Environmental Assessment for the Proposed Holcim (US) Inc. Lee Island Project

Submitted to:
U.S. Army Corps of Engineers

On behalf of:
Holcim (US) Inc.

Prepared by:
MACTEC Engineering and Consulting, Inc.
(f/k/a Harding ESE, Inc.)
St. Louis, Missouri

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Table of Contents

Section Page

Table of Contents
(continued)

Section Page

Table of Contents
(continued)

Section Page

(continued)

Page

List of Tables

List of Figures

(continued)

List of Appendices

List of Abbreviations and Acronyms

ADT	Average Daily Traffic
ATF	Bureau of Alcohol, Tobacco and Firearms
BA	Biological Assessment
BACT	Best Available Control Technology
BMPs	Best Management Practices
BNSF	Burlington Northern Santa Fe
CARES	Center for Agricultural Resource and Environmental Systems
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
DHV	design hour volume
EA	Environmental Assessment
EO	Executive Order
FBFMs	Flood Boundary Floodway Maps
FEMA	Federal Emergency Management Agency
FHBMs	Flood Hazard Boundary Maps
FHWA	Federal Highway Administration
FIRMs	Flood Insurance Rate Maps
FW	farmed wetland
gpm	gallons per minute
HAP	hazardous air pollutant
HEC	Hydrologic Engineering Center
HEC-HMS	Hydrologic Engineering Center-Hydrologic Modeling System
HEC-RAS	Hydrologic Engineering Center-River Analysis System
HSPF	Hydrologic Simulation Program-Fortran
IDBC	Isle du Bois Creek
LBG	Leggette, Brashears & Graham, Inc.
LOS	level of service
MDC	Missouri Department of Conservation
MDNR	Missouri Department of Natural Resources
MMR	Middle Mississippi River
MMT	million tons (all tonnage references are in metric units)
MOA	Memorandum of Agreement
MoDOT	Missouri Department of Transportation
MoRAP	Missouri Resource Assessment Partnership
MSDIS	Missouri Spatial Data Information System
MSHA	Mine Safety and Health Administration
msl	mean sea level
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act

(continued)

NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Registry of Historic Places
NWI	National Wetland Inventory
NWP	Nationwide Permit
PEM	palustrine emergent
PFO	palustrine forested wetland
PSD	Prevention of Significant Deterioration
PUB	palustrine unconsolidated bottom
RIAC	River Industry Action Committee
RM	River Mile
SHPO	State Historic Preservation Office
SWANCC	Solid Waste Agency of Northern Cook County
USACE	U.S. Army Corps of Engineers
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
vpd	vehicles per day
vph	vehicles per hour
WBS	World Bird Sanctuary
WDHES	WDH Ecological Services

1.0 Introduction

1.1 Background

On August 8, 2000, Holcim (US) Inc. (Holcim) [1] submitted a Section 404/401 and Section 10 Permit Application to the U.S. Army Corps of Engineers (USACE) for Holcim's proposed Lee Island project (project). The project involves the construction of a 4 million ton (MMT) [2] per year portland cement plant, including a limestone quarry, harbor, and barge fleeting area, at a central location on the Mississippi River.[3] The project site is approximately 3,916 acres in size (of which approximately 2,200 acres will be set aside as a buffer area), and is located primarily in Ste. Genevieve County, approximately 40 river miles south of downtown St. Louis between Mississippi River Miles (RM) 138 and 139 (Figure 1-1).

On November 6, 2000, the USACE issued a joint USACE-Missouri Department of Natural Resources (MDNR) public notice (P-2259) for the project. On January 24, 2001, a public workshop was held. The comment period for the public notice was extended until February 5, 2001 as a result of public and agency requests and the public workshop, and has effectively remained open throughout as the USACE has continued to receive comments up to the present. Comments regarding the project have been submitted to the USACE by federal and state agencies and the public.

This Environmental Assessment (EA) has been prepared by Holcim under the National Environmental Policy Act (NEPA), 42 United States Code (USC) 4371 et seq., and implementing regulations, 40 Code of Federal Regulations (CFR) Part 1500; 33 CFR Part 325, Appendix B. Its purpose is to evaluate the potential environmental impacts associated with the proposed project. This EA describes the project components, summarizes the alternatives considered, and assesses potential impacts to the natural and human environment (including water quality, hydrology, wetlands, wildlife, water supplies, traffic, and economics). Pursuant to 40 CFR 1506.5(b), an applicant may prepare an EA provided the USACE makes an independent evaluation of the environmental issues and takes responsibility for the scope and content of the EA.

1.2 Supporting Studies

Holcim has conducted more than two dozen studies of the project site (see annotated list in Appendix A) in order to understand its ecological and cultural resources, physical characteristics, and potential environmental and human use impacts. These studies were used to develop detailed design alternatives and/or evaluate the environmental impacts of the relevant project components, and are hereby incorporated by reference. The studies include the following:

- Section 404/401 and Section 10 Permit Application Companion Report (ESE, 2000a);
- Preliminary Jurisdictional Wetland Determination Report (ESE, 2000b);
- Supplemental Alternatives Analyses (Harding ESE, 2002a) (see Appendix B);
- Aquatic Resource and Water Quality Characterization Report and Addendum (Harding ESE, 2001a and 2002b);
- Water Resources and Hydrology Report (STS Consultants, Ltd. (STS) et al, 2002);

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1 Holnam Inc. changed its name to Holcim (US) Inc. on December 12, 2001. All references to Holnam have been changed to Holcim.

2 All tonnage references are in metric units.

3 As explained in more detail in Section 3.1.1, only portions of the project require a permit from the USACE. However, this Environmental Assessment evaluates the entire project.

- Vegetation Survey and Community Type Map (Harding ESE, 2001b);
- Wetland and Stream Mitigation Plan (Harding ESE, 2002c);
- Biological Assessment (BA) (Harding ESE, 2002d);
- Endangered Species Investigation Bat Survey Report (WDH Ecological Services (WDHES), 2002);
- Amphibian and Reptile Relocation Study (Harding ESE, 2002e);
- Short-Term Site Assessment and Avian Population Survey (World Bird Sanctuary (WBS), 2001a);
- Spring Migratory and Summer Breeding Bird Site Assessment (WBS, 2001b); and
- Avian Fall and Winter Site Assessment and Population Survey (WBS, 2002).

2.0 Project Purpose and Need

2.1 Overall Project Purpose

The overall purpose of the project is to construct a 4 MMT per year portland cement plant, including a limestone quarry, harbor, and barge fleeting area, at a central location on the Mississippi River.

2.2 Summary of Basic Project Purposes and Needs

The basic purposes and needs for the project are to:

- Develop additional low-cost portland cement production capacity to maintain and expand Holcim's market share in the River market (defined in Section 2.2.1);
- Ensure consistent supply to customers in the River market by displacing Holcim's current reliance on imported cement;
- Enable transportation by water to Holcim's distribution terminals in the River market – which requires access to a major navigable river;
- Achieve a central strategic location, below any locks and dams on the Mississippi or Ohio Rivers;
- Provide adequate access for truck and rail transportation – when water transportation is not possible or practical;
- Obtain limestone – in sufficient quantity and quality – for an on-site quarry; and
- Acquire a contiguous tract of land large enough to accommodate a cement plant, quarry, harbor, barge fleeting area, and significant buffer area.

2.2.1 Develop Additional Low-Cost Production Capacity for River Market

The River market consists of those parts of the U.S. that are accessible by navigation on the Mississippi River system. Within the Mississippi River system, cement and other bulk products are principally transported by barge. Utilizing the Mississippi River system, Holcim has for many years supplied portland cement to the River market via distribution terminals in such major cities as Chicago, St. Louis, Minneapolis, Cincinnati, Memphis, and New Orleans.

Annual U.S. and River market demand for portland cement has steadily increased during the 1990s, and is expected to continue to grow. For example, the Portland Cement Association is projecting that after a downturn in 2002, total U.S. portland cement consumption will increase from 105.1 MMT in 2000 to over 110 MMT by the year 2005. In 2000, Holcim supplied 5.2 MMT of portland cement to the River market. This is approximately 18.5 percent of the total River market. To maintain and potentially expand Holcim's River market share in the face of aggressive competition within the cement industry, Holcim needs additional low-cost cement production capacity. A central purpose of the project is to meet this need. Based on current and projected future demand in the River market, and production considerations, Holcim has determined that a cement plant capable of producing 4 MMT per year of low-cost cement is necessary to meet these requirements.

2.2.2 Ensure Consistent Supply by Displacing Imported Cement

In recent years, there has been increasing reliance on imported cement to serve U.S. demand. For example, in 1990, less than 1 MMT of portland cement was imported to fulfill overall demand in the River market. The total amount of cement imported into the River market has increased during the 1990s, peaking at 5.8 MMT in 1999. In 1999, Holcim imported 2.9 MMT of cement per year into the Mississippi River system, or approximately 50 percent of the total. Reliance on imported cement greatly increases the business risk of not being able to supply customers in a timely manner with a consistent

quality product. A basic purpose and need of the project is to ensure a consistent and low-cost supply of cement to River market customers by displacing Holcim's current reliance on imported cement. This can only be achieved by constructing new capacity to produce low-cost cement in the River market.

2.2.3 Enable Water Transportation – Major River Access

The economic viability of any new cement plant serving the River market is dependent on access to a major navigable river. Access means the plant must be located adjacent to a major navigable river where a harbor and fleeting area can be constructed for barge transportation. Without river access for water transportation, the project is not economically viable.

From the proposed plant, Holcim is expecting to ship approximately 80 percent of its finished product by barge. The remainder would be shipped by rail and truck. In addition, Holcim would receive most of its secondary raw materials and its coal by barge. In a large area such as the River market, barge shipment is by far the most cost-efficient means of transportation. For example, a single barge tow, typically consisting of 15 barges, can carry the equivalent of 225 rail cars or 780 trucks. Based on industry figures and Holcim's logistics experience, rail transportation can cost three to four times more than barge transportation, depending on distance and season, and truck transportation 10 to 12 times more than barging. In addition, barge traffic is safer and has less environmental impact.

2.2.4 Central Strategic Location Below Locks and Dams on Mississippi and Ohio Rivers

A central strategic location also means a location below any locks and dams on the Mississippi River system. A location below locks and dams is necessary to minimize risk of river closure so that Holcim can ship product and receive fuel and secondary raw materials year-round. Year-round barge transportation capability is especially important to enable Holcim to provide uninterrupted customer service to the lower River market (i.e., New Orleans and other southern cities), which typically has demand for cement year-round. The requirement for a central strategic location below any locks and dams excludes alternative sites on the Missouri, Illinois, and Ohio Rivers, as well as the Mississippi River north of St. Louis.

2.2.5 Access to Rail and Truck Transportation

Where barge shipment is not possible or practical, Holcim must have the capability to ship finished product to customers by truck or rail. Truck or rail is also necessary to receive supplies and some secondary raw materials. Typically, truck or rail would be used for transportation over shorter distances or where the destination is not accessible by barge.

2.2.6 Adequate Quantity and Quality of Limestone for On-site Quarry

The project requires a limestone quarry on-site, with adequate mineral reserves. In terms of quantity, the project requires enough limestone to supply a 4 MMT per year plant for 100+ years. In terms of quality, the limestone must be suitable for the efficient manufacture of portland cement (i.e., high in calcium and low in alkali, hydrocarbons and magnesium). The chemical composition of the limestone has a direct effect on the plant design specifications, and the resulting air/water/solid waste production. It is reasonable and typical to expect that some secondary raw materials must be provided from off-site sources. Therefore, a basic purpose and need of the project is to obtain a quarry on-site that can produce cement-quality limestone in sufficient quantity for a 100+ year quarry life, with secondary raw materials available on-site, or economically available from nearby off-site locations.

2.2.7 Adequate Available Land

Finally, the project requires an available tract of land large enough to accommodate a cement plant, quarry, harbor, and significant buffer area. Depending on the thickness of the mineral reserves, a rough estimate of the total land area required would be 1,000 to 2,000 acres, not including a buffer area. In addition, the land – preferably owned by one or a few landowners – must be available for purchase. Numerous small parcels owned by numerous different individuals would unduly complicate and frustrate the land acquisition process.

For further information and explanation of project purposes and needs, see Appendix B: Supplemental Alternatives Analyses (Harding ESE, 2002a).

3.0 Project Alternatives

3.1 Preferred Alternative – Proposed Action

3.1.1 Project Description

The proposed project involves the construction of a 4 MMT portland cement plant, including a limestone quarry, harbor, and barge fleeting area. As shown in Figure 3-1, the project has a number of components, including the following:

- a single kiln line portland cement plant;
- a limestone quarry;
- fill (depositional) areas for quarry overburden and harbor excavation material;
- a small harbor and associated loading/unloading facilities,
- an in-river barge fleeting facility; and
- a 2,200-acre buffer area.

Some of these components, or portions of them, require the issuance of a permit from the USACE. The in-river barge fleeting facility requires a permit under Section 10 of the Rivers and Harbors Act, 33 USC 804, because it would involve structures or work in navigable waters (the Mississippi River). The harbor requires a permit under Section 404 of the Clean Water Act, 33 USC 1314, because it would involve the discharge of dredged or fill material into waters of the U.S. (wetlands). The limestone quarry requires a Section 404 permit to impact other waters of the U.S. (jurisdictional intermittent streams, seeps, and springs).

The cement plant project component originally required a Section 404 permit because it would have involved filling some wetlands. However, as explained in Section 3.1.2, Holcim has modified the cement plant design to avoid wetlands along Isle du Bois Creek. In addition, the USACE has determined that two small isolated wetlands that would have been impacted by the cement plant are not waters of the U.S. (USACE Jurisdictional Determination, September 19, 2002). Based on these changes, construction of the cement plant alone does not require a permit from the USACE. Nevertheless, this EA evaluates the entire project, including the cement plant.

It should also be noted that an access road was originally shown as a project component. However, the access road was constructed during October 2000 – August 2001 to provide safe and direct access through the site to the former quarry[4] and the Mississippi River. The access road has independent utility (if Holcim does not receive the necessary permits for the project, the access road would still allow development of the property for alternative uses), does not commit Holcim to the project, and was authorized under a separate USACE nationwide permit (NWP) 14. The access road is being evaluated as part of this EA to ensure full consideration of potential environmental issues.

Cement Plant

A 4 MMT single kiln line portland cement plant is proposed to be constructed on the site. The cement plant will be located primarily within a former quarry area south of Isle du Bois Creek and immediately west of Lee Island (see Figure 3-1). The plant will be constructed at or above an elevation of 412 feet, which is above the Mississippi River's 100-year flood elevation (406 feet above mean sea level (msl)) and 500-year flood elevation (411 feet msl). Most of the cement plant area will consist of impervious surfaces

[4] The site includes a former quarry that was active from the 1960s to the mid 1980s.

including plant buildings, pavement, and rock surfaces. A sedimentation basin will also be constructed just below the cement plant area to collect, detain, and treat stormwater.

Quarry and Fill Areas

The quarry plan illustrated in Figure 3-2 consists of the extraction of limestone mineral reserves over a period of 100+ years. In addition to a permit from the USACE, quarrying activities will be conducted in accordance with a permit from the MDNR Land Reclamation Program. The total land area within the "100+ years" quarry boundary (which also includes the cement plant area) is approximately 1,261 acres. Quarrying activities will occur on two faces (west and east faces) to obtain the correct mixture for cement manufacture. The west quarry initially will be approximately 1,000 feet in width, starting at the western valley wall of Raddy Hollow, and the face will advance to the southwest. The east quarry face (approximately 800 feet in length) will start on the eastern valley wall of Raddy Hollow and progress to the east, toward the bluffs along the Mississippi River. The east quarry will proceed along the bluffs to a point near Old Quarry Hollow (Hollows D and E). At approximately 30 to 40 years, the east quarry will then turn to the northwest in order to connect with the south flank of the west quarry. A sedimentation basin will also be constructed at the base of Raddy Hollow to collect, detain, and treat all stormwater from the quarry.

Several fill and storage areas will also be established within the quarry limits to contain fill material resulting from construction of the harbor and cement plant, and operation of the quarry (see Figure 3-1). A fill area at the Old Quarry Hollow will be constructed to accommodate material excavated during construction of the harbor. The total proposed area of fill in the Old Quarry Hollow is approximately 109 acres: 49 acres in the north branch and 60 acres in the south branch. A 106-acre fill area in Raddy Hollow will also be developed to accommodate overburden and unusable rock generated during construction of the cement plant and operation of the quarry. Topsoil recovered from harbor excavation, cement plant construction, and quarry operation will be placed in a topsoil stockpile area in the proposed quarry. This area is located on the south side of the access road in Hollow L and is expected to cover an area of approximately 13 acres. Sedimentation basins will be incorporated into the design of this storage area and each of the fill areas. The basins will capture stormwater runoff from upstream exposed material areas and also from any upstream-undisturbed areas that may drain over the exposed material. The basins will be designed to manage runoff from a 100-year 24-hour storm event.

Land reclamation will begin after approximately 8 to 10 years of quarry operations. Objectives of Holcim's Long Term Land Reclamation Strategy will be to reconstruct the existing rugged upland topography, at a lower elevation, and replace the jurisdictional intermittent stream systems, to the extent practical, using fluvial geomorphology and state-of-the-art methods and practices. Reclaimed areas will be seeded and planted with native vegetation species that will re-establish the forest and provide a range of wildlife habitats. Small ponds will be created to provide additional upland aquatic habitat. Holcim has proposed to construct one pond for every 50 acres of reclaimed area. A lake with vegetated fringes will cover approximately the eastern one-third of the quarry.

The lake will be filled by precipitation draining from the buffer area and reclaimed, stabilized, and revegetated land. No development, including that associated with the cement plant, will drain into the lake. Within the quarry boundary, a berm will be constructed in Old Quarry Hollow to protect the quarry operations from inflow from the Mississippi River during severe flooding, up to the 500-year flood elevation (411 feet msl). This berm will be constructed when the quarry begins to reach Old Quarry Hollow, approximately 20 years after project commencement.

Holcim will utilize best engineering practices and land reclamation techniques to ensure that Old Quarry Hollow will not be a possible avenue for Mississippi River incursion or discharge from the lake to the

Mississippi River. Through the land reclamation process, Holcim will design the final elevation of the Raddy Hollow spillway to be below the elevation of the Old Quarry Hollow berm structure, and thus be the single point of lake discharge or Mississippi River inflow. Mississippi River inflow could only occur during extreme flood events (i.e., 500-year flood), which would naturally have already impacted downstream waters such as Isle du Bois Creek and associated wetlands.

In the event of unusually heavy rainfall prior to completion of reclamation, water will discharge through the Raddy Hollow sedimentation basin, where it will be controlled and managed prior to release. After completion of land reclamation, any discharge from the lake due to unusually heavy rainfall would occur through the Raddy Hollow spillway.

Harbor

The proposed harbor will cover an area of approximately 47 acres (see Figure 3-1) and will consist of 26 acres of open water and 21 acres of land-based facilities. Approximately 30 barges could be tied off in the harbor waiting for loading-unloading of bulk material. Approximately five permanent deck or work barges would be associated with the loading-unloading service, support, and maintenance operations in the harbor. The harbor will have a single (approximately 300-foot wide) entrance to the Mississippi River at the southern end of the harbor. This design minimizes sedimentation of the harbor, which in turn will minimize potential maintenance dredging requirements. The harbor perimeter will be comprised of vertical steel sheet pile walls at the loading facilities and sloped excavated earth covered with erosion resistant materials in the remaining areas. The base elevation of the proposed harbor is designed to be at an elevation of 344 feet above msl.

Cement will be transported from the cement plant silos via two fully enclosed air slide conveying systems to surge bins located at the harbor edge. A fully enclosed air slide conveying system will transport the cement from the surge bins to the barges. The barge unloading systems will consist of three permanently moored barges located within the harbor. A backhoe will unload barges containing gypsum, coal, clay, or other materials with large material size and moisture. The backhoe will unload into receiving hoppers that load a covered belt conveying system to transport the materials to the cement plant. A pneumatic unloading system will be utilized for handling dry flyash, which will be conveyed to the cement plant via air transport in an enclosed pipe.

Construction of the harbor will require the excavation of approximately 1,800,000 cubic yards of earth materials using a combination of excavation and hydraulic dredging methods. Topsoil recovered from the harbor excavation will be placed in the topsoil storage area. Material excavation above the water table will be accomplished in the "dry" by land-based earth moving equipment and relocated to the north branch of Old Quarry Hollow. It is anticipated and preferred that excavation of the harbor take place during the late fall and winter months as this time period corresponds to low river levels, which will maximize the dry excavation of the harbor.

Sediment and erosion control measures will be put in place prior to implementing the harbor excavation plan. A small berm will be constructed around the harbor perimeter and work areas, with a silt fence positioned at the outside edge of the berm. The berm will contain runoff from the harbor construction area, prevent upland runoff from entering the construction area, and provide a measure of safety against moderate flood stages of the River. Work area runoff within the berm will be contained and directed to the excavation.

Excavation below the water table will be accomplished with a hydraulic dredge. Dredged material, comprised of approximately 80 percent water and 20 percent solid material, will be pumped (via pipeline) in a slurry form to the south branch of Old Quarry Hollow where it will be deposited behind a dam that

will be permitted and constructed according to MDNR Dam Safety Program specifications. Sediment and erosion control measures including sedimentation basins will be in place prior to dry-material deposition in the north branch of Old Quarry Hollow and prior to dam construction on the south branch of Old Quarry Hollow. Once the slurry is deposited in the south branch of Old Quarry Hollow, the solids will settle out and the clear (decant) water will be gravity-fed back to the harbor excavation. This system is a closed loop system, and the activity will continue until the design limits for the quarry harbor footprint have been established within the confines of the earthen protective barrier strip. Prior to breakthrough to the Mississippi River, a sediment curtain will be put in place and the recycle line will be disengaged, causing dredged slurry to flow in only one direction, to the dam impoundment. The excavation by dredging of the earthen barrier strip will finalize the harbor excavation.

Periodic maintenance dredging of 10,000 to 65,000 cubic yards of material from the proposed harbor entrance and harbor bottom may be required on a yearly basis to maintain sufficient clearance for barges and operations. All maintenance dredging activities will be accomplished with hydraulic dredging equipment to minimize the amount of sediment stirring. This activity, if needed, will be authorized by the appropriate USACE permit. The dredged material will be pumped to an approved upland non-jurisdictional disposal location (or other future environmentally preferable location). It is anticipated that the decanted water will be recycled back to the dredging operation in a closed loop process. If decanted water needs to be discharged, it will be regulated under the appropriate permit and will meet state and federal standards. The sediment/solids (clay-silt-sand) generated in this process will be placed in the designated upland non-jurisdictional disposal areas. Dredged material will not be placed in the Mississippi River or Isle du Bois Creek

In-River Fleeting

The in-river fleeting will consist of two components: a north fleeting area and a south fleeting area (see Figure 3-1). The barges temporarily stored in these areas will be transported into the harbor for loading/unloading via tugboat. Transloading of material will not occur on the Mississippi River.

Product will be moved from the facility using established barge carriers. Portland cement is the primary bulk material that will be transported by barge from the facility. Coal, sand, clay, gypsum, iron ore/slag, flyash, and bottom ash, which are used in the cement manufacturing process, will be transported to the plant via barge.

The north fleeting area will be used to store primarily empty barges and will have a capacity of 60 barges. At full capacity, the fleeting configuration will be 5 barges wide by 12 barges long. The construction of the north fleeting area will include, at most, two 35-foot diameter head cells and 12 breasting supports.

The south fleeting area will be used primarily to store full barges and will have a maximum capacity of 23 barges. At full capacity, the fleeting configuration will be a staggered configuration consisting of 3 barges wide by 5 barges long and 2 barges wide by 4 barges long. The south fleeting area will include, at most, one 35-foot diameter head cell and nine breasting supports. The tow sizes will be determined in coordination with the transportation industry and will depend on river traffic volumes, river levels, and other navigational issues

The cells in the river fleeting areas will be constructed where sufficient water depth exists for the barges without dredging the riverbank or constructing retaining walls. The cells will consist of interlocking steel sheeting driven into the riverbed, and filled with granular material.

Periodic in-river maintenance dredging may be necessary in the north and south fleeting areas to maintain sufficient clearance. This activity, if needed, will be authorized by a separate USACE individual permit.

However, Holcim does not expect maintenance dredging to be required annually. The historic and current water depths in these areas are sufficient even at low water to accommodate fleeting without dredging (see further discussion in Section 5.1.1.2). Any needed maintenance dredging activities will be accomplished with hydraulic dredging equipment (or future state-of-the-art technology) to minimize the amount of sediment stirring, and the removed material will be disposed of in an approved upland non-jurisdictional location (or other future environmentally preferable location).

Access Road

As stated in Section 3.1, this EA also includes analysis of an access road from U.S. Route 61 (Highway 61) to the proposed plant area and quarry site (see Figure 3-1). Under USACE NWP 14, construction of the access road began in October 2000 and was completed to subgrade in August 2001. From Highway 61, the roadway was constructed to an elevation that varies between 415 feet and 600 feet, over a distance of about 2.5 miles to the former quarry area. The road passes through steep and wooded terrain, and crosses four principal hollows: Raddy Hollow and Hollows A, I and L. The dominant cover type is upland forest. The roadway has a typical width of 30 feet (two 15-foot wide lanes) and typically 9-foot wide shoulders. During final construction, the access road will be completed and paved with concrete.

3.1.2 Project Design Alternatives – Avoidance and Minimization

The project as described in the public notice was designed based on careful examination of alternatives, following the principles of impact avoidance and minimization. Various design alternatives were generated for the cement plant, quarry, harbor, and fleeting area. These alternatives were then evaluated based on project requirements and the need to avoid and minimize environmental impacts. In each case, preferred alternatives were selected.

For example, the harbor design alternatives process began by comparing in-river fleeting with off-river alternatives. That effort was followed by evaluating areas within the Lee Island floodplain that were logical and practicable locations for a harbor and also minimized impacts to the environment.

Upon selection of the general harbor location, four detailed harbor design alternatives were evaluated thoroughly with regard to navigation impacts, wetland impacts, and the quantity of harbor excavation material generated. A combination of in-river fleeting along with the small harbor alternative (with the minimum floodplain and wetland impacts) was selected as the preferred alternative. By choosing the small harbor alternative, overall impacts to harbor wetlands were reduced from 28.6 to 13.8 acres, and more area was made available for wetland mitigation on southern Lee Island.

For further discussion of the design alternatives process, see the Companion Report and Public Notice P-2259.

3.1.3 Project Modifications

Since the public notice, the project has been further modified to reduce environmental impacts in response to comments and agency recommendations. By letters to the USACE dated May 8, 2001 and June 29, 2001, Holcim committed to:

- Avoid North and Hickory Hollows (the two hollows north of Isle du Bois Creek in Jefferson County that would have been used to dispose of overburden/harbor excavation material); and
- Avoid Isle du Bois Creek and its wetlands.

As a result, Holcim withdrew from its permit application:

- North and Hickory Hollows;

- The western and eastern portions of the preferred haul road (that would have connected the cement plant/harbor with North and Hickory Hollows); and
- The improvements to two crossings of Isle du Bois Creek (that would have been required for the haul road).

Holcim also committed to relocate the overall cement plant footprint and associated railroad spur farther to the south to avoid Isle du Bois Creek wetlands.

The results of these project modifications include:

- Increase of total project buffer area. Avoidance of North and Hickory Hollows will increase the project buffer area to approximately 2,200 acres (the buffer area will be undisturbed land around the plant/quarry area that will be maintained and managed in its natural condition). All project land located in Jefferson County will now be set aside as part of the buffer area.
- Elimination of sedimentation basins and stormwater discharges north of Isle du Bois Creek. Avoidance of North and Hickory Hollows eliminates any sedimentation basins and stormwater discharges north of Isle du Bois Creek, but requires addition/enlargement of sedimentation basins for run-off from areas within the quarry.
- Avoidance of North and Hickory Hollows also requires placement of the overburden and harbor excavation material in two areas within the limits of the quarry: the Raddy Hollow fill area (at the head of Raddy Hollow) and the Old Quarry Hollow fill area (see Figure 3-1). A dam will be required in south Old Quarry Hollow to hold some of the harbor excavation material. The Raddy Hollow fill area requires the extension of a small portion of the quarry to the west (by approximately 50 acres), but there will be no increased impacts to regulated resources as a consequence of the extension. A topsoil storage area will also be located near the west boundary of the quarry (see Figure 3-1). The fill areas and topsoil storage area will be seeded and controlled to protect against erosion. The material in the fill areas will eventually be used in the cement manufacturing process or in reclamation, and the topsoil will be used in mitigation and reclamation. The fill areas and topsoil storage areas ultimately will be quarried and reclaimed.
- Avoidance of North Hollow results in avoidance to the North Hollow calcareous glade.
- Reduction in impact to jurisdictional streams. Avoidance of Hickory Hollow reduces overall project impacts to jurisdictional streams by 0.2 mile from 3.4 miles to 3.2 miles.
- Reduction in impact to wetlands. Avoidance of wetland impacts along Isle du Bois Creek that were associated with the railroad spur, the preferred haul road, and the crossings reduces overall impacts to wetlands by approximately 2.6 acres.
- Avoidance of all direct impacts to Isle du Bois Creek.

3.1.4 Project Area Size and Timing of Impacts

The public notice stated that approximately 2,000 acres of the 4,000-acre site will be directly utilized by the project. However, the project will not directly utilize as much of the site as originally indicated. First, based on more accurate mapping, the area for the project site is approximately 3,916 acres. Second, as a result of the project modifications, the buffer area has been increased to approximately 2,200 acres – more than half of the project site. Third, the area that will be directly utilized by the project is now approximately 1,322 acres. This figure includes approximately 1,261 acres for the quarry (the quarry also includes the cement plant area), 47 acres for the harbor and associated infrastructure, and 14 acres for the cement plant sedimentation basin.

