

V. ASSOCIATED ANALYSES

A. Upper Site Assessments. As noted in the “Project Description” section of this report, less detailed, qualitative assessments were conducted for the upper UMR-IWW lock and dam sites. Separate assessments, each somewhat different in character, were conducted for the Mississippi and Illinois.

1. Mississippi Locks and Dams 11-19. Two 1-day meetings were held in June 1997 with pertinent resource agency personnel to discuss resources of concern and potential construction impacts at these locks. The approach taken was to utilize planning maps similar to those used at the lower sites (illustrating proposed locations of large-scale measures - Appendix A), other existing information, and resources of concern originally identified at initial site visits conducted in 1994. Agency participants were asked to update the latter pieces of information as appropriate, and all the assembled information was then used to make a general determination of impacts. Our intention was also explained to extrapolate information from the lower site assessments, in terms of AAHUs and habitat replacement costs, to similar impact situations at these areas.

a. L/D 19, Keokuk, IA. The existing lock is one of only two 1,200-foot locks on the system, but its inherent capacity is compromised by severe approach conditions due to its location on the inside of a sharp bend. Approach conditions are further complicated by severe upstream cross-currents and two bridges just downstream of the lock. Only Location 3 is a feasible placement for a new lock. The primary footprint impacts here are due to lock construction and downstream dredging to improve the approach (Appendix A). The dredging, along with guidewall extensions, are proposed as small-scale improvements. The dredging would impact an area of rock/rubble bottom that is a known walleye spawning area; the adjacent near-shore area has been identified as a potential mussel bed. Recreational fishing areas adjacent to the lock chamber and power plant would also be affected, and it would be desirable to provide fishing access to or around any new lock facility. Landside impacts appear to be minimal, though part of the proposed staging area may affect a field that has reverted from agricultural use. General points made were that there is considerable silting in and hence shallowing upstream of the lock. It was suggested that a beneficial use for dredged material would be for island construction upstream of the lock.

b. L/D 18, Burlington, IA. Existing approach conditions are considered to be good at this site. Possible new lock construction would be at Locations 2, 3, or 4 (Appendix A). Due to the marshy nature of the area adjacent to the lock, staging areas are immediately adjacent to the lock or some distance upland on the Illinois side. Structural small-scale measures include guidewall extensions and a small dredging area upstream of the lock (would also be dredged as part of any large-scale measure). Illinois officials voiced concerns with the loss of a downstream boat access, as well as impacts to the Oquawka State Refuge, particularly with lock Location 2. Flows introduced by gate replacement for lock Location 4 would impinge on a small island, with potential shoreline impacts to bottomland hardwoods. A large area immediately downstream of the lock (approximately 4 river miles) has been identified as a potential mussel bed.

c. L/D 17, New Boston, IL. This lock has a relatively straight approach, though some outdraft problems exist. It is also one of the few sites where both a Location 1 and a wicket gate option remain under consideration. Lock Locations 2, 3, and 4 are also included (Appendix A). Proposed approach improvements (including dredging, bank excavation and re-configuration of wing dikes) pose major environmental impacts. Various combinations would apply to both large- and small-scale measures, as well as the wicket gate option. There is an identified mussel bed as well as secondary endangered mussel habitat just upstream of the lock; both would be impacted by proposed approach improvements. The complexity of this lock site necessitates that each possible lock location be discussed in turn.

For Location 1, the largest area of terrestrial (bottomland hardwood) habitat would be lost to excavation (approximately 40-45 acres; a similar-sized area at La Grange L/D resulted in an AAHU loss of 61.1) and a levee would require relocation. Two existing wing dikes upstream would be removed for this location. A somewhat lower acreage of bankline would require excavation for Location 2; the current wing dike configuration would remain unchanged. New wing dikes (5 total) would be required for Locations 3 and 4, and again a somewhat reduced landside area would be excavated as these locations are farther toward the channel. Any guidewall extensions done as a small-scale measure would require landside excavation (approximately 6 acres), and an upstream extension would require the dike field (5 dikes).

The wicket gate option requires extensive dredging both upstream and downstream. A popular walleye fishing area would be impacted downstream, and major agency opposition was expressed concerning the required closure of connecting channels in the area of Turkey Island and Turkey Chute.

d. L/D 16, Muscatine IA. Existing approach conditions at this site are relatively poor, particularly on the downbound approach. Upstream approach improvements would be required in the form of channel excavation and a series of wing dikes; two existing dikes would also be removed. The extent and alignment of the dredge areas varies by lock location, as indicated on the planning map (Appendix A). Upstream guide/guardwall extensions as a small-scale measure would also require the dredging of corresponding channels. The channel would go through a submerged island, which would be subject to re-filling; it is estimated that the channel would establish itself within 5 years. The dredged area would potentially impact plant beds and duck blind locations; this requires confirmation from area waterfowl/wildlife biologists. The proposed filling of a deep hole just below the dam and adjacent to a Location 4 lockwall may impact an existing fishery. Mussel beds have been documented both upstream and downstream of the lock within the analysis area; these locations would require confirmation. Terrestrial impacts are limited at this site; approximately 7 acres of forest and wetland would be lost on the gate replacement area.

e. L/D 15, Rock Island, IL. L/D 15 is located in a highly urbanized area between the cities of Davenport, IA and Rock Island, IL. Several physical constraints limit

the available options here to a lock extension at Locations 2 or 3, extending in the upstream direction only (Appendix A). Outdraft conditions (a situation where tows are pulled away from the lock chamber by currents flowing towards the dam) can be severe at this site, and the entire Pool 15 (the pooled area above the lock and dam) is one of the most congested on the system. Proposed approach improvements consist of five submerged wing dikes upstream and a deflection dike downstream at the mouth of Sylvan Slough (the large side channel behind Arsenal Island); there is no dredging proposed. The forebay upstream of the lock would be used for staging, thus limiting terrestrial impacts; however, a portion of the island near the opening of this bay would need to be cut back.

Two major resource concerns were identified. One is the potential presence of a rich mussel bed upstream of the lock. This bed would fall directly under the lock footprint as well as be affected by the wing dike placement. Downstream, a known walleye spawning area occurs near the tip of Arsenal Island, and this could potentially be impacted by any lockwall extensions as well as the planned deflection dike.

f. L/D 14, Le Claire, IA. Due to the lock's location on a bend and existing flow conditions, considerable maneuvering is required on approaches here. The lock is adjacent to Smith's Island, which in turn separates it from the Le Claire Canal, a historically and environmentally sensitive side channel area (Appendix A). A small lock at the downstream end of the canal serves recreational and Corps maintenance fleet traffic. An additional complication at this site is a proposed hydropower project, which has been under consideration for some time but still awaits a final decision. If this proposal were implemented, all flow would need to be diverted when it is in operation.

Considerable dredging is proposed to alleviate the approach problems; the majority would be upstream. A portion of the upstream dredging coincides with identified secondary habitat for the endangered Higgins' eye mussel; possible presence of this species, as well as other mussel resources in the area, would need to be confirmed with detailed surveys. More detailed impact assessments would also require information on fisheries. The upstream tip of Smith's Island would also be lost to the dredging; this portion is non-forested wetland. Resource agency personnel also pointed out that a large portion of the island is proposed for staging or placement, and this would be unacceptable due to wetland impacts. The agencies also suggested rock placement at various locations in the main channel and in Le Claire Canal itself to provide submerged structure and flow diversion.

g. L/D 13, Fulton, IL. Approach conditions are generally good at this site, but wind can be a problem as the pool is quite wide (Appendix A). Resource concerns were considered to be minimal. A popular sport fishery (walk-in and boat) would be lost in the Location 4 gate replacement area, along with approximately 4 acres of forested area. Any new lock construction itself was not considered to have any potential fisheries impacts; however, a possible exception is a Location 2 downstream guidewall extension (proposed as both a large- and small-scale measure) interfering with a stream confluence. Also, the proposed filling of a deep hole (for Location 4) in the tailwater is a concern; such holes are especially favored by paddlefish. There is no existing information on mussel resources at this site. It was suggested that material from the upstream dredge cut be used

to extend the existing rock wall and create a protective barrier for the adjacent backwater area. The downstream dredging would remove a large (~12 acres) swath of bottomland hardwoods, with the acreage becoming aquatic area. Similar situations at the lower lock sites resulted in bottomland hardwood habitat losses of as much as 40 AAHUs. Again, it was suggested that the dredged material could be placed in the channel to provide additional structure.

h. L/D 12, Bellevue, IA. Outdraft can be a problem here on the upstream approach. The downstream exit can also be problematic as tows have a difficult time getting off the wall and avoiding a protruding wing dam; dredging is proposed to help alleviate this problem (Appendix A). Similar to L/ D 13, two large deep holes exist below the dam, and again one would be filled in the event of Location 4 lock construction. Both holes are valuable areas for fish. Also related to a Location 4, gate replacement and the removal of wing dams downstream would severely impact popular sport fishing areas. In terms of the downstream lock footprint, the entire area is considered good fish habitat (suspected walleye and sauger spawning sites), and two boat ramps also would be affected. These ramps provide important access points to local residents, given their immediate proximity to the city of Bellevue. The resource agencies emphasized the recreational and public use importance of this area, noting that the city relies heavily on the river and its resources. They also suggested a good enhancement opportunity would be to place the replacement gates at the mouth of a major side channel near the end of the overflow section of the dam; this would avoid fishery impacts while introducing flow into the backwater complex. A major concern also exists in terms of mussel impacts, since at least three beds have been identified in the analysis area; one of these would be directly impacted by downstream lock extensions.

i. L/D 11, Dubuque, IA. This lock is situated on the inside of a bend, and there is a substantial outdraft problem on the upper approach. For large-scale measures, only a Location 2 or 3 lock extension remains under consideration. Additional measures under consideration consist primarily of various dike configurations upstream and downstream (small-scale would only be upstream) of the lock to train new channel alignments (Appendix A). Some existing dikes would also be removed on the left descending bank downstream of the dam. There is no dredging proposed. A deep hole in the tailwater would be filled, but no immediate concern was raised with this as had been at other sites. Agency personnel also felt that a downstream wall extension may actually enhance fisheries by creating more slackwater habitat. Information on mussel resources is limited, but the endangered Higgins' eye is known to occur below the dam on the left bank; this area is not likely to be affected by any measure. Additional surveys would be needed for the area in general prior to any identified construction.

2. Upper Illinois River Locks and Dams (Lockport to Starved Rock). Initial Navigation Study planning determined that large-scale measures would not be warranted above Peoria Lock and Dam on the Illinois River, due primarily to current and projected commercial traffic levels. Thus, consideration of possible improvements at sites above La Grange focused on small-scale measures, and these are primarily non-structural. One exception would be extensive dredging under consideration above the Marseilles lock to

alleviate congestion due to a narrow, shallow channel. Consideration of these measures took place at a series of on-site meetings on December 10-11, 1996. In attendance at these meetings were study team members, lockmasters, an industry representative, and a representative from the Illinois Department of Natural Resources. The discussions focused on existing approach conditions and other time-consuming elements of the lockage process at each site. Natural resource concerns were generally limited, but a brief site-by-site summary is presented as follows:

a. Lockport Lock, Lockport, Illinois. Approach conditions are generally good, but a canal width restriction upstream requires tow re-configuration. Physical limitations do not allow guidewall extensions either upstream or downstream. Additional tow assistance may be helpful, as well as a pair of downstream mooring cells. No resource concerns were identified.

b. Brandon Road Lock and Dam, Joliet, Illinois. The major concern upstream is wind; even a relatively light wind can affect tow entry and exit. Downstream, a shallow, rock bottom canal makes tow passage difficult. No structural measures were considered aside from mooring cells (two below the lock and one above). Again, no resource concerns were voiced at this site.

c. Dresden Island Lock and Dam, Morris, Illinois. Approach conditions are generally good, but upbound tows have difficulty with a narrow railroad bridge opening. This bridge actually is a major impediment, and consideration has been given by other agencies to its removal or replacement. Additional mooring cells were again recommended as the most useful measure at this site. These would be particularly beneficial upstream where tows presently push into the bank near I&M Canal Preserve lands, with resultant resource damage.

d. Marseilles Lock, Marseilles, Illinois. This site is generally considered as the major bottleneck on the entire Illinois due to the narrow, shallow 2.5-mile approach canal above the lock. Downstream, existing mooring cells are considered a hazard because they are improperly located; a similar situation also occurs above the lock. Industry would consider removal of these cells beneficial, and strategic placement of new cells upstream and downstream would lessen resource damage to banklines. Extended guidewalls are also considered as a potential benefit at this site; exact length and position are yet to be determined. The other major structural improvement recommended at Marseilles is channel improvements in the upstream canal. The current approach would be to excavate specific passing areas rather than dredge the entire canal; the latter would be problematic due to costs as well as limitations imposed by considerable rock substrate. Preliminary studies have been done on this proposal, including planning for dredged material placement. Environmental studies would need to be expanded or supplemented. The general area was identified during the site visit as a world class walleye/sauger fishery, and concerns were voiced on the impact of any channel alterations as well as ongoing siltation in the canal.

e. Starved Rock Lock, Utica, Illinois. The upstream approach is considered good at Starved Rock; downstream, a narrow channel that is subject to silting in makes the

approach difficult. A recommendation will be carried forward that a submerged dike or similar structure be considered to remedy this situation; if siltation can be limited, placement of a mooring cell here would also help bankline impacts to Plum Island. Discussion of additional tow assistance revealed that any consideration of a remote mooring facility upstream would need to consider potential impacts on submerged historic properties (the submerged Delbridge Island). No other structural measures were considered, other than those immediately associated with the lock facility.

