7.0 Monitoring, Reporting, and Adaptive Management

7.1 Introduction

The Service's implementing regulations require NiSource to monitor, report, and assess the impacts of the take of MSCHP "take species" that will result from covered activities over the term of the Incidental Take Permit (ITP). This chapter describes the monitoring, reporting, and adaptive management components of the MSHCP.

The goal of the monitoring and reporting is to provide a reliable basis for documenting compliance, effectiveness, and implementation of the MSHCP, ITP, and IA throughout the permit term. Compliance monitoring and implementation monitoring, which are roughly equivalent, provide means for the Service to verify that NiSource is carrying out the terms of the MSHCP, ITP and IA. Effects and effectiveness monitoring will enable the Service and NiSource to evaluate the effects of the covered activities on take species and determine whether the conservation program of the MSHCP is effectively achieving its biological goals and objectives. Through effectiveness monitoring, NiSource and the Service also will be able to assess the need for implementation of adaptive management measures to improve the MSHCP's conservation strategy.

NiSource's monitoring and reporting will (1) document implementation of AMMs and mitigation measures; (2) document both the anticipated and actual take of take species (whether through individuals or surrogates); (3) document compliance with AMMs and mitigation requirements; (4) evaluate the effectiveness of the conservation program; (5) assess the need for responses to changed circumstances or adaptive management; (6) document the implementation of and effectiveness of any measures undertaken to respond to changed circumstances or adaptive management measures; (7) provide an itemized accounting of mitigation efforts and expenditures for all species; and (8) explain how implementation, including funding, continues to be assured.

7.2 General Requirements

An HCP must describe the steps that an applicant will take to monitor the impacts of the covered activities on take species. 50 C.F.R. §§ 17.22(b)(1)(iii)(B) and 17.32(b)(1)(iii)(C)(2). The Service's Five-Point Policy provides that the monitoring program of an HCP include information to (1) evaluate compliance (Section 7.3); (2) determine if the biological goals and objectives are being met (Section 7.4); and (3) provide feedback information for an adaptive management strategy, if one is used. (Section 7.6) (65 Fed. Reg. 32242, 35253 [June 1, 2000]). Inasmuch as an ITP is required to include reporting requirements, the Service advises applicants to specify reporting requirements in the HCP that allow the Service to track take levels occurring under the ITP and to ensure the conservation program is being properly implemented. *See* HCP Handbook at 6-25.

The Service defines adaptive management as "a method for examining alternative strategies for meeting measurable biological goals and objectives, and then, if necessary, adjusting future conservation management actions according to what is learned." 65 Fed. Reg. at 35252. It is a tool used to address uncertainty in the

conservation of certain species included in an HCP. *Id.* The foundation of an adaptive management strategy is identifying the uncertainty to be addressed. The Five-Point Policy also notes that:

> [o]ften, a direct relationship exists between the level of biological uncertainty for a take species and the degree of risk that an incidental take permit could pose for that species. Therefore, the operating conservation program may need to be relatively cautious initially and adjusted later based on new information, even though a cautious approach may limit the number of alternative strategies that may be tested.

Id.

Service guidance provides that an HCP's adaptive management program should: (1) identify uncertainties and the questions that need to be addressed to resolve uncertainties; (2) develop alternative strategies and determine which to implement; (3) integrate a monitoring program that is able to detect the necessary information for evaluation of the conservation strategy; and (4) incorporate feedback loops that link implementation and monitoring to a decision-making process. *Id*. The feedback process is necessary to ensure that new information gained from the monitoring program results in effective change in the management of the species. Whenever an adaptive management strategy is used, the HCP must outline the agreed-upon future changes to the operating conservation plan. *Id.*

Although the adaptive management strategy anticipates future modifications to implementing the conservation program, the strategy becomes part of the HCP's provisions and, therefore, is integral to the proper implementation of the plan. As such, the adaptive management strategy is subject to the Service's "No Surprises" rule and assurances (discussed further in Chapter 10).

7.3 Compliance and Implementation Monitoring

Implementation of the MSHCP by NiSource will be accomplished by utilizing an MSHCP implementation team comprised of the NGT&S Natural Resource Permitting group, in partnership with NiSource Corporate Environmental Services to establish the overall management processes and systems within the parameters of the MSHCP, ITP, and IA. A member of this implementation team will be designated as the MSHCP Coordinator, who will be responsible for monitoring NiSource's compliance with the MSHCP, ITP and IA as it engages in the covered activities within the covered lands. The Natural Resource Permitting group's manager has primary responsibility for implementation.

The monitoring of covered activities, including but not limited to implementation of the AMMs, mitigation, and adaptive management measures, as appropriate, will be performed by NiSource personnel as well as contract environmental specialists for larger covered activities. Such personnel (i.e., field Operations employees, field environmental specialists, environmental inspectors assigned to various operations and maintenance construction projects, or other natural resource permitting specialists) will document within the MSHCP database reporting system

whether projects completed pursuant to the MSHCP included application of appropriate AMMs. Whether AMMs were implemented successfully will be monitored and documented by NiSource personnel or contracted species specialists by one or more acceptable methods, such as a specific visual field survey of impacted area, completed restoration/revegetation growth in accordance with FERC Plan and Procedures for erosion control, revegetation, and river and stream crossing procedures, or a biological field survey conducted by a species specialist. The biological effectiveness of certain AMMs will also be monitored and is discussed in Section 7.4. Species specialists will be retained by NiSource as needed to assess areas of recognized environmental sensitivity or specific areas agreed to by NiSource and the Service. As described in Chapter 6, for certain covered activities in certain areas, NiSource may perform a pre-activity survey. These surveys will be done by internal NiSource experts or contract environmental specialists who meet qualifications established by the Service and NiSource. Information obtained from these pre-activity surveys will be entered into a GIS database that will be used to track species and habitat information.

Implementation of the MSHCP will be supported by the use of an internet-based information tool that is under development with the Service. This tool, IPaC, allows the user to go on-line, specify a project location and activity, and receive resource information about the project site (**Appendix O**). IPaC will provide data on the biological resources within the project location (i.e., the MSHCP species as well as other species not addressed in the MSHCP) and the AMMs to implement in the project area. NiSource is currently working with the Service to develop a beta site specific to this MSHCP. The site will provide the most current ecological information regarding species present within and adjacent to NiSource covered lands and it will have the specific, approved AMMs and environmental construction standards for on-the-ground implementation of pipeline activities. As part of its overall compliance with the ESA, NiSource also will use IPaC to determine when other federally listed species, not addressed in this MSHCP, may occur within the vicinity of NiSource projects. Note, the Service will be evaluating the potential for impacts to other species in their Biological Opinion.

IPaC will also be programmed to provide a monitoring, reporting, and tracking module for NiSource to ensure proper MSHCP implementation.

Should the IPaC program not be ready at the time of MSHCP implementation, NiSource will utilize its project tracking database called ProjStat to collect monitoring and implementation data to support the annual report described in Section 7.7.

Specifically, NiSource will track the following information:

- The overall number and percentage of covered activities for which AMMs (mandatory and non-mandatory) were implemented.
- The number and percentage of covered activities for which AMMs (mandatory and non-mandatory) were implemented for each activity type.
- The specific reason applicable non-mandatory AMMs were not implemented.

- The number and locations of covered activities where take species (each to be named individually) were identified on or near a worksite and the AMMs implemented at those worksites.

The environmental inspectors, and the MSHCP implementation team, also will develop and implement quality assurance and quality control processes to assess the accuracy of the monitoring data.

NiSource also will maintain a running total of take of each take species and the mitigation measures taken to compensate for such take over the term of the permit. To help assess the utility and reliability of take calculations in Chapter 6, NiSource will also provide a comparison of its requested versus actual take. All of this information will be included in the annual report NiSource will submit to the Service. This documentation will be used to verify that NiSource is mitigating for take of the take species in accordance with the MSHCP and ITP. The monitoring section of the annual report will provide details of mitigation actions, including copies of deeds for all real property transactions, contracts for other mitigation transactions, and descriptions of both NiSource-initiated mitigation actions and mitigation proposals from the Mitigation Panel.

7.3.1 Prior Notification

As part of NiSource's commitment to facilitate communication with the Service regarding activities covered in this MSHCP and the ITP, NiSource will provide an annual informational "prior notification" of planned projects. This prior notification will include: (1) notification of the daily routine projects that will be carried out for operation and maintenance, safety, or new construction purposes, and (2) notification of whether the projects are in the vicinity of MSHCP species or their habitat. This notification, as more fully explained below, will be provided electronically by NiSource to the appropriate Service Field Office(s) and the Service MSHCP contact. This annual notification is for information purposes only and no response is necessary from the Service prior to NiSource proceeding with the planned covered activities in accordance with the MSHCP and ITP. However, the Service will have the opportunity to make site-specific recommendations for NiSource's consideration.