The remaining area consists of approximately 28 acres of the access road which lie outside the quarry boundary and the approximately 366-acre area between the "ultimate extent of the quarry" and the "100+ years" quarry boundary. As shown on Sheet 8 of 10 in the public notice, Holcim has only applied

for a permit to impact jurisdictional waters within the "100+ years" boundary of the proposed quarry (which, as stated, is an area of approximately 1,261 acres). If Holcim were to eventually require limestone reserves in the area between the "100+ years" boundary and the "ultimate extent of the quarry" boundary, Holcim would have to apply to the USACE for authorization to impact jurisdictional waters in that area, and to MDNR for authorization to quarry the additional acreage. In the meantime, the 366-acre area will remain undisturbed forested land contiguous with the buffer area, and will not be directly utilized under the USACE 404 permit.

In the first 3 years of the project (initial construction and development), the following areas will be impacted: 47 acres for the harbor and associated infrastructure, 14 acres for the cement plant sedimentation basin, and, within the quarry boundary, 227 acres – consisting of approximately 109 acres for the Old Quarry Hollow fill area, 54 acres for the Raddy Hollow fill area, 13 acres for the topsoil storage area, and 51 additional acres for the cement plant (approximately 56 acres in the area of the former quarry that will be required for the cement plant were previously impacted during construction of the access road).

Development of the quarry will occur at an average rate of about 12 acres per year. During the first 10 years of quarry operations, the quarry will advance at an average rate of approximately 18 acres per year. In addition, the first 10 years of quarry operations will involve a 27-acre expansion of the Raddy Hollow fill area in year 4, and a 28-acre expansion of the Raddy Hollow fill area in year 7. After the first 10 years, quarry advancement will begin to slow down so that after 50 years, the quarry is advancing at an average rate of only approximately 8 to 10 acres per year.

No more than approximately 200 acres will be actively quarried at one time. After the first 8 to 10 years of quarry operations, when sufficient area has been opened, concurrent reclamation will begin in accordance with MDNR land reclamation requirements.

3.2 Alternatives Considered But Eliminated from Further Consideration

Several alternatives were considered by Holcim during the planning phase of the project, but were eliminated from further consideration. Alternatives that were considered included the No Action alternative, expansion of other Holcim plants, alternative sites, and alternative site designs. Reasons for the elimination of these alternatives were varied and included the failure to adequately meet stated project purposes and needs, navigational and safety concerns, and environmental impacts. A thorough discussion and analysis of these alternatives is presented in the Supplemental Alternatives Analyses (Harding ESE, 2002a, Appendix B) and is summarized in the following sections.

3.2.1 No Action

This alternative would not fulfill the project purpose of developing additional low-cost cement production capacity to serve the River market. The No Action alternative would result in continued importing of cement, which creates serious business risk for Holcim. The No Action alternative would unacceptably restrict Holcim's ability to remain competitive in the cement industry.

In addition, continued reliance on imported cement would entail global and regional environmental impacts in the form of greater ship and barge traffic, increased shipping fuel consumption, corresponding air emissions, and the increased potential for accidents. Most current imports involve transoceanic shipments, which are expected to be reduced by a new cement plant located on the Mississippi River system. Further, overseas imports through New Orleans must travel significant distances on the Mississippi River to reach upper Midwest destinations such as Chicago and Minneapolis. A more

centrally located plant on the Mississippi River system would shorten overall freight distances, and potentially lessen overall global and regional impacts on fuel usage and air quality.

Further, the No Action alternative would likely result in competitors expanding existing operations or constructing new plants in the River market area to produce low-cost cement to meet future expected customer demand – and taking market share from Holcim. It can be expected that construction or expansion of plants by other companies would produce overall environmental impacts – resulting from harbors, fleeting areas, quarries, roads, etc. – similar to those associated with Holcim's proposed project.

Finally, the No Action alternative would likely result in other uses for the project site than preservation. Because the site contains high quality limestone, it would be an attractive location for a quarry operation. The site was previously the location of a limestone quarry from the 1960s through the mid-1980s. A new quarry operator could also seek a permit for a harbor or barge fleeting operation on the river. Other potential alternative uses of the project site could include farming and logging, both of which are historical uses of the property.

3.2.2 Expand Clarksville Plant

Holcim considered whether its existing Clarksville, Missouri plant – which is the only Holcim plant presently located on the Mississippi River system – could be used to fulfill project purposes. Because the Clarksville plant currently produces 1.3 MMT of cement per year, a 4.0 MMT per year capacity increase would require total production from Clarksville to expand to approximately 5.3 MMT per year. However, expanding the Clarksville plant was determined not to be possible. First, one of the basic purposes of this project is to provide year-round water transportation, which requires a location that is not subject to river closure. Clarksville is above (upstream of) the southernmost locks and dams on the Mississippi River. These locks and dams are subject to winter closure by weather and/or repairs. Therefore, the Clarksville plant cannot fulfill this basic project purpose. Second, expansion of the plant to 5.3 MMT per year would require expansion of the harbor. However, expansion of the Clarksville harbor is not possible due to land acquisition and environmental constraints. Directly to the north of the existing harbor are wetlands owned by the USACE and managed as a conservation area. The area directly to the south of the existing harbor is also wetlands and property of the USACE. The area to the west of the existing harbor is limited by a state highway and the railroad line spur serving the plant. The area to the east of the existing harbor is the Mississippi River. Third, due to design considerations, the existing Clarksville plant cannot be upgraded to produce the required 5.3 MMT per year. The existing plant was built in 1967 using "wet" process technology, which is not compatible with current (industry standard) "dry" process technology. Therefore, a retrofit of the existing plant to the required capacity is not economically or technically feasible. A new plant using "dry" process technology would have to be constructed at the site. Other environmental and process reasons why expanding the Clarksville plant is not a practicable alternative are provided in Section 2.6 of the Supplemental Alternatives Analyses (see Appendix B).

3.2.3 Expand Other Holcim Plants

Holcim considered whether the project purposes could be met by increasing capacity and production at one or more of Holcim's existing U.S. plants. Plants located too far from the Mississippi River market were excluded because transportation costs would be prohibitive. Based on their geographic location in or near the Mississippi River market geographic area, the following plants were considered for expansion: Mason City, Iowa; Artesia, Mississippi; Dundee, Michigan; and Theodore, Alabama. However, none of these plants can fulfill the project purposes. The Mason City, Artesia, and Dundee plants do not have water access or sufficient limestone reserves. In addition, the raw materials in the Dundee quarry are not of adequate quality for a "dry" process plant. The Theodore plant is located on a deep-water harbor in Mobile Bay, but is not acceptable as it is not a strategic location for the Mississippi River market, has an

off-site quarry in Florida, and does not have sufficient limestone reserves to meet the 100+ year quarry life requirement for this project.

Therefore, expanding other Holcim plants in or near the Mississippi River market is not a viable alternative (see Appendix B: Supplemental Alternatives Analyses, Section 2.7 for additional or more detailed explanation).

3.2.4 Other Sites

Holcim considered alternative locations not owned by the company. Based on project purposes, Holcim considered various sites on the Mississippi River between St. Louis, Missouri and Scott City, Missouri (which is just south of Cape Girardeau, Missouri). There were two main reasons this area was selected. First, a basic project purpose is to obtain a central strategic location that minimizes risk of river closure (i.e., that is below any locks and dams on the Mississippi or Ohio Rivers). This requirement effectively excludes any alternative sites on the Mississippi River north of St. Louis or on the Missouri or Illinois Rivers, which both join the Mississippi River above the southernmost lock and dam. Also, the presence of locks and dams on the Ohio River just above its confluence with the Mississippi River effectively excludes any alternative sites on the Ohio River or its tributaries. Essentially, the only location that meets the requirement for a central strategic location below any locks or dams is the central portion of the Mississippi River below St. Louis.

Second, the need for adequate cement-quality limestone reserves excludes sites south of Scott City, Missouri. Over the years, the geology of the Mississippi River has been well explored for various purposes, including the mapping of mineral reserves. United States and state geological survey maps show there are no outcroppings of limestone suitable for the production of cement on the Mississippi River from Scott City, Missouri to the Gulf of Mexico. This is due to geologic factors such as the widening of the river valley and deposition of sediment.

Thus, the only geographic area warranting consideration for alternative sites is limited to the Mississippi River between St. Louis, Missouri, and Scott City, Missouri. As discussed below, there are several potential sites for a large cement plant in this target area. However, for various reasons, these sites are not practicable alternatives.[5]

In the target area, many of the prospective sites identified by Holcim, or the mineral rights at those sites, were already owned by other cement producers or quarry operators who compete with Holcim, directly or indirectly, making these sites not reasonably available for acquisition by Holcim. This factor alone disqualified several alternative sites in Ste. Genevieve County and other locations in the target area.

Other sites on the Missouri side of the Mississippi River in the target area were not practicable alternatives because they did not meet project purposes for one or more of the following reasons:

- insufficient limestone reserves;
- insufficient contiguous land area;
- too many small landowners;
- land not available for purchase;
- lack of access to road transportation;

[5] The following discussion is general. The specific information supporting this discussion is proprietary commercial information, which is privileged and confidential. The specific information has been voluntarily submitted separately to the USACE under Freedom of Information Act exemption (b)(4), 5 USC 552(b)(4).

- insufficient area available for a harbor;
- potential navigation and safety hazards; and
- the presence of major gas or electric lines.

In addition, at the prospective sites where a harbor and quarry would have otherwise been feasible, the wetland and stream impacts would likely be similar to or greater than those associated with Holcim's proposed project.

The Illinois side of the Mississippi River from East St. Louis down to a point across from Scott City, Missouri, was generally found not to be a practicable alternative because it does not have limestone outcroppings or cement plant sites within an economic distance of the Mississippi River. Typically, the bluffs on the Illinois side that contain limestone outcroppings are separated from the Mississippi River by 3 to 5 miles of floodplain (in contrast to the bluffs on the Missouri side, which are frequently very close to the Mississippi River). Any cement plant built to use the limestone from these bluffs would also have to be located 3 to 5 miles from the Mississippi River. Holcim would not construct a cement plant in the floodplain as this would expose the facility to undue business risk from flooding. Also, the location of a cement plant 3 to 5 miles from the harbor would make construction of a mechanical conveyance system uneconomical. In addition, acquiring the land or rights of way for the conveyance system and a road to access the harbor would be difficult over so great a distance. Moreover, development (harbor, road to harbor, and conveyor system) across this width of floodplain would likely result in wetland impacts similar to or greater than the proposed project. Finally, the Illinois side of the Mississippi River generally lacks access to an adequate rail and truck transportation infrastructure. There is no interstate or even four-lane highway serving the Illinois side, and although there is a rail line, it does not service the distribution terminals on the Mississippi River system that Holcim uses (instead, the Burlington Northern Santa Fe (BNSF) rail line on the Missouri side of the Mississippi River services those terminals).

One prospective site in Illinois was found with limestone deposits sufficiently close to the Mississippi River to warrant evaluation. Upon further investigation, however, it was determined that a quarry was not possible at this location due to the presence of existing commercial and residential development over the mineral reserves.

Based on careful analysis of potential alternative locations, there were no practicable alternatives to the project site in light of project purposes.

3.2.5 Other Project Designs

Holcim considered building a smaller (2 or 3 MMT) plant at the project site or the alternative site locations that were examined. However, a smaller plant would not provide sufficient capacity, and production costs would increase because economies of scale would be lost. Therefore, a smaller plant would not fulfill the project purposes of creating sufficient new low-cost capacity to maintain and expand Holcim's market share in the Mississippi River market while enabling the company to reliably and effectively serve its customers. Holcim also examined the possibility of fleeting and transloading barges only in the Mississippi River to avoid impacts to any wetlands on the Lee Island floodplain. However, it was determined that this is not feasible as it would result in a higher potential for navigation hazards and would jeopardize the safety of employees. As explained in Section 3.1.2, Holcim considered other project configurations (i.e., harbor location and design alternatives, plant layout alternatives, etc.) (ESE, 2000a) and selected those that avoided and minimized impacts.

4.0 Environmental Setting

4.1 Regional Environmental Setting

The site is located in the Mississippi River section of the Ozark Border Natural Division (Thom and Wilson, 1980). This section consists of rugged river hills with generally shallow soils and exposed bedrock. Thicker, loess (silt) derived soils are present on the ridge tops. Limestone bluffs along the Mississippi River with deep, narrow hollows are features of this area. This specific area of the project site is referred to as the "Brickey Hills." Upland deciduous forest is the predominant terrestrial community type; however, glades and bottomland forest communities are also present.

The climate is considered humid continental, and the average rainfall is approximately 38 inches per year. The total topographic relief of the site is approximately 550 feet. The highest point is near the southwestern edge of the site at 930 feet msl. Except for Isle du Bois Creek, the lowest point is the Mississippi River floodplain with an elevation of approximately 380 feet msl.

The site is divided into three major landscape components:

- Mississippi River floodplain (approximately 170 acres) consisting of mostly active farm fields and wetlands;
- Isle du Bois Creek and floodplain (approximately 130 acres) consisting of active farm fields, wetlands, and some old field habitats; and
- Uplands (approximately 3,600 acres) consisting of narrow ridges separated by deep valleys (hollows). Typical elevation differences between the ridge tops and valley bottoms are 200 to 400 feet. Numerous small cliffs and rock ledges are located on the steep, forested slopes.

4.2 Site History and Existing Condition

The project site is located in a rural, but not pristine, setting. The project site and surrounding area has been used for various purposes over the years. Previous activities conducted on the site included selective logging, farming, and quarrying. As a result of these past activities, the site has retained features and characteristics that are relevant in assessing environmental impacts of the proposed project. Following is a description of previous uses, pre-existing conditions when Holcim acquired the property, current uses of the project site, and adjacent land uses:

- The site is located just to the south of AmerenUE's Rush Island 1,250 megawatt coal-fired electric power generating plant. The Rush Island plant smokestack is visible from various places on the project site. Rush Island's 120-acre flyash disposal pond extends to within 200 feet of Isle du Bois Creek and the project site boundary.
- A large limestone quarry – Brickeys Stone – is located about a mile south of the project site on the Mississippi River.
- An active, frequently used main line of the BNSF Railroad traverses the entire site along the base of the Mississippi River bluffs.
- Numerous tows consisting of 15 or more barges traverse this reach of the Mississippi River on a daily basis.
- The site was the location of a now-abandoned limestone quarry that was active from the 1960s to the early 1980s.
- A substantial amount of overburden and tailings from the former quarry was deposited in large piles that remain on about 20 acres of Lee Island floodplain at and near the location of the proposed harbor.

- The former quarry also had a USACE-permitted barge fleeting and loading operation on the Mississippi River. The ramp down to the Mississippi River and the road leading to it still exist on the property.
- Another abandoned quarry was operated in Old Quarry Hollow near the eastern boundary of the proposed quarry, just to the west of the railroad tracks about midway down Lee Island.
- There is a large abandoned architectural stone quarry a few hundred yards south of Morrison Hollow at the southern end of the project site along the river between the railroad tracks and the bluff.
- There is a small active marble quarry – the Arch Johnston Quarry - directly adjacent to the project site on the north side.
- A previous landowner constructed an 8-foot high low-water crossing in Isle du Bois Creek that effectively dams water upstream behind it and blocks fish passage during parts of the year.
- A previous landowner constructed an access road along the south side of Isle du Bois Creek. Because the access road had no culverts, it blocked the drainage from two of the three jurisdictional intermittent streams in the proposed quarry area to Isle du Bois Creek (through Raddy Hollow and Von Behren's Hollow).
- When Holcim acquired the project site, there were several areas where trash/junk had accumulated over the years. One of those areas was an open garbage dump adjacent to Wetland L in Hollow L along Isle du Bois Creek. Holcim cleaned up these areas, including the garbage dump, collecting more than 30 tractor-trailer truckloads of garbage, some dilapidated buildings, old cars, and abandoned equipment.
- The site is traversed by dirt and gravel roads which were constructed and maintained by previous landowners along the tops of most of the ridges.
- The site has been selectively logged in the past by previous landowners (and portions would still be logged today by leaseholders if Holcim had not halted or suspended logging rights pending a permit decision).
- For many years, most of the Lee Island floodplain and areas along Isle du Bois Creek have been farmed (farming is continuing pending a permit decision).

5.0 Physical/Chemical Characteristics and Anticipated Changes

5.1 Water Resources

This section provides an assessment of potential project impacts to the surface water and groundwater resources of the site and incorporates findings of the Water Resources and Hydrology Report (STS et al., 2002). Among other things, the Water Resources and Hydrology Report assessed potential impacts to water quality (including such factors as sediment and nutrient loadings) and water quantity (including drainage patterns, discharge and runoff, and base flow).

5.1.1 Surface Water Resources

5.1.1.1 Existing Conditions

Predominant site surface water resources consist of Isle du Bois Creek and the Mississippi River. Isle du Bois Creek is a second order perennial stream that drains much of the site and generally forms the northern boundary of the proposed quarry and cement plant developments (see Figure 3-1). Other less dominant water resources consist of approximately 6.0 miles of jurisdictional intermittent streams (Table 5-1), 25 springs, and 7 seeps (see Figure 3-2). Several of these intermittent streams (Hickory Hollow, Raddy Hollow, Von Behren's Hollow, and Hollow L) drain towards Isle du Bois Creek, whereas three others (Wolf Hollow, Longs Hollow, and Old Quarry Hollow) discharge to the Mississippi River. Morrison Creek is an intermittent stream located south of the project area.

Table 5-1. Jurisdictional Intermittent Streams within the Site

Intermittent Stream	Length (ft)
Von Behren's Hollow (Hollow A)	2,320
Raddy Hollow (Hollow B)	5,370
Raddy Hollow tributary (Hollow C)	2,360
Wolf Hollow (Hollow G)	11,900
Longs Hollow (Hollow H)	4,250
Hickory Hollow	3,800
Old Quarry Hollow (Hollows D and E)	500
Hollow L	1,000
Total	31,500

The Mississippi River is a large surface water feature that exerts a dominating (seasonal) influence on the adjacent floodplains and wetlands, and on Isle du Bois Creek. In the vicinity of the project the Mississippi River has been channelized with wing dikes and revetments. Turbidity is generally high and the current swift, with few quiet backwaters. The Mississippi River at the proposed harbor and in-river fleeting area (right descending bank) typically consists of deep (greater than 20 feet) water, swift currents, a steep bank, and mostly clay/silt substrate. No wing dams are located along the proposed development area. In contrast, the left descending bank of the Mississippi River (across from the proposed project on the Illinois side of the Mississippi River) is characterized by shallower water, and a more complex array of in-stream features including wing dams and side channels (i.e., those associated with Beagles Island). At the project site, the Mississippi River average annual discharge is 150,000 cubic feet per second (cfs). The discharge varies with season, with average spring, summer, fall and winter discharges of 250,000; 170,000; 125,000; and 125,000 cfs, respectively. Mississippi River water quality can generally be categorized as having relatively high levels of sediment and nutrients as compared to many small to medium sized streams.

Isle du Bois Creek has a watershed of approximately 14,859 acres and an estimated median annual discharge of approximately 4.5 cfs (STS et al., 2002). Isle du Bois Creek discharge changes with the seasons, with spring (wet season) discharges over 10 cfs and fall (dry season) discharges of approximately 1 cfs. Water quality of Isle du Bois Creek was characterized by obtaining samples in 2001 on four separate occasions: spring, summer, fall, and during a storm event. On-site intermittent streams (e.g., Raddy Hollow) were sampled in the spring and fall of 2001. The water quality results of Isle du Bois Creek and on-site intermittent streams are within the typical ranges for Ozark streams as presented in detail in the Aquatic Resources and Water Quality Characterization Report and Addendum (Harding ESE, 2001a and 2002b).

In the vicinity of the project site, Isle du Bois Creek may be generally subdivided into three distinct subsections based on characteristics of water quality, substrate, and hydrology:

- The upper section of Isle du Bois Creek, located off the site near Highway 61, is rarely influenced by backwater flooding from the Mississippi River and receives groundwater discharge during both wet and dry periods. This section's lower boundary is defined as a point approximately 1.45 miles downstream of the Highway 61 bridge. Within this section the creek has a cobble/gravel substrate and is typically characterized by clear, fast moving water with abundant and diverse aquatic life.
- The middle section of Isle du Bois Creek is defined at its upstream end as a point 1.45 miles downstream of the Highway 61 bridge and at its downstream end by the low water crossing (see Figure 3-1), an approximately 8-foot high structure constructed by a previous landowner. This structure is located near the proposed cement plant area and has the effect of impounding water upstream at an elevation of 377.4 feet. As a result, the middle section of Isle du Bois Creek has a clay/silt substrate and is characterized by slower moving water and predominantly pool habitat. The impounded pool above the low water crossing extends upstream through most of the middle section of Isle du Bois Creek. When the Mississippi River exceeds an elevation of 377.4 feet, it affects the water levels and, in part, water quality in the middle Isle du Bois Creek section. This Mississippi River influence on the middle Isle du Bois Creek section occurs approximately 73 days per year (long-term average).
- The lower section of Isle du Bois Creek, from the Mississippi River confluence upstream to the low water crossing, is seasonally influenced by the Mississippi River. Substrates within this section of the creek are composed of predominantly clay and silt. This section of the creek is impounded by sediment deposits at the Mississippi River confluence and has an observed pool elevation of approximately 370 feet. The Mississippi River exceeds this elevation (on average) approximately 183 days per year. Therefore, water levels and water quality of lower Isle du Bois Creek are influenced by the Mississippi River about 183 days a year.

5.1.1.2 Potential Impacts to Surface Water Resources

Potential direct and indirect impacts to surface water resources were evaluated thoroughly. Direct impacts are those which are localized and immediate in their effect (e.g., excavation or filling of a stream, or changes in surface water quality within project development limits). Indirect impacts are those that affect the same resources, but would be evident somewhat later in time or somewhat removed in distance from the primary areas of operation (e.g., changes in surface water quality in streams outside the project development limits). For this analysis, indirect impacts were considered to be potential changes to Isle du Bois Creek and the Mississippi River.

For the purposes of evaluating direct and indirect impacts and designing mitigation measures to compensate for those impacts, the discussion of surface water impacts has been organized into the following subsections:

- Cement Plant, Limestone Quarry, Associated Fill and Storage Areas, and Access Road;
- Harbor; and
- In-River Fleeting Area on the Mississippi River.

For each of these actions, a range of analyses was conducted to determine the potential impact on water quality and hydrology. Modeling tools used to perform the analysis of impacts to surface water quantity (i.e., stormwater runoff) and quality included:

- Hydrologic Engineering Center (HEC)-2 – used to estimate one-dimensional Mississippi River water surface elevations and frequencies;
- Hydrologic Engineering Center-River Analysis System (HEC-RAS) – used to estimate flood and normal Mississippi River and Isle du Bois Creek levels, erosion and sediment transport potential, and evaluate the backwater influence of the Mississippi River on Isle du Bois Creek;
- Hydrologic Engineering Center-Hydrologic Modeling System (HEC-HMS) – used to estimate stormwater runoff volumes and flow rates for Isle du Bois Creek and select sub-watersheds; and
- Hydrologic Simulation Program-Fortran (HSPF) – used to model annual surface water runoff volume and nutrient and sediment production from the proposed quarry and cement plant sub-watersheds.

This analysis included an evaluation of the extensive information available concerning the site's soils, topography, geology, hydrology, land cover types, and surface water modeling and has been presented in detail in the Water Resources and Hydrology Report (STS et al., 2002).

Cement Plant, Limestone Quarry, Associated Fill and Storage Areas, and Access Road

Direct Impacts -- Surface water resources will be impacted at different times over the course of the life of the quarry, with some areas being impacted within the first 10 years and other areas not being impacted for several or many decades. After the first 8 to 10 years, some of these resources will be undergoing reclamation, while the advancing quarry is affecting other areas. The total direct impact and the approximate sequence of impacts to jurisdictional intermittent streams are presented in Table 5-2. In total, approximately 3.2 miles of jurisdictional intermittent streams and 13 springs/seeps will be impacted within the "100+ years" quarry boundary.

Table 5-2. Approximate Quarry Impacts to Jurisdictional Intermittent Streams

Year	Impacts to Intermittent Streams by Time Interval (feet)	Cumulative Impacts to Intermittent Streams for Time Intervals (feet)	
0-5†	5,100	5,100	
5-10	960	6,060	
10-20	1,110	7,170	
20-30	580	7,750	
30-40	1,030	8,780	
40-50	0	8,780	
50-60	290	9,070	
60-70	700	9,770	
70-80	1,010	10,780	
80-90	1,530	12,310	
90-100	2,390	14,700	
100+	2,270	16,970	(3.2 miles)

† Includes approximately 300 feet of intermittent stream that will be impacted by overburden storage.

Conversion of lands to developed areas (i.e., cement plant area, quarry, etc.) will also cause a direct change in the characteristics of surface water runoff. However, surface water runoff from developed areas will be captured and conveyed to one of four sedimentation basins (cement plant, Raddy Hollow, Topsoil Storage Area, and Old Quarry Hollow) for detention and treatment prior to its release to Isle du Bois Creek or the Mississippi River. Each of these sedimentation basins will be subject to stormwater discharge (National Pollutant Discharge Elimination System (NPDES)) permits and designed with Best Management Practices (BMPs). Basins will be large enough to manage discharges up to a 100-year, 24-hour event. The basins will effectively moderate peak runoff and detain/remove sediment. These basins will also include a sediment sump, vegetated fringes, and other features to improve water quality prior to its release to Isle du Bois Creek or the Mississippi River.

The analysis of direct impacts of the project was presented in detail in the Water Resources and Hydrology Report (STS et al., 2002). This analysis focused on the changes in the volumes and flow rates of annual surface water and stormwater runoff (due to the effects of land clearing and site development), and resultant changes to the following water quality indicator parameters: total sediment, total phosphorus, and total nitrogen. Detailed analyses of impacts including water quality and stormwater modeling were completed for the Raddy Hollow and cement plant sub-watersheds.

The Raddy Hollow and cement plant sub-watersheds were modeled in a conservative fashion in order to provide a "worst case" assessment of potential impacts. For example, all existing vegetated and forested surfaces within these sub-watersheds that will experience disturbance during the first 10 years of development were assumed to be completely cleared of vegetation. This assumption ("bare earth scenario") exaggerates the estimated impacts, and provides a conservative method of evaluating the relative influence of development activities on the water quality and hydrology of Isle du Bois Creek.

As presented in the Water Resources and Hydrology Report (STS et al., 2002), at Year 10, the maximum impact scenario, the project will have impacted only 2.9 percent (approximately 425 acres) of the total 14,859-acre watershed of the Isle du Bois Creek. This is considered to be an inflated estimate because some areas will be undergoing reclamation by that time.

Conclusions regarding water quality and hydrology impacts from the Raddy Hollow fill area, topsoil storage area, and the access road were inferred from the detailed analyses for the Raddy Hollow cement plant and quarry area.

Indirect Impacts -- Because of the mitigating effects of the sedimentation basins, the assessment of indirect impacts focuses on the water quantity and quality of receiving waters, as discussed below.

Tables 5-3 and 5-4 summarize the water quality and hydrology impacts at Year 10 (after sedimentation basin control) to Isle du Bois Creek resulting from the cement plant, limestone quarry, associated fill and storage areas, and access road.

As shown in Table 5-3, the potential indirect impacts to Isle du Bois Creek from the proposed condition at Year 10 (including sedimentation basin controls) are an estimated 7.0 percent increase in annual surface water runoff volume but a 3.7 percent decrease in annual sediment in runoff. Despite the development within the watershed, nutrient loading to Isle du Bois Creek is expected to be comparable to existing levels with increases of 0.5 percent or less of total nitrogen and phosphorus when compared to baseline conditions.

Table 5-3. Summary of Potential Indirect Impacts to Annual Surface Water Runoff and Water Quality of Isle du Bois Creek (IDBC)[1]

	Impacts to Isle du Bois Creek		
Runoff Parameter	IDBC Existing Condition	Proposed Change	Change (%)
Annual Surface Water Runoff Volume (acre-feet)	14,725	+1,023[2]	+7.0
Annual Sediment (tons)	5,750	-215[3]	-3.7
Annual Total Nitrogen (pounds)[4]	22,500	+101[5]	+0.5
Annual Total Phosphorus (pounds)[4]	9,200	+16[6]	+0.2

1 Raddy Hollow fill area, topsoil storage area, and access road data inferred from Raddy Hollow analysis.

2 Total of cement plant (+34 acre-feet), Raddy Hollow cement plant and quarry (+499 acre-feet), Raddy Hollow Fill Area (+280 acre-feet), topsoil storage area (+35 acre-feet), and access road (+178 acre-feet).

3 Total of cement plant (-53 tons), Raddy Hollow cement plant and quarry (-107 tons), Raddy Hollow Fill Area (-60 tons), topsoil storage area (-10 tons), and access road (+15 tons).

4 Assumes zero BMP effectiveness.

5 Total of cement plant (-32 lbs.), Raddy Hollow cement plant and quarry (+63 lbs.), Raddy Hollow Fill Area (+40 lbs.), topsoil storage area (+5 lbs.), and access road (+25 lbs.).

6 Total of cement plant (-3 lbs.), Raddy Hollow cement plant and quarry (+8 lbs.), Raddy Hollow Fill Area (+5 lbs.), topsoil storage area (+1 lbs.), and access road (+5 lbs.).

Source: STS et al., 2002.