B. Tailwater Impact Analysis. The U.S. Fish and Wildlife Service voiced concern that the HEP procedures used in this study would not adequately evaluate the impacts resulting from construction-induced changes in the tailwaters, mainly those changes occurring in the main channel. To address those concerns, available aquatic habitat in the tailwater was determined using output from calibrated depth and velocity models. Description of this modeling effort can be found in Appendix E. The effect of new construction was determined by comparing the amount of available habitat before construction with the amount of habitat available after construction. This type of analysis has been used in past studies (dealing with both regulatory dams and hydropower generation) by melding depth, velocity, and substrate parameters into a grid, matrix or contour diagram(s) (Wilcox D.B., 1987). A similar approach was employed for this study using depth and velocity data. Initially, substrate data (when available) were also included in this analysis but were later removed due to concerns about extrapolating the data. Using the known habitat requirements of selected fish species, output from the models was used to determine increases and decreases in habitat. It was determined that of the remaining construction alternatives, lock Location 4, with a replacement of a gate in the overflow section, would be the alternative most likely to cause changes in the tailwater. Consequently, that alternative was modeled and evaluated at each lock and dam.

The models were developed using velocity and depth information from existing sources. Substrate information was collected in 1997 at Locks and Dams 22, 25, and La Grange. At the time of substrate sampling, prototype velocity data were collected to allow further model calibration. This sampling was specifically designed to match the draft outputs of the hydraulic modeling, so transect and sample point spacing was concentrated in areas of predicted velocity change. Descriptions of the substrate sampling and hydraulic modeling are included below. Additional substrate information was incorporated from ponar samples taken during mussel surveys performed in 1997.

Substrate, velocity, and bathymetric data were imported into Arc Info to identify and quantify existing habitat and to determine changes in habitat with construction of a 1,200-foot lock and guidewall at Location 4. With the input of biologists from the U.S. Fish and Wildlife Service, Illinois Department of Natural Resources, and Missouri Department of Conservation, a group of fishes was chosen to reflect habitat changes in the tailwaters. The known habitat requirements (velocity and depth) of those species were used to determine available habitat. Substrate data were not extensive enough to allow incorporation into a grid or accurate extrapolation throughout the entire tailwaters, but are generally discussed relative to habitat gains and losses. Evaluations were conducted for Locks and Dams 20-25 on the Upper Mississippi River. Appendix F illustrates and summarizes changes in available habitat by species and by lock and dam. Results are presented in Section 6 of

this report. Though substrate data were collected at La Grange, complete analyses were not performed at this site or at Peoria Lock and Dam. For Peoria, only a 1-dimensional hydraulic model exists, and no models were ever developed for La Grange. There is no Location 4 lock option at either of these sites, and recent (preliminary) economic and traffic forecast information indicates that recommendation of large-scale measures at these sites is unlikely in the foreseeable future. Thus, model development or detailed analyses were not considered appropriate.

Table 8 shows the fishes and habitat variables evaluated in this study. The information included came from Habitat Suitability Index Models (Blue Books) and from Instream Flow Incremental Methods (IFIM) published by the U.S. Fish and Wildlife Service.

TABLE 8: Habitat Variables Used in Tailwater Analysis

Species	Velocity(cm/sec)	Depth (m)	Flow (cfs)	Substrate*
Lake sturgeon forage	2-58	.23-10.5	50,000-75,000	silt, sand, gravel, cobble
Lake sturgeon spawning	6-150	.15-6	95,000-120,000	gravel, cobble, boulder
Channel catfish general	0-26	Any	50,000-75,000	logs, boulders, brush, debris
Paddlefish spawning	25-No limit	No limit	95,000-120,000	gravel, cobble
Paddlefish foraging	0-38	2.4-No limit	50,000-75,000	any
Sauger/walleye spawning	42-115	Any	95,000-120,000	gravel, cobble, boulder, bedrock
Sauger/walleye winter	0-11	1.4-No limit	50,000-75,000	any
Emerald shiner general	0-50	Any	high and low flows	any
Largemouth bass general	0-13	Any	50,000-75,000	vegetation, logs, debris
Largemouth bass spawning	0-4	Any	95,000-120,000	sand, silt, clay, gravel
Largemouth bass winter	0-1.2	Any	50,000-75,000	cover

* Substrate was not used as a variable in the model. Substrate information, when available, was added to and evaluated with the modeling results.

1. Description of Substrate Sampling. The majority of existing substrate data have been collected for very limited and specific project locations, primarily maintenance dredging. To extend data coverage in the tailwater areas under study and to complement other information on depth and velocity, substrate information was collected in 1997 at

three lock and dam sites—L/Ds 22, 25 and La Grange. The sampling design consisted of individual sample sites arranged in a grid system, and concentrated in areas where structural changes are proposed and where hydraulic models in turn predicted changes in velocity to occur. The majority of samples were collected downstream of the dam; upstream, safety was a major concern, and flow changes were predicted to be very localized.

The survey boat was equipped with differential Global Positioning System (GPS), allowing recording of coordinates for each site and ready import into GIS coverages of the overall tailwater. The sampling device was a 2-inch-diameter core sampler, and core lengths ranged from 1 inch to 10 inches. Field observations of samples were made and other pertinent information recorded at the time of sample collection. Sample sizes were as follows: L/D 22 - 53; L/D 25 - 22; and La Grange - 17. Samples were analyzed by the Rock Island District's Geotechnical Laboratory for grain size distribution (minus #200 sieve size) and D_{10} particle size. Classification of samples was in accordance with the "Unified Soils Classification System" (U.S. Bureau of Reclamation). All data were then color coded onto six broad categories and overlaid on existing GIS coverages of velocity and depth information.

2. Results. Areas of suitable velocity and depth for each species were calculated and are portrayed on the figures located in Appendix F. Summary changes in available habitat are also included. Habitat losses were defined as areas that, without the project, were suitable habitat for the species, but with the project would become unsuitable habitat. Habitat gains represent the change from unsuitable habitat before the project to suitable habitat after the project. Suitable velocity, depth, and substrate requirements for each species were determined utilizing the suitability index curves that were used in the site-specific HEP analysis. Values of 0.5 to 1 (on a 0-1 scale) were considered suitable. Values below 0.5, while still having some value to the species, were not considered suitable for this exercise.

As indicated in Table 8, low-flow conditions ranged from 50,000 to 75,000 cfs and high flow conditions ranged from 95,000-120,000 cfs. As mentioned in the introductory section, substrate information was not included in the actual analyses, but is discussed in a general manner.

It is important to remember that in this analysis only depth and velocity were modeled, and that other factors like substrate, turbidity, disturbance, and the availability of cover, to name a few, also influence the presence of particular species. Adequate depths and velocities do not ensure that a species will occur in areas that appear as suitable habitat. Instead, these analyses should be used as a general overview of the changes that are expected to occur at each lock and dam but do not indicate absolute gains or losses in habitat.

Lock and Dam 20

Lake Sturgeon - At low flows, most of the area landward of the proposed 1,200-foot lock would become unsuitable lake sturgeon foraging habitat. Discussions with the Missouri Department of Conservation indicated that some habitat might be enhanced in the eddy created near the end of the guidewall. Substrate in the area is suitable for lake sturgeon foraging, varying from silt and sand to gravel and cobble. The predominate substrate appears to be sand.

At high flows, the same area landward of the proposed lock becomes unsuitable spawning habitat, as do some areas adjacent to the small island on the left descending bank. Lake sturgeon require gravel, cobble, or boulders as spawning substrate. According to the lake sturgeon HSI model, sand is a poor spawning substrate. Ponar samples collected in 1997 showed that most of the area downstream of the gates on the left descending bank (indicated as suitable or lost habitat) does not have the substrate required for spawning. Samples collected downstream and near shore of the present lock revealed a high percentage ($\geq 50\%$) of suitable spawning substrate. The area directly downstream of the auxiliary lock bay, indicated as lost habitat, does not have suitable spawning habitat.

Channel Catfish - At low flows, there is an increase in available habitat landward of the lock and guidewall. Substrate sampled in the area ranged from gravel to silt, but consisted mostly of sand. A small area (approx. 1.5 acres) directly below the existing gates would become unsuitable habitat. These results are a good example where the model's output may not reflect actual gains and losses in habitat. Channel catfish have a strong association with cover (logs, debris, riprap, cavities), and areas without this cover will likely not provide high quality suitable habitat, regardless of velocity. This type of habitat, in association with the tailwaters, is usually found only along the banks of the river.

Paddlefish - At low flows, the model shows a mid-channel decrease in suitable paddlefish foraging habitat. Some small patches below the existing auxiliary lock bay also show a decrease in foraging habitat. Substrate in these areas is predominantly sand. Substrate, according to the paddlefish HSI model, is not a variable in determining foraging habitat.

At high flows, the area inside and downstream of the lockwall would become unsuitable spawning habitat. Based on ponar samples, some of the substrate in this area could be suitable for spawning (gravel, cobble). An area adjacent to the small island on the left descending bank also becomes unsuitable. The substrate within that area is a mixture of sand and gravelly sand and would not be suitable spawning substrate. The model indicates that most of the tailwater area (515 acres) is suitable spawning habitat. In actuality, most of this area probably does not have suitable spawning substrate.

Sauger/Walleye - At winter flows, the area inside the lockwall would become suitable overwintering habitat. The actual value of the habitat would likely be compromised by potential ice flushing through the lock and winter tow or recreational craft passage. Substrate at that site varies from sand to gravel and cobble.

During high flows, approximately 20 acres along the main channel border become unsuitable spawning habitat. Ponar samples collected along the right descending bank found some gravel and cobble in those areas of lost habitat. Most of the area indicated as suitable spawning habitat probably does not have suitable substrate (gravel, cobble, or rubble).

Emerald Shiner - At low flows, the entire tailwater shows a minor decrease in available habitat. This change is not large enough to appear on the figure (Appendix F). At high flows, a narrow strip along the new 1,200-foot lockwall and an area on the left descending bank become suitable emerald shiner habitat. Substrate in these areas varies from sand to gravel and cobble. A small area immediately below the dam would become unsuitable habitat.

Largemouth Bass - Like the channel catfish, largemouth bass have a strong association with bottom cover. Areas without cover may not be used, even with appropriate depths and velocities. Changes in these areas (the main channel and directly behind and below the proposed lock) are not as important as changes in areas with cover (the main channel border). Most of the changes in habitat at L/D 20 occur landward of the new lock and probably would not impact largemouth bass habitat. Very few habitat changes occur along the main channel border.

Lock and Dam 21

Substrate information from Lock and Dam 21 was not available.

Lake Sturgeon - With construction of the 1,200-foot lock, an area on the left descending bank adjacent to the existing boat ramp would become unsuitable spawning habitat at high flows. The results of the model also showed increases in suitable spawning habitat near the mouth of Monkey Chute and the replacement gate (on the right descending bank). Further discussions with the Missouri Department of Conservation indicated that neither area likely contained suitable spawning substrate.

At low flows, the model showed that a large area landward from the 1,200-foot lock and guidewall would become unsuitable lake sturgeon forage habitat. A large area below the gates in the main channel also becomes unsuitable. The area below the mouth of Monkey Chute and the replacement gate appears to become suitable lake sturgeon forage habitat. The types of substrates typically found in Mississippi river tailwaters are suitable for lake sturgeon foraging.

Channel Catfish - At low flows, most of the area landward and downstream of the 1,200-foot lock and guidewall (approx. 26 acres) would become suitable for catfish. A narrow band along the right descending bank, below the replacement gate, would become unsuitable catfish habitat (approx. 9 acres). The actual habitat value of these sites would likely relate to the amount of cover present. Given the location of the changes, it is not likely that either site in its entirety provides, or provided, good catfish habitat.

Paddlefish - At low flows, the area landward of the 1,200-foot lock would become unsuitable paddlefish forage habitat, while an area downstream of the lock would become suitable habitat. An area on the right descending bank, below the last existing gate, would also become unsuitable forage habitat.

At high flows, the area landward of the lock and guidewall becomes unsuitable for paddlefish spawning. An area downstream from the replacement gate on the right descending bank would become suitable for spawning. Discussions with the Missouri Department of Conservation indicated that essentially no suitable spawning habitat was available below L/D 21.

Sauger/Walleye - At low flows, a sizeable area (approx. 30 acres) landward and downstream of the 1,200-foot lock and guidewall becomes suitable wintering habitat. Similar to L/D 20, the value of the overwintering habitat would likely be a result of the regularity of ice flushing through the lock and winter tow or recreational craft passage. Small pockets of habitat (approx. 7 acres) throughout the tailwater become unsuitable wintering habitat.

At high flows, a large area (>30 acres) landward and downstream of the 1,200-foot lock and guidewall becomes unsuitable spawning habitat. Approximately 13 acres directly downstream from the proposed replacement gate would become unsuitable spawning habitat.

Emerald Shiner - The model results indicate that at low flows nearly 37 acres in the main channel would become unsuitable emerald shiner habitat. At high flows, 19 acres extending downstream from the replacement gate would become unsuitable habitat for emerald shiner. Approximately 30 acres of suitable habitat would be created behind and below the new lock and guidewall.

