.3	+6604
Other services, except public administration	3054	4.3	3379	4.8	+325	42,366	5.0	33,474	4.6	–8892
Public administration	1618	2.3	2147	3.1	+529	34,272	4.0	28,796	4.0	–5476
Total	**70,344**		**69,703**		**–641 (–0.9%)**	**851,110**		**726,108**		**–60,876 (–7.2%)**

Sources: USCB 2000a, 2010f.

Table 2-29. Area Employment by Industry – Lucas County, Ohio, in 2000 and 2010

	Lucas County				
	2000		2010		
Occupation	**Persons**	**%**	**Persons**	**%**	**Net Change**
Agriculture; forestry; fishing and hunting; mining	866	<1	571	<1	–295
Construction	12,230	5.8	10,184	5.1	–2046
Manufacturing	38,774	18.3	29,496	14.7	–9278
Wholesale trade	8411	4.8	5993	3.0	–2418
Retail trade	25,977	12.3	23,891	11.9	–2086
Transportation and warehousing; utilities	11,599	5.5	11,970	5.9	+371
Information	4079	1.9	3502	1.7	–577
Finance and insurance; real estate and rental and leasing	10,258	4.8	10,323	5.1	+65
Professional, scientific, and management; administrative and waste management services	19,036	9.0	17,552	8.7	–1484
Educational services; healthcare; social assistance	46,342	21.9	51,706	25.8	+5364
Arts, entertainment, and recreation; accommodation and food services	17,110	8.1	20,357	10.1	+3247
Other services, except public administration	10,226	4.8	8736	4.4	–1490
Public administration	7111	3.4	6430	3.2	–681
Total	**212,019**		**200,711**		**–11,308 (–5.3%)**

Sources: USCB 2000b; 2010f

toward a health care and services based economy. SEMCOG forecasts continued growth in the health care and services industries (SEMCOG 2008a).

Overall, with the decline in population as discussed in Section 2.5.1 and with the loss of jobs and transition from higher to lower wage and salary rates, the economy in southeast Michigan is in transition. Overall, the State of Michigan, and southeast Michigan in particular, have experienced a decline in average income, housing prices, and income and property tax revenues (Scorzone and Zin 2010). The decline in tax revenues, along with a declining population, has resulted in a lower level of investment in infrastructure (SEMCOG 2010b).

Table 2-30. Labor Force Statistics for Monroe, Wayne, and Lucas Counties in 2000 and 2010

	Monroe County		Wayne County		Lucas County	
	2000	**2010**	**2000**	**2010**	**2000**	**2010**
Total labor force	77,194	70,724	952,300	844,184	227,304	214,733
Employed workers	74,756	61,921	911,069	719,390	217,049	190,514
Unemployed workers	2438	8803	41,231	1124,794	10,255	24,219
Unemployment rate	3.2	12.4	4.3	14.8	4.5	11.3

Source: USBLS 2012

Monroe County

Monroe County employment was nearly 70,724 workers in 2010 (USBLS 2012). Approximately 40 percent of the jobs in Monroe County are in two sectors: manufacturing sector and educational services/healthcare/social assistance sector. The four largest employers in Monroe County in 2007 were Detroit Edison, with approximately 1500 employees; Mercy Memorial Hospital, with approximately 1300 employees; the supermarket chain Meijer Inc., with approximately 1025 employees; and the Monroe Public Schools school district, with approximately 1000 employees (Monroe County Finance Department 2008). In 2007, Ford Motor Company closed Automotive Component Holdings, formerly named Visteon Corporation, causing a loss of 1200 jobs.

Detroit Edison's workforce of approximately 1500 workers is employed at the Fermi plant site and the coal-fired Monroe County Power Plant. During outages, an additional 1200 to 1500 outage workers are also employed at the Fermi plant site for a period of 30 days every 18 months. Between 2009 and 2010, Detroit Edison had a construction workforce at the Monroe County Power Plant to conduct capital improvements of the air emission control equipment (Detroit Edison 2011a). Future projects involving installation of air pollution control equipment will require a workforce ranging from 100 to 550 workers. Detroit Edison expects the work at the Monroe County Power Plant will be completed by 2014 (Detroit Edison 2011c).

Monroe County experienced growth in several sectors, most notably in the professional scientific and management/administrative and waste management services sector and the educational services/healthcare/social assistance sector, but experienced losses in primarily construction and manufacturing for a net loss in jobs between 2000 and 2010 of just under 1 percent. The total labor force declined from 77,000 in 2000 to 70,000 in 2010, and the U.S. Bureau of Labor Statistics (USBLS) reported a rise in unemployment from 3.2 percent in 2000 to 12.4 percent in 2010.

Monroe County's economy benefits from an extensive transportation network, waterfront access, energy supplies, and agricultural production. Three major railroad lines and I-75 traverse Monroe County from north to south. Access to the waterfront of Lake Erie provides industrial, commercial, and recreation-based economic opportunities. The Port of Monroe provides a point of access for Great Lakes shipping and transport through the Great Lakes-Saint Lawrence Seaway. Thirty-seven other marinas are located within Monroe County, and the Lake Erie shoreline, with its beaches, boat launch facilities, and campgrounds, is attractive to tourists. Three major energy facilities are located in Monroe County, including Detroit Edison's Fermi 2 Plant and its coal-fired Monroe Power Plant and Consumer's Energy's J.R. Whiting Power Plant (Monroe County Planning Department and Commission 2010). Approximately 62 percent of Monroe County's land is in farmland. In 2007, the USDA reported that the value of agricultural products sold from Monroe County was $130 million (USDA 2007). Between 2006 and 2016, job growth is expected in the healthcare, service, professional, and farming occupations (Michigan Department of Energy, Labor and Economic Growth 2010a).

Wayne County

Employment in Wayne County was 844,184 workers in 2010 (USBLS 2012). Approximately 40 percent of the jobs in Wayne County are in two sectors: manufacturing sector and educational services/healthcare/social assistance sector. In 2010, Wayne County had 121,536 manufacturing jobs and 162,976 jobs in educational services/healthcare/social assistance. The four largest employers in Wayne County in 2007 were Ford Motor Company, with approximately 42,309 employees; the Detroit School District, with approximately 17,329 employees; the City of Detroit, with approximately 13,593 employees; and the Henry Ford Health System, with approximately 11,475 employees (Wayne County Department of Management and Budget 2008).

Wayne County is part of a large urbanized area within the Detroit-Warren-Livonia MSA, which encompasses 10 principal cities in a six-county area and had a combined estimated population in 2010 of 4.3 million. In addition to Ford Motor Company, other large manufacturing businesses in the metropolitan area as of 2008 included General Motors Corporation (41,861 employees); Chrysler LLC (32,597 employees); Automotive Component Holdings, an automotive supplier (4497 employees); and Johnson Controls Automotive Experience, an automotive supplier (4205 employees). Several healthcare systems were also large employers in the metropolitan area as of 2008, in addition to Henry Ford Health System and including the University of Michigan Health System (16,551 employees), St. John Providence Health System (14,286 employees), Trinity Health (13,012 employees), Beaumont Hospitals (12,638), and Detroit Medical Center (11,003 employees) (Detroit Economic Growth Corporation 2010).

Wayne County is served by major transportation routes, including highway, air transport, rail, and waterway shipping routes, which support the economy of the area. International trade with Canada, which is conducted primarily by truck traffic across the Ambassador Bridge, contributes significantly to the local economy. Wayne County was the destination or origin for 11,987 cross-border trucks and 123,012 tons of cargo in 2006. Passenger trips across the border also contribute toward retail spending and tourism (SEMCOG 2009b). In addition, the Detroit/Wayne County Port Authority maintains freight transportation hubs for rail, trucking, and shipping. In 2005, the Port of Detroit imported and exported 17 million tons of cargo, with revenues of approximately $165 million (Detroit/Wayne County Port Authority 2010). The Detroit Metropolitan Wayne County Airport (DTW), located in Wayne County, served more than 36 million passengers in 2007 (DTW 2009).

Between 2000 and 2010, Wayne County lost approximately 125,000 jobs, primarily in the manufacturing and construction sectors. Some growth occurred in educational services, healthcare and social assistance, the arts, entertainment, recreation, and accommodation and food services, but it did not make up for the jobs lost. In addition to losses in manufacturing and construction, Wayne County also experienced job losses in other employment sectors, including wholesale and retail trade and transportation, indicating that its economy is closely linked to its manufacturing base. During this time period, Wayne County lost members of the labor force as well as population. These trends are attributed to workers leaving the area to pursue jobs elsewhere, production workers taking buyouts and early retirement in the restructuring process, and an aging population (SEMCOG 2007). In 2010, the USBLS reported the unemployment rate for Wayne County was 14.8 percent. Nationally, the unemployment rate in 2010 was 9.6 percent; and in the State of Michigan it was 12.7 percent.

Between 2006 and 2016, job growth is expected in the healthcare, service, professional, and farming occupations (Michigan Department of Energy, Labor, and Economic Growth 2010a).

Lucas County

Lucas County had 214,733 employed workers in 2010 (USBLS 2012). Approximately 26 percent of the workforce is employed in the educational services/healthcare/social assistance sector. Manufacturing and retail trade employ approximately 15 percent and 12 percent, respectively. The four largest employers in Lucas County in 2007 were Promedica Health Systems, with approximately 11,265 employees; Mercy Health Partners, with approximately 6723 employees; the University of Toledo, with approximately 4987 employees; and the Toledo School District, with approximately 4554 employees (Lucas County Auditor's Office 2008).

Lucas County is part of an urbanized area within the Toledo MSA, which encompasses the City of Toledo and three other counties. The economy of Lucas County is integrated with the economy of the City of Toledo and communities within the MSA. The economy has been supported by agricultural and industrial production, transportation, and warehousing (Regional Growth Partnership 2010). Approximately 49 percent of the land area in Lucas County is in farmland. In 2007, the USDA reported that the value of agricultural products sold from Lucas County was $47 million (USDA 2007). Large manufacturing businesses in the Toledo area as of 2009 included General Motors Corporation (2924 employees), Chrysler LLC

(2261 employees), The Andersons (grain storage, process, and retail; 1793 employees), Libbey, Inc. (glass manufacturing; 1047 employees), Owens-Corning (glass manufacturing; 950 employees), and Dana Corporation (automotive parts manufacturing; 850 employees) (Regional Growth Partnership 2010). Other nonmanufacturing employers in the MSA, in addition to the four largest employers listed above, are Bowling Green State University (5400 employees), Lucas County (3934 employees), and Kroger, Inc. (retail grocery; 2747 employees) (Regional Growth Partnership 2010).

Transportation and warehousing also support the economy in Lucas County. The Toledo-Lucas County Port Authority maintains freight transportation hubs for rail, trucking, and shipping. Sixteen terminal operators are located at the Port of Toledo on Lake Erie, providing access to the Great Lakes Saint Lawrence Seaway; they involve grain and food storage (ADM Grain Company, The Andersons, Hansen Mueller), fuel storage (BP-Husky Refining, Seneca Petroleum, and Sunoco MidAmerica M&R), and other operations. Toledo is a major railroad hub for Canadian National (North American), CSX Transportation (CSX), and Norfolk Southern Railway (Regional Growth Partnership 2010).

Between 2000 and 2010, Lucas County lost 11,000 jobs. Job losses occurred primarily in construction, manufacturing, and the wholesale and retail trade sectors, with fewer job losses in other sectors of the economy. The county gained jobs in the educational services/healthcare/social assistance sector and the arts/entertainment/recreation and accommodation/food services sectors. Between 2000 and 2010, the unemployment rate for the county increased from 4.5 percent to 11.3 percent. In the State of Ohio, the unemployment rate in 2010 was 10.1 percent (USBLS 2012).

Heavy Construction Workforce in Economic Impact Area

A portion of the existing construction workforce in Monroe, Wayne, and Lucas Counties is engaged in the type of heavy craft construction work that would be required for building a nuclear power plant facility. Detroit Edison identified the following types of heavy craft construction workers who would be employed for construction of Fermi 3: supervisors, boilermakers, brick and stone masons, carpenters, laborers, paving and surfacing workers, operating engineers, electricians, insulation workers, plumbers and steamfitters, rebar workers, sheet metal workers, and millwrights (Detroit Edison 2011a).

Table 2-31 provides an estimate of the size of the labor pool for the metropolitan areas that include Monroe and Wayne Counties in Michigan and Lucas County, Ohio, for the types of workers that would be needed for construction of Fermi 3. The review team notes that the total estimates do not equal the sum for detailed occupations because total estimates include occupations not shown separately. Included in the total are occupations within the extraction industry (e.g., drilling and mining) and other construction occupations that are not occupations that would be used for constructing Fermi 3. However, also included in the total are

Table 2-31. Construction Industry Occupational Employment Estimates in the Economic Impact Area[a] in 2008

Occupation Title[b]	Monroe, Michigan MSA	Detroit-Livonia-Dearborn, Michigan Metropolitan Division	Toledo, Ohio MSA
Boilermakers	–[c]	120	70
Brickmasons and blockmasons	–	550	160
Carpenters	160	2200	1850
Cement masons and concrete finishers	70	320	340
Stonemasons	–	–	–
Construction laborers	330	2380	1320
Paving, surfacing, and tamping equipment operators	–	120	50
Operating engineers and other construction equipment operators	130	1570	600
Electricians	210	3660	1340
Insulation workers: floor, ceiling, and wall	–	–	–
Insulation workers: mechanical	–	–	–
Painters, construction, and maintenance	–	790	420
Reinforcing iron and rebar workers	–	–	–
Plumbers, pipefitters, and steamfitters	210	1860	1120
Sheet metal workers	–	430	460
Structural iron and steel workers	100	190	150
Millwrights[d]	40	1140	–
Total construction and extraction occupations[e]	1850	19,430	11,410

Source: USBLS 2008

(a) Data are presented by the USBLS for metropolitan areas that include the counties identified as the economic impact area. The geographical area for the Monroe MSA is Monroe County, and the geographical area for the Detroit-Livonia-Dearborn Metropolitan Division is Wayne County. However, the geographical area for the Toledo MSA includes Fulton, Ottawa, and Wood Counties as well as Lucas County, Ohio.

(b) The occupational titles presented are those occupations that Detroit Edison plans to use for construction of Fermi 3.

(c) – = Data are not reported for this occupation type.

(d) Millwrights are classified by the USBLS under the Installation, Maintenance, and Repair Occupations.

(e) Included in the total are occupations within the extraction industry (e.g., drilling and mining) and other construction occupations, which are not occupations that would be used to construct Fermi 3. However, included in the total are construction occupations that would be used by Detroit Edison to construct Fermi 3 but have not been reported by USBLS by construction type. Therefore, total estimates do not equal the sum for detailed occupations because total estimates include occupations not shown separately. Estimates do not include self-employed workers.

construction occupations that would be used by Detroit Edison to construct Fermi 3, but have not been reported by USBLS by construction type. Estimates do not include self-employed workers.

Table 2-32 provides the 2016 employment projections for the types of heavy craft construction workers who would be employed for building Fermi 3. The State of Michigan forecasts a modest growth in all of the major craft occupations; the State of Ohio also forecasts growth in the major craft occupations, except for sheet metal workers and millwrights (Michigan

Table 2-32. Michigan and Ohio Construction Labor Force by Major Craft Occupation

	Michigan			Ohio		
Construction Category	**2006 Actual**	**2016 Projected**	**Net Change**	**2006 Actual**	**2016 Projected**	**Net Change**
Construction and Extraction Occupations[(a)]	184,180	195,890	+11,710	246,120	263,130	+17,010
Boilermakers	520	580	+60	590	670	+80
Brickmasons and blockmasons	4740	5220	+480	6510	7180	+670
Carpenters	31,710	33,710	+2000	41,220	44,930	+3710
Cement masons and concrete finishers	4140	4490	+350	6610	7340	+730
Stonemasons	260	280	+20	440	490	+50
Construction laborers	27,240	29,330	+2090	32,330	35,270	+2940
Paving, surfacing, and tamping equipment operators	2250	2420	+170	1810	1930	+120
Operating engineers and other construction equipment operators	9090	9680	+590	12,080	12,950	+870
Electricians	24,000	25,070	+1070	30,190	30,400	+210
Insulation workers: floor, ceiling, and wall	480	530	+50	1160	1230	+70
Insulation workers: mechanical	480	510	+30	560	600	+40
Painters, construction, and maintenance	8580	9090	+510	12,620	13,970	+1350
Reinforcing iron and rebar workers	170	200	+30	900	1020	+120
Plumbers, pipefitters, and steamfitters	15,060	15,760	+700	18,120	19,110	+990
Sheet metal workers	4960	5190	+230	5770	5750	–20
Structural iron and steel workers	1600	1650	+50	2690	2780	+90
Millwrights[(b)]	5500	5520	+20	5410	4550	–860

Sources: Michigan Department of Energy, Labor, and Economic Growth 2010b; Ohio Department of Job and Family Services 2008

(a) Total estimates do not equal the sum for detailed occupations because total estimates include occupations not shown separately. Estimates do not include self-employed workers.

(b) Millwrights are classified by the USBLS under the installation, maintenance, and repair occupations.

Department of Energy, Labor and Economic Growth 2010b; Ohio Department of Job and Family Services 2008).

Detroit Edison identified the following occupations specific to the operations workforce for Fermi 3: management, operations, engineering, maintenance, outage and planning, major modification and site support, organizational effectiveness, radiation protection, training, security, supply chain management, and telecommunications (Detroit Edison 2011a).

Table 2-33 lists the 2006 statewide labor force and the 2016 projections for the statewide labor force for occupational categories that correspond to the operations workforce that would be required for Fermi 3. The State of Michigan forecasts growth in most of the occupations that support operations, especially in the occupations with broad applications in multiple industries (Michigan Department of Energy, Labor, and Economic Growth 2010b). The State of Ohio also

Table 2-33. Michigan and Ohio Nuclear Operations Labor Force by Occupation

	Michigan			Ohio		
Occupation	**2006**	**2016 Projected**	**Net Change**	**2006**	**2016 Projected**	**Net Change**
General and operations managers	36,460	35,450	–1010	56,770	54,430	–2340
Accountants and auditors	34,290	38,230	+3940	49,080	54,050	+4970
Computer software engineers Applications and systems software	19,420	24,400	+4980	23,770	31,760	+7990
Network and computer system Administrators	7850	9270	+1420	12,020	14,510	+2490
Chemical engineers	1050	1160	+110	1530	1570	+40
Civil engineers	6190	6870	+680	5990	6460	+470
Electrical engineers	6370	6790	+420	4440	4500	+60
Mechanical engineers	24,730	25,970	+1240	11,350	10,630	–720
Nuclear technicians	90	90	0	400	400	0
Security guards	25,360	27,600	+2240	31,390	33,680	+2290
Office and administration support	699,660	723,590	+23,930	917,670	943,850	+26,180
Nuclear power reactor operators	–[(a)]	–	–	150	160	+10
Power distributors and dispatchers	490	470	–20	160	140	–20
Power plant operators	1640	1680	+40	1260	1220	–40
Stationary engineers and boiler operators	1310	1320	+10	2080	1970	–110

Sources: Michigan Department of Energy, Labor, and Economic Growth 2010b; Ohio Department of Job and Family Services 2008

(a) – = Data are not reported for this occupation type.

forecasts growth in the occupations with broad applications, but it also forecasts modest declines in general and operations managers, mechanical engineers, power distributors and dispatchers, power plant operators, and stationary engineers and boiler operators (Ohio Department of Job and Family Services 2008).

2.5.2.2 Taxes

This section describes the State and local tax structure and tax revenue for jurisdictions in the area of the proposed Fermi 3.

State

Income and sales taxes are the principal sources of tax revenues for the States of Michigan and Ohio, accounting for more than half of the tax receipts for fiscal year (FY) 2009 in both States (Table 2-34). Corporate taxes account for 12 percent of tax revenues in Michigan and Ohio. Most of the tax revenues go to a general fund that supports various State activities in both Michigan and Ohio, as defined in each State's budget. The State of Michigan also receives a portion of property tax revenue from a State education tax, which is collected at the local level. The State education tax supports the State School Aid Fund, which, along with 2 percent of the sales tax and contributions from other sources, allows the State to provide an equitable redistribution of school aid throughout the State. All local school districts are provided with a minimum allowance per pupil, which has lowered the spending gap between low- and high-spending school districts.

Table 2-34. Tax Revenue for the States of Michigan and Ohio

	FY 2009[a] Net Receipts in 1000s (percent of total)			
	Michigan		Ohio	
Tax Source	Dollars	Percent	Dollars	Percent
Individual income	6,071,541	29	8,228,349	39
Sales and Use	7,417,881	35	7,276,288	34
Corporate	2,602,517	12	2,443,059	12
State education	2,145,886	10	–[b]	–
Cigarettes	984,028	5	924,764	4
Motor vehicle fuel	957,202	5	1,743,151	8
Other taxes and fees[c]	890,287	4	648,284	3
Total	**21,069,342**		**21,263,895**	

Sources: Michigan Department of Treasury 2010; Ohio Office of Management and Budget 2009

(a) FY 2009 for the State of Michigan is October 1, 2008, through September 30, 2009. FY 2009 for the State of Ohio is July 1, 2008, through June 30, 2009.

(b) – = The State of Ohio does not collect a State education tax.

(c) Includes real estate transfer tax, airport parking tax, convention center utility tax, and others.

Tax rates for income, sales and use, corporate, and State education in the States of Michigan and Ohio are shown in Table 2-35.

Table 2-35. Tax Rates in the States of Michigan and Ohio

Tax Source	2009 Tax Rates	
	Michigan	**Ohio**
Individual income	4.35 percent[a]	0.618 percent on the first $5000 of income to 6.24 percent on the amount in excess of $200,000[b]
Sales and Use[c]	6 percent[d] [e]	5.5 percent
Corporate [f]	Income: 4.95 percent Modified gross receipts: 0.8 percent	Gross receipts: 0.26 percent
State education	$6 per $1000 of assessed value	–[g]

Sources: Citizen Research Council of Michigan 2011; Ohio Department of Taxation 2009

(a) Rate applies from 2007 through 2011, decreasing annually thereafter through 2015, at which time the rate is set at 3.9 percent.
(b) The State of Ohio enacted a 4.2 percent annual across-the-board tax rate reduction between 2005 and 2009. In 2010, the State Tax Commission is required to adjust the tax rate for each income bracket based on inflation.
(c) Michigan has no city, local, or county sales tax. The county sales tax rate for Lucas County, Ohio, is 1.25 percent, which is in addition to the 5.5 percent State sales tax.
(d) 2 percent of the sales and use tax is dedicated to the School State Aid Fund.
(e) Sales of electricity, natural gas, and home heating fuels for residential use are taxed at a rate of 4 percent; commercial and industrial users are taxed at a rate of 6 percent.
(f) For Michigan, this is the Michigan business tax. For Ohio, this is the commercial activity tax, which replaced the corporation franchise tax as of 2009.
(g) – = The State of Ohio does not collect a State education tax.

Local

Table 2-36 presents the total revenue, property tax revenue, percent of total revenues, and millage rate for property taxes (property tax rate per $1000) for each county in Monroe, Wayne, and Lucas Counties.

In the State of Michigan, local jurisdictions have taxing authority for income (cities only), selected sales revenue (i.e., hotel accommodations and stadium and convention facilities), and various property taxes.

Under the Michigan Uniform City Income Tax Act, individual cities in Michigan may adopt a city uniform income tax. Generally, the rate is 1 percent for residents and corporations and 0.5 percent for nonresidents with earnings in the imposing city. Cities with populations larger than 750,000 may impose rates up to 2.5 percent on residents, 1.0 percent on corporations, and 1.25 percent on nonresidents (Citizen Research Council of Michigan 2011). Cities with income taxes in Wayne County include Detroit (2.5 percent for residents, 1.0 percent for corporations,

Table 2-36. Property Tax Revenue and Millage Rates for Monroe, Wayne, and Lucas Counties (FY 2009)

Rates and Revenues	Monroe County	Wayne County	Lucas County
Tax revenues			
Total revenue[(a)]	$64,974,874	$522,088,000	$248,270,000
Total property tax revenue	$32,028,207	$364,895,000	$102,305,000
Percent of total revenues	49	70	41
Millage rates			
Direct county millage rate[(a)]	4.8	6.6	2.0
Overlapping rates[(b)]			
Cities and village	10.33 to 18.96	11.43 to 38.95	0.80 to 7.00
Townships	0.70 to 9.66	2.36 to 14.04	4.80 to 24.25
School districts[(c)]	28.95 to 37.99	18.00 to 33.50	46.85 to 125.85
Intermediate school districts	3.46 to 7.28	3.37 to 4.75	–[(d)]

Sources: Monroe County Finance Department 2009; Wayne County Department of Management and Budget 2009; Lucas County Auditor's Office 2009

(a) General Fund only.

(b) Millage rates for special districts, special authorities, and other community facilities (e.g., libraries, community colleges) are not shown.

(c) Millage rates for school districts in Monroe and Wayne Counties includes 6 mills for the State School Aid Fund.

(d) – = Lucas County does not have a separate tax rate for intermediate school districts.

and 1.25 percent for nonresidents); Hamtramck (1.0 percent for residents, 1.0 percent for corporations, and 0.5 percent for nonresidents); and Highland Park (2.0 percent for residents, 2.0 percent for corporations, and 1.0 percent for nonresidents). None of the cities in Monroe County impose income taxes (Citizen Research Council of Michigan 2011).

Property taxes are the primary source of revenue in Monroe and Wayne Counties. As shown in Table 2-36, property taxes represent 49 percent of total revenue in Monroe County. In Wayne County, property tax revenue represents 70 percent of total county revenue (Monroe County Finance Department 2009; Wayne County Department of Management and Budget 2009).

Millage for local school districts in Michigan is limited to the lesser of 18 mills or the 1993 millage rate (when the State School Aid Fund was established) because the State funds most of the operating expenses for schools. In addition, principal residences, industrial personal property, and qualified agricultural property are entirely exempt from school millages, and commercial personal property is partially exempt. However, if the per-pupil foundation allowance falls below the State minimum allowance, school districts may reduce the exemption on principal residence and qualified agricultural property or may levy additional mills on all property to generate the per-pupil allowance. School districts may also levy taxes to fund capital expenditures. In 2009, the State average millage rate, including the 6-mill State education tax, was 39.13 mills (Citizen Research Council of Michigan 2011).

Millage rates for county property tax revenue and revenue of overlapping jurisdictions in Monroe and Wayne Counties are shown in Table 2-36.

In the State of Ohio, only the State and counties may levy a general sales tax; however, cities, villages, and townships may also levy sales taxes on accommodations and admissions. In addition to the State, cities and villages in Ohio may levy income taxes. All local jurisdictions may levy property taxes, including schools and other special districts (i.e., fire, water, and sewer). Property taxes are the primary source of revenue in Lucas County.

As of 2006, 566 municipalities (235 cities and 331 villages) in the State of Ohio levied an income tax. The tax rates are flat rates, and the maximum rate allowed under State law is 1 percent without voter approval. In 2006, municipal income tax rates ranged from 0.30 percent to 3 percent (Ohio Department of Taxation 2009).

As shown in Table 2-36, property taxes represent 41 percent of total revenue in Lucas County (Lucas County Auditor's Office 2009).

Fermi 2

The major State and local taxes paid by Detroit Edison are the Michigan business tax, property tax, and sales tax on purchases of goods and services for operation and maintenance of the plant. In addition, consumers of electricity pay a State sales tax on the electricity used, which is collected by Detroit Edison and paid to the State of Michigan.

Detroit Edison paid $149 million in combined Federal and State income tax in 2007 (Detroit Edison 2010e). Detroit Edison estimates that it paid, on average, $1.154 million per year in direct sales taxes (those taxes generated by direct expenditures for operation and maintenance of the plant site and capital expenditures) during the years 2002 through 2007. An additional $4.44 million in indirect sales tax revenues was generated, benefitting the States of both Michigan and Ohio (Detroit Edison 2011a). Indirect sales tax revenue is based on expenditures by workers as a portion of their take-home salary.

Table 2-37 shows the estimated State sales tax revenue based on electrical usage by consumers within the Detroit Edison service area in 2009.

Detroit Edison is also assessed property tax by local jurisdictions within Monroe County. Detroit Edison is the leading taxpayer in Monroe County. In 2009, its assessed value was $820 million, or 13.3 percent of the total county taxable assessed value, which includes the coal-fired Monroe Power Plant as well as Fermi 2. Over the past 9 years, Detroit Edison's assessed value has declined. In 2000, the assessed value of the Fermi plant was $1,146 million, or 25.4 percent of the total county taxable assessed value (Monroe County Finance Department 2009). In 2009, Detroit Edison paid a millage rate of approximately 47.33 mills, dispersed to the local

Table 2-37. Estimated Sales Tax Revenue from Electrical Usage by Consumers within the Detroit Edison Service Area in 2009[(a)]

Consumers	Usage[(b)] (MWh)	Total Revenue (in millions of $)	Sales Tax Rate[(c)]	Total Sales Tax Revenue (in millions of $)
Residential	14,625,206	1754	0.04	70
Commercial	18,190,402	1617	0.06	97
Industrial	9,932,275	687	0.06	41
Total				208

Source: DOE/EIA 2009

(a) Detroit Edison owns and operates eight fossil-fuel plants, one hydroelectric plant, and various oil or gas-fueled peaking units as well as Fermi 2 within the State of Michigan (Detroit Edison 2010e).

(b) Detroit Edison reports that approximately 14 percent of its power generation is nuclear (Detroit Edison 2010e).