Table 5-4. Summary of Potential Indirect Impacts on Stormwater Hydrology of Isle du Bois Creek (IDBC)[1]

	Impacts to Isle du Bois Creek		
Storm Event Runoff Parameter (100-Year)	IDBC Existing Condition	Proposed Change	Change (%)
Peak Flow Rate (cfs)	17,929	-2,193[2]	-12.2
Volume (acre-feet)	4,477	+64[3]	+1.4

1 Raddy Hollow fill area, topsoil storage area, and access road data inferred from Raddy Hollow analysis.

2 Total of cement plant (-599 cfs), Raddy Hollow cement plant and quarry (-938 cfs), Raddy Hollow Fill Area (-660 cfs), topsoil storage area (-80 cfs), and access road (+84 cfs).

3 Total of cement plant (+7 acre-feet), Raddy Hollow cement plant and quarry (+29 acre-feet), Raddy Hollow Fill Area (+16 acre-feet), topsoil storage area (+2 acre-feet), and access road (+10 acre-feet).

Source: STS et al., 2002.

As shown in Table 5-4, the peak 100-year storm runoff volume will increase by approximately 1.4 percent, but peak storm flow rates for this event will be reduced by an estimated 12.2 percent when compared to the existing baseline Isle du Bois Creek condition.

Based on the results summarized in Tables 5-3 and 5-4, the combined changes in stormwater, sediment, and nutrients in runoff during individual storm events, and on an annual basis as well, are insignificant compared to baseline conditions. Additionally, the development within the Isle du Bois Creek watershed will have no significant impact to Isle du Bois Creek water quality and hydrology because it will affect a relatively small percentage of the watershed of Isle du Bois Creek, and the hydrology and water quality of the lower section of the Isle du Bois Creek is significantly influenced by backwater flooding from the Mississippi River.

Potential indirect impacts to the water quality and hydrology of the Mississippi River were also analyzed in detail in the Water Resources and Hydrology Report (STS et al., 2002). The total area of the site that

will have been disturbed by Year 10 of development/operation (the maximum impact scenario) is estimated to account for 581 acres of the watershed of the Mississippi River, which is an insignificant portion of the total watershed area of the Mississippi River upstream of the site. Potential impacts to the Isle du Bois Creek watershed could theoretically have a localized effect on the Mississippi River. However, as stated above, the project will not adversely impact the water quality or hydrology of Isle du Bois Creek and will not, therefore, adversely affect the Mississippi River. Additionally, because the Mississippi River is a large turbid river, any minor addition of suspended solids as a result of the project would not represent a significant impact on water quality.

As is discussed in Section 3.1.1, the project will also result in the creation of a 500-acre lake as part of reclamation. The water source for the lake will consist of precipitation run-off and some groundwater. The post-reclamation run-off that will fill the lake will drain over the undisturbed buffer area and over reclaimed, stabilized, and revegetated land. Given proper land reclamation construction and management, this run-off is expected to meet state water quality standards. No development, including that associated with the cement plant, will drain into the lake.

Based on hydrogeological testing performed by Holcim, the bedrock (Plattin Limestone) in the area of the proposed quarry and the bluffs is hard and dense, with few permeable features. Additionally, the rock underlying the quarry excavation area (i.e., the Joachim Dolomite) has generally low permeability and does not transmit groundwater rapidly (Bognar, 2003).

Any groundwater that is slowly contributed to the lake will be equal in quality to the naturally occurring water in the Plattin Limestone. This water is considered to be fit for human consumption and therefore of good quality.

Because the water in the lake from run-off and groundwater will be of good quality, lake water should not cause any degradation of groundwater quality (STS et al., 2002).

Potential impacts to surface waters will also be mitigated as part of Holcim's Wetland and Stream Mitigation Plan, which provides for the replacement of 3.2 miles of jurisdictional intermittent streams on a 1:1 basis. The Wetland and Stream Mitigation Plan will be integrated into the Long Term Land Reclamation Strategy and will be implemented over the 100+ year life of the quarry.

Additional mitigation for impacts to surface water resources will include enhancement of the Isle du Bois Creek riparian corridor, as described in the Wetland and Stream Mitigation Plan. The restoration of farmed wetlands within the Isle du Bois Creek floodplain by re-establishing bottomland forest will have the added benefit of creating an expanded and continuous swath of bottomland riparian habitat along Isle du Bois Creek.

The creation of a lake and a variety of upland ponds that will further compensate for impacts to surface water resources. The lake will provide ecological and wildlife opportunities by providing additional habitat for a variety of upland, bottomland, wetland, aquatic, and migratory species. The lake will be designed in such a way as to contain shallow shoreline areas that will become submergent and emergent wetland areas. Because lake water quality is expected to meet Missouri water quality standards, any discharge of excess lake water would not adversely impact Isle du Bois Creek.

Finally, it should also be recognized that reclaimed land surfaces will be contoured, stabilized, and vegetated to reduce erosion from site runoff. Consequently, actual runoff characteristics are expected to be less than suggested by the maximum impact scenario that was used to model potential impacts.

Harbor

As explained in the Water Resources and Hydrology Report, the harbor will not cause significant direct or indirect surface water impacts. Permanent harbor perimeter erosion control measures will include riprap construction on harbor slopes and the establishment of vegetated buffer areas. These features will be in place prior to initiating the river connection. After excavation of the harbor, small portions of the remaining land surface located adjacent to the harbor will drain to the harbor instead of the existing wetlands. All disturbed areas will be managed with BMPs to offset potential water quality impacts. For example, strips of deep-rooted vegetation will be established adjacent to the stone riprap slopes of the harbor perimeter. Drainage swales will be grass-lined, and access roads will be constructed primarily of gravel.

Excavation of the harbor will also be accomplished to minimize the possibility of direct nutrient or sediment impacts to adjacent wetlands. A vegetated buffer area will be established between the harbor construction and southern Lee Island wetland mitigation area prior to or concurrent with excavation. Any stormwater that comes into contact with exposed harbor excavation areas will drain toward the excavation. In addition, BMPs including the use of erosion and sedimentation controls will be put in place to avoid potential indirect impacts to the Mississippi River and adjacent wetlands due to sedimentation.

Disturbance of existing river substrate will not occur until the last remaining barrier blocking connection from the excavated harbor with the Mississippi River is removed. Substrates along the outside border of this barrier consist of stone revetment placed along the Mississippi River's bank line for erosion control. Once the barrier is excavated, additional substrate would be created by the hydrological connection of the Mississippi River's flow into the inland harbor.

During operations, there is the possibility that harbor activities may also result in incidental releases of oil and grease due to towboat operations (i.e., minor leakage from equipment). However, given the high frequency of towboat operation on the Mississippi River, the minor amount of these potential releases, and spill prevention and reporting requirements, this potential impact is not considered to be significant. A minimal amount of substrate disturbance could also potentially occur during excessive low water periods when the churning actions of towboat propellers move in and out of the fleeting and inland harbor area. Any such substrate disturbance is not expected to result in a significant change in water quality as the Mississippi River is a highly turbid environment that is characterized by frequent towboat activity. Substrate disturbance is not likely to occur during normal river stage, as the channel of the Mississippi River is deeper along the length of Lee Island (right descending bank).

Water levels in the harbor will immediately correspond to the elevation changes of the Mississippi River. No significant impacts on currents, circulation or drainage patterns are expected to result from the harbor construction.

Periodic maintenance dredging within the harbor may be required to remove accumulated sediments down to the elevation of the harbor's original contours. However, as stated in Section 3.1.1, maintenance dredging will be performed using hydraulic dredging techniques and will consist of the disposal of dredged material to an upland disposal site. Use of hydraulic dredging will control the release of sediments such that any release of dredged sediments will be minimal and will not result in any significant degradation of water quality.

In-River Fleeting

An in-river fleeting area is proposed to accommodate a total capacity of 83 barges (see Figure 3-1). Fleeting will occur within two separate areas along the right descending bank. No dredging would be

required to construct or initiate fleeting within the Mississippi River. However, unpredictable Mississippi River stages and changing river/substrate conditions are likely to occur over the anticipated 100+ year project life. Therefore, it is appropriate to preliminarily address the potential impacts that may result from unanticipated in-river maintenance dredging.

According to a review of the 1998 USACE Hydrographic Survey Maps, the most likely area requiring future dredging would be located in the vicinity of the proposed upper fleeting area. Historical data suggests that an underwater bar periodically forms near the right descending bank of the Mississippi River, at approximately Mississippi RM 138.9 to 139.1. The formation of this bar is most likely influenced by bed load carried into the Mississippi River by Isle du Bois Creek (the confluence of Isle du Bois Creek and the Mississippi River is located just upstream, along the right descending bank, at approximate RM 139.4). It is unlikely that the maintained dikes along the left (Illinois) descending bank are influencing this periodic formation.

In general, the deeper flow channel of the Mississippi River is found along the right descending bank in this reach. As such, the bar's formation is subject to periodic change resulting from the variable deposition of sediments by Isle du Bois Creek and the Mississippi River's natural tendency to erode the formation away with its higher flow velocities. Historical data shows that the area potentially requiring dredging is nearly absent in some years, particularly after high water events that apparently scour it away.

Therefore, potential future dredging requirements of this bar would likely result in minimal impact to the Mississippi River or aquatic life, as the bar appears to be somewhat ephemeral and subject to periodic disturbance by the Mississippi River. Holcim would be required to apply for a separate USACE permit if maintenance dredging becomes necessary.

Because of the project's location along an outside bend of the Mississippi River, the main channel of the riverine habitats within the vicinity of the proposed fleeting area is subject to regular perturbation and disturbance due to highly erosive currents and frequent tow activity, and is constantly undergoing a natural process of maintaining a deep-water channel within the fleeting portion of the project area. It is unlikely that Mississippi River currents, circulation or drainage patterns will be adversely altered as a result of the project's fleeting activities.

5.1.2 Site Geology and Groundwater Resources

The geology, hydrogeology, and soils of the site have been extensively studied to evaluate the on-site mineral resources, the potential need for quarry dewatering, groundwater supply for the facility, and geotechnical engineering applications (Leggette, Brashears & Graham, Inc. (LBG), 2000; STS et al., 2002; Brown, 2001; LBG, 2002). Studies included subsurface drilling and testing, installation of groundwater monitoring wells, hydraulic conductivity (permeability) testing of bedrock, collection of groundwater elevations, bedrock joint/fracture trend analysis, aerial photogeologic interpretation, groundwater elevation mapping, and groundwater flow analysis of the various alluvial aquifers, as well as multiple bedrock aquifers.

Site Geology

The bedrock formations at the site consist predominantly of limestone interbedded with thin (8- to 26-foot) shale beds (see Appendix B, Figure 3-1). The formations at the site that will be impacted by the proposed development (surface downward) consist of the following:

- Burlington Limestone (average thickness of 127 feet);
- Fern Glen Limestone (average thickness of 27 feet);
- Maquoketa Shale (average thickness of 26 feet);

- Kimmswick Limestone (average thickness of 40 feet);
- Decorah Shales (average thickness of 8 feet);
- Plattin Limestone (average thickness of 210 feet); and
- Bloomsdale Limestone (average thickness of 16 feet).

The Plattin Limestone is the principal quarrying unit at the site. The above formations are underlain by the Joachim Dolomite (approximately 200 feet thick), which in turn is underlain by the St. Peter Sandstone. The Joachim Dolomite will not be quarried, and will form the bottom of the quarry. The Joachim Dolomite is a regional barrier (i.e., aquitard) to groundwater movement and separates the quarrying units from the underlying St. Peter Sandstone, which is a useable aquifer.

Groundwater Resources

The St. Peter Sandstone is considered part of the Ozark Aquifer system. Neither water yields nor water quality within the St. Peter Sandstone and deeper formations will be impacted by the quarry because the Joachim Dolomite separates these formations from the quarry (Bognar, 2003). The overlying formations to be quarried are not considered significant aquifers (MDNR, 1997). The use of these formations by local well users and potential impacts due to the project development are presented in Section 7.1. This analysis determined that there will not be significant effects on water supply wells of nearby property owners.

The bedrock formations to be quarried contain groundwater in the bedding planes, joints, solution conduits, and pores, which flow towards Isle du Bois Creek and/or eventually the Mississippi River. Based upon site-specific testing, the formations to be quarried have generally low permeability and do not transmit groundwater in large quantities. Therefore, impacts to groundwater flow to Isle du Bois Creek or the Mississippi River through the bedrock matrix are not anticipated to be significant.

A comprehensive survey of the site resulted in the identification of several small springs and solution voids. The typical groundwater discharges observed at the springs/seeps ranged from 1 to 10 gallons per minute (gpm). Some of the larger springs/seeps were observed to have wet weather flows in the 50 to 100 gpm range. Typical dimensions of the solution voids were in the order of 1 to 3 feet in diameter and 5 to 10 feet in length. Two solution voids along the river bluffs had diameters in the 4- to 6-foot range and a length of 20 to 30 feet.

Given the nature of these karst features (springs/seeps and solution voids), the on-site aquifers are considered to have "immature" karst development. This condition indicates that the site bedrock has not developed large, integrated cave/spring systems that are more typical of karst areas of the Ozarks. In mature karst systems most of the surface water flows directly into the bedrock via sinkholes or losing streams.

In general, immature karst systems, similar to that of the project site, are characterized by upland surface water flow that is largely conveyed via ephemeral and intermittent stream systems, rather than the underlying bedrock. Subsurface water flow, however, may contribute locally to some of the larger on-site intermittent stream systems (e.g., Von Behren's Hollow, North Hollow) as surface water appears to enter the alluvial deposits (silt, sand, gravel) and/or shallow bedrock and subsequently re-emerge downstream via gaining stream sections or small springs. Given these conditions, the potential project related impacts to groundwater quality and/or quantity are not expected to be as significant as such impacts would be in a mature karst system.

Minor variations in groundwater flow may occur on the project site but only in the immediate vicinity of the quarry, and the effect would be localized due to the relative impermeability of the rock formations. With regard to regional groundwater flow or gradient, the quarry is not anticipated to result in significant impacts due to the following conditions:

- The matrix of material to be quarried has generally low permeability and does not transmit groundwater in large quantities.
- Much of the material to be quarried is above the Mississippi River and Isle du Bois Creek floodplain groundwater tables.

Only when the quarry advances to the elevation below Isle du Bois Creek and the Mississippi River could local impacts to groundwater flow direction and gradient occur. Such effects would last only as long as the water table is depressed during active excavation within the quarry.

Groundwater quality will not be significantly affected as a result of the quarrying process. The quarrying process involves the extraction of earth material, which is not an activity that creates pollutants or pathways that could affect groundwater quality. In the unlikely event of a spill (e.g., accidental release of pollutants from a vehicle), any material will be cleaned up promptly in accordance with an approved spill response plan. In addition, the base of the proposed quarry is underlain by the Joachim Dolomite, which is an aquitard that will provide further protection from any potential impact to groundwater quantity or quality.

Alluvial Aquifer Resources

The Mississippi River floodplain area (approximately 170 acres) of the site has been studied for both harbor design and potential groundwater resource purposes. These studies included numerous soil borings, monitoring wells, geotechnical and geochemical sampling, and the monitoring of groundwater and river elevations. The floodplain unconsolidated materials consist predominantly of silts, sands, and gravel. These materials are overlain by clay loam and sandy loam soils. The unconsolidated silt, sand, and gravel comprise an alluvial aquifer that ranges from approximately 50 feet thick near the bluffs to approximately 100 feet thick near the Mississippi River. Monitoring of river and groundwater elevations shows that the alluvial aquifer responds relatively quickly (within days) to changes in Mississippi River elevations. This is due to the ability of the aquifer to transmit large volumes of groundwater quickly (i.e., high permeability).

The harbor construction would remove some unconsolidated materials from the shallow portion of the alluvial aquifer. Approximately 47 acres of the 170-acre floodplain will be impacted by the proposed harbor, which will consist of about 26 acres of open water and 21 acres of proposed development. This will result in some localized changes in aquifer properties (groundwater flow patterns, storage, etc.) but these changes are not expected to be significant due to the high permeability of the alluvial aquifer, which will still be able to respond to changes in Mississippi River elevations. In addition, the remaining area of the Mississippi River floodplain will still be bordered by the Mississippi River, with no structures blocking the interaction of the Mississippi River and the alluvial aquifer. Therefore, the harbor construction will not cause significant impacts to the alluvial aquifer groundwater resources and subsequent impacts to groundwater-supplied wetlands.

5.2 Floodplain

All available Flood Insurance Rate Maps (FIRMs), Flood Boundary Floodway Maps (FBFMs), and Flood Hazard Boundary Maps (FHBMs) from the Federal Emergency Management Agency (FEMA) for the project area were obtained and reviewed. Information from FIRMs, FBFMs, and FHBMs was used in conjunction with hydrologic modeling to quantify floodplain and floodway occurrence (STS et al., 2002).

This analysis indicates that approximately 363 acres of Zone A (100-year) floodplain occur at the project site on the Mississippi River floodplain (Lee Island) and the Isle du Bois Creek floodplain. The 100-year flood elevation at the confluence of the Mississippi River and Isle du Bois Creek is 406 feet msl. Relatively small extensions of floodplain areas are also mapped within the lower extents of several hollows (Raddy Hollow, Old Quarry Hollow, Von Behren's Hollow).

Project development that will encroach upon the floodplain is the result of the development of the harbor and associated loading/unloading infrastructure on Lee Island, the cement plant sedimentation basin, filling in conjunction with the rail spur, and grading along the lowest reaches of Raddy Hollow and Old Quarry Hollow and Von Behren's Hollow. The total impact associated with this encroachment will result in the loss of approximately 85 acre-feet of storage within the floodplain of the Mississippi River in the vicinity of Old Quarry Hollow and Isle du Bois Creek (Weaver, 2003). This impact however, will be offset by an increase in flood storage associated with the construction of the harbor (approximately 342 acre-feet). Consequently, the overall project will result in the increase of flood storage in conjunction with the Mississippi River of approximately 257 acre-feet. All other project components would be constructed above the 100-year floodplain.

In accordance with Executive Order (EO) 11988 (Floodplain Management) and 33 CFR 320.4(1), development in a floodplain should only be authorized when there are no practicable alternatives outside the floodplain. However, there are no practicable alternatives outside the floodplain for the proposed harbor, as the harbor is a necessary project component and is by its very nature, a feature that must be located in a floodplain area (see discussion of alternatives, Section 3.0). Similarly, there are no practicable alternatives outside the floodplain for the cement plant sedimentation basin. The basin must be located well below the elevation of the cement plant area in order to collect runoff

As demonstrated in Holcim's Floodplain Development Permit Application submitted to Ste. Genevieve County on November 12, 2002, with subsequent addendum, the project meets the applicable flood ordinance criteria, including no significant impact to the base flood elevation or the 100-year floodway elevation of either Isle du Bois Creek or the Mississippi River.

EO 11988 also requires that federal agencies attempt to restore and preserve the natural and beneficial values of floodplains. In general, natural river floodplains are important resources with numerous natural and beneficial values. Important floodplain functions include the dissipation of floods, erosion control, sediment and nutrient retention, water quality enhancement, and fish and wildlife habitat. Natural floodplain ecosystems are areas that provide fish and wildlife species with a variety of resting, feeding, and nesting habitats.

Most of the site floodplain, including the portion of the Lee Island floodplain that would be taken by the proposed harbor, consists of active farm fields with limited functional values (e.g., wildlife habitat, erosion control/sediment retention). Of the approximately 47 acres of floodplain that would be taken, approximately 11 acres are existing tailings piles and 31 acres are areas that have been farmed for many years. In addition, Holcim's mitigation (see Sections 6.1 and 6.6) will help compensate for any loss of floodplain value. The southern Lee Island wetland mitigation area, for example, will improve the pollutant filtering function of the floodplain, reduce erosion, and provide enhanced habitat for fish, birds, and other wildlife.

6.0 Biological Characteristics and Anticipated Changes

As stated in Section 1.0, Holcim has conducted numerous studies to characterize the biological resources at the project site. Studies specific to biological resources include the Companion Report (ESE, 2000a), Preliminary Jurisdictional Wetland Determination Report (ESE, 2000b), Short-Term Site Assessment and Avian Population Survey (WBS, 2001a), Spring Migratory and Summer Breeding Bird Site Assessment (WBS, 2001b), Avian Fall and Winter Site Assessment and Population Survey (WBS, 2002), Biological Assessment (Harding ESE, 2002d), Endangered Species Investigation Bat Survey Report (WDHES, 2002), Aquatic Resource and Water Quality Characterization Report and Addendum (Harding ESE, 2001a and 2002b), Wetland and Stream Mitigation Plan (Harding ESE, 2002c), Vegetation Survey and Community Type Map (Harding ESE, 2001b), and the Amphibian and Reptile Relocation Study (Harding ESE 2002e).

The following presents a general description of biological characteristics of the project site (described and evaluated in detail by the above-referenced reports) and impact assessment (anticipated changes) for wetlands and streams, fish and other aquatic organisms, wildlife, and plant species.

6.1 Wetlands

6.1.1 Existing Conditions

Holcim submitted its Section 404/401/10 permit application to the USACE, with a Companion Report (ESE, 2000a) and Preliminary Jurisdictional Wetland Determination Report (ESE, 2000b) on August 8, 2000. The Companion Report and the Preliminary Jurisdictional Wetland Determination Report included a summary of the ecological resources found on-site, including wetlands and streams. These reports identified wetland and stream impacts and mitigation opportunities. The public notice (P-2259) included a description of impacts to wetlands and surface water resources, as well as potential areas for wetland mitigation. On September 18, 2002, Natural Resources Conservation Service (NRCS) issued a written Wetland Determination that essentially concurred with the findings of the Preliminary Jurisdictional Wetland Determination Report for wetlands on agricultural lands except that two wetlands previously classified as emergent (palustrine emergent (PEM)) were reclassified as farmed wetlands (FW). On September 19, 2002, the USACE issued its approved Jurisdictional Determination affirming the Preliminary Jurisdictional Wetland Determination Report and the minor reclassification of farmed wetlands by NRCS, except that Wetland K and the Upland Pond – two small isolated wetlands totaling 0.2 acres - were determined to be non-jurisdictional wetlands under a recent Supreme Court decision (*Solid Waste Agency of Northern Cook County (SWANCC) v. U.S. Army Corps of Engineers*, 121 S. Ct. 675, January 9, 2001). The USACE's approved Jurisdictional Determination reduced the overall project wetland impacts from approximately 14.2 acres to approximately 14 acres. Despite the NRCS and USACE changes to the project site wetland delineation, Holcim is not proposing any revisions to the mitigation ratios, acreage, or types of wetland mitigation originally set forth in the Wetland and Stream Mitigation Plan.

A total of approximately 141 acres of jurisdictional wetlands have been identified within the project site (Table 6-1). Approximately 47 acres of wetlands were mapped on Lee Island. Many of these wetlands are farmed wetlands that have been disturbed by historic and active agricultural use. These wetlands are located in broad topographic depressions or swales (relict scars) formed by the Mississippi River. For the Lee Island wetlands, the dominant (seasonal) hydrology source is the Mississippi River, but ponding of direct precipitation and alluvial groundwater discharge are also contributing hydrology sources. Due to

soil disturbance from farming and periodic flooding, vegetation of farmed wetlands is dominated by "weedy" plant species such as cocklebur (*Xanthium strumarium*), fog fruit (*Phyla lanceolata*), and swamp smartweed (*Polygonum coccineum*). Additional species identified from emergent wetlands on Lee Island included river bulrush (*Scirpus fluviatilis*), upright burhead (*Echinodorus berteroi*), and asters (*Aster* spp.). Willows (*Salix* spp.), sycamore (*Platanus occidentalis*), cottonwood (*Populus deltoides*), and buttonbush (*Cephalanthus occidentalis*) were found to be characteristic of scrub shrub and forested wetlands located on the western portion of Lee Island.

Table 6-1. Wetlands of the Project Site

Wetland Type	Acres
Farmed Wetland (FW)	54.3
Palustrine Emergent (PEM)	11.1
Palustrine Forested (PFO)	68.0
Palustrine Scrub Shrub (PSS)	7.6
Total	141.0

The majority of the wetlands on the project site are associated with the Isle du Bois Creek floodplain (approximately 94 acres). Wetlands identified included emergent, scrub-shrub, and forested wetlands located in broad depressions or low floodplain (relict scar) areas. Some of the Isle du Bois Creek wetlands have a hydrology that is seasonally dominated by the Mississippi River. However, other surface water and groundwater sources also contribute to the hydrology of these wetlands. Dominant trees within these wetlands include green ash (*Fraxinus pennsylvananica*), swamp privet (*Forestiera acuminata*), silver maple (*Acer saccharinum*), sycamore, and slippery elm (*Ulmus rubra*). Characteristic non-woody plants observed include smartweed (*Polygonum* spp.), giant ragweed (*Ambrosia trifida*), stinging nettle (*Urtica dioica*), beggars-tick (*Bidens frondosa*), and fog fruit.

Limited wetlands occur within the uplands. The total jurisdictional wetland area within the uplands is restricted to approximately 0.1 acre at Old Quarry Hollow.

Floodplain wetlands provide functional value through flood attenuation and storage, groundwater discharge/recharge, seasonal/temporary fish and wildlife values (forage/cover/spawning), and sediment retention and nutrient removal. However, such functions as fish and wildlife habitat, and sediment retention and nutrient removal, are reduced for those wetlands on Lee Island and the floodplain of Isle du Bois Creek that have been converted to agricultural use.

6.1.2 Anticipated Impacts to Jurisdictional Wetlands and Proposed Mitigation

Summary of Impacts

Table 6-2 summarizes the project direct impacts to jurisdictional wetlands and the mitigation requirements (replacement ratios) in the MDNR's Aquatic Resources Mitigation Guidelines, which were developed in cooperation with U.S. Environmental Protection Agency (USEPA), U.S. Fish and Wildlife Service (USFWS), Missouri Department of Conservation (MDC), and other federal and state agencies (MDNR, 1999). The Wetland and Stream Mitigation Plan (Harding ESE, 2002c) provides additional details on the wetland impacts and the proposed mitigation plans.

The harbor will impact approximately 13.9 acres of wetlands consisting of palustrine forested (PFO, 1.8 acres) and farmed (FW, 12.1 acres) wetland communities. Most of these wetlands have been disturbed due to past or current farming practices, limiting their functional values. Impacts to these wetlands will involve excavation to create the open water area of the harbor and the placement of fill to support land-side harbor facilities and activities.

Table 6-2. MDNR Required Wetland Mitigation Compensation Acreage for the Project

Project Component	Approximate Area of Impact (acre)	Wetland Type	Mitigation Ratio*	Required Compensation Acreage
Harbor	12.1†	Farmed Wetland (FW)	1:1	12.1
	1.8	Forested (PFO)	3:1	5.4
Quarry	0.01	Emergent (PEM)	2:1	0.02
	0.08	Forested (PFO)	3:1	0.24
Totals	14.0			17.76

* MDNR Aquatic Resources Mitigation Guidelines.
† Includes 7.5 acres of previously classified emergent (PEM) wetland.

Potential indirect impacts to the harbor wetlands were also assessed in detail in the Water Resources and Hydrology Report (STS et al., 2002). Potential mechanisms of indirect impact included the alteration of wetland hydrology (via surface water runoff and groundwater discharge) and changes in water quality due to characteristics of site runoff and stormwater flow from the site. Analyses of changes in surface water runoff characteristics (quantity and quality) were conducted by extensive modeling that considered the effectiveness of the stormwater sedimentation basins that would be constructed on site. The modeling determined that no significant change in either the water quality or hydrology of wetlands adjacent to developed areas would occur.

The analysis also evaluated the potential for changes in groundwater discharge patterns and the extent to which groundwater discharge supports wetland hydrology. Extensive studies of the site have demonstrated that groundwater conductivity within the associated geologic formations matrix is low (LBG, 2000). This fact coupled with the fact that the hydrology of most of the site wetlands is seasonally driven by surface water flooding of the Mississippi River, indicates that there will be no significant indirect impact on the hydrology of the harbor wetlands.

Two jurisdictional wetlands at Old Quarry Hollow, totaling approximately 0.1 acre, will be affected by the storage of material that will be excavated from the Mississippi River floodplain to construct the harbor. These impacts will be fully mitigated, as discussed below.

Wetland Mitigation

Compensation to jurisdictional wetlands is required to mitigate for unavoidable impacts. The compensation ratios that would be required by MDNR average just over 2:1, with a 1:1 ratio for FW wetlands and 3:1 for PFO wetlands. Application of these ratios would require the creation of approximately 17.8 acres of jurisdictional wetlands (see Table 6-2). Holcim has proposed greater mitigation commitments on southern Lee Island and within the Isle du Bois Creek floodplain that entail wetland restoration, creation, preservation, stream channel restoration, and buffer development.

As presented in the Wetland and Stream Mitigation Plan (Harding ESE, 2002c), sufficient acreage south of the proposed harbor on Lee Island exists to create new wetlands to compensate for the wetlands that would be impacted by the project. As is detailed in Table 6-3, the total area of southern Lee Island (south of the proposed harbor and east of the railroad tracks) is approximately 71.8 acres, not including a narrow strip of the Mississippi River bank. On southern Lee Island, Holcim is proposing to create approximately 25.5 acres of new wetlands from non-jurisdictional cultivated fields and restore approximately 12.8 acres of farmed wetlands. In addition, Holcim is proposing to restore approximately 7.1 acres of relict stream

channels (subject to future feasibility studies), and create an approximately 3.6-acre vegetated buffer below the harbor. Approximately 2.0 acres of existing farmed wetland will remain on southern Lee Island and may be used for additional wetland restoration. In addition to these commitments, approximately 13.2 acres of forested wetlands on Lee Island will be preserved and together with the restored and created wetlands will form a contiguous high-quality wetland mitigation complex that will provide valuable wetland functions.