Largemouth Bass - Like the channel catfish, largemouth bass have a strong association with bottom cover. Areas without cover may not be used, even with appropriate depths and velocities. Changes in these areas (the main channel and directly behind and below the proposed lock) are not as important as changes in areas with cover (the main channel border). Most of the low-flow changes in habitat do not occur in these areas with cover. Those changes that do occur in the main channel border appear to be equally split between gains and losses in habitat. Adult overwintering and fry development habitat gains and losses are nearly equal, with 9.4 acres lost below the replacement gate and 9 acres gained landward of the guidewall.

At high flows, almost 6 acres below the replacement gate would become unsuitable spawning habitat. Approximately 21 acres landward of the 1,200-foot lock and guidewall would become suitable largemouth bass spawning habitat. Neither area likely provides, or provided, much suitable spawning habitat.

Lock and Dam 22

Lake Sturgeon - With construction of a 1,200-foot lock and guidewall, the area landward of the structures would become unsuitable foraging habitat at low flows according to the model. Substrate in the area, largely sands, provides suitable foraging substrate. A large area extending outside and downstream of the lockwall and guidewall would also become unsuitable forage habitat. Substrates in that area are also primarily sand. Near the overflow section of the dam there is an area that, based on Missouri Department of Conservation fish sampling data, is confirmed lake sturgeon habitat. This area shows both increases and decreases in available habitat at low flows. An area approximately 0.5 acre in size appears to become unsuitable forage habitat, while immediately downstream of the area a 0.9-acre area becomes suitable habitat. Substrate in that area consists of silts and sands.

At high flows, the area landward of the new 1,200-foot lock becomes unsuitable for lake sturgeon spawning. Substrate in the area is predominately sand, a poor spawning substrate. In fact, most of the area indicated as spawning habitat in the tailwater does not have a suitable spawning substrate (per substrate samples collected below L/D 22 and discussions with the Missouri Department of Conservation). Some small pockets below the overflow section are also projected to become unsuitable, while other small pockets in the same area are projected to become suitable spawning habitat. The model also indicated that the area inside the new lock chamber would become suitable spawning habitat. The location of this habitat, however, essentially negates its value.

Channel Catfish - At low flows, an area (approx. 30 acres) landward of the 1,200-foot lock and extending downstream becomes suitable habitat. A section extending downstream from the replacement gate (approx. 13 acres) becomes unsuitable habitat. Most of these changes occur in the main channel border where the chances of suitable cover are good.

Paddlefish - At low flows, the area landward of the 1,200-foot lock would become unsuitable paddlefish forage habitat. An area immediately downstream of the new lock and extending along the right descending bank would become suitable. On the opposite shoreline, extending downstream from the replacement gate, there is a loss of foraging habitat.

During high flows, a 30-acre area landward and downstream of the 1,200-foot lockwall and guidewall would become unsuitable spawning habitat. Substrate in that area is primarily coarse sand. Downstream from the replacement gate, approximately 12 acres of suitable spawning habitat is created. Substrate varies from rock to sand and silt. Substrate sampling actually indicated that very little suitable spawning substrate (gravel, cobble, and boulder) was present in the tailwater and that those areas with suitable substrate were not affected.

Sauger/Walleye - During low flows, the model indicated that an area extending downstream from the replacement gate would become unsuitable wintering habitat. A

moderately sized area landward and downstream of the 1,200-foot lock and guidewall becomes suitable wintering habitat. The value of the overwintering habitat would likely be a result of the regularity of ice flushing through the lock and winter tow or recreational craft passage.

At high flows, a large (>40 acre) area along the Missouri side of the river becomes unsuitable spawning habitat. Substrate samples showed that most of the area lost was sand, a poor spawning substrate. Some gravel was also found. Approximately 12 acres of habitat was created downstream of replacement gate. This area is mostly clays and sands, which are not good spawning substrates.

Emerald Shiner - At low flows, a slender area immediately landward and downstream of the 1,200-foot lock would be suitable emerald shiner habitat. A moderately sized (approx. 28 acres) mid-channel area becomes unsuitable habitat. Substrate in the area consists mainly of sand. At high flows, a long, slender main channel border area, landward and downstream of the 1,200-foot lock and guidewall, becomes suitable emerald shiner habitat. Substrate in this area is primarily coarse sand but includes some gravel. A slender section extending downstream from the replacement gate would become unsuitable for the species. Substrate varies from rock to silt and sand.

Largemouth Bass - At low flows, an area landward of the 1,200-foot lock near the existing auxiliary lock bay becomes unsuitable habitat. Substrate in the area is sand and silt. An area below the 1,200-foot lock and along the shoreline would become suitable habitat. Substrate in that area is primarily coarse sand but also contains some gravel. A section downstream from the replacement gate also becomes unsuitable largemouth bass habitat. Substrates in that section vary from rock to silt and sand. Discussions with the Missouri Department of Conservation revealed that most of these areas lack the necessary cover to be suitable largemouth bass habitat. Only those areas on the bank edge of the main channel border provide suitable cover. Those areas were largely unaffected.

Fry development and wintering habitat for largemouth bass increase immediately below and landward of the 1,200-foot lock and guidewall. This area probably has very little actual habitat for fry development (lack of cover), but may serve as overwintering habitat for adult fish. Substrates in that area consist of sand with some gravel. Habitat losses are clustered in small areas throughout the tailwater.

The area landward of the 1,200-foot lock and guidewall becomes suitable spawning habitat during high flows. Lack of cover and potential traffic disturbance make the value of this increased habitat questionable. Substrates in the area vary from silt to sand and gravel. Losses in spawning habitat occur in small patches throughout the tailwaters and in small areas along Cottell Island.

Lock and Dam 24

Lake Sturgeon - The model indicated that at low flows the area landward of the 1,200-foot lock and guidewall would be unsuitable lake sturgeon forage habitat. Further

discussions with the Missouri Department of Conservation indicated that some habitat might be created or enhanced in the eddy created near the end of the guidewall. A large mid-channel area from the lockwall to the head of Clarksville Island would also become unsuitable. Overall, 95 acres of forage habitat would be lost. Downstream, a narrow strip of area (approx. 7 acres) along the right bank would become suitable habitat.

At high flows, an area landward of the lock and guidewall would become unsuitable for spawning. That area is predominately coarse sand and small gravel. Other small areas near Clarksville Island and downstream on the right descending bank also become unsuitable spawning habitat. Substrate in those areas is unknown. Several small areas, totaling only 1.5 acres, would become suitable spawning habitat.

Channel Catfish - During low flows, the area landward of the 1,200-foot lock and guidewall becomes suitable channel catfish habitat. Substrates in the area are predominately medium to coarse sand and gravel. Losses in habitat are seen below the replacement gate, near the mouth of the Clarksville Island side channel. Losses are also seen throughout the side channel. Substrate near the mouth is primarily silt and fine sand. Substrate composition is not known in the side channel.

Paddlefish - The results of the model indicated at low flows that the lock chamber and an area downstream and landward would become suitable paddlefish forage habitat. Substrates in the area are believed to be predominately medium to coarse sand and gravel. The area immediately adjacent to the existing lock and auxiliary lock bay would become unsuitable habitat. In addition, two areas directly below the replacement gate would become unsuitable forage habitat. Substrates in these areas are primarily silt and fine sand.

At high flows, approximately 48 acres landward and downstream of the lock and guidewall would become unsuitable spawning habitat. Most of the area does not provide suitable spawning substrate. A small 7-acre area in the side channel, near the replacement gate, becomes suitable spawning habitat. Substrates in that area are primarily sand and are not suitable for spawning. Based on available ponar samples and Missouri Department of Conservation information, most of the area indicated as suitable spawning habitat does not have appropriate substrate.

Sauger/Walleye - At low flows, the model indicated that the area landward and downstream of the 1,200-foot lock and guidewall would become suitable wintering habitat. The same area also becomes unsuitable spawning habitat during high flows. Substrates in the area are believed to be predominately medium to coarse sand and gravel. Several areas downstream of the replacement gate would become suitable spawning habitat. Most of the area appears to be sand, a poor spawning substrate. Two large areas in the side channel also become suitable habitat. Substrate in those two areas is not known.

Emerald Shiner - At low flows, a strip along the right descending bank would become suitable emerald shiner habitat. The model also indicated that habitat would be lost immediately below the replacement gate and along Clarksville Island, extending into the main channel. At high flows, the strip of suitable habitat along the right descending bank

nearly doubles in size. Losses in emerald shiner habitat at high flows are seen at the mouth of the side channel and throughout the side channel adjacent to Clarksville Island.

Largemouth Bass - Approximately 36 acres landward and downstream of the 1,200-foot lock and guidewall becomes suitable habitat at low flows. Substrates in the area range from medium and coarse sand to gravel. Discussions with the Missouri Department of Conservation suggest that only the habitat near the bank could actually be suitable. The area immediately below the replacement gate (6 acres) becomes unsuitable largemouth bass habitat. Substrates were predominately silt and fine sand. Fry development and overwintering habitat increase landward of the guidewall. Again, most of this area would not be used by largemouth bass fry due to lack of cover. The area could provide overwintering habitat. Almost no fry development and overwintering habitat is lost (> 1 acre). The results for spawning habitat are similar. At high flows, almost 23 acres of habitat is created. All of these acres are landward of the 1,200-foot lock and guidewall. Sedimentation and tow passage could greatly diminish the value of this new habitat. No spawning habitat would be lost.

Lock and Dam 25

The model for L/D 25 was different from the other models. At high flows, the L/D 25 model had a gate placed in the auxiliary lock bay, landward of a Location 4 lock and guidewall. At low flows, the standard replacement gate position (in the overflow area) was modeled.

Lake Sturgeon - At low flows, the model showed a loss (10 acres) in foraging habitat. Most of these losses would be associated with the footprint of the new lock or area landward of the lock. There would also be habitat lost downstream in the main channel. Substrates immediately near the lock vary from fine to medium sand and some gravel. A small area immediately downstream of the existing lock would become suitable forage habitat. At high flows, an area directly below the mouth of Sandy Slough, along the right descending bank, becomes unsuitable spawning habitat. Substrates in the area range from fine to coarse sand, which are not suitable spawning substrates. Along the left descending bank, two thin ribbons of suitable habitat would be created. Substrates in those areas are believed to be predominately sand, an unsuitable spawning substrate.

Channel Catfish - At low flows, the area below the auxiliary lock bay becomes unsuitable catfish habitat, as does a small strip of habitat along the main channel border on the left descending bank. The predominate substrate below the auxiliary lock bay is sand. The model indicated that habitat would be created in the new lock chamber. This habitat in reality has little value. There would be an increase in habitat along the right descending bank below the mouth of Sandy Slough. Substrates in this area vary from sand to gravel and cobble.

Paddlefish - At low flows, foraging habitat would be lost within and landward of the 1,200-foot lock. A thin strip of habitat would also be lost along the left descending bank.

An area of suitable forage habitat would be downstream of the new lock and extending along the right descending bank. Substrates in that area are medium to coarse sands.

At high flows, paddlefish spawning habitat would be lost landward and downstream of the 1,200-foot lock and guidewall. Substrates in the area are mainly medium to coarse sands, but also include a small patch of gravel and cobble that would provide suitable spawning substrate. Small slender patches of spawning habitat would be created along the left descending bank. Substrate in the area is predominately sand, which is not a suitable spawning substrate. Discussions with the Missouri Department of Conservation suggest that most of the area that the models indicated was suitable habitat did not have appropriate spawning substrates.

Sauger/Walleye - Overwintering habitat at low flows would be created within the 1,200-foot lock chamber (low value habitat), immediately downstream of the lock, and along the right descending bank below Sandy Slough. Overwintering habitat would be lost immediately below the auxiliary lock bay.

At high flows, there is a loss of spawning habitat immediately downstream of the lock and in a sizable area below the mouth of Sandy Slough. Substrates throughout the area range from medium to coarse sands to gravel and cobble. There are also several long patches of suitable spawning habitat, the largest occurring below the overflow section along the left descending bank. Substrates in that area vary from silt and clay to sand.

Emerald Shiner - At low flows, there would be large areas of suitable habitat lost in the main channel. There would also be a loss of habitat directly below the auxiliary lock bay. At high flows, a sizable area landward and downstream of the 1,200-foot lock and guidewall becomes suitable habitat. Losses in habitat were seen along the left descending bank and in the main channel directly below the dam.

Largemouth Bass - During low flows, suitable habitat for adult and juvenile largemouth bass would be lost immediately below the auxiliary lock bay. This area probably would not provide suitable cover. Increases in suitable habitat would occur below the lock (adjacent to the guidewall), which would not provide suitable cover, and along the right descending bank near the mouth of Sandy Slough, which is likely to have suitable cover. Substrate in that area is medium to coarse sand.

Overwintering and fry habitat is almost non-existent in the tailwater and would slightly increase with a new lock and guidewall. Most of these areas would not be used by largemouth bass fry due to lack of cover. These areas could provide overwintering habitat.

At high flows, the lock chamber becomes suitable spawning habitat, but in reality has no spawning value. Spawning habitat would be created along the shoreline below Sandy Slough. Substrates in the area vary from medium and coarse sand to some gravel and cobble. A small amount of spawning habitat would be lost along the right descending bank.

3. Discussion. The habitat changes described previously are based on velocity and depth. Substrate information, when known, was included in the results. As stated earlier, many other factors and variables affect the suitability of habitat for the different species. Adequate depths and velocities do not ensure that a species will occur in areas that appear to be suitable habitat. Instead, these analyses should be used as a general overview of the changes that are expected to occur at each lock and dam and do not indicate absolute gains or losses in habitat. However, some conclusions can be drawn.