The information will include a general description (activity type and location) of the projects to be undertaken during the year. NiSource will also point out any projects proposed in MSHCP habitats. Because it may be necessary to perform projects during the year that were not originally planned, the list of projects will be periodically updated and provided to the appropriate Service points of contact.

7.4 Effects and Effectiveness Monitoring

NiSource will monitor the effects of the covered activities that require compensatory mitigation. In addition, there are several avoidance and minimization measures that will be monitored for effectiveness as part of the adaptive management program.

In addition to the items listed in Section 7.3 above, NiSource's MSHCP Coordinator will compile a list of all activities performed, indicating the type of

activity, where it occurred, the amount of habitat affected, the AMMs implemented, and calculated take (individuals or surrogates) of take species. Specifically, the MSHCP Coordinator will use data collected during the previous year to report the areas of temporary and permanent habitat loss based on the size of the work area (determined during any pre-activity surveys or other site-specific evaluation) and the percentage of that area providing suitable habitat for each species. For each species, the total acreage (across sites) of occupied or assumed occupied habitat impacts will be calculated. Activities which result in take that can be monitored in terms of individuals or surrogates other than their habitat will also be tracked and included in the overall annual compensation calculation.

NiSource will be responsible for monitoring the effectiveness of mitigation measures. It will likely be undertaken by project proponents, i.e., the parties whose mitigation proposals are funded by the Mitigation Fund or the party responsible for implementing any NiSource-initiated mitigation effort. At the time of project approval, monitoring protocols will be conveyed to the project proponent by NiSource, following coordination with the Service to ensure that the most up-to-date scientific protocols are followed for the take species on the project site. **Appendix L** contains known monitoring protocols for take species and will be updated as needed during the life of the permit. While it is anticipated that project proponents will perform most of the mitigation effectiveness monitoring, the ultimate responsibility for ensuring that the monitoring is performed sufficiently, completely, and in accordance with this MSHCP and the ITP and IA, lies with NiSource. NiSource will report monitoring results to the Service regardless of the entity that undertakes the mitigation project. Because NiSource is responsible for fully compensating for any take, if the results from the monitoring of the mitigation measures demonstrate a lack of success, additional mitigation measures will be implemented to compensate for the shortfall as discussed in the adaptive management section that follows and the changed circumstances section in Chapter 10.

In addition to monitoring effectiveness of the mitigation, NiSource is responsible for evaluating the effectiveness of avoidance and minimization measures. Many of the AMMs are the same or quite similar to measures NiSource has implemented for years. Because of this history, few issues with implementation and effectiveness are anticipated. For each AMM, NiSource and the Service evaluated the risk to the species if it were to fail and the likelihood that the AMM would be successful. For AMMs that have been successfully implemented by the industry for many years and have been proven to be effective at avoiding or minimizing impacts to MSHCP species, no effectiveness monitoring is required; however, compliance monitoring (confirmation that the AMMs were implemented appropriately) will be conducted. However, NiSource and the Service have identified several AMMs with a moderate to high degree of risk to the species upon failure and a moderate to high degree of uncertainty regarding their likelihood of success. NiSource will undertake additional effectiveness monitoring for these AMMs, as part of the adaptive management program described in Section 7.6.

7.4.1 Indiana Bat Effectiveness Monitoring

Effectiveness monitoring will be conducted to evaluate the assumptions that were part of the calculation of take for the Indiana bat for a suite of activities that result in indirect and/or direct effects. The results of this monitoring will be provided to the Service with the annual report at the end of the calendar year in which the monitoring was completed.

Indirect Effects

Neither NiSource nor the Service are aware of any studies that have monitored the response of Indiana bat colonies to new construction of pipeline ROWs or storage field expansions. Therefore, several assumptions were made when estimating the take and impact of take of these activities. To evaluate these assumptions, NiSource will take part in a larger future study to monitor the response of maternity colonies to habitat removal activities. To this end, NiSource will contribute $150,000 to its NFWF mitigation account either by year 5 of MSHCP implementation or prior to any construction project affecting known maternity colony habitat, which ever comes first. These monies will be used to initiate a larger research project, possibly in combination with research for other similar linear projects such as a highway construction project, to evaluate direct and indirect effects of partial habitat removal within a maternity colonies home range. The results of such studies will be used, through adaptive management, to adjust assumptions used for this MSHCP.

Direct Effects

The only activities that are anticipated to directly affect Indiana bats and result in death or injury are use of waste pits and clearing in suitable habitat where no surveys have been conducted but Indiana bats may be present.

Waste Pits: For the first five years of MSHCP implementation, NiSource will conduct monitoring of waste pits within 10 miles of one P3 or P4 hibernaculum (preference of P3) to look for dead bats. The hibernaculum with the most overlap of potential swarming/staging habitat in comparison with the number of waste pits and in closest proximity of the waste pits to hibernaculum entrance(s) will be used for this monitoring. All of these waste pits active between April 1 and November 15 will be monitored on a daily basis.

Clearing in Suitable Habitat: While some clearing will occur in suitable habitat where the existence of a maternity colony will not be known, take is calculated based on that contingency and appropriate AMMs will be employed in those cases.

Direct and Indirect Effects

In order to evaluate the reasonableness of the modeling (*see* Chapter 6, section 6.2.1.1) used to estimate the number of predicted maternity colonies taken by NiSource covered activities (*see* Chapter 6, sections 6.2.1.4 and 6.2.1.5), NiSource and the Service will coordinate every 5 years and consider all new information available at that time to reassess assumptions used in the model.

In addition, NiSource will conduct an assessment of suitable habitat within the covered lands to test assumptions related to the estimate of the number of maternity

colonies affected by NiSource activities. NiSource will contract with a permitted bat biologist to conduct acoustic surveys over portions of the covered lands with suitable summer habitat but without documented maternity colonies. Indiana bat summer habitat surveyed by The Conservation Fund for this MSHCP and all other available acoustic and netting within the covered lands will be considered as baseline for this effort. Surveys implemented to test assumptions concerning maternity colonies will focus in areas with limited or no sampling data available from the TCF or other sampling efforts.

The monitoring will begin the first summer season following the publication of guidelines acceptable to the Service for acoustic monitoring methods. The following protocol for sampling location and level of effort represent NiSource's preliminary understanding of what is adequate to provide additional information concerning the assumptions used in the estimate of the number of maternity colonies impacted under the MSHCP. These protocols are subject to review and revision under the amendment process in Chapter 9 as data are acquired through this effort or from other sources.

Protocol

a) Acoustic surveys will be conducted within the states of Ohio, Pennsylvania, West Virginia, and Northeastern Kentucky where future NiSource construction is likely.

b) Acoustic surveys will be conducted within the covered lands.

c) Acoustic surveys will focus on counties in Ohio, Pennsylvania, West Virginia, and northeastern Kentucky where there are gaps in TCF (or other) data.

d) Acoustic survey effort will be in proportion to miles of NiSource ROW. The total acreage of covered lands surveyed will be 100,000 acres (156 miles of the covered lands along the ROW). For Ohio, the amount of surveying proposed is 44 percent of the total (44,000 acres). For Pennsylvania, the amount of surveying proposed is 22 percent of the total (22,000 acres). For West Virginia, the amount of surveying proposed is 23 percent of the total (23,000 acres). For Northeast Kentucky, the amount of surveying proposed is 10 percent of the total (10,000 acres). Based on our existing understanding of the coverage of acoustic surveys, this would equate to the deployment of approximately 63 acoustic arrays to get a 90% probability of detection.[1]

e) To the extent possible acoustic surveys will be conducted in suitable habitat for new construction in the first 15 years of the permit as new construction is planned. Any positive identification of Indiana bat calls will be assumed to be females associated with a maternity colony and result in implementation of summer habitat AMMs unless NiSource chooses to conduct additional mist-

[1] One acoustic array is comprised of two detectors receiving data for two nights. One array is estimated to detect Indiana bats at 90% probability over approximately 1,600 acres of linear covered lands (2.5 miles corridor length x one mile corridor width = 2.5 square miles = 1,600 acres). Therefore 100,000 acres divided by 1.600 is 63 arrays (28 in Ohio, 14 in Pennsylvania, 14 in West Virginia, and seven in Kentucky).

netting surveys in the area to determine whether or not the calls represent a maternity colony.