(c) Detroit Edison reports that most of its customers are located within the State of Michigan (Detroit Edison 2010e). Therefore, the estimated sales tax revenue is based on the State of Michigan sales tax rate.

jurisdictions outlined in Table 2-38. Total property taxes paid by Detroit Edison for the Fermi 2 plant site are shown in Table 2-38.

Table 2-38. Estimated 2009 Property Tax for Detroit Edison

Jurisdiction	Millage in 2009	Total Estimated Tax in 2009 (in millions of $)
Monroe County – Operation	4.8	3.9
Monroe County – Senior Citizens	0.5	0.4
Monroe County Community College	2.18	1.8
Monroe County Library	1.0	0.8
Monroe Intermediate School District	4.75	3.9
Frenchtown Charter Township	6.8	5.6
Jefferson Schools	18.5	15.2
State Education Tax	6.0	4.9
Resort Authority	2.8	2.3
Total	47.33	38.8

Source: Monroe County Finance Department 2009

2.5.2.3 Transportation

This section provides an overview of the regional transportation facilities in the local area, including air, rail, and barge, that could provide service for the Fermi plant site. The discussion of the roads and highways in the local area focuses on the immediate vicinity of the Fermi site, where traffic impacts associated with the commute of the preconstruction, construction, and operational workforce to and from the Fermi site are more likely to occur. Commuter traffic beyond the immediate vicinity of the site would be dispersed and would not be expected to affect traffic patterns or level of service on more distant roadways.

Air

The largest commercial airport in the Fermi site region is DTW, located approximately 19 mi north of the Fermi plant site. DTW serves domestic and international passenger carriers and air cargo flights. In 2007, more than 467,000 annual flight operations went through DTW, serving more than 36 million passengers. In 2007, it was the 10th largest airport in the country, based on number of passengers served (DTW 2009).

Willow Run Airport is located 7 mi west of DTW and serves cargo, corporate, and general aviation flights. It is one of the country's largest airports for handling cargo air freight. DTW and the Willow Run Airport are operated by the Wayne County Airport Authority. There are numerous other cargo, passenger, and private airports in the Fermi site region. Table 2-39 lists the public airports in the vicinity of the Fermi plant site.

Table 2-39. Public Use Airports in the Local Area

Name	Location	Type of Operation	Distance from Fermi Site (mi)	Direction from Fermi Site
Wickenheiser Airport	Carleton, Michigan	General aviation	7	NW
Custer Airport	Monroe, Michigan	General aviation	9	W
Grosse Ile Municipal Airport	Detroit/Grosse Ile, Michigan	General aviation	11	NNW
Erie Aerodrome	Erie, Michigan	General aviation	18	SW
Detroit Metropolitan Wayne County Airport	Detroit, Michigan	Commercial, air taxi, general aviation	19	NNW
Willow Run Airport	Ypsilanti, Michigan	Commercial, air taxi, general aviation	24	NNW
Toledo Suburban Airport	Lambertville, Michigan	General aviation	25	SW
Gradolph Field Airport	Petersburg, Michigan	General aviation	25	W
Toledo Express Airport	Toledo, Ohio	Commercial, air taxi, general aviation	>40	SW
Coleman A. Young Municipal Airport	Detroit, Michigan	General aviation, air taxi	33	NNE

Source: AirNav.com 2009

Rail

Three major railway systems provide service to or at stations near the Fermi site because it is centrally located between Detroit and Toledo: Canadian National (CN), CSX, and Norfolk

Southern Railway (NS) (Monroe County Planning Department and Commission 2010). A rail spur from the main line CN railway extends into the Fermi site parallel to Enrico Fermi Drive. This rail spur allows large and heavy equipment to be transported to the plant site (Detroit Edison 2011a).

Shipping

Barges, freighters, and bulk cargo ships use Lake Erie in the vicinity of the Fermi site. Most of the barge traffic on Lake Erie near the Fermi site occurs to and from the Ports of Toledo, Detroit, and Monroe, which are part of the Great Lakes-St. Lawrence Seaway system, which connects shipments from the Atlantic Ocean to the Midwest. In 2008, 4232 vessels traveled through the seaway. During that same year, the Toledo port received 138 shipments and exported 126 shipments, and the Port of Detroit received 140 shipments and exported 49 shipments (St. Lawrence Seaway Management Corporation 2009). The Port of Monroe is not considered a major port but has received heavy equipment for the Fermi 2 power plant in the past. A barge slip and offloading area is located at the Fermi plant site; it was used to offload equipment during Fermi 2 construction, but is no longer in use (Detroit Edison 2011a).

Roads/Highways

The region within a 50-mi radius surrounding the Fermi site has a highly developed roadway network. I-75, which extends through Monroe County and Frenchtown Charter Township, is 2 mi east of the Fermi plant site and provides access from the Fermi site north to Detroit and south to Toledo. I-275 splits from I-75 north of the Fermi plant site and continues in a northwesterly direction, providing a western bypass around the Detroit metropolitan area, and access to the DTW, western Wayne County, and Oakland County. It connects to I-94 and I-96, which are the primary Michigan east-west interstates.

The main entrance to the site is at Enrico Fermi Drive, which connects to N. Dixie Highway after crossing Toll Road and Leroux Road. N. Dixie Highway links the site to local communities north and south and connects to many other key local and regional highways. To the south, N. Dixie Highway provides access to I-75 at an interchange approximately 6.2 mi southwest of the site. It also intersects Nadeau Road south of the site, which provides another interchange with I-75 approximately 6 mi west of the site. To the north, N. Dixie Highway intersects with Swan Creek Road, which has an interchange with I-75 approximately 6 mi to the northwest of the Fermi site.

Existing roadways in the vicinity of the Fermi site are shown on Figure 2-16. The average daily traffic (ADT) volume for these roadways is shown on Table 2-40. Most of the roads in the area, excluding I-75 and N. Dixie Highway, are low-volume roads, with an ADT of fewer than 5000 vehicles per day. These traffic volumes are generally below the capacity of the roads (Mannik & Smith Group, Inc. 2009).

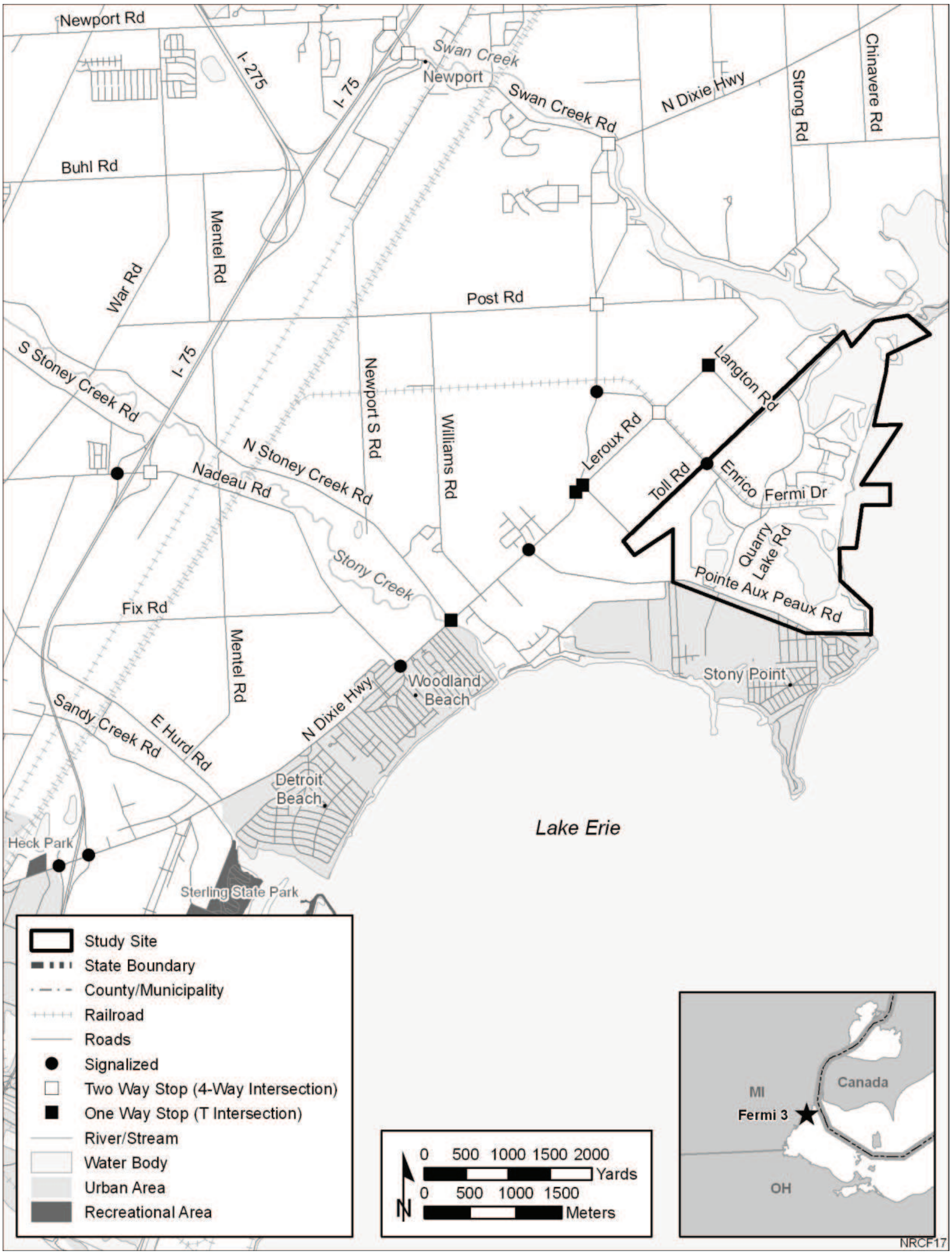

Figure 2-16. Local Roadways near the Fermi Site (Mannik & Smith Group, Inc. 2009)

Table 2-40. Existing Average Daily Traffic Volumes on Local Roadways

Roadway	Weekday ADT	Weekend ADT
I-75, N. Dixie Highway to Nadeau Road	16,800	–[(a)]
I-75, I-275 to Newport/Swan Creek Road	31,200	–
N. Dixie Highway, I-75 to Nadeau Road	12,700	–
N. Dixie Highway, Stony Creek to Pointe Aux Peaux Road	8494	7219
N. Dixie Highway, south of Enrico Fermi Drive	4307	–
Nadeau Road	5300	–
Pointe Aux Peaux Road	4110	3766
Swan Creek Road	4300	–
Enrico Fermi Drive	2378	611
Post Road, east of N. Dixie Highway	275	260
Leroux Road	124	125

Source: Mannik & Smith Group, Inc. 2009
(a) – = ADT volumes were not collected during the weekend for these roadways.

In May 2009, Detroit Edison performed a level of service (LOS) analysis for the intersections of these roadways during the peak traffic periods associated with the arrival and departure of Fermi plant employees during normal operations. LOS is a designation of operational conditions on a roadway or intersection, ranging from A (best) to F (worst). LOS categories as defined in the *Highway Capacity Manual* are listed on Table 2-41. The LOS analysis was conducted in accordance with the Transportation Research Board's *Highway Capacity Manual* to evaluate the operational efficiency at each intersection and its approaching roadway(s). This analysis was conducted to determine the baseline conditions from which the traffic impacts associated with construction and operation of Fermi 3 could be compared. Table 2-42 provides the LOS at local intersections during the morning and afternoon commutes to and from the Fermi plant site. All intersections in the immediate vicinity of the Fermi plant site operated at acceptable LOSs. The Mannik & Smith Group identified deficiencies at three intersections associated with the I-75 interchanges (Mannik & Smith Group, Inc. 2009):

- Northbound I-75 ramp, left turn to westbound Nadeau Road
- Northbound I-75 ramp, left turn to westbound Swan Creek Road
- Southbound I-75 ramp, northbound approach at Swan Creek Road.

Mannik & Smith Group, Inc. determined that beyond the immediate vicinity of Fermi 2, the traffic associated with the Fermi workforce would not be distinguishable from the ADT volumes on major commuting routes, such as I-75. Therefore, the traffic analysis did not encompass the entire economic impact area. The review team reviewed the traffic analysis prepared by The Mannik & Smith Group, Inc., and concurred with the findings.

Table 2-41. Level of Service Categories

Level of Service	Definition
Intersections with signals	
A	Acceptable: little or no delay, few vehicles stopped at intersection
B	Acceptable: short traffic delays, progression is still good
C	Acceptable: average traffic delays, many vehicles go through intersection without stopping, but a significant amount are stopped
D	Acceptable (marginal): long traffic delays, unfavorable progression, more vehicles stopped at intersection, individual cycles may fail
E	Moderately deficient: very long traffic delays, individual cycles frequently fail
F	Deficient: extreme traffic delays, over-saturation
Intersections with no signals	
A	Acceptable: primarily free flow
B	Acceptable: reasonably free flow
C	Acceptable: stable flow
D	Acceptable (marginal): marginal congestion
E	Moderately deficient: unstable congestion
F	Deficient: very congested

SEMCOG is the region's designated metropolitan planning organization for regional transportation planning. Short-range (e.g., 2008 to 2011) priorities for funding by cities, county road commissions, transit agencies, and the Michigan Department of Transportation are included on a list called the Transportation Improvement Program (TIP), which is regularly updated (SEMCOG 2009c). Projects funded under the TIP are drawn from the long-range RTP, the latest version of which is the *Direction 2035 Regional Transportation Plan for Southeast Michigan* (SEMCOG 2009d). Included in the RTP are more than 1500 projects throughout southeast Michigan that address roadway congestion and safety, bridges, bicycling/walking, public transit, and freight transport.

Specific transportation projects in the vicinity of the Fermi site that are included in either the TIP or the RTP include adding a center left-turn lane on N. Dixie Highway. Improvements between Grand Boulevard and Stony Creek Road were completed in 2008; improvements between Stony Creek Road and Swan Creek Road are still pending (Brudzinski 2011). Other projects identified in the TIP were roadway resurfacing projects on some of the roadways in the vicinity of the Fermi site. None of the deficiencies identified in the LOS analysis are currently addressed by roadway improvements in the TIP or the RTP (SEMCOG 2009c, d).

Public transportation in Monroe County is provided by the Lake Erie Transportation Commission. The Lake Erie Transportation Commission operates a bus service called the Lake Erie Transit (LET). It has eight fixed routes serving the City of Monroe and Monroe Charter and Frenchtown Charter Townships. The Lake Erie Transportation Commission also provides a

Table 2-42. Existing Level of Service in 2009 on Area Roadway Intersections during Peak Morning and Afternoon Workforce Commutes

Intersection	Approach/Movement	LOS Peak Morning	LOS Peak Afternoon
Northbound I-75 ramps and Dixie Hwy.	Northbound ramp	C	C
	N. Dixie Hwy./eastbound	A	A
	N. Dixie Hwy./westbound	A	A
Northbound I-75 ramps and Nadeau Rd.	Northbound ramp/left turn	F	D
	Northbound ramp/right turn	Free	Free
	Nadeau Rd./eastbound/thru/left turn	A	A
	Nadeau Rd./westbound	Free	Free
Northbound I-75 ramps and Swan Creek Rd.	Northbound ramp/left turn	D	E
	Northbound ramp/right turn	B	B
	Swan Creek Rd./southeast-bound	Free	Free
	Swan Creek Rd./northwest-bound	A	A
Southbound I-75 ramps and Swan Creek Rd./ Newport Rd.	Southbound ramp (northbound approach)	C	E
	Newport Rd./northwest-bound	A	A
	Newport Rd./southeast-bound	A	A
	Swan Creek Rd./southbound	A	D
N. Dixie Hwy. and Stony Creek Rd.	Stony Creek Rd./eastbound	C	C
	North Dixie Hwy./northbound	A	A
	North Dixie Hwy./southbound	Free	Free
N. Dixie Hwy. and Pointe Aux Peaux Rd.	N. Dixie Hwy./northeast-bound	B	B
	North Dixie Hwy./southwest-bound	A	C
	Pointe Aux Peaux Rd./northwest-bound	B	B
N. Dixie Hwy. and Leroux Rd.	Leroux Rd./southwest-bound	B	B
	North Dixie Hwy./northbound	Free	Free
	North Dixie Hwy./southbound	A	A
N. Dixie Hwy. and Enrico Fermi Dr.	N. Dixie Hwy./northbound	A	A
	N. Dixie Hwy./southbound	A	B
	Enrico Fermi Dr./westbound	C	B
N. Dixie Hwy. and Post Rd.	Post Rd./eastbound	C	C
	Post Rd./westbound	B	B
	North Dixie Hwy./northbound	A	A
	North Dixie Hwy./southbound	B	A
Enrico Fermi Dr. and Leroux Rd.	Leroux Rd./northeast-bound	B	A
	Leroux Rd./southwest-bound	A	A
	Enrico Fermi Dr./southeast/northwest	Free	Free

Dial-a-Ride program for residents in Frenchtown Charter and Bedford Townships; residents are transported from their homes to any destination within the township or to one of the LET fixed lines. Ridership is approximately 400,000 persons annually (LET undated). For the 2007 fiscal year, LET served 358,196 passengers (Michigan Department of Transportation 2009). None of the routes provided by LET directly access the Fermi plant site.

2.5.2.4 Aesthetics

The location of Fermi 3 would be within the existing Fermi site along the Lake Erie shoreline. Elevations at the site range from lake level to 25 ft above lake level. Existing plant structures include the decommissioned Fermi 1, Fermi 2 (operating), and two 400-ft-tall cooling towers. The cooling towers, neutral gray concrete in color, are the predominant visible structures on the site and are visible from outside the site property boundaries in all directions. Topography in the vicinity of the plant site is fairly flat, with some lower elevation wetland areas along the Lake Erie shoreline, including the Fermi site and the surrounding DRIWR.

Surrounding land use is predominantly agricultural, with some residential areas that are within the viewshed of the plant site. Several small beach communities are located along the Lake Erie shore within 5 mi of the Fermi plant site, including Estral Beach, Stony Point, Detroit Beach, and Woodland Beach. Several public and private beaches are located along the Lake Erie shoreline in Monroe and Wayne Counties. Many small marinas and docks are also located along the Lake Erie shoreline within the vicinity and viewshed of the Fermi site. Lake Erie provides a wide variety of water-related recreational opportunities, and recreational boating on Lake Erie is an important resource to the State. The Fermi site and buildings are easily viewed by boaters in Lake Erie.

Recreational facilities and areas in Monroe, Wayne, and Lucas Counties offer a wide variety of active and passive recreational opportunities such as boating, swimming, hiking, camping, picnicking, and bird watching. The following discussion focuses on major parks and recreational facilities in the local area and their management and highlights prominent park features.

The DRIWR is one of the largest Federally managed recreational and conservation lands in the local area. It encompasses 656 ac of the Fermi site and is managed by the FWS. The DRIWR's acquisition boundary extends 48 mi along the Lake Erie shoreline from the Detroit River to the River Raisin, with lands that can be acquired as they become available. Although the portion of the DRIWR that is within the Fermi site is not open to the public, other portions are open and provide opportunities for hunting, fishing, and wildlife observation. The River Raisin National Battlefield Park, located in Monroe County, is also under Federal control. Located approximately 7 mi from the Fermi site, it is a recent addition to the National Park System. The park and visitor center had been operated previously by the Monroe County Historical Society and the Monroe County Historical Commission.

State recreational areas in Monroe County total 7413 ac and include Sterling State Park and three game areas – Point Mouillee State, Petersburg State, and Erie State – as well as several boat access sites and road rest areas. The two Fermi 2 cooling towers are visible from Point Mouillee State Game Area (3.1 mi to the northeast) and Sterling State Park (4.8 mi to the south-southwest). Point Mouillee State Game Area (3466 ac) is one of the largest freshwater marsh restoration projects in the world. Waterfowl, shorebirds, and other wetland wildlife are the primary attraction at this site. Sterling State Park (1300 ac) is the only State Park on the Lake Erie shoreline of Michigan. It has campgrounds, beach access, a boat launch, a playground, and nature trails.

The Huron-Clinton Metropolitan Authority (HCMA) is a regional special park district encompassing Wayne, Oakland, Macomb, Washtenaw, and Livingston Counties. The HCMA operates 13 Metroparks totaling 23,630 ac. These Metroparks are located along the Huron and Clinton Rivers, providing a greenbelt around the Detroit metropolitan area. The parks are generally more than 1000 ac each, with Stony Creek and Kensington being more than 4300 ac.

Monroe County, Wayne County, and the City of Detroit also manage a number of parks and recreational facilities. Several regional recreational trail and greenway initiatives include the Detroit Heritage River Water Trail, Downriver Linked Greenways Initiative, and Southeast Michigan Greenways Initiative.

Lucas County contains many Federal, State, and local park and conservation lands. Along Lake Erie is the Ottawa National Wildlife Refuge (NWR) Complex, which consists of three NWRs and a waterfowl production area. The Cedar Point NWR, West Sister Island NWR, and a portion of the Ottawa NWR are located in Lucas County. State lands include the 2202-ac Magee Marsh Wildlife Refuge, the 3101-ac Maumee State Forest, and the 1336-ac Maumee Bay State Park (ODNR 2009a).

The Metroparks in and around the Toledo area encompass 11 parks, totaling 10,500 ac. These parks provide a variety of passive and active recreational opportunities and preserve the natural and cultural features of the area.

2.5.2.5 Housing

This section provides an overview of the housing market in Monroe, Wayne, and Lucas Counties, including information on the housing stock, vacancy rates, house values, rental costs, and basic services. Also included is information about short-term accommodations, including hotels and motels, and sites for recreational vehicles (RVs), which could support the temporary construction workers as well as outage workers.

As shown in Table 2-43, the USCB identified more than 1 million housing units in Monroe, Wayne, and Lucas Counties in 2010. The vacancy rate within the three counties ranged

Table 2-43. Selected Housing Characteristics for Monroe, Wayne, and Lucas Counties, 2010

Characteristics	Monroe County	Wayne County	Lucas County
Total Housing Units	62,930	826,328	202,659
Occupied	58,298	690,943	179,000
Owner-occupied (number of units)	47,048	464,603	116,420
Owner-occupied (percent)	80.7	67.2	65.0
Renter-occupied (number of units)	11,250	226,340	62,580
Renter-occupied (percent)	19.3	32.8	35.0
Vacant	4632	135,385	23,659
Vacancy Rate			
Homeowner (percent)	2.4	4.4	3.8
Rental (percent)	9.1	11.3	10.6
Units in Structure for Total Housing Units			
1 unit (number of units)	48,546	619,739	144,020
1 unit (percent)	77.0	75.0	71.1
2–4 units (number of units)	2749	67,387	18,355
2–4 units (percent)	4.4	8.2	9.1
5 or more units (number of units)	5764	124,878	34,860
5 or more units (percent)	9.2	15.1	17.2
Mobile homes (number of units)	5864	14,207	5401
Mobile homes (percent)	9.3	1.7	2.7
Other (boat, RV, van, etc.) (number of units)	7	117	23
Other (boat, RV, van, etc.) (percent)	<1	<1	<1
Lack of Services within Occupied Housing Units			
Lacking complete plumbing facilities (number of units)	209	4909	327
Lacking complete plumbing facilities (percent)	<1	<1	<1
Lacking complete kitchen facilities (number of units)	220	6617	1204
Lacking complete kitchen facilities (percent)	<1	1.0	<1
No telephone service available (number of units)	3060	36,793	6213
No telephone service available (percent)	5.2	5.3	3.5
>1 occupant/room (number of units)	545	15,135	1400
>1 occupant/room (percent)	<1	2.2	<1

Source: USCB 2010h

between 2.4 and 2.9 percent for owner-occupied housing and 11.3 and 14.4 percent for rental units, with Wayne County having the highest vacancy rates. Most of the housing units are owner-occupied single-family units, with owner occupancy highest in Monroe County. Occupied units generally offer basic services, including plumbing, kitchens, and telephone service.

Median housing costs for Monroe, Wayne, and Lucas Counties in 2010 are provided in Table 2-44. Housing costs are comparable throughout the area, although the median housing values tend to be higher in Monroe County, whereas the rental cost is slightly higher in Wayne County.

Table 2-44. Housing Costs for Monroe, Wayne, and Lucas Counties, 2010

Parameter	Monroe	Wayne	Lucas
Median Housing Value	$161,800	$121,100	$122,400
Median Monthly Cost			
Housing units with a mortgage	$1451	$1397	$1243
Housing units without a mortgage	$451	$486	$463
Median Monthly Rent	$733	$759	$631

Sources: USCB 2010h

SEMCOG provides regional housing information and trends for counties in southeast Michigan, including Monroe and Wayne Counties. SEMCOG reported that the number of mobile home parks and sites and amount of building permit activity in southeast Michigan as of 2008 indicated that Wayne County had 68 mobile home parks and 15,835 mobile home sites.

Monroe County had 29 mobile home parks and 7452 mobile home sites (SEMCOG 2008b). Monroe County reported that 17.2 percent of the surveyed sites were vacant in 2006 (Detroit Edison 2011a).

In 2008, Monroe County approved permits for the construction of 118 new housing units and the demolition of 44 housing units, resulting in a net increase of 74 new units. During the same year, permits for construction of 1062 new housing units and the demolition of 3498 housing units were approved in Detroit and the remainder of Wayne County, resulting in a net loss of 2436 units. Permits for residential construction have declined over the past few years in southeast Michigan. Data on building permit activity between 2005 and 2008 are provided in Table 2-45. These trends continued in 2009, with a net of 40 units approved in Monroe County and a loss of 101 units in Wayne County (SEMCOG 2010b).

The housing market has also been affected by foreclosures in southeast Michigan and in other areas of the country. The U.S. Department of Housing and Urban Development (HUD) has estimated housing foreclosures for each county in the country under its new Neighborhood

Table 2-45. Housing Construction Trends in Monroe and Wayne Counties, 2005–2008

Parameter	Wayne County				Monroe County			
	2005	2006	2007	2008	2005	2006	2007	2008
New building units	4864	2789	1422	1062	919	583	351	118
Demolitions	2419	1897	1976	3498	43	64	59	44
Net units	**2445**	**892**	**–554**	**–2436**	**876**	**519**	**292**	**74**

Source: SEMCOG 2010b

Stabilization Program, which provides grants for State and local governments and nonprofit organizations to acquire and redevelop foreclosed properties that may otherwise lead to abandonment and neighborhood decline (HUD 2008). HUD estimated the number of housing foreclosures in 2007 and the first six months of 2008 throughout the country. In Monroe County, HUD estimated that 2398 properties were in foreclosure, representing a rate of 6.5 percent of the housing units with a mortgage. In Wayne County, HUD estimated that 48,944 properties were in foreclosure, a rate of 11.2 percent of the housing units with a mortgage (HUD 2008).

SEMCOG forecasts a slow increase in the number of occupied units in Monroe County through 2035 (see Table 2-46). Wayne County experienced a decline in the number of occupied units between 1990 and 2008, with growth occurring in the next decade and through 2035.

Table 2-46. Historic and Forecasted Number of Occupied Units, 2020–2035

	Historical			Forecast Period		
County	1990	2000	2010	2020	2030	2035
Monroe	46,508	53,772	58,298	63,307	67,709	69,388
Wayne	780,535	768,440	690,943	717,116	738,524	747,632

Source: SEMCOG 2008a; USCB 2010h

Assuming that the average vacancy rate for Monroe and Wayne Counties remains constant, an estimated 4495 units would be vacant in 2020 in Monroe County and an estimated 62,389 units would be vacant in 2020 in Wayne County.

An estimated 375 short-term accommodation establishments are located within 50 mi of the City of Monroe; they include hotels and motels, bed and breakfast inns, cabins, cottages, condos, historic inns, and campgrounds (Detroit Edison 2011a). Table 2-47 provides an estimate of the number of RV sites within Wayne, Monroe, and Lucas Counties. Although the number of units in other short-term accommodation establishments has not been estimated, the review team assumes that some units would be available during construction of Fermi 3.

Table 2-47. Campground/Recreational Vehicle Sites near Fermi Plant Site

Name	Location	Number of Sites
Monroe County		
Covered Wagon Camp Resort	Ottawa Lake	140
Harbortown RV Resort	Monroe Township	250
Monroe County/Toledo North KOA	Summerfield	NR[a]
River Raisin Canoe Livery Campground	Dundee	19
River Raisin Marine and Campground	Monroe	
Totem Pole Park LLC	Summerfield	130
Camp Lord Willing Management RV Park and Campground	Frenchtown Township	110
KC Campground	Milan	100
Pirolli Park Campground	Summerfield	NR

Sources: Michigan Association of RV Parks and Campgrounds 2011; Pure Michigan 2011; Monroe County Parks Commission 2008
(a) NR = Not reported.

2.5.2.6 Public Services

This section provides information about water supply and wastewater treatment and police, fire response, and healthcare services available to the residents of Monroe, Wayne, and Lucas Counties. Educational services are discussed in Section 2.5.2.7.

Water Supply Services

Residents of Monroe, Wayne, and Lucas Counties obtain potable water through wells or municipal water supplies. The capacities of the major water suppliers servicing the local area are provided below.

<u>Monroe County</u>

Several municipal water suppliers provide water to residents of Monroe County, including the City of Monroe; Frenchtown Charter Township; City of Toledo, Ohio; and the DWSD. Table 2-48 shows the total treatment capacity, average daily flow, and maximum daily flow for these municipal water suppliers. Residents outside areas supported by these municipal suppliers obtain water through private wells (Monroe County Planning Department and Commission 2010).