As in many large river systems, velocity appears to drive changes in habitat. In general, the placement of a 1,200-foot lock in Location 4 and the associated guidewall would cause a decrease in velocity landward of the structures. Replacement of the gates in the overflow section of the dam would increase velocities. Consequently, the area below the gate should scour and deepen, resembling the conditions below existing gates. **Conclusions should be made cautiously when evaluating these data.** They give a general idea of where velocity and depth have changed, but not that the habitat was suitable in the first place.

Lake Sturgeon - All five tailwaters examined in this analysis had net losses in forage habitat with the project. By percentage, losses in habitat in the tailwater ranged from 1.3% to 13.3%. Lake sturgeon are known to forage over a range of substrates (silt to cobble), most of which occurred in the analysis areas. Because substrates in the tailwater are suitable for foraging, it is likely that these losses in habitat are genuine. However, the significance of these losses is relatively small, as most of the Mississippi River provides suitable forage habitat. Net losses in spawning habitat were seen at every site except L/D 25, which showed a 2% increase in habitat. Losses at the other locks and dams ranged from 1.1% to 5.1%. Losses in habitat tended to occur landward and downstream of a new lock and guidewall. In most cases, the areas that became suitable spawning habitat were located along the bank opposite the new lock. It is difficult to determine if these changes (losses/gains) are real. Lake sturgeon spawn over a variety of substrates, with gravel, cobble, and boulder being the preferred (suitable) substrates according to the HEP model. These types of substrate are found, but are not abundant, in the tailwaters. Because these substrates are not abundant in the tailwater, determining their presence while sampling is difficult, and consequently determining actual changes in habitat is difficult. Likely, much of the area that the model reported as suitable habitat, based on depth and velocity, does not provide a suitable spawning substrate.

Channel Catfish - Four of the five tailwaters showed an increase in channel catfish habitat (L/D 24 had no change) with the project. Increases ranged from 6.1% to 12%. Most of the gains occurred landward and downstream of the new lock and guidewall. Losses were generally located downstream of the replacement gates. It is likely that these reflect actual changes in habitat. At each L/D, most of the suitable habitat was confined to the main channel border. Channel catfish have a strong association with cover (logs, debris, riprap, cavities), and areas without this cover will likely not provide suitable habitat, regardless of velocity. On the river, these types of cover are most plentiful along the main channel border. Given that cover is available in the main channel border to attract catfish, changes in velocity in these areas would alter available habitat.

Paddlefish - Paddlefish forage habitat increased at three sites (L/D 22, 24, and 25) and decreased at two sites (L/D 20 and 21). Habitat increased as much as 21% and decreased as much as 13%. Losses were generally located landward of the new lock (likely depth-related) and downstream of the new replacement gate (likely velocity-related). Gains were largely located downstream of the new lock and guidewall. Velocity and depth are the two major determinants of paddlefish forage habitat so it is likely that the changes in habitat produced by the models were accurate. Spawning habitat decreased at all five locks. Losses ranged from 3.7% to 6.3%. Losses were largely confined to the area landward and downstream of the new lock and guidewall. Gains in spawning habitat were typically seen below the new replacement gate. Paddlefish typically move through the dams and tailwaters to more suitable spawning habitat within the navigation pools or in tributary rivers, but will spawn downstream of dams if an appropriate substrate is available. Other factors like temperature, dissolved oxygen levels, and rising water levels (all largely unaffected by construction) are important for paddlefish spawning success. Suitable substrate for spawning is gravel or cobble. Without exception, almost the entire tailwater below each lock and dam was considered suitable spawning habitat. In reality, only a small percentage of that habitat (that with gravel or cobble substrate) is actually suitable. Because these two substrates are not abundant in the tailwater, determining their presence while sampling is difficult, and consequently determining accurate changes in spawning habitat is difficult.

Sauger/Walleye - Overwintering habitat increased at all five sites with the project. Increases ranged from (32% to 741%). Most of the overwintering habitat was created landward and downstream of the new lock and guidewall. Losses in overwintering habitat usually occurred below the new replacement gate. Overwintering habitat at the locks and dams is generally very limited, and increases in available habitat are desirable. The value of this newly created habitat would be directly tied to the amount of disturbance it receives. During the winter, fish are in a very low state of activity, and even small levels of disturbance may induce enough stress to cause death. Most of the habitat is landward of the new lock and guidewall and would be isolated from winter tow traffic. Instead, disturbance at these sites would likely come from operation of the 600-foot lock or from operations practices like flushing ice through the 600-foot lock chamber. If these areas are not disturbed, they could provide suitable overwintering habitat. However, if they are disturbed infrequently during the winter, they could actually be very detrimental to fish by creating an attractive, yet potentially deadly, overwintering area.

Spawning habitat also decreased at almost every site. Decreases ranged from 4% to 7%. One site, L/D 24, increased less than 1%. Most of the losses in spawning habitat were landward and downstream of the new lock and guidewall. Gains in habitat were typically associated with the bank opposite the lock, usually downstream from the new replacement gate. Sauger and walleye use a variety of spawning substrates including cobble, gravel, boulder, or bedrock. The highest increases in overwintering (+741%) and spawning habitat (+979%) were seen at L/D 24. These unusual increases can be attributed to the existing homogeneity of habitat at that location. L/D 24 lies on a straight stretch of the

river with little quality habitat or aquatic diversity, so construction changes have a large effect on the area.

Emerald Shiner - At low flows, emerald shiner habitat decreased in every tailwater. Losses ranged from 0.01% to 9.7%. At high flows, emerald shiner habitat increased in every tailwater. Increases ranged from 4.9% to 15.4%. The difference between high and low flows can be explained by the fact that during high flows emerald shiner habitat is restricted to the main channel border. During low flows, shiner habitat extends farther into the main channel. Construction of a new lock and guidewall creates a suitable lower velocity shadow landward and downstream during high flows. This shadow provides suitable emerald shiner habitat. During low flows, losses in habitat occur largely in the main channel below the existing gates. During high flows, losses are generally confined to areas downstream of the replacement lock. Emerald shiners are considered habitat generalists, being found most everywhere in the river. Model results for this species should be accurate. Because of their generalist nature, loss of emerald shiner habitat in the tailwaters is likely not to be significant.

Largemouth Bass - At low flows, largemouth bass adult and juvenile habitat would be created at every lock except L/D 22, which had no change. Increases for the other four sites ranged from 8.4% to 265%. Most of the habitat would be created landward and downstream of the new lock and guidewall. Losses in habitat were concentrated near the existing lock or below the replacement gate. Like the channel catfish, suitable habitat for the largemouth bass would be confined to the main channel border. Largemouth bass have a strong association with bottom cover (logs, debris, aquatic vegetation) and areas without this cover will likely not provide suitable habitat, regardless of velocity. On the river, these types of cover are most plentiful along the main channel border. Given that cover is available in the main channel border, changes in velocity in these areas would alter available habitat.

Four of the five lock sites had an increase in fry development and adult overwintering habitat. Increases ranged from 15.8% to 2016%. One site, L/D 21, had a decrease in available habitat of 1.5%. Most of the overwintering and fry development habitat was created landward of the new lock and guidewall. Losses in habitat were generally small and had no pattern of occurrence. Similar to the walleye and sauger, overwintering habitat at the locks and dams is generally very limited, and increases in available habitat are desirable. Like those species, the value of this newly created habitat would be directly tied to the amount of disturbance it receives. Lack of appropriate cover at most locks greatly diminishes the value of any fry habitat.

Potential largemouth bass spawning habitat increased at every site in this study. Increases ranged from 21.5% to 1661%. Similar to other species, most of the gains in habitat come landward of the new lock and guidewall. Losses in habitat were confined to the bank opposite the lock, below the replacement gate. Largemouth bass spawn over a range of substrates, with silt being the notable exception. Given the location of most of the created habitat, it is possible that large amounts of silt would be present, making the true value of this habitat questionable.

L/D 24 again showed extremely large increases in adult juvenile habitat (+265%), overwintering and fry development habitat (+2016%), and spawning habitat (+1661%). Again, these increases can be attributed to the homogeneity of habitat at that location.

Largemouth bass are not usually found in high numbers in tailwater areas, preferring other more suitable areas on the Mississippi River like backwaters and side channels. While changes in largemouth bass habitat are important in the tailwater because they show general changes in velocity and depth resulting from construction, it is important to remember that those changes do not indicate that the largemouth bass actually occur in those areas (which in most cases they do not).

The HAT believes that this tailwater analysis provides a useful tool for estimating the extent of construction-induced velocity changes throughout the tailwaters. However, more confidence in estimating effects on individual species is given to the HEP evaluation because it has considered all of the life requisites required by the fishes that utilize the area. The results of this analysis shed light on potential measures to minimize velocity-induced habitat changes in the tailwaters or even enhance areas, but should not be used to estimate the extent of fisheries impacts without further study.

C. Evaluation of Mussel Resources. Existing literature was reviewed to determine known mussel concentrations within potential impact areas at L/D 11-25 on the Mississippi River and Peoria and La Grange on the Illinois River (Table 9). At L/Ds 20, 22, 24, and 25 on the Mississippi River and Peoria Lock on the Illinois River, there was insufficient information to determine the potential for mussel impacts. A brail survey was conducted by the Rock Island District's Environmental Analysis Branch staff at Peoria Lock and by QST Environmental at Mississippi River L/Ds 20, 22, 24 and 25. Existing information from L/Ds 11-19 is summarized here, but no surveys were conducted. Should future construction activities be proposed, surveys also will be required at those locks and dams.

Mussel surveys are typically undertaken for individual site-specific projects, surveys, or monitoring, and therefore data only exist where there has been a project or prior study. Existing surveys were located and examined for information pertinent to areas identified for potential construction measures within this study. Those studies, general location, and a summary of the results are included in Table 9. More specific information may be found within the survey reports listed in the literature cited. Areas not listed are not necessarily devoid of mussels but have not been surveyed.

**TABLE 9: Known Mussel Concentrations within Vicinity
of Locks and Dams, Various Surveys**
(Does not Include 1997 Surveys)

Lock and Dam	Report or Study	Location of Mussels	Results
11	Wisconsin DNR	RM 583 L	Higgins' eye
12	Stanley Consultants	RM 557.4-557.6 L	12 sp., including Higgins' eye
14	Approach Improvement EA	494-496 L	"rich mussel bed"
15	Stanley Consultants	L Above lock	18 sp., 259 individuals
16	Stanley Consultants	Upstream	7 sp., 18 individuals
17	Stanley Consultants	Upstream	20 sp., 326 individuals
18	Approach Improvement EA	Downstream Bed	Higgins' eye
19	Stanley Consultants	Up/Downstream R	See report
21	Miller 1996, South Quincy levee	Up/Downstream R	
22	Missouri DOC	RM 300-299 R	Sanctuary
25	Miller 1996	RM 240	
IWW La Grange	Personal Comm. LTRM	No known concentration	

Important river reaches for freshwater mussels in the Upper Mississippi River are summarized in Table 10 below. These were taken from Miller, et al. 1997. Areas not listed below are not necessarily lacking in mussel resources but may not have been identified.

**TABLE 10: Important Mussel Habitat within
the Vicinity of Potential Construction**

Lock and Dam			
12	14	15	17
RM 556.8-558.2 L, MS RM 556.0-556.8 R, MS	RM 494.0-496.4 L, SH RM 492.0-493.0 L, SH	RM 481.3-482.4, SH	RM 438.0-439.7 L, SH
18	19	21	22
RM 406.0-410.5 L	RM 364.6-364.8 R RM 361.5-364, MS	RM 325.2-328.5 R RM 324.2-324.9 R	RM 299.6-300.2 R, MS

L - Left Descending Bank, R - Right Descending Bank
 MS - Mussel Sanctuary
 SH - Secondary Habitat (*Lampsilis higginsii*)

The areas listed in Table 10 should be avoided. They are considered to be some of the most valuable mussel beds in the Upper Mississippi River, based not only on the presence of the endangered Higgins' eye pearly mussel (*Lampsilis higginsii*) but also total density and species richness (Miller et al., 1997). Project features with potential impacts to those sites will require formal consultation under Section 7 of the Endangered Species Act as they are likely to contain *L. higginsii*. They may contain State-listed species as well.

In an effort to fill data gaps at Locks and Dams 20, 22, 24, 25 on the Upper Mississippi River and Peoria on the Illinois River, exploratory survey surveys were conducted. QST Environmental was asked to perform exploratory surveys at identified locations upstream and downstream of each lock and dam. Areas identified for lock placement, channel improvement, gate replacement, and wing dam placements were identified as potential impact areas and thus were surveyed for existing mussel resources. Areas upstream at Locks and Dams 22 and 25 were found to contain mussel beds, and an area downstream of L/D 24 was found to contain a concentration of mussels. To better determine the numbers and species richness found in each of these areas, dive surveys would need to be conducted. Complete findings of the QST survey are available in the contractor's report (QST Environmental, 1997).

Potential site-specific mussel impacts at each lock and dam are discussed below. The potential for impacts was evaluated by using the above-listed sources and comparing location information to potential navigation improvement measures at each lock and dam.

1. Mississippi River.

Lock and Dam 11

The Wisconsin DNR reports a known location of Higgins' eye downstream from the dam at River Mile 583, left bank (Thiel, 1981). The area is not impacted by site-specific construction, but if gate replacement or flow changes are necessary, the site may be impacted. There is also an indication that there may be mussels in the downstream approach to the lock on the right bank.