7.5 Integration of Monitoring and Adaptive Management

An HCP's monitoring program should adequately assess the results of its adaptive management strategy (when applicable), and the two must be integrally linked. The monitoring program is essential to determining whether the strategy is providing the desired outcome of achieving the biological goals of the HCP. Under this MSHCP, the analyses of take species and habitat, and associated monitoring data, will be used to identify if and where adaptive management actions should be implemented. Specifically, data from the monitoring program will be used to determine when adaptive management is necessary and to select the appropriate adaptive management option to implement. When an adaptive management action is implemented, the monitoring program will be used to evaluate the response of the take species and/or impact to habitat and whether the action effectively addresses the concern identified.

NiSource's responsibilities for integrating the monitoring and adaptive management programs of this MSHCP include: (1) gathering monitoring data on the effectiveness of AMMs as well as mitigation and maintaining a database; (2) assessing results of AMM and mitigation monitoring to determine effects on the take species; (3) if effects are not what was anticipated, implementing in coordination with the Service, the necessary changes to the conservation program as well as to the MSHCP, permit, and IA pursuant to Chapter 9, if needed, to ensure minimization and mitigation consistent with the Service's permit issuance criteria; and (4) monitoring and evaluating the implementation and effectiveness of adaptive management strategies.

7.6 Adaptive Management

7.6.1 Overview of Adaptive Management

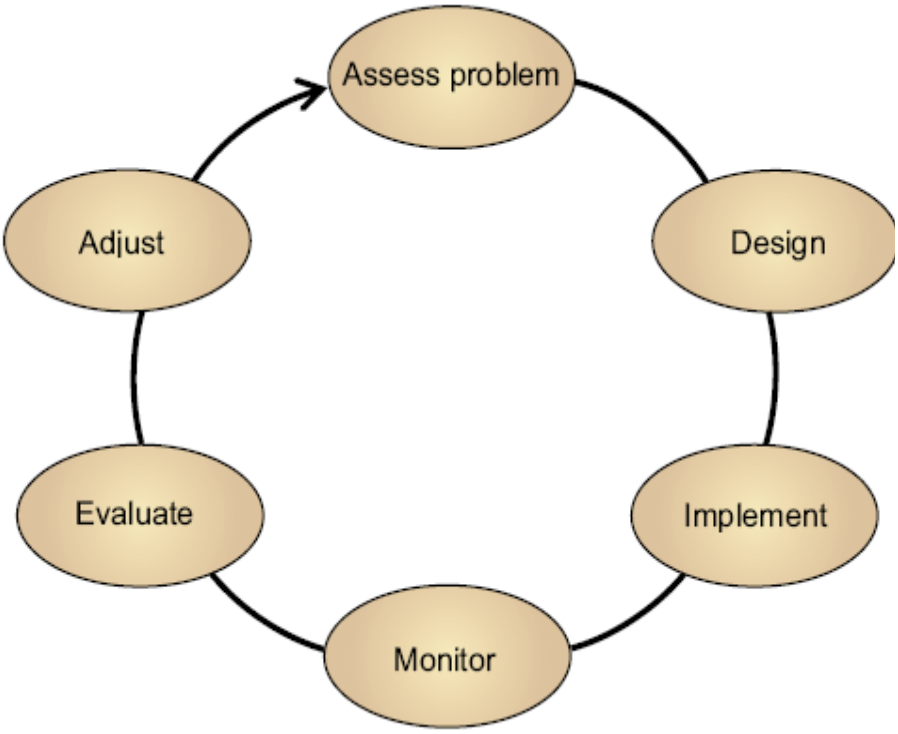
The adaptive management approach for this MSHCP includes the adaptive management framework, types of performance measures, how decision-making is to proceed, and the inclusion of any safeguards built into the adaptive management framework should objectives not be achieved. Adaptive management will allow for continuous improvement of the MSHCP based upon new information gathered during the duration of the permit, improved modeling, new technology, and changed circumstances. As mentioned above, new information collected as a result of the MSHCP monitoring programs will play a key role in all of the adaptive management programs described below.

Based on the best scientific information currently available, it is expected that the MSHCP's conservation measures will effectively achieve the biological goals and objectives. However, there is some uncertainty associated with various mitigation strategies, some AMMs, species known and/or modeled occurrences, and covered lands habitat conditions. Results of effectiveness monitoring may also indicate that some AMMs or mitigation measures are more or less effective than anticipated.

Thus, in addition to monitoring, the MSHCP includes an adaptive management program designed to gauge the effectiveness of the conservation measures and

implementation thereof, and to propose alternative or modified management measures in response to the monitoring results. **Figure 7.6.1-1** illustrates how the adaptive management program will work.

Figure 7.6.1-1 Adaptive Management Process (from Tech Guide)



7.6.2 Goals of Adaptive Management

The goal of adaptive management as undertaken in this MSHCP is designed to ensure that the conservation program measures (implementation of AMMs and mitigation for take of take species) function as desired and meet their intended biological goals and objectives. The adaptive management process for AMMs and mitigation procedures that have significant uncertainty and consequences for the target species are discussed below. Specifically, data will be collected and analyzed to confirm that AMMs are effective and that mitigation sufficiently compensates for the impact of take of the species.

7.6.3 Applying and Implementing Adaptive Management

Not every area of uncertainty in an MSHCP is appropriate to address through adaptive management. Adaptive management is a process for considering alternative strategies for meeting biological goals and objectives and modifying future conservation strategies based on what is learned from the implementation of the alternative strategies. Therefore, adaptive management is best suited to address uncertainty in the MSHCP's conservation framework. Accordingly, the MSHCP focuses adaptive management on critical biological processes or conservation measures

where uncertainty may influence the accuracy or prediction or effectiveness of proposed conservation measures.

A key element of adaptive management is the establishment of testable hypotheses tied to management objectives. If the data validate the hypothesis being tested, the adaptive management in that instance is complete and need not be continued. The Service retains the ability to reduce the amount, frequency, or duration of data collection (i.e., "the first three reports") provided evidence that the conservation measure is performing as intended.

If the monitoring results reveal, however, that the hypotheses or presumptions are incorrect, NiSource and the Service will implement the alternatives identified in this chapter and, as necessary, develop and implement other strategies to improve the AMMs and/or mitigation efforts being undertaken. Consistent with the cyclical design of adaptive management, should a change to AMMs or mitigation be triggered, further monitoring of the contingency would be required to gauge effectiveness. This will continue until the alternative achieves the desired effectiveness, or it is jointly determined that the presumed response can not be achieved. In addition, whenever a hypothesis proves to be incorrect, NiSource and the Service will:

1) calculate additional take that has occurred, if any;

2) identify any mitigation required to compensate for that unanticipated take;

3) adjust the calculation of take prospectively, where appropriate;

4) evaluate whether there is a need to further adjust the allowable level of take in the permit; and, if necessary;

5) amend the MSHCP, ITP and\or IA in accordance with the terms of Chapter 9; and,

6) find that the taking still will not appreciably reduce the likelihood of the survival and recovery of the species in the wild, as required by 16 U.S.C §1539(a)(2)(B)(iv), 50 C.F.R. §§ 17.22(b)(2)(i)(D) and 17.32(b)(2)(i)(D).[2]

Each of these will be addressed, at a minimum, through the feedback mechanisms identified in Section 7.6.5 and through NiSource's annual report under Section 7.7.

In any case where an AMM simply fails to provide the anticipated protection and there is evidence from effectiveness monitoring or other credible sources (e.g., the local Service Field Office) documenting failure that results in additional take, the MSHCP, and if necessary, the ITP may be amended in accordance with Chapter 9. Similarly, if there is evidence that the AMMs perform better than expected, the compensatory mitigation requirements may be reevaluated and reduced by the Service, if appropriate.

The processes described in Section 7.6.4 address species-specific adaptive management. This process is separate from the process for addressing responses to changed and/or unforeseen circumstances described in Chapter 10.

[2] The Service, alone, will make this determination.

7.6.4 Species-specific Adaptive Management Strategies

7.6.4.1 Nashville Crayfish

7.6.4.1.1 Avoidance and Minimization Measures

There are four key areas of uncertainty identified with respect to implementation of avoidance and minimization measures for the Nashville crayfish. These are the potential impacts associated with survey and crayfish relocation (AMM #1); horizontal directional drill (HDD) (AMM #4); downstream impacts from dry-ditch crossings (AMM #7); and inspection for erosion (AMM #9). Storm events have the potential to disturb sediments and confound the results of monitoring. Therefore, sediment monitoring may not be conducted during or within 48 hours after a storm event that affects the monitoring site.