The City of Monroe pumps and treats water from Lake Erie. It operates a joint intake and pumping facility with Frenchtown Charter Township. The city's water treatment and distribution system serves the City of Monroe and portions of the surrounding townships, including Monroe Charter, Raisinville, Exeter, Ida, and London. In addition, the City of Monroe supplies water in

Table 2-48. Capacity of Municipal Water Suppliers in Monroe, Wayne, and Lucas Counties

Municipal Water Supplier	Treatment Capacity (MGD)	Average Daily Flow (MGD)	Maximum Daily Flow (MGD)
City of Monroe[a]	18	7.8	10.9
Frenchtown Charter Township[a]	8	2.1	3.9
City of Milan[a]	2	1.2	NR[b]
Detroit Water and Sewage District[c]	1720	622	794
City of Toledo [c]	120	73	104

Sources: Monroe County Planning Department and Commission 2010; Ellenwood 2010; Leffler 2010
(a) 2005 data.
(b) NR = not reported.
(c) 2009 data.

bulk to the Village of Dundee and the City of Petersburg, serving an estimated population of 53,000 residents. The City of Monroe treatment plant has an 18 MGD treatment capacity. The average daily and maximum daily water demands for the service area provided by the City of Monroe treatment plant were 7.8 MGD and 10.9 MGD, respectively, in 2005 (Monroe County Planning Department and Commission 2010).

Frenchtown Charter Township shares the water intake with the City of Monroe and operates a water treatment plant that services approximately 20,000 residents and other nonresidential customers within the township. Frenchtown Charter Township also provides the potable water supply for the Fermi plant site. The average daily and maximum daily water demands for Frenchtown Charter Township in 2005 were 2.1 MGD and 3.9 MGD, respectively. The plant doubled its capacity from 4 to 8 MGD in 2006, which was projected to be sufficient for a minimum of 20 years (Monroe County Planning Department and Commission 2010).

The southern portion of Monroe County, including Bedford, Erie, and LaSalle Townships, and the City of Luna Pier receive water supplies through the City of Toledo, Ohio, water treatment and distribution system. Northern portions of Monroe County, including Ash Township, Berlin Township, and the Villages of Carleton, Estral Beach, and South Rockwood, receive water supplies either directly through the DWSD treatment and distribution system via the township, which then distributes the water to the villages, or wholesale from DWSD.

The City of Milan in Monroe County has its own water treatment plant, drawing from groundwater wells located within the city limits. The plant has a 2.0 MGD capacity and treats an average daily demand of 1.2 MGD (Monroe County Planning Department and Commission 2010).

Wayne County

Residents of Wayne County receive water from the Detroit Water and Sewerage Department (DWSD), which also supplies water to residents in the City of Detroit and 126 neighboring communities in all or portions of Oakland, Macomb, St. Clair, Lapeer, Genesee, Washtenaw, and Monroe Counties. The DWSD maintains three intake facilities that draw water from Lake Huron and the Detroit River and five water treatment plants. The total capacity of the treatment plants is approximately 1720 MGD. The average daily and maximum daily water demands in 2009 were 622 MGD and 794 MGD, respectively (DWSD 2004; Ellenwood 2010).

Lucas County

Residents in Lucas County are served by two municipal water suppliers. Toledo's water treatment and distribution system serves the city residents and portions of Lucas County, including the Cities of Maumee, Sylvania, and Perrysburg, and portions of Monroe County, Michigan, and Wood County, Ohio. Within the Collins Park Treatment Plant are two facilities, one with an 80-MGD treatment capacity and a second with a 40-MGD treatment capacity. In 2009, the average daily demand was 73 MGD, and the maximum daily demand was 104 MGD (Leffler 2010).

The City of Oregon's water treatment and distribution system serves city residents and portions of eastern Lucas County. Because of its distance from the Fermi 3 site, this public facility is not expected to be impacted and is not discussed further.

Wastewater Treatment Services

Monroe County

Wastewater treatment services are provided by a number of townships and municipalities in Monroe County, which service residential, commercial, and industrial customers within the City of Monroe; in Frenchtown Charter, Monroe Charter, Raisinville, Bedford, Berlin, Ida, York, LaSalle and Ash Townships; in the Cities of Milan, Petersburg, and Luna Pier; and in the Villages of Dundee, Carleton, and Maybee. Other residents within the county are served by private, onsite wastewater disposal systems (Monroe County Planning Department and Commission 2010). Table 2-49 shows the design flow, average daily flow, and maximum daily flow for the municipal wastewater treatment facilities that service these areas.

The following discussion focuses on wastewater treatment system for the City of Monroe, where the largest concentration of the construction and operation workforces associated with Fermi 3 would be expected to reside.

Table 2-49. Flows in Major Public Wastewater Treatment Facilities in Monroe, Wayne, and Lucas Counties

Municipal Wastewater Treatment Plant (WWTP)	NPDES Permit Date	Design Flow (MGD)[a]	Avg. Daily Flow (MGD)[b]	Max. Daily Flow (MGD)[b]
Monroe County				
City of Monroe (including Frenchtown Charter, Monroe Charter, and Raisinville Townships)	2010	24	15.9	67
Bedford Township	2007	6	–[c]	–
Berlin Township	2006	1.8	–	–
Ida and Raisinville Townships	2009	0.14	–	–
City of Milan (including York and Milan Townships)	2010	2.5	1.3	3.5
City of Petersburg	2010	0.2	0.12	0.85
City of Luna Pier (including LaSalle Township)	2011	0.35	0.24	0.58
Village of Dundee	2011	1.5	–	–
Village of Carlton (including Ash Township)	2010	0.74	0.39	0.95
Village of Maybee	2009	0.08	–	–
Wayne County				
Detroit Water and Sewage District	2008	930		
Grosse Ile Township	2008	2.5	2.5	10.5
City of Rockwood	2009	1.0	0.4	2.4
City of Trenton	2008	6.5	4.5	10.8
Wayne County Downriver WWTP	2008	125		
Lucas County				
Bayview WWTP		195	71	160

Sources: MDEQ 2011; McGibbeny 2010

(a) Basis of effluent limitations in NPDES permit.

(b) As reported in the NPDES application.

(c) – = Not available.

The Monroe Metropolitan Water Pollution Control System serves approximately 52,000 residents within the City of Monroe, large portions of Monroe Charter and Frenchtown Charter Townships, and a small portion of Raisinville Township. The plant has a design capacity of 24 MGD and average daily flow of 16 MGD, for an available capacity of about 34 percent during normal flow periods. During heavy rain events, the treatment plant can be overloaded from excessive stormwater and groundwater. The maximum daily flow that has occurred is 67 MGD (MDEQ 2011).

Wayne County

Residents of Wayne County are served by two large municipal wastewater treatment systems (WWTPs) (DSWD and the Wayne County Downriver WWTP) and by three small municipal systems (Grosse Ile Township, and the Cities of Rockwood and Trenton).

The DWSD owns and operates one of the largest single-site WWTPs in the United States. It serves the northern portion of Wayne County, including Detroit and portions of Macomb and Oakland Counties, a service area covering 946 mi^2 and 76 communities. The system includes four principal regional interceptors, 14 pumping stations, 3383 mi of sewers in Detroit, and an estimated 8770 mi in the suburban communities served by DWSD. Currently, DWSD's WWTP has a design flow of 930 MGD. The plant currently treats an average of 727 MGD (DWSD 2003; Ellenwood 2010).

Wayne County operates the Downriver WWTP located in Wyandotte, Michigan, which serves 13 communities in the remaining portions of Wayne County that are not served by the DWSD. It has a design flow of 125 MGD and treats an average daily flow of 52 MGD (MDEQ 2011; Hubbell, Roth, and Clark, Inc. 2009).

Lucas County

Lucas County residents are served by various wastewater treatment systems. The City of Toledo's Bayview WWTP is one of the largest wastewater treatment facilities in northwest Ohio. It provides treatment services to an area of approximately 120 mi^2 with a population of approximately 398,000 residents within the City of Toledo, City of Rossford, Villages of Walbridge and Ottawa Hills, and portions of Wood County, Lucas County, and the Village of Northwood. The total capacity of the system is 195 MGD. The average daily and maximum daily water demands in 2009 were 71 MGD and 160 MGD, respectively, for an available capacity of about 64 percent (Toledo Waterways Initiative 2009; McGibbeny 2010).

Police Services

Police jurisdictions operating in Monroe County include the City of Monroe Police Department, Monroe County Sheriff, and Michigan State Police. Municipal jurisdictions, including the Cities of Luna Pier and Milan, the Villages of Carleton and South Rockwood, and Erie Township also maintain police departments.

Police jurisdictions operating in Wayne County include the City of Detroit Police Department, the Wayne County Sheriff, and the Michigan State Police. More than 40 other jurisdictions within Wayne County also maintain police departments.

Police jurisdictions in Lucas County include the Lucas County Sheriff, the City of Toledo, the City of Oregon, and the City of Maumee. The Villages of Holland and Waterville and Sylvania Township also maintain police departments.

The number of law enforcement personnel employed in county and municipal governments in Ohio and Michigan is provided in Table 2-50. The ratio of law enforcement personnel per 1000 residents throughout the county (county and municipal jurisdictions combined) is provided in Table 2-51.

State Police also serve populations within Monroe, Lucas, and Wayne Counties. The Michigan State Police organization is divided into seven districts. Monroe and Wayne Counties are within District 2, which also includes Washtenaw, Macomb, St. Clair, and Oakland Counties. In 2008, the total number of law enforcement personnel employed by the Michigan State Police was 2907 full-time employees, which included 1830 officers and1077 civilians (FBI 2009). In March 2011, the Michigan State Police announced a regional restructuring plan involving a reduction in the number of posts from 62 to 29 and the redesignation of 12 posts as detachments. Although the plan results in fewer facilities, the number of State Police overall does not decrease (Michigan State Police 2011).

The Ohio State Highway Patrol is organized into nine districts. Lucas County is within District 1, which also includes Wood, Fulton, Henry, Defiance, Williams, Paulding, Putnam, Van Wert, Allen, and Hardin Counties. In 2008, the total number of law enforcement personnel employed by the Ohio State Highway Patrol was 2630 full-time employees, which included 1556 officers and 1074 civilians (FBI 2009).

Fire Response Services

Twenty-one jurisdictions within Monroe County have fire response services, primarily staffed by volunteer firefighters. Career firefighters staff the City of Monroe Fire Department and the Frenchtown Charter Township, with staffs of 37 and 33, respectively. Forty-five jurisdictions have fire response services within Wayne County, and 15 jurisdictions within Lucas County have fire response services. The largest fire departments within the economic impact area are in the City of Detroit, which has 48 stations and a staff of 1738, and in the City of Toledo, which has 17 stations and a staff of 508. Townships, cities, and villages in Monroe, Wayne, and

Table 2-50. Law Enforcement Personnel in Monroe, Wayne, and Lucas Counties

Jurisdiction[a]	Law Enforcement Personnel		
	Civilians[b]	Officers[c]	Total
County Sheriffs			
Monroe County	96	106	202
Wayne County	166	1064	1230
Lucas County	229	289	518
Municipal Police Departments			
Monroe County			
Carleton	1	3	4
Erie Township	1	5	6
Luna Pier	0	4	4
Milan	3	9	12
Monroe	5	40	45
South Rockwood	0	4	4
Wayne County			
Allen Park	4	44	48
Belleville	2	9	11
Brownstown Township	11	38	49
Canton Township	37	87	124
Dearborn	32	198	230
Dearborn Heights	25	85	110
Detroit	369	3032	3401
Ecorse	5	26	31
Flat Rock	3	24	27
Garden City	8	38	46
Gibralter	1	10	11
Grosse Ile Township	7	17	24
Grosse Pointe	2	25	27
Grosse Pointe Farms	13	35	48
Grosse Pointe Park	6	43	49
Grosse Pointe Shores	3	18	21
Grosse Pointe Woods	6	40	46
Hamtramck	0	44	44
Harper Woods	3	35	38
Huron Township	5	20	25
Inkster	10	58	68
Lincoln Park	10	51	61
Livonia	35	148	183
Melvindale	3	23	26
Northville	1	16	17

Table 2-50. (contd)

Jurisdiction[(a)]	Law Enforcement Personnel		
	Civilians[(b)]	Officers[(c)]	Total
Northville Township	12	34	46
Plymouth	1	15	16
Plymouth Township	15	31	46
Redford Township	17	64	81
River Rouge	1	19	20
Riverview	3	29	32
Rockwood	1	8	9
Romulus	18	55	73
Southgate	9	38	47
Sumpter Township	7	15	22
Taylor	15	92	107
Trenton	1	37	38
Van Buren Township	16	44	60
Wayne	10	39	49
Westland	25	100	125
Woodhaven	3	31	34
Wyandotte	10	38	48
Lucas County			
Holland	0	9	9
Maumee	15	45	60
Oregon	14	46	60
Sylvania Township	15	43	58
Toledo	134	639	773
Waterville	1	12	13
Total County Sheriff and Municipal Law Enforcement Personnel			
Monroe County			277
Wayne County			6957
Lucas County			973

Source: FBI 2009

(a) State police also serve populations within Monroe, Lucas, and Wayne Counties, but they are not included in these totals because they serve multiple jurisdictions.

(b) Civilians include personnel, such as clerks, radio dispatchers, meter attendants, jailers, correctional officers, and mechanics, who are full-time employees of the agency.

(c) Officers are individuals who ordinarily carry a firearm and a badge, have full arrest powers, and are paid from governmental funds set aside specifically for sworn law enforcement representatives.

Table 2-51. Population Served by Law Enforcement Personnel in Monroe, Wayne, and Lucas Counties

County	Law Enforcement Personnel	Population Served[(a)]	Law Enforcement Personnel per 1000 Residents (2010)
Monroe	277	152,021	1.8
Wayne	6822	1,820,584	3.7
Lucas	973	441,815	2.2

Source: FBI 2009
(a) 2010 population from the USCB (USCB 2010a, b).

Lucas Counties that maintain fire protection services are listed in Table 2-52. The number of fire response personnel per 1000 residents is provided in Table 2-53.

Healthcare Services

Mercy Memorial Hospital is staffed by 235 full-time physicians and 1100 full-time equivalent staff members and is the primary healthcare facility in Monroe County. It is also the primary treatment facility for any injury at the Fermi plant. There are 238 licensed beds in the hospital, and the daily average number of inpatients in 2010 was about 169. Mercy Memorial Hospital has recently undergone a major, $34 million renovation, which doubled the capacity of the emergency center from 25,000 to 60,000 patient visits per year and increased its capability to respond to higher-level traumas (Kreiger 2011). In 2007, the emergency center accommodated 42,040 patient visits (Mercy Memorial Hospital 2009).

Thirty-two hospitals are located in Wayne County, 17 of which are located in Detroit (Wayne County 2009). The largest healthcare providers, which operate multiple facilities, include the Henry Ford Health System (11,475 employees), the Detroit Medical Center (10,150 employees), and Oakwood Healthcare, Inc. (7510 employees) (Wayne County Department of Management and Budget 2008).

The Toledo/Lucas County area has 12 hospitals. The largest healthcare provider is Promedica Health Systems (11,265 employees), which operates several of the hospitals in the Toledo area, including the Toledo Hospital, Toledo Children’s Hospital, and Bay Park Community Hospital (City of Oregon). Another large healthcare provider in the Toledo area is Mercy Health Partners (6723), which operates the Mercy St. Vincent Medical Center, Mercy St. Charles Hospital (City of Oregon), Mercy St. Anne’s Hospital, and Mercy Children’s Hospital. The University of Toledo Medical Center is also located in Toledo.

Data on the number of healthcare workers employed in Monroe, Wayne, and Lucas Counties and the ratio of healthcare workers per 1000 residents are provided in Table 2-54. Healthcare workers are workers within the “healthcare practitioner and technical occupations,” and “healthcare support occupations” as defined by the U.S. Bureau of Labor Statistics, Standard Occupational Classification System.

Table 2-52. Fire Response Personnel in Monroe, Wayne, and Lucas Counties

Fire Department Name	Department Type	Number of Stations	Number of Personnel: Firefighters: Active (career)	Number of Personnel: Firefighters: Active (volunteer)	Number of Personnel: Firefighters: Active (paid per call)	Number of Personnel: Non-firefighting (civilian)	Number of Personnel: Non-firefighting (volunteer)	Total
Monroe County								
Ash Township Volunteer Fire Department	Volunteer	2	0	40	0	0	0	40
Bedford Fire Department	Volunteer	3	0	0	64	0	0	64
Bedford Fire Department 2	Volunteer	1	0	30	0	0	0	30
Berlin Charter Township Fire Department 1	Volunteer	1	0	0	28	0	0	28
Berlin Charter Township Fire Department 2	Volunteer	1	0	0	23	0	0	23
Dundee Township Fire Department	Volunteer	1	0	30	0	0	0	30
Erie Township Fire Department	Volunteer	1	0	22	0	0	0	22
Estral Beach Fire Department	Volunteer	1	0	8	0	0	6	14
Exeter Township Fire Department	Volunteer	1	0	0	26	0	0	26
Frenchtown Charter Township Fire Department	Mostly career	4	18	0	14	1	0	33
Ida Township Volunteer Fire Department	Volunteer	1	0	26	0	0	1	27
La Salle Volunteer Fire Department	Volunteer	1	0	24	0	0	0	24
London-Maybee-Raisinville	Volunteer	1	0	21	0	0	0	21
Luna Pier Volunteer Fire Department	Volunteer	1	0	0	21	0	2	23
Milan Area Fire Department	Volunteer	1	0	0	36	1	0	37
Monroe Charter Township Fire Department	Volunteer	3	0	0	25	0	0	25
Monroe Fire Department	Career	3	37	0	0	0	0	37
Morin Point Fire Department	Volunteer	1	0	29	0	0	3	32
Ottawa Lake Volunteer Fire Department	Volunteer	1	0	22	0	0	0	22
Summerfield TWP Volunteer Fire Department	Volunteer	1	0	0	26	0	0	26
Whiteford Township Volunteer Fire Department	Volunteer	1	0	22	0	0	0	22
Wayne County								
Allen Park Fire Department	Career	1	32	0	0	1	0	33
Belleville Fire Department	Volunteer	1	0	0	16	0	0	16
Brownstown Fire Department	Career	4	30	0	0	1	0	31
Canton Fire Department	Career	2	53	0	0	2	0	55
Charter Township of Redford Fire Department	Career	3	39	0	0	1	0	40
City of Detroit Fire Department	Career	48	1260	0	0	478	0	1738

Table 2-52. (contd)

Fire Department Name	Department Type	Number of Stations	Number of Personnel: Firefighters: Active (career)	Firefighters: Active (volunteer)	Firefighters: Active (paid per call)	Non-firefighting (civilian)	Non-firefighting (volunteer)	Total
City of Harper Woods Fire Department	Career	1	12	0	0	0	0	12
City of Inkster Fire Department	Career	1	18	0	0	6	0	24
City of Northville Fire Department	Mostly volunteer	1	1	0	28	0	0	29
Dearborn Fire Department	Career	4	121	0	0	2	0	123
Dearborn Heights Fire Department	Career	2	54	0	0	1	0	55
Ecorse Fire Department	Mostly career	1	14	0	10	0	0	24
Flat Rock Fire Department	Mostly volunteer	1	7	0	25	0	0	32
Garden City Fire Department	Career	1	20	0	0	1	0	21
Gibraltar Fire Department	Volunteer	1	0	0	30	0	0	30
Great Lakes Operations Fire Department	Career	2	15	0	0	0	0	15
Grosse Ile Fire Department	Mostly volunteer	1	2	32	0	1	0	35
Grosse Pointe City Fire Department	Career	1	25	0	0	6	0	31
Grosse Pointe Farms Public Safety	Career	1	35	0	0	0	0	35
Grosse Pointe Park Department of Public Safety	Career	1	44	0	0	8	0	52
Grosse Pointe Shores Department of Public Safety	Mostly career	1	19	8	0	0	0	27
Grosse Pointe Woods Department of Public Safety	Career	1	47	0	0	6	0	53
Hamtramck Fire Department	Career	1	25	0	0	0	0	25
Highland Park Department of Public Safety	Career	1	43	0	0	0	0	43
Huron Township Fire Department	Mostly volunteer	3	6	0	30	0	0	36
Lincoln Park Fire Department	Career	1	32	0	0	1	0	33
Livonia Fire and Rescue	Career	5	91	0	0	5	0	96
Melvindale Fire Department	Career	1	14	0	0	1	0	15
Metro Fire Department, Ltd.	Volunteer	2	0	5	2	0	10	17
Northville Township Fire/Rescue Department	Career	2	15	0	0	0	0	15
Plymouth Community Fire Department	Mostly career	3	31	0	7	1	0	39
River Rouge Fire Department	Career	1	27	0	0	0	0	27
Riverview Fire Department	Mostly volunteer	1	2	0	50	8	0	60
Rockwood Fire Department	Volunteer	1	0	0	21	5	0	26

Table 2-52. (contd)

			Number of Personnel					
			Firefighters					
Fire Department Name	Department Type	Number of Stations	Active (career)	Active (volunteer)	Active (paid per call)	Non-firefighting (civilian)	Non-firefighting (volunteer)	Total
Romulus Fire Department	Mostly volunteer	4	8	0	32	1	0	41
Southgate Fire Department	Career	1	27	0	0	1	0	28
Sumpter Township Fire Department	Volunteer	2	0	0	30	0	0	30
Taylor Fire Department	Career	3	66	0	0	3	0	69
Trenton Fire Department	Career	2	33	0	0	1	0	34
Van Buren Fire Department	Mostly volunteer	2	2	0	32	0	0	34
Wayne County Department of Airports	Career	3	65	0	0	2	0	67
Wayne Fire Department	Career	1	21	0	0	2	0	23
Westland Fire Department	Career	5	78	0	0	2	0	80
Woodhaven Fire Department	Mostly volunteer	2	7	0	20	0	1	28
Wyandotte Fire Department	Career	2	29	0	0	1	0	30
Lucas County								
180th Ohio Air National Guard Fire Department	Career	1	40	0	0	0	0	40
Jerusalem Township Fire Department	Volunteer	1	0	28	0	0	0	28
Maumee Fire Station 1	Mostly volunteer	2	20	0	55	1	0	76
Monclova Township Fire-Rescue Department	Mostly volunteer	1	2	0	33	0	0	35
Oregon Fire Department	Mostly volunteer	3	12	0	95	1	0	108
Ottawa Hills Fire Department	Career	1	10	0	0	0	0	10
Providence Township Fire and Rescue	Mostly volunteer	1	1	32	32	0	6	71
Richfield Township Fire Department	Volunteer	1	0	33	0	0	1	34
Spencer Township Fire-Rescue	Volunteer	1	0	26	0	0	0	26
Springfield Township Fire Department	Mostly career	3	40	0	36	5	0	81
Sylvania Township Fire Department	Mostly career	4	55	0	8	1	0	64
Toledo Fire Department	Career	17	494	0	0	14	0	508
Washington Township Fire Department	Volunteer	1	0	0	40	0	0	40
Waterville Fire Department	Mostly volunteer	1	6	0	26	1	0	33
Whitehouse Department	Mostly volunteer	1	11	0	30	0	0	41

Table 2-52. (contd)

Fire Department Name	Department Type	Number of Stations	Number of Personnel					Total
			Firefighters					
			Active (career)	Active (volunteer)	Active (paid per call)	Non-firefighting (civilian)	Non-firefighting (volunteer)	
Total Municipal Fire Department Personnel								
Monroe County		31	55	274	263	2	12	606
Wayne County		129	2470	45	333	548	11	3407
Lucas County		39	691	119	355	23	7	1195

Source: FEMA 2010

Table 2-53. Population Served by Firefighters in Monroe, Wayne, and Lucas Counties

County	Fire Protection Service Personnel	Population Served[(a)]	Firefighters per 1000 Residents (2008 estimate)
Monroe	606	152,021	4.0
Wayne	3407	1,820,584	1.9
Lucas	1195	441,815	2.7

Source: FEMA 2010
(a) 2010 population from the USCB (USCB 2010a, b).

Table 2-54. Population Served by Healthcare Workers in Economic Impact Area

Jurisdiction[(a)]	Number of Healthcare Workers	2010 Population Served[(b)]	Healthcare Workers per 1000 Residents (2010)
Monroe, Michigan MSA			
Healthcare practitioner and technical occupations[(c)]	1750		
Healthcare support occupations [(d)]	1020		
Total	2770	152,021	18.2
Warren-Livonia, Michigan MSA			
Healthcare practitioner and technical occupations	45,640		
Healthcare support occupations	23,390		
Total	69,030	4,296,250	16.1
Toledo, Ohio MSA			
Healthcare practitioner and technical occupations	22,140		
Healthcare support occupations	12,460		
Total	34,600	651,429	53.1

Source: USBLS 2008; USCB 2010d
(a) Occupational employment is provided for the metropolitan area in which the county is located.
(b) 2010 population from the USCB for metropolitan areas (USCB 2010d).
(c) Includes physicians, dentists, registered nurses, therapists, medical and clinical laboratory technicians, emergency medical technicians and paramedics, and others as defined by the USBLS (2008).
(d) Includes home health aides; nursing aides, orderlies and attendants; and other healthcare assistants as defined by the USBLS (2008).

2.5.2.7 Education

Tables 2-55 through 2-57 list selected characteristics, including the number of schools, district enrollment, and the student-to-teacher ratio for the 2008–2009 school year for all public school districts in Monroe, Wayne, and Lucas Counties. Michigan does not mandate a student-to-

Table 2-55. Monroe County Public School Districts

School District	Location	Grades	Number of Schools	Students	Teachers	Student-Teacher Ratio
Public School District						
Airport Community School District	Carleton	K-12	6	2935	157	18.6
Bedford Public Schools	Temperance	K-12	8	5223	280	18.7
Dundee Community Schools	Dundee	K-12	4	1687	88	19.1
Ida Public School District	Ida	K-12	3	1674	100	16.7
Jefferson Schools (Monroe)	Monroe	K-12	7	2177	121	18.0
Mason Consolidated Schools (Monroe)	Erie	K-12	3	1374	86	15.9
Monroe Public Schools	Monroe	K-12	14	6683	334	20.0
Summerfield School District	Petersburg	K-12	3	790	43	18.6
Whiteford Agricultural Schools	Ottawa Lake	K-12	3	740	45	16.6
Total Public School District Enrollment				23,283		
Regional District						
Monroe ISD	Monroe	K-12	6	1006	101	10.0

Source: U.S. Department of Education 2010

teacher ratio, but some of the local school districts have adopted a standard student-to-teacher ratio. The student-to-teacher ratio in Ohio is prescribed under the Ohio Administrative Code as a districtwide average of 25 students to one full time equivalent (FTE) teacher for regular classrooms.

There are 9 public school districts (Table 2-55), 14 private or parochial schools, and 2 charter schools in Monroe County. Monroe County is also served by the Monroe County Intermediate School District (ISD), which provides specialized education services and resources to the schools. The Monroe County ISD operates specialized education facilities, including the Monroe County Educational Center for children with developmental disabilities, the Monroe County Transition Center for secondary students with disabilities, the Monroe County Hearing Impaired Program, the Holiday Camp, and academic programming for students in the juvenile justice system at the Monroe County Youth Center.

The total enrollment within the Monroe County public school districts during the 2008–2009 school year was 23,283 students. The Monroe public schools district is the largest district in Monroe County; it includes the City of Monroe and all or part of the five surrounding townships. School enrollment for the Monroe County public school district was 6683 students during the 2008–2009 school year.

Table 2-56. Wayne County Public School Districts

School District	Location	Grades	Number of Schools	Students	Teachers	Student-Teacher Ratio
Allen Park Public Schools	Allen Park	K-12	6	3737	175	21.3
City of Harper Woods Schools	Harper Woods	K-12	4	1264	60	21.1
Clarenceville School District	Livonia	K-12	4	1884	98	19.2
Crestwood School District	Dearborn Heights	K-12	5	3458	176	19.7
Dearborn City School District	Dearborn	K-12	36	18,478	1090	17.0
Dearborn Heights School District #7	Dearborn Heights	K-12	6	2859	146	19.5
Detroit School District	Detroit	PK-12	199	97,577	5953	16.4
Ecorse Public School District	Ecorse	K-12	4	1057	54	19.6
Flat Rock Community Schools	Flat Rock	PK-12	5	1917	90	21.3
Garden City School District	Garden City	K-12	10	5256	354	14.9
Gibraltar School District	Woodhaven	K-12	8	3705	190	19.5
Grosse Ile Township Schools	Grosse Ile	K-12	4	1875	104	18.0
Grosse Point Public Schools	Grosse Point	K-12	16	8606	540	16.0
Hamtramck Public Schools	Hamtramck	K-12	7	2936	159	18.5
Highland Park City Schools	Highland Park	K-12	5	3032	154	19.7
Huron School District	New Boston	K-12	5	287	126	19.8
Lincoln Park Public Schools	Lincoln Park	PK-12	13	4891	275	17.8
Livonia Public Schools	Livonia	K-12	28	16,864	931	18.1
Melvindale-North Allen Park Schools	Melvindale	K-12	4	2801	134	20.9
Northville Public Schools	Northville	K-12	12	7275	437	16.7
Plymouth-Canton Community Schools	Plymouth	PK-12	27	19,235	948	20.3
Redford Union School District	Redford	K-12	9	3565	218	16.4
River Rouge School District	River Rouge	K-12	4	1206	57	21.1
Riverview Community School District	Riverview	K-12	5	2631	127	20.7
Romulus Community Schools	Romulus	K-12	10	4090	201	20.4
School District of the City of Inkster	Inkster	K-12	5	3218	112	28.9
South Redford School District	Redford	K-12	7	3381	178	19.0
Southgate Community School District	Southgate	K-12	12	5689	297	19.2
Taylor School District	Taylor	K-12	17	9226	500	18.4
Trenton Public Schools	Trenton	K-12	5	2877	173	16.6
Van Buren Public Schools	Belleville	K-12	12	5944	352	16.9
Wayne-Westland Community School District	Westland	PK-12	27	13,654	741	18.4
Westwood Community Schools	Dearborn Heights	K-12	8	2013	129	15.6
Woodhaven-Brownstown School District	Brownstown	K-12	9	5390	289	18.7

Table 2-56. (contd)

School District	Location	Grades	Number of Schools	Students	Teachers	Student-Teacher Ratio
Wyandotte City School District	Wyandotte	K-12	11	4984	285	17.5
Total Public School District Enrollment				276,862		
Regional District						
Wayne Regional District	Wayne	–[(a)]	2	107	NA[(b)]	

Source: U.S. Department of Education 2010
(a) – Data were not reported.
(b) NA = Not applicable.