Lock and Dam 12

River Miles 556.8 - 558.2 left bank and 556.0- 556-8 right bank are listed as mussel sanctuaries (Miller ,1997). Stanley Consultants found Higgins' eye in a mussel bed located above the dam at River Miles 557.4-557.6, left bank. There is potential for impacting the entire mussel sanctuary with lock extensions and gate replacement. This would include footprint and velocity change impacts.

Lock and Dam 13

No information is available for L/D 13. Surveys should be conducted if construction is proposed for this area to determine the presence of mussels.

Lock and Dam 14

The Higgins' eye Mussel Recovery Plan identifies River Miles 494.0-496.4, left bank and River Miles 492.0-493.0, left bank as Secondary Habitat for the species. An environmental assessment prepared for approach improvements at L/D 14 mentions a "rich mussel bed" at River Miles 494-496, left bank. Proposed improvements at this lock include extensive channel widening upstream as well as downstream of the lock. If the project is implemented, the area should be surveyed for mussels to determine the effect of sediment transport from dredging on any adjacent mussel beds.

Lock and Dam 15

Immediately above the lock on the left bank, Stanley Consultants (1987) reported a rich mussel bed. This would be potentially affected by both the footprint of a lock extension and associated placement of a series of weirs. Downstream from the lock from River Miles 481.3-482.4 is classified as Secondary Habitat for Higgins' eye.

Lock and Dam 16

Upstream of the lock on the left bank, Stanley Consultants (1987) reported a mussel bed in the approach to the lock. This would be impacted by both the footprints of new lock construction and by proposed weirs and extensive channel improvements. The Natural

Resource Inventory (COE/USFWS 1984) identifies both the areas immediately downstream of the lock and on the opposite shoreline as mussel beds. Perry (1979) and Lopinot (1977) both report mussel beds from River Miles 453.7- 456.5. The right bank is reported to be a commercial mussel bed. If a mussel bed still exists downstream from the lock and dam, it may be affected by the footprint of a lock and by increased flow from gate replacement.

Lock and Dam 17

Stanley Consultants (1987) reported a mussel bed above the lock in the approach area. This would potentially be impacted by proposed weirs and lock footprint. The Higgins' eye Mussel Recovery Plan identifies River Miles 438.0-439.7, left bank as Secondary Habitat. If further channel modifications are proposed, the area should be surveyed and measures evaluated for potential effects. There is extensive dredging and a wicket gate proposed for this location, which should all be surveyed to determine if other mussel concentrations are within the vicinity.

Lock and Dam 18

Miller et al. (1997) lists River Miles 406.0-410.5, left bank as containing a mussel bed and Cawley (1985) recorded Higgins' eye in the vicinity. Lock placement may directly impact a portion of this mussel bed at River Mile 410. Detailed surveys should be conducted prior to any construction to determine the extent of this mussel bed and presence of listed species.

Lock and Dam 19

Upstream of the lock at River Miles 364.6-364.8, right bank is identified in Miller et al. (1997) as an important mussel bed on the Upper Mississippi River. Stanley Consultants (1987) described the area and survey conducted at the site. Downstream, River Miles 361.5-364, right bank is defined as mussel sanctuary. Freitag (1978) and Fuller (1978) described mussel surveys between River Miles 360 and 364.1. Impacts at this site may include the footprint of a lock, channel widening downstream of the lock, and placement of bendway weirs upstream of the lock. Detailed surveys should be conducted prior to any construction to determine the extent of this mussel bed and presence of listed species.

Lock and Dam 20

There was no existing information pertaining to mussels at L/D 20. An exploratory trail survey was conducted in October 1997 to determine the presence of native mussels in the project area (QST Environmental, 1997). Areas of potential footprint impacts or that would be affected by velocity changes due to construction were surveyed with a total of 63 trail transects. An area downstream from the lock on the right descending bank from the vicinity of RM 342.7-342 was found to have the largest number of individuals and species. Four species and 12 individuals were collected in nine trail transects. Included in this was the Illinois State threatened butterfly (*Ellipsaria lineolata*) and Missouri watch list

hickorynut (*Obovaria olivaria*). Hickorynut was also collected on the opposite side of the river in areas that would be dredged if a wicket gate were to be selected as an alternative; however, large concentrations of mussels were not present in these locations.

Lock and Dam 21

River Miles 324.2-324.9 and 325.2-328.5, right bank are identified as important mussel habitat in Miller et al. (1997). Additional information can be found in Ecological Analysts (1981d) pertaining to the area downstream from the lock where no concentrations of mussels were found. Numerous additional surveys are listed in the Natural Resource Inventory. The entire right descending bank is known to be rich mussel habitat. Impacts to the area should be avoided. Placement of a new gate on the right bank may affect the mussel beds and habitat by changing flow. If navigation improvements are chosen for this lock, additional surveys should be conducted.

Lock and Dam 22

Downstream from the lock between River Miles 299.6-300.2, right bank is a mussel sanctuary. The area is not affected by construction impacts, and hydraulic modeling shows that velocity should not change within the vicinity of the mussel sanctuary. Areas identified as potential impact areas resulting from navigation improvements were surveyed by brail in October (QST Environmental, 1997). A rich mussel bed was found on the right descending bank above the lock. The brail survey found 214 individuals (including 89 juveniles captured on the brail by byssal threads) consisting of 14 species. Included in this were the Illinois threatened butterfly, Missouri watch list hickorynut, and Missouri rare species rock pocketbook (*Arcidens confragosus*) and wartyback (*Quadrula nodulata*). The species diversity and number of juveniles located suggest a healthy mussel bed. Impacts to this area should be avoided. A series of emergent wing dikes is proposed for the vicinity. The mussel bed should be surveyed further through a dive survey to determine its extent and species composition. Different measures to reduce the outdraft problem for tow traffic and avoid impacts to the mussel bed should be sought. In addition to footprint impacts, velocity changes and associated sedimentation will affect this mussel bed. Two individuals were collected immediately downstream of the proposed gate replacement area, but no mussels were collected in any other survey locations.

Lock and Dam 24

No existing information was found within the project vicinity. Areas identified as potential impact areas resulting from navigation improvements were surveyed by brail in October (QST Environmental, 1997). Upstream of the lock, several mussels were found concentrated above the existing wing dam (8 individuals, 4 species) and in another area approximately 400 yards upstream (2 individuals, 2 species). A concentration of mussels was found downstream of the lock near the Clarksville, Missouri, shoreline. The concentration was found near shore in an area not within the footprint but may have increased sedimentation due to decreased flows behind the lockwall. Twenty-nine individuals, including the Illinois threatened butterfly, Missouri watch list hickorynut, and

Missouri rare species rock pocketbook and wartyback were collected. This area should be surveyed to determine the extent of the mussel concentration and determine if a bed is present.

Lock and Dam 25

No existing information was found for the project vicinity. Areas identified as potential impact areas resulting from navigation improvements were surveyed by brail in October (QST Environmental, 1997). A mussel bed was located immediately upstream from the lock on the right bank. Thirteen transects yielded 125 individuals consisting of 14 species, most of which were found in 4 brail transects within the upstream portion of the area. Placement of a 1,200-foot lock in Location 1 would require the mussel bed to be excavated for an approach channel. Immediately upstream of the overflow section of the dam adjacent to the first gate, 49 individuals consisting of 9 species were located with the brail. Both areas included Missouri watch list hickorynut, and Missouri rare species rock pocketbook and wartyback. If a lock is placed at Location 4, there may be a new gate placed in the overflow section of the dam. Placement of the gate would change the velocity and substrate found within the site. Dive surveys should be conducted at both locations to determine the extent and species composition of these areas.

2. Illinois River.

Peoria Lock and Dam

Although the LTRM conducts surveys in Peoria Pool and La Grange Pool upstream and downstream of the lock, they do not have information from the immediate vicinity. Rock Island District personnel conducted a brail survey at Peoria Lock on the Illinois River and did not find concentrations of mussels anywhere within the impact area. Results of the survey are summarized below.

Brail Survey at Peoria Lock and Dam, 16 September 1997

Upstream 1 - Upstream of Lock and Dam. River Mile 158.2, left descending bank from Standard Oil Dock to footings of the I-474 Bridge. Shoreline is mud, cobble, occasional trees and developed.

<u>Substrate</u>	<u>Depth</u>	<u>Results</u>
Run 1-Sand/silt	12-14 feet	0
Run 2-Sand/silt		0
Run 3-gravel/sand/shells		0

No mussels were found on the brail. Several dead shells were found in ponar grabs. They were identified as spike (*Elliptio dilatata*), deertoe (*Truncilla truncata*), ebony shell (*Fusconaia ebena*), and pigtoe (*Fusconaia flava*).

Upstream 2 - Underneath I-474 to upstream of lock, left descending bank.

Substrate	Depth	Results
Gravel/cobble	17-19 feet	Run 1- 0 Run 2- 0

Downstream 1 - Downstream of the mouth of Lick Creek. Left descending bank from the mouth of the creek to RM 156. Shoreline is sand with some gravel. Adjacent area forested.

Substrate	Depth	Results
Sand/silt, predominantly sand	5-9 feet	Run 1- Deertoe 1 ¾" Run 2- 0

Downstream 2 - Downstream from the Agrochem Dock (RM 157) to just upstream from Gas Line Warning Sign. Left descending bank. Shoreline is sand. Adjacent area forested.

Substrate	Depth	Results
Silt/sand	9-12 feet	Run 1- 1 Giant floater (<i>Anodonta grandis</i>) 5 ½" Run 2- 0

Downstream 3 - Left descending bank immediately below lock. Shoreline is sand, cobble, and forested. Extends from sewer outfall to Gas Line Warning Sign above Agrochem Dock.

Substrate	Depth	Results
Sand	Run 1- 17 feet Run 2- 10-11 feet	Run 1- 0 Run 2- 1 Giant floater*

**Fell from trail before measurements taken*

La Grange Lock and Dam

A dive survey was conducted at Illinois River Mile 80.0, left bank by the Illinois Natural History Survey (Whitney et al., 1997). The survey did not find any mussels. The right bank immediately below the lock was dredged in the summer of 1996 and therefore it is assumed that there are no mussels in the vicinity. Thus, the likelihood for finding concentrations of mussels within the vicinity of La Grange Lock is very low (Scott Whitney, INHS, personal communication).

D. Potential Site-Specific Endangered Species Impacts. This report does not constitute a Biological Assessment (BA), but portions of it will be utilized in the site-specific portion of the Biological Assessment. Potential impacts to endangered species are being evaluated in a BA and through ongoing Section 7 Consultation with the U.S. Fish and Wildlife

Service. The BA is being done in a tiered manner to coincide with the Systemic Environmental Impact Statement. The first tier will evaluate systemic impacts as well as potential impacts at L/Ds 20-25, Peoria and La Grange. If future construction is to occur, detailed site-specific evaluations will occur and include supplemental NEPA documents and second tiers to the BA, which will be site-specific. Potential endangered species impacts at L/Ds 20-25, Peoria, and La Grange are described here for planning purposes only. Recommendations for surveys and avoid and minimize measures are included, but determination of the potential effect on endangered species will be made in the BA. Compilations of federally listed species potentially occurring at L/Ds 11-19 on the Mississippi River are also included (see Appendix G) but are not discussed in detail. If measures are proposed for those sites, each will be addressed in detail as appropriate. State-listed species will be evaluated as part of the EIS but are listed in Appendix G for information.

Should federally listed species be found that are likely to be affected by any proposed measure, formal consultation under Section 7 of the Endangered Species Act will be initiated. This consultation will require a determination by the Corps as to the extent of site-specific impacts and their effect on the species. Measures to avoid or minimize impacts should be sought, with emphasis given to avoiding impacts altogether. These measures will be coordinated with the U.S. Fish and Wildlife Service and respective State agencies.

Lock and Dam 20

The following federally listed species are listed as occurring within the counties adjacent to the lock and dam and may occur in the project area:

Indiana bat (*Myotis sodalis*)
Bald eagle (*Haliaeetus leucocephalus*)
Higgins' eye pearly mussel (*Lampsilis higginsii*)
Fat pocketbook mussel (*Proptera capax*)

The alternative that includes placement of a wicket gate on the Illinois side of the dam would include removal of an island, which is made up of bottomland forest habitat. With this alternative, there may be impacts to the Indiana bat and bald eagle. This alternative should be avoided to avoid effects to these species. Large mussel concentrations were not located during trail surveys, and therefore endangered mussels are not likely to be impacted by channel alignment associated with the wicket gate.

Bat surveys will be required prior to clearing of the island and the forested area upstream from the lock. A habitat survey to determine suitability of the forest for Indiana bat roost habitat and a bat survey to determine usage by the species will need to be completed. If the area is to be cleared, it should only be cleared between September and April to avoid impacting roosting bats. If the area is found to contain suitable habitat, there may be a need to replace it by planting tree species that provide roost habitat.

During winter, bald eagles perch in the large trees found on the island and feed in the tailwaters of the dam. Removing those trees will require that eagles find other perch trees within the vicinity. There are not many large trees within that area that provide alternative perching sites for the species. Bald eagles are listed to breed and presumably nest somewhere nearby, but outside the project area. The project will not affect the nesting habitat. Clearing of perching habitat should be avoided. If this is not possible, the trees should be replaced. Replacement should be in close proximity to the dam and done as soon as possible as they will not be large enough to replace the habitat for at least 25 years. In addition to planting suitable trees to provide future perching areas, it is possible to construct eagle perches. Options for this include installing large, dead trees or telephone poles with platforms erected.