Table 6-3. Tabulation of Proposed Wetland Mitigation Commitments

Community Type	Existing Resource (acres)	Proposed Mitigation Activity	Proposed Resource
Southern Lee Island Floodplain			
Non-wetland			
Cultivated Field	36.2	Convert 25.5 acres to PEM/PSS complex, 3.6 acres to vegetated buffer, 7.1 acres to stream channel restoration	0.0
Floodplain Forest	7.6	Preserve	7.6
		Vegetated harbor buffer	3.6
Subtotal Non-Wetland:	***43.8***		***11.2***
"Waters of U.S." (Including Wetlands)			
Farmed Wetland (FW)	14.8	Restore 12.8 acres to PEM/PSS complex	2.0*
Emergent Wetland (PEM)	0	Creation/restoration	22.3
Scrub Shrub Wetland (PSS)	0	Creation/restoration	16.0
Forested Wetland (PFO)	13.2	Preserve	13.2
		Stream Channel Restoration	7.1
Subtotal Wetlands:	***28.0***		***60.6***
Total (All Types):	**71.8**		**71.8**
Isle du Bois Creek Floodplain			
Farmed Wetland (FW)	22.8	Restore 22.8 acres to PSS	0
Emergent Wetland (PEM)	11.1	Preserve	11.1
Scrub-Shrub Wetland (PSS)	7.6	Preserve, restore 22.8 acres	30.4
Forested Wetland (PFO)	52.9	Preserve	52.9
Total Wetlands:	**94.4**		**94.4**

* Farmed wetland acreage available for future restoration (subject to detailed design phase)
Note: Table does not include impacted areas or other wetland areas on north Lee Island.

In addition, there are a number of areas along the floodplain of Isle du Bois Creek that are available and will be used for wetland restoration. Mitigative commitments along Isle du Bois Creek include the restoration of 22.8 acres of farmed wetlands to scrub shrub wetlands (ultimately transitioning to forested wetlands), and the preservation of 11.1 acres of emergent wetlands, 7.6 acres of scrub shrub wetlands, and 52.9 acres of forested wetlands (see Table 6-3).

In summary, Holcim has proposed to create 25.5 acres of wetlands (southern Lee Island) and restore 35.6 acres (12.8 acres on southern Lee Island, 22.8 acres within the floodplain of Isle du Bois Creek). This totals a commitment to create and restore approximately 61 acres of wetlands in compensation for impacts to approximately 14 acres, and equates to a combined mitigation ratio of approximately 4.3:1.

Wetland mitigation will entail enhancing currently degraded wetlands (e.g., farmed wetlands), restoring previously impacted wetlands, and creating new wetlands from non-wetland areas on Lee Island. The creation and restoration of wetlands will effectively result in an increase of jurisdictional wetlands within the project area. Because such wetlands will be closely associated with the Mississippi River and Isle du Bois Creek, they will have a highly reliable wetland hydrology. In addition, these wetlands will be designed and constructed in such a manner that they will incorporate a heterogeneous mosaic of plant communities and microhabitats (emergent and scrub-shrub communities, open water, vernal pools, shallow channels, etc.) that will ensure a high level of performance for such functions as sediment and nutrient retention and removal, flood storage, water quality enhancement, wildlife habitat, and support for fish feeding and reproduction. A 3.6-acre vegetated buffer area between the southern Lee Island wetland mitigation site and the proposed harbor will also be established. The wetland creation and restoration activities will be initiated after all necessary permits are issued and prior to or concurrent with the filling of any wetlands. Considering the extent and quality of the proposed mitigation, no significant adverse impacts to wetlands of the project area will occur.

Mitigated wetlands will also be the subject of an approved monitoring program designed to evaluate performance (i.e., success), potential problems (e.g., invasive species), and prescribe appropriate corrective and maintenance measures, if necessary.

6.2 Endangered or Threatened Species

Extensive effort has been expended to inventory and characterize the natural resources of the project site and identify endangered, threatened or other listed species that may be present. Based upon literature research, coordination with state and federal agencies, and site-specific studies (see Section 1.0), threatened and endangered species that are present or may be present at the site were identified. Table 6-4 presents species that are either federally or state listed and have been observed on the project site.

Many of the species included in Table 6-4 are state listed bird species that were observed occasionally on the site. With the exception of the northern crawfish frog, none of the state listed species were determined to use the site for nesting or reproduction. Consequently, potential impacts to these species are considered to be insignificant. In 2001, the northern crawfish frog was identified by sound only at a single farmed wetland that would be impacted by the harbor on Lee Island. However, the species was not observed or heard in subsequent field surveys in 2002. Potential mitigative measures to offset impacts to this species include the creation and restoration of extensive wetlands on Lee Island and the relocation of selected individuals, if any are found, prior to impact of project area wetlands.

Federally listed species known to occur or potentially occur at the site were evaluated in detail. No critical habitat for any federally listed species has been formally designated at the site or within the immediate vicinity. In response to agency concerns, Holcim submitted a Biological Assessment (BA) for the proposed project on January 10, 2002, which is incorporated into this EA by reference. The BA was prepared at the request of the USFWS as part of the consultation process under the Endangered Species Act. The species analyzed in the BA included the following:

- Indiana bat;
- gray bat;
- peregrine falcon;
- Hine's emerald dragonfly; and

- bald eagle;
- interior least tern;
- pallid sturgeon.

Table 6-4. Listed Species to be Evaluated

Common Name	Scientific Name	Listing Status* Federal	Listing Status* State	Identified On-site
Mammals				
Gray bat	*Myotis grisescens*	E	E	Yes†
Indiana bat	*Myotis sodalis*	E	E	Yes
Northern long-eared bat	*Mytois septentrionalis*		S3	Yes
Birds				
Bald eagle	*Haliaeetus leucocephalus*	T	E	Yes
Black-crowned night heron	*Nycticorax nycticorax*		S2	Yes
Black vulture	*Coragyps atratus*		S3	Yes
Brown creeper	*Certhia americana*		SU	Yes
Chestnut-sided warbler	*Dendroica pennsylvanica*		S3	Yes
Cooper's hawk	*Accipiter cooperii*		S3	Yes
Great egret	*Ardea alba*		S3	Yes
Henslow's sparrow	*Ammodamus henslowii*		S2	Yes
Little blue heron	*Egretta caerula*		S2	Yes
Mississippi kite	*Ictinia mississippiensis*		S2	Yes
Northern harrier	*Circus cyaneus*		S1,S2,E	Yes
Osprey	*Pandion haliaetus*		SX	Yes
Pied-billed grebe	*Podilymbus podiceps*		S2	Yes
Red-shouldered hawk	*Buteo lineatus*		S3	Yes
Sharp-shinned hawk	*Accipiter striatus*		S2	Yes
Fish				
Pallid sturgeon	*Scaphirhynchus albus*	E	E	No**
Amphibians				
Northern crawfish frog	*Rana areolata circulosa*		S3	Yes‡

* E-endangered, T-threatened
S1-species, which are critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state
S2-species, which are imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state
S3-species that are rare or uncommon in the state.
SU-Species that are unrankable, possibly imperiled.
SX-Species that are extirpated from the state.

† Identified from Anabat records only, not collected by mistnetting

** Known to occasionally occur in Mississippi River.

‡ Identified (heard once, but not observed) during a bat survey in 2001.

The BA provided the following information regarding each of the above-listed species: a summary of its status and distribution, a discussion of whether the species and/or its habitat is present on the project site, and an assessment of potential impacts on the species and/or its habitat due to project construction and operation.

6.2.1 Indiana Bat

The Indiana bat is a federally listed endangered species found throughout much of the eastern half of the U.S. The Indiana bat lives in caves during the winter and in forested areas during the rest of the year. The largest numbers of Indiana bats are found in Indiana, Kentucky, and Missouri. A large cave (hibernacula) containing more than 30,000 Indiana bats is located in Washington County, Missouri, about 30 miles from the project site. Indiana bats have been previously observed in Jefferson County, Missouri, but were not previously known on the project site.

Indiana bat summer habitat includes mature floodplain, riparian, and adjacent upland forests. Indiana bats roost and establish maternity colonies primarily beneath the loose bark of dead, dying or live hickory, oak and other trees. Foraging areas of Indiana bats are primarily tree canopies of floodplain, riparian, and upland forests. Suitable summer roosting and foraging habitat for the Indiana bat is available on the project site. Indiana bat winter habitat consists exclusively of caves and mines with specific temperature and humidity ranges. There is no suitable winter habitat for Indiana bats on the project site.

A comprehensive investigation was conducted for Indiana and gray bats on the project site. Bat surveys were performed during summer and fall, 2001, under the supervision of an expert, William Hendricks of WDHES. The surveys included mist netting (in accordance with USFWS guidelines), radio telemetry, and Anabat acoustic detection technology.

During the surveys, WDHES mist netted 28 different locations at the project site. A total of 94 bats were captured representing six species including the Indiana bat. Two Indiana bat maternity roosts and three Indiana bat male roosts were located during the study. Four of the roosts were located along Isle du Bois Creek in the project buffer area. These included three male roosts and one maternity roost. The other roost, a maternity roost, was located off-site across the Mississippi River in Illinois.

Several solution voids were investigated as potential winter habitat (hibernacula), but field observation and mist netting revealed no evidence of Indiana bats at these locations. The solution voids on the site were determined to be unsuitable for Indiana bat hibernation.

Indiana bats were detected traveling and presumably foraging in several areas of the project site by radio telemetry and Anabat technology. Indiana bats were tracked flying along ridge-top roads and in hollows on the project site. Generally, Indiana bats followed the predominant corridors within the site including the Isle du Bois Creek riparian corridor. There was evidence of foraging by Indiana bats in Hickory Hollow north of the Isle du Bois Creek and along the Lee Island slough. Radio-tagged females from the off-site maternity roost also were detected on-site.

Potential direct and indirect impacts to the Indiana bat were assessed. Because suitable caves or solution voids do not exist on-site, there will be no impact to winter habitat (hibernacula). Direct impact to summer habitat roost trees is not expected because all roosts located during the investigation are in the buffer area or off-site. Direct impact to potentially unidentified roost trees within the quarry will be avoided by following tree clearing restrictions expected to be imposed as a permit condition. Tree clearing will result in some loss of foraging habitat, but no adverse impact to the Indiana bat is anticipated as it is likely that bats will avoid the cleared areas and use the substantial areas of remaining forest in the quarry and buffer area. In addition, wetland and stream mitigation will result in planting of trees along Isle du Bois Creek and on southern Lee Island, which is expected to increase the suitability of these areas as foraging habitat. Additional conservation measures will focus on maintaining or restoring suitable forested habitat. Land reclamation activities will also be ongoing and will entail the replacement of trees that in time will provide suitable habitat.

Activity in the center of the project site (cement plant, harbor, and harbor excavation material deposition area) should not significantly affect foraging by Indiana bats from the roost site across the Mississippi River. Suitable foraging habitat exists on the Illinois side of the Mississippi River, and immediately south of the project site. The creation of the wetland complex and restoration of the slough on southern Lee Island as part of Holcim's mitigation plan will also enhance foraging habitat for bats from across the Mississippi River. The mitigation area on Lee Island may actually facilitate transition to the upland ridge-tops and hollows. Bats avoiding the Old Quarry Hollow area where harbor excavation material is disposed, but seeking to access the upland forest on-site, will likely use adjacent Wolf or Longs Hollows. The quarry will not impact these areas for many years. Indiana bats may also simply fly over activity in the center of the site to reach suitable foraging areas in the site uplands.

Potential indirect effects resulting from changes in noise, light, and dust were also considered. The level at which sound may adversely affect Indiana bats is unknown. However, one of the identified male roosts was located approximately 40 yards from the active railroad line. There was no evidence that passing trains disturbed this roost. Quarry blasting will typically be limited to two brief periods daily (during daytime hours only) and should not affect the existing Indiana bat roosts located across Isle du Bois Creek. Sound from the quarry will also be contained by landscape features such as surrounding hills, a ridge between the quarry and Isle du Bois Creek, and the bluff along the Mississippi River. Similarly, noise from cement plant operation is not expected to be significant and will diminish with distance. Little is known regarding the relationship of fugitive light and its effects on summer Indiana bat habitat, or roosting and foraging activities. However, illumination specialists will be used to minimize stray light from the cement plant, quarry and harbor areas in a manner consistent with safety and operations. Dust will be managed in accordance with the facility's air permit, and minimized by storage of materials in enclosed buildings.

Based on evaluation of potential direct and indirect effects, Holcim and the USACE determined that the project is not likely to adversely affect the Indiana bat. However, on July 3, 2002, the USACE, USFWS, and Holcim entered into formal consultation on the Indiana bat.

Holcim anticipates that USFWS will issue a Biological Opinion finding the project will not jeopardize the Indiana bat, provided Holcim implements the conservation measures set out in the Biological Assessment.

6.2.2 Gray Bat

The gray bat is a federally listed endangered species with populations in Missouri as well as other states. There are no historic records for the gray bat within the project site, but the gray bat has been documented in Jefferson and Washington Counties.

Gray bat colonies are restricted primarily to caves or cave-like structures, such as mines and even storm sewers. The species does not roost in trees. Gray bats do not appear to inhabit the project site. Several solution voids were surveyed during the summer and fall seasons using mist nets with no gray bats captured. There was no evidence that gray bats had inhabited any of the solution voids in the past. Given the specific environmental requirements (temperature, etc.) for gray bat use of caves, no suitable hibernation or roosting habitat exists on site.

Using state-of-the-art Anabat acoustic bat detection technology, WDHES detected a small number of gray bats using the project area. These gray bats appeared to be traveling and foraging as they flew within the Mississippi River and Isle du Bois Creek corridors and the uplands on the project site. Gray bats typically travel and forage along major watercourses (rivers, perennial streams).

Potential direct and indirect impacts to the gray bat were assessed. Because there are no caves suitable for the gray bat on-site, no direct impacts to winter hibernating or summer roosting habitat will occur. No direct impacts to foraging habitat should occur along the Isle du Bois Creek riparian corridor, which is contained within the buffer area, and will be enhanced by implementation of the wetland and stream mitigation plan and other conservation measures. Any direct impact to gray bat foraging habitat along the Mississippi River should be minimal and mitigated by the establishment of the southern Lee Island wetland area. Potential mechanisms for indirect impacts due to sound, light, and dust are similar to the Indiana bat. However, colonies of gray bats have been found in such unusual, high noise areas as storm sewers and underneath roadway bridges; therefore, noise should not be a significant factor. Light and dust will be controlled as discussed for the Indiana bat.

Based on evaluation of potential direct and indirect effects, the project is not likely to adversely affect the gray bat. By letter dated May 8, 2002, USFWS concurred with this determination, noting that if gray bats use the project area, their presence is entirely transitory and temporary in nature.

6.2.3 Bald Eagle

The bald eagle is a federally threatened species known to occur widely in the continental United States. Bald eagle habitat within the Middle Mississippi River (MMR) primarily consists of wintering habitat. The number of bald eagles wintering in Missouri has increased from 955 in 1981 to 2,621 in 1997. Roosting and nesting sites generally occur in tall, mature, and over-mature trees that provide a clear path to water, including eastern cottonwood and American sycamore.

The WBS conducted a site assessment and avian population survey on the project site (Section 6.5). Immature and adult bald eagles were observed perched in trees and soaring over the Mississippi River and its bluffs on both the Missouri and Illinois sides of the river. Current activities at the Rush Island Power Plant located immediately upriver and just north of Isle du Bois Creek apparently had little or no effect upon the behavior of the bald eagle. The observed activity was consistent with the bald eagle using the site as a migratory stopover. No evidence of nests or nesting territories during the established breeding season was found on the site.

The WBS concluded that the project will not impact bald eagle roosting habitat or potential nesting habitat located along the Mississippi River bluff line. Additionally, there is ample roost habitat upstream and downstream of the site, as well as across the river along the Illinois bank. There will be no direct disturbance to these areas by the proposed project and no limitation of roosting areas along the Mississippi River within the region. As discussed in Section 6.6.2, Holcim intends to preserve a forested area along the bluffs to maintain trees that are potentially suitable for bald eagle roosting. Therefore, the project is not likely to adversely affect the bald eagle. By letter dated May 8, 2002, USFWS concurred with this determination.

6.2.4 Interior Least Tern

The interior least tern is a federally endangered species, with a widespread range along the Mississippi and Missouri Rivers and their tributaries. Least tern nesting habitat consists of exposed sand and gravel bars, and is widely distributed within the MMR depending on river stage and flow conditions.

The WBS did not observe least terns within the vicinity of the project area, and found no suitable nesting habitat on Lee Island. Potentially suitable sandbar habitat may exist across the Mississippi River from the project area along the left descending bank (Illinois side). Barge fleeting operations associated with the project area are limited to the right descending bank, and will not impact sandbars or potentially suitable

habitat across the Mississippi River. The least tern will not be affected by the proposed project. By letter dated July 29, 2002, USFWS concurred with this determination.

6.2.5 Peregrine Falcon

The peregrine falcon was delisted by the USFWS in 1994, but is currently listed as a state endangered species in Missouri. Natural perching and nesting sites for peregrine falcon include cliffs and series of cliffs and ledges within approximately 0.5 to 1 mile of water. No peregrine falcons have been observed in the project area or in the immediate vicinity, and no evidence of nesting activity was found during the established breeding season. The WBS concluded that peregrine falcons do not appear to use the site for hunting or nesting. The peregrine falcon will not be affected by the project. By letter dated July 29, 2002, USFWS indicated that the peregrine falcon is not a federally listed species and not subject to USFWS jurisdiction.

6.2.6 Hine's Emerald Dragonfly

Hine's emerald dragonfly is a federally endangered species that has only been found in Missouri in Reynolds County. Hine's emerald dragonfly habitat is typically characterized by small, slow-flowing, shallow spring-fed seeps and streams, underlain by limestone-dolomite bedrock, and hydrologically connected to densely vegetated marshes or fens.

A dragonfly survey of the project area was conducted, with the assistance of Linden Trial of the MDC, to determine the presence of the Hine's emerald dragonfly. No lifestage of the Hine's emerald dragonfly was observed during field activities. Based upon field reconnaissance efforts, and review of the habitat requirements of the Hine's emerald dragonfly, suitable habitat does not exist on site. The Hine's emerald dragonfly is not likely to be adversely affected by the proposed project. By letter dated May 8, 2002, USFWS concurred with this determination.

6.2.7 Pallid Sturgeon

The pallid sturgeon is a federally endangered species that inhabits the Missouri and Mississippi Rivers. The pallid sturgeon is a benthic (bottom-dwelling) fish that prefers turbid, swift flowing water and it apparently spawns over coarse substrate such as gravel.

Studies performed over the past decade found the pallid sturgeon in the Mississippi River in the vicinity of Rush Island and Lee Island. During one 6-year study, radio-tagged pallid sturgeons were identified six times between RM 138 and 140, toward the Illinois side of the Mississippi River. The study indicates that pallid sturgeon are often found in the main channel of the Mississippi River, but positively select for main channel border, downstream island tips, between wing dams, and at wing-dam tips. Pallid sturgeons were most often found in water with maximum depths from 9 to 37 meters.

Sampling for pallid sturgeon or gravel substrate has been conducted for this project. In July 1999, MACTEC sampled the substrate in the vicinity of the project site. Substrate was determined to be primarily sand. In April 2000, MDC conducted sampling in the vicinity of the project site (RM 137 to 139) using a benthic trawl. Observations included a potential gravel bar near the mouth of Isle du Bois Creek. No pallid sturgeons were captured during MDC's sampling effort. MDC also performed a study in January 2002 aimed at collecting pallid sturgeon. The study was conducted within the MMR in a reach upstream of the site and resulted in the collection of 92 shovelnose sturgeon, one pallid sturgeon, and one hybrid sturgeon. The single pallid sturgeon was collected outside of Holcim's project area within a dike field along the Illinois bank. Depths from which sturgeon were collected were typically between 30 and 60 feet – considerably deeper than that which exists in the area affected by the project.

The only aspect of the project that could have a potential impact on the pallid sturgeon in the Mississippi River is the barge fleeting area. However, the barge fleeting area will not impact the pallid sturgeon's ability to: (1) travel in the main channel of the Mississippi River, or (2) utilize habitat on the Illinois side of the Mississippi River. Both the main channel border habitat and other habitat types selected for by species are more abundant on the Illinois side (i.e., between wing dams and wing dam tips). As a result, the barge fleeting area is not likely to adversely affect the pallid sturgeon.

Similar conclusions with USFWS concurrence were reached for barge fleeting expansion projects at the AmerenUE Rush Island power plant immediately to the north, and the Brickeys Stone quarry 1 mile south. Both fleets were reviewed and approved by USFWS for placement within 75 to 100 feet of the right descending bank of the Mississippi River, without any request for a BA or Section 7 consultation. In particular, the Brickeys Stone fleeting project allowed two fleets, 55 barges total, to be placed in waters shallower than Holcim's proposed upper fleeting area.

For further information on the pallid sturgeon and other species, see Holcim's BA and the following letters: USACE March 19, 2002 letter to USFWS; USFWS May 8, 2002 letter to USACE; USACE June 27, 2002 letter to USFWS; and USFWS July 29, 2002 letter to USACE.

In its July 29, 2002 letter, USFWS concurred that construction and operation of the harbor is not likely to adversely affect the pallid sturgeon. USFWS reserved the right to comment on potential effects on the pallid sturgeon if Holcim applies for a separate permit to perform maintenance dredging in the north fleeting area.

6.3 Aquatic Ecosystems

The aquatic resources of the site were characterized in the Companion Report (ESE, 2000a), Aquatic Resource and Water Quality Characterization Report and Addendum (Harding ESE, 2001a and 2002b), and Wetland and Stream Mitigation Plan (Harding ESE, 2002c). In general, site aquatic resources are dominated by lotic (flowing water) ecosystems with only minor representation by lentic (non-flowing water) ecosystems. Lotic ecosystems consist of the Mississippi River, Isle du Bois Creek, intermittent streams, and isolated small springs and seeps. Lentic ecosystems are represented by a 0.2-acre farm pond located in the uplands near the mouth of Isle du Bois Creek.

6.3.1 Isle du Bois Creek

Isle du Bois Creek is the only on-site perennial stream (except the Mississippi River). Additionally, with the exception of Spring 20 and the Mississippi River, it is the only lotic habitat on site that provides habitat for fish. The stretch of Isle du Bois Creek within the vicinity of the site (just north of Highway 61 to the confluence with the Mississippi River) is characterized by distinct changes in in-stream conditions. Habitat types and features are, therefore, quite different when comparing Isle du Bois Creek just upstream and downstream of the Highway 61 bridge to its lower reach near the Mississippi River. The differences are evident in habitat characteristics such as water depth, flow regime, substrates, and water clarity. The variability in aquatic habitat is important in understanding the relative condition of the resident biotic community (i.e., tolerant versus intolerant species) and potential impacts on the local aquatic ecosystem. Consequently, for the purposes of analysis, as stated previously in Section 5.1.1.1, Isle du Bois Creek was divided into three sections:

- Upper Section (located off-site) -- characterized by clear, fast moving water over gravel/sand substrates with variable riffle, run, and pool habitats;
- Middle Section -- characterized by slower moving, slightly turbid water with mixed sand/gravel and silt/clay substrates, consisting of predominantly pool habitat; and

- Lower Section -- characterized by slow moving, turbid water with silt/clay substrates. This section consists almost entirely of pool habitat and is influenced by backwater flooding from the Mississippi River an average of approximately 183 days per year.

Based upon the habitat structure and the fish species that were collected, the upper section is characteristic of a headwater/upper gradient stream reach, while the lower section is characteristic of a large river tributary stream reach. The largest number and diversity of fish were collected from the upper section of Isle du Bois Creek. Dominant fish species in the upper section included Ozark minnow and central stoneroller. Most of the fish species collected within this reach are commonly associated with small- to medium-sized creeks with continuous flow, high to moderate gradient, clean gravel and cobble substrate, and intermittent riffles and runs. Several of the species collected (Ozark minnow, bigeye chub, black redhorse, and bigeye shiner) are classified in the intolerant group, which is considered to be sensitive to water quality changes (USEPA, 1994).

The middle section of Isle du Bois Creek is typically an impounded condition as it is located upstream of the low water crossing. This section of Isle du Bois Creek is also influenced by backwater flooding from the Mississippi River, usually in the spring (April-May), an average of approximately 73 days each year. The fish species collected from the middle section of Isle du Bois Creek are more common representatives of low flow systems found in medium to big rivers. Most of the fish species collected within the middle section of Isle du Bois Creek are classified in the moderately tolerant group and are not considered highly sensitive to changes in water quality, which is typical of medium to big rivers (USEPA, 1994). Several game species were collected, including: largemouth bass, spotted bass, walleye, bluegill, bigmouth buffalo, longear sunfish, and freshwater drum.

The majority of the fish collected from the lower section are common species found in larger rivers (grass carp, smallmouth buffalo, river carpsucker, emerald shiner). Isle du Bois Creek widens and deepens within the lower portion of this section and is often inundated by backwater flooding from the Mississippi River (on an average annual basis, approximately 183 days each year). In general, the fish species collected within the lower section are classified in the intermediate (moderately tolerant) group (USEPA, 1994) and are not considered highly sensitive to changes in water quality (Harding ESE, 2001a and Harding ESE, 2002b).

No federally or state listed fish species were identified in Isle du Bois Creek during three rounds of sampling (spring, summer, fall) conducted in 2001 or through literature searches or consultations with MDNR and USFWS.

As stated in Section 3.1.4, the project has been modified to avoid direct impacts to Isle du Bois Creek and its floodplain. Consequently, no direct impacts to Isle du Bois Creek are anticipated as a result of the project. Potential indirect impacts to Isle du Bois Creek water quality have been presented in Section 5.0. Based upon the conclusions of the Water Resources and Hydrology Report (STS et al., 2002), no significant impacts (i.e., nutrient loading, sediment loading, etc.) to Isle du Bois Creek water quality will be caused by project development. As stated above, the points at which stormwater from the plant and quarry areas will be released to Isle du Bois Creek are influenced by seasonal backwater flooding from the Mississippi River and contain fish communities that are considered tolerant to water quality changes. In addition, stormwater runoff from these areas will be managed by sedimentation basins prior to its release to Isle du Bois Creek. Therefore, no significant impacts to aquatic life in Isle du Bois Creek are anticipated.

6.3.2 Mississippi River

The Mississippi River is a large channelized river characterized by a wide variety of fish species that are adapted to an environment typified by swift currents and high turbidity. The common fishes that are characteristic of the Big River faunal region (including the Mississippi River) include: chestnut lamprey (*Ichthyomyzon castaneus*), shovelnose sturgeon (*Scaphirhynchus platorynchus*), skipjack herring (*Alosa chrysochloris*), goldeneye (*Hiodon tergisus*), blue sucker (*Cycleptus elongatus*) , blue catfish (*Ictalurus furcatus*), channel catfish (*Ictalurus punctatus*), flathead catfish (*Polydictis olivaris*), white bass (*Morone chrysops*), sauger (*Stizostedion canadense*), freshwater drum (*Aplodinotus grunniens*), flathead chub (*Hybopsis gracilis*), silver chub (*Hybopsis storeriana*), emerald shiner (*Notropis atherinoides*), and river shiner (*Notropis blennius*) (Pflieger, 1997). Non-indigenous species that have become dominant in the MMR include carp (*Cyprinus carpio*), silver carp (*Hypophthalmicthys molitrix*), and bighead carp (*Hypophyhalmichthys nobilis*). Fish species that have become uncommon in the MMR include pallid sturgeon (*Scaphirhynchus albus*), western silvery minnow (*Hybognathus argyritis*), plains minnow (*Hyboganthus placitus*), flathead chub (*Hybopsis gracilis*), sturgeon chub (*Macrhybopsis gelida*), and sicklefin chub (*Macrhybopsis meeki*).

The proposed harbor and in-river fleeting facility are not expected to significantly impact the aquatic resources of the Mississippi River. As designed, the harbor will result in the conversion of wetland and non-wetland habitat (see Section 6.1) to approximately 26 acres of open water habitat that will be accessible by Mississippi River fish and other aquatic biota year-round. While this area will not offer high habitat value due to its design (steep, vertical bank lines) and frequent tow operation, it will provide a quiescent zone that may be used by fish periodically to seek refuge from the main channel current.

The in-river barge fleeting is expected to have some direct impacts to aquatic life during construction and any long-term maintenance dredging (should it be required, see Section 3.1). Construction of the river cells would result in direct mortality to less mobile aquatic organisms (e.g., benthic invertebrates such as segmented and unsegmented worms, insect larvae, etc.) within the small area of the immediate construction zone. Construction activities may also cause a temporary localized increase in turbidity, and subsequent localized scouring in the vicinity of the barge cells. Periodic sediment scouring and subsequent downstream deposition may also occur under conditions of lower Mississippi River stage due to tow boat prop wash effects. However, given the context of the project (i.e., a large turbid river system that is subject to a high level of barge activity) and the short-term disruption of the aquatic environment, no significant impacts to the aquatic biota of the Mississippi River are expected.

A study was also conducted to determine the potential occurrence of freshwater mussels (unionids) within the Mississippi River in the proposed in-river fleeting area. Substrate sampling and a unionid brail survey were performed to ascertain the potential for suitable unionid habitat as well as unionid occurrence adjacent to the proposed project site. The results of the study indicated that although there is potential suitable habitat for unionids within a narrow strip of gravel, the probability of mussel occurrence in this stretch of the Mississippi River is very low. No unionids (live or dead) were collected during sampling efforts.