Table 2-57. Lucas County Public School Districts

School District/ Charter School/ Regional District	Location	Grades	Number of Schools	Students	Teachers	Student-Teacher Ratio
School District						
Anthony Wayne Local	Whitehouse	PK-12	6	4631	210	22.1
Maumee City	Maumee	PK-12	6	2844	171	16.7
Oregon City	Oregon	PK-12	7	3870	249	15.5
Ottawa Hills Local	Toledo	PK-12	2	996	71	14.0
Springfield Local	Holland	PK-12	6	4030	219	18.4
Sylvania City	Sylvania	PK-12	12	7640	489	15.6
Toledo City	Toledo	PK-12	67	26,516	1888	14.0
Washington Local	Toledo	PK-12	12	6736	419	16.1
Total Public School District Enrollment				57,263		
Regional District						
Lucas Regional District	Toledo	–[(a)]	5	NA[(b)]	54	

Source: U.S. Department of Education 2010
(a) – = Data were not reported.
(b) NA = Not applicable.

The student-to-teacher ratio within the Monroe County public school districts ranged from 15.9:1 (Mason Consolidated Schools) to 20.0:1 (Monroe Public Schools); the nationwide ratio was 15.3 students to one teacher, and the statewide ratio was 17.5 students to one teacher. Most of the districts were equal to or exceeded the State average student-to-teacher ratio, with the Monroe County public school district having the highest student-to-teacher ratio.

Wayne County has 35 school districts and 74 public school academies or charter schools. The county is also served by the Wayne County Regional Educational Service Agency (RESA), which provides specialized education services and resources to the schools. The total enrollment within the Wayne County public school districts was 276,862 students during the 2008–2009 school year. The largest district in Wayne County is the Detroit school district, with more than 97,000 students. Other large school districts include the Dearborn City school district, Plymouth-Canton community schools, Wayne Westland community schools, and Livonia public schools.

In March 2010, the Detroit school district announced plans to reduce approximately 4 million ft^2 of excess capacity (55 schools) to address declining enrollment. In 1994, kindergarten enrollment was 16,046 students; it declined to 6039 in 2009 (Detroit Public Schools 2010). In February 2011, the State mandated that with a budget deficit of $327 million, the Detroit Public Schools needed to close 70 schools between 2011 and 2012. After a series of town hall meetings, the Detroit Public Schools announced in May 2011 that it could reduce operating costs by $75 to $99 million by transferring 45 of the schools proposed for closure to local and national groups and charter school operators. In its Renaissance Plan 2012, 18 schools would close during the summer of 2011 if a charter operator is not identified (Detroit Public Schools 2010).

The student-to-teacher ratio within the Wayne County public school districts ranged from 14.9 students per teacher (Garden City schools) to 28.9 students per teacher (City of Inkster schools); the nationwide ratio was 15.3 students per teacher, and the statewide ratio was 17.5 students per teacher. All but one school exceeded the national student-to-teacher ratio, and approximately 71 percent of the schools exceeded the State student-to-teacher ratio.

Lucas County has 8 school districts and 38 academies and alternative schools. The total enrollment within the Lucas County public school districts during the 2008–2009 school year was 57,263 students. The Toledo City School District is the largest district in Lucas County, with 26,516 students attending during the 2008–2009 school year.

The student-to-teacher ratio within the Lucas County public school districts ranged from 14.0 students per teacher (Ottawa Hills Local schools and Toledo City School District) to 22.1 students per teacher (Anthony Wayne Local schools); nationally, the ratio was 15.3 students per teacher, and within the State of Ohio, the ratio was 16.1 students per teacher. Fifty percent of the districts have fewer students per teacher than the statewide ratio, and all the school districts are below the State-mandated ratio of one teacher to 25 students.

Numerous colleges and universities are within the local area, including Monroe County Community College (MCCC), Wayne State University, University of Detroit, University of Michigan-Dearborn, and University of Toledo. Over the past few years, MCCC and Lakeland Community College, in Kirkland, Ohio, have developed a nuclear engineering technology program in anticipation of a forecasted need for workers in the nuclear energy industry. MCCC has also recently developed a new heavy and industrial construction technology certificate program that is designed to support the anticipated building workforce needed for Fermi 3.

2.6 Environmental Justice

Environmental justice refers to a Federal policy established by Executive Order 12898 (59 FR 7629) under which each Federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations.[a] The Council on Environmental Quality (CEQ) has provided guidance for addressing environmental justice (CEQ 1997). Although it is not subject to the Executive Order, the Commission has voluntarily committed to undertake environmental justice reviews. On August 24, 2004, the Commission issued its policy statement on the treatment of environmental justice matters in licensing actions (69 FR 52040).

This section provides a general description of the minority and low-income populations within a 50-mi radius of the proposed Fermi 3 site. This geographic area covers all or a portion of eight counties in Michigan (Jackson, Lenawee, Livingston, Macomb, Monroe, Oakland, Washtenaw, and Wayne) and eight counties in Ohio (Erie, Fulton, Henry, Lucas, Ottawa, Sandusky, Seneca, Wood). Two Canadian census divisions (Essex, Chatham-Kent) are also located within a 50-mi radius of the Fermi 3 site.

The characterization of minority and low-income populations in this section forms the analytical baseline from which potential environmental justice effects would be determined. The characterization of populations of interest includes an assessment of “populations of particular interest or unusual circumstances” (e.g., minority or low-income communities exceptionally dependent on subsistence resources or identifiable in compact locations such as Native American settlements).

2.6.1 Methodology

The review team first examined the geographic distribution of minority and low-income populations within a 50-mi radius of Fermi 3 by using the ArcGIS 10 geographical information system (GIS) software. This software allows the user to map and analyze demographic information from the U.S. Census Bureau at the census block group level[b] for a defined geographic area. The review team verified its analysis by field inquiries to numerous agencies and groups (Appendix B).

(a) Minority categories are defined as American Indian or Alaskan Native, Asian, Native Hawaiian or other Pacific Islander, Black races, or Hispanic ethnicity. “Other” may be considered a separate minority category. Low income refers to individuals living in households meeting the official poverty definition. To see the USCB definition and values for poverty visit the USCB Web site at http://www.census.gov.

(b) A census block is the smallest geographic area for which the USCB collects and tabulates sample data. A block group is the next level above census blocks in the geographic hierarchy and is a subdivision of a census tract or block numbering area.

The first step in the review team's environmental justice methodology is to examine each census block group that was fully or partially included within a 50-mi radius of Fermi 3 in order to determine for each block group whether the percentage of any minority or low-income population is great enough to identify that block group as a minority or low-income population of interest. If either of the two criteria discussed below are met for a census block group, that census block group is considered a minority or low-income population of interest warranting further investigation. The two criteria are whether:

- The minority or low-income population exceeds 50 percent of the total population for the census block group, or
- The percentage of the minority or low-income population is at least 20 percentage points greater than the same minority or low-income population's percentage in the respective State.

The populations of minority groups in Michigan and Ohio are shown on Table 2-58.

Table 2-58. Population by Race in Michigan and Ohio, 2010

	Population by Race			
	Michigan		Ohio	
Category	**Persons**	**%**[(a)]	**Persons**	**%**
White	7,895,340	79.3	9,598,726	83.4
Black or African American	1,401,616	14.1	1,391,240	12.1
American Indian and Alaska Native	54,502	0.5	22,785	0.2
Asian	242,886	2.4	186,464	1.6
Native Hawaiian and other Pacific Islander	2722	<0.1	2162	<0.1
Hispanic or Latino (of any race)	423,412	4.3	333,019	2.9
Some other race/two or more races	355,621	3.6	311,054	2.7
Total population	**9,952,687**		**11,512,431**	
Aggregate minority (percent)		23.1		18.4

Source: USCB 2010i
(a) Note: percentages may not add to 100 percent due to rounding.

The identification of census block groups that met one or both of the two criteria noted above is not sufficient for the review team to conclude that a disproportionately high and adverse impact exists. Likewise, the lack of census block groups meeting the above criteria cannot be construed as evidence of no disproportionately high and adverse impacts upon minority or low-income populations. The review team must also conduct an active public outreach and on-the-ground investigation in the region of the plant to determine whether minority or low-income populations in the region that were not identified in the census mapping exercise may exist. To reach an environmental justice conclusion, the review team investigated all populations in greater detail to identify pathways by which environmental impacts could have disproportionately high and adverse effects on minority or low-income communities. To identify pathways to disproportionately high and adverse effects, the review team considered the following:

- Health considerations:
  - Are the radiological or other health effects significant or above generally accepted norms?
  - Is the risk or rate of hazard significant and appreciably in excess of the general population's?
  - Do the radiological or other health effects occur in groups that are affected by cumulative or multiple adverse exposure from environmental hazards?
- Environmental considerations:
  - Is there an impact on the natural or physical environment that significantly and adversely affects a particular group?
  - Are there any significant adverse impacts on a group that appreciably exceed or are likely to appreciably exceed those on the general population?
  - Do the environmental effects occur in groups affected by cumulative or multiple adverse exposure to environmental hazards?

Under NRC's methodology, if this more detailed investigation does not yield any potentially disproportionately high and adverse impacts on populations of interest, the review team could conclude that there are no environmental justice impacts from the proposed action. If, however, the review team found any potential disproportionately high and adverse effects and potential pathways by which those impacts could occur, the review team would then (1) determine there was the potential for a disproportionately high and adverse impact on minority or low-income populations, (2) fully characterize the nature and extent of that impact, and (3) identify possible mitigation measures that may be used to lessen that impact.

The remainder of this section discusses the results of the search for potentially affected populations of interest.

2.6.1.1 Minority Populations

The review team assessed the populations for each minority group, as well as for an "aggregate" minority population, which is calculated as the "Total Population" minus all persons identified as "White—Not Hispanic or Latino.". For each of the 4281 census block groups fully or partially within a 50-mi radius of Fermi 3, the percent of the census block group's population represented by each minority population was calculated separately and in aggregate and compared with the two criteria listed above. Table 2-59 displays the results of that Census search, indicating that:

- 1221 census block groups within the 50-mi radius met the criteria and are considered to have a Black or African-American population of interest.
- No census block groups within the 50-mi radius met the criteria for, and none is considered to have, an American Indian or Alaskan Native population of interest.
- 100 census block groups within the 50-mi radius met the criteria and are considered to have an Asian population of interest.
- No census block groups within the 50-mi radius met the criteria for, and none is considered to have, a Native Hawaiian or other Pacific Islander population of interest.
- 320 census block groups within the 50-mi radius met the criteria and are considered to have a Hispanic or Latino population of interest.
- 1352 census block groups within the 50-mi radius met the criteria and are considered to have an aggregate minority population of interest.

Most of the census block groups classified as minority populations of interest lie to the north and south of the Fermi plant site in Wayne and Lucas Counties, respectively (Figures 2-17, 2-18, and 2-19). One census block group within Monroe County qualifies as a minority population of interest. This census block group is the closest minority population of interest to the proposed site, located in the City of Monroe, approximately 5 mi southwest of the Fermi 3.

Table 2-59 shows the results of the analysis to identify minority populations of interest within a 50-mi radius of Fermi 3. Figures 2-17, 2-18, and 2-19 show the geographic locations of the minority populations of interest within the 50-mi radius.

There is one Native American population within a 50-mi radius of the proposed Fermi 3 plant site, located on Walpole Island, Canada, approximately 50 mi northeast of the site. The island is inhabited by the Chippewa, Potawatomi, and Ottawa peoples. In 2006, the population was 1878 persons (Statistics Canada 2012). Because this Native American population of interest is at the limit of the 50-mi region, and because it is in Canada, the review team did not include it in its environmental justice investigation.

2.6.1.2 Low-Income Populations

The review team calculated the percent of households in each of the 4281 census block groups within a 50-mi radius of Fermi 3 and identified 579 census block groups that met the low-income measurement for being populations of interest (Table 2-60).

Table 2-59. Results of the Census Block Group Analysis for Minority Populations of Interest within the Region (50-mi radius)[(a)]

State/County	Total Census Block Groups	Number of Census Block Groups with Minority Populations of Interest					
		Black	American Indian	Asian	Pacific Islander	Hispanic	Aggregate
Michigan							
Jackson	6	0	0	0	0	0	0
Lenawee	69	1	0	0	0	6	1
Livingston	58	0	0	0	0	0	0
Macomb	530	35	0	5	0	4	36
Monroe	123	1	0	0	0	1	1
Oakland	770	138	0	41	0	25	170
St. Clair	1	0	0	0	0	0	0
Washtenaw	251	28	0	22	0	0	51
Wayne	1822	916	0	30	0	72	974
Ohio							
Erie	47	8	0	0	0	19	10
Fulton	18	0	0	0	0	0	0
Henry	3	0	0	0	0	0	0
Lucas	398	94	0	2	0	175	106
Ottawa	43	0	0	0	0	2	0
Sandusky	55	0	0	0	0	11	3
Seneca	6	0	0	0	0	0	0
Wood	81	0	0	0	0	5	0
Total	**4281**	**1221**	**0**	**100**	**0**	**320**	**1352**

Source: USCB 2010i
(a) Shaded rows indicate counties in the economic impact area.

Most of the census block groups classified as low-income populations of interest lie to the north and to the south of the Fermi site in Wayne and Lucas Counties, respectively (Figure 2-20).

One census block group within Monroe County also qualifies as a low-income population of interest. This census block group is the same minority population identified above as being the population of interest closest to the Fermi plant site (approximately 5 mi away).

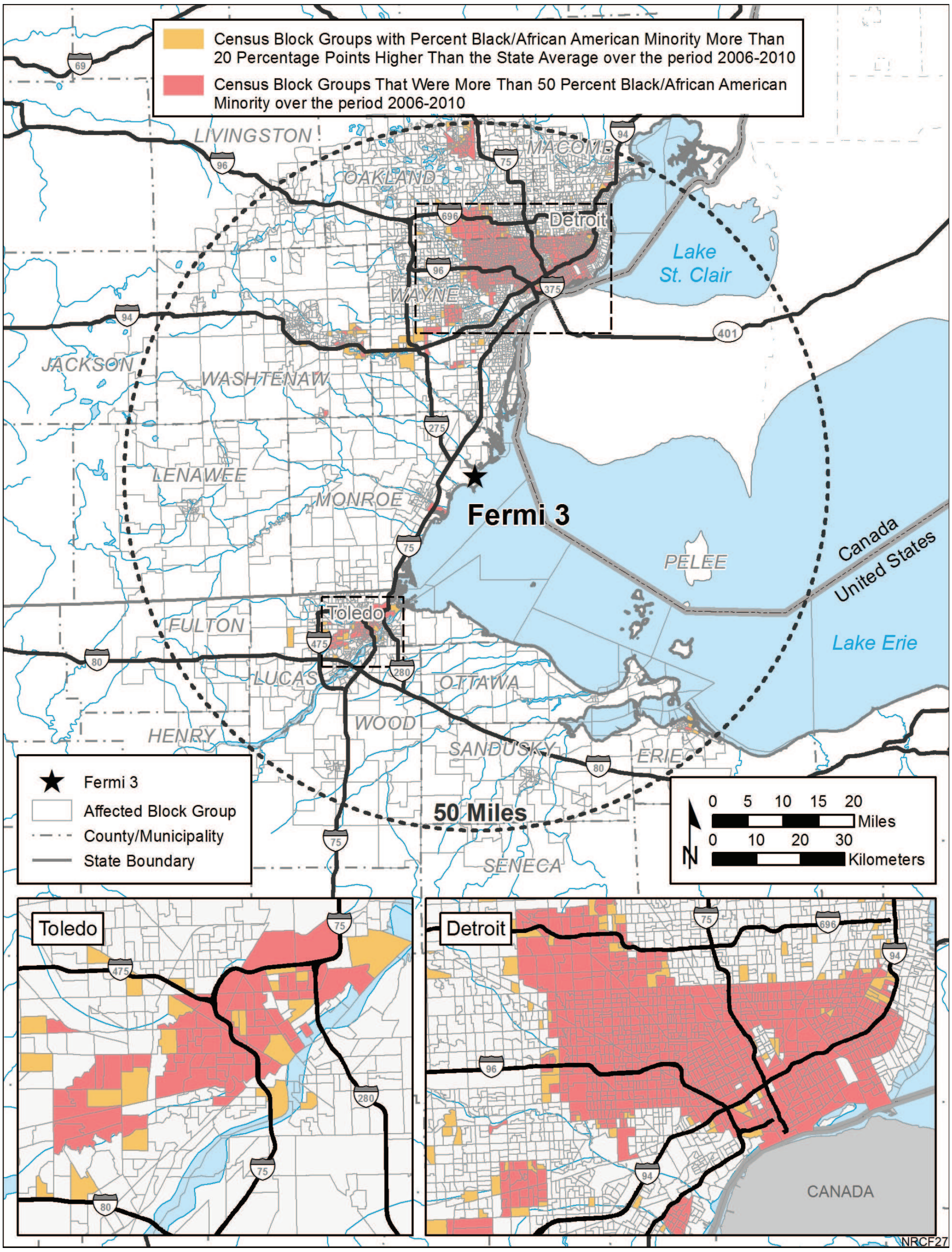

Figure 2-17. Black and African-American Minority Census Block Group Populations of Interest within a 50-mi Radius of Fermi 3 (USCB 2010i)

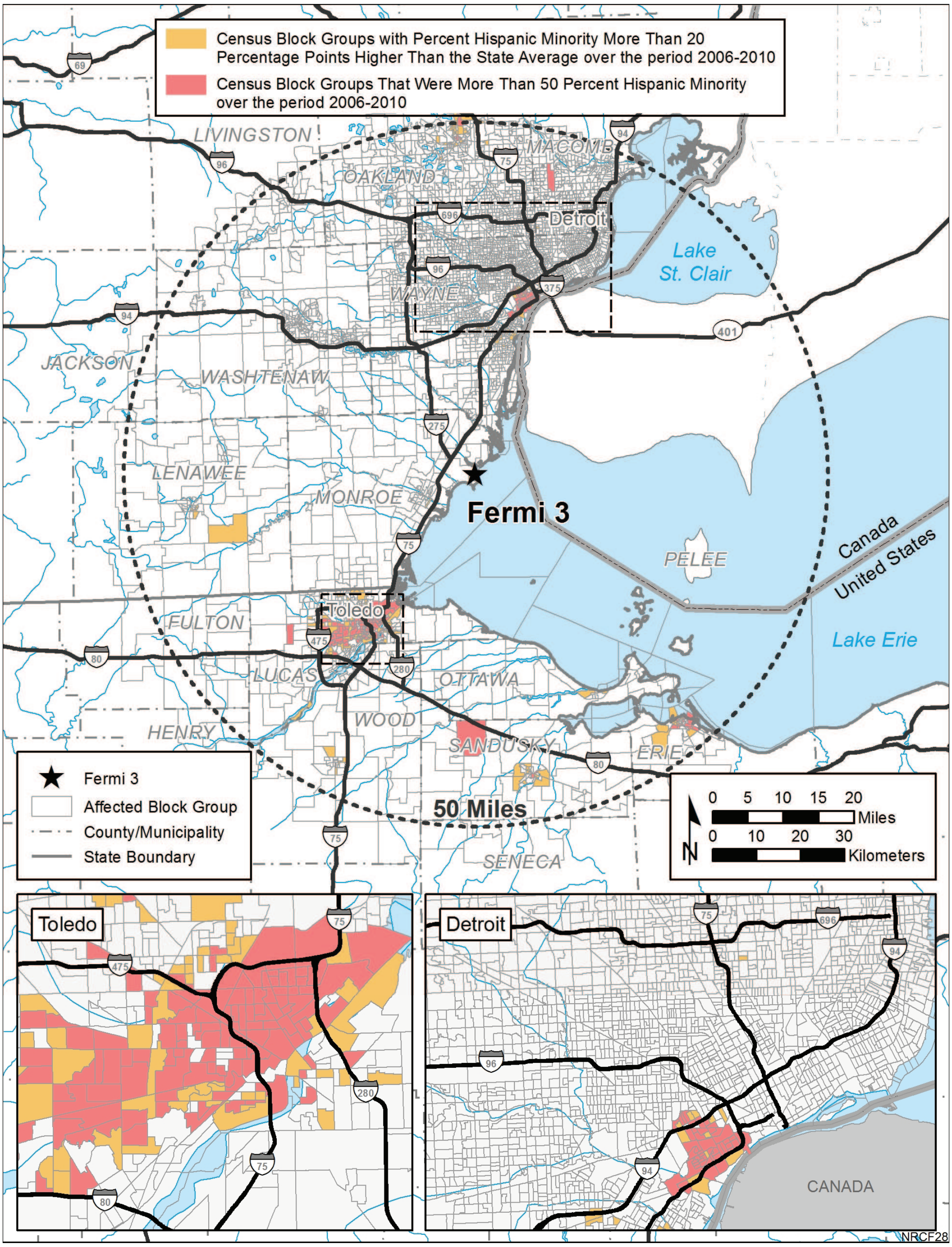

Figure 2-18. Hispanic Minority Census Block Group Populations of Interest within a 50-mi Radius of Fermi 3 (USCB 2010i)

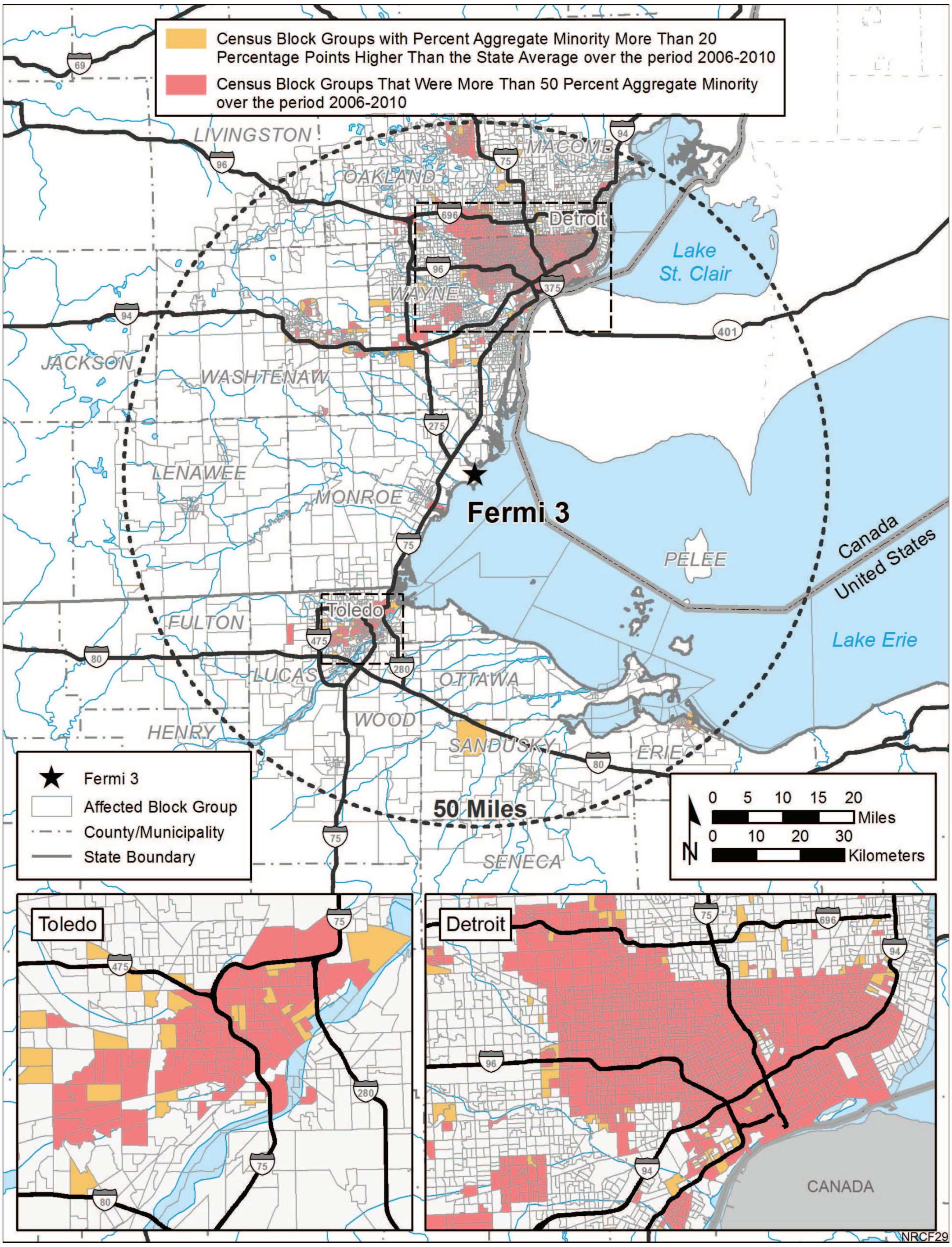

Figure 2-19. Aggregate Minority Census Block Group Populations of Interest within a 50-mi Radius of Fermi 3 (USCB 2010i)

Table 2-60. Results of the Census Block Group Analysis for Low-Income Populations of Interest within the Region (50-mi radius)[(a)]

State and County	Total Number of Census Block Groups	Number of Census Block Groups with Low-Income Populations of Interest	Percent of Census Block Groups with Low-Income Populations of Interest
Michigan			
Jackson	6	0	0
Lenawee	69	4	5.8
Livingston	58	0	0
Macomb	530	25	4.7
Monroe	123	1	0.8
Oakland	770	40	5.2
St. Clair	1	0	0
Washtenaw	251	34	13.5
Wayne	1822	479	26.3
Ohio			
Erie	47	5	10.6
Fulton	18	0	0
Henry	3	0	0
Lucas	398	81	20.4
Ottawa	43	0	0
Sandusky	55	1	1.8
Seneca	6	0	0
Wood	81	9	11.1
Total	**4281**	**679**	**15.9**

Source: USCB 2010j
(a) Shaded rows indicate counties in the economic impact area.

2.6.2 Scoping and Outreach

The review team conducted interviews with community leaders within the 50-mi region to verify and supplement the list of populations of interest and to identify pathways by which a disproportionately high and adverse environmental or socioeconomic effect could be experienced by minority or low-income communities. The review team provided the region with an advanced notice of public scoping meeting in accordance with NRC guidance. In these scoping and outreach activities, the review team did not identify any additional groups of minority or low-income persons not already identified in the GIS analysis of census data.

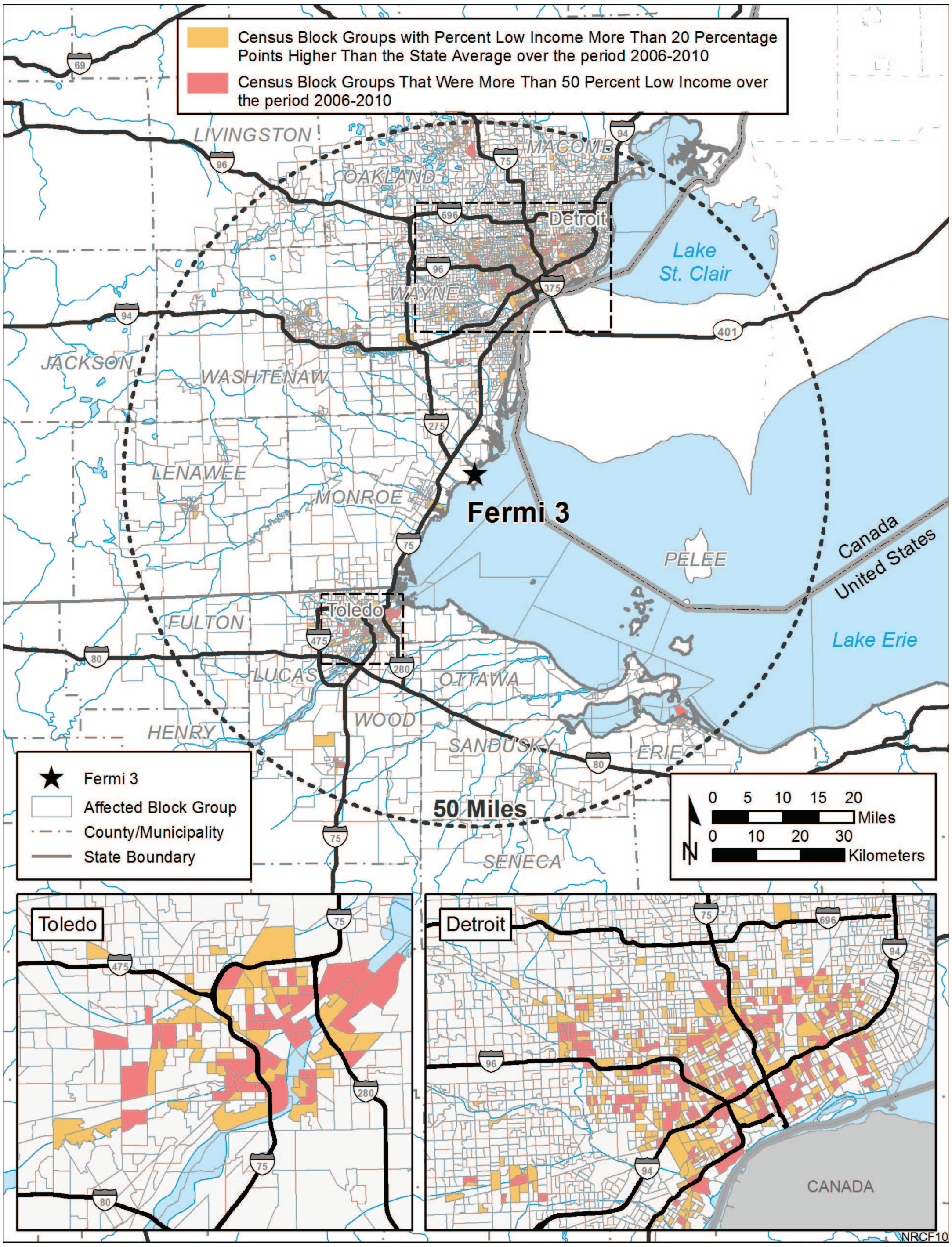

Figure 2-20. Low-Income Census Block Group Populations of Interest within a 50-mi Radius of Fermi 3 (USCB 2010j)

2.6.3 Subsistence and Communities with Unique Characteristics

The next step in the review team's methodology is to examine whether or not any of the identified minority or low-income populations appear to have a unique characteristic that could lead to a disproportionately high and adverse effect. Examples of unique characteristics include lack of vehicles, sensitivity to noise, close proximity to the plant, or subsistence activities. Such unique characteristics must be demonstrably present in the population and relevant to the potential environmental impacts of the plant. If the impacts from the proposed action appear to adversely affect an identified minority or low-income population through a unique characteristic, then the review team makes a determination whether the adverse impact is disproportionately high when compared with that in the general population.