Brail surveys of the area downstream from the existing lock found 6 species and 12 individuals. Densities that would indicate the presence of mussel beds were not located and therefore it is not likely that endangered mussels would be affected by construction.

Lock and Dam 21

The following federally listed species are listed as occurring within the counties adjacent to the locks and dams and potentially occur within the project area:

Indiana bat
Bald eagle
Higgins' eye pearly mussel
Fat pocketbook mussel

Bald eagles are known to winter in the area and perch in trees adjacent to the lock and dam. The species commonly feeds in the tailwaters of the dam. Alternatives that require clearing of bottomland forest will potentially impact bald eagle perch trees and Indiana bat habitat. Although forest is to be cleared, there is other adjacent forest habitat that will not be impacted by the project. Therefore, perch trees are still available for the eagle. Impacts to the species will be temporary due to disturbance during construction. Bat surveys will be required prior to clearing. The area should only be cleared between September and April to avoid impacting roosting bats. If the area is found suitable for the species or if roost trees are found, impacts should be avoided.

Prior mussel surveys have found mussel beds located on the right descending bank of the river both upstream and downstream of the dam. In addition, the area downstream that may require dredging potentially contains mussels. Endangered species have been found in previous surveys, and therefore more detailed mussel surveys will be required prior to construction activities. They should be conducted in the above-mentioned locations as well as in areas proposed for placement of wing dams and the lock itself. These will both delineate the extent and species diversity of mussel beds and determine the presence of endangered species. Impacts to mussel beds should be avoided.

Lock and Dam 22

The following federally listed species are listed to potentially occur within the counties adjacent to the lock and dam and may occur in the project area:

Indiana bat
Bald eagle
Fat pocketbook mussel
Gray bat (*Myotis grisescens*)

Bald eagles are known to winter in the area and perch in trees adjacent to the lock and dam. The species commonly feeds in the tailwaters of the dam. Alternatives that require clearing of bottomland forest will potentially impact bald eagle perch trees and Indiana bat habitat. Although forest is to be cleared, there is other forest habitat adjacent that will not be impacted by the project. However, clearing of perch trees should still be avoided. Impacts to the species will be temporary due to disturbance during construction.

Bat surveys will be required prior to clearing. The area may only be cleared between September and April to avoid impacting roosting Indiana bats. Some of the bottomland forest to potentially be impacted by staging contains trees that may provide Indiana bat summer roost habitat. If not avoidable, there will be a need to restore it after construction by planting tree species that provide roost habitat. The gray bat potentially occurs in the area and potentially feeds over the edge of the forest canopy. There should be no impact to the species.

The fat pocketbook mussel is known to occur downstream of the lock on the right descending bank within a rich mussel bed. The area is a designated mussel sanctuary by the Missouri Department of Conservation. This area must be avoided. More detailed mussel surveys may be necessary immediately downstream of the dam if a lock is to be placed there. The Higgins' eye pearly mussel is also listed as potentially occurring in the area. Mussel surveys found a mussel bed upstream of the lock on the right descending bank. Thirteen species and 214 individuals were collected, including juvenile mussels, in trail surveys. Construction of a dike field is proposed for this area. More extensive mussel surveys, including dive surveys, should be conducted in this location to determine the extent of the mussel bed and presence of endangered species. Impacts to this bed should be avoided.

Lock and Dam 24

The following federally listed species are listed to occur in the counties adjacent to the lock and may exist within the vicinity of the project:

Indiana bat

Bald eagle
Fat pocketbook mussel
Gray bat
Decurrent false aster (*Boltonia decurrens*)

Bald eagles are known to winter in the area and perch in trees adjacent to the lock and dam. The species commonly feeds in the tailwaters of the dam. Alternatives that require clearing of bottomland forest will potentially impact bald eagle perch trees and potential Indiana bat summer roost habitat. The trees to be cleared adjacent to the lock for staging provide perch sites for large numbers of bald eagle during winter. Suitable trees are available across the river for the species to perch in. However, the city of Clarksville holds an annual Bald Eagle Days and the public may object to losing bald eagle viewing opportunities nearby. Clearing of bald eagle perch trees should be avoided. Bat surveys will be required prior to clearing. The area may only be cleared between September and April to avoid impacting roosting Indiana bats. If the area is found to be suitable for the Indiana bat or if roost trees are found, they should be avoided or impacts minimized.

If mussel concentrations are found within the locations proposed for dredging, more detailed mussel surveys will be required. These will both delineate the extent and species diversity of mussel beds and determine presence of endangered species. Impacts to mussel beds should be avoided.

The decurrent false aster is listed as potentially occurring in the area. A survey for the species may be required prior to construction to avoid impacts. Although this site is within the range of the species, it has never been located in the area.

Lock and Dam 25

The following federally listed species are listed to occur in the counties adjacent to the lock and may exist within the vicinity of the project:

Indiana bat
Bald eagle

The bald eagle is known to winter near the lock, and there is potential for the Indiana bat to be found there as well. With selection of lock Location 1, a large area of perch trees would be cleared. There are some suitable perch trees downstream in what is now a sanctuary owned by the Nature Conservancy and in forested areas across the river that will not be impacted. However, some of the largest trees in the area, and those preferred by bald eagles for perching, would be cleared. Clearing of those trees would displace the eagles and cause them to increase their use of alternative perching areas. Evaluation of bald eagle usage of the area is currently under way. The selection of Location 1 will initiate Formal Consultation under Section 7 of the Endangered Species Act. This consultation will either require the Corps to avoid impacting the area or replace the habitat to be lost. If avoidance is not possible, habitat should be replaced through planting of suitable perch trees. In addition to planting suitable trees to provide future perching areas, it is possible to construct eagle perches. Options for this include installation of large, dead trees or

telephone poles with platforms erected. This location is also a popular eagle watching area for visitors from St. Louis, Missouri.

A forested area downstream from the lock that may be cleared for lock Location 1 may be suitable for Indiana bat summer roost habitat. Bat surveys may be required prior to clearing. The area should only be cleared between September and April to avoid impacting roosting Indiana bats. If the area is found suitable for the species or if roost trees are found, they should be avoided or impacts minimized.

Brail surveys for mussels located a mussel bed upstream from the lock. Thirteen species and 125 individuals were found in the brail survey. This area would be dredged for a new channel alignment with lock Location 1. Diving surveys will be required on this location to more accurately determine the extent of the mussel bed and species diversity and determine the presence of federally or State-listed species.

Peoria Lock and Dam

The following federally listed species are listed to occur in the counties adjacent to the lock and may exist within the vicinity of the project:

Decurrent false aster
Indiana bat
Running buffalo clover (*Trifolium stoloniferum*)

The decurrent false aster is listed as occurring within Peoria and Tazewell Counties within the Illinois River floodplain. Surveys for the species may be required prior to construction to ensure that the species will not be impacted. If it is found, measures to minimize impacts or relocate affected populations may be necessary.

The running buffalo clover is listed as potentially occurring in Tazewell County. The species occurs in disturbed bottomland meadows, which are not found within the project area. Therefore, it is not likely that the project will affect the species.

The forested area downstream from the lock to be cleared for staging may be suitable for Indiana bat summer roost habitat. Bat surveys may be required prior to clearing. The area should only be cleared between September and April to avoid impacting roosting Indiana bats. If the area is found suitable for the species or if roost trees are found, they should be avoided.

La Grange Lock and Dam

The following federally listed species are known to occur in the counties adjacent to the lock and may exist within the vicinity of the project:

Decurrent false aster
Indiana bat
Bald eagle

The bald eagle winters along the Illinois River and may be found wintering in the forested area to be cleared upstream from the lock. It feeds commonly in dam tailwaters.

Present use of the forest by bald eagles is not recorded; however, they are known to be present throughout the Illinois River Valley. No nesting is recorded in the vicinity and therefore clearing of the forest will not likely affect the bald eagle at this location.

The forest upstream from the lock proposed for clearing within lock Locations 1 and 2 provides potential Indiana bat summer roost habitat. Bat surveys will be required prior to clearing. The area may only be cleared between September and April to avoid impacting roosting Indiana bats. If the area is found suitable for the species or if roost trees are found, they should be avoided or impacts minimized.

Specific Species Notes

Bald Eagle - Clearing of perching habitat should be avoided. If avoidance is not possible, the habitat will need to be replaced. This replacement should be in close proximity to the dam and done as soon as possible since trees will not be large enough to replace the habitat for at least 25 years. In addition to planting suitable trees to provide future perching areas, it is possible to construct eagle perches for short-term replacement. Options for this include installation of large, dead trees or telephone poles with platforms erected. The potential impacts on eagles and the nature of any replacement and will be determined in the endangered species consultation process with the U.S. Fish and Wildlife Service and State agencies.

Indiana Bat - If habitat suitable for Indiana bat roost colonies is to be impacted, it may only be cleared between September 1 and April 30. In order to replace Indiana bat habitat, planting of the following tree species will be required: shagbark and shellbark hickory, bitternut hickory, American elm, slippery elm, eastern cottonwood, silver maple, white oak, red oak, post oak, and shingle oak. Since the species requires trees of nearly 11 inches in diameter and with peeling bark, or dead trees, the replacement trees will not provide suitable habitat for some time.

E. Socio-Economic Analysis. This analysis addresses anticipated socio-economic impacts of reducing traffic congestion and increasing navigation capacity for Locks 11-25 on the Upper Mississippi River (UMR) and Locks 1-8 (Lockport to La Grange) on the Illinois Waterway (IWW). Large-scale measures for reducing congestion include extending an existing lock or providing a second lock at an existing lock and dam site. Six alternative locations for placement of new locks were considered in the initial investigation performed by the Engineering Work Group. After a screening process, some of the six locations proved to be infeasible. The surviving locations are addressed within the site-specific analysis for each lock site.

This analysis addresses the socio-economic impacts in two sections. Section 1 will look at the anticipated systemic impacts associated with increased capacity for UMR Locks 11-19

and IWW Locks 1-6. This section does not address construction impacts at these sites. (NOTE: This format was chosen to correspond with the general nature of the environmental evaluations done at these sites. A more complete socio-economic assessment will be completed for the system Environmental Impact Statement.) Section 2 will address in general the potential site-specific impacts for UMR Locks 20-25, plus Peoria and La Grange Locks on the IWW. These site-specific locations have been identified as the most likely locations for large-scale improvements at some time in the future.

Data sources for this analysis included existing socio-economic reports, information provided by the site-specific habitat assessment study team, and interviews with pertinent local officials and lockmasters.

1. General Systemic Assessment. Increasing the flow of traffic through the lower river locks could impact communities in the upper river corridor. More traffic on the river could stimulate community and regional growth throughout the river corridor, and could increase the economic viability of the river communities with the expansion of business and industry. Overall, impacts at the upper locks would be more positive than negative, especially since the surrounding urban or rural settings will not likely be interrupted by construction activities.

a. Community and Regional Growth. The existence of a cost-effective, efficient transportation system created by the locks and dams on the UMR-IWW System has provided stimulus for growth of river communities and the entire Midwest region. Midwest producers rely on low-cost river transportation to compete in-world markets. Large-scale improvements to the system would help to provide for continued growth opportunities at each individual site and allow the region to remain competitive in regional, national, and international markets.

b. Community Cohesion. No major impacts on overall community cohesion in the upper river corridor would be expected from the construction of large-scale improvements at the lower lock sites.

c. Displacement of People. No residential relocations would be necessitated in the upstream corridor by an increase in navigation capacity at lower locks.

d. Property Value and Tax Revenues. The proposed projects would have little impact on property values or resulting tax revenues. Any long-term effects on property values and tax revenues would be related to community and regional growth. Increasing traffic has the potential for affecting property values at sites where there are residential properties located adjacent to existing locks. Impacts will be based on perceptions that more traffic on the river may diminish the desirability of a riverfront property and, therefore, make the real estate less desirable in the eyes of prospective buyers.

e. Public Facilities and Services. The UMR-IWW System is a vital component of the national transportation infrastructure. With timely and appropriate improvements, it will continue to serve recreational, commercial and environmental interests over the long term. The system also provides recreation opportunities to residents of the states through which the rivers flow. These opportunities include boating, fishing, hunting, trapping, camping, sightseeing, swimming, skiing, sport fishing, and wildlife observation. Public access to these recreational events in the upper river corridor will not be hindered or interrupted by improving navigation capacity at downstream locks.

Swing-span vehicle bridges, located at some lock and dam sites, will open more frequently with an increase in navigation traffic, causing more delays for vehicles using the bridge to cross the river.

f. Life, Health, and Safety. Overall, the proposed projects would eliminate some of the hazards of transiting the river locks and congestion at the locks, thereby improving the safety conditions for towing industry and lock personnel. Improving navigation capacity would also reduce safety hazards for recreational vessels by minimizing the times when commercial and recreation crafts are using a lock at the same time.