6.3.3 Intermittent Streams/Springs/Seeps

The intermittent streams on the project site, in general, are characterized by rocky, non-vegetated beds that contain water flow only seasonally or in response to storm events. Given these conditions, these areas generally do not provide sustained habitats for aquatic biota. Several small sections of these systems (i.e., springs/seeps) do receive groundwater discharge for more extended periods and therefore, provide a limited amount of aquatic habitat. In total, approximately 6.0 miles of intermittent

jurisdictional streams (see Table 5-1) and 25 springs and 7 seep areas have been identified within the site (see Figure 3-1). In some areas (e.g., Raddy Hollow), seep areas and springs are coincident, forming a single groundwater discharge zone.

Holcim performed additional studies in spring and fall 2001 to characterize the upland aquatic resources and habitats. One finding from this sampling program is that many of these areas provide only limited seasonal aquatic habitats. Seven springs and seeps were sampled for benthic invertebrates and other aquatic biota (salamanders, frogs, etc.). Fauna associated with the springs/seeps included amphibians (frogs and salamanders), aquatic gastropods, amphipods, and flatworms. Although one spring location (Spring 20) was observed to support a fish community consisting of sculpins and other species (Harding ESE, 2001a), this spring is located at the edge of the floodplain of Isle du Bois Creek (not in the uplands) and will not be affected by the proposed project. These locations were also sampled for water quality (see the Aquatic Resource and Water Quality Characterization Report, and Addendum).

The upland surface water resources will be impacted at different times over the course of the life of the quarry, with some areas being impacted within the first 10 years and other areas not being impacted for several or many decades. After the first 8 to 10 years, some of these resources will be undergoing reclamation, while the advancing quarry is impacting other areas. The approximate sequence of intermittent stream impacts is presented in Table 5-2. In total, approximately 3.2 miles of intermittent streams will be impacted within the "100+ years" quarry boundary.

Anticipated impacts include direct impacts to 13 spring/seeps and localized mortality of associated biota due to quarry operations. It is also anticipated that several of the springs/seeps at the edge of the buffer area may be impacted by groundwater changes induced by the quarry development. However, such impacts will not occur all at once, but will be realized incrementally over several decades as the quarry operations proceed. Additionally, the buffer area (approximately 2,200 acres) contains some spring/seep habitats, which will not be impacted.

6.3.4 Lee Island Slough

The Lee Island slough is crossed by an existing gravel road and receives backwater flooding from the Mississippi River during periods of high water stage and surface water runoff from the river floodplain. Sediment deposits have partially blocked the downstream end of the slough, thus cutting it off from the Mississippi River for part of the year. The slough is a fairly deep, steep-sided impoundment with the banks dropping off into approximately 10 to 12 feet of water (high water periods). The slough is seasonally dry. The bottom sediments consist of detritus and organic muck. Fish collected from the Lee Island slough were representative of medium to big rivers and the collections were dominated by gizzard shad, common carp, and emerald shiner.

The Lee Island slough will not be negatively impacted by the project development. Stormwater runoff from the Old Quarry Hollow harbor excavation fill areas will discharge to the slough. This stormwater will be controlled with BMPs and sedimentation basins. The basins will be designed to attenuate 100-year storm events. The basins will prevent excess sediment or nutrients from entering the slough. As discussed in Section 6.6.1.2, Holcim proposes to restore the slough's lower connection to the Mississippi River, thereby increasing its value to river fish communities.

6.3.5 Impounded Aquatic Ecosystems

The only lentic (non-flowing) aquatic resource located at the site is the Upland Pond, an isolated man-made pond located south of Isle du Bois Creek. The pond is small (0.2 acre) and is located above the 500-year floodplain and lacks a hydrologic connection between the pond and the creek. Therefore, based

upon a recent U.S. Supreme Court decision (*SWANCC*) (see Section 6.1.1), this area is no longer considered a "water of the U.S." The pond was excavated by a previous landowner for recreational fishing, and consists predominantly of open water with a small, vegetated fringe. The pond likely supports small populations of fish (catfish, etc.), aquatic insects, and amphibians. Wildlife (deer, raccoon, etc.) may also use the pond as a water source.

Construction of the cement plant will result in direct impacts to the 0.2-acre pond. However, it should be noted that losses to this small lentic ecosystem will be more than offset by project mitigation that will include a 500-acre lake within the quarry and numerous small upland ponds. In addition, the design of the sedimentation basins will include the planting of emergent vegetation. Such features will not only result in the development of aquatic habitats that may be used by aquatic biota, but they will also perform an important function for resident and migratory wildlife.

6.4 Plant Communities

6.4.1 Plant Community Types

Plant communities of the project area were documented and characterized by conducting a thorough vegetation inventory. In addition, plant communities of the site were identified and mapped. The Vegetation Survey and Community Type Map report (Harding ESE, 2001b) entailed the use of field surveys conducted at various times at the project site from May 1999 to September 2001. Surveys performed during May 2001 to September 2001 were specifically completed to observe those species that flower in the spring/early summer and late summer/fall seasons.

The objectives of the vegetation surveys and plant community mapping study were to provide a detailed description of terrestrial communities, determine the occurrence of any federal or state listed species, unique or rare plant species or plant communities, and assist in evaluating impacts to terrestrial resources. Additionally, information collected from the study will also be used in the formulation of the land reclamation strategy and a site management plan.

Plant community descriptions were developed from the Preliminary Jurisdictional Wetland Determination Report, the Companion Report, and the 2001 fieldwork. Each plant identified at the site was entered into a master plant list, which is included in an appendix to the Vegetation Survey and Community Type Map report.

Field surveys were performed by MACTEC, Dan Drees (an ecologist), and Dr. James Trager of the Missouri Botanical Garden, Shaw Nature Reserve. These surveys specifically searched for, but did not locate, any federal or state listed plant species. The master plant list compiled for the project site contains over 500 plant species. A variety of forested community types dominate the site (Table 6-5).

The site terrestrial communities are comprised of upland, bottomland, and wetland ecosystems. Wetland communities of the site have been previously described in Section 5.1 and will not be further discussed here. Plant communities have been divided into a number of different types as presented in detail in the Vegetation Survey and Community Type Map report. Upland forest, consisting of a number of distinct types, is most well represented on the site, accounting for nearly 3,300 acres (see Table 6-5).

Upland Forests

The site supports a mosaic of upland forest types that are represented by Mesic (moist) Limestone Forest, Dry-Mesic Limestone and Dry-Mesic Chert Forest, Dry Limestone and Dry Chert Forest, Limestone Cliff, and Dry-Mesic Sandstone Forest. These woodlands vary in their location with respect to slope, ridgetop, and aspect. Consequently, they differ with regard to supporting soil and parent material (limestone, chert, sandstone), drainage, light, and moisture conditions. Some of the characteristic trees species include white oak (*Quercus alba*), red oak (*Q. rubra*), post oak (*Quercus stellata*), shagbark hickory (*Carya ovata*), blackjack oak (*Q. marilandica*), chinquapin oak (*Q. prinoides acuminata*), sugar maple (*Acer saccharum*), hackberry (*Celtis occidentalis*), and flowering dogwood (*Cornus florida*). Common shrub species include wing sumac (*Rhus copallina*), smooth sumac (*R. glabra*), wild gooseberry (*Ribes missourienses*), and fragrant sumac (*R. aromatica*).

Among these, the Dry-Mesic Sandstone Forest is an uncommon community type that consists of a broad band (approximately 1,000 to 1,500 feet) located on the western edge of the site. Effort was made during the development of the access road to minimize impacts to this community type. Characteristic plants of this community type include sugar maple, red oak, white oak, and flowering dogwood. Hairy lip fern (*Cheilanthes lanosa*), a plant characteristic of sandstone substrates, was observed in this community. A small (approximately 30-foot diameter) gap was observed within the sandstone forest that contained prickly pear cactus (*Opuntia compressa*).

Table 6-5. Impacts to Land Cover

Cover Type	Entire Site (acres)†	Project Impacts* Acres†	Project Impacts* Percent of Total Site†
Agriculture/Grasslands			
Active Farm Field	77	18	0.5
Old Field	189	4	0.1
Subtotal	266	22	0.6
Forest			
Dry Limestone and Chert Forest	945	312	8.0
Dry-Mesic Limestone and Chert Forest	1,998	769	20.5
Mesic Limestone Forest	173	95	2.4
Sandstone Forest	104	7	0.2
Limestone Cliff	37	4	0.1
Dolomite Outcropping Forest	37	2	0.1
Isle du Bois Creek Riparian Zone	1	0	0
Mesic Bottomland Forest	61	10	0.3
Subtotal	3,356	1,192	31.5
Dolomite Glade	8	0	0
Wetlands			
Farmed Wetland (FW)	54.3	12.1	0.3
Palustrine Emergent (PEM)	11.1	0	0
Palustrine Forested (PFO)	68.0	1.9	0
Palustrine Scrub Shrub (PSS)	7.6	0	0
Subtotal	141.0	14	0.4
Urban/Developed	130	94	2.4
Water	15	0	0
Total	3,916	1,322	34.8

* Includes access road impacts.
† Acres are approximate

Mesic Bottomland Forest

The Mesic Bottomland Forest consists of either small remnant communities on the Mississippi River and Isle du Bois Creek floodplains or small communities in lower valley bottoms in proximity to these floodplains. In some areas, these communities grade into forested wetlands. The soils are generally deep and moist (mesic), but not saturated for sufficient periods to meet the wetland inundation criteria. Characteristic plants include sugar maple, sycamore, hackberry, green ash (*Fraxinus pensylvanica*), slippery elm, and beggars tick (*Bidens* spp.). The understory and groundcover are usually tall and well developed. There appears to have been extensive logging of some of these communities (e.g., Old Quarry Hollow).

Glades

Glades are an unusual community type that often contain remnant or relict floral and faunal species. A distinct band of interspersed dolomite glades are located on the western side of the site. These glades were identified early in the planning process and were successfully avoided in the construction of the access road and will not be impacted by any other project component. These glades are underlain by the Joachim Dolomite, just upslope of the St. Peter Sandstone outcrop. The dolomite glades have steep, generally west facing slopes with thin, rapidly drained soils. Rock fragments and dolomite rock outcrops were observed. The dolomite glades of the Cambrian-Ordovician formations (which include the Joachim Dolomite) are considered uncommon and decreasing due to habitat loss and suppression of fire.

Characteristic plants of the dolomite glades are little bluestem (*Schizachyrium scoparium*); big bluestem (*Andropogon gerardii*); poverty grass (*Sporobolus neglectus*); prairie dropseed (*Sporobolus heterolepis*); yellow puccoon (*Lithospermum canescens*); glade coneflower (*Echinacea simulata*); chinquapin oak; American aloe (*Manfueda virginica*), and Carolina buckthorn (*Rhamnus caroliniana*). However, eastern red cedar (*Juniperis virginiana*) has invaded many of these glades to varying degrees. As a conservation measure, Holcim has committed to performing habitat management of the glades to control invasive woody species and enhance the overall quality of the glades (see Section 6.6.2).

Actively Cultivated and Old Fields

Both actively cultivated and abandoned fields are present on the site. In large part, actively cultivated fields occur on Lee Island and in scattered fields within the floodplain of Isle du Bois Creek. Many of these areas are subject to periodic inundation by the Mississippi River and have been identified as farmed wetlands. Several small (approximately 100 feet by 100 feet) fields also occur in upland areas but in general, agriculture is limited in the uplands due to the rocky substrate and shallow soils. Typical crops include soybeans and corn. Vegetation occurring in cultivated fields typically consists of "weedy" species such as foxtail (*Setaria glauca*), giant ragweed (*Ambrosia trifida*), and common ragweed.

There are also a few, small old fields in the uplands. A notable exception is the large, old field (approximately 150 acres) on the southern boundary of the site. This field is located in the buffer area and, therefore, will not be impacted. Plants identified in the old fields on the site included common ragweed (*Ambrosia artemisiifolia*), giant ragweed, broom sedge (*Andropogon virginicus*), horseweed (*Erigeron canadensis*), goldenrod (*Solidago* spp.), dogbane (*Apocynum cannabinum*), common milkweed (*Asclepias syriaca*), ox-eye daisy (*Chrysanthemum leucanthemum*), Canada thistle (*Cirsium arvense*), bindweed (*Convolvulus* spp.), and Queen Anne's lace (*Daucus carota*).

6.4.2 Environmental Impacts to Plant Communities and Proposed Mitigation

The number of acres of vegetation communities anticipated to be impacted as a result of the proposed project is summarized in Table 6-5. Among the community types found on the site, dry mesic limestone and chert forest will be the community type that is most affected (769 acres). Other less affected community types include dry limestone and chert forest (312 acres) and mesic limestone forest (95 acres, see Table 6-5). Consequences of construction and operation of each of the proposed project elements include the direct removal and loss of vegetation and the associated habitats they represent, and in some areas, the potential introduction of exotic and nuisance species. For example, removal of forested areas for the purposes of quarrying operations will establish a "disturbed" edge (ecotone) that may be composed of early successional species. Such edges may also be colonized by exotic or nuisance species (e.g., Japanese honeysuckle (*Lonicera japonica*)) that may out-compete native species.

Proposed mitigation for impacts to upland communities entails the reclamation of lands within the quarry. The principal objectives of the site reclamation will be to reconstruct the existing topography, at a lower

elevation, and replace the intermittent streams, to the extent practical, using fluvial geomorphology and state-of-the-art methods and practices. Reclaimed areas will be seeded and planted with native vegetation species that will over time provide a range of wildlife habitats. Forested areas will be restored as a result of this effort such that the reclamation of the quarry will result in the creation of lands that have a substantially re-developed forest cover after approximately 60 years, thereby replacing lost habitat. Small ponds will be created to provide upland aquatic habitat and intermittent streams will be created. Areas within the quarry limits that will not be subject to mining in the near term will be maintained adjacent to reclaimed areas to provide the largest contiguous wildlife habitat possible. Some areas will not be quarried for many years. An extensive buffer area extends around most of the proposed quarry and fill areas. These areas will be maintained in a natural condition and will provide a "seed bank" for the reclaimed areas. Holcim's Long Term Land Reclamation Strategy will be integrated with the Wetland and Stream Mitigation Plan, and the conservation measures that Holcim proposed in its BA (Harding ESE, 2002d). Such measures are detailed in Section 6.6.

Based on extensive commitments, reclamation, the maintenance of an extensive buffer area, the long period over which the impacts will occur, and the slow progression of site disturbance once the quarry is developed (average rate of 12 acres per year), it is concluded that the project will not result in significant adverse impacts to plant communities.

6.5 Wildlife

6.5.1 Birds

The avian (bird) usage of the project site has been extensively studied by WBS (WBS, 2001a; WBS, 2001b; WBS, 2002a). As a result of WBS surveys over multiple seasons, a total of 158 bird species were observed on-site (Davies, 2003). Common species observed to occur on the site included blue jay (*Cyanocitta cristata)*, American crow (*Corvus brachyrhynchos)*, American goldfinch (*Carduelis tristis)*, barn swallow (*Hirundo rustica)*, tufted titmouse (*Baeolophus bicolor)*, Carolina chickadee (*Poecile carolinensis)*, downy woodpecker (*Picoides pubescens)*, northern flicker (*Colaptes auratus)*, eastern wood pewee (*Contopus virens)*, and red-eyed vireo (*Vireo olivaceus)*.

Many species of neotropical migrant songbirds (defined as spending the majority of the year in the tropic zones of North and South America) have been recorded at the site during the WBS bird surveys. These species use a variety of habitats throughout the site. Neotropical migratory species observed to occur on the site include Eastern wood pewee, wood thrush (*Hylocichla mustelina)*, red-eyed vireo, Kentucky warbler (*Oporornis formosus)*, common yellowthroat (*Geothlypis trichas)*, and ovenbird (*Seiurus aurocapillus)*. However, the cerulean warbler (*Dendroica cerulea*), a species of interest to some parties who commented on the Public Notice, was not found at the site. Many of the neotropical migrant songbirds have shown significant, long-range declines in population across their North American breeding areas, presumably due to habitat loss, increased predation and nest parasitism. The brown-headed cowbird (*Molothrus ater*) is recognized to be the cause of nest parasitism among neotropical migrants (Herkert et al., 1993). The brown-headed cowbird was observed throughout the site and is likely parasitizing nests of neotropical migrants within the site. The presence of the brown-headed cowbird indicates that some degree of habitat fragmentation has already occurred on the project site, likely due to previous disturbances such as farming and logging (WBS, 2001b).

A local heron rookery located on the Illinois side of the Mississippi River at Beagles Island is known to support nesting great blue herons (*Ardea herodius*). Direct impacts to the Beagles Island rookery itself will not occur, as all project development will take place on the Missouri side of the Mississippi River. However, construction of the harbor facility will result in the direct loss of wetlands that have been

observed to be used by great blue herons for foraging. Consequently, the project will result in some short-term reduction in foraging habitat for this and other water-dependent species. Such potential impacts, however, are expected to be short-lived and will be compensated for by the restoration and creation of wetlands on southern Lee Island and within the Isle du Bois Creek floodplain that will provide valuable foraging and nesting habitat for a wide variety of water-dependent bird species.

Potential impacts to birds as a result of the project are associated with the alteration and loss of habitats as presented in Table 6-5. For the most part, direct mortality to birds as a result of project construction is expected to be low as birds are highly mobile. Land conversion alone could be expected to reduce the overall carrying capacity of the site due to the accompanying alteration of associated habitats. However, as is presented in Table 6-5, the primary impact to natural cover types (and hence, bird habitat) is to forest types that are well represented on and adjacent to the site. Approximately 73 species of birds may utilize habitats within the proposed quarry for nesting (Davies, 2003). No or minimal impacts will occur to uncommon habitats (e.g., glades, sandstone forest, etc.). Consequently, localized displacement of species that may be dependent on such unusual habitats is not expected to occur. Additionally, conversion of natural habitats of the site will occur over a long period of time and will be mitigated for by the development of reclaimed areas that, over time, will be restored to a variety of cover types. Conservation measures will also be implemented over the life of the project to manage the extensive buffer area lands to enhance their suitability and value to a variety of wildlife species. WBS indicated that several areas of the site were particularly well-used by neotropical migratory birds. Those areas included the bluffs along the Mississippi River, Wolf Hollow, Hickory and North Hollows, and Isle du Bois Creek floodplain areas. With the exception of Wolf Hollow, each of these areas will be preserved in the buffer and will be available for future, long term use by birds. Additionally, while Wolf Hollow will be impacted, it will not be impacted for many years (60 to 100 years). Consequently, the maintenance of these extensive forested areas within the buffer coupled with the long term, slow progression of the quarry will provide for continued support of neotropical migrants. Furthermore, in consideration of the planned mitigation and conservation measures (e.g., restoration and enhancement of glades, a tallgrass prairie in the southwestern corner of the buffer area, riparian corridors, and wetlands), bird diversity for the site as a whole may be expected to increase as these measures will improve existing habitat quality and develop new habitats that may be utilized by resident and migratory birds. Such measures will be particularly beneficial to such species as Henslow's sparrow and northern harrier which were observed to utilize the field in Morrison Hollow proposed for prairie restoration.

Potential indirect impacts to birds may be associated with noise (i.e., blasting) and fugitive dust emissions as a result of quarry operation. Potential effects from these activities include periodic startling of birds (and other fauna), avoidance of areas in close proximity to the quarry face (i.e., the area in which blasting occurs), and avoidance of areas subject to fugitive dust emissions. These impacts however, are not significant as they are expected to be rather localized in nature and will be mitigated by factors of distance (due to natural attenuation of dust and noise energy—see Sections 7.9 and 7.10), and will be further mitigated by active dust control measures (see Section 7.9).

6.5.2 Amphibians and Reptiles

Due to property size and differences of natural community types, the project site offers a variety of habitats suitable for amphibian and reptile species. Thirty-one amphibian and reptile species have been identified at the site. Representative groups included frogs, salamanders, turtles, snakes, and lizards. No federally listed amphibian or reptile species have been observed at the project site. The northern crawfish frog (*Rana areolata),* a Missouri amphibian species of conservation concern, was heard at the site during field sampling in 2001, but no individuals were observed or heard during field surveys conducted in the

spring of 2002. This species breeds in temporary pools in the Mississippi River floodplain such as those located in the vicinity of the proposed harbor.

Potential impacts to amphibians and reptiles on the project site include direct mortality during construction and facility operation, and reduced population due to the effects of habitat alteration. Holcim's proposed wetland and stream mitigation, conservation measures, and land reclamation efforts will serve to offset some of the impacts to amphibian and reptile species on-site by enhancing or providing additional habitat. Frogs, toads, aquatic and semi-aquatic turtles, and some snake species will benefit from the creation and restoration of wetlands and streams.

In addition, Holcim is considering the relocation of selected species from impacted areas to suitable habitats in un-impacted areas, where feasible, as discussed in the Amphibian and Reptile Relocation Study (Harding ESE, 2002e). Species considered to be potential relocation candidates are those from specialized niche habitats (e.g., springs/seeps and wetlands) and include the *Eurycea* spp. (long-tailed, dark-sided, and cave salamanders), the *Plethodon* spp. (slimy and southern red-backed) salamanders, and northern crawfish frog. Because there is some documented evidence of success relocating *Eurycea* and *Rana* species, the literature suggests that a relocation effort for the candidate crawfish frog and *Eurycea/Plethodon* salamander species could be initiated at the site on an experimental basis. Feasibility of such a relocation effort, however, has not yet been fully assessed and will be dependent on such factors as the availability of suitable habitats, timing, and individual species' life history characteristics.

6.5.3 Other Wildlife

Other wildlife known or expected to occur on the site include, but are not limited to, such species as white-tailed deer (*Odocoileus virginanus*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus)*, raccoon (*Procyon lotor*), skunk (*Mephitus mephitus*), mink (*Mustela vison*), eastern cottontail rabbit (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinensis*), shrews (masked, short-tailed), bats, various rodents, and other species. Potential impacts to such wildlife include displacement due to habitat conversion and loss, and direct mortality during construction and operation (particularly for smaller, less mobile species). Such impacts however, are expected to occur incrementally across the site as habitat conversion will occur over the life of the project. Reclamation of the site will also proceed incrementally and will provide habitat that will be suitable to a variety of wildlife species. As these habitats develop, they will be recolonized by dispersal of wildlife from resident populations in the buffer (see Figure 3-1).

6.6 Mitigation Measures

6.6.1 Avoidance, Minimization, and Mitigation

6.6.1.1 Avoidance and Minimization

Avoidance and minimization of impacts to regulated (wetlands and listed species) and non-regulated (forested uplands and non-listed species) resources has been practiced throughout the alternative development, evaluation, and design phases of the proposed project (see Section 3.1.2). As discussed in Section 3.1.3, a number of additional project modifications were made after the public notice to avoid areas such as North and Hickory Hollows. These changes were made as a result of agency and public comments, USACE request, and biological survey work supporting this EA.

6.6.1.2 Mitigation

A Wetland and Stream Mitigation Plan (Harding ESE, 2002c) has been submitted to the USACE and MDNR as a component of the Section 404/401 and Section 10 permitting process. The mitigation plan

provides a detailed description of the wetland and stream mitigation proposed by Holcim. The plan was also forwarded to the USEPA, MDC, and USFWS for their review. Final details of the plan will be developed through the permitting process.

Mitigation of Impacts to Wetlands

As detailed in Section 6.1.2, Holcim will create and restore a total of approximately 61 acres of wetlands to compensate for the approximately 14 acres of wetlands that would be impacted by the project. The wetland mitigation will include creation of 25.5 acres of wetlands on southern Lee Island and restoration of 35.6 acres of wetlands on southern Lee Island and within the floodplain of Isle du Bois Creek. Successful implementation of this plan will increase the amount of quality habitat on Lee Island and enhance the riparian corridor along Isle du Bois Creek.

Mitigation of Impacts to Other Aquatic Resources (Streams, Seeps/Springs)

Mitigation of impacts to the other aquatic resources will consist of three components:

- On-site Quarry Area Reclamation – During the quarry land reclamation effort, Holcim will reconstruct the existing rugged upland topography, at a lower elevation, and replace the intermittent stream systems, to the extent practical, using fluvial geomorphology and state-of-the-art methods and practices. In all, Holcim will recreate 3.2 miles of jurisdictional intermittent streams, compensating for impacts on a 1:1 basis. In addition, small ponds will be created to provide additional upland aquatic habitat, and a lake with vegetated fringes will cover approximately the eastern one-third of the quarry. Reclamation efforts will be initiated between 8 and 10 years after starting the quarry operation.

  Holcim has provided cross-sections showing a profile of the anticipated elevations of the reclaimed topography (see Holcim's Land Reclamation Permit Application, Exhibit D). Generally, the anticipated elevations of the area that will contain reconstructed jurisdictional intermittent streams are approximately 50 percent of the original elevations. Although it is not possible to reconstruct the same heights in the topography present at the site, state-of-the-art techniques can be used to re-create physical structure and features that will provide hydrologic, water quality, and aquatic habitat functions similar to the existing jurisdictional intermittent streams (Saperstein, 2003). Lower stream gradients will facilitate the use of measures to prevent erosion and the establishment of features such as riffle/pool complexes that will provide aquatic habitat (see Holcim's Long Term Land Reclamation Strategy).

  Holcim's land reclamation plan is well conceived from a mitigation standpoint, especially considering the inefficiency of placing overburden and fill material within the quarry limits (which became a requirement in order to avoid impacts to Isle du Bois Creek and areas north of the creek) (Saperstein, 2003). Reclamation is efficiently integrated with the mining plan to follow the advancing quarry as closely as possible without time delays (after opening of the first 200 acres). Reclamation will generally proceed across the quarry area from west to east, enabling the efficient use, placement, and contouring of overburden, fill material, and topsoil, followed by development of the lake in the latter stages of reclamation (Saperstein, 2003; Long Term Land Reclamation Strategy). Holcim's land reclamation plan exceeds the minimum requirements of the MDNR land reclamation program (Saperstein, 2003).

- Stream Channel Restoration – Relict stream channels have been observed to be associated with Isle du Bois Creek and the Lee Island floodplain. Such channels historically carried water from Isle du Bois Creek and/or the Mississippi River during periods of high flow. Restoration of these features will provide additional stream habitat and overbank flooding of adjacent wetland areas. Restoration activities will begin in advance of opening the quarry. Subject to feasibility studies,

the areas available for restoration could include as much as 3,400 feet (0.64 miles) of stream channel restoration within the Mississippi River floodplain, approximately 1,480 feet (0.28 miles) of stream channel restoration along Isle du Bois Creek, and the potential of 6,250 feet (1.20 miles) of stream bank stabilization within Isle du Bois Creek. Bank stabilization measures will be applied only where they are environmentally beneficial (e.g., reaches of Isle du Bois Creek with highly unstable and failing banks, such as outside bends along agricultural fields lacking riparian zones). No bank stabilization measures will be applied in areas that have good, well-established vegetative cover and are not vulnerable to continued erosive degradation.

- Enhancement of Isle du Bois Creek Riparian Corridor – Isle du Bois Creek offers excellent restoration/mitigation opportunities. Most of the Isle du Bois Creek floodplain is currently farmed, with occasional overbank flooding. The farm fields can be planted with a variety of vegetation in order to decrease erosion and sediment input, and increase pollutant filtering, wildlife usage, and other functions. Additionally, several areas along the length of Isle du Bois Creek were observed to be subject to bank erosion and failure. As stated, such areas can be stabilized to provide additional water quality improvement within the stream system. Restoration measures will occur in advance of the commencement of quarrying activities.

As an additional mitigative measure for the project, Holcim proposes to open and reconnect the drainage patterns of the Lee Island slough located at the base of the site bluffs. The mouth and scattered portions of the slough have silted in to the point that flow/drainage is nearly non-existent. Fish entering the slough under conditions of high river stage are typically trapped within the slough and subject to mortality as the slough slowly dries out over the summer months. Holcim proposes to excavate material from these areas to re-establish a connection with the Mississippi River. This improved connection with the Mississippi River, coupled with the proposed wetland enhancement and creation on Lee Island, will further enhance the aquatic ecosystem of the project area. Under conditions of high river stage, Mississippi River fish may be expected to travel up the Lee Island slough and enter mitigation wetlands on Lee Island to forage and spawn. The development of shallow pools and interconnecting channels that provide access to the restored slough, will facilitate the return of juvenile fish to the Mississippi River from this area.

6.6.2 Proposed Conservation Measures

Holcim has proposed conservation and management measures to maximize the wildlife value and ecosystem function of the buffer area, undisturbed areas in the quarry, reclaimed areas in the quarry, and mitigation areas (Harding ESE, 2002d). The goals of the conservation measures are to optimize and balance the project's operational processes and need for flexibility, while protecting and enhancing the ecological integrity and diversity of the natural systems that exist on-site. This overall effort will occur on two levels:

1. On-site Conservation – A site management plan will be developed that will focus on maintaining and enhancing, where practicable, the ecological integrity of existing upland and bottomland communities. Emphasis will be placed on active management practices with the goal of restoring some vegetation communities to their pre-settlement condition (e.g., restoration of dolomite glades); and
2. Facility Operation – An integrated quarrying and reclamation plan will pursue the goals of returning natural habitats to those areas that have been mined, while applying site management goals and objectives to undisturbed areas in advance of quarrying activities. This effort will be an ongoing process throughout the operational life of the quarry.

The design and implementation of the conservation measures will not consider only one use, or be directed toward the protection of only one species. Rather, the focus will be to achieve and balance the

broadest possible range of short- and long-term objectives, with particular emphasis on maintaining preservation and function of ecological communities.