Subsistence uses of natural resources are often intended to supplement income by providing food or other resources that free up actual earnings for additional purchases. Common categories of subsistence uses include gathering plants, fishing, and hunting. Some subsistence use is undertaken for ceremonial and traditional cultural purposes. Subsistence use often involves using publicly held resources, such as rivers (subsistence fishing) or forests (hunting or gathering of vegetation), but it also includes the use of privately owned resources such as home vegetable gardens. Subsistence information is often site-specific and difficult to differentiate from the recreational uses of natural resources. Therefore, the review team presents subsistence information in a more qualitative manner on the basis of diverse sources of published and anecdotal information.

Approximately 206 ac of the 1260-ac Fermi site are currently developed. The general public is not allowed uncontrolled access to the site for safety and security reasons; thus, no ceremonial, culturally significant, or subsistence gathering of vegetation occurs on the site. In addition, the DRIWR encompasses a 656-ac portion of the Fermi plant site that is not open to the public. The public is also prohibited from using the waters of Lake Erie for fishing, swimming, or boating within a 1-mi exclusion zone around the plant site.

During the development of the ER, Detroit Edison contacted several local persons with knowledge of the potential for subsistence activities in Monroe County. These persons included the Monroe County Sheriff, the Superintendent of the Monroe County Intermediate School District, two local church officials, and a landowner who has farmed more than 200 ac approximately 2 mi from the site for more than 30 years. The review team concluded from discussions with these contacts that no subsistence activities are occurring on or near the site.

2.6.4 Migrant Populations

Migrant labor or a migrant worker is defined by the USDA as a "farm worker whose employment required travel that prevented the migrant worker from returning to his/her place of residence the same day." From an environmental justice perspective, there is a potential for such groups in some circumstances to be disproportionately affected by emissions in the environment. However, as discussed in Section 2.5, only 27 of 222 farms employing hired labor reported that they use migrant labor (USDA 2007). Even if all of the migrant workers were minority or low-income individuals, on the basis of the average number of hired workers per farm in Monroe County, the review team estimated that the total number of migrant workers is about 216 in the Monroe County. No information was available on their actual location of employment within the county.

2.6.5 Environmental Justice Summary

The review team found census block groups with aggregate minority or low-income populations that exceed the percentage criteria established for environmental justice analyses. Consequently, the review team performed additional analyses before making a final environmental justice determination. On the basis of the information in the Detroit Edison ER, public input, and its own outreach and analysis, the review team determined that because there are minority and low-income populations of interest in the region, impacts on these communities must be considered in greater detail, as discussed in Section 2.6.1. The result of the review team analyses of construction impacts can be found in Section 4.5 of this EIS. Analyses of operation impacts can be found in Section 5.5.

2.7 Historic and Cultural Resources

In accordance with 36 CFR 800.8(c), the NRC and the USACE have elected to use the National Environmental Policy Act of 1969, as amended (NEPA), process to comply with the obligations found under Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA). As a cooperating agency, the USACE is part of the NRC review team, involved in all aspects of the environmental review. The USACE is the primary Federal agency that will review and authorize regulated activities in waters of the United States, including wetlands. The NRC will determine whether or not to issue a COL for Fermi 3. For the purposes of Section 106, the NRC is the lead Federal agency consulting with the State Historic Preservation Office/Officer (SHPO) for the COL permit.

This section discusses the cultural background of the Fermi 3 site region, including prehistoric and historic resources (Section 2.7.1). It also details the efforts that have been taken to identify cultural resources within the area of potential effects (APE) and the cultural resources and historic properties that were identified (Section 2.7.2). A description of the NHPA Section 106 consultation efforts accomplished to date is also provided (Section 2.7.4). The assessments of impacts of the proposed building and operation of Fermi 3 and its associated facilities on historic properties identified within the APE, pursuant to Section 106 of the NHPA, are found in Sections 4.6 and 5.6, respectively.

2.7.1 Cultural Background

The cultural background for the proposed Fermi 3 project location and the surrounding region was developed as part of the Phase I cultural resources investigations and the submerged sites sensitivity assessment that were conducted for the Fermi 3 project in support of the COL application ER (Demeter et al. 2008; Weir 2008a; Taylor 2009) and is summarized here.

The proposed Fermi 3 project location and the surrounding region show evidence of both prehistoric and historic occupation and/or settlement by Native Americans and Euroamericans that has continued through to the present. Archaeological records suggest that the Fermi 3 project location and the surrounding area have had the potential for occupation from the Paleo-Indian period (ca. 10,000 BC to 8000 BC), the Archaic Period (ca. 8000 BC to 550 BC), and the Woodland Period (ca. 600 BC to AD 1600). Native American groups that lived in the region at the time of contact with early European explorers and settlers were identified from historic written accounts, which indicated that these contact-period Native American groups were associated with the Erie, an Iroquoian group, and with the Wendat/Huron, Ottawa, Miami, and the allied Fox and Mouscatine, which are all Algonquian groups (Demeter et al. 2008).

According to the Michigan Department of Human Services and the Bureau of Indian Affairs, there are currently 12 Federally recognized Indian Tribes in the State of Michigan primarily associated with the Chippewa, Ottawa, and Potawatomi. None of these 12 Federally recognized Indian Tribes are located within the proposed Fermi 3 project area or its surrounding region in southeastern Michigan. However, the closest of these 12 Federally recognized Indian Tribes are three groups of Potawatomi Indians in southwestern Michigan and one group of Chippewa Indians in central Michigan: the Nottawaseppi Huron Band of Potawatomi Indians in Calhoun County; the Pokagon Band of Potawatomi Indians in Cass County; the Gun Lake Potawatomi Tribe (also known as the Match-e-be-nash-she-wish Band of Potawatomi Indians of Michigan) in Allegan County; and the Saginaw Chippewa Indian Tribe, located on the Isabella Indian Reservation in Isabella County (Michigan Department of Human Services 2010; Michigan Department of Human Services undated; 73 FR 18553).

The National Park Service (NPS) Native American Consultation Database (NACD), developed as part of NPS's national program for compliance with the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), identified three Federally recognized Indian Tribes with judicially established land claims within Monroe County, Michigan. One is the Hannahville Indian Community in Menominee County, Michigan (northern Michigan). The other two are located outside the State of Michigan: the Forest County Potawatomi Community in Forest County, Wisconsin (northeastern Wisconsin), and the Ottawa Tribe of Oklahoma in Ottawa County, Oklahoma (northeastern Oklahoma) (NPS 2010b). Because judicially established land claims are based on proven ancestral or historic ties to lands (USGS 1993; NPS 2010a), these three Federally recognized Indian Tribes may also have been prehistorically or historically associated with the Fermi 3 project location or its surrounding region.

The regional historic cultural background begins with European exploration and settlement by the French in the 17th century, followed by British control of the area in the mid to late 18th century. After the War of 1812, the region came under American control and was reorganized into counties, including the establishment of Monroe County and the Village of Monroe in 1817. With the opening of a Federal Land Office in the area in 1824, increasing settlement occurred in the region through the remainder of the 19th century. However, because the Fermi 3 project area was historically a wetland environment, little settlement occurred in the project area in the 19th century, although the shoreline areas have been used for commercial fishing purposes and upland areas were used for vineyards and silica sand mining. By the early 20th century, wealthy Detroit residents began to purchase lots and build summer cottage communities or resorts to the south of the Fermi 3 project area, along the Lake Erie shoreline. These seasonal communities have been converted since the mid 20th century to year-round communities that are still occupied today, including the Stony Point, Woodland Beach, and Detroit Beach communities located south/southwest of the Fermi 3 project area (Demeter et al. 2008).

Shoreline and offshore areas in the vicinity of the Fermi site may have been used prehistorically and historically by Native Americans for fishing, hunting, and gathering plant resources. Historic Euroamerican activities along the shoreline and in offshore areas in the region also have been associated with fishing, including the development of commercial fishing industries associated with lake herring (*Coregonus artedii*), lake sturgeon (*Acipenser fulvescens*), lake whitefish (*Coregonus clupeaformis*), and common carp (*Cyprinus carpio*) in the region from the mid-19th to the early 20th centuries (Demeter et al. 2008; Weir 2008a; University of Wisconsin Sea Grant Institute 2002). The local commercial fishing industry was subsequently replaced in the early 20th century by the development of shoreline areas as seasonal (summer) communities or resorts, as described above. Currently, shoreline areas in the vicinity of the Fermi site support the Fermi 1 and 2 plant facilities and the year-round beach communities to the northeast and southwest of the Fermi 3 project area.

2.7.2 Historic and Cultural Resources at the Site

To identify the historic properties and cultural resources at the Fermi 3 site and along associated transmission line corridors, the review team reviewed the following information:

- Fermi 3 ER (Detroit Edison 2011a) – Detroit Edison's contractor, Black & Veatch Corporation (Black & Veatch), summarized the conclusions of investigations undertaken to identify and evaluate cultural resources and historic properties in the APE for the Fermi 3 project.
- NRC site audit, February 2009 – NRC review team consulted with the Michigan SHPO and also conducted an on-the-ground visit of the Fermi 3 site and the direct and indirect APEs for the Fermi 3 project.

- Detroit Edison's RAI responses – letters dated July 31, 2009; September 30, 2009; and November 23, 2009 (Detroit Edison 2009f, d, and e, respectively).
- Detroit Edison technical report – Fermi 3 Phase I cultural resources investigation, July 2008 (Demeter et al. 2008).
- Detroit Edison technical report – Fermi 3 submerged sites sensitivity study, December 2008 (Weir 2008a).
- Detroit Edison technical report – Fermi 1 preliminary *National Register of Historic Places* evaluation, March 2009 (Kuranda et al. 2009).
- Detroit Edison technical report – Fermi 3 archaeological survey, November 2009 (Taylor 2009).
- Detroit Edison technical report – Fermi 3 cultural resources review, March 2011 (Taylor 2011).

Determination of APE

The NRC has determined that the APE for the environmental review consists of the area containing the proposed Fermi 3 power plant site where ground-disturbing activities could potentially occur (the direct APE) and surrounding areas that may be indirectly (visually) affected by the building and operation of Fermi 3 and associated facilities (the indirect APE) (see Figure 2-21). Historic and cultural resources identified within the direct APE are considered onsite resources. Historic and cultural resources identified within the indirect APE are considered offsite resources.

The direct and indirect APEs identified by the NRC for the environmental review correspond to three APEs identified by Detroit Edison and Commonwealth Cultural Resources Group, Inc. (CCRG), in consultation with the Michigan SHPO for the Phase I cultural resources investigation, as follows: the direct APE, which corresponds to the archaeological APE discussed in Phase I reports; the indirect APE, which corresponds to that portion of the aboveground resources APE that is discussed in Phase I reports that is outside the archaeological APE; and a submerged sites APE, which the NRC considers in the offshore (aquatic) portions of the direct APE.

The direct APE consists of an area that is approximately 520 ac within which Fermi 3 and associated facilities would be constructed and that would include the area at the site that will be impacted by ground-disturbing activities associated with building and operating Fermi 3. Areas within the direct APE include the existing Fermi 1 and Fermi 2 plant sites, a series of interconnected roadway grades, a stone quarry, two spoils-disposal zones, and areas possibly affected by building the Fermi 3 cooling tower, laydown areas, and a new access road (Demeter et al. 2008). Additional areas were subsequently determined to be potentially affected

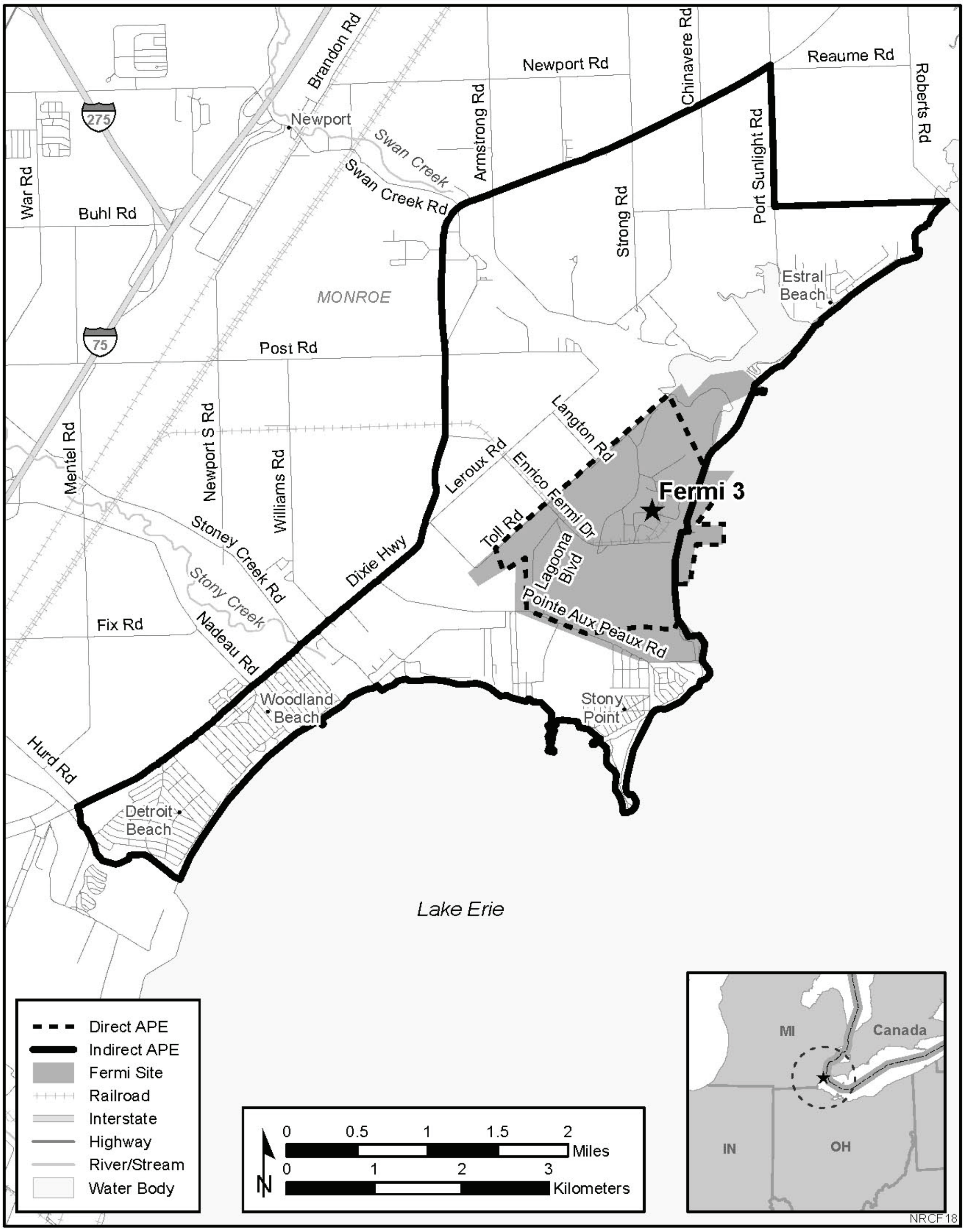

Figure 2-21. Fermi 3 Cultural Resources Area of Potential Effects

by ground-disturbing activities associated with the use of a laydown area during the building phase and building of a meteorological tower and its associated access road, and they are considered part of the direct APE by the NRC review team. These additional areas, totaling 28.5 ac, were also subjected to additional Phase I archaeological investigations (Taylor 2009, 2011). One previously recorded cultural resource, an archaeological site, is located in the direct APE (Demeter et al. 2008) and is discussed in greater detail below.

The indirect APE consists of offsite areas surrounding the proposed Fermi 3 power plant site to address the potential for indirect visual impacts or effects on cultural resources and historic properties (buildings or structures) that may result from building and operating Fermi 3. The indirect APE consists of an area of about 6680 ac that extends approximately parallel to the shoreline of Lake Erie and includes the nearest shoreline settlements of Estral Beach to the northeast and Woodland Beach and Detroit Beach to the southwest of the Fermi 3 site (Detroit Edison 2011a; Conway 2007; Weir 2008b).

The indirect APE does not include the direct APE. One previously recorded *National Register of Historic Places* (NRHP)-eligible historic property, a building at 5046 Williams Road, is located offsite in the indirect APE (Demeter et al. 2008) and is discussed in greater detail below. Two other previously recorded cultural resources, both archaeological sites that have not been evaluated for NRHP-eligibility, are also located in the indirect APE (Demeter et al. 2008).

The submerged sites APE was identified by CCRG to address the potential for impacts on offshore cultural resources or historic properties that might result from building and operating Fermi 3 and its water intake and discharge structures. This approximately 130-ac area includes the existing discharge conduit and cooling water intake channel for the Fermi 1 and 2 units, as well as the existing barge dock and channel for the Fermi plant property (Weir 2008a). No previously identified shipwrecks or archaeological sites are located within the submerged sites APE (Weir 2008a; Demeter et al. 2008).

Phase I Cultural Resources Investigations

CCRG conducted Phase I cultural resources investigations within the terrestrial portions of the Fermi 3 APE between November 2007 and April 2008 and in October 2009 (Detroit Edison 2011a; Demeter et al. 2008; Taylor 2009). The purpose of these Phase I cultural resources investigations was to identify cultural resources and historic properties within the direct and indirect APEs and to evaluate the NRHP-eligibility of any newly identified cultural resources and any previously identified cultural resources that had not been evaluated for NRHP eligibility.

The archaeological survey conducted as part of the Phase I cultural resources investigation resulted in the identification of eight archaeological resources within the direct APE (one previously recorded prehistoric site location; four newly identified prehistoric find spots or isolated artifacts; two newly identified historic sites; and one newly identified multicomponent site [prehistoric and historic]). None of these eight archaeological resources were recommended eligible for listing in the NRHP (see Table 2-61). The aboveground resources survey conducted as part of the Phase I cultural resources investigation identified a total of 84 architectural resources within the direct and indirect APE (consisting of buildings or structures). Twenty-two of these architectural resources have been determined or recommended eligible for listing in the NRHP; the remaining architectural resources have been recommended not eligible for listing in the NRHP (see Table 2-62).

Archaeological Resources

Ten archaeological resources have been identified within the direct and indirect APEs: eight in the direct APE and two in the indirect APE. The eight archaeological resources identified in the direct APE consist of one previously recorded archaeological site location, four newly identified prehistoric archaeological find spots or isolated artifacts, two newly identified historic archaeological sites, and one newly identified multicomponent (prehistoric and historic) archaeological site (Detroit Edison 2011a). The one previously recorded onsite archaeological site location was revisited during the Phase I cultural resources investigation, but no evidence of this previously recorded site was observed. The site appears to have been destroyed by natural shoreline erosion due to wave action and/or landfilling and installation of riprap for erosion control, and no further archaeological investigations have been recommended for this previously recorded site.

The remaining seven newly identified archaeological resources within the direct APE were evaluated for NRHP eligibility under Criterion D. The four prehistoric archaeological find spots or isolated artifacts and the single prehistoric artifact identified at the multicomponent archaeological site are nondiagnostic (i.e., the artifact cannot be interpreted for function and/or cannot be dated to a specific prehistoric cultural period), are not associated with any other prehistoric materials or features, and would not contribute information beyond what is already known of the prehistoric context for the Fermi 3 site. The lack of diagnostic information renders these prehistoric archaeological resources minimally important with regard to their research value. The two newly identified historic archaeological sites and the historic component of the one multicomponent archaeological site have been evaluated as possessing limited interpretive value such that none are likely to contribute significant information relative to past regional historic land use patterns (Demeter et al. 2008). As such, none of the seven newly identified archaeological resources in the direct APE have been recommended as being eligible for listing in the NRHP under Criterion D, and no further archaeological investigations have been recommended for any of these seven onsite archaeological resources (Detroit Edison 2011a; Demeter et al. 2008; Taylor 2009).

Table 2-61. Fermi 3 Archaeological Resources Identified – Phase I Investigations

Site Number	Site Description	Site Age or Cultural Period	NRHP–Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
20MR702	Onsite Previously Recorded Prehistoric Archaeological Site	Unidentified Prehistoric	Not Eligible[(a)] – Site destroyed by natural erosion and/or installation of rip-rap for erosion control	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR818	Onsite Multi-component (Prehistoric and Historic) Surface Artifact Scatter	Unidentified Prehistoric and Late 19th to Early 20th Century	Recommended Not Eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR819	Onsite Isolated Prehistoric Find Spot	Unidentified Prehistoric	Recommended Not Eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR820	Onsite Isolated Prehistoric Find Spot	Unidentified Prehistoric	Recommended Not Eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR821	Onsite Isolated Prehistoric Find Spot	Unidentified Prehistoric	Recommended Not Eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR822	Onsite Isolated Prehistoric Find Spot	Unidentified Prehistoric	Recommended Not Eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR823	Onsite Historic Archaeological Site	Early to mid 20th Century	Recommended Not Eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR825	Onsite Historic Surface Artifact Scatter and Pet Cemetery	20th Century	Recommended Not Eligible[(b)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]

Sources: Demeter et al. 2008; Taylor 2009
(a) Demeter et al. 2008.
(b) Taylor 2009.
(c) Conway 2011.

Table 2-62. Fermi 3 Aboveground Resources Identified – Phase I Investigations

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
Fermi Drive (Enrico Fermi Atomic Power Plant [Fermi 1])	Onsite Nuclear Power Plant	1956	Recommended NRHP-eligible (Criterion A and C)[b]	Evaluation of NRHP-eligibility[a] [b]	Concurrence indicated in May 9, 2011, letter[c]
5046 Williams Rd.	Offsite Previously Recorded Front-Gabled-Style House	c. 1840	Determined NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
2381 Hurd Rd.	Offsite New England One-and-a-Half-Style House	c. 1850	Recommended NRHP-eligible (Criteria A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
2122 N. Dixie Hwy.	Offsite Gabled-Ell-Style House	c. 1875	Recommended NRHP-eligible (Criteria A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
2430 N. Dixie Hwy. (St. Anne's Catholic Church Grotto)	Offsite Vernacular-style Ecclesiastical Structure (Grotto)	1956	Recommended NRHP-eligible (Criterion C, Exception A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Near 4973 N. Dixie Hwy.	Offsite Greek Revival-Style House	c. 1840	Recommended NRHP-eligible (Criterion A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
5179 N. Dixie Hwy. (Dixie Skateland)	Offsite Vernacular-Style Skating Rink	1958	Recommended NRHP-eligible (Criterion A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6068 N. Dixie Hwy.	Offsite Farmstead Complex: Side-Gabled House and Vernacular-Style Barn and Other Outbuildings[d]	c. 1885	Recommended NRHP-eligible (Criterion A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
N. Dixie Hwy. (St. Charles Cemetery)	Offsite Late 19th Century Cemetery	1882	Recommended NRHP-eligible (Criterion A and Exception D)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
N. Dixie Hwy. (Old St. Charles [White or LaDue] Cemetery)	Offsite Mid 19th Century Cemetery	1851	Recommended NRHP-eligible (Criterion A and Exception D)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8109 Swan Creek Rd. (St. Charles [Borromeo] Church Complex)	Offsite Victorian Gothic-Style Church and Outbuildings[d]	1882-1886	Recommended NRHP-eligible (Criterion C and Exception A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6344 Trombley Road (Jacob Masserant Farmstead Complex)	Offsite Farmstead Complex: Hall-and-Parlor-style House, Three-Bay Threshing Barn and Associated Outbuildings[d]	c. 1853	Recommended NRHP-eligible (Criterion A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6511 Leroux Road (Joseph Fix Farmstead Complex)	Offsite Farmstead Complex: Gabled-Ell-style House, Three-Bay Threshing Barn and Associated Outbuildings[d]	1878	Recommended NRHP-eligible (Criterion A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Table 2-62. (contd)

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
3684 Brest Rd. (Frenchtown Township District No. 13 School)	Offsite Standardized School Plan-Style School	1926-1927	Recommended NRHP-eligible (Criterion A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3738 Brest Rd. (Dewey House)	Offsite Greek Revival-Style House	c. 1840	Recommended NRHP-eligible (Criterion A, B and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Pearl Drive Historic District			Recommended NRHP-eligible (Criterion A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3535 Pearl Dr.	Offsite Prairie-Colonial Revival-Style House	c. 1927	Contributing element[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3555 Pearl Dr.	Offsite Prairie-Colonial Revival-Style House	c. 1927	Contributing element[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3575 Pearl Dr.	Offsite Prairie-Colonial Revival-Style House	c. 1927	Contributing element[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3595 Pearl Dr.	Offsite Prairie-Colonial Revival-Style House	c. 1927	Contributing element[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
2983 Third St.	Offsite Tudor Revival-Style House (Cotswold Cottage/ Storybook substyle)	c. 1940	Recommended NRHP-eligible (Criterion C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3677 Lakeview Dr.	Offsite Contemporary Folk-Style House	c. 1945	Recommended NRHP-eligible (Criterion C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3360 Elmwood St.	Offsite Mediterranean-Style House	c. 1940	Recommended NRHP-eligible (Criterion C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3390 Lawndale St.	Offsite Queen Anne-style House	c. 1910	Recommended NRHP-eligible (Criterion A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3518 Nippising St. (Indian Trails Clubhouse)	Offsite Vernacular-style Civic Building	c. 1930-1940	Recommended NRHP-eligible (Criterion A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3606 Lakeshore Dr.	Offsite Mediterranean-Style House	c. 1940	Recommended NRHP-eligible (Criterion C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3351 N. Dixie Hwy. (Joey's Frenchtown Bar)	Offsite Commercial Building with American Foursquare-Style Base	c. 1910	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3979 N. Dixie Hwy.	Offsite T-Plan-Style Farmstead[d]	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
5163 N. Dixie Hwy.	Offsite Gabled-Ell-Style House	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
5795 N. Dixie Hwy.	Offsite T-Plan-Style House and Farmstead Complex[d]	c. 1870	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Table 2-62. (contd)

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
6175 N. Dixie Hwy.	Offsite Gabled-Ell-Style House	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7180 N. Dixie Hwy.	Offsite Upright and Wing-Style House	c. 1850	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7858 N. Dixie Hwy.	Offsite Vernacular-Style Commercial Building	c. 1920	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8106 N. Dixie Hwy.	Offsite Gabled-Ell-style House	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8145 N. Dixie Hwy.	Offsite Cross-gabled-style House and Farmstead Complex[d]	c. 1870	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8207 N. Dixie Hwy. (F. Bondy or Masserant House)	Offsite Gabled-ell-style House	1887	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8527 N. Dixie Hwy.	Offsite Vernacular Side-Gabled-Style House	c. 1840	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8563 N. Dixie Hwy.	Offsite Upright and Wing-Style House	c. 1850	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8570 N. Dixie Hwy.	Gabled-Ell-Style House	c. 1900	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7781 Swan Creek Rd.	Offsite Foursquare-Style House	c. 1910	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8038 Swan Creek Rd.	Offsite Side-Gabled-Style House	c. 1850	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7705 Strong Rd.	Offsite Gabled-Ell-Style House and Farmstead Complex[d]	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7831 Strong Rd.	Offsite Gabled-Ell-Style House and Farmstead Complex[d]	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8180 Chinaware Rd.	Offsite Gabled-Ell-Style House and Farmstead Complex[d]	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8594 Port Sunlight Rd.	Offsite Cross-Gabled-Style House and Farmstead Complex[d]	c. 1890	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Lakeshore Dr.	Offsite Art Moderne-Style House	c. 1925	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Table 2-62. (contd)

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
6771 Lakeshore Dr.	Offsite Minimal Traditional-style House	c. 1940	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6771 Lakeshore Dr.	Offsite Vernacular-Style Fire Pit	c. 1945	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6708 Lakeshore Dr.	Offsite Vernacular-Style House	c. 1920	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7497 Lakeshore Dr. (Estral Beach Hotel)	Offsite Neoclassical Revival-Style Commercial Building	1922	Recommended Not NRHP-Eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7194 Lakeview Blvd. (Estral Beach Fire Station 58 and Village Hall)	Offsite Vernacular Civic Buildings[d]	1968	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
5603 Post Rd.	Offsite Foursquare-Style House	c. 1910	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
5701 Post Rd.	Offsite Queen Anne-Style House	c. 1895	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6994 Post Rd.	Offsite Gabled-ell House	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
4610 Burke Rd.	Offsite Colonial Revival-Style House	c. 1915	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3880 Lakeshore Dr.	Offsite Tudor Revival-Style House	c. 1942	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3195 Brest Rd.	Offsite Foursquare-Style House	c. 1910	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Lakeshore Dr. (between 6771 and 3689)	Offsite Vernacular-Style House	c. 1930	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3704 Lakeshore Dr.	Offsite Contemporary Folk-Style House	c. 1925	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3019 Second St.	Offsite Tudor Revival-Style House	c. 1940	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3013 Tenth St.	Offsite Side-gabled Vernacular-style House	c. 1930	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3260 Eleventh St.	Offsite Side-Gabled Vernacular-Style House	c. 1930	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3028 Harborview (Detroit Beach Boat Club)	Offsite Side-Gabled Vernacular-Style Civic Building	Mid 20th Century	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Harborview (Substation)	Offsite Vernacular-Style Industrial Building	c. 1960	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Table 2-62. (contd)

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
2112 Grand Blvd.	Offsite Foursquare-Style House	c. 1920	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Grand Blvd. (next to 2015)	Offsite Front-Gabled (clipped) Vernacular-Style House	c. 1930	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Sources: Demeter et al. 2008; Kuranda et al. 2009

(a) Demeter et al. 2008.
(b) Kuranda et al. 2009.
(c) Conway 2011.
(d) Two or more architectural resources were evaluated at this location.