Increased navigation capacity on the UMR-IWW System has the potential to increase hazardous spills on the river and to lead to more accidents between craft on the river.

g. Business and Industrial Growth. Expansion of the navigation capacity through large-scale improvements may allow for the development or expansion of businesses and industries, fleeting areas, and terminals in the river corridor. New terminal development could occur on undeveloped or open lands adjacent to urban areas.

h. Employment and Labor Force. Temporary increases in employment and labor force would be site-specific and are not anticipated in the near term in the upper reaches of the UMR-IWW System. The labor pool for communities on the lower portion of the system, and directly impacted by construction activities, is large enough to provide the temporary supply of workers needed, and the demand would not be expected to draw from the labor pool of upstream communities. Long-term impacts to employment and labor force in the upper river reaches would be related to business and industrial growth resulting from indirect positive impacts of improved efficiency of the Upper Mississippi navigation system as a whole.

i. Farm Displacement. No farmsteads would be affected by increased navigation capacity or large-scale improvements at lower lock sites. Potential use of agricultural land for dredged material placement would be addressed on a site-specific basis.

j. Noise Levels. Construction activities are limited to the lower river sites, so it is unlikely that the upper portion of the system would experience any impacts from

the increased noise levels due to the construction. Increased traffic through the upper locks could cause major noise impacts for homes that are located adjacent to existing lock sites.

k. Aesthetics. Construction of new lock facilities and the resulting increase in navigation traffic would not likely impact the aesthetics of the upper river corridor and would not diminish the viewscape of public areas or local communities. Potential fleeting area impacts will be addressed in the system EIS.

2. Specific Assessments for Lower Sites. This section addresses the potential site-specific socio-economic impacts associated with large-scale improvements at UMR L/Ds 20-25, and Peoria and La Grange L/Ds on the IWW. The assessment is directed toward the potential impacts resulting from the construction of new lock facilities (i.e., new 1,200-foot locks) or extending the existing lock chamber. References to placement sites (for borrow or dredged material) are for purposes of general socio-economic assessment only. These areas are not being addressed in the overall site-specific habitat analyses at this time.

a. Lock and Dam 20 - Canton, Missouri. (Locations 2, 3 or 4 under consideration, as well as a wicket gate option to allow open pass.)

(1) Community and Regional Growth. The existence of a cost-effective, efficient transportation system created by the locks and dams on the UMR-IWW System has provided stimulus for growth of river communities and the entire Midwest region. Overall, large-scale improvements at L/D 20 would help to provide for continued growth opportunities in Canton, Missouri. Community and regional growth are impacted directly and indirectly by the effects of construction activity, expansion of existing firms, and establishment of new firms within the region.

(2) Community Cohesion. Land use surrounding L/D 20 is shared by agricultural, industrial, residential, and recreational interests. A public park, an oil company loading dock, and a ferry crossing are located within a mile of the lock and dam. Several homes in Illinois and Missouri are located within a one-mile radius of the proposed construction locations. No significant negative impacts to community cohesion would be expected.

(3) Displacement of People. Construction of a new lock facility at any of the locations would not require any residential relocations.

(4) Property Values and Tax Revenues. Short-term impacts to tax revenues would result from the use of agricultural land for placement sites and staging areas during construction, which would temporarily remove the land from crop production. Long-term effects on property values and tax revenues would be related to community and regional growth.

(5) Public Facilities and Services. Use of Locations 2, 3, or 4 could require navigation interruptions during construction and relocation of the public ferry landing.

The ferry is used by residents who work in Illinois, as well as by trucks transporting grain to an upstream terminal.

Use of Locations 2 or 3 would adversely impact the public park, an oil company terminal, and the public ferry. If Location 4 is used, there would be adverse impacts to an upstream grain loading dock and public fishing area.

(6) Life, Health, and Safety. Overall, the proposed project would eliminate some of the hazards of transiting the river locks and congestion at the locks, thereby improving the safety conditions for towing industry and lock personnel. Improving navigation capacity would also reduce safety hazards for recreational vessels by minimizing the times when commercial and recreation crafts are using the lock at the same time.

(7) Business and Industrial Growth. A commercial dock for an upstream grain elevator may require relocation if Location 4 is selected, possibly interfering with business at the grain terminal. A lock extension could necessitate the relocation of a downstream oil company dock in order to provide adequate clearance for boats leaving the lock.

A short-term increase in business and industrial activity would be noticed in the project vicinity due to purchases made for construction work and purchases made by construction workers (i.e., meals and lodging). Expansion of the navigation capacity through large-scale improvements may allow for long-term business and industrial growth through the development or expansion of businesses and industries, fleeting areas, and terminals in the river corridor.

(8) Employment and Labor Force. As one of the potential sites being analyzed for new lock facilities, the area would experience a temporary increase in employment during project construction. It is estimated that an average of 300 workers would be employed during the construction effort. Workers would be hired through labor unions at Canton, Missouri, and other communities in the area. Between 1986 and 1994, rehabilitation efforts at L/D 20 employed a similar number of workers with similar impacts.

Long-term impacts to employment or the labor force in the Canton area would be related to business and industrial growth resulting from indirect positive impacts of improved efficiency of the navigation system as a whole.

(9) Farm Displacement. Depending upon the construction location selected, between 47 and 105 acres of agricultural land would be used for placement sites and staging areas; however, no farmsteads would be displaced as a result of new lock construction.

(10) Noise Levels. Heavy machinery would temporarily raise noise levels during project construction. Low-density residential development is located within one-

half mile from the proposed locations and would be affected by the increased noise levels. Use of Location 4 puts a new lock where there currently is none, and the increased traffic may change noise levels in the town of Meyer, Illinois.

A 1,200-foot lock positively impacts noise levels by eliminating the making and breaking of tows, thereby decreasing noise levels for the town of Canton.

(11) Aesthetics. The aesthetic appeal of any type of construction activity is low; however, construction would be temporary and would not permanently impair the aesthetic resources of the surrounding areas. Use of Location 4 would change the aesthetics of the area for residents of Meyer. Placing a new lock where there was none could change the view of the river; however, the impact would be minor because the town already is situated behind a levee.

b. Lock and Dam 21 - Quincy, Illinois. (Locations 2, 3 or 4 under consideration.)

(1) Community and Regional Growth. The existence of a cost-effective, efficient transportation system created by the locks and dams on the UMR-IWW System has provided stimulus for growth of river communities and the entire Midwest region. Overall, large-scale improvements at L/D 21 would help to provide for continued growth opportunities in Quincy, Illinois. Community and regional growth are impacted directly and indirectly by the effects of construction activity, expansion of existing firms, and establishment of new firms within the region.

(2) Community Cohesion. Land surrounding L/D 21 is primarily agricultural. Several commercial loading docks are located approximately 2 miles upstream of the lock and dam, and a small boat ramp is located about one-half mile downstream. No effect on community cohesion would be expected due to the limited residential development in the project vicinity.

(3) Displacement of People. Construction of a new lock facility at Locations 2, 3, or 4 would not require any residential relocations.

(4) Property Values and Tax Revenues. Short-term impacts on tax revenues would result from the use of agricultural land for placement sites and staging areas during construction, which would temporarily remove the land from crop production. Long-term effects on property values and tax revenues would be related to community and regional growth.

(5) Public Facilities and Services. The sewage treatment plant for the city of Quincy, Illinois, is located on the left downstream bank directly across from the proposed construction locations. Construction is not expected to interfere with the operation of the plant or the discharge line. The construction staging area would temporarily impact recreational fishing and access to the public boat ramp (the ramp would be lost with a Location 2 lock) located near the downstream end of the existing lock.

The South Quincy Levee and Drainage District is located next to the designated construction staging area. Use of this area would not impact the integrity of the levee system or diminish the effectiveness of this public facility.

(6) Life, Health, and Safety. Overall, the proposed projects would eliminate some of the hazards of transiting the river locks and congestion at the locks, thereby improving the safety conditions for towing industry and lock personnel. Improving navigation capacity would also reduce safety hazards for recreational vessels by minimizing the times when commercial and recreation craft are using the lock at the same time.

(7) Business and Industrial Growth. Possible impacts to business and industrial growth in the Quincy area could occur. Commercial loading docks and a barge dock located upstream of the site may require relocation in order to provide adequate clearance for boats leaving a longer lock.

A short-term increase in business and industrial activity would be noticed in the project vicinity due to purchases made for construction work and purchases made by construction workers (i.e., meals and lodging). Expansion of the navigation capacity through large-scale improvements may allow for long-term business and industrial growth through the development or expansion of businesses and industries, fleeting areas, and terminals in the river corridor.

(8) Employment and Labor Force. As one of the potential sites being analyzed for new lock facilities, the area would experience a temporary increase in employment during project construction. It is estimated that an average of 300 workers would be employed during the construction effort. Workers would be hired through labor unions at Quincy, Illinois, and other nearby communities. Between 1987 and 1990, rehabilitation efforts at L/D 21 employed a similar number of workers with similar impacts.

Long-term impacts to employment or the labor for in the Quincy area would be related to business and industrial growth resulting from indirect positive impacts of improved efficiency of the navigation system as a whole.

(9) Farm Displacement. No farmsteads would be displaced as a result of new lock construction at L/D 21. The South Quincy Levee and Drainage District is located on the downstream Illinois riverbank, directly across from the existing lock site and the proposed construction Locations 2, 3, and 4. The Levee District will allow two small placement sites to be placed directly behind the levee on agricultural land, removing between 6 and 15 acres from production.

(10) Noise Levels. Heavy machinery would temporarily raise noise levels during project construction. Since the project area is primarily rural in nature, no significant impacts from increased noise levels would result.

(11) Aesthetics. The aesthetic appeal of any type of construction activity is low; however, construction would be temporary and would not significantly diminish the aesthetic resources of the surrounding areas.

c. Lock and Dam 22 - Saverton, Missouri (Locations 2, 3, or 4 under consideration.)

(1) Community and Regional Growth. The existence of a cost-effective, efficient transportation system created by the locks and dams on the UMR-IWW System has provided stimulus for growth of river communities and the entire Midwest region. Overall, large-scale improvements at L/D 22 would help to provide for continued growth opportunities in Saverton, Missouri. Community and regional growth are impacted directly and indirectly by the effects of construction activity, expansion of existing firms, and establishment of new firms within the region.

(2) Community Cohesion. Land surrounding L/D 22 is primarily for agricultural or recreational use. No effect on community cohesion would be expected due to the limited residential development in the project vicinity.

(3) Displacement of People. There are some residential structures located across from the downstream end of the staging area; however, no relocations would be required.

(4) Property Values and Tax Revenues. Short-term impacts on tax revenues would result from the use of agricultural land for placement sites during construction, which would temporarily remove the land from crop production. Long-term effects on property values and tax revenues would be related to community and regional growth.

(5) Public Facilities and Services. The Park 'N Fish Public Use Area is located across the river from the existing lock and dam, but would not be significantly impacted by construction activities. An existing boat ramp on the Missouri side, near the end of the existing guidewall, would be lost with a lock Location 2; subsequent relocation would need to be considered.

(6) Life, Health, and Safety. Overall, the proposed projects would eliminate some of the hazards of transiting the river locks and congestion at the locks, thereby improving the safety conditions for towing industry and lock personnel. Improving navigation capacity would also reduce safety hazards for recreational vessels by minimizing the times when both commercial and recreation crafts are using the lock at the same time.

(7) Business and Industrial Growth. A short-term increase in business and industrial activity would be noticed in the project vicinity due to purchases made for construction work and purchases made by construction workers (i.e., meals and lodging).

Expansion of the navigation capacity through large-scale improvements may allow for long-term business and industrial growth through the development or expansion of businesses and industries, fleeting areas, and terminals in the river corridor. Construction activities at L/D 22 would not require any business relocations.

(8) Employment and Labor Force. As one of the potential sites being analyzed for new lock facilities, the area would experience a temporary increase in employment during project construction. It is estimated that an average of 300 workers would be employed during the construction effort. Workers would be hired through labor unions at Saverton, Missouri, and other communities in the area. Between 1987 and 1990, rehabilitation efforts at L/D 22 employed a similar number of workers with similar impacts.

Long-term impacts to employment or the labor force in the Saverton area would be related to business and industrial growth resulting from indirect, positive impacts of improved efficiency of the navigation system as a whole.

(9) Farm Displacement. Depending upon the location selected, between 5 and 24 acres of land would be used for staging area and placement sites; however, no farmsteads would be displaced as a result of new lock construction at location.

(10) Noise Levels. Heavy machinery would temporarily raise noise levels during project construction. The project area is basically rural in nature, featuring large spans of open fields and a public use area that has a relatively small number of visitors per day. While general construction noise potentially could disturb recreationists, it is unlikely that an increase in noise levels would have a significant negative impact on the surrounding area.

(11) Aesthetics. The aesthetic appeal of any type of construction activity is low; however, construction would be temporary and would not significantly diminish the aesthetic resources of the surrounding areas.

d. Lock and Dam 24 - Clarksville, Missouri. (Locations 2, 3, or 4 under consideration.)

(1) Community and Regional Growth. The existence of a cost-effective, efficient transportation system created by the locks and dams on the UMR-IWW System has provided stimulus for growth of river communities and the entire Midwest region. Overall, large-scale improvements at L/D 24 would help to provide for continued growth opportunities in Clarksville, Missouri. Community and regional growth are impacted directly and indirectly by the effects of construction activity, expansion of existing firms, and establishment of new firms within the region.

(2) Community Cohesion. Land surrounding L/D 24 is used for agricultural, industrial, residential, or recreational purposes. The city of Clarksville is

located next to the designated construction staging area. No significant impacts to community cohesion are anticipated.

(3) Displacement of People. Construction of a new lock facility at Locations 2, 3, or 4 would not require any residential relocations.

(4) Property Values and Tax Revenues. Short-term impacts on tax revenues would result from the use of agricultural land for placement sites and staging areas during construction, removing the cropland from production. Long-term effects on property values and tax revenues would be related to community and regional growth.