AMM #1: There is uncertainty associated with the mortality estimate for moving Nashville crayfish outside of the stream crossing construction area.

The hypothesis relevant to relocation of Nashville crayfish is:

Nashville crayfish relocated outside of the construction area will not have more than 50% mortality any time within six months after relocation.

Adaptive management will be employed to evaluate and address the accuracy of the estimated 50% survival rate of individuals relocated out of the construction area. NiSource will have the relocated crayfish marked and recaptured (or use another acceptable methodology approved by the Service) to determine the fate of those individuals at multiple time periods (specifically one week, one month, and six months after relocation) as compared to a group of animals in similar habitat that have not been relocated. In addition, the study will mark and recapture (or use another acceptable methodology approved by the Service) to document impacts to a sample of the Nashville crayfish already inhabiting the relocation site to ensure that NiSource is not simply replacing one group with another. These studies will be performed for the first three relocation activities that NiSource conducts. The results will be used to appropriately adjust the compensatory mitigation requirements identified elsewhere in this MSHCP.

The trigger relevant to relocation of Nashville crayfish is 50% survival. If the survival rate at any point prior to six months after relocation for any of the three relocation actions is below 50%, or if loss of Nashville crayfish previously inhabiting the relocation site is greater than 10% of reference site during the same period, then the alternative adaptive management measures listed below will be evaluated and implemented as necessary.

Alternatives that can be implemented should the trigger occur:

A. Relocate Nashville crayfish to suitable habitat in an unoccupied section of the project stream if available; as described earlier in this chapter, the adaptive management steps described here would continue to apply to the new site.

B. Relocate Nashville crayfish to another Service approved stream having suitable habitat and within the range of the Nashville crayfish; as described earlier in this

chapter, the adaptive management steps described here would continue to apply to the new site.

C. Relocate Nashville crayfish to artificial ponds with suitable habitat (or other Service-approved temporary habitat) as a temporary measure until more data are available to support successful relocation into stream habitat within the species' range. As described earlier in this chapter, the adaptive management steps described here would continue to apply to the new site.

D. If the trigger occurs at two or more monitoring sites (initial sites or adaptive management sites), NiSource will (a) follow steps in section 7.6.3, and (b) apply adaptive management to at least three additional sites. If more than two of the next three sites also reach the threshold, NiSource will defer to the Service to determine whether or not relocation should be continued. If the Service determines that relocation is not effective and should be discontinued, a mortality estimate of 100% will be used for Nashville crayfish impacted by stream crossing actions and the take estimate revised accordingly.

AMM #4: There is uncertainty associated with the evaluation and implementation of HDD within Nashville crayfish habitat. HDD can be a valuable tool to avoid impacts to aquatic organisms, but can also, when employed under inappropriate conditions, cause significant damage to those organisms.

The hypothesis relative to HDD is:

NiSource will develop a detailed report for each Nashville crayfish stream crossing. Each plan must adequately inform a decision on whether or not to implement HDD at the site as described in Section 5.2.1.1 and ***Appendix J****. It must accurately predict the likelihood of success that the HDD, when implemented, would avoid take of Nashville crayfish and other significant environmental impacts (e.g., extensive loss of riparian corridor).*

Adaptive management will be employed to evaluate and address the effectiveness of the report in providing information necessary to inform a decision on HDD occurring at a site and when HDD is employed, in accurately predicting the success criteria listed in the hypothesis. The first three reports will be submitted to the Service for review prior to implementation of any stream crossing with the potential to take Nashville crayfish. The Service will evaluate the plans for completeness and sufficient detail relevant to providing for an informed decision on implementing an HDD in Nashville crayfish habitat. For HDDs that are implemented, the Service will evaluate the success (as defined in the hypothesis) of the HDD crossing based on the data and content (i.e., recommendations of the applicable HDD Plan).

The triggers for implementation of additional adaptive management measures in relation to AMM #4 are (1) a determination by the Service that any of the three reports evaluated are not providing information useful in making a decision concerning whether or not to implement HDD in Nashville crayfish habitat, or (2) when an HDD is implemented, there is disagreement between the data and recommendations in the Plan and success of the HDD crossing (i.e., the HDD Plan recommends HDD and a major frac-out occurs that leads to take of Nashville crayfish).

Alternatives that can be implemented should either of the triggers occur:

A. A meeting between NiSource and Service staff to revise the specific HDD Plan (and the planning process) prior to NiSource's engaging in HDD at another site with the potential to impact Nashville crayfish.

B. If the Service and NiSource staff are unable to reach agreement on a revised HDD Plan (and planning process), a report will be prepared outlining the specific disagreement and potential resolutions. This report will be forwarded to NiSource and Service management for consideration and a decision on a path forward.

C. If the Service or NiSource management do not agree on a resolution, discard AMM #4 and follow steps in 7.6.3.

AMM #7: There is uncertainty associated with the downstream sediment impacts of a dry-ditch stream crossing in Nashville crayfish habitat.

The hypothesis relative to downstream sediment impacts from dry-ditch crossing is:

Levels of suspended sediments or sediment deposition at a point 10 feet upstream of the upstream coffer dam and at a point 100 feet downstream of the downstream coffer dam will not exceed background levels of sediment at the project site by more than 10% during and immediately after construction (for at least 48 hours after coffer dams are removed) and there will not be greater than a 10% increase between sediment deposition on the stream substrate based on the average of the samples taken prior to commencement of work by NiSource at the site and after construction.

Adaptive management will be employed to evaluate and address the effectiveness of the dry-ditch crossing method in limiting sediments to the 175-foot (75 feet within the coffer dams and 100 feet downstream) area identified as causing take of Nashville crayfish. For the first three dry-ditch crossings in Nashville crayfish habitat, NiSource will fund a person (with qualifications and expertise in testing suspended sediments in streams) to evaluate during construction the 100-foot area downstream of the downstream coffer dam and as far downstream as there are levels of suspended sediments greater than 10% above background levels as measured in the same stream reach, and at least 200 feet upstream of the upstream coffer dam. In addition, NiSource will fund a person (with qualifications and expertise in measuring sediment deposition on the stream substrate) to take sufficient randomly placed measurements not more than 48 hours before commencement of covered activities (prior to any equipment moving in or placement of coffer dams) and the same number of measurements in the same locations, not more than 48 hours after major earth disturbance is completed. These measurements will be used to accurately assess the depth of sediment deposits within the area 200 feet downstream of the downstream coffer dam and 50 feet upstream of the upstream coffer dam.

In order to address the impacts of both suspended sediments and those that settle in the 175-foot area, two triggers for implementation of adaptive management measures in relation to AMM #7 will be used: (1) suspended sediments greater than 10% as compared to the 175-foot area and (2) a greater than 10% average increase in sediment covering the substrate as determined by the randomly placed "before" and "after"

measurements. If it is determined that the 175-foot area identified as causing take is too large (sediment impacts are less than 10%), the required take calculation and mitigation acreages will be reevaluated.

Alternatives that can be implemented should the triggers occur (these remedies would be applied to all future dry-ditch crossings):

A. Additional process-related remedies would be employed (e.g., working during extreme low water conditions, better training, and additional stream crossing oversight).

B. Additional physical measure would be employed (e.g., more water tight coffer dams, filtering of the bypass water, using smaller equipment).

C. Abandonment of the dry-ditch crossing method for a new approach proven to reduce sediment inputs during stream crossings (e.g., advanced boring or HDD processes or other techniques) and follow steps in 7.6.3.

AMM #9: There is uncertainty associated with inspecting and documenting the early stages of bank or stream bottom erosion in stream reaches where there are existing pipeline crossings.

The hypothesis relative to the early detection of erosion at pipeline crossings is:

The frequency and method of pipeline crossing inspections will detect erosion of the bank and stream bottom, and NiSource will correct the erosion problem before it results in take of Nashville crayfish or their habitat.