Holcim proposes to use a habitat-based approach to site management. This broader approach will include a number of considerations, such as:

- protecting existing habitats by creating a buffer area and maintaining undisturbed areas in advance of quarrying activities;
- maintaining existing, viable populations and communities; and
- sustaining and enhancing ecological processes within the buffer area, and focusing efforts to re-establish natural processes in the quarry area through reclamation.

Holcim has committed to the following specific habitat-based conservation measures including:

1. Acceptance of conservation measures as terms and conditions of the USACE Individual 404/401/10 Permit.
2. Agreement with the concept of deed restrictions to ensure compliance with mitigation/conservation measures.
3. Management of a buffer area around the plant and quarry operation, and along the Isle du Bois Creek riparian corridor. Approximately 2,200 acres of the 3,916-acre site are available as buffer area.
4. Management of the forested areas, including the buffer area and areas inside the ultimate quarry boundary in advance of quarrying activities, which may include controlled burns, and selective logging or elimination of logging. Currently, logging activities by a previous landowner retaining logging rights in Wolf Hollow have been suspended pending a determination as to whether this activity would be desirable from a conservation standpoint. Other logging activities by previous landowners retaining these rights were halted along the Isle du Bois Creek riparian corridor, including in North Hollow and Hickory Hollow.
5. Agreement to appropriate restrictions on tree clearing for the Indiana bat.
6. Protection of the Mississippi River bluff and its forested habitat that is suitable for bald eagle roosting (only the first 400 feet of bluff adjacent to the existing quarry will be impacted; approximately 1.3 miles of bluff will be preserved).
7. Establishment of a tall grass prairie in the southwest corner of the buffer area as recommended by the WBS.
8. Protection and enhancement of the Isle du Bois Creek riparian corridor and Mississippi River floodplain in accordance with the Wetland and Stream Mitigation Plan. This will include:
    a) Discontinuing farming along the Isle du Bois Creek and Mississippi River floodplains;
    b) Creating new wetlands and enhancing existing farmed wetlands.
    c) Re-establishing and expanding the bottomland forests on the floodplains;
    d) Planting native species and establishing native community types;
    e) Repairing and enhancing the existing low water crossing (this work is likely to be authorized by a Nationwide Permit 3 from the USACE, independent of the project, and is anticipated to enhance the opportunity for fish passage upstream and downstream within Isle du Bois Creek).
9. Enhancement of the Lee Island slough backwater aquatic habitat by removing sediment at the mouth and other portions of the slough, thereby improving the connection to the Mississippi River.
10. Protection of Isle du Bois Creek and Mississippi River water quality by use of properly designed, maintained, and operated sedimentation basins.
11. Enhancement of dolomite and limestone glade habitats, which may include cedar tree removal and/or controlled burns.

12. Integration of the Long Term Land Reclamation Strategy with the Wetland and Stream Mitigation Plan. Quarry reclamation activities will include:
    a. Ongoing reclamation as quarrying progresses. Reclamation will commence after an initial period to open the quarry (8 to 10 years) and then will occur continuously behind the advancing quarry. Undisturbed areas in advance of quarry activities will be integrated with reclaimed areas to provide the largest contiguous wildlife habitat possible;
    b. Reconstructing the existing rugged upland topography, at a lower elevation, and replacing the intermittent stream systems, to the extent practical, using fluvial geomorphology and state-of-the-art methods and practices.
    c. Reseeding and planting of reclaimed quarried areas with native vegetation species that will provide a range of wildlife habitats;
    d. Creation of a lake with vegetated fringes and small ponds to provide additional upland aquatic habitat.

6.7 Biological Availability of Contaminants

The project will not cause any contamination of the surrounding terrestrial or aquatic environments. The cement manufacturing process will not generate hazardous waste and will not discharge hazardous substances to any water body. In fact, the cement plant can beneficially utilize waste tires as a fuel source in the production of portland cement as indicated in Section 7.6. Quarrying will not generate any hazardous wastes or materials. Any hazardous materials used by the facility for purposes such as vehicle or equipment maintenance (e.g., motor oil) will be properly inventoried, stored, managed, and disposed or recycled in accordance with all applicable regulations to protect the environment.

7.0 Human Use Characteristics and Anticipated Changes

The following sections present an analysis of potential project impacts on the human environment.

7.1 Existing and Potential Water Supplies

Holcim evaluated whether the project would adversely affect the water wells of local residents in both Missouri and Illinois as a result of quarry operation and water supply. Extensive hydrogeologic investigation of the project site was performed in an effort to document site conditions and assess potential hydrogeologic impacts (LBG, 2000). A detailed evaluation of potential impacts to the water quality or water quantity in local residents' wells is provided in the Water Resources and Hydrology Report (STS et al., 2002). The project components with the potential to impact these resources are the proposed quarry and the proposed production well. The production well is planned to be located near the cement plant to supply its water needs.

Missouri Water Wells

In brief, Holcim identified wells at local residences in the vicinity of Morrison Hollow, within the upper alluvial valley of Isle du Bois Creek, and along Highway 61. In most cases these wells are located more than a mile from the nearest edge of the proposed quarry and even further from the cement plant area. Therefore, distance alone provides some level of protection to the residential wells from the proposed quarry and production well. LBG (2000) has also shown that the area's stratigraphy (underlying rock formations) dips at a 2 percent rate from west to east (toward the Mississippi River). Consequently, almost all the residential wells are located in a position that is hydraulically upgradient from the proposed quarry and production well. Several local resident wells are side gradient (on a parallel path with groundwater flowing toward the plant or quarry), but none are downgradient. Additionally, the source (recharge) areas of the aquifer(s) supplying water to these residential wells lie in an area that is upgradient (west) of the project site.

Low permeability of the Joachim Dolomite (see Section 5.1.2) is a factor that also prevents the quarry from impacting local well production. The floor of the quarry will be the Joachim Dolomite formation, but the local resident wells, which are at depths ranging from 100 to 330 feet, mostly use water from lower formations, such as the Roubidoux, Cotter, and St. Peter Sandstone formations. Because the Joachim Dolomite is an aquitard (i.e., a barrier to water movement), it will prevent the flow of water between the quarry excavation, which will be in the higher Plattin Limestone, and the local resident well formations. Consequently, the quarry will not draw down or otherwise impact the aquifers which supply the local resident wells (Bognar, 2003).

The stratigraphy of the site as discussed above, coupled with production well construction techniques, will also protect local wells from impact by the project. In contrast to the target zones of local wells, the target zone for the production well is 1,100 to 1,800 feet below grade, with the majority of water being produced from units 1,600 to 1,800 feet below grade (e.g., Gasconade, Eminence and Potosi formations). Construction of the production well will include a grouted casing to a great depth (Cotter formation) that will prevent groundwater from directly entering the well from shallower formations. Low permeability bedrock units, including beds within the Cotter formation and the Jefferson City Dolomite, separate the local residential wells from the proposed production well target formations. In addition, the proposed production well will not produce significant quantities of water from the formations used by the residential wells. Therefore, the proposed production well is not anticipated to impact the water yields or water quality to the residential wells.

Before the proposed production well is developed, however, further testing will be conducted to determine whether there will be any significant impacts to local residential wells. Potential significant impacts to the water supply of these wells will be mitigated by appropriate measures or will result in the use of an alternative water supply.

Illinois Water Wells

On the Illinois side, there are several wells potentially within a mile of the project site, but none deeper than 70 feet. At that depth, all of the Illinois wells would be completed in the Mississippi River alluvial aquifer. Because they are in the alluvial aquifer on the opposite side of the river, they are not connected to aquifers on the Missouri side and are therefore, not potentially impacted by the project.

Summary

In summary, the proposed quarry and the water production well are not anticipated to significantly alter the availability and quality of water from nearby wells for several reasons:

1. Source areas supplying groundwater to Missouri residential wells are upgradient from the wells and the project site (consequently, no interruption of groundwater flow supplying these wells will occur);
2. Most Missouri residential wells are located upgradient of the project site. Consequently, water supplying these wells will not be interrupted by activities associated with the project.
3. A few Missouri residential wells are located side gradient to the project site. However, water flowing to and past side gradient wells is on a path parallel to the path of water flowing to and past the proposed plant and quarry, and will therefore not be significantly affected by the project.
4. Quarrying activities will be limited to the strata above the Joachim Dolomite formation. The Joachim Dolomite acts as an aquitard that will prevent the transmission of water between the quarry and local resident well formations.
5. Water supply for the cement plant will be derived from formations significantly below and hydraulically separated by confining units from formations which are used for residential supply;
6. Design of the Holcim production well (including a sealed casing to great depth) will prevent the direct capture of water from shallower aquifers.
7. Resident wells in Illinois are developed in the shallow alluvial aquifer and are therefore not connected to the aquifers on the Missouri side of the river; and
8. Residential water supply wells are located distant from the quarry and plant site.

7.2 Recreational or Commercial Fisheries

The reach of the Mississippi River where the project site is located is not frequently used for recreation. A public access at the Harry S. Truman Memorial Park is managed by MDC and is located immediately upstream of the AmerenUE Rush Island plant. The access consists of a boat ramp and does not have restroom or picnic facilities. Consequently, use of the access and the river in the vicinity of the project site is limited to local residents who fish along the bank (upstream of AmerenUE's plant) and occasional boat fishermen who fish various locations on the Mississippi River. Little information is available documenting the extent to which the Mississippi River is locally used by commercial fishermen. However, typical commercially important fish harvested within the reach include blue, channel and flathead catfish, smallmouth and bigmouth buffalo, and silver and common carp as described in Section 6.3. No significant impacts to either the recreational or the commercial fishery is expected to occur as a result of the project as the project will not result in a significant adverse impact (direct or indirect) to either aquatic biota or their associated habitat.

7.3 Aesthetics

The project site is well situated to minimize aesthetic impacts. Most project activities including the cement plant, harbor, and quarry will be concealed from the view of local residents by distance and the forested ridges of the buffer area.

From the Mississippi River, the most visible components of the project will be the in-river barge fleeting operations, the harbor, and the storage silos along the bluffs. Such developments will alter the aesthetic character in the vicinity of the Mississippi River by creating a harbor and in-river fleeting area. It should be recognized however, that the current viewshed is not that of a pristine environment and does not have any unique features that are not found elsewhere along the Mississippi River. Rather, the viewshed is one that has been subjected to past quarrying activities and has been impacted by the deposition of large tailings piles along the Mississippi River that are not consistent with the natural riverine aesthetic. In addition, AmerenUE's Rush Island Plant is located immediately upstream of the project site and is an industrial site characterized by visible features such as smoke stacks, coal piles, barge fleeting areas, and a barge unloading facility.

It should also be noted that most of the project development will not be visible from the Mississippi River due to the preservation of all but a small segment of the bluffs. The cement plant will only be visible as the site is approached from the north, and the entire quarry will be concealed by the bluffs. The development of wetlands on the southern part of Lee Island in conjunction with the wetland mitigation effort will also afford an enhancement of the aesthetics of the area.

7.4 Parks, National and Historic Monuments, Etc.

There are no parks, national landmarks, historic monuments or similar areas located within the project site. The nearest such resource is Harry S. Truman Memorial Park, a small unimproved park located north of the AmerenUE Rush Island facility. This site is unimproved (i.e., lacking any picnic areas, restroom facilities, paved parking, etc.) but does have a boat ramp that is used for river access. Other parklands located in the vicinity of the project area include the Magnolia Hollow Conservation Area which is located approximately 6 miles south of the site, and the Harlow Island Division of the Middle Mississippi National Wildlife Refuge located approximately 2.5 miles north of the site at Mississippi RM 141 to 145. This portion of the refuge is currently undeveloped and consists of 1,224 acres on the Missouri side of the Mississippi River. The Felix Valle House historic site is located about 13 miles from the site, and Hawn State Park is located about 17 miles from the site. Project development will not impact any of these areas.

7.5 Traffic/Transportation Patterns

Access to the project site is provided by Highway 61, a two-lane north-south arterial roadway, which is parallel to Interstate Highway 55 (I-55) in Ste. Genevieve County. Approximately one half mile north of the entrance to the facility is the Route TT intersection (see Figure 3-1). Route TT extends westerly from Highway 61 and crosses I-55. Currently, no access to Route TT is provided at I-55. From the project site, access to I-55 is obtained either at the Highway 61 interchange in southern Jefferson County or at the Route OO/DD interchange in northern Ste. Genevieve County.

Traffic volumes along Highway 61 are relatively low. Published data from the Missouri Department of Transportation (MoDOT) indicates that the year 2000 average daily traffic (ADT) volume on Highway 61 was 1,192 vehicles per day (vpd). By comparison, the volume on I-55 was 15,045 vpd. Given a standard assumption that the design hour volume (DHV) is 10 percent of the daily volume in a rural area,

approximately 119 vehicles per hour (vph) are present on Highway 61 in the peak hour. Assuming the volume consists of 8 percent trucks (or 10 trucks), the level of service (LOS) on Highway 61 is a level A (good, free-flow traffic conditions). Level of service is a ranking system ranging from A (highest quality) to F (lowest quality—breakdown in traffic in both directions) as described in the Highway Capacity Manual (Federal Highway Administration (FHWA), 1998).

In order to assess potential impacts of the project on the traffic and roadway conditions of the local road system, the projected truck traffic from the Holcim cement plant was added to the existing traffic volume on Highway 61. This additional volume was used to compute the forecasted LOS on Highway 61 and to determine the effects of the Holcim plant on the traffic on Highway 61. Table 7-1 indicates traffic volumes, supplied by Holcim, which can be expected on Highway 61 once the Holcim plant is operational.

Once operational, the Holcim plant is expected to generate a peak hourly volume of 108 passenger cars and 41 trucks. This volume is expected in the morning. The projected traffic from the Holcim plant raises the DHV on Highway 61 to 268 vph consisting of 19 percent trucks (51 trucks).

Table 7-1. Breakdown of Traffic Generated by the Project

Type of Traffic	Typical Daily Volume	Peak Hourly Volume
Cement Shipping (Inbound)	132 trucks* (empty)	13 trucks
Cement Shipping (Outbound)	132 trucks* (loaded)	13 trucks
Raw Materials (Inbound)	72 trucks (loaded)	7 trucks
Raw Materials (Outbound)	72 trucks (empty)	7 trucks
Employee Traffic†	308[2]	108 passenger cars[2]
Miscellaneous Deliveries	4 trucks	1 truck
Total		108 passenger cars/41 trucks

*Bulk cement trucks – during peak shipping seasons, May through August.

†Employee Traffic
140 first shift employees
40 second shift employees
20 third shift employees
Use first shift as a "worst-case" volume.
Assumes 1.3 passengers per vehicle.
"Cars" include cars and light duty trucks (pickups)

Assuming that the total 268 vehicles enter and exit the plant entirely in one direction (a conservative assumption), the LOS on Highway 61 would be a level C, which is an acceptable level for a rural setting (Highway Capacity Manual, FHWA, 1998). Consequently, no significant impact on the nearby roadway will occur. The actual LOS on Highway 61 is likely to be better than a level C, because it is likely that some of the employee traffic would originate from south of the plant.

7.6 Energy Consumption or Generation

The construction and operation of the proposed facility will result in the direct consumption of a number of fuel sources. Operation of the cement plant is expected to utilize the fuel as indicated in Table 7-2. Gasoline, diesel fuel, and electricity will also be required to support construction and operation of other elements of the project (quarry, harbor, material transport, etc.). Adequate supplies of gasoline, diesel fuel, and electrical energy are readily available to construct the facility and operate it at its expected capacity. The proposed plant will consume significantly less energy per ton of cement than existing older plants.

Table 7-2. Anticipated Energy Usage by the Cement Plant

Energy Type/Source	Quantity
Electricity	100 Megawatts
Coal	500,000-600,000 tons per year
Waste Tires	up to 5,000,000 tires per year

Note: Start-up fuels (e.g., natural gas, liquid petroleum gas (LPG), fuel oil) will also be required for kiln operation.

Additional fuel consumption will also result from the transportation of portland cement to markets within the region. However, shipping by barge is more energy efficient than other forms of transport (truck and rail), and correspondingly consumes less energy (Table 7-3).

Table 7-3. Shipment of Lee Island Annual Production*

Transportation Mode	Comparable Fuel Usage
Truck	40.5 million gallons
Rail	12 million gallons
Barge	4.7 million gallons

* Assumed 500 miles in distance.

7.7 Navigation

The project is not expected to result in significantly increased barge traffic that would strain the Mississippi River navigation system. Any increase that could be attributable to Holcim – which is expected to be minor – would be a small percentage of the existing barge traffic on the Mississippi River. To ship cement, Holcim uses common carrier barge lines. In doing so, Holcim relies on the common carrier "backhaul" transportation system, where costs are reduced by the carrier's ability to schedule return shipments for other companies, so that the barge is used both ways. Barge tows moving on the river consist of loaded and empty barges moving north and south. Barges which bring salt and fertilizer up from New Orleans to northern cities could be used by Holcim on the return trip to ship cement to the southern Mississippi River market. Conversely, empty barges moving up-river to pick up grain for export could be used by Holcim to transport cement to northern markets. This practice should substantially minimize any net increase of barge traffic from the proposed plant, especially considering that Holcim is already shipping imported cement on the Mississippi River that would be replaced by the project's production.

The River Industry Action Committee (RIAC) provided specific recommendations relating to matters such as the width of the north and south barge fleeting areas, and operational safety requirements such as lighting. Holcim followed the RIAC fleeting configuration recommendations in the design of the fleeting areas. Holcim will also follow the RIAC operational recommendations, except the recommendation to avoid tows larger than 25 barges because this not within Holcim's control. The common carrier barge lines determine the size of the tows.

7.8 Safety

The cement plant, harbor and quarry will comply with all appropriate Mine Safety and Health Administration (MSHA) and U.S. Coast Guard (river operations) regulatory requirements to ensure proper worker safety and health. Blasting within the quarry will occur only during daylight hours, typically once in the morning and once in the afternoon. All blasting will comply with Bureau of Alcohol, Tobacco and Firearms (ATF) safety regulations. Within the harbor and fleeting areas, proper

adherence to restrictions on fleet sizes, and the requirement that other boats observe safe passage distances near the fleeting area, will ensure that safety concerns are minimal.

7.9 Air Quality

During initial development (e.g., construction of the harbor and fleeting areas, construction of the cement plant, establishment of fill areas and haul roads in the quarry, and preparation of the quarry) air emissions will consist of dust and engine exhaust from equipment and vehicles. Air emissions from these initial development activities will be temporary.

During both initial development and operation of the project, dust will be controlled by watering dry areas or other methods as necessary to comply with MDNR air regulations limiting the emission of fugitive dust. For example, during operation of the quarry, haul roads will be watered or dust suppressant will be applied as needed to ensure fugitive dust is properly controlled. Also, dust settles out of the air rapidly, further minimizing the potential for adverse dust impacts (Lague, 2003).

Using standard air dispersion modeling methods, Holcim has studied the potential impacts of particulate matter (dust and engine exhaust) from the project on the surrounding area (URS, 2003). Two worst-case scenarios were modeled: (1) the initial temporary project development activities (as described above); and (2) year 10 of quarry operations (e.g., drilling and blasting, loading and unloading, hauling, and crushing) combined with other project air emissions. For each scenario, the modeling determined the concentrations of PM_{10} (coarse particulate matter) and $PM_{2.5}$ (fine particulate matter) in the ambient air outside the project site boundary, including appropriate background levels.

The modeling demonstrated that under each scenario, PM_{10} and $PM_{2.5}$ concentrations will be below the applicable USEPA National Ambient Air Quality Standards (NAAQS). The NAAQS are standards that have been developed to protect human health (including the most sensitive part of the population). The PM_{10} NAAQS have been in effect for a number of years; the $PM_{2.5}$ NAAQS have been promulgated, but have not yet been implemented. The modeling results show that no significant impact would occur to human health from project particulate matter emissions, either in the area immediately surrounding the project site or in the St. Louis metropolitan area (URS , 2003; Lague, 2003; Salzman, 2003). Moreover, project particulate matter emissions will be primarily composed of limestone dust, which is not toxic (Salzman, 2003).

In addition, Holcim cannot begin construction of the project without an air permit from the MDNR Air Pollution Control Program. Holcim cannot obtain an MDNR air permit without demonstrating that the project's air emissions will comply with all applicable federal and state air quality and control standards. Those standards, which include the NAAQS, have been developed to protect human health (including the most sensitive part of the population) and the environment.

As part of the air permitting process, Holcim has conducted air dispersion modeling for both criteria pollutants (e.g., PM_{10}, sulfur dioxide, oxides of nitrogen, and carbon monoxide) and hazardous air pollutants (HAP) (including mercury) using MDNR-approved procedures. The modeling demonstrated that project criteria pollutant impacts will be below the applicable NAAQS, indicating no significant impact would occur to human health from project air emissions. The modeling also demonstrated that project criteria pollutant and HAP emission impacts, including impacts of atmospheric deposition to plants, soils, or animal life in the vicinity of the project, would be below USEPA and MDNR-defined impact thresholds, indicating no significant impact would occur to the environment from project air emissions.

In addition to the HAP modeling results, mercury air emissions are considered a global problem, the vast majority of elemental mercury is not readily deposited and is transported globally, there is no evidence that mercury air emissions from the cement plant would have a localized effect, mercury problems in water do not have a direct correlation with the facilities neighboring those waters, and there is not a current mercury toxicity problem in the Mississippi River.

As another part of the air permitting process, computer modeling conducted by a Holcim consultant (Environ International Corp., 2001) and separately by a USEPA/MDNR consultant (Alpine Geophysics, 2001) has shown that project air emissions will have an insignificant impact on local and regional ozone air quality.

Recently, the MDNR has concluded that the emissions controls proposed by Holcim in its air permit application are the Best Available Control Technology (BACT), a requirement under the air permitting program. The USACE has been provided Holcim's application for the MDNR air permit, the addenda to the application, the modeling reports, and the BACT determination.

7.10 Noise and Vibrations

Local residents will not be adversely affected by noise or vibrations. The cement plant will incorporate state-of-the-art technology to reduce noise, and must meet regulatory limits established by MSHA for ambient noise both inside and outside. Noise and vibration impacts from blasting or other operations in the quarry will be limited by several factors, including landscape features, distance, and blasting controls. The natural landscape, including the bluffs along the Mississippi River, the surrounding hills, and a ridge between the quarry and Isle du Bois Creek, will keep the quarry relatively isolated and provide good containment of sound from the quarry. The buffer area, which will surround the quarry on all sides, will prevent any development encroaching on the quarry. As explained in Section 7.17, the buffer area will maintain substantial distance – typically at least 1 mile – between the quarry and local residents. In addition, blasting will occur only during daylight hours, typically once in the morning (approximately 11:30 a.m. to 12:00 p.m. and once in the afternoon (approximately at 4:00 p.m.). Based on these factors of distance, the natural attenuation of noise and vibration energy by the intervening rock formations, and the rugged terrain, quarry operations will not have a significant impact on local residents (Saperstein, 2003). All blasting will comply with the applicable ATF and MSHA regulations, and with guidelines developed by the Office of Surface Mining Reclamation and Enforcement (Department of Interior). Holcim is very experienced in using a variety of standard blasting practices to help ensure that ground vibrations do not adversely impact neighboring homes or other structures. This was demonstrated during construction of the access road, when Holcim conducted blasting in the 64-acre quarry area under a land reclamation permit without complaint from neighbors. Holcim has also conducted on-site testing of experimental blasting using seismographic equipment. This testing determined that blasting can be properly controlled at the site and there are no unusual geological features that would adversely affect the use of standard blasting controls (Saperstein, 2003; Vibra-Tech, 2002). The study also concluded that there would be no damage to aboveground or underground structures beyond 1,000 feet (Vibra-Tech, 2002). During the night, quarry operations will be limited to drilling, loading, hauling, and crushing operations, which generate minimal noise. Quarry operations will also be subject to regulatory limits established by MSHA for ambient noise. Considering all these factors, there should be no significant noise or vibration impacts to local residents from blasting or other quarry operations.

7.11 Archaeological and Historical Sites

Holcim performed a “Phase I” cultural resource survey at the project site (ARG, 2000a), which identified a number of prehistoric, historic and modern architectural sites. In coordination with the responsible government agency, the Missouri State Historic Preservation Office (SHPO), only five of the prehistoric

sites were determined potentially eligible for inclusion on the National Registry of Historic Places (NRHP). Of those five sites, only one – a prehistoric Native American field camp – would actually be impacted by the project. This site is referred to as "23SG1."

Subsequently, Holcim performed a "Phase II" investigation of Site 23SG1 (ARG, 2000b). This work resulted in a January 2, 2002 Memorandum of Agreement (MOA), under section 106 of the National Historic Preservation Act, between the USACE, the SHPO, and Holcim. The MOA primarily addresses the recovery of significant information from Site 23SG1. However, as a precaution, the MOA also provides that Holcim will protect any historic sites potentially eligible for inclusion on the NRHP, should they be determined in the future to be affected by the project.

The MOA provides for the handling of Site 23SG1 by means of a "Phase III" "data recovery" operation. Data recovery operations will be conducted in accordance with a plan attached to the MOA (ARG, 2000c). The operations will be carried out by trained archaeologists, who will conduct a field investigation and excavation, in accordance with standard Department of the Interior procedures to collect all significant cultural artifacts and deposits. All recovered material will be returned to a laboratory where it will be washed, sorted, and cataloged. As appropriate, some of the material will be tested or analyzed using specialized techniques such as radiocarbon dating. A report will be provided within 12 months to the SHPO following Phase III data recovery. All recovered material and records will be permanently curated at the Division of American Archaeology, University of Missouri, Columbia, or approved alternate location.

Efforts were made during the development of the MOA to coordinate with Native American groups that may have an interest in the various prehistoric sites at the project site. However, no Native American tribes were identified with religious or cultural interests or concerns that would be affected at the project site.

Pursuant to the MOA, cultural resources at the project site will be handled properly under the requirements of the National Historic Preservation Act and state regulations. The Phase III data recovery operation at Site 23SG1 will ensure that there will be no significant impacts related to cultural resources because the artifacts from this location will be collected, removed, and preserved.

7.12 Land Use Classification

Current land use of the site consists of quarry, agricultural land (cultivated field), and open space. The proposed use of the site is consistent with some past land uses, as a part of the project site had been used as a quarry. Some undeveloped portions of the site will be converted from open space to industrial uses. As a result of reclamation activities, quarried areas will ultimately revert back to open space with more natural habitats and characteristics. The buffer area, approximately 2,200 acres, will be maintained as open space and will sustain its present land use designation. None of the site will require rezoning, as Ste. Genevieve County does not have zoning. The proposed fleeting area on the Mississippi River is and will remain open water, and will not require a change in use.

7.13 Economics

The project will bring approximately 200 long-term, good-paying jobs and an annual payroll of approximately $10 million to Ste. Genevieve County. A study – The Economic Impact of the Lee Island Cement Plant in Ste. Genevieve County – that was conducted at Holcim's request by the Center for Economic and Business Research in the Donald L. Harrison School of Business at Southeast Missouri State University (Appendix A), determined that the project will:

- During the peak year in the construction phase, create 431 direct construction-related jobs and another 281 indirect jobs for residents of Ste. Genevieve and Jefferson counties;
- During the peak year in the construction phase, create 848 direct construction-related jobs and another 938 indirect jobs on a statewide basis.
- After construction, increase annual employment in the state by 536 new jobs as a result of project operations and additional spending created by the project and its employees;
- After construction, increase annual personal income in Jefferson and Ste. Genevieve counties by $24 million and in the state by $32 million;

In addition, Holcim also will be responsible for payments to the Ste. Genevieve County R-II School District totaling more than $35 million over 20 years, and payments to Ste. Genevieve County of more than $12 million over 20 years. As a result of those payments, Holcim will be one of the largest contributors to the county's overall revenue base. Finally, when the project becomes operational, the state will receive an additional $1.37 million in retail sales and personal income tax revenue. In summary, the project will have a significant beneficial impact to the regional and state economies.

7.14 Prime and Unique Farmland

The site contains three soils that could potentially be classified as prime farmland: Beaucoup silty clay loam, the Carr fine sandy loam, and the Auxvasse silt loam (Soil Conservation Service (SCS, 1985)). The Beaucoup is a deep, poorly drained, high organic content clay loam soil on the Mississippi River floodplain. The Beaucoup is considered prime farmland where it is drained and protected from flooding. At the site, the Beaucoup is (in part) drained but is not protected from flooding (i.e., levee, etc.). Therefore, the Beaucoup is not considered prime farmland at the site.

The Auxvasse is a deep, poorly drained soil on low stream terraces. The Auxvasse is located at the proposed cement plant location. Most of this area had been previously disturbed by the former quarry operations. The Auxvasse is considered prime farmland if it is drained. The remnant Auxvasse soil is not drained; therefore it is not considered prime farmland.

The Carr soils are deep, well-drained, sandy soils that are located on slight ridges on the Mississippi River floodplain. The Carr soil is considered prime farmland by NRCS even without protection by a levee. A small area (5.2 acres) of Carr soil, which has historically been farmed on Lee Island, will be impacted by harbor development. This small area is the only prime or unique farmland that would be impacted by the project. The project will not cause any change in surrounding land use that would impact prime or unique farmland. In consideration of the abundance of prime farmlands within the Mississippi River floodplain within both Illinois and Missouri, no significant impact to prime or unique farmlands will occur as a result of the project.

7.15 Food and Fiber Production

The project will remove approximately 22 acres from active crop production. In addition, over the life of the project, a total of approximately 1,120 acres of forestland will be cleared, though ongoing reclamation, including re-establishment of forest, will mitigate the phased impacts of the quarry. Preservation of the buffer area and the reclaimed areas will effectively eliminate such lands from timber production.