The two previously recorded archaeological resources identified within the indirect APE consist of a prehistoric site and a historic (19th century) site. Neither of these offsite archaeological resources has been evaluated for NRHP eligibility (Demeter et al. 2008).

Architectural Resources

The 84 architectural resources identified within the direct and indirect APEs consist of historic buildings or structures. The NRHP-eligibility status of the 84 architectural resources is as follows:

- One offsite previously recorded historic property, a house at 5046 Williams Road in the indirect APE, was determined NRHP-eligible by the Michigan SHPO in 1995 (Detroit Edison 2011a; Demeter et al. 2008).
- One onsite architectural resource, the Enrico Fermi Atomic Power Plant Unit 1 (Fermi 1), is located within the direct APE. Fermi 1 was evaluated for NRHP eligibility as part of a separate project and appears to meet the criteria for NRHP eligibility (Detroit Edison 2011a; Kuranda et al. 2009; Conway 2011). Fermi 1 was also designated a Nuclear Historic Landmark by the American Nuclear Society in October 1986 (American Nuclear Society 2010).
- One offsite proposed historic district, the Pearl Drive Historic District in the indirect APE, composed of four houses, has been recommended as NRHP eligible as a result of cultural resource investigations for this project (Detroit Edison 2011a; Demeter et al. 2008).
- Nineteen offsite individual buildings or structures in the indirect APE (consisting of houses, farmstead complexes, cemeteries, ecclesiastical complexes or structures, civic buildings, and miscellaneous community or recreational buildings) have been recommended as NRHP eligible as a result of cultural resource investigations for this project (Detroit Edison 2011a; Demeter et al. 2008).
- Sixty-two offsite architectural resources in the indirect APE (consisting of individual houses, farmstead complexes, ecclesiastical complexes or structures, civic buildings, industrial and commercial buildings, and miscellaneous community or recreational buildings) have been recommended as not eligible for listing in the NRHP as a result of cultural resources investigations for this project (Detroit Edison 2011a; Demeter et al. 2008).

Historic Properties

One offsite previously recorded historic property is located within the indirect APE: a house at 5046 Williams Road, which was determined to be NRHP eligible by the Michigan SHPO in 1995 (Detroit Edison 2011a; Demeter et al. 2008).

One onsite property is located within the direct APE: Fermi 1, which was evaluated for NRHP eligibility as part of a separate project and appears to meet the criteria for NRHP eligibility. The Michigan SHPO indicated concurrence with this finding per the letter dated May 9, 2011 (Detroit Edison 2011a; Kuranda et al. 2009; Conway 2011).

Twenty additional offsite properties within the indirect APE have been recommended to be NRHP eligible. These resources include:

- The proposed Pearl Drive Historic District, composed of four houses (Detroit Edison 2011a; Demeter et al. 2008), and
- Nineteen individual buildings or structures (Detroit Edison 2011a; Demeter et al. 2008).

The Phase I cultural resources investigations did not discover any human remains in the terrestrial portions of the APE (Demeter et al. 2008; Taylor 2009).

The proposed new approximately 11-mi transmission line route from the Sumpter-Post Road junction to the Milan Substation has been assessed as having a moderate to high potential for identifying archaeological resources; however, no Phase I cultural resource investigations were conducted (Detroit Edison 2011a).

Submerged Sites Sensitivity Study

CCRG reported the results of the submerged sites sensitivity study in December 2008 (Weir 2008a). The purpose of the submerged sites sensitivity study was to identify previously recorded submerged sites and maritime-related resources within the submerged sites APE and to determine the likelihood that previously unidentified submerged sites and maritime-related resources would be located within the submerged sites APE. On the basis of the presence of known resources in areas outside the submerged sites APE, the lack of research on submerged sites within the general project area, and the shallow water environment within the submerged sites APE, CCRG concluded that the submerged sites APE has a moderate to high sensitivity for containing previously unidentified maritime-related resources. However, no previously recorded submerged sites or maritime-related resources (including archaeological sites, structures such as docks, or shipwrecks) were identified within the submerged sites APE and portions of the APE along the shoreline and in the vicinity of the current outfall pipes, water intake pipes, dock, and channel were assessed as having been previously disturbed by landfilling and dredging during the building and operation of Fermi 1 and 2 (Weir 2008a).

The results of the Phase I cultural resource investigations conducted for the Fermi 3 project (Demeter et al. 2008; Taylor 2009, 2011), including the results of the submerged sites sensitivity assessment (Weir 2008a), have been submitted to the Michigan SHPO for review and comment under Section 106 of the NHPA.

Traditional Cultural Properties

Detroit Edison contacted six Native American groups in an effort to identify any traditional cultural properties in the area of the Fermi 3 site and/or to determine whether the Fermi 3 site is an area that is otherwise sensitive to these groups with respect to cultural resources. Five of the six Native American groups are Federally recognized Indian Tribes: the Match-e-be-nash-she-wish Band of Potawatomi Indians of Michigan; the Huron Potawatomi, Inc.; the Forest County Potawatomi Community of Wisconsin; the Hannahville Indian Community; and the Saginaw Chippewa Indian Tribe of Michigan (Detroit Edison 2009d). The NRC also contacted these five Federally recognized Indian Tribes as part of consultation under NEPA and Section 106 of the NHPA (see Section 2.7.4). The remaining Native American group contacted by Detroit Edison was the non-Federally recognized Native American group (the Wyandot of Anderdon Nation) (Detroit Edison 2009d).

None of the five Federally recognized Indian Tribes responded to Detroit Edison. The non-Federally recognized Native American group responded to Detroit Edison’s contact but did not identify any traditional cultural properties in the area of the Fermi 3 site or indicate that the Fermi 3 site is an area that is sensitive to this group with respect to cultural resources (Detroit Edison 2011a; Gronda 2008). Responses from Federally recognized Indian Tribes that the NRC has received to date are discussed in Section 2.7.4.

2.7.3 Historic and Cultural Resources within the Transmission Line Corridor

The proposed transmission line route will extend from the Fermi 3 site in Monroe County north and west to the existing Milan Substation in Washtenaw County. The majority of the proposed transmission line route, from the Fermi 3 project area in Monroe County north to the Sumpter-Post Road junction in Wayne County, will utilize an existing transmission line route. The remaining portion of the proposed transmission line route, from the Sumpter-Post Road junction in Wayne County west to the existing Milan substation in Washtenaw County, will utilize a new, undeveloped transmission line route.

Efforts to identify cultural resources along the proposed transmission line route consisted of site file research for the entire proposed transmission line route and a field view of the proposed new portion of the route. The APE for the site file search for the entire proposed transmission line route was defined as a 1.5-mi area around the proposed route from the Fermi 3 site in Monroe County to the existing Milan Substation in Washtenaw County. Site file searches identified a total of 77 previously recorded archaeological resources within the proposed transmission line route APE; no previously recorded architectural resources or NRHP-listed or NRHP-eligible historic properties were identified (Detroit Edison Corporation 2011a). Six of the 77 archaeological resources would be crossed by that portion of the proposed transmission line route that would require a new corridor. These six archaeological resources, which consist of five prehistoric archaeological sites and one historic archaeological site, were previously determined to not be NRHP eligible (see Table 2-63).

Table 2-63. Identified Transmission Line Corridor Archaeological Resources

Site Number	Site Description	Site Age or Cultural Period	NRHP–Eligibility Status
20WN928	Previously Recorded Prehistoric Archaeological Site	Unidentified Prehistoric	Determined Not Eligible
20WN927	Previously Recorded Prehistoric Archaeological Site	Woodland	Determined Not Eligible
20WN972	Previously Recorded Prehistoric Archaeological Site	Late Woodland	Determined Not Eligible
20WN 973	Previously Recorded Prehistoric	Unidentified Prehistoric	Determined Not Eligible
20WN976	Previously Recorded Prehistoric	Late Woodland	Determined Not Eligible
20WN1043	Historic Archaeological Site	19th and 20th Century	Determined Not Eligible

Source: Detroit Edison 2011a

The preliminary field view of the APE for both archaeological and aboveground resources was limited to the portion of the proposed transmission line route that would require a new corridor, and it extended 1.5 mi on either side of an assumed 300-ft-wide corridor centerline (Detroit Edison 2011a). Results of this field view of the proposed new transmission line route indicated a moderate to high potential for identifying archaeological resources and the few aboveground resources that meet the minimum age requirement or retain sufficient integrity to be considered for NRHP eligibility (Detroit Edison 2011a).

Cultural resources impacts related to construction of the proposed transmission lines are discussed in Sections 4.6, 10.2.1, and 10.4.1.5. Operational impacts of the proposed transmission lines on cultural resources are discussed in Sections 5.6 and 10.2.2, and cumulative transmission line cultural resource impacts are discussed in Section 7.5.

2.7.4 Section 106 Consultation

In December 2008, the NRC initiated Section 106 consultation for the proposed Fermi 3 project with the Michigan SHPO and the Advisory Council on Historic Preservation (ACHP) as part of the scoping process for the review of the Fermi 3 COL application under NEPA, consistent with 36 CFR 800.8(c) (NRC 2008a, b) (see Appendix C). In December 2008, the NRC also initiated Section 106 consultation for the proposed Fermi 3 project with a total of 17 Federally recognized Indian Tribes, in accordance with 36 CFR 800.2(c)(2)(ii) and 36 CFR 800.3(c), (see Appendix C for complete listing). Twelve of the Indian Tribes contacted as part of the scoping process are located in the State of Michigan. The remaining five Indian Tribes are located outside the State of Michigan but are either within a 50-mi radius of the Fermi 3 project or have a judicially established land claim in Monroe County, Michigan, or in lands within a 50-mi radius of Fermi 3. In these letters, the NRC provided information about the proposed action and indicated that Section 106 consultation would be integrated with the NEPA process in accordance with 36 CFR 800.8 and would include participation in the scoping process; the identification of cultural resources and historic properties, including those historic properties of traditional religious or cultural importance to Federally recognized Indian Tribes; the assessment of effects of the proposed action on any historic properties; and the resolution of any adverse effects on historic properties.

The USACE issued Public Notice LRE-2008-00443-1-S11 (USACE 2011c) to solicit comments from the public; Federal, State, and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of regulated activities associated with the Fermi 3 project. The comments received are under review and are being considered by the USACE to determine whether to issue, modify, condition, or deny a permit and to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors.

The ACHP responded to the NRC, indicating that the NRC must notify the Michigan SHPO and meet the standards in 36 CFR 800.8(c)(1)(i) through (v); and that it should notify the ACHP in the event that the NRC determines, in consultation with the SHPO/Tribal Historic Preservation Office (THPO) and other consulting parties, that the proposed undertaking may adversely affect properties listed, or eligible for listing, on the NRHP, and submit to the ACHP any EIS that is prepared pursuant to 36 CFR 800.8(c)(2)(i) (Vaughn 2009). The NRC notified the ACHP of the finding of adverse effects on Fermi 1 and invited the ACHP to participate in the consultation to resolve the adverse effects, in accordance with 36 CFR 800.6 (NRC 2011).

In a December 21, 2009, phone conversation, Mr. Brian Grennell of the Michigan SHPO suggested that the NRC provide him with a completed Michigan SHPO's *Application for Section 106 Review* form to facilitate his Section 106 review of the Fermi 3 COL application. This form was further discussed in a phone conference with Mr. Grennell on August 5, 2010. The NRC sent the completed form to the Michigan SHPO in a letter dated December 17, 2010. In a response letter dated May 9, 2011 (that was received on May 10, 2011), the Michigan SHPO stated that Fermi 1 appeared to meet the criteria for listing in the NRHP and that it concurred with the NRC's determination that demolition would have an adverse effect on Fermi 1 (Conway 2011).

To date, one of the 17 Federally recognized Indian Tribes, the Delaware Nation, Oklahoma, has responded to the NRC (Smith 2011). In a letter dated December 30, 2011, the Delaware Nation requested to be a consulting party on the project and requested that all surveys, reports, and information pertaining to the project be forwarded to the Delaware Nation Cultural Preservation Director for review. NRC forwarded the requested surveys, reports, and information to the Delaware Nation on February 21, 2012 (NRC 2012a). To date, the Delaware Nation has not provided any comments or identified any concerns regarding the surveys, reports, and information pertaining to the project and did not participate in the development of the Memorandum of Agreement (MOA) to resolve adverse effects of the Fermi 3 project on Fermi 1.

The NRC review team conducted consultation to resolve the adverse effect of Fermi 3 on historic properties (specifically, Fermi 1) in accordance with 36 CFR 800.6. NRC, the Michigan SHPO, Detroit Edison, and the Monroe County Community College were the consulting parties. As a result of this consultation, an MOA between NRC and the Michigan SHPO was developed, stipulating measures for Detroit Edison to implement to resolve the adverse effects of Fermi 3 on Fermi 1. These measures will consist of recordation of the Fermi 1 structure and development of a public exhibit on the history of Fermi 1.

The MOA's first (recordation) stipulation states that Detroit Edison will conduct recordation documentation of the Fermi 1 structure in accordance with Michigan SHPO *Documentation Guidelines,* submit original documentation packages to the Michigan SHPO for review and approval, and submit original documentation packages to the State Archives of Michigan and the Monroe County Library within one year of the date of the executed MOA. The MOA's first stipulation has been met because the Michigan SHPO stated in a letter dated May 7, 2012, that it had reviewed and accepted the recordation materials submitted by DTE (MacFarlane-Faes 2012), and DTE has submitted original documentation packages to the State Archives of Michigan and the Monroe County Library and Reference Center.

The MOA's second stipulation states that Detroit Edison will develop and establish a permanent public exhibit on the history of Fermi 1 in consultation with Monroe County Community College and other interested parties and the Michigan SHPO within two years of the signed MOA. The MOA states that Detroit Edison will coordinate with the various parties to develop a mutually acceptable plan for the scope, location, and design of this exhibit and, at the conclusion of the exhibit, will offer any remaining archival items pertaining to the history of Fermi 1 to local, State, and Federal agencies and nonprofit organizations potentially interested in the permanent retention or display of these items (NRC 2012b). Per the direction of the Michigan SHPO, the NRC requested comments from seven interested parties on the draft MOA, six of which replied stating they had no comments (see Appendix C). (The seventh did not reply.) The MOA was thus finalized and signed on March 20, 2012, by the Michigan SHPO after being signed by the NRC, DTE, and Monroe County Community College. A copy of the executed MOA was forwarded to the ACHP for filing (NRC 2012c). The MOA's first stipulation has been met because the Michigan SHPO stated in a letter dated May 7, 2012, that it had reviewed and accepted the recordation materials submitted by DTE (MacFarlane-Faes 2012), and DTE has submitted original documentation packages to the State Archives of Michigan and the Monroe County Library and Reference Center.

On January 14, 2009, the NRC conducted two public scoping meetings (an afternoon session and an evening session), with USACE participation, in Monroe, Michigan, at the Monroe County

Community College's La-Z-Boy Center Meyer Theater. Comments made during the scoping meetings identified five additional historic or cultural resources in the vicinity of the Fermi 3 site (NRC 2009a). The five historic or cultural resources identified during the scoping meetings are as follows:

- Monroe Harbor.
- River Raisin Battlefield, an NRHP-listed historic property and a congressionally authorized addition to the NPS.
- A portion of the existing Motor Cities National Heritage Area, a Congressionally designated area that is collaboratively managed by Federal, State, and local public and private agencies and groups to promote natural, cultural, historic, and scenic resources that combine to form a cohesive, nationally important landscape arising from patterns of human activity shaped by geography (in this case, the development of the automotive industry and the relationship between labor and industry).
- A proposed War of 1812 Bicentennial Legacy Commission project, developed under the auspices of the Michigan Commission on the Commemoration of the Bicentennial of the War of 1812 by the Experiential Tourism Task Group, War of 1812 Bicentennial Steering Committee in Monroe County, and consisting of the proposed reestablishment of wild rice (*Zizania aquatica*), with the help of the Native American Community, in unspecified areas suitable for its propagation.
- A proposed War of 1812 Bicentennial Legacy Commission project consisting of the proposed development of a nonmotorized trail, Hull's Road Coastal Heritage Trail along North Dixie Highway, in part in the vicinity of the Fermi 3 site, as part of the Downriver Greenways Initiative (NRC 2009a).

Two of the five historic or cultural resources identified during the scoping meetings, Monroe Harbor and the River Raisin Battlefield, are outside the Fermi 3 APE. Another two of the five resources, the Motor Cities National Heritage Area and the proposed reestablishment of wild rice as a proposed War of 1812 Bicentennial Legacy Commission project, overlap but do not have specific or identified locations within the Fermi 3 APE. The fifth resource, the proposed development of Hull's Road Coastal Heritage Trail along North Dixie Highway, would be located along or immediately adjacent to the western boundary of the indirect APE. No other comments or concerns regarding historic and cultural resources were made at the scoping meetings.

According to 10 CFR 50.10(a)(2)(vii) the building of transmission lines is not considered an NRC-authorized activity. Therefore, the NRC considers the offsite proposed transmission lines to be outside the NRC's APE and therefore not part of the NRC's consultation.

2.8 Geology

The geology and associated seismological and geotechnical conditions at the proposed Fermi Unit 3 site are described in Section 2.5 of the FSAR, which is part of the COL application (Detroit Edison 2012b). A summary of the geology of the Fermi site is provided in Section 2.6 of the ER (Detroit Edison 2011a). Both the FSAR and the ER were informed by the characterization conducted for the now decommissioned Fermi 1 and the operating Fermi 2 and the results of subsurface investigations performed recently to support the COL application. The staff's descriptions of the geological features of the site and the vicinity and its detailed analyses and evaluations of geological, seismological, and geotechnical data, as required for an assessment of the site-safety issues related to Fermi 3, are, or will be, included in the staff's Safety Evaluation Report.

The Fermi site is in the Eastern Lake section of the Central Lowland physiographic province (USGS 2010a). The geologic setting is described in detail in the FSAR (Detroit Edison 2012b). In summary, the site is in a relatively tectonically stable region, with glacial and glaciolacustrine Pleistocene deposits underlain by a thick succession of Paleozoic sedimentary bedrock. The near-surface units are summarized in Table 2-64. Excavation for some site buildings extends through the surficial unconsolidated materials and into the Bass Islands Group bedrock.

Table 2-64. Geologic Units at the Fermi 3 Site

Formation	Geologic Age	Description	Approx. Thickness (ft)	Approx. Depth to Upper Contact (ft)
Fill	Recent	Various gravel-cobble fill and fine-grained fill	Up to 15	0
Lacustrine deposits	Pleistocene	Mainly clay and silty clay	0 to 8.7	Up to 15
Glacial deposits	Pleistocene	Clay with sand or gravel, silt with sand or gravel, clayey gravel	6 to 19	15 to 20
Bass Islands Group	Silurian	Dolomite	Up to 99	28
Salina Group	Silurian	Shale, halite, dolomite, anhydrite	Hundreds	119

Source: Detroit Edison 2012b

The Fermi site is fairly flat, with site elevations mainly in a range of approximately 575 to 595 ft. Most existing Fermi facilities, including Fermi 2, are located at elevation 583.0 ft plant grade datum (581.8 ft NAVD 88), and Fermi 3 would be located on an area elevated to 590.0 ft plant grade datum (587.8 NAVD 88), with safety-related facilities at a minimum of 590.5 ft plant grade datum (589.3 NAVD 88).

The average water elevation for Lake Erie is estimated to be 571.6 ft NAVD 88 (NOAA 2009a). A rock barrier is present east of Fermi 2 at the shoreline to protect against high water levels of

Lake Erie. The rock barrier crest elevation is at 581.8 ft NAVD 88. Over the past 30 years, the Lake Erie shoreline at the Fermi site has remained fairly stable. Additional hydrologic information, including information on lake level and site drainage, is in Section 2.3.1.1.

Soils adjacent to the developed portion of the Fermi site are primarily Lenawee silty clay loam, a very poorly drained soil developed on till-floored lake plains (USDA 2010).

Mineral resources in Monroe County are summarized in a USGS (2010b) database of locations and deposit types. The resources include active and inactive quarries, sand and gravel pits, and clay pits. The nearest extraction site to the Fermi property is a clay pit 6 mi to the north. Several additional quarries in the county, including the Fermi quarries that were used to support the building of Fermi 2, are described by Reeves et al. (2004) and Detroit Edison (2011a). The nearest offsite quarry is about 3 mi north-northwest of the Fermi site. In Monroe County, bedrock aquifers are the main groundwater resource; glacial drift generally provides water only in small to moderate quantities (Reeves et al. 2004). Further hydrogeologic information is in Section 2.3.1.2.

2.9 Meteorology and Air Quality

The following sections describe the climate and air quality of the Fermi 3 site. Section 2.9.1 describes the climate of the region and area in the immediate vicinity of the Fermi 3 site, Section 2.9.2 describes the air quality of the region, Section 2.9.3 describes atmospheric dispersion at the site, and Section 2.9.4 describes the meteorological monitoring program at the site.

2.9.1 Climate

The Fermi 3 site is located in Monroe County in the southeastern corner of Michigan. Its climate is influenced by Lake Erie and its location with respect to major storm tracks. The Fermi 3 site has a humid continental climate that is marked by variable weather patterns and that features cold winters with frequent snowfalls and warm and humid summers with frequent thunderstorms. Because of its proximity to Lake Erie, the site experiences relatively small diurnal and seasonal temperature ranges compared with those at comparable latitudes. Air masses approach the region mostly from the southwest, except when they come from the northwest during spring months. The closest first-order weather stations with long periods of record are Detroit Metropolitan Airport, about 17 mi north-northwest of the site; Toledo Express Airport, about 38 mi southwest of the site; and Flint Bishop International Airport, about 74 mi north-northwest of the site. These stations provide a good indication of the general climate at the site because of their proximity. The general area surrounding the site is relatively flat, with no topographic features that would cause the local climate to deviate significantly from the regional climate.

The following statistics are derived from local climatological data for Detroit Metropolitan Airport (NCDC 2010a). Temperatures are more variable in the winter than in the summer because of the differences in air mass source regions. Mean daytime maximum temperatures range from about 31.1°F in January to about 83.1°F in July, while mean nighttime minimum temperatures range from about 17.0°F in January to about 62.1°F in July. Monthly average wind speeds range from about 7.6 miles per hour (mph) in August to about 11.4 mph in January. Precipitation varies slightly from season to season, with the highest of 9.81 in. in summer and the lowest of 6.30 in. in winter. Snow generally occurs from October to April, with an annual total of 44.0 in., of which about 90 percent falls from December to March.

On a larger scale, climate change is a subject of national and international interest. The recent compilation of the state of knowledge in this area by the U.S. Global Change Research Program (USGCRP), a Federal Advisory Committee (USGCRP 2009) has been considered in preparation of this EIS. The USGCRP has provided valuable insights regarding the state of knowledge of climate change. The projected change in temperature from the “recent past” (1961–1979) over the period encompassing the licensing action (i.e., to the period 2040 to 2059 in the USGCRP report) in the vicinity of the Fermi site is an increase of between 3 to 5°F. While the USGCRP has not incrementally forecast the change in precipitation by decade to align with the licensing action, the projected change in precipitation from the “recent past” (1961–1979) to the period 2080 to 2099 was presented. The USGCRP report forecasts that northern areas will become wetter as a result of more northward incursions of storm tracks: about a 15 to 20 percent increase in winter and spring, a 5 to 10 percent decrease in summer, and a 0 to 5 percent increase in fall around the Fermi site (USGCRP 2009).

On the basis of the assessments of the USGCRP and the National Academy of Sciences’ National Research Council, the EPA determined that potential changes in climate caused by greenhouse gas (GHG) emissions endanger public health and welfare (74 FR 66496). The EPA indicated that although ambient concentrations of GHGs do not cause direct adverse health effects (such as respiratory or toxic effects), public health risks and impacts can result indirectly from changes in climate. As a result of the determination by the EPA and the recognition that mitigative actions are necessary to reduce impacts, the review team concludes that the effect of GHG emissions on climate and the environment is already noticeable but not yet destabilizing. The Commission has provided guidance to the NRC staff to consider carbon dioxide and other GHG emissions in its NEPA reviews and has directed that such considerations should encompass emissions from constructing and operating a facility as well as from the fuel cycle (NRC 2009b). The review team characterized the affected environment and the potential GHG impacts of the proposed action and alternatives in this EIS. Consideration of GHG emissions was treated as an element of the existing air quality assessment that is essential in a NEPA analysis. In addition, in situations in which it was important to do so, the review team considered the effects of the changing environment during the period of the proposed action on other resource assessments.

2.9.1.1 Wind

To examine regional wind patterns around the Fermi site, the staff reviewed wind roses from the three nearby first-order weather stations (Detroit, Toledo, and Flint) for the years 2005 through 2009 (NCDC 2010b). Overall wind patterns among the three nearby first-order weather stations show some similarity, but monthly wind patterns are somewhat different, and these differences are primarily attributable to the position of storm tracks. The wind rose from the closest first-order weather station, Detroit Metropolitan Airport, is presented in Figure 2-22.

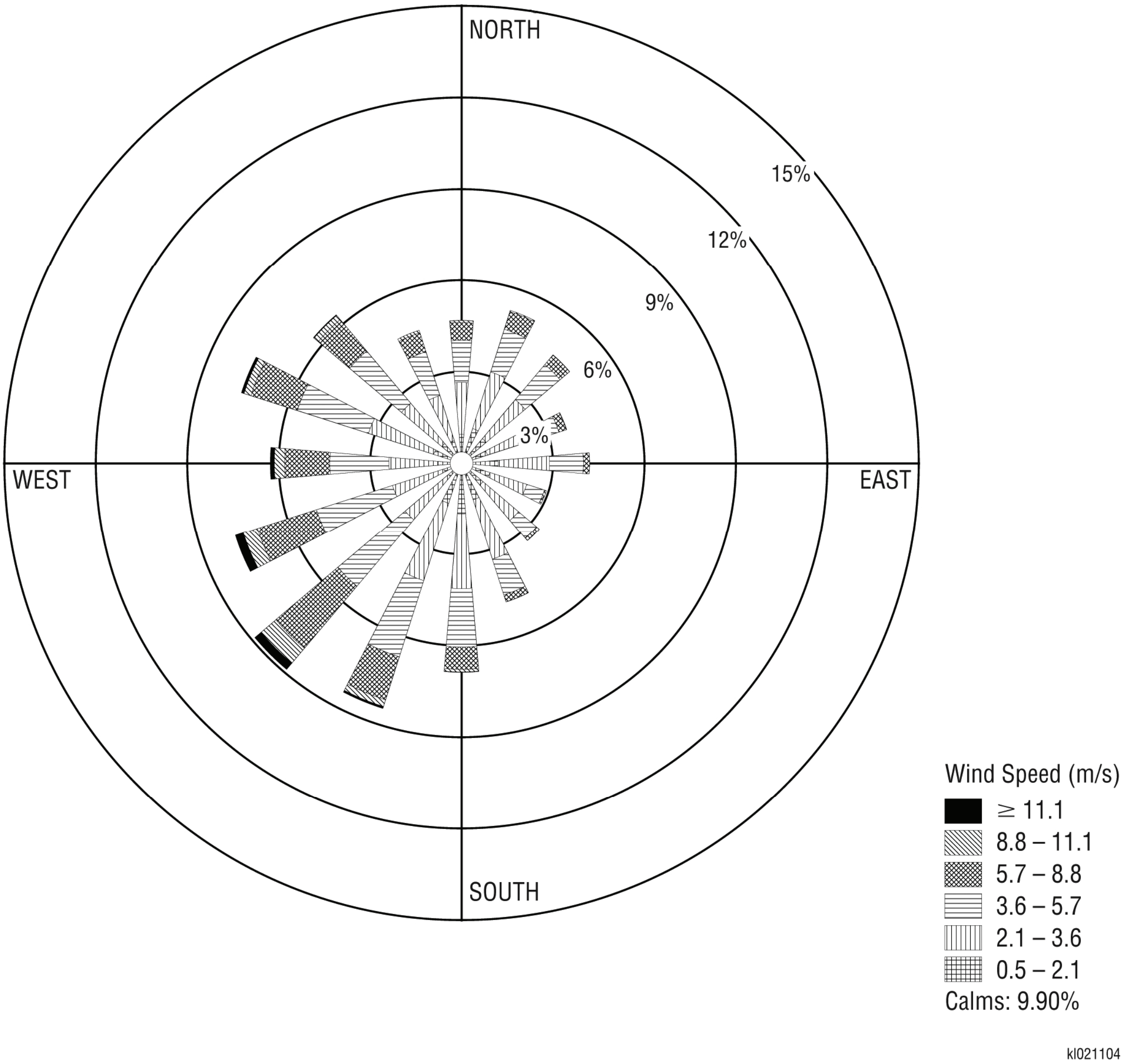

Figure 2-22. Wind Rose at 33-ft Height at the Detroit Metropolitan Airport, Detroit, Michigan, 2005 to 2009 (Data source: NCDC 2010b)

As shown in Figure 2-22, the average annual wind speed at Detroit Metropolitan Airport is about 8.6 mph. For the same period, average annual wind speeds at Toledo (8.1 mph) are lower than those at Flint and Detroit, both of which are 8.6 mph. The Detroit seasonal lowest wind speed of 7.2 mph occurs in summer, while the Detroit seasonal highest wind speed of 10.0 mph occurs in winter. Although not prominent, the prevailing wind direction is from the southwest (about 8.9 percent of the time). Prevailing winds are from the west-southwest for Toledo and from the south-southwest for Flint. About 25 percent of the time, winds at Detroit blow from southwesterly directions, including south-southwest, southwest, and west-southwest. Typically, when the Bermuda High sits over the southeastern United States and storm tracks move north of the Fermi site, southwesterly winds dominate. During winter months when a storm track is situated near the Fermi site, westerly and northwesterly winds become more frequent.