(5) Public Facilities and Services. The Mississippi River provides a wide variety of recreational opportunities for residents of the Clarksville area. Wintering bald eagles are a major tourist attraction in the city of Clarksville, including the Annual Bald Eagle Days celebration. The potential exists for adverse impacts to wildlife observation opportunities, recreational fishing and boating, and use of the Clarksville city park and public boat ramp if Locations 2 or 3 are used.

There are no anticipated impacts for Location 4.

(6) Life, Health, and Safety. Overall, the proposed projects would eliminate some of the hazards of transiting the river locks and congestion at the locks, thereby improving the safety conditions for towing industry and lock personnel. Improving navigation capacity would also reduce safety hazards for recreational vessels by minimizing the times when commercial and recreation crafts are using the lock at the same time.

(7) Business and Industrial Growth. A short-term increase in business and industrial activity would be noticed in the project vicinity due to purchases made for construction work and purchases made by construction workers (i.e., meals and lodging). Expansion of the navigation capacity through large-scale improvements may allow for long-term business and industrial growth through the development or expansion of businesses and industries, fleeting areas, and terminals in the river corridor. Construction activities at L/D 24 would not require any business or industrial relocations.

(8) Employment and Labor Force. As one of the potential sites being analyzed for new lock facilities, the area would experience a temporary increase in employment during project construction. It is estimated that an average of 300 workers would be employed during the construction effort. Workers would be hired through labor unions at Clarksville, Missouri, and other nearby communities.

Long-term impacts to employment or the labor force in the Clarksville area would be related to business and industrial growth resulting from indirect, positive impacts of improved efficiency of the navigation system as a whole.

(9) Farm Displacement. Depending upon the location selected, land would be used for a staging area and placement site; however, no farmsteads would be displaced as a result of the proposed lock construction.

(10) Noise Levels. Heavy machinery would temporarily raise noise levels during project construction. Low-density residential development and the business district of Clarksville are located within one-half mile from the proposed construction site. Increased noise levels would have a detrimental effect on the residents and business owners/patrons in the area. The remainder of the project area is rural in nature and would not be significantly affected by the increase in noise levels. No permanent impacts are evident.

A 1,200-foot lock positively impacts noise levels by eliminating the making and breaking of tows, thereby decreasing noise levels for the town of Clarksville.

(11) Aesthetics. The aesthetic appeal of any type of construction activity is low; however, construction would be temporary. Construction of a 1,200-foot lock at Locations 2 or 3 could result in a negative impact on area aesthetics. The new lock would be within the viewscape of the city residents and visitors, diminishing the aesthetic resources of the surrounding area. Eagle watching activities could also be affected. However, a new lock may become a tourist attraction, as has been the case with Melvin Price Lock and Dam.

e. Lock and Dam 25 - Winfield, Missouri. (Locations 1, 2, 3, or 4 under consideration.)

(1) Community and Regional Growth. The existence of a cost-effective, efficient transportation system created by the locks and dams on the UMR-IWW System has provided stimulus for growth of river communities and the entire Midwest region. Overall, large-scale improvements at L/D 25 would help to provide for continued growth opportunities in the area. Community and regional growth are impacted directly and indirectly by the effects of construction activity, expansion of existing firms, and establishment of new firms within the region.

Construction of a new lock facility at the land-based Location 1 has the potential for negative impacts to community and regional growth. Use of this location may necessitate the relocation of the grain elevator and the public ferry landing.

(2) Community Cohesion. The potential for relocating eight permanent residences exists with use of the land-based Location 1. The relocation option may be unfavorable as the long-time residents may not be willing to move, and the impact on community life could be negative as viewed by the residents involved. Pursuing the relocation of residents who do not wish to move would involve the condemnation process. This process involves considerable time and money and generally does not result in a favorable public opinion towards the Government.

(3) Displacement of People. Approximately eight residences are located along river in potential zone of footprint for construction at Location 1. Relocation of the homeowners would involve purchasing the existing structures. Locations 2, 3 and 4 are farther towards the channel and would not cause displacement of people.

(4) Property Values and Tax Revenues. Short-term effects on tax revenues would result from the use of agricultural land for placement sites and staging areas during construction. The relocation of residential structures removes the properties from the tax roles and decreases property tax revenues for Lincoln County.

Long-term effects on property values and tax revenues would be related to community and regional growth. Impacts to property values and tax revenues would depend on impacts to the public ferry and the grain elevator.

(5) Public Facilities and Services. Several negative impacts to public facilities and services would occur with the use of the right downstream bankline and agricultural land for a staging area during construction and lock construction itself. The public ferry landing would have to be moved or would go out of business if a Location 1, 2 or 3 lock were constructed. The ferry carries 300 vehicles per day and provides the only crossing along the Mississippi River for about 46 miles in either direction. A small marina that provides docking for about 10 recreational boats would need a new access channel or would have to be relocated. Recreational access to Sandy Slough, a significant eagle feeding area, would be blocked temporarily during construction. Bradley Island Public Use Area, located about one-half mile upstream of the existing lock and dam, has about 25 visitors per day that would lose access to the area during construction. The entire island would be lost with a Location 1 lock.

(6) Life, Health, and Safety. Overall, the proposed projects would eliminate some of the hazards of transiting the river locks and congestion at the locks, thereby improving the safety conditions for towing industry and lock personnel. Improving navigation capacity would also reduce safety hazards for recreational vessels by minimizing the times when commercial and recreation crafts are using the lock at the same time.

(7) Business and Industrial Growth. A short-term increase in business and industrial activity would be noticed in the project vicinity due to purchases made for construction work and purchases made by construction workers (i.e., meals and lodging). Business and industrial growth could be negatively impacted if the grain terminal on right downstream bank and the grain elevator dock would need relocation, and if the public ferry would go out of business.

Expansion of the navigation capacity through large-scale improvements may allow for long-term businesses and industrial growth through the development or expansion of business and industries, fleeting areas, and terminals in the river corridor.

(8) Employment and Labor Force. Many residents in Illinois communities across the river use the public ferry for crossing the river to save travel time and distance. Loss of the public ferry would require driving approximately 46 miles in either direction to cross the river to work.

As one of the potential sites being analyzed for new lock facilities, the area would experience a temporary increase in employment during project construction. It is estimated that an average of 300 workers would be employed during the construction effort. Workers would be hired through labor unions at Winfield, Missouri, and other communities in the area.

Long-term impacts to employment or the labor force in the Winfield area would be related to business and industrial growth resulting from indirect positive impacts of improved efficiency of the navigation system as a whole.

(9) Farm Displacement. Depending upon the lock location selected, between 8 and 125 acres of agricultural land would be used for construction staging areas and placement sites; however, no farmsteads would be displaced as a result of the proposed lock construction.

(10) Noise Levels. Heavy machinery would temporarily raise noise levels during project construction. Low-density residential development is located within one-half mile of the proposed construction site and would be affected by the increased noise levels. The remainder of the project area is rural in nature; therefore, it is unlikely that this noise level increase would significantly affect the surrounding population. No permanent impacts are evident.

(11) Aesthetics. The aesthetic appeal of any type of construction activity is low; however, construction would be temporary. A potential negative impact is that the construction staging area is within the viewscape of the residents, recreationists, and tourists, including eagle watching activities.

f. Peoria Lock and Dam - Peoria, Illinois. (Locations 1 or 2 under consideration.)

(1) Community and Regional Growth. The existence of a cost-effective, efficient transportation system created by the locks and dams on the UMR-IWW System has provided stimulus for growth of river communities and the entire Midwest region. Overall, large-scale improvements at Peoria Lock would help to provide for continued growth opportunities in Peoria, Illinois. Community and regional growth are impacted directly and indirectly by the effects of construction activity, expansion of existing firms, and establishment of new firms within the region.

Construction of a new lock facility at Locations 1 or 2 has the potential for negative impacts to community and regional growth. Use of these locations may necessitate the relocation of an upstream grain elevator and commercial docks. At the very downstream

end of the staging area is a loading area for agricultural chemicals that could require relocation.

(2) Community Cohesion. Land surrounding Peoria Lock is primarily light industrial with residential development nearby. A portion of the city of Creve Coeur is located on the bluff overlooking the river, approximately one mile north of the proposed construction location. A section of light industrial properties lies adjacent to the staging area, and another residential area of Creve Coeur is about one-half-mile south of the construction site. No significant impacts to community cohesion are anticipated.

(3) Displacement of People. Construction of a new lock facility at Locations 1 or 2 would not require any residential relocations.

(4) Property Values and Tax Revenues. Short-term effects on tax revenues would result from the use of agricultural land for placement sites and staging areas during construction. Long-term effects on property values and tax revenues would be related to community and regional growth.

(5) Public Facilities and Services. Public facilities negatively impacted by the proposed construction activities include a loading area for agricultural chemicals, a grain elevator, and commercial loading docks.

(6) Life, Health, and Safety. Overall, the proposed projects would eliminate some of the hazards of transiting the river locks and congestion at the locks, thereby improving the safety conditions for towing industry and lock personnel. Improving navigation capacity would also reduce safety hazards for recreational vessels by minimizing the times when commercial and recreation craft are using the lock at the same time.

(7) Business and Industrial Growth. A short-term increase in business and industrial activity would be noticed in the project vicinity due to purchases made for construction work and purchases made by construction workers (i.e., meals and lodging). Expansion of the navigation capacity through large-scale improvements may allow for long-term business and industrial growth through the development or expansion of businesses and industries, fleeting areas, and terminals in the river corridor.

(8) Employment and Labor Force. As one of the potential sites being analyzed for new lock facilities, the area would experience a temporary increase in employment during project construction. It is estimated that an average of 300 workers would be employed during the construction effort. Workers would be hired through labor unions at Peoria, Illinois, and other nearby communities. Between 1986 and 1991, rehabilitation efforts at Peoria Lock employed a similar number of workers with similar impacts.

Long-term impacts to employment or the labor force in the Peoria area would be related to business and industrial growth resulting from indirect, positive impacts of improved efficiency of the navigation system as a whole.

(9) Farm Displacement. There is little agricultural land in the project vicinity. No farmsteads would be displaced as a result of new lock construction.

(10) Noise Levels. Heavy machinery would temporarily raise noise levels during project construction. Low-density residential and industrial areas are located within one mile from the proposed locations; however, no permanent impacts to sensitive receptors would result.

(11) Aesthetics. The aesthetic appeal of any type of construction activity is low; however, construction would be temporary and would not significantly diminish the aesthetic resources of the surrounding areas.

g. La Grange Lock and Dam - La Grange, Illinois. (Locations 1 or 2 under consideration.)

(1) Community and Regional Growth. The existence of a cost-effective, efficient transportation system created by the locks and dams on the UMR-IWW System has provided stimulus for growth of river communities and the entire Midwest region. Overall, large-scale improvements at La Grange Lock would help to provide for continued growth opportunities in the La Grange, Illinois, area. Community and regional growth are impacted directly and indirectly by the effects of construction activity, expansion of existing firms, and establishment of new firms within the region.

(2) Community Cohesion. Land surrounding the La Grange Lock is agricultural and forested. No significant impact to community cohesion would be expected due to the limited residential development in the project vicinity.

(3) Displacement of People. Construction at this site will not require any residential relocations.

(4) Property Values and Tax Revenues. Short-term effects on tax revenues would result from the use of land for placement sites and staging areas during construction. Long-term effects on property values and tax revenues would be related to community and regional growth.

(5) Public Facilities and Services. Access to a recreational boat ramp upstream of the site will be negatively impacted by the proposed construction. A large wetland complex, which is privately owned and used for duck hunting, would be impacted by a Location 1 lock; approximately 6 acres would be lost. Much of the area adjacent to the lock is proposed for addition to the Illinois River National Wildlife Refuge complex; the fate of this proposal is unknown but will need to be considered in future planning.

(6) Life, Health, and Safety. Overall, the proposed projects would eliminate some of the hazards of transiting the river locks and congestion at the locks, thereby improving the safety conditions for towing industry and lock personnel. Improving navigation capacity would also reduce safety hazards for recreational vessels by minimizing the times when commercial and recreation crafts are using the lock at the same time.

(7) Business and Industrial Growth. A short-term increase in business and industrial activity would be noticed in the project vicinity due to purchases made for construction work and purchases made by construction workers (i.e., meals and lodging). Expansion of the navigation capacity through large-scale improvements may allow for long-term business and industrial growth through the development or expansion of businesses and industries, fleeting areas, and terminals in the river corridor. Construction at this site will not require any business or industrial relocations.

(8) Employment and Labor Force. As one of the potential sites being analyzed for new lock facilities, the area would experience a temporary increase in employment during project construction. It is estimated that an average of 300 workers would be employed during the construction effort. Workers would be hired through labor unions at La Grange, Illinois, and other communities in the area. Between 1986 and 1991, rehabilitation efforts at La Grange Lock employed a similar number of workers with similar impacts.

Long-term impacts to employment or the labor force in the La Grange area would be related to business and industrial growth resulting from indirect, positive impacts of improved efficiency of the navigation system as a whole.

(9) Farm Displacement. Use of Location 1 would require removal of approximately 118 acres of agricultural land from production; Location 2 requires the use of 21 acres. No farmsteads would be displaced.

(10) Noise Levels. The project area is rural in nature, featuring large spans of open fields. A temporary increase in noise levels during project construction will not significantly affect the surrounding area.

(11) Aesthetics. The proposed new lock construction at this site would not impact the aesthetic resources of the area.