Adaptive management will be employed to evaluate and address the effectiveness of pipeline crossing erosion inspections in identifying incipient erosion problems and repairing them before they result in take of the Nashville crayfish. For each pipeline inspection in Nashville crayfish streams during the first three years after issuance of the ITP, inspectors will provide to the Service a written summary of their inspection and digital photographs 100 feet upstream and downstream of pipeline crossing on both banks. NiSource will also provide the Service with a list of any of those sites slated for repair. In addition, the Service may require NiSource to fund a person qualified to measure sediment deposits on the stream substrate to sample up to five sites at two separate time periods (six months apart) to determine if erosion detected in photographs is impacting crayfish habitat. These samples will entail measurements at a sufficient number of points within the areas 100 feet upstream and 100 feet downstream of the pipeline crossing to determine at the 0.05 level of significance that there is a greater than 10% average increase in sediments between the two sample periods. The sampling locations will have similar stream dynamics to ensure compatible data. Using these data, the Service will determine whether the inspection program is effectively identifying incipient erosion at pipeline crossings before it results in take of Nashville crayfish. Similarly, if the first three years of inspection program data show that the stream banks are stable and that little change is documented from annual inspections, the time frame will be increased to every two years.

The trigger for implementation of adaptive management measures for AMM #9 is if the Service determines, based on photographic data provided by NiSource, that incipient erosion is occurring at any of the monitored pipeline crossings and the

sediment deposit measurements upstream or downstream of that pipeline crossing (if required by the Service) indicate a greater than 10% average increase in sediment on the stream bottom in the sampled area between the two sample periods.

Alternatives that can be implemented should the trigger occur:

A. Additional training of inspectors to better recognize incipient erosion problems.

B. More frequent erosion inspections of pipeline crossings in Nashville crayfish habitat.

C. Implementation of more protective bank stabilization and other erosion control measures in Nashville crayfish habitat.

D. Implementation of a shorter time period within which to repair incipient erosion problems after they are identified.

E. Follow steps in 7.6.3.

7.6.4.1.2 Mitigation

There is one area of uncertainty identified in the proposed mitigation for Nashville crayfish.

Mitigation Option A: There is uncertainty associated with the effectiveness of habitat creation/restoration in attracting and meeting the life history requirements of Nashville crayfish.

The hypotheses relevant to effectiveness of habitat creation/restoration to attract Nashville crayfish are:

Habitat creation/restoration measures (in-stream slab rock and riparian restoration) within an unoccupied stream reach in the Mill Creek watershed will attract Nashville crayfish and will support a typical density (1.0 to 2.0 animals per square meter) over at least two generations (approximately two years after restoration).

The trigger for evaluating adaptive management measures and determining which measures should be implemented is, if after two years from the completion of the restoration, Nashville crayfish have not occupied the created or restored site at a density of approximately 1.0 to 2.0 animals per square meter. To determine if the created/restored habitat is performing as intended, a qualified biologist will visit the site after one year (to evaluate habitat and qualitatively document any colonization) and re-visit after the second year to determine if an average density of 1.0 to 2.0 Nashville crayfish per square meter are using the creation/restoration site and again after the third year to insure the minimum of two generations criterion is met. Details of this data collection methodology will follow current best available methods and will be incorporated into the mitigation plans submitted to the Service by NiSource.

Alternatives that can be implemented should the trigger occur:

A. Evaluate the habitat restoration to ensure that slab rock has remained in place and whether riparian restoration survival rate is at least 75% and, if not, repair or replace slab rock and restore riparian habitat as necessary to achieve prescribed restoration criteria.

B. After consultation with the Service, State of Tennessee, academia, and other relevant organizations, NiSource will introduce or reintroduce Nashville crayfish to the restored site.

C. After consultation with the Service, State of Tennessee, academia, and other relevant organizations, NiSource will identify and restore another site within the range of the Nashville crayfish. The new site must meet the criteria for a mitigation site as detailed in Chapter 6 including being permanently protected.

7.6.4.2 Bog Turtle

7.6.4.2.1 Avoidance and Minimization Measures

There are two key areas of uncertainty identified with respect to implementation of avoidance and minimization measures for the bog turtle. These are the potential impacts associated with employment of silt fences around construction activities (AMM #3) and hydrological impacts associated with upland (AMM #20) or stream work (AMM #21).

AMM #3: There is uncertainty as to whether the silt fencing will always keep turtles out and sedimentation in the work zone.

The hypotheses relative to the success of silt fencing are:

Silt fencing will keep bog turtles out of and contain sediments within the work zone.

NiSource will monitor every known or assumed bog turtle site where AMM #3 is employed for effectiveness the first five years. If the AMM is entirely effective at every known or assumed bog turtle site for the five years, no further effectiveness monitoring is required. However, compliance monitoring is still needed. If no activities are conducted in any known or assumed bog turtle sites in the first five years, this monitoring requirement will continue for the next five following years.

If any worker, i.e., NiSource personnel or contractor, finds a turtle inside the work area, all work in that area must stop and an approved surveyor will determine species and move the turtle to a safe area. Work in that area can then continue. The exclusion structure will be examined and an attempt made to determine why it failed (silt fence not buried deeply enough, vandalism, etc.). If the reason can be discerned, the AMM will be modified and all future exclusion structures will be installed utilizing specifications that address this concern. If the reason for failure cannot be determined or addressed with enhanced specifications, for all future projects, the AMM will be modified to include the requirement that a qualified surveyor needs to be onsite during all construction activities instead of just prior to such activities and after breaches.

Alternatives that can be implemented should the threshold above be satisfied:

A. If sedimentation is not entirely contained within fenced areas, NiSource will ensure that additional sediment/erosion tools specified within its ECS are implemented within 24 hours.

B. Follow steps in 7.6.3.

AMM #20 and #21: There is uncertainty as to whether NiSource can adequately ensure that its activities will not result in changes to the wetland that would result in take of bog turtles.

The hypothesis relative to the success of NiSource maintaining hydrology is:

NiSource activities will not permanently alter bog turtle wetlands.

NiSource will monitor at least five known bog turtle wetlands in a variety of situations (e.g., upland work within 300 feet upstream of a wetland, trenching within 300 feet of a wetland). Monitoring methodologies include documentation of (1) plant assemblages and densities, (2) soil conditions, (3) hydrological sources, and (4) grade and contour. These data will be collected within 30 days prior to an activity and periodically thereafter to determine whether the wetland suitability for bog turtles has been adversely affected.

The threshold for AMM #20 and #21 is no significant change in the core fen habitat that may affect bog turtles. If the AMMs are entirely effective in all situations, no further effectiveness monitoring would be required. However, compliance monitoring still would be needed.

Alternatives to evaluate if the thresholds are exceeded:

A. Revise AMMs to utilize more or different trenchline barriers to prevent water from following the pipeline. As described earlier in this chapter, the adaptive management steps described here would continue to apply to the new AMM.
B. Work with the Service to develop other methods to restrict water flow from the wetland (new AMMs). As described earlier in this chapter, the adaptive management steps described here would continue to apply to the new AMM.
C. Require project rerouting to avoid bog turtle habitat.
D. Follow steps in 7.6.3.

7.6.4.2.2 Mitigation

The key area of uncertainty identified in the proposed mitigation for bog turtle is the success of restoring suitable bog turtle habitat at a given site.

The hypotheses relevant to effectiveness of habitat creation/restoration to attract bog turtle are:

Habitat restoration measures will successfully recreate suitable habitat for bog turtles and expand nesting and basking habitat within occupied sites.

While bog turtle habitat restoration projects have occurred throughout the northeast for many years, each site needs an adaptive management strategy to ensure success. For example, interior fencing may need to be shifted to move grazers into the areas the Service would like restored, or herbicide may need to be applied in additional years than originally anticipated. All bog turtle mitigation projects need to include an initial plan for restoration and an adaptive management plan to account for alterations. The threshold for action is if there is more than a 10% reduction in acreage or unsuccessful restoration of core fen and/or nesting habitat as specified in the site-

specific mitigation/restoration plan, then alternative adaptive management measures will be evaluated and additional actions implemented.

Alternatives to evaluate if the thresholds are exceeded:

A. Altering grazers (e.g., shifting from sheep to goats).

B. Installing additional interior fencing to shift grazing patterns.

C. Altering grazing patterns (e.g., keeping animals onsite year-round).

D. Creating additional canopy openings with tree removal.

E. Conducting another round of herbicide application.

7.6.4.3 Indiana Bat

7.6.4.3.1 Avoidance and Minimization Measures

There are five key areas of uncertainty identified with respect to implementation of avoidance and minimization measures for the Indiana bat. Four of these are incorporated into an adaptive management strategy. These are the potential impacts associated with the disposal of spoil beyond 100 feet of known hibernacula entrances and associated sinkholes (AMM #5), blasting beyond 0.5 mile of known hibernacula (AMM #7), drilling beyond 0.5 mile of known hibernacula (AMM #8), and removal of potential roost trees less than nine inches dbh (AMM #27). AMM #2i involves the initial assessment of potential winter habitat by NiSource or its designee. This AMM will be monitored for compliance to ensure NiSource or its designee is correctly identifying which openings are potentially suitable for Indiana bats but will not require adaptive management strategies.