Figure 2-23 presents the 33-ft height wind rose at the Fermi site based on 2001 to 2007 onsite wind data (Detroit Edison 2010c). Average annual wind speed is about 6.6 mph, which is approximately three-fourths of that at the Detroit Metropolitan Airport. The reason for differences in wind speeds is that the meteorological tower at the Fermi site is surrounded by forest and existing Fermi 2 facilities, while the tower at the airport is exposed to open areas. The prevailing wind direction is from the southwest (about 11.2 percent of the time). Similar to Detroit, winds blow from southwesterly directions, including south-southwest, southwest, and west-southwest, about 30.2 percent of the time. Overall, annual and monthly wind direction patterns of the two stations are quite similar. The exception is higher frequencies of occurrence of the southeast components for the Fermi site, which are attributable to onshore lake breezes that develop most often during late spring through early fall.

2.9.1.2 Temperature

The temperature measured at the 33-ft level of the Fermi meteorological tower is considered to be representative of the Fermi 3 site. Temperature data from the tower for the 2001 through 2007 time period show that the annual average temperature is 50.6°F, with the lowest monthly average temperature of 27.3°F occurring in January and the highest monthly average temperature of 73.5°F occurring in July. During this 7-year period, the absolute minimum temperature was –3.8°F, and the absolute maximum temperature was 94.3°F. These temperatures are consistent with long-term values for Detroit Metropolitan Airport, with a monthly minimum of 24.5°F in January and a monthly maximum of 73.5°F in July during climate normal years (1971–2000). About 12.0 days per year have a maximum temperature that is higher than or equal to 90°F, while about 130 days per year have a minimum temperature that is lower than or equal to 32°F (NCDC 2010a).

2.9.1.3 Atmospheric Moisture

The moisture content of the atmosphere can be represented in a variety of ways. The most common are in terms of relative humidity, precipitation, and fog. The atmospheric moisture

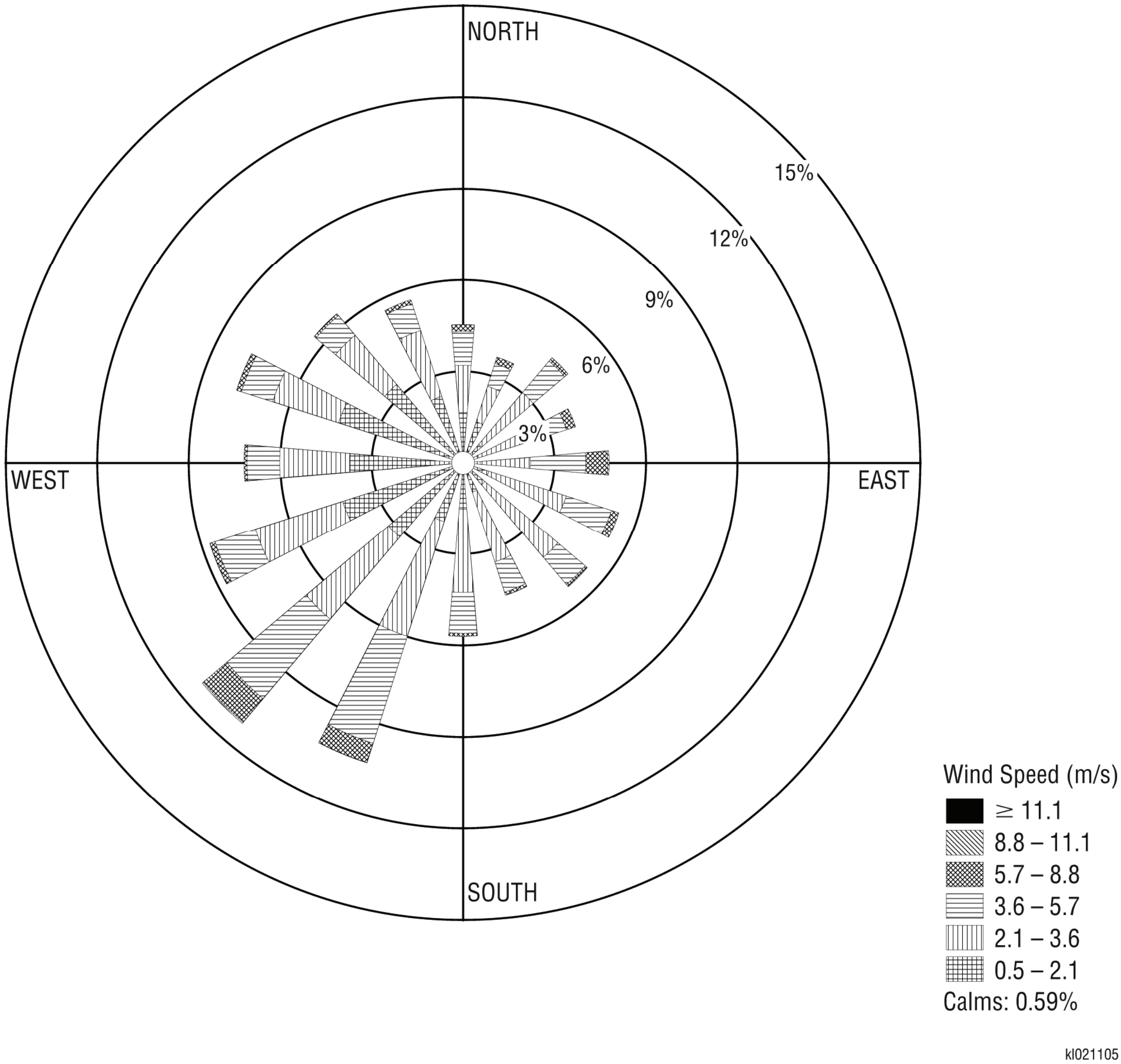

Figure 2-23. Wind Rose at 33-ft Height at the Fermi Site, Monroe County, Michigan, 2001 to 2007 (Data source: Detroit Edison 2010c)

measurements at the Fermi site include precipitation and dew-point temperature. Wet-bulb temperature, relative humidity, fog, and visibility data are not collected at the Fermi site.

For precipitation, historic measurement data at the Detroit Metropolitan Airport are presented because of frequent malfunctions of the precipitation sensor at the Fermi site during the 2003–2007 period. Annual precipitation averaged about 32.9 in. during climate normal years

(1971–2000) (NCDC 2010a). Measurable precipitation of 0.01 in. or more occurred about 137 days per year. Wintertime storm tracks are typically positioned south of Detroit, which could bring combinations of rain, snow, freezing rain, and sleet, along with heavy snowfall accumulations on occasion.

The area surrounding the Fermi site experiences abundant precipitation, and about 38 percent of the days have precipitation levels of at least 0.01 in., but droughts still occur at times. According to the Palmer Drought Index (NCDC 2010c), which determines the severity of drought conditions, more than 10 droughts have occurred in Michigan since 1900, and a recent drought was recorded in the late 1990s. Overall, the frequency of extreme drought conditions has been decreasing, and more wet years have been prevalent since 1940.

The annual average relative humidity at the Detroit Metropolitan Airport is about 71 percent. Relative humidity remains relatively uniform throughout the year, with the lowest monthly average of 65 percent occurring in April and May and the highest monthly average of 77 percent occurring in December (NCDC 2010a). Relative humidity is lowest during the day (the annual average relative humidity at 1 p.m. local standard time is 60 percent) and highest during early morning (the annual average relative humidity at 7 a.m. local standard time is 81 percent). Because of its proximity to Lake Erie, the Fermi site is expected to experience higher relative humidity and smaller monthly variations than locations that are farther inland but at a comparable latitude (e.g., Detroit Metropolitan Airport).

Fog occurs when horizontal visibility is less than or equal to 7 mi. On the basis of this criterion, fog occurred about 12.7 percent of the time (1114 hours per year) at the Detroit Metropolitan Airport during the period 1961–1995 (NCDC 1993; NCDC 1997). Fog occurs more frequently in winter than in summer, with the highest frequency of 17.5 percent of the time occurring in December and the lowest frequency of 9.0 percent of the time occurring in June. For the same period, heavy fog that restricts visibility to less than or equal to 0.25 mi is reported about 0.7 percent of the time (62.4 hours per year) on an annual basis. Monthly variations for heavy fog are almost the same as those for fog. Heavy fog occurred about 17.8 days per year, with about 2 to 3 days occurring in winter and less than 1 day occurring in summer (NCDC 2010a).

2.9.1.4 Atmospheric Stability

Atmospheric stability is a meteorological parameter that describes the dispersion characteristics of the atmosphere. It can be determined by the difference in temperature between two heights. A seven-category atmospheric stability classification scheme (ranging from A for extremely unstable to G for extremely stable) based on temperature differences is set forth in NRC’s Regulatory Guide 1.23, Revision 1 (NRC 2007). When the temperature decreases rapidly with height (typically during the day, when the sun is heating the ground), the atmosphere is unstable, and atmospheric dispersion is greater. Conversely, when temperature increases with height (typically during the night as a result of the radiative cooling of the ground), the atmosphere is stable, and dispersion is more limited. The stability category between unstable and stable conditions is D (neutral), which would occur typically with higher wind speeds and/or higher cloud cover, irrespective of day or night.

Onsite temperature measurement data at the 10-m and 60-m levels of the Fermi meteorological tower for the years 2001 through 2007 are used to determine the stability classes for the site. On an annual basis, D stability (neutral) is the most prevalent single stability class, accounting for about 31.6 percent of the time. The unstable conditions (A to C) occur approximately 28.2 percent of the time, while the stable conditions (E to G) occur about 40.2 percent of the time. Stability patterns vary from season to season. Stabilities A (extremely unstable), D (neutral), and E (slightly stable) are most frequent and can occur throughout the year. Stability A occurs more frequently from mid-spring to early fall when solar radiation is the strongest, and Stability D peaks in winter months. However, frequencies of Stability E remain fairly constant throughout the year.

The temperature contrast at the coastal boundary, due to uneven heating rates of land and water, can cause local lake/land breeze circulation. Around the Fermi site, a lake/land breeze occurs primarily in the warmer months (May to October), with its peak strength happening in the summer. When cooler air over a large water body (i.e., Lake Erie) advances inland during lake breeze conditions, a thermal internal boundary layer begins to develop because of the mechanical and thermal effects at the land-water interface. Typically, a lake breeze begins around late morning and peaks around mid-afternoon. As the sun sets, the land-lake temperature difference decreases and the lake breeze disappears. At night, the land cools off more quickly than the water, and this temperature contrast causes a land breeze, blowing from land to water. The strength of the land breeze is usually weaker than that of its daytime counterpart, the lake breeze.

On the basis of 2001–2007 onsite hourly temperature difference data, extremely unstable conditions (Stability A) occurred about 29 percent of the time when onshore winds blew from Lake Erie, in wind directions ranging from east-northeast to south. These wind conditions can occur during onshore flow conditions, either as local lake breezes or synoptic winds blowing from Lake Erie toward the land. In particular, an autoconvective condition with a lapse rate of –3.4°C per 100 m was frequently exceeded with onshore wind flows (the autoconvective lapse rate represents severe extremely unstable conditions when the density of the atmosphere increases with height). Autoconvective conditions account for about 31 percent of extremely unstable conditions under onshore wind flow conditions. Colder lake air affects temperatures at the 60-m height more than those at the 10-m height because the lower portion of the onshore flow is heated first by the land surface as it comes ashore. The existing meteorological tower is located about 0.5 mi from Lake Erie. At night, the Fermi site has air with relatively more moisture than the air at an inland site at a comparable latitude, and less radiative cooling occurs, which can lead to more neutral conditions than stable conditions. About 70 percent of extremely stable conditions (Stability G) occurred when offshore winds with drier air prevailed (i.e., blowing from the land toward Lake Erie). As a consequence, atmospheric stability and its attendant dispersion characteristics are affected considerably by Lake Erie.

2.9.1.5 Severe Weather

The site can experience severe weather in the form of thunderstorms, lightning, hail, ice storms, waterspouts, and tornadoes.

Thunderstorms occur about 32 days per year at the Detroit Metropolitan Airport (NCDC 2010a). Thunderstorms are most active during the summer months: on about 1 of 5 days from June through August. The Detroit area experiences about 5 days per year of damaging severe thunderstorms with straight winds greater than 50 knots (57.5 mph) (NSSL 2009). Another hazard of thunderstorms is lightning, which can strike up to 10 mi away from the rain. Some lightning strikes have caused injuries, including fatalities, or property damage, including that from disruptions of electrical circuits and wildfires. The Detroit area experienced about two to four flashes of lightning per square kilometer per year from 1996 through 2005 (NOAA 2009b).

On the basis of 1955–2002 data, the 1°-latitude-by-1°-longitude area around the Fermi site experienced about 16.5 hail events per year when hail diameters were 0.75 in. or more and fewer than one hail event per year when hail diameters were 2 in. or more (Schaefer et al. 2004). Seventy-two hail events have been reported for Monroe County (which encompasses the Fermi site) since 1963, eleven of which involved hail diameters of 1.75 in. or more (NCDC 2010d). The event with the largest hail diameter reported for Monroe County occurred on March 27, 1991; the diameter was 4 in. The majority of hail events occurred in April through July, and no hail was reported from November through February.

The Fermi site and surrounding region can experience wintry precipitation such as ice storms mostly during winter and early spring. Data for 1976 to 1990 indicate that freezing rain occurred on about 5 days/year around the Fermi site, while ice pellets occurred on about 4 days/year (Cortinas et al. 2004). Freezing rain and ice pellets occur mostly from November through April, peaking during the winter months. Thirty-seven snow and ice storms have been reported in Monroe County since 1993 (NCDC 2010d). A total of nine freezing rain events were reported in Monroe County, and ice accumulation during most events was 0.5 in. or lower. The highest ice accumulation, ranging from 1.5 to 2.5 in., occurred on March 13 and 14, 1997, when a major ice storm hit southeastern Michigan.

On occasion, tornadoes occur in the area surrounding the Fermi site, but they are less frequent and destructive than those in the "tornado alley" of the central United States. For the period 1950 to 2009, 28 tornadoes were reported in Monroe County, with an average frequency of one every two years (NCDC 2010d). More than 75 percent of the tornadoes occurring in Monroe

County were relatively weak (less than or equal to F2 on the Fujita tornado scale). However, two F3 and four F4 tornadoes were reported in Monroe County; the combined F4 tornadoes caused 17 fatalities, 57 injuries, and considerable property damage. On the basis of tornado statistics for the Fermi site vicinity, the review team estimates the probability of a tornado striking the proposed Fermi 3 reactor building to be about 5 in 10,000 (5×10^{-4}) per year (Ramsdell and Rishel 2007).

Around 2:30 a.m. on June 6, 2010, a tornado touched down in Detroit Beach, Michigan, traveled about 5 mi northeast, and entered Lake Erie at Estral Beach six minutes later (AnnArbor.com 2010). On the basis of the observed damage, the tornado can be classified as an EF1 tornado. The tornado's track had a width of 500 yd and an estimated top wind speed of 90 mph. Fermi 2, which was along the tornado's path, automatically shut down as a precaution. Although the reactor building was undamaged, the storm tore a 20- by 30-ft hole in the roof of the building housing the steam turbines, blew off siding from the auxiliary building, and damaged the cooling fins at the twin natural draft cooling towers (MonroeNews.com 2010). The Fermi 2 reactor was safely shut down and kept in standby mode for more than a week as repairs to associated facilities were made.

Waterspouts, which are considered to be tornadoes on water but with weaker strength, were reported twice in 1997 and 1998 along Monroe County's shoreline (NCDC 2010d). On July 26, 1998, one waterspout was reported off the shoreline of Stony Point, which is located a couple of miles south of the Fermi site.

2.9.2 Air Quality

The discussion on air quality includes six common criteria air pollutants for which the EPA has established National Ambient Air Quality Standards (NAAQS): sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$; particles with an aerodynamic diameter of less than or equal to 10 micrometers (μm) and 2.5 μm, respectively), and lead (Pb). The air quality discussion also covers heat-trapping GHGs (primarily carbon dioxide [CO_2]), which have been the principal factor causing climate change over the last 50 years (USGCRP 2009).

The Fermi 3 site is in Monroe County, Michigan, which, with Lucas and Wood Counties in Ohio, is in the Metropolitan Toledo Interstate Air Quality Control Region (AQCR) (40 CFR 81.43). However, nonattainment status for $PM_{2.5}$ is reported as a part of the Detroit-Ann Arbor Designated Area in 40 CFR 81.323. Surrounding AQCRs include the Metropolitan Detroit-Port Huron Intrastate AQCR to the north and the South Central Michigan Intrastate AQCR to the west. Monroe County and its neighboring counties are designated as an attainment area for all criteria pollutants except $PM_{2.5}$ (EPA 2010b). Monroe County is designated as a nonattainment area for $PM_{2.5}$, as are six other southeastern counties, including the Detroit metropolitan area and its downwind areas. In July 2011, the MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011). In July 2012, the EPA issued a proposed rule designating southeastern Michigan as having attained both the 1997 annual $PM_{2.5}$ NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS, based on 2009–2011 ambient air monitoring data (77 FR 39659, dated July 5, 2012) but the final determination has yet to be made. On June 29, 2009, Monroe County, with seven other southeastern counties including the Detroit metropolitan area, was redesignated from a nonattainment area to a maintenance area for the 8-hour ozone standard, and, on August 9, 2007, Lucas and Wood Counties in Ohio were redesignated (EPA 2010b).

Class I Areas as defined by the Clean Air Act are national parks larger than 6000 ac, wilderness areas, national memorial parks larger than 5000 ac, and international parks that have stringent protection from air pollution damage. There are no mandatory Class I Federal areas where visibility is an important value in the lower peninsula of Michigan. The nearest Class I area is Otter Creek Wilderness Area in West Virginia, which is located about 275 mi southeast of the Fermi site.

Air emission sources from the Fermi 3 site would include standby diesel generators and diesel fire pumps operating on an intermittent basis, an auxiliary boiler, and cooling towers. Only small amounts of air pollutant emissions from the Fermi 3 site would be released, because there is no primary combustion involved in generating power from nuclear energy. Considering the distance to the Class I areas and the minor nature of air emissions from the Fermi 3 site, there is little likelihood that activities at the Fermi 3 site could adversely affect air quality and air-quality-related values (e.g., visibility or acid deposition) in any of the Class I areas. However, a new air operating permit would be required for the proposed Fermi 3 site.

Climate changes are under way in the United States and globally, and their extent is projected to continue to grow substantially over next several decades unless intense concerted measures are taken to reverse this trend. Climate-related changes include rising temperatures and sea levels; increased frequency and intensity of extreme weather (e.g., heavy downpours, floods, and droughts); earlier snowmelts and associated frequent wildfires; and reduced snow cover, glaciers, permafrost, and sea ice. Climate changes are closely linked to increases in GHGs (USGCRP 2009). GHGs are transparent to incoming short-wave radiation from the sun but opaque to outgoing long-wave (infrared) radiation from the earth's surface. The net effect over time is a trapping of absorbed radiation and a tendency to warm the earth's atmosphere, which together constitute the "greenhouse effect." Since the onset of the Industrial Revolution in the mid 1700s, human activities have contributed to the production of GHGs, primarily through deforestation and the combustion of fossil fuels such as coal, oil, and natural gas. The principal GHGs that enter the atmosphere due to human activities include CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). However, some GHGs such as CO_2, CH_4, and N_2O are emitted to the atmosphere through natural processes as well.

2.9.3 Atmospheric Dispersion

Atmospheric dispersion factors (χ/Q values) are used to evaluate the potential consequences of accidental and routine releases at the Fermi 3 site. Onsite meteorological data from the 6-year period 2002–2007 were used by Detroit Edison to develop the atmospheric dispersion factors presented in the ER (Detroit Edison 2011a).

Detroit Edison provided the review team with hourly meteorological data recorded for the 6-year period from January 2002 through December 2007 (Detroit Edison 2011a). The staff viewed the meteorological site and instrumentation, reviewed the available information on the meteorological measurement program, and evaluated data collected by the program.

Visual inspection during a site audit conducted on February 2 to 6, 2009, indicated that the distance from the meteorological tower to the nearest obstruction (i.e., the wooded area located west of the tower) was less than 10 obstruction heights. This distance is not consistent with Revision1 of Regulatory Guide 1.23 (NRC 2007), which states wind sensors should be located over level, open terrain at a distance of at least 10 times the height of any nearby obstruction, if the height of the obstruction exceeds one-half of the height of the wind measurement. In a response to a series of Requests for Additional Information (RAIs) from the staff, Detroit Edison performed a review of wind data ranging from 1975 through 2003 and concluded that the nearby trees could be affecting the 10-m wind speed measurements during the period 2002–2007; that is, the potential exists for the wind measurements at the 10-m elevation to be lower than the actual wind speed at the 10-m elevation. Detroit Edison assessed the effect of lower measured wind speeds at the 10-m level on its short-term (accident) atmospheric dispersion estimates (χ/Q values) and concluded that it was conservative to determine these dispersion estimates by using the lower measured wind speed at the 10-m elevation. Detroit Edison also assessed the effects of lower measured wind speed at the 10-m level on its long-term (routine) atmospheric dispersion estimates and concluded that the higher (more conservative) χ/Q and deposition (D/Q) values from either the 1985–1989 period (when trees to the west of the meteorological tower were lower) or 2002–2007 period should be used in the routine release dose analysis.

2.9.3.1 Short-Term Dispersion Estimates

Acceptable methods of calculating short-term (accident) χ/Q values for design-basis accidents (DBAs) from meteorological data are set forth in Regulatory Guide 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants* (NRC 1983). The short-term χ/Q values were estimated using the PAVAN computer program (Bander 1982), which implements the methodology of Regulatory Guide 1.145.

For environmental reviews, Section 7.1 of NUREG-1555 (NRC 2000) states that DBA consequences should be evaluated by assuming realistic meteorological conditions (i.e., 50-percentile χ/Q values) at the Exclusion Area Boundary (EAB) and outer boundary of the

Low Population Zone (LPZ). The EAB and LPZ at the Fermi 3 site are circles centered at the Reactor Building with radii of 2928 ft and 3 mi, respectively. For conservatism, Detroit Edison defined dose calculation EAB and LPZ distances of 2428 ft and 2.9 mi, respectively, which were derived by using the distance from the outer edge of a circle centered on the Reactor Building that encompassed all possible release points. A 6-year (2002–2007) composite joint frequency distribution of wind speed, wind direction, and atmospheric stability was used to evaluate a ground-level (10-m level) release. The PAVAN model estimates 50-percentile overall site (i.e., non-direction-specific) 1-hour χ/Q values (which are assumed to persist for 2 hours) at the dose calculation EAB and LPZ distances. Atmospheric dispersion factors for intermediate periods at the dose calculation LPZ distance were estimated by logarithmic interpolation between the 50-percentile 1-hour χ/Q value and the corresponding annual average χ/Q value. Table 2-65 presents χ/Q results at dose calculation EAB and LPZ distances as a function of averaging time.

Table 2-65. Atmospheric Dispersion Factors for Design Basis Accidents at Fermi 3 Site

	χ/Q (s/m^3) by Averaging Time					
Location	**0–2 Hours**	**0–8 Hours**	**8–24 Hours**	**1–4 Days**	**4–30 Days**	**Annual Average**
Dose Calculation EAB	5.675×10^{-5}	–[(a)]	–	–	–	4.09×10^{-5}
Dose Calculation LPZ	4.026×10^{-6}	3.057×10^{-6}	2.664×10^{-6}	1.977×10^{-6}	1.287×10^{-6}	7.62×10^{-7}

Source: Detroit Edison 2011a

(a) A dash denotes “not applicable.”

The review team independently ran the PAVAN model by using the 2002–2007 meteorological data and obtained results similar to those of Detroit Edison. The team also independently ran the PAVAN model by using a composite joint frequency distribution derived from the 1985–1989 Fermi 2 onsite meteorological database submitted by Detroit Edison in response to a staff RAI.

Detroit Edison stated that aerial photographs of the area surrounding the Fermi meteorological tower during this time period confirmed the absence of significant air flow obstructions to wind measurements at the 10-m elevation. The staff found that its short-term atmospheric dispersion estimates that resulted from using the 1985–1989 composite joint frequency distribution were less conservative than Detroit Edison’s values from using the 2002–2007 composite joint frequency distribution. The staff therefore concluded that Detroit Edison has identified a conservative set of 50-percentile EAB and LPZ short-term atmospheric dispersion factors by using the 2002–2007 composite joint frequency distribution.

2.9.3.2 Long-Term Dispersion Estimates

Long-term dispersion estimates for use in evaluation of the radiological impacts of normal operations were calculated by Detroit Edison by using the XOQDOQ computer code (Sagendorf et al. 1982). This code implements the guidance set forth in Regulatory Guide 1.111 (NRC 1977) for estimation of atmospheric dispersion (χ/Q) and deposition factors (D/Q) for use in evaluation of the consequences of normal reactor operations.

Three release pathways were considered: ground-level releases from the Radwaste Building stack and mixed-mode releases (part-time elevated and part-time ground-level) from the Reactor Building/Fuel Building stack and the Turbine Building stack. As it did with PAVAN, Detroit Edison initially used a 6-year (2002–2007) composite joint frequency distribution of wind speed, wind direction, and atmospheric stability to evaluate potential impacts from routine releases at the Fermi 3 site. Distances from the release point to the site boundary, nearest residence, garden, sheep, goat, meat cow, and milk cow for all sectors were considered. These distances were computed by using distances from the outer edge of a circle, centered on the Reactor Building, which encompassed all three release pathways. Dry deposition and site and regional topography were considered for the dispersion analysis.

The NRC staff independently ran the XOQDOQ model by using the 2002–2007 meteorological data and obtained results similar to those of the Detroit Edison. The staff also independently ran the XOQDOQ model by using a composite joint frequency distribution derived from the 1985–1989 Fermi 2 onsite meteorological database submitted in Detroit Edison’s response to an RAI. The staff found that in several cases, its long-term atmospheric dispersion estimates that resulted from using the 1985–1989 composite joint frequency distribution were more conservative than Detroit Edison’s values from using the 2002–2007 composite joint frequency distribution. Accordingly, the applicant eventually used the higher χ/Q and D/Q values from either the 1985–1989 period or the 2002–2007 period in its routine release dose analyses. The maximum annual average χ/Q values for three plume depletion scenarios (i.e., no decay and the default half-life decay periods of 2.26 and 8 days) and annual average relative D/Q values are presented in Table 2-66. The long-term atmospheric dispersion and deposition estimates presented in the Table 2-66 are the higher values from either the 1985–1989 period or the 2002–2007 period.