7.16 Mineral Needs

The purpose of this project is to quarry the on-site mineral resources. Consequently, it will result in the extraction of limestone mineral reserves from the site. Other off-site mineral reserves will be required for

facility operation. Raw materials that will be required from off-site sources include sand, clay, gypsum, iron ore/slag, flyash, and bottom ash. Such minerals also include the necessary coal and petroleum that will be needed to supply the facility with the required energy sources needed for operation.

7.17 Consideration of Private Property

The area around the project site is rural undeveloped land with large acreage homesteads. Holcim intentionally acquired sufficient land to provide a substantial buffer area to ensure the project would not adversely impact any surrounding residents. The buffer area will maintain considerable distance - typically 1 mile or more - between the homes of local residents and project activities. To the northwest, the nearest residents are approximately 1.5 miles from the cement plant or quarry. To the west, the home of the nearest resident is more than 1 mile from the cement plant and approximately 2/3 mile from the closest point in the quarry. To the south, the home of the nearest resident is approximately 1 mile from the closest point in the quarry and farther from the cement plant. In addition to distance, the hilly, forested landscape of the buffer area will contain and isolate the project activities from local residents. And to the east the nearest residents are more than several miles away from the project site, across the Mississippi River and the wider floodplain on the Illinois side.

Due largely to the protective effect of the buffer, the project will not cause decreased property values in the local area. Holcim conducted a study which demonstrated that properly operated quarries with buffer areas do not have an adverse effect on local property values. The study also showed that Holcim's Clarksville quarry and cement plant did not have an adverse effect on local property values (Nunn, 2003). In addition, the cement plant, quarry, and harbor will not be visible to local residents, and as explained in Section 7.10, there will be no significant impacts from blasting or other noise. Further, as explained in Section 7.1, there will be no adverse impact to the water wells of local residents, and as explained in Section 7.9, there will be no adverse dust impacts. For these reasons, the project will not cause any significant impact to private property.

7.18 Environmental Justice

Executive Order 12898 requires that federal agencies identify and evaluate potential disproportionately high and adverse environmental effects on minority and low-income populations. The residential population within the vicinity of the project is located in a rural setting and is not characterized as being composed of either low income or minority groups. Therefore, no disproportionate adverse impact to such groups will occur as a result of the project.

8.0 Analysis of Indirect, Secondary, and Cumulative Effects

This section evaluates potential indirect, secondary, and cumulative impacts to the resources of the project area. Direct impacts are those localized and immediate in their effect (e.g., surface water runoff); indirect impacts are those that may affect those same resources, but would be evident somewhat later in time or somewhat removed in distance from the primary areas of operation, and are still reasonably foreseeable (e.g., changes in groundwater flow or water sources to wetlands). Secondary development, a term that typically refers to those impacts that result from the off-site growth-induced effects of a project, are those impacts associated with resulting residential and commercial development, and the construction of needed infrastructure (roadways, utilities, etc.). However, potential secondary development must be reasonably foreseeable to warrant analysis under NEPA. Cumulative impacts are those that may result from the incremental impact of the project when added to known or potential impacts from other past, present, and reasonably foreseeable future actions.

8.1 Indirect Impacts

Potential indirect impacts from the project have been addressed in many of the previous sections of this document. For example, potential indirect impacts were analyzed to the:

- Water quality and hydrology of Isle du Bois Creek (see Section 5.1.1);
- Water quality and hydrology of the Mississippi River (see Section 5.1.1) (including potential indirect impacts due to barge fleeting, harbor construction and operation, and maintenance dredging);
- Groundwater (see Section 5.1.2),
- Wetlands and aquatic resources of the project area (see Sections 6.1 and 6.3);
- Local residents (see Section 7.1 – potable groundwater supply, Section 7.9 – dust, and Section 7.10 – noise and blasting impacts);
- Capacity and condition of adjacent roadways (see Section 7.5), and
- Socioeconomic factors such as employment, income and tax base (see Section 7.13);

As discussed in each of these sections, no significant indirect impacts are anticipated because of the efforts undertaken to avoid, minimize, and mitigate for potential project impacts. In particular, the cement plant and quarry were assessed as having no significant indirect impacts to water quality and flow of Isle du Bois Creek and or the Mississippi River, especially given the effectiveness of MDNR-permitted sedimentation basins and BMPs.

Similarly, the creation and restoration of wetlands on Lee Island and along Isle du Bois Creek will compensate for the loss of any wetland functions, preventing indirect effects to the aquatic ecosystem that otherwise may occur. In fact, indirect effects resulting from the creation and restoration of wetlands along Isle du Bois Creek and on the southern half of Lee Island are expected to be positive, as such wetlands will:

- Increase soil stabilization and reduce erosion;
- Contain wetland plant communities with greater structural complexity and therefore, improve wildlife habitat;
- Provide expanded and improved wetland foraging areas for such wildlife as the great blue heron and the Indiana bat; and
- Increase the function and value of the site as a foraging and nursery area for fishes and other aquatic life.

8.2 Secondary Impacts

No extensive secondary development as a result of the project is anticipated, although the project is expected to generate favorable economic growth in the Ste. Genevieve County and Jefferson County area (the two-county region). For example, the project will bring approximately 200 long-term jobs and an annual payroll of approximately $10 million to Ste. Genevieve County (Southeast Missouri State University, 2001).

Most of the workers at the plant will reside within a variety of communities within the two-county region (which includes Festus/Crystal City, Bloomsdale, and Ste. Genevieve), but some may commute from the St. Louis area and Illinois. Potential secondary residential development resulting from the project is expected to be limited, as most workers will likely commute from their current residence, or rent/buy an existing apartment or home. Some limited new construction may occur, but such development will likely take place within existing permitted residential areas or occur on a very sporadic basis in rural areas. Secondary impacts due to such limited, sporadic development are not considered to be significant.

Similarly, extensive new commercial support development is not expected in the immediate area surrounding the project site, especially due to its rural nature and distance from any other development. The most likely scenario would be a gas station and convenience store at the nearest I-55 interchange. At present, the nearest interchange to the north (7 miles) is at Highway 61, which is served by a single gas station. The nearest interchange to the south (3 miles) is the OO-DD Highway interchange, which has no services.

As discussed in Section 7.5, the project is expected to increase local traffic. This traffic would only occur on Highway 61, a two-lane main road that runs roughly parallel to I-55. As discussed in Section 8.3.1.2, MoDOT has proposed a new I-55 interchange at Route TT that would be constructed relatively near the project site. If this interchange is built as proposed, increases in local traffic on TT may create a demand for a gas station/convenience store at the I-55/TT interchange. Such a development may consist of a convenience store, fuel pumps, and associated parking, and may occur on a relatively small parcel of land (e.g., likely less than 2 acres). Impacts from such limited secondary commercial development would not be considered to be significant. Furthermore, a new interchange at Route TT would substantially reduce traffic on Highway 61, thereby improving its level of service.

8.3 Cumulative Impacts

A cumulative impact analysis must consider the potential impact on the environment that may result from the incremental impact of the project when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). The methodology for performing such analyses is set forth in "Considering Cumulative Effects Under the NEPA" (Council on Environmental Quality (CEQ), 1997) and includes the following:

1. Identification of the area in which effects of the project may be felt;
2. Assessment of the impacts that are expected in that area from the project;
3. Identification of other actions (past, present, and reasonably foreseeable) that have had or are expected to have impacts in the same area;
4. Assessment of the impacts or expected impacts from these other actions, and
5. Assessment of the overall impact that can be expected if the individual impacts are allowed to accumulate.

For this project, cumulative impacts were assessed within the context of three geographic areas. The geographic areas for analysis were selected based on the environmental effects that may occur to each of the primary resources under consideration. Primary resource categories and their associated geographic areas are as follows.

1. **Water-related Effects***:* The area in which water-related effects of the project may be evident was determined to include the project site, the watershed of Isle du Bois Creek, and the Mississippi River from Crystal City in southern Jefferson County to the southern boundary of Ste. Genevieve County. Selection of a portion of the Mississippi River upstream of the project site was designed to allow for consideration of actions occurring in upstream areas and their potential for cumulative impacts on downstream areas.
2. **Upland-related Effects:** The area in which upland-related effects of the project may be evident is the area from Festus-Crystal City in southern Jefferson County to the southern boundary of Ste. Genevieve County. This area was selected in order to consider potential cumulative impacts on birds and wildlife from forest fragmentation south of the St. Louis metropolitan area.
3. **Air Quality-related Effects:** The area in which air quality-related effects may be evident is the St. Louis ozone nonattainment area and the Ste. Genevieve County PSD airshed.

8.3.1 Water-Related Effects

8.3.1.1 Background and Area of Analysis

A proper analysis of potential cumulative impacts to wetlands and other aquatic resources must consider that both direct and indirect water-related effects of the project will be mitigated, as described in more detail throughout this document. The analysis must also consider the context within which the project is located, which is the Mississippi River and the watershed of Isle du Bois Creek. The reach of the Mississippi River between Crystal City and the southern boundary of Ste. Genevieve County is a relatively undeveloped area characterized by limestone bluffs close to the river along the Missouri side and a wider bottomland floodplain on the Illinois side. Historically, there has been a significant loss of wetlands and extensive closure of side channels within this reach due to the construction of an extensive levee system coupled with drainage of agricultural lands. This area, together with the watershed of Isle du Bois Creek provides a sufficiently large enough context within which the potential water-related cumulative effects of the project may be analyzed.

Figure 8-1 depicts the loss of wetlands and aquatic resources within the Open Reach of the MMR (i.e., the unimpounded reach of the MMR) from 1891 to 1989. Over this approximately 100-year period, MMR wetlands and aquatic resources have been significantly altered as a result of the construction of projects aimed at improving navigation (wing dams, closure structures, etc.) coupled with the expansion of agriculture within the floodplain (resulting in drainage and land clearing). However, in recent years, the wetland resource within this segment of the MMR has stabilized and has even demonstrated willow and cottonwood stand regeneration within floodplain areas (U.S. Geological Survey (USGS), 1999). As a result of the extensive levee system, wetlands within the MMR are largely confined to the area within the levee system and along the main channel of the river. It is this resource that is most vulnerable to cumulative impacts from the project when considered in combination with other regional actions. Consequently, the evaluation of cumulative impacts to water resources focused on this geographic area.

8.3.1.2 Analysis of Cumulative Effects

Figure 8-2 presents a compilation of the National Wetland Inventory (NWI) wetlands (including the main stem Mississippi River) within this area from Crystal City to the southern boundary of Ste. Genevieve County. In total, wetlands and open water account for 49 percent (25,287 acres) of the geographic area. Outside of the main channel, the dominant wetland resource consists of forested wetlands (9,835 acres) and emergent wetlands (2,137 acres). Scrub shrub wetlands account for a lesser amount of the resource

(965 acres). By contrast, the project will impact approximately 14 acres of wetlands, which represents only approximately 0.03 percent of the geographic area and 0.1 percent of the wetlands within the geographic area. In addition, the project will create or restore approximately 61 acres of wetlands to compensate for the 14 acres impacted by the project.

There are several active mineral or industrial operations on the Missouri side of the Mississippi River that operate within the geographic area of consideration:

- Weber limestone aggregate quarry fleeting area (approximately 3 miles below Crystal City);
- River Cement plant, quarry, and fleeting area (approximately 6 miles north of Lee Island);
- AmerenUE's Rush Island power plant (immediately north of Lee Island);
- Brickeys Stone limestone aggregate quarry (approximately 1 mile south of Lee Island);
- Tower Rock/Chemical Lime aggregate quarry, lime plant, and fleeting area (just north of the town of Ste. Genevieve); and
- Mississippi Lime's barge load-out facility (0.25-mile north of the ferry port in St. Genevieve).

Each of these facilities is an existing permitted operation that forms the long-established baseline land use within the area.

Figure 8-2 and Table 8-1 identify recent past, present, and reasonably foreseeable future actions within this geographic area that can be assessed to determine cumulative effects on the wetland and aquatic resources. This information, developed from USACE Public Notices, indicates that within recent years (i.e., since 1998), seven projects have been proposed that would entail some in-stream work within the Mississippi River (fleeting, dredging).[6] There are no other reasonably foreseeable future projects in this geographic area.

The potential water-related impacts of the projects listed in Figure 8-2 and Table 8-1 that could warrant analysis would include wetland and stream impacts, stormwater run-off, barge fleeting impacts, and dredging impacts. Each of these issues is discussed below.

Wetland and Stream Impacts

Very few of these projects have had or would have an effect on wetlands. In fact, AmerenUE's recent application for a loop track at its Rush Island plant is the only project in recent years that would impact wetlands within this geographic area. As with Holcim's project, these potential impacts will be mitigated by the restoration of a suitable number of acres of wetlands, and will likely result in the creation of a greater acreage of wetlands than that which exists currently. As is summarized in Table 8-1, the cumulative impact to wetlands is 19.75 acres. Mitigation for these projects (once complete) will result in the creation and/or restoration of 73.6 acres of wetlands.

As was the case with wetlands, few projects were identified that would result in stream impacts. The 1998 application by Brickeys Stone to expand their quarry south of the Holcim project site was the only such project identified and would result in direct impacts to 1.5 miles of jurisdictional streams. Again however, permit conditions impose stream mitigation requirements that will result in the replacement of

[6] In a supplemental comment to the USACE, several other proposed or foreseeable actions on this reach of the Mississippi River were identified. These actions, however, have been cancelled or otherwise cannot be considered. The proposal to construct the Kimmswick casino has been dropped (note: this project was outside the area of analysis). Continental Cement is not pursuing the construction of a cement plant north of Ste. Genevieve, but instead is planning to expand its Hannibal, Missouri plant, which is located more than 200 miles north of the project site (well above St. Louis) and therefore, is not within the area of analysis. River Cement has not actually submitted a permit application, and therefore the water-related impacts that may be associated with plant expansion are uncertain.

streams on a 1:1 basis and together with the Holcim project would result in the creation of 4.7 miles of streams.

Table 8-1. Summary of Projects Affecting "Waters of the US" in the Vicinity of the Lee Island Site

Project Name	Applicant	Permit No.	Date/Year	River Mile	Wetland Impact	Stream Impact	Forest Impact	Mitigation
Past Projects								
Quarry Development and Expansion	Brickeys Stone Co.	2122	August 1998	136	0	1.5 mi	0	1.5 miles of jurisdictional stream
Dredging	Jotori Dredging Co.	2126	September 1998	139-154	0	0	0	
Rock/Gravel Loading Area Construction and Maintenance Dredging	Mississippi Lime Co.	2150	March 1999	125.5	0	0	0	
Expansion of Existing Barge Fleeting Facility (30 barges)	Brickeys Stone Co.	2226	June 2000	135.8	0	0	0	
Rush Island, Barge Unloading and Fleeting Facility	AmerenUE	2238	August 2000	140	0	0	0	
Maintenance Dredging (open water disposal)	Chemical Lime Co.	2286	May 2001	126.0	0	0	0	
Dredging	Southern Illinois Sand Co.	2322	April 2002	78-155	0	0	0	
Present Projects								
Rush Island, Railroad Loop Track	AmerenUE	2334	May 2002	140	5.75 ac	0		12.5 acres of wetland (proposed)
Lee Island Project (harbor, quarry, cement plant)	Holcim (US) Inc.	2259	December 2000	138-139	14 ac	3.2 mi		3.2 miles of jurisdictional streams, 61 acres of wetland creation and restoration
Reasonably Foreseeable Future Projects								
Interchange Development at I-55 and Highway TT	MoDOT	Permit applicability not known at this time			Unknown	0	Unknown	
Total					19.75 ac	4.7 mi		73.5 acres of wetlands, 4.7 miles of streams

In terms of impacts to wetlands and streams, therefore, no significant cumulative impacts are anticipated.

Stormwater Runoff Impacts

For purposes of analysis, it is assumed that each of the projects in Figure 8-2 and Table 8-1 involves some stormwater run-off. It is also recognized that activities associated with industrial operations must utilize stormwater controls under general or site-specific permits. In addition, given the context of the Mississippi River (i.e., a very large, turbid river that has been heavily modified for commercial navigation activities), cumulative impacts must reach a higher threshold to achieve a level of significance.

As demonstrated by the Water Resources and Hydrology Report (STS et al., 2002), the Holcim project will not cause a significant change in the water quality or quantity of Isle du Bois Creek or the Mississippi River. Considering the effectiveness of stormwater controls in minimizing and mitigating potential water quality degradation, and the context of the Mississippi River, no significant adverse cumulative impact to the water quality or quantity of the river is expected.

Barge Fleeting Impacts

The assessment of potential water-related cumulative impacts from barge fleeting is primarily associated with potential effects to fish. In addition to Holcim, several other projects in the area involve fleeting operations. While such operations may entrain fish, resulting in individual stress and/or mortality, there is no evidence that significant adverse impacts from those fleeting or barging operations have occurred to fish populations or communities. In addition, the proposed Holcim fleeting area and others (Rush Island, Brickeys) are located in areas with reduced habitat complexity (e.g., on the Missouri side of the Mississippi River), and therefore avoid potential impacts to fish associated with the increased habitat diversity on the Illinois side of the Mississippi River (wing dams, island tips, etc.). Therefore, although the project will increase the amount of local barge traffic, the cumulative impact of the increases attributable to the fleeting areas within the area of analysis should not be significant.

Dredging Impacts

Dredging actions that may occasionally occur in the area of analysis would be those maintenance dredging or commercial dredging operations identified in Figure 8-2 and Table 8-1. For example, Southern Illinois Sand Company has applied for a permit to re-authorize its existing commercial sand dredging operation between RM 78 and 155. Jotori Dredging received a permit in 1998 that re-authorized its dredging of sand between RM 139 and 154. Rush Island's fleeting area is in relatively deep water and therefore is not expected to require frequent periodic maintenance dredging. The Brickeys Stone fleeting area is in shallower water and may require periodic maintenance dredging. Expected impacts from each of these operations include the elevation of suspended solid concentrations in the immediate vicinity of the dredge or discharge point (which will dissipate rapidly at the completion of the operation), direct mortality of benthic organisms entrained by the dredges, and potential smothering of benthos in areas subject to open water disposal. Impacts to areas directly affected by dredging, however, are expected to be temporary, as recolonization of such areas by benthic invertebrates can be expected to occur within one or two years (Prussian et al., 1999).

With regard to the Holcim project, the cumulative impacts expected from any potential maintenance dredging are minimal for the following reasons:

- dredging will not be required to construct the Holcim fleeting areas;
- dredging activity during construction of the harbor will be physically separated from the Mississippi River until the final connection is made;
- periodic in-river maintenance dredging is not expected to be required on an annual basis;
- any in-river maintenance dredging will be accomplished with hydraulic dredging equipment;
- all dredged material will be disposed of in an approved non-jurisdictional upland location and not in the Mississippi River; and
- fauna of the Mississippi River are generally tolerant of water quality conditions characterized by high turbidities.

Any sediment plumes from other dredging actions are not likely to combine with sediment from the project, especially considering the relative infrequency of dredging operations in this reach and the distance between the various actions. Hydraulic dredging and upland disposal as proposed by Holcim will have the advantage of further minimizing turbidity from suspension of sediments as well as

eliminating potential impacts to benthic invertebrates on the river bottom from the settling of suspended material. Consequently, the proposed dredging operations at the site, in addition to other dredging projects/activity on the Mississippi River, should not cause significant cumulative impacts to Mississippi River water quality or aquatic habitat.

Isle du Bois Creek Impacts

Potential cumulative impacts to Isle du Bois Creek were also considered by evaluating other projects (past, present or reasonably foreseeable) within the Isle du Bois Creek watershed. The only such project identified is the proposed development of an interchange on I-55 at Route TT. MoDOT maintains a revolving 5-year plan that identifies proposed roadway improvements. The current plan (2002-2006 Highway and Bridge Construction Program) identifies construction of a new interchange at the Route TT overpass at I-55. The interchange design also consists of replacing the existing bridge at Route TT. This project is identified as an economic development project with the right of way being funded by Holcim. This project would occur within the Isle du Bois Creek watershed, but direct impacts to Isle du Bois Creek are not anticipated as any construction activity would likely not occur within 500 feet of the stream channel (Route TT is approximately 1,400 feet from the channel). Additionally, proper use of erosion and sedimentation controls, as required by MDNR, will prevent any degradation of the water quality or aquatic resources of Isle du Bois Creek. In contrast, wetland restoration will actually enhance the riparian corridor along Isle du Bois Creek (see Section 6.1.2). Therefore, the Holcim project would not cause any identifiable cumulative impacts within the Isle du Bois Creek watershed.

8.3.2 Upland-Related Effects

8.3.2.1 Background and Area of Analysis

The primary cumulative impact concerns within upland areas are those associated with the direct loss of land cover types and the associated impacts to flora and fauna, and at a landscape level—forest fragmentation, and its resultant impacts on neotropical migratory birds. In order to assess the project's potential for cumulative impacts within upland areas, an analysis was undertaken to evaluate the regional availability of forest lands and other habitats. The geographic area under consideration for this analysis included the southern half of Jefferson County and the whole of Ste. Genevieve County. This geographic area is approximately 495,000 acres in size and is considered to be a sufficiently large enough area that contains a sufficient composition of forested lands and other natural cover types to provide a context within which cumulative impacts may be assessed.

Figure 8-3 and Table 8-2 provide a summary of the analysis performed and include a presentation of the trends in land cover from 1975 to 1990 using existing data from the Center for Agricultural Resource and Environmental Systems (CARES) database (USEPA, 1994) and the Missouri Spatial Data Information System (MSDIS) (Missouri Resource Assessment Partnership (MoRAP), 1999). These data sets represent the best information available and no attempt was made to validate or field verify land cover designations within the geographic area under consideration. It should be noted that the two datasets were presented in different formats (shape file versus grid) and are, therefore, not entirely compatible. In addition, some merging of land use classifications was performed to resolve differences in the land cover classification nomenclature between the two years. Additionally, these differences also account for some of the discrepancies in acreages among categories. For example, "dolomite glade" was a category that was present in the 1990 database but was not used in 1975. Conversely, "transitional areas" was a cover type in 1975 but not in 1990.

Table 8-2. Trend in Cover Types within Ste. Genevieve County and the Southern Half of Jefferson County from 1975 to 1990

	Geographic Area				Project Site**		Project Impacts**		
	1975*		1990†						
Cover Type	Acres	%	Acres	%	Acres	%	Acres	% of Site	% of Area
Agriculture/Grasslands									
Active Farm Field	164,594	33.2	193,406	39.1	77	2.0	18	0.5	0.003
Old Field					189	4.8	4	0.1	0.001
Subtotal	164,594	33.2	193,406	39.1	266	6.8	22	0.6	0.004
Forest									
Total Deciduous Forest	257,323	52.0	257,230	52.0	3,356	85.4	1,192	31.5	0.241
Mixed Forest	57,041	11.5	33,230	6.7					
Evergreen Forest	1,711	0.3	2,333	0.5				-	-
Total Forest	316,075	63.8	292,793	59.1	3,356	85.4	1,192	31.5	0.241
Dolomite Glade			411	0.1	8	0.2	0	0	0
Wetlands‡									
Farmed Wetland (FW)					46.8	1.2	12.1	0.3	0.002
Palustrine Emergent (PEM)			24	0	18.5	0.5	0	0	0
Palustrine Forested (PFO)	192	0	1,717	0.3	68.0	2.0	1.9	0	0.0004
Palustrine Scrub-Shrub (PSS)			11	0	7.6	0.2	0	0	0
Palustrine Unconsolidated Bottom (PUB)					0.3	0	0	0	0
Subtotal	192	0	1,752	0.4	141.0	3.9	14	0.4	0.003
Urban/Developed	10,535	2.1	3,543	0.7	130	3.3	94	2.4	0.019
Barren	28	0	138	0					
Water	2,287	0.5	3,046	0.6	15	0.4	0	0	0
Transitional Areas	1,378	0.3							
Total	495,089	100.0	495,089	100.0	3,916	100.0	1,322	34.8	0.267

* Calculated for Ste. Genevieve and S. Jefferson Counties, USEPA, 1994
† Calculated for Ste. Genevieve and S. Jefferson Counties, MoRAP, 1999
** MACTEC, Inc.
‡ Note: wetlands from 1975 and 1990 do not represent NWI wetland mapping or field delineation and are, therefore, not comparable to Lee Island site data. For a more representative assessment of wetland trends and impacts see Figure 8-2.

8.3.2.2 Analysis of Cumulative Effects

Land Cover Impacts

Primary land cover types within the geographic region under consideration were agriculture/grasslands and forest, which together, accounted for approximately 97 to 98 percent of the area. Less well-represented cover types included wetlands (0.4 percent in 1990), urban/developed lands (2.1 percent in 1975) and water (0.6 percent in 1990). A comparison of the two datasets indicates that between 1975 and 1990 the amount of agricultural/grassland within the geographic area increased by approximately 5.9 percent (approximately 29,000 acres). Conversely, the amount of forestland decreased from 63.8 percent to 59.1 percent (approximately 23,000 acres). This reduction however, appears to have been primarily associated with the conversion of mixed forest rather than deciduous or evergreen forest (see Table 8-2). Additionally, this decrease may be offset by a general trend of increasing forest land statewide. As presented by Zerr et al. (2003) forested cover within the state of Missouri increased by approximately 179,000 acres from 1984 to 2000. Increased attention to wetland mapping over the intervening years from 1975 to 1990 probably accounts for the apparent increase in wetland acreage (from 192 acres to 1,752 acres) and is likely an artifact of mapping methodology. It is likely that the loss of forested areas over the 15-year time interval corresponds to conversion of forested lands to agricultural uses coupled with expanding residential and commercial development.

Table 8-2 also provides a comparative summary of the Holcim project impacts to each land cover type. While the Holcim project (through development of the quarry) will impact approximately 1,120 acres of forest land over the life of the project, as discussed in Section 6.4, these impacts will occur incrementally and correspond to a rate of forest land conversion (average of 12 acres per year) that is insignificant. In addition, these impacts will be compensated for by ongoing land reclamation beginning approximately 8 to 10 years after the quarry is opened. Table 8-2 also indicates that the conversion of the forest land is not significant within the context of the area of geographic analysis. For example, the total forest impact attributable to the project is equivalent to only 0.241 percent of the total area of analysis and 0.463 percent of the forest land within the same area.

An investigation was conducted to identify other past, present, and reasonably foreseeable future projects that may have an impact on the terrestrial ecosystems of the geographic area of analysis. Past and present projects identified included a general trend in residential and commercial development and other quarrying operations.

With regard to residential and commercial development, no large-scale reasonably foreseeable future projects were identified in either southern Jefferson County or Ste. Genevieve County. However, the trend of "suburban sprawl" in the St. Louis region is well established. For example, proposed developments associated with USACE Public Notices from 1988 to 2002 resulted in the conversion of more than 2,600 acres of lands within the St. Louis area to developed uses. Some of this development, and much more not requiring an individual USACE Section 404 permit, has also been evident in the geographic area of analysis (notably southern Jefferson County).

With regard to quarries, operations vary in terms of overall size of the bonded area and in terms of the life of the permitted area. Several operations were identified that have the potential to impact upland resources (Table 8-3). However, little can be inferred as to the overall cumulative impact of these operations as information about the specific resources affected by each of these projects is not known. In each case however, the operations are, like the Holcim project, characterized by a slow annual expansion rate, and are permitted facilities that have approved mine plans which requires reclamation of the mined area.

Table 8-3. Summary of Other Permitted Quarry Operations within the Geographic Area

Operator and Comments	Acres
Holcim - Lee Island - Current –Posted bond for 64 acres	64 bonded
Holcim – Lee Island – Pending Hearing Posted additional bond for 68 acres (68 acres – development) included in 100 year permit 1261 acres	68 bonded 1,261 at 100 yrs
Brickeys Stone, LLC – Current – 03/15/01 to 07/15/01 Long Term Mine Plan – 50 years (72 acres - lake /110 acres - wildlife)	182
Fred Weber, Inc. Festus, Missouri Expires in 2010 (native grasses, hardwood forests, intermittent glades)	274
Unimin Corp. Pevely, Missouri (unmanaged wildlife habitat)	258
River Cement – Current – 12/11/2000 to 10/31/2001 217 acres limestone – Festus, Missouri Long term Mine Plan – 3 years (clay)	217
Tower Rock Stone, Ste. Genevieve, Missouri Long Term Mine Plan through 2012 – 566.5 acres	359

Source: MDNR Land Reclamation Program.

Potential impacts to flora and fauna as a result of land cover conversion include loss of breeding and foraging habitat, direct mortality (particularly for plants and less mobile fauna), exposure to "edge" effects (i.e., increased light penetration along new forest edges, modification in temperature regimes, increased potential for establishment of noxious or exotic species), and reduced population sizes. While such potential impacts may occur with land cover alteration, it is impossible to fully evaluate such impacts within the context of this project (or other individual projects) as such impacts are extremely localized, and site specific. In spite of this lack of specificity, it is concluded that the Holcim project will not result in a significant cumulative impact to flora and fauna for the following reasons:

1. **Slow Rate of Quarry Expansion and Habitat Conversion**. After the development of the plant and quarry within the first 10 years, the rate of expansion will be extremely slow (see Section 3.1.4). In the context of other land disturbances occurring in the geographic region (e.g., development of subdivisions which has resulted in the extensive conversion of open lands, often at a rate that far exceeds the annual conversion rate anticipated for the Holcim project), the rate of impact to upland habitats is extremely small and does not result in significant impact to the resource.
2. **Preservation of Extensive Buffer Areas**. The commitment to preserve 2,200 acres of buffer for use as wildlife habitat will provide for the long-term support of indigenous floral and faunal species. This preservation will include interior upland forests, the bottomland forests of Isle du Bois Creek, and the bluff area between the quarry and Lee Island, and will be sufficiently large to continue to support a high diversity of species within the site. Additionally, the maintenance of such an extensive buffer system will provide a valuable source from which resident faunal populations may disperse into the reclaimed quarry site. Dispersal of such species is expected to occur at different rates for different species depending on their particular life history and habitat requirements, and will be in accordance with the development of suitable habitats on the reclaimed site.
3. **Reclamation of the Quarry Site**. Anticipated impacts to upland resources at the project site will be offset by a long-term reclamation strategy that will restore upland habitats after year 8 to 10. This commitment to site reclamation will result in the creation of lands that have a substantially re-developed forest cover after approximately 50 years of growth, thereby replacing lost habitat.