AMM #5: There is uncertainty associated with the ability of NiSource to avoid take of Indiana bat by disposing spoil greater than 100 feet away from known hibernacula entrances and associated sinkholes.

The hypothesis relevant to AMM #5 is:

Known Indiana bat hibernacula within the covered lands will not be impacted from the disposal of spoil material greater than 100 feet from known hibernacula entrances and associated sinkholes.

Adaptive management will be employed to determine if the disposal of spoil material at locations greater than 100 feet from known Indiana bat hibernacula entrances and associated sinkholes is causing take of Indiana bats in hibernacula. The disposal of spoil can result in changes to the hibernacula microclimate by the blockage of airflow and/or a modification of how air flows into the hibernacula. NiSource will contract with a permitted bat biologist to collect hibernacula microclimate data using dataloggers (for approximately 15 days before and after spoil placement but no less than 30 days total) near the location of bat roosts and video documentation of hibernating bats during construction activities (if construction activities occur during hibernation season or the site is a summer roost for cave obligate bat species). Analysis of the video is designed to document whether the bats in hibernation are affected by the spoil disposal through unnatural arousal from torpor and/or changes to roosting

locations within the hibernacula. The data will be used to evaluate and document pre-, during, and post-disposal of spoil any significant modification to hibernacula microclimate, as well as to bats directly, and the impact this may have on hibernating Indiana bats. These studies, which would be coordinated with the Service prior to implementation of the covered activities, will be performed for the first three covered activities that NiSource conducts within the recharge area of a known and/or presumed Indiana bat hibernacula, excluding known or presumed hibernacula that are not accessible due to safety concerns (e.g., abandoned underground coal mines).

If the spoil disposal does not result in a measurable modification to hibernacula microclimate and/or cause an immediate disturbance to hibernating bats during construction of the three covered activities, adaptive management would be complete. If a measurable modification or disturbance of bats is observed, alternative adaptive management measures will be evaluated, additional adaptive management actions will be implemented, and studies will continue until three such covered activities are successfully implemented without adverse impacts to bats. Alternatives include:

A. NiSource will determine the distance from known and/or presumed hibernacula that spoil disposal may occur without modifying hibernacula microclimate by placing spoil a greater distance from the hibernacula at subsequent sites.

B. NiSource will remove all spoil from the recharge areas of known and/or presumed Indiana bat hibernacula.

C. Follow steps in 7.6.3.

AMM #7: There is uncertainty associated with the potential effects of blasting beyond 0.5 mile of known hibernacula.

The hypothesis relevant to AMM #7 is:

Known Indiana bat hibernacula within the covered lands will not be impacted from blasting beyond 0.5 mile of known Indiana bat hibernacula.

Adaptive management will be employed to determine if the blasting at locations greater than 0.5 mile from known and/or presumed Indiana bat hibernacula entrances and associated sinkholes is causing take of Indiana bats in hibernacula. NiSource will contract with permitted bat biologists to evaluate the impact to the species during blasting activities as well as pre- and post-blasting. The biologists also will document any modification to hibernacula microclimate and evaluate the impact this may have on hibernating Indiana bats. Data will be collected on the hibernacula microclimate using dataloggers (for approximately 15 days before and after blasting but no less than 30 days total) near the location of bat roosts. In addition, hibernating bats will be recorded with video equipment during blasting activities (if construction activities occur during hibernation season or the site is a summer roost for cave obligate bat species) to determine the impact blasting may have on hibernating Indiana bats. Analysis of the video is designed to document whether the bats are affected by the blasting through unnatural arousal from torpor and/or changes to roosting locations within the hibernacula. These studies, which will be coordinated with the Service prior to implementation of the covered activities, will be performed for the first three blasting activities that NiSource conducts within 2.5 miles of a known and/or presumed Indiana

bat hibernacula, excluding known or presumed hibernacula that are not accessible due to safety concerns (e.g., abandoned underground coal mines).

If the blasting does not result in a measurable modification to hibernacula microclimate or cause immediate disturbance to hibernating bats, adaptive management would be complete. If a measurable modification or disturbance of bats is observed, alternative adaptive management measures will be evaluated, additional adaptive management actions will be implemented, and studies will continue until three such covered activities are successfully implemented without adverse impacts to bats. Alternatives include:

A. NiSource will determine the distance from known and/or presumed hibernacula where blasting may occur without disturbing Indiana bats and/or modifying hibernacula microclimate and ensure that all future blasting occurs at least that distance or a greater distance from known sites.

B. Follow steps in 7.6.3.

AMM #8: There is uncertainty associated with the potential effects of drilling beyond 0.5 mile of known hibernacula.

The hypothesis relevant to AMM #8 is:

Known Indiana bat hibernacula within the covered lands will not be impacted from drilling beyond 0.5 mile of known Indiana bat hibernacula.

Adaptive management will be employed to determine if the drilling at locations greater than 0.5 mile from known and/or presumed Indiana bat hibernacula entrances and associated sinkholes is causing take of Indiana bats in hibernacula. NiSource will contract with permitted bat biologists to evaluate the impacts to the species during drilling activities as well as pre- and post-drilling to document and evaluate any modification to hibernacula microclimate and the impact this may have on hibernating Indiana bats. Data will be collected on the hibernacula microclimate using dataloggers near the location of bat roosts (for approximately 15 days before and after drilling but no less than 30 days total). In addition, hibernating bats will be recorded with video equipment during drilling activities (if construction activities occur during hibernation season or the site is a summer roost for cave-obligate bat species) to determine the impact drilling may have on hibernating Indiana bats. Analysis of the video is designed to document whether the bats are affected by the drilling through unnatural arousal from torpor and/or changes to roosting locations within the hibernacula. These studies, which will be coordinated with the Service prior to implementation of the covered activities, will be performed for the first three drilling activities that NiSource conducts within the 2.5 miles of a known and/or presumed Indiana bat hibernacula, excluding known or presumed hibernacula that are not accessible due to safety concerns (e.g., abandoned underground coal mines).

If the drilling does not result in a measurable modification to hibernacula microclimate or cause immediate disturbance to hibernating bats, adaptive management would be complete. If a measurable modification or disturbance of bats is observed alternative adaptive management measures will be evaluated, additional adaptive management actions will be implemented, and studies will continue until three such

covered activities are successfully implemented without adverse impacts to bats. Alternatives include:

A. NiSource will determine the distance from known and/or presumed hibernacula, where drilling may occur without disturbing Indiana bats and/or modifying hibernacula microclimate, and ensure that all future drilling occurs at least that distance or a greater distance from known sites.

B. Follow steps in 7.6.3.

AMM #27: There is uncertainty whether removing trees less than nine inches dbh from within the existing ROW and appurtenant facility lands during the summer active period will cause take of Indiana bats.

NiSource must ensure that trees greater than nine inches dbh are not removed while potentially occupied by Indiana bats. There is uncertainty, however, whether nine inches dbh is an adequate threshold to avoid take of Indiana bats within the existing ROW and appurtenant facility lands.

The hypothesis relative to AMM #27 is:

Indiana bats are unlikely to roost in trees less than nine inches dbh within the NiSource work areas due to the fact that the activities will occur within the existing ROW and appurtenant facility lands.

Adaptive management will be employed to determine whether the hypothesis is correct. NiSource will observe all trees ≥ five inches dbh but < nine inches dbh that are located within these existing ROW and appurtenant facility lands for bats on three O&M activities locations. Each of the three O&M activities must require the clearing of trees ≥ five inches dbh but < nine inches dbh. NiSource will either ensure that at least one employee of its environmental staff or a permitted bat biologist is present at the time of clearing. This individual will observe trees ≥ five inches dbh but < nine inches dbh as they are being removed from the existing ROW and/or appurtenant facility lands for bats. NiSource will record any observations of bats flying out of roosts during tree clearing and/or dead or injured bats on the ground after trees are cut. In case dead or injured bats are documented as a result of clearing where NiSource has used its environmental staff as the observer, NiSource will immediately contract a permitted bat biologist to identify the dead or injured species of bat(s).