2.9.4 Meteorological Monitoring

There has been a meteorological monitoring program at the Fermi site since June 1975. The initial instrumentation was installed to provide the onsite meteorological information required for licensing of Fermi 2. The Fermi 2 meteorological monitoring program provides the basis for the Fermi 3 preapplication meteorological monitoring program. The instrumentation is described briefly in the Fermi 3 ER (Detroit Edison 2011a). However, the natural draft cooling tower for Fermi 3 would be built prior to the building of Fermi 3 in the approximate location of the current

Table 2-66. Maximum Annual Average Atmospheric Dispersion and Deposition Factors from Routine Releases at Selected Receptors

Receptor	Downwind Sector	Distance (mi)	Emission Source Stack	Mode of Release	χ/Q (s/m^{-3})[a] No Decay Undepleted	χ/Q 2.26-Day Decay Undepleted	χ/Q 8-Day Decay Depleted	D/Q (m^{-2})
Site boundary	SSE	0.61	Radwaste Bldg.	Ground level	1.1×10^{-5}	1.1×10^{-5}	1.0×10^{-5}	–[b]
Site boundary	NW	0.48	Radwaste Bldg.	Ground level	–	–	–	4.9×10^{-8}
Site boundary	WNW	0.48	Reactor Bldg./ Fuel Bldg.	Mixed	–	–	–	1.7×10^{-8}
Site boundary	NW	0.48	Reactor Bldg. Fuel Bldg.	Mixed	8.7×10^{-7}	8.7×10^{-7}	8.1×10^{-7}	–
Site boundary	WNW	0.48	Turbine Bldg.	Mixed	–	–	–	1.5×10^{-8}
Site boundary	NW	0.48	Turbine Bldg.	Mixed	9.6×10^{-7}	9.6×10^{-7}	8.9×10^{-7}	1.5×10^{-8}
Residence	NW	059	Radwaste Bldg.	Ground level	7.0×10^{-6}	7.0×10^{-6}	6.3×10^{-6}	3.4×10^{-8}
Residence	NW	0.59	Reactor Bldg./ Fuel Bldg.	Mixed	6.8×10^{-7}	6.8×10^{-7}	6.3×10^{-7}	1.2×10^{-8}
Residence	NW	0.59	Turbine Bldg.	Mixed	7.2×10^{-7}	7.2×10^{-7}	6.6×10^{-7}	1.2×10^{-8}
Vegetable garden	NW	0.60	Radwaste Bldg.	Ground level	7.0×10^{-6}	7.0×10^{-6}	6.3×10^{-6}	3.4×10^{-8}
Vegetable garden	NW	0.60	Reactor Bldg./ Fuel Bldg.	Mixed	6.8×10^{-7}	6.8×10^{-7}	6.3×10^{-7}	1.2×10^{-8}
Vegetable garden	NW	0.60	Turbine Bldg.	Mixed	7.1×10^{-7}	7.1×10^{-7}	6.5×10^{-7}	1.1×10^{-8}
Sheep	NNE	4.41	Radwaste Bldg.	Ground level	1.9×10^{-7}	1.8×10^{-7}	1.4×10^{-7}	5.7×10^{-10}
Sheep	NNE	4.41	Reactor Bldg./ Fuel Bldg.	Mixed	4.8×10^{-8}	4.8×10^{-8}	4.3×10^{-8}	2.8×10^{-10}
Sheep	NNE	4.41	Turbine Bldg.	Mixed	4.3×10^{-8}	4.3×10^{-8}	3.8×10^{-8}	2.8×10^{-10}
Goat	WNW	2.21	Radwaste Bldg.	Ground level	3.0×10^{-7}	3.0×10^{-7}	2.4×10^{-7}	1.5×10^{-9}
Goat	WNW	2.21	Reactor Bldg./ Fuel Bldg.	Mixed	7.7×10^{-8}	7.7×10^{-8}	7.0×10^{-8}	8.4×10^{-10}
Goat	WNW	2.21	Turbine Bldg.	Mixed	6.9×10^{-8}	6.9×10^{-8}	6.1×10^{-8}	7.9×10^{-10}

Table 2-66. (contd)

Receptor	Downwind Sector	Distance (mi)	Emission Source Stack	Mode of Release	χ/Q (s/m^{-3})[(a)] No Decay Undepleted	χ/Q (s/m^{-3})[(a)] 2.26-Day Decay Undepleted	χ/Q (s/m^{-3})[(a)] 8-Day Decay Depleted	D/Q (m^{-2})
Meat cow	NNE	4.41	Radwaste Bldg.	Ground level	1.9×10^{-7}	1.8×10^{-7}	1.4×10^{-7}	–
Meat cow	NNW	2.95	Radwaste Bldg.	Ground level	–	1.8×10^{-7}	1.4×10^{-7}	6.4×10^{-10}
Meat cow	NNE	4.41	Reactor Bldg./ Fuel Bldg.	Mixed	4.8×10^{-8}	4.8×10^{-8}	4.3×10^{-8}	–
Meat cow	NNW	2.95	Reactor Bldg./ Fuel Bldg.	Mixed	4.8×10^{-8}	–	4.3×10^{-8}	3.4×10^{-10}
Meat cow	NNE	4.41	Turbine Bldg.	Mixed	4.3×10^{-8}	4.3×10^{-8}	3.8×10^{-8}	–
Meat cow	NNW	2.95	Turbine Bldg.	Mixed	4.3×10^{-8}	–	3.8×10^{-8}	3.3×10^{-10}
Milk cow	WNW	2.09	Radwaste Bldg.	Ground level	3.4×10^{-7}	3.3×10^{-7}	2.8×10^{-7}	1.7×10^{-9}
Milk cow	WNW	2.09	Reactor Bldg./ Fuel Bldg.	Mixed	8.4×10^{-8}	8.4×10^{-8}	7.7×10^{-8}	9.5×10^{-10}
Milk cow	WNW	2.09	Turbine Bldg.	Mixed	7.6×10^{-8}	7.5×10^{-8}	6.8×10^{-8}	8.9×10^{-10}

Source: Detroit Edison 2011a

(a) Atmospheric dispersion and deposition factors presented in the table are the higher values from either the 1985–1989 period or the 2002–2007 period.

(b) A dash denotes “not applicable.”

meteorological tower; thus, the meteorological tower would be relocated to the southeast corner of the Fermi site, which is located about 0.9 mi south-southeast of the current meteorological tower.

The current meteorological tower is located about 1113 ft west-southwest of the proposed location of the Fermi 3 containment building and has a height of 197 ft above plant grade. The primary instrumentation on the open-latticed tower consists of 10-m and 60-m wind speed and direction sensors; a 10-m vertical wind speed sensor; a 10-m air temperature sensor; a 10- to 60-m vertical air temperature difference system; a 10-m dew point sensor; and a 1.5-m (ground level) heated tipping bucket rain gauge. The sensor types, heights, and locations relative to buildings conform to *Proposed Revision 1 to Regulatory Guide 1.23, Meteorological Programs in Support of Nuclear Power Plants* (NRC 1980), except for the proximity of the trees to the meteorological tower, as discussed below. There are secondary sensors for all parameters except dew point and precipitation.

Data from the sensors are routed through signal conditioning equipment and then sent to digital data recorders. An analog backup record of the outputs is also maintained. Sensors, electronics, and recording equipment are calibrated on a six-month basis or more frequently if indicated by operating history. Visits are made to the tower twice a week for collection of data and visual inspection of the sensors and recording equipment.

Data from the primary and secondary sensors are fed independently to data acquisition equipment of the Integrated Plant Computer System (IPCS) in the Fermi 2 Control Room. The IPCS screens data for validity and quality, performs meteorological calculations, updates archives, and displays data. The data are available in five formats: instantaneous values, 1-minute blocked averages, 15-minute rolling averages, 15-minute blocked averages, and 1-hour blocked averages. Routine data summaries are generated for each day, calendar month, and calendar year. In addition, joint frequency distributions of wind speed and direction by Pasquill stability class are created from the 1-hour blocked averages.

The new meteorological tower will be located about 4750 ft south-southeast of the Fermi 3 reactor building; it will be a guyed open-latticed tower that is 197 ft high. The site is wooded, and trees will need to be trimmed to heights less than 16 ft out to a distance satisfying the 10 times building-height distance specified in Revision 1 of Regulatory Guide 1.23 (NRC 2007). A climate-controlled instrument shelter will be installed at the base of the tower. Primary and secondary sensors on the new tower will monitor the same parameters as do those on the existing Fermi 2 tower. The new tower will be operational for at least one and possibly two years prior to decommissioning of the existing tower.

The data recording process for the new program will mirror the process for the existing tower, except for the replacement of signal conditioning equipment that is no longer available.

Instrument calibration, service, and maintenance procedures currently in use will be continued for the new program. Data reduction, transmission, acquisition, and processing used in the preapplication program will continue to be used for the construction, preoperational, and operational programs.

Detroit Edison provided the review team with meteorological data for the 6-year period from January 2002 through December 2007 (Detroit Edison 2010c). The staff used these data to independently estimate atmospheric dispersion factors for the site. The staff viewed the meteorological site and instrumentation, reviewed the available information on the meteorological measurement program, and evaluated data collected by the program.

As stated previously, visual inspection during the site audit in February 2009 indicated that the distance from the meteorological tower to the nearest obstruction (i.e., the wooded area located west of the tower) is less than the guidance provided in the proposed Revision 1 of Regulatory Guide 1.23 (NRC 1980), which states that the height of natural or man-made obstructions to air movement should ideally be lower than the measuring level to a horizontal distance of ten times the measuring level height. Revision 1 of Regulatory Guide 1.23 (NRC 2007) provides further guidance regarding the tower's proximity to obstructions to air movement, stating that wind sensors should be located over level, open terrain at a distance of at least 10 times the height of any nearby obstruction, if the height of the obstruction exceeds one-half of the height of the wind measurement. In a response to a series of RAIs from the staff, Detroit Edison performed a review of wind data ranging from 1975 through 2003 and concluded that the nearby trees could be affecting the 10-m wind speed measurements during the period 2002–2007; that is, the potential exists for the wind measurements at the 10-m elevation to be lower than the actual wind speed at the 10-m elevation. Detroit Edison provided a copy of the 1985–1989 data from the Fermi 2 meteorological tower in a response to a staff RAI. The staff found that the 1985–1989 data had a lower frequency of (1) low wind speeds at the 10-m elevation and (2) extremely unstable (stability class A) conditions. Discrepancies in wind speed and stability class frequency distributions between the two databases create uncertainty as to which one of the two datasets (1985–1989 versus 2002–2007) is most representative of site conditions for the purposes of performing atmospheric dispersion analyses. Given the uncertainty in the data, the short-term dispersion estimates discussed in Section 2.9.3.1 and the long-term dispersion estimates discussed in Section 2.9.3.2 were evaluated by using both sets of data, and the more conservative (bounding) dispersion estimates were used. These evaluations are discussed in more detail in Section 2.9.3.

The staff found that the lower 10-m wind speed measurements associated with the 2002–2007 meteorological data produced higher (more conservative) atmospheric dispersion factors for the short-term dispersion estimates used to support the design-basis accident assessments discussed in Section 5.11.1. This is because the design-basis accident assessments are based on ground-level releases and the algorithms used to estimate dispersion for ground-level releases predict decreasing atmospheric dispersion factors (i.e., more favorable dispersion conditions) for higher wind speeds. Because the severe accident assessments discussed in Section 5.11.2 are also based on ground-level releases, the use of the 2002–2007 meteorological data should produce bounding atmospheric dispersion estimates for the severe accident assessments as well. Given that the severe accident consequence calculations using the 2002–2007 meteorological data are significantly below the relevant safety goals, any changes in results from the use of a new set of meteorological data would not be expected to change the final conclusions.

2.10 Nonradiological Health

This section describes aspects of the environment at the Fermi site and vicinity associated with nonradiological human health impacts. The section provides the basis for evaluating impacts to human health from building and operating the proposed Fermi 3. Building activities have the potential to affect public and occupational health, create impacts from noise, and impact the health of the public and workers from the transportation of construction materials and personnel to the Fermi site. Operation of Fermi 3 has the potential to impact the public and workers at the Fermi site from operation of the cooling system, noise generated by operations, electromagnetic fields (EMFs) generated by transmission systems, and transportation of operations and outage workers to and from the Fermi site.

2.10.1 Public and Occupational Health

This section describes public and occupational health at the Fermi site and vicinity associated with air quality, occupational injuries, and etiological agents (i.e., disease-causing microorganisms).

2.10.1.1 Air Quality

Public and occupational health can be affected by changes in air quality from activities that contribute to fugitive dust, vehicle and equipment exhaust emissions, and automobile exhaust from commuter traffic (NRC 1996). Air quality for Monroe County and the Fermi site vicinity is discussed in Section 2.9.2. As discussed in that section, this area is designated as an attainment area for all criteria pollutants except $PM_{2.5}$ (EPA 2010b). Monroe County, as well as six other southeastern counties including the Detroit metropolitan area, are designated as nonattainment areas for the $PM_{2.5}$ standard. In July 2011, the MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011). In July 2012, the EPA issued a proposed rule designating southeastern Michigan as having attained both the 1997 annual $PM_{2.5}$ NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS, based on 2009–2011 ambient air monitoring data (77 FR 39659, dated July 5, 2012) but the final determination has yet to be made. Recently, Monroe County, as well as seven other southeastern counties in Michigan and Lucas and Wood Counties in Ohio, were redesignated from nonattainment areas to maintenance areas for the 8-hour ozone standard (EPA 2010b).

2.10.1.2 Occupational Injuries

In general, occupational health risks to workers and onsite personnel engaged in activities such as building, maintenance, testing, excavation, and modifications are expected to be dominated by occupational injuries (e.g., falls, electric shock, asphyxiation) or occupational illnesses. Historically, actual injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates, with a 2008 average incidence rate of 0.7 per 100 workers (USBLS 2009a). The annual incidence rates (the number of injuries and illnesses per 100 full-time workers) for the State of Michigan and the United States for electrical power generation, transmission, and distribution workers are 3.7 and 3.2, respectively (USBLS 2009a, b). These statistics are used to estimate the likely number of occupational injuries and illnesses for operation of the existing Fermi 2 and predict the likely number of cases for the proposed Fermi 3.

Occupational injury and fatality risks are reduced by strict adherence to NRC and Occupational Safety and Health Administration (OSHA) safety standards, practices, and procedures to minimize worker exposures. Appropriate State and local statutes also must be considered when assessing the occupational hazards and health risks associated with the Fermi site. Currently, the Fermi site has programs and personnel to promote safe work practices and respond to occupational injuries and illnesses for Fermi 2. Procedures are in place with the objective of providing personnel who work at the Fermi site with an effective means of preventing accidents due to unsafe conditions and unsafe acts. They include safe work practices to address: hearing protection; personal protective equipment; electrical safety; chemical handling, storage, and use; and other industrial hazards. Personnel are provided with training on safety procedures (Detroit Edison 2011a).

2.10.1.3 Etiological Agents

Public and occupational health can be compromised by activities at the Fermi site that encourage the growth of disease-causing microorganisms (etiological agents). Thermal discharges from Fermi 2 into the circulating water system and Lake Erie (Detroit Edison 2011a) have the potential to increase the growth of thermophilic microorganisms. The types of organisms of concern for public and occupational health include enteric pathogens (such as *Salmonella* spp., *Shigella* spp., and *Pseudomonas aeruginosa*), thermophilic fungi, bacteria (such as *Legionella* spp.), and free-living amoeba (such as *Naegleria fowleri* and *Acanthamoeba* spp.). These microorganisms could give rise to potentially serious human health concerns, particularly at high exposure levels.

Available data assembled by the Centers for Disease Control and Prevention (CDC) for the years 2000 to 2008 (CDC 2002, 2003, 2004, 2005, 2006, 2007, 2008a, 2009, 2010) were reviewed for outbreaks of *Legionellosis*, *Salmonellosis*, or *Shigellosis*. Outbreaks that occurred in Michigan from 2000 to 2008 were within the range of national trends in terms of cases per 100,000 population or total cases per year, and the outbreaks were associated with pools, spas, or lakes. According to the Detroit Edison correspondence with Michigan Department of Community Health (MDCH) in April 2008, it was noted that the department did not record any major waterborne disease outbreaks within Michigan in the last 10 years (Detroit Edison 2010a). The CDC Council of State Territorial Epidemiologists Naegleria Work Group, after reviewing the data from different sources, identified 121 fatal cases of primary amebic meningoencephalitis (a disease caused by *Naegleria fowleri*) in the United States from 1937 to 2007; most cases occurred in southern States during the months of July and September (CDC 2008b).

2.10.2 Noise

Any pressure variation that the human ear can detect is considered as sound, and noise is defined as unwanted sound. Sound is described in terms of amplitude (perceived as loudness) and frequency (perceived as pitch). Sound pressure levels are typically measured by using the logarithmic decibel (dB) scale. A-weighting (denoted by dBA) (Acoustical Society of America 1983, 1985) is widely used to account for human sensitivity to frequencies of sound (i.e., less sensitive to lower and higher frequencies and most sensitive to sounds between 1 and 5 kHz), which correlates well with a human's subjective reaction to sound. Several sound descriptors have been developed to account for variations of sound with time. L_{90} is the sound level exceeded 90 percent of the time, called the residual sound level (or background level) or fairly steady lower sound level on which discrete single sound events are superimposed. The equivalent continuous sound level (L_{eq}) is a sound level that, if it were continuous during a specific time period, would contain the same total energy as a time-varying sound. (Unless designated otherwise, all sound levels are instantaneous or L_{eq} values measured over short [e.g., 1-minute] time periods.) In addition, human responses to noise differ depending on the time of the day (e.g., higher sensitivity to noise during nighttime hours because of lower background noise levels). The day-night average sound level (L_{dn} or DNL) is a single dBA value calculated from hourly L_{eq} over a 24-hour period, with the addition of 10 dBA to sound levels from 10 p.m. to 7 a.m. to account for the greater sensitivity of most people to nighttime noise. Generally, a 3-dBA change over existing noise levels is considered to be a "just noticeable" difference, and a 10-dBA increase is subjectively perceived as a doubling in loudness and almost always causes an adverse community response.

There are no State or county noise regulations for Michigan or Monroe County. The only local noise regulation applicable to the Fermi site is Frenchtown Charter Township Noise Ordinance No. 184, which generally prohibits construction noise "unreasonably annoying to other persons, other than between the hours of 7:00 a.m. and 7:00 p.m." Section 5.3.4 of NUREG-1555

(NRC 2000) states that noise levels are acceptable if the L_{dn} outside a residence is less than 65 dBA, which is consistent with HUD regulations for exterior noise standards (24 CFR 51.101(a)(8)). For context, the sound level of a quiet office is 50 dBA, a normal conversation (at about 3 ft) is 60 dBA, busy traffic is 70 dBA, and a noisy office with machines or an average factory is 80 dBA (Tipler 1991).

An ambient sound level survey was conducted November 26–28, 2007, with Fermi 2 in operation, at seven noise monitoring locations (NMLs) that were selected on the basis of the locations of the nearest noise-sensitive receptors in various directions within 1.5 mi of the Fermi 2 site (Detroit Edison 2011a). Weather conditions were conducive to the measurement of sound levels except during a period with a high average wind speed (10 a.m. to 3 p.m. on November 27, 2007). The noises observed were typical of suburban locations and included local and distant traffic, trains, birds, and dogs barking. Some intermittent gunshot noise from the Fermi firing range was heard at three of the seven NMLs and noise from the Fermi cooling towers were faintly audible at five of the seven NMLs. At two NMLs, noise related to transmission lines was heard. Manned 10-minute L_{eq} measurements were collected at all seven NMLs, and continuous 24-hour noise monitoring was conducted at three NMLs. L_{dn} values were derived on the basis of 10-minute L_{eq} values measured every hour over a 24-hour period.

The highest and lowest sound levels occurred between 10 a.m. and 2 p.m. and between 11 p.m. and 3 a.m., respectively, which are typical times for suburban areas due to local and highway traffic volume. Measured L_{90} values at all NMLs ranged from 32 to 42 dBA, which are typical of suburban areas (Bishop and Schomer 1991). Measured L_{dn} values at three NMLs ranged from 54 to 63 dBA. Even including the period of higher wind speed, which could increase sound levels by several dB, the measured L_{dn} values were below 65 dBA.

2.10.3 Transportation

The Fermi site is accessible by roadways, water, and rail for transport of equipment, materials, and supplies. Construction, operations, and outage workers would access the site by roadway. No public transportation system to the site is available. The regional transportation system is described in Section 2.5.2.3. Existing roadways in the vicinity of the Fermi site are shown on Figure 2-16.

The main entrance to the site is at Enrico Fermi Drive, which connects to N. Dixie Highway after crossing Toll Road and Leroux Road. Enrico Fermi Drive is primarily a private drive for Fermi plant site ingress and egress. There is a signalized intersection at N. Dixie Highway, a four-way stop at Leroux Road, and a one-way stop (T-intersection) at Toll Road (Mannik & Smith Group, Inc. 2009). Most of the roads in the area, excluding I-75 and N. Dixie Highway, are low-volume roads, with an average daily traffic (ADT) volume of less than 5000 vehicles per day. These traffic volumes are generally below the capacity of the roads (Mannik & Smith Group, Inc. 2009).

Roadway accident data for roadway segments and intersections in southeast Michigan are maintained by the SEMCOG. In Monroe County, 3689 accidents occurred in 2009 (SEMCOG 2010c). Approximately 79 percent of the accidents involved property damage only. Approximately 20 percent involved injury, of which 2.5 percent were considered incapacitating injuries. Less than 1 percent of the accidents involved a fatality (SEMCOG 2010c).

Table 2-67 provides the intersections and roadway segments near the Fermi plant site that have a high frequency of accidents. Accident data are evaluated by local jurisdictions, SEMCOG, and the Michigan Department of Transportation to identify problem areas and to develop solutions – such as signalization, roadway improvements, public education, or enforcement – to reduce the number of accidents.

Table 2-67. High-Frequency Accident Intersections and Roadway Segments in Frenchtown Charter Township, 2005–2009

Roadway	Intersection or Roadway Segment	2008 Average Daily Traffic Volume	Total No. of Accidents (2005–2009)	Average Annual No. of Accidents (2005–2009)
Intersection				
N. Dixie Hwy.	Southbound I-75 ramp	NA[(a)]	25	5
Roadway Segments				
N. Dixie Hwy.	Sandy Creek Rd. to Nadeau Rd.	12,700	99	20
Southbound I-75	I-75/Nadeau Rd. ramp to southbound I-275 and northbound I-75 split	21,200	62	12
Nadeau Rd.	I-75/Nadeau Rd. ramp and N. Dixie Hwy.	5300	56	11
Northbound I-75	Sandy Creek Rd. to I-75/Nadeau Rd. ramp	16,800	55	11
Northbound I-75	I-75/N. Dixie Hwy. ramp to Sandy Creek Rd.	16,800	55	10
Southbound I-75	N. Dixie Hwy. to I-75/N. Dixie Hwy. ramp	16,800	48	10

Source: SEMCOG 2010d, e
(a) NA = Not applicable.

SEMCOG is the region's designated metropolitan planning organization for regional transportation planning. The latest version of SEMCOG's long-range RTP is *Direction 2035 Regional Transportation Plan for Southeast Michigan* (SEMCOG 2009d). Short-range (e.g., 2008 to 2011) priorities for funding by cities, county road commissions, transit agencies, and the Michigan Department of Transportation are included on a list called the TIP, which is regularly updated. Projects funded under the TIP are drawn from the long-range RTP. Included in the RTP are more than 1500 projects throughout southeast Michigan that address roadway congestion and safety, as well as bridges, bicycling/walking, public transit, and freight transport.

2.10.4 Electromagnetic Fields

Transmission lines generate both electric and magnetic fields, referred to collectively as EMFs. Public and worker health can be compromised by acute and chronic exposure to EMFs from power transmission systems, including switching stations (or substations) onsite and transmission lines connecting the plant to the regional electrical distribution grid. Transmission lines operate at a frequency of 60 Hz (60 cycles per second), which is considered to be extremely low frequency (ELF). In comparison, television transmitters have frequencies of 55 to 890 MHz, and microwaves have frequencies of 1000 MHz and greater (NRC 1996).

Electric shock resulting from direct access to energized conductors or from induced charges in metallic structures is an example of an acute effect from EMFs associated with transmission lines (NRC 1996). Objects near transmission lines can become electrically charged by close proximity to the electric field of the line. An induced current can be generated in such cases; it can flow from the line through the object into the ground. Capacitive charges can occur in objects that are in the electric field of a line, storing the electric charge while they are electrically isolated from the ground. A person standing on the ground can receive an electric shock by coming into contact with such an object because of the sudden discharge of the capacitive charge through the person's body to the ground. Such acute effects are controlled and minimized by conformance with National Electrical Safety Code (NESC) criteria.

Onsite transmission lines that would connect Fermi 3 to the proposed new Fermi 3 switchyard would be constructed and owned by Detroit Edison (Detroit Edison 2011a). Transmission lines that serve Fermi 3 offsite would be created and operated by ITC*Transmission* (Detroit Edison 2011a), which also operates and manages the transmission system of existing Fermi 2 at the Fermi site (Detroit Edison 2011a). The existing ITC*Transmission* system meets NESC criteria for induced currents (Detroit Edison 2011a). Detroit Edison stated that all transmission lines would comply with applicable regulatory standards and that the design and construction of the proposed Fermi 3 substation and transmission circuits would comply with NESC provisions (Detroit Edison 2011a). ITC*Transmission* would ensure that the electric field strength under the new transmission lines would conform to NESC guidelines (maximum of less than 7.5 kV/m within the ROW and maximum of less than 2.6 kV/m at the edge of the ROW) (Detroit Edison 2011a).

Long-term or chronic exposure to power transmission lines has been studied for a number of years. These health effects were evaluated in NUREG 1437 (NRC 1996) and are discussed in the ER (Detroit Edison 2011a). NUREG 1437 reviewed human health and EMFs and concluded:

The chronic effects of electromagnetic fields (EMFs) associated with nuclear plants and associated transmission lines are uncertain. Studies of 60-Hz EMFs have not uncovered consistent evidence linking harmful effects with field exposures. EMFs are unlike other agents that have a toxic effect (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be forced and longer-term effects, if real, are subtle. Because the state of the science is currently inadequate, no generic conclusion on human health impacts is possible.

2.11 Radiological Environment

A REMP has been conducted around the Fermi site since 1978. This program measures radiation and radioactive materials from all sources, including the existing units at the Fermi site. The REMP includes the following pathways: direct radiation; atmospheric, aquatic, and terrestrial environments; groundwater; and surface water. A preoperational surveillance program was established to determine baseline conditions and quantify the radioactivity, and its variability, in the area prior to the operation of Fermi 2. After routine operation of Fermi 2 started in 1985, the monitoring program continued to assess the radiological impacts to workers, the public, and the environment.

The results of this monitoring are documented in annual reports entitled *Fermi 2 – [Year] Radioactive Effluent Release and Radiological Environmental Operating Report for the Period January 1, [Year], through December 31, [Year]*. The NRC staff reviewed these annual reports for calendar years 2004 through 2010 (Detroit Edison 2005, 2006, 2007, 2008b, 2009g, 2010d, 2011b). These reports show that exposures or concentrations in air, water, and vegetation are comparable to, if not statistically indiscernible from, preoperational levels, with the exception of tritium, as described below.

NRC's Lessons Learned Task Force Report (NRC 2006) made recommendations regarding potential unmonitored groundwater contamination at U.S. nuclear plants. In response to that report, the Nuclear Energy Institute (NEI) developed the Ground Water Protection Initiative (NEI 2007). Detroit Edison implemented the initiative and began additional groundwater sampling in various locations that may be a source of groundwater contamination around the Fermi site in the fourth quarter of 2007. The changes to the groundwater monitoring program based on the NEI initiative and results of this additional groundwater sampling are summarized in Appendix B of the Radioactive Effluent Release Report for 2008 (Detroit Edison 2009g). The sporadic and variable trace quantities of tritium (maximum concentration observed was 1950 pCi/L) were detected in the few shallow groundwater wells downwind from the Fermi 2 stack. Detroit Edison attributed this to the recapture of tritium in precipitation from the plant's gaseous effluent (Detroit Edison 2009a). The detected tritium concentrations were far below the EPA drinking water standard of 20,000 pCi/L (41 FR 28402).

2.12 Related Federal Projects and Consultations

The staff reviewed the possibility that activities of other Federal agencies might affect the issuance of a COL to Detroit Edison for the proposed Fermi 3. Any such activities could result in cumulative environmental impacts and the possible need for another Federal agency to become a cooperating agency for preparation of the EIS (10 CFR 51.10(b)(2)).

Fermi 3 would be sited on existing land owned by Detroit Edison. Approximately 656 ac of undeveloped lands on the Fermi site are managed as part of the DRIWR. Detroit Edison has had a cooperative agreement with FWS since 2003 that allows the FWS to assist in managing the refuge areas while Detroit Edison retains ownership and control of the entire site. Under the agreement, Detroit Edison and the FWS may end the agreement either in whole or in part, meaning that lands currently included as part of the DRIWR could be removed from the refuge. While approximately 2 ac would be removed during the construction of Fermi 3, Detroit Edison has stated that it intends to return all undisturbed wetlands to the DRIWR after construction of Fermi 3 is complete (Detroit Edison 2011a).

The 345-kV transmission system and associated corridors are currently owned and operated by ITC*Transmission*. The majority of the length of the three new transmission lines required for Fermi 3 would be located within existing transmission corridors. Although construction of the new transmission lines may require the acquisition of new ROWs (Detroit Edison 2011a), it is not expected that these activities will require any Federal action.

There is very little Federal land within 50 mi of the site. The majority of a 480-ac former U.S. Department of Defense (DOD) property about 4 mi northwest of the Fermi site was sold to a private owner in the mid-1980s. A portion of the site is currently owned by the State of Michigan and is used by the Michigan Army National Guard (Detroit Edison 2011a). No plans for future use of this site have been specified by the DOD. The River Raisin National Battlefield Park, located in Monroe County 7 mi to the southwest of Fermi site, is under Federal control. The Cedar Point National Wildlife Refuge and the Ottawa National Wildlife Refuge, both located to the east of Toledo, Ohio, are approximately 25 mi and 30 mi from the site, respectively (National Atlas.gov 2010). There are no wilderness areas or rivers included in the national wild and scenic rivers system within 50 mi of the site, and the closest Native American Tribal reservations are more than 50 mi from the site (National Atlas.gov 2010).

After reviewing the Federal activities in the region surrounding the Fermi site, particularly with regard to their potential of having impacts on wetlands associated with the construction and operation of the Fermi 3 intake and discharge structures and other related facilities that are not under NRC's jurisdictional authority, the staff determined that it would be advantageous for USACE to become a cooperating agency for preparation of the EIS.

The NRC is required under Section 102(2)(C) of NEPA to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in the subject matter of the EIS. During the course of preparing this EIS, the NRC consulted with the USACE, FWS, EPA, and the NOAA Fisheries Service. Related correspondence is included in Appendix F.

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