For example, Figure 8-4 presents a schematic representation of the land cover within the quarry over the 100+ year life of the project. While representational (actual rates and timing of the reclaimed lands may vary somewhat), the figure clearly illustrates both the preservation of the buffer and the increasing redevelopment of forested lands within the quarry as reclamation progresses. Lands that are reclaimed at Year 10 and beyond are characterized as grassland, oldfield, and successional forest communities until approximately 50 years after reclamation. Thereafter, such areas will be of a woodland character and may be expected to support wildlife species typical of such cover. This reclamation and restoration of the quarry area will continue beyond the 100+ year life of the project and will ultimately result in the redevelopment of approximately 650 acres of forest as is illustrated in Figure 8-4. Unlike the effects of residential and commercial development, the Holcim project will entail the reclamation of the site to natural habitats that can be used by indigenous wildlife.

4. **Overall Commitment to Habitat-based Conservation Measures**. Holcim's commitment to extensive habitat-based conservation measures as detailed in Section 6.6.2 will improve habitat quality and may increase bird diversity and use of the site. For example, restoration of a tallgrass prairie in the southwestern portion of the site will benefit grassland dependent birds that may also be impacted by small habitat patch sizes within the region.

Habitat Fragmentation Impacts

Transitional areas between forest lands and open cover types (e.g., grasslands) have long been recognized as "edge" areas that often contain a greater species richness than that of each of the adjoining communities (Odum, 1968). While such areas are often characterized by greater species richness, it is also recognized that the diminishing area of contiguous natural habitats (e.g., forest) is detrimental to particular species that are area sensitive. Of particular concern is the potential impact of habitat fragmentation on neotropical migratory birds. Relative area-sensitivity of a number of bird species found on the Holcim site by WBS has been reported by Herkert et al. (1993) (Table 8-4). Additional concerns center on the increased vulnerability of forest nesting species to the fragmentation of forest lands and its associated edge effects. The following discussion assesses the potential cumulative impacts of the Holcim project in the context of these issues.

In overview, it appears that the cover type of the geographic area under consideration (i.e., southern Jefferson and Ste. Genevieve counties) is characterized as fragmented as a result of the long history of mixed uses. Jefferson County, in particular, demonstrates a high degree of fragmentation (see Figure 8-3), and reflects the suburbanization of much of this area. Similarly, Ste. Genevieve County appears to exhibit some degree of fragmentation which has largely been attributable to agricultural uses. However, selected portions of Ste. Genevieve County (including the Brickey Hills area) are dominated by larger tracts of deciduous forest. For example, other large tracts of largely contiguous forested land are likely to remain intact within the geographic area of analysis including approximately 10,000 acres within the Brickey Hills, nearly 11,000 acres south of Lawrenceton, approximately 16,000 acres in the vicinity of Hawn State Park, approximately 15,000 acres northeast of Coffman, and approximately 25,000 acres in southern Ste. Genevieve County north and east of Womack (see Figure 8-3).

Preservation of forest lands within the region is an important component to enhancing the long term support to neotropical migrants. In particular, the preservation of large, relatively contiguous tracts of forest land is important to those woodland birds that are highly area sensitive (see Table 8-4). Within the region, it should also be noted that, with respect to Ste. Genevieve County, little additional fragmentation had occurred from 1975 to 1990, suggesting a higher degree of stability in the forested cover within these areas. Several land areas are in public ownership and will therefore, be preserved as relatively stable forested area. Notably, this includes Hawn State Park (4,953 acres) and lands within the Mark Twain National Forest near Womack (approximately 25,000 acres).

Table 8-4. Area Sensitivity* of Selected Forest and Grassland Bird Species Observed† at the Holcim Site

Forest Birds		
High Sensitivity	**Moderate Sensitivity**	**Low Sensitivity**
Broad-winged hawk	Yellow-billed cuckoo	Downy woodpecker
Pileated woodpecker	Hairy woodpecker	Red-headed woodpecker
Least flycatcher	Acadian flycatcher	Red-bellied woodpecker
Yellow-throated vireo	Scarlet tanager	Great crested flycatcher
Black-and-white warbler	Summer tanager	Eastern wood-pewee
Worm-eating warbler	Red-eyed vireo	Blue jay
Ovenbird	Northern parula	Brown-headed cowbird
American redstart	Yellow-throated warbler	Common grackle
Brown creeper	Louisiana waterthrush	Northern cardinal
	Kentucky warbler	Indigo bunting
	White-breasted nuthatch	Gray catbird
	Tufted titmouse	Carolina wren
	Blue-gray gnatcatcher	House wren
	Wood thrush	Black-capped chickadee
		American robin
Grassland Birds		
High Sensitivity	**Moderate Sensitivity**	**Low Sensitivity**
Northern harrier	Eastern meadowlark	Northern bobwhite
		Red-winged blackbird
		American goldfinch
		Field sparrow
		Song sparrow
		Common yellowthroat

Source: * Herkert et al., 1993.
† WBS, 2002a and 2002b.

Holcim will also ensure the preservation of a significant amount of natural habitats. Preservation of the buffer coupled with a commitment to create and restore additional habitats will provide for the continued support of neotropical migratory birds. Specific measures that will benefit this group of birds include:

- **Buffer Preservation**. In areas where forest patches are reduced in size (e.g., less than 1,000 acres, the habitat suitability of these areas to such sensitive species as ovenbird and pileated woodpecker may be reduced (Herkert, et al, 1993). In the case of the Holcim site, however, overall forest patch size (and hence, suitability of such areas for woodland wildlife species) will remain large due to the preservation of the predominantly forested buffer (approximately 2,200 acres) coupled with the progressive reclamation of the quarry to an ultimately forested condition (see Figure 8-4). The buffer and the undisturbed area outside the 100+ year quarry boundary are dominated by forested lands (2,164 acres) which will provide extensive habitats that will ensure the continued support of neotropical migrants. Additionally, these lands have a high degree of contiguity that will also provide suitable habitat for highly area-sensitive forest species.
- **Native Prairie Restoration**. The restoration of native prairie within the southern portion of the site will benefit migratory and resident grassland and prairie species (e.g., northern harrier, grasshopper sparrow, etc.). This habitat has been greatly reduced over all of its former range and restoration of this 150-acre area would support grassland Neotropical migrant species.

- **Isle du Bois Creek Floodplain Wetland Restoration.** The restoration of 22.8 acres of farmed wetlands to scrub shrub (ultimately forested wetlands) within the floodplain of Isle du Bois Creek will have the effect of reforesting cultivated fields. After such areas have had sufficient time to develop, this will ultimately reduce the fragmentation of this bottomland ecosystem. This will provide increased contiguity of forest within the Holcim site and will effectively enhance the Isle du Bois Creek riparian corridor.
- **Lee Island Wetland Restoration and Creation.** The restoration of 12.8 acres (farmed wetlands) and creation of 25.5 acres on Lee Island to a complex of emergent and scrub shrub wetlands will benefit wetland and water-dependent species including wading birds (e.g., great blue heron, egrets, etc.), waterfowl and shorebirds.
- **Preservation of the Bluff Area**. Studies performed by the WBS have shown that the bluff area supports particularly high concentrations of neotropical migratory species during peak migration periods. Preservation of the 400-foot wide bluff area will provide continued support for neotropical migrants during their movements along the Mississippi flyway.

It should be noted that while much of the Holcim project site is forested, as illustrated in Figures 3-1 and 8-3, some effects of fragmentation (due to previous farming, logging, and quarrying activities) have already occurred on the project site, as evidenced by the presence of the brown-headed cowbird within much of the site (WBS, 2001). The brown-headed cowbird was present in nearly all transect surveys performed by the WBS and suggests that despite the site's dominance by wooded cover types, there is a significant amount of forest edge along old ridge roads, agricultural fields and other disturbed areas. This suggests that neotropical migrants nesting within the interior of the project site are presently being affected by cowbird parasitism. Consequently, neotropical migrants would not be subjected to a new threat to reproductive success as a result of the project. Conservation measures within the buffer (including habitat enhancement and management) will further enhance the quality and contiguity of forest lands on the Holcim site and may be effective in reducing the incidence of cowbird parasitism on the site.

Based on the evaluation of other past, present, and reasonably foreseeable future actions as discussed previously, coupled with the findings of other analyses of potential project impacts as presented in previous sections of this document (and other documents incorporated by reference), the Holcim project will not result in significant adverse cumulative impacts associated with forest fragmentation.

8.3.3 Air-Related Effects

Missouri will not issue air permits for projects if they will, alone or cumulatively, cause or contribute to violations of air quality standards. The Missouri air regulations include an ongoing requirement that all future major projects in this region make the same cumulative demonstrations to show that their project, along with all others, will not significantly degrade the region's air quality. Thus, there is an inherent cumulative-impact safeguard in the air permitting analysis. Holcim's modeling results for its air permit demonstrate that its air emissions, and those of others in the region, will not have a cumulative adverse effect on air quality. The state's air quality regulations also require that any future projects will have to make the same demonstration. Therefore, there should be no adverse cumulative impacts on local or regional air quality from the Holcim project in conjunction with other projects.

8.3.4 Summary

In summary, there will not be any significant cumulative adverse environmental impact from the incremental impact of the Holcim project when considered together with other past, present, and reasonably foreseeable future projects in the area.

9.0 References

Alpine Geophysics. 2001. Analysis of the Ozone Air Quality Impacts of the Proposed Holnam, Inc. Portland Cement Manufacturing Plant.

American Resources Group (ARG). 2000a. Phase I Cultural Resources Survey and Assessment at the Holnam Quarry Property. Ste. Genevieve and Jefferson Counties, Missouri.

American Resources Group (ARG). 2000b. Phase II Investigation at Site 23SG1. Ste. Genevieve and Jefferson Counties, Missouri.

American Resources Group (ARG). 2000c. Research Design and Methodology for Phase III Data Recovery Operations at Site 23SG1.

Bognar, John. 2003. Leggette, Brashears & Graham, Inc. Testimony at MDNR Land Reclamation Commission Public Hearing. February 19-21, 2003

Brown Soil Services. 2001. Soils Report, Quarry Site, Project.

Council on Environmental Quality (CEQ), Executive Office of the President. 1997. Considering Cumulative Effects Under the National Environmental Policy Act. January 1997. http://ceq.eh.doe.gov/nepa/ccenepa

Davies, Simon. 2003. World Bird Sanctuary. Personal communication.

Environ International Corporation. 2001. Estimation of the Impacts of the Proposed Holnam Lee Island Facility on Ozone Attainment and the Draft St. Louis SIP Ozone Attainment Demonstration.

Environmental Science & Engineering, Inc. (ESE). 2000a. Section 404/401 and Section 10 Permit Application Companion Report for the Proposed Holnam Inc. Lee Island Plant

Environmental Science & Engineering, Inc. (ESE). 2000b. Preliminary Jurisdictional Wetland Determination Report for the Proposed Holnam Inc. Lee Island Site.

Federal Highway Administration. 1998. Highway Capacity Manual. Special Report 209, third edition.

Harding ESE, Inc. 2001a. Aquatic Resource and Water Quality Characterization Report for the Proposed Holnam Inc. Lee Island Plant.

Harding ESE, Inc. 2001b. Vegetation Survey and Community Type Map for the Proposed Holnam Project.

Harding ESE, Inc. 2002a. Supplemental Alternatives Analyses for the Proposed Holcim (US) Inc. Project.

Harding ESE, Inc. 2002b. Addendum for the Aquatic Resource and Water Quality Characterization Report for the Proposed Holcim (US) Inc. Project.

Harding ESE, Inc. 2002c. Wetland and Stream Mitigation Plan for the Proposed Holcim (US) Inc. Project.

Harding ESE, Inc. 2002d. Biological Assessment for the Proposed Holcim (US) Inc. Project. Report prepared for Holcim (US) Inc.

Harding ESE, Inc. 2002e. Amphibian and Reptile Relocation Study for the Proposed Holcim (US) Inc. Lee Island Site.

Herkert, James R., Robert E Szafoni, Vernon M. Kleen, and John E. Schwegman. 1993. Habitat establishment, enhancement and management for forest and grassland birds in Illinois. Division of Natural Heritage, Illinois Department of Conservation, Natural Heritage Technical Publication #1, Springfield, Illinois. Northern Prairie Wildlife Research Center htttp://www.npwrc.usgs.gov/resource/othrdata/manbook/manbook.htm (Version 16JUL97).

Holcim (US) Inc. 2002. The Long Term Land Reclamation Strategy of the Proposed Holcim (US) Lee Island Cement Manufacturing Facility Located in Ste. Genevieve and Jefferson Counties, Missouri. Plan submitted to MDNR Land Reclamation Program.

Lague, John. 2003. URS Corporation. Testimony at MDNR Land Reclamation Commission Public Hearing. February 19-21, 2003

Leggette, Brashears & Graham, Inc. (LBG). 2000. Hydrogeologic Investigation, Project, Ste. Genevieve and Jefferson Counties, Missouri.

Leggette, Brashears & Graham, Inc. (LBG). 2002. Geochemical Analysis of Ground Water and Unconsolidated Earth Materials at the Proposed Harbor

Missouri Department of Natural Resources (MDNR). 1997. Groundwater Resources of Missouri. Water Resources Report Number 46. Missouri State Water Plan Series, Volume II.

Missouri Resource Assessment Partnership (MoRAP). 1999. Landcover of the State of Missouri, Landsat TM data ranging from 1991 to 1993. http://maps.cares.missouri.edu/maproom/index.html

Mississippi River Commission. 1999. 1890's Mississippi River Commission Data. http://www.umesc.usgs.gov/geographic_search/river_selection/upper_mississippi/reach_3/open_1/or1_gis_data.html

Nunn, David. 2003. The Nunn Company. Testimony at MDNR Land Reclamation Commission Public Hearing. February 19-21, 2003

Odum, Eugene P. 1968. Fundamental of Ecology. W.B. Saunders Company. Philadelphia, PA

Pflieger, W. 1997. Fishes of Missouri. Revised Edition. Missouri Department of Conservation.

Prussian, A.M., T.V. Royer, and G.W. Minshall. 1999. Impact of suction dredging on water quality, benthic habitat, and biota in the Fortymile River, Resurrection Creek, and Chatanika River, Alaska. Prepared for USEPA Region 10, Seattle, Washington by Idaho State University, Pocatello, Idaho. http://www.akmining.com/mine/1999epa.htm

Salzman, Gary. 2003. University of Missouri-Kansas City, School of Medicine. Testimony at MDNR Land Reclamation Commission Public Hearing. February 19-21, 2003.

Saperstein, Lee. 2003. University of Missouri-Rolla. Testimony at MDNR Land Reclamation Commission Public Hearing. February 19-21, 2003.

Soil Conservation Service (U.S. Department of Agriculture). 1985. Soil Survey of Ste. Genevieve County, Missouri.

Southeast Missouri State University. 2001. The Economic Impact of the Lee Island Cement Plant in Ste. Genevieve County. Report prepared for Holcim (US) Inc.

STS Consultants, Ltd., Harding ESE, Inc., and Leggette, Brashears & Graham, Inc. (LBG). 2002. Water Resources and Hydrology Report.

Thom, R.H. and J.H. Wilson. 1980. The Natural Divisions of Missouri. Transactions of the Missouri Academy of Science, 14:9-23.

URS Corporation. 2003. Modeling Evaluation of Particulate Matter Emissions and Associated Air Quality Impacts from the Proposed Holcim Quarry.

U.S. Environmental Protection Agency's (USEPA) Office of Information Resources Management (OIRM). 1994. 1970s to early 1980s 1:250,000 Scale Quadrangles of Landuse/Landcover GIRAS Spatial Data in the Conterminous United States. http://maps.cares.missouri.edu/maproom/index.html

U.S. Fish and Wildlife Service (USFWS). 1984. National Wetland Inventory, Bloomsdale Quadrangle.

U.S. Fish and Wildlife Service (USFWS), National Wetlands Inventory (NWI). 1987. Kaskasia Quadrangle Map. http://www.nwi.fws.gov/downloads.htm

U.S. Fish and Wildlife Service (USFWS), National Wetlands Inventory (NWI). 1993. Bloomsdale, Danby, Prairie Du Rocher (IL), Sainte Genevieve, Selma, Valmeyer Quadrangle Maps. http://www.nwi.fws.gov/downloads.htm

U.S. Geological Survey (USGS). 1999. Ecological Status and Trends of the Upper Mississippi River system, 1998. A Report of the Long-Term Resource Monitoring Program. U.S. Geological Survey, Upper Midwest Environmental Services Center, La Crosse, Wisconsin. ZTRMP 99-1001.

Upper Midwest Environmental Sciences Center. 1989. 1989 Color Infrared Aerial Photos. http://www.umesc.usgs.gov/geographic_search/river_selection/upper_mississippi/reach_3/open_1/or1_gis_data.html

Vibra-Tech. 2002. Blast Vibration Site Evaluation, Holcim (US) Inc., Lee Island Facility.

Waterway Simulation Technology, Inc. 2000. Lee Island Cement Plant Navigation Impact Study.

WDH Ecological Services (WDHES). 2002. Endangered Species Investigation, Bat Survey Report (Indiana and Gray Bats (*Myotis sodalis and Myotis grisescens*), Proposed Project, Holcim (US) Inc.

Weaver, William. 2003. Personal communication. STS Consultants, Ltd.

World Bird Sanctuary (WBS). 2001a. Short-Term Site Assessment and Avian Population Survey.

World Bird Sanctuary (WBS). 2001b. Spring Migratory and Summer Breeding Bird Site Assessment.

World Bird Sanctuary (WBS). 2002a. Avian Late Fall Migration and Fall/Wintering Grounds Site Assessment and Population Survey

Zerr, D.P., R. Sugumaran, and P. ManojKumar. 2003. Land Cover Change in Missouri from 1984 to 2000 Derived from Landsat Satellite Imagery, An Element of an Agricultural Land-Use Trends Visualization System. Center for Agricultural Resource and Environmental Systems, University of Missouri, Columbia. Paper Presented at the Annual Missouri Fish and Wildlife Conference, January 29-31, 2003.

Appendix A

List of Studies

Appendix A
List of Studies
(All studies are incorporated by reference as a part of the EA)

1. Phase I Cultural Resources Survey and Assessment (American Resources Group (ARG), 2000) - The objectives of the survey were to identify cultural resources (historical or archaeological) located within the project area and provide a preliminary assessment of their eligibility for listing to the National Register of Historical Places (NRHP).

2. Navigation Impact Study (Waterway Simulation Technology, Inc., May 24, 2000) - A navigation impact study was conducted by Waterway Simulation Technology, Inc. to determine if the proposed project would affect navigation on the Mississippi River. Coordination occurred between the study team and the U.S. Coast Guard, the River Industry Action Committee (RIAC) and the USACE. This study was included as Appendix E of the Section 404/401 and Section 10 Permit Application Companion Report.

3. Hydrogeologic Investigation (Leggette, Brashears & Graham, Inc. (LBG), 2000) - This report detailed the results of subsurface drilling and testing conducted at the site. Information included regional and site-specific hydrogeology, joint/fracture trend analysis, and hydraulic conductivity testing. This information has subsequently been updated in several geotechnical reports (STS Consultants, Ltd., 2001 and LBG, 2001).

4. Preliminary Jurisdictional Wetland Determination Report (ESE, August 8, 2000) - A wetland determination report was completed, identifying wetlands and waters of the United States that were considered to be jurisdictional within the property boundaries. Ninety-seven wetland plots, high resolution aerial photography, historical photographs, topography, soil survey maps, and hydrology data were used to describe the approximately 141 acres of wetlands at the site. Coordination occurred with USACE, and included the Natural Resources Conservation Services (NRCS) where there were potential jurisdictional wetlands within active agricultural areas.

5. Section 404/401 and Section 10 Permit Application Companion Report (ESE, August 8, 2000) - This report provides a description of the project, characterization of the project site including information about the regulated resources on the site, information about design alternatives that had been considered, proposed mitigation measures, and preliminary environmental analysis. The following studies are included: Appendix A--Terrestrial Ecological Characterization, Appendix B--Threatened and Endangered Species, Appendix C--Mississippi River Substrate and Unionid (Mussel) Survey, Appendix D--Other Site Features and Upland Hydrogeologic Conceptual Model, and Appendix E--Lee Island Cement Plant Navigation Impact Study.

6. Phase II Investigation at Site 23SG1 (ARG, 2000) - The objectives of this effort were to assess the historical significance of site 23SG1. A field investigation was conducted to map and characterize this site.

7. Short-Term Site Assessment and Avian Population Survey (World Bird Sanctuary, March 31, 2001) - The World Bird Sanctuary conducted an initial bird habitat suitability assessment and late winter/early spring (March) bird population survey on the project site.

8. Research Design and Methodology for Phase III Data Recovery Operations at Site 23SG1 (ARG, November 2000) – This study presents a plan for data recovery operations at Site 23SG1. Holcim, the USACE, and the SHPO have signed a Memorandum of Agreement dated January 2, 2002 that,

among other things, requires Phase III data recovery operations for Site 23SG1 in accordance with this plan.

9. Estimation of the Impacts of the Proposed Holnam Lee Island Facility on Ozone Attainment and the Draft St. Louis SIP Ozone Attainment Demonstration (Environ International Corporation, May 8, 2001) - This study determined that the Lee Island facility would not jeopardize the St. Louis region's attainment of the 1-hour ozone standard. The conclusions are based on results of a photochemical modeling exercise where Missouri's State Implementation Plan (SIP) demonstration was modified to include the Lee Island cement plant and compared to the existing demonstration model.

10. Analysis of the Ozone Air Quality Impacts of the Proposed Holnam, Inc. Portland Cement Manufacturing Plant (Alpine Geophysics, May 14, 2001) – This study, prepared for USEPA Region VII, determined that the predicted overall impact of the Lee Island facility on peak ozone levels in the St. Louis area will be very small. The size of the predicted impacts (both positive and negative impacts were predicted) were considered far too small to be declared statistically significant. The conclusions were based on results of a photochemical modeling exercise where Missouri's State Implementation Plan (SIP) demonstration was modified to include the Lee Island cement plant and compared to the existing demonstration model.

11. The Economic Impact of the Lee Island Cement Plant in Ste. Genevieve County (Southeast Missouri State University, July 2001) – This report provides an analysis of the economic impacts arising from the construction of the proposed facility on Ste. Genevieve and Jefferson counties and the state of Missouri, and impact on tax revenues.

12. Soils Report, Quarry Site, Project (Brown Soil Services, 2001) – The soils report provides a detailed map of the proposed quarry area soils and describes the different soil types (e.g., silt, clay, etc.), and soil thickness.

13. Draft Biological Assessment (Harding ESE, September 10, 2001) – A Biological Assessment (BA) was completed at the request of the U.S. Fish and Wildlife Service (USFWS) and USACE as part of the informal consultation process under the Endangered Species Act. Species reviewed included the Indiana bat, gray bat, bald eagle, Hine's emerald dragonfly, pallid sturgeon, least tern, and peregrine falcon. This draft was submitted to obtain FWS review and advice on Holcim's analysis and proposed conservation measures.

14. Aquatic Resource and Water Quality Characterization Report (Harding ESE, November 1, 2001) – This report provides results of aquatic and water quality sampling of Isle du Bois Creek, tributary streams (e.g., Raddy Hollow, etc.), and selected springs/seeps. Spring, summer, and storm event water quality sampling results are presented. Spring and summer fish sampling results are also presented. The water quality results were compared to similar Ozark streams.

15. Vegetation Survey and Community Type Map (Harding ESE, November 1, 2001) – This study presents descriptions and a map of the natural plant communities (e.g., mesic forests, dolomite glades, etc.) identified at the site. Information (plants and community types) from the Preliminary Jurisdictional Wetland Determination Report is integrated into this report in order to provide a comprehensive evaluation of the vegetative communities and plant species found at the site. This information will be used in the reclamation and site management plans.

16. Spring Migratory and Summer Breeding Bird Site Assessment (World Bird Sanctuary, December 10, 2001) – The World Bird Sanctuary conducted a comprehensive survey to identify migratory and

breeding bird species utilizing the site. The work included identifying neotropical migratory species, and mapping areas currently being utilized by bird populations.

17. The Long Term Land Reclamation Strategy of the Proposed Holcim Lee Island Cement Manufacturing Facility (Holcim, revised January 2002) - This plan was submitted to the MDNR Land Reclamation Program with the plant quarry permit application. The plan provides the chronology of quarrying, and outlines the goals and objectives of the reclamation strategy.

18. Biological Assessment (Harding ESE, January 10, 2002) – The Biological Assessment (BA) was completed at the request of the U.S. Fish and Wildlife Service (USFWS) and USACE as part of the informal consultation process under the Endangered Species Act. Species reviewed included the Indiana bat, gray bat, bald eagle, Hine's emerald dragonfly, pallid sturgeon, least tern, and peregrine falcon.

19. Endangered Species Investigation Bat Survey Report (WDHES, January 10, 2002) – This study utilized mist netting, radio tagging, and accousting monitoring to determine the use of the site by bats, including the Indiana and gray bats. This information will assist in designing on-site conservation and mitigation measures.

20. Amphibian and Reptile Relocation Study (Harding ESE, March 1, 2002) – This document provides a brief overview of the scientific literature on the relocation of herpetofauna (amphibians and reptiles). Additional information is presented evaluating the potential to relocate on-site amphibians and reptiles prior to the commencement of quarrying activities.

21. Wetland and Stream Mitigation Plan (Harding ESE, March 26, 2002) – This plan describes the potential wetland and stream impacts associated with the project and the mitigation proposed by Holcim. This plan was originally submitted to the USACE and MDNR on November 7, 2001, but was later revised (with only minor changes) and re-submitted to the USACE, and to MDNR as part of Holcim's application for a water quality certification.

22. Supplemental Alternatives Analyses (Harding ESE, March 29, 2002) - This report addresses additional information about alternatives requested by various commenters, including project site alternatives (alternative off-site locations), quarry plan alternatives (underground mining and avoidance of Wolf Hollow), and fill disposal area alternatives.

23. Geochemical Analysis of Ground Water and Unconsolidated Earth Materials at the Proposed Harbor (LBG, March 27, 2002) – This study analyzes groundwater and soil samples collected on Lee Island at the site of the proposed harbor. This information was used to evaluate potential impacts from either the placement and storage of the harbor excavation material on-site, or its beneficial use or storage off-site. A report on this study has been prepared for submission to MDNR as part of Holcim's application for an individual site-specific stormwater permit for activities associated with harbor construction.

24. Addendum for the Aquatic Resource and Water Quality Characterization Report (Harding ESE, May 2, 2002) – This report provides supplemental information including: fall season (2001) fish and water quality sampling results, and spring/fall benthic invertebrate sampling results.

25. Water Resources and Hydrology Report (STS Consultants, Ltd., LBG and ESE, May 7, 2002) – This study evaluates the potential for water quality and hydrologic impacts associated with the change from pre-project conditions to those that result during phased project development and reclamation.

Surface water models were used to quantify potential impacts associated with the cement plant, quarry, and fill areas. Proposed mitigation measures to prevent potential impacts are presented.

26. Harbor Excavation Material Storage Option Study (Holcim, 2001-2002, unpublished) – This on-going study involves the identification of potential, additional alternatives for the storage of the harbor excavation material. While on-site locations were identified inside the quarry boundary, the goal remains to identify a storage area or beneficial use off-site.

27. Avian Fall and Winter Site Assessment and Population Survey (World Bird Sanctuary, July 1, 2002) – The World Bird Sanctuary surveyed bird usage of the site during fall and winter.

28. Mississippi River Base Flood Modeling – "No Rise" Certificate Documentation (STS Consultants, Ltd., October 12, 2002 – This study shows that construction of the in-river fleeting cells and harbor would not cause any increase in flood levels.

29. A Market Study of the Effect of Quarries on the Value of Nearby Real Estate (David Nunn and Joe Rose, The Nunn Company, November 12, 2002) – This study examined the effect of quarries in Missouri on the property values of surrounding landowners by investigating quarries in Ste. Genevieve County, Jefferson County, Clarksville, and Jefferson City, using paired sales analysis techniques and interviews with real estate appraisers and other professionals.

30. Blast Vibration Site Evaluation, Holcim (US) Inc., Lee Island Facility (Vibra-Tech, December 3, 2002) – This study measured ground vibrations produced from blasting at three primary test sites in order to determine the likely effects on uncontrolled structures and wells surrounding the project site. Typical ground vibration response was found indicating full blasting operations can be conducted without damage to aboveground or underground structures beyond 1,000 feet.

31. Modeling Evaluation of Particulate Matter Emissions and Associated Air Quality Impacts from the Proposed Holcim Quarry (URS Corporation, February 14, 2003 – This study evaluated worst-case PM_{10} and $PM_{2.5}$ concentrations in the ambient air from the project site fenceline outward for two scenarios – initial construction and year ten of quarry operations (including mining activities, reclamation activities, and cement plant emissions.

Appendix B

Supplemental Alternatives Analysis