If any bats are observed flying out of trees or dead or injured Indiana bats are discovered:

A. NiSource will revise the AMM to decrease the allowable diameter of trees cleared during the active period.

B. Follow steps in 7.6.3.

7.6.4.3.2 Mitigation

The key area of uncertainty identified in the proposed mitigation for the Indiana bat is the effectiveness of winter habitat restoration projects in attracting Indiana bats and meeting the species' life history requirements. While winter habitat restoration projects are not part of the current mitigation package (*see* Chapter 6.2.1.6), they may

be considered in the future. However, the experimental nature of this relatively new science requires a delay in the identification of specific responses beyond that described below.

The hypothesis relevant to effectiveness of winter habitat restoration to attract Indiana bats is:

Winter habitat restoration measures (construction of air dams (internal and external), sinkhole restoration, demolition and removal of man-made structures, closure of man-made entrances and other agreed upon measures) within degraded caves and/or mines that exhibit the potential for successful restoration, such as, but not limited to, those caves identified as having High Potential in the draft revised Indiana bat Recovery Plan, will attract Indiana bats, and meet the species winter life history requirements.

The threshold for evaluating and implementing alternative adaptive management measures is if Indiana bat populations have not occupied and subsequently increased at the restored hibernacula within four years of restoration. To determine if the restored habitat is performing as intended, a qualified biologist will visit the site beginning two years after the restoration and re-visit every other year for one year or until Indiana bats are documented and increasing at the restored hibernacula. If such have not occurred, NiSource will seek input from bat and cave experts to determine the reasons and what measures to implement to make the site more attractive to bats. Upon receiving approval of these measures from the Service, NiSource would then implement those measures and monitoring would be repeated as described above. If Indiana bats have not occupied the site within four years of implementation of the remedial measures and NiSource has attempted, in good faith, to implement the Service-approved measures suggested by the bat and cave experts, the mitigation will be considered complete as designed. The purpose of this acceptance is to allow the site to take longer to develop before moving on to a new site. If Indiana bats have still not occupied the site within the first 10 years, NiSource will consult with the Service about acceptable future actions, which may include mitigation at a new site. NiSource would then be responsible for the mitigation at a new site. Details of these data collections will be provided with the mitigation plans submitted by NiSource to the Service.

7.6.4.4. Clubshell, Fanshell, Northern Riffleshell, James spinymussel and Sheepnose Mussels

7.6.4.4.1 Mussel Take Calculation

NiSource proposes to use a sediment transport model to estimate take of mussels when the open-cut stream crossing methodology is used. This model, discussed briefly in Chapter 6 and provided in **Appendix L**, is based on numerous assumptions that have not been field tested or otherwise subjected to verification. Because of the uncertainty associated, this model requires validation within the context of adaptive management.

The hypothesis regarding the sediment transport model is:

Lethal impacts from sediment covering the river substrate to 0.236 inches of sediment extend 1060 feet downstream of the open-cut crossing, and levels of suspended sediment

at or above 600 mg/l causing harm to mussels extend an additional 2,640 feet downstream of the lethal zone.

Adaptive management will be employed to determine the accuracy of the model under various stream conditions (width, flow rate, geographical location). A person (with qualifications and expertise in testing suspended sediments in streams) will evaluate during construction the sediment plume downstream of the open cut trench as far downstream as there are levels of suspended sediments greater than 600 mg/l. In addition, a person (with qualifications and expertise in measuring sediment deposition on the stream substrate) will take randomly placed measurements in the "lethal" zone, not more than 48 hours before commencement of covered activities (prior to any equipment moving to the site), and again not more than 48 hours after completion of the covered activities. Measurements will be taken in the same locations before and after completion of the work. This monitoring will occur for the first three open-cut crossings carried out on different streams for all mussels in the MSHCP (i.e., if two open-cut crossings are done on the same stream only one would be monitored and counted for adaptive management, but if an open cut crossing was carried out for clubshell and one for fanshell on different streams, it would be counted as two monitoring events for adaptive management).

The thresholds for the model will be consistent measurements of suspended sediments less than 600 mg/l and the absence of a statistically significant average increase greater than 10% in sediment covering the substrate as determined by the randomly placed "before" and "after" measurements. If it is determined that the 1,060-foot area previously identified as causing lethal impacts or the 2,640-foot area causing harm and harassment is too large (sediment impacts are less than 10%), the predictive model will be revised, along with the mitigation strategy, if necessary.

Alternatives to evaluate if the thresholds are met within the estimated distances:

A. Revise the estimated take for that stream based on the actual lethal area and harm area based on the actual measurements, which might require reevaluating the take calculation and mitigation requirements, and amending the MSHCP and permit as necessary, consistent with Chapter 9.

B. Revise the take calculation model if the Service determines that sufficient data have been gathered to develop a more accurate model, which might require reevaluating mitigation requirements and amending the MSHCP and permit as necessary, consistent with Chapter 9.

C. Develop a new model to estimate lethal take and harm and harassment zones for stream crossings, and follow steps in 7.6.3.

7.6.4.4.2 Avoidance and Minimization Measures

There are four key areas of uncertainty identified with respect to implementation of avoidance and minimization measures for the clubshell, fanshell, northern riffleshell, and sheepnose mussels (in this section collectively referred to as "mussels"). These are the HDD (AMM #3); inspection for erosion (AMM #8); hydrostatic testing (option b or c) (AMM #18); cleaning equipment for invasive species (AMM #20). Note that for all

adaptive management involving sediment monitoring, monitoring may not be conducted during or within 48 hours after a storm event that affects the monitoring site.

AMM #3: There is uncertainty associated with the evaluation and implementation of HDD within mussel habitat. HDD can be a valuable tool to avoid impacts to aquatic organisms, but can also cause significant damage to those organisms when employed under inappropriate conditions.

The hypothesis relative to HDD is:

NiSource will develop a detailed report for each mussel stream crossing. Each plan must adequately inform a decision on whether or not to implement HDD at the site as described in Section 5.2.1.1 and ***Appendix J****. It must accurately predict the likelihood of success that the HDD, when implemented, would avoid take of mussels and other significant environmental impacts (e.g., extensive loss of riparian corridor).*

Adaptive management will be employed to evaluate and address the effectiveness of the report in providing information necessary to inform a decision on HDD occurring at a site and when HDD is employed, in accurately predicting the success criteria listed in the hypothesis. The first three reports will be submitted to the Service for review prior to implementation of any stream crossing with the potential to take mussels. The Service will evaluate the plans for completeness and sufficient detail to determine whether they will allow for an informed decision on implementing an HDD in mussel habitat. For HDDs that are implemented, the Service will evaluate the success (as defined in the hypothesis) of the HDD crossing based on the data and content (i.e., recommendations of the applicable HDD Plan).

The triggers for implementation of additional adaptive management measures in relation to AMM #3 are (1) a determination by the Service that any of the three reports evaluated are not providing information useful in making a decision concerning whether or not to implement HDD in mussel habitat, or (2) when an HDD is implemented, there is disagreement between the data and recommendations in the Plan and success of the HDD crossing (i.e., the HDD Plan recommends HDD and a major frac-out occurs that leads to take of mussels).

Alternatives to evaluate if either of the triggers occurs:

A. A meeting between NiSource and Service staff to revise the specific HDD Plan (and the planning process) prior to NiSource's engaging in HDD at another site with the potential to impact mussels.

B. If the Service and NiSource staff are unable to reach an agreement on a revised HDD Plan (and planning process), a report will be prepared outlining the specific disagreement and potential resolutions. This report will be forwarded to NiSource and Service management for consideration and a decision on a path forward.

C. If the Service or NiSource management do not agree on a resolution, discard AMM#3 and follow steps in 7.6.3.

AMM #8: There is uncertainty associated with inspecting and documenting the early stages of bank or stream bottom erosion in stream reaches where there are existing pipeline crossings.

The hypothesis relative to the early detection of erosion at pipeline crossings is:

The frequency and method of pipeline crossing inspections will detect erosion of the bank and stream bottom, and NiSource will correct the erosion problem before it results in take of mussels or their habitat.

Adaptive management will be employed to evaluate and address the effectiveness of pipeline crossing erosion inspections in identifying incipient erosion problems and repairing them before they result in take of the mussels. For each pipeline inspection in mussel streams during the first three years after issuance of the ITP, inspectors will provide to the Service a written summary of their inspection and digital photographs 100 feet upstream and downstream of pipeline crossing on both banks. NiSource will also provide the Service with a list of any of those sites slated for repair. In addition, the Service may require NiSource to retain a person qualified to measure sediment deposits on the stream substrate. The person would sample up to five sites at two separate time periods (likely two to six months apart) to determine if erosion detected in photographs is impacting mussels or their habitat. These samples will entail measurements at a sufficient number of points within the areas 100 feet upstream and 100 feet downstream of the pipeline crossing to determine at the 0.05 level of significance if there is a greater than 10% average increase in sediments between the two sample periods. The sampling locations will have similar stream dynamics to ensure compatible data. Using these data, the Service will determine whether the inspection program is effectively identifying incipient erosion at pipeline crossings before it results in take of mussels. Similarly, if the first three years of inspection program data show that the stream banks are stable and that little change is documented from annual inspections, the time frame will be increased to every two years.

The trigger for implementation of adaptive management measures for AMM#8 is if the Service determines, based on photographic data provided by NiSource, that incipient erosion is occurring at any of the monitored pipeline crossings and (if required by the Service) the sediment deposit measurements upstream or downstream of that pipeline crossing indicate a greater than 10% average increase in sediment on the stream bottom in the sampled area between the two sample periods.

Alternatives to evaluate the trigger occurs:

A. Additional training of inspectors to better recognize incipient erosion problems.

B. More frequent erosion inspections of pipeline crossings in mussel's habitat.

C. Implementation of more protective bank stabilization and other erosion control measures in mussel's habitat.

D. Implementation of a shorter time period within which to repair incipient erosion problems after they are identified.

E. Follow steps in 7.6.3.

AMM #17 and #18: There is uncertainty associated with the potential effects of withdrawing and discharging hydrostatic test water into mussel habitat.

The hypothesis relevant to hydrostatic testing for the mussels is:

Hydrostatic water withdrawal and discharge under the MSHCP within mussel habitat will not entrap mussels or cause sediment impacts to mussels.

Adaptive management will be employed to determine if the withdrawal of hydrostatic test water from a mussel stream entraps mussels and if discharge of hydrostatic test water into a mussel stream causes significant increased suspended sediment. NiSource will monitor the effectiveness of the appropriate ECS procedures (screens, rate of withdrawal, etc.) in preventing the entrapment of mussels. The monitoring design will be developed and provided to the Service for approval prior to implementation of the monitoring activity. NiSource will also monitor water discharge into mussel streams (options b or c of AMM #18). A person with qualifications and expertise to test suspended sediments in streams will evaluate the suspended sediments at a reference point upstream of the discharge site, but in the same stream reach, and within 75 feet downstream of the discharge site during discharge, at regular intervals until levels not greater than 10% above those taken at the reference point are achieved. The monitoring will be performed on the first three water withdrawal and discharge actions in occupied mussel habitat

The threshold for action relevant to hydrostatic testing is if any juvenile or adult mussel becomes entrapped against or suctioned through the screens hydrostatic water withdrawal. The threshold for water discharge is if suspended sediments measure greater than 10% above the reading at the reference, downstream of the discharge point, during discharge of hydrostatic test water into mussel streams.

Alternatives to evaluate if the thresholds are exceeded:

A. NiSource will immediately discontinue water withdrawal for hydrostatic testing from the mussel stream and relocate the withdrawal site away from the mussel resource or find an alternate water source.

B. NiSource will employ smaller diameter withdrawal pipes, finer mesh screens, slower rate of withdrawal, or a combination of these measures if water withdrawal recommences at the monitored site as well as at all future mussel streams.

C. NiSource will immediately discontinue discharge of water into mussel streams and employ additional erosion control measures (e.g., sediment traps, slower discharge rate) to filter or reduce the energy of the water before it enters mussel streams.

D. NiSource will relocate the water discharge point away from mussel resources.

E. Follow steps in 7.6.3.

AMM #20: There is uncertainty concerning the effectiveness of protocols for cleaning all potentially harmful invasive species (e.g., zebra mussels and quagga mussels) subject to changed circumstances (*see* Chapter 10) from equipment.

The hypothesis relevant to cleaning equipment is:

The protocols in place will remove all potentially harmful invasive species from equipment before it comes in contact with an occupied stream.

Adaptive management will be employed to ensure that the protocols in place in AMM #20 are effective in removing all potentially harmful invasive species from

NiSource construction equipment before it comes in contact with and could introduce invasive species into occupied streams. NiSource will monitor the effectiveness of the protocols by requiring the inspection of equipment by a qualified biologist before and after the equipment is cleaned for a minimum of the first three times cleaning of equipment is required. The biologist will have expertise in identifying various life stages (veligers, seeds, etc.) of potentially harmful invasive species and determining whether the cleaning process effectively removes all potentially harmful forms of invasive species from the equipment. If new invasives are indentified, NiSource will conduct similar protocols to ensure that cleaning methods are effective for those species as well.

The trigger relevant to cleaning is identification of any form (e.g., larval, adult) of any potentially harmful invasive species on the equipment after the cleaning process.

Alternatives to evaluate if the trigger is met:

A. Implement revised training procedures in coordination with the Service for cleaning equipment, which would be subject to additional monitoring as described above.

B. Implement revised cleaning protocols in coordination with the Service, which would be subject to additional monitoring as described above.

C. Discontinue use of equipment in occupied mussel streams that has been in contact with streams containing potentially harmful invasive species.

D. Follow steps in 7.6.3.

7.6.4.4.3 Mitigation

Mitigation in Construction Zone

There is uncertainty associated with enhancement of the substrate within the construction zone of any pipeline repair, replacement, or relocation that disturbs the stream bottom.

The hypothesis relevant to substrate enhancement is:

The suitable substrate material (e.g., gravel) will stay in place for at least five years without washing downstream off-site or becoming unsuitable from excessive sediment deposition over the top or within the interstitial spaces of the material.

Adaptive management will be employed on the first three enhancement sites on different streams to determine whether at five years (assuming that no 100-year floods occur during that period) after enhancement the substrate remains suitable habitat for the relevant mussel (clubshell, fanshell, northern riffleshell, sheepnose, or James spinymussel).

The triggers for adaptive management are (1) if a habitat survey by a qualified malocalogist in years two and five after enhancement determines that more than 25% of the area of the enhanced substrate has been washed off-site, (2) that greater than 25% of the enhanced area is no longer suitable (criteria to be agreed to by Service prior to survey) because of influx of sediment or (3) a combination of these two factors has resulted in more than 25% of the enhanced area being unsuitable during the five year period after enhancement.

Alternatives to evaluate if a trigger occurs:

A. Re-enhance the area that is no longer suitable if the cause of the washing away or sediment impacts no longer threatens the enhancement or if NiSource can correct the cause of impacts (e.g., upstream bank protection). The re-enhancement would be subject to additional monitoring as described above.

B. Conduct enhancement at least equal to the area lost at another site in close proximity to an extant population of the target mussel so that there is opportunity for colonization (this could entail implementing additional area of enhancement at another NiSource construction site).

C. Correct the source of the impacts (washing away or sediment) if at least 50% of the enhanced area is still suitable.

Mitigation Option A: There is uncertainty associated with the propagation and augmentation/reintroduction mitigation option for northern riffleshell mussels.

The hypothesis relevant to propagation and augmentation/reintroduction is:

Mussels will be successfully cultivated and established in suitable habitat and survive to reproductive age (approximately five years old).

Adaptive management will be employed to determine if 80% of base number of mussels (i.e., the base mitigation amount not including the number of additional mussels established using the 1.5 multiplier to compensate for loss) reintroduced into unoccupied suitable habitat or introduced to augment an existing population) survive to five years old. A qualified biologist using the best available mark and recapture techniques for mussels (**Appendix L**) will evaluate a statistically valid sample of the reestablished mussels to determine the survival percentage at one year, three years, and again at five years post re-establishment.

The trigger for adaptive management will be an estimate at anytime, including the five-year survey, that is below 80% survival of the base number of the mussels (i.e., the base mitigation amount not including the number of additional mussels established using the 1.5 multiplier to compensate for loss) re-established.

Alternatives to evaluate if the trigger occurs:

A. Propagate and reestablish additional mussels at the same site (if there is 50% to 80% survival of the base number reestablished after five years) to bring the total up to 100% of the base number of mussels required for the mitigation and re-initiate the monitoring process.

B. Propagate and reestablish mussels following the original mitigation requirements of Chapter 6 at a new location.

7.6.4.5 American Burying Beetle

7.6.4.5.1 Avoidance and Minimization Measures

There is no uncertainty identified with respect to implementation of avoidance and minimization measures for the ABB.

7.6.4.5.2 Mitigation

There is no uncertainty identified with respect to implementation of mitigation for the ABB.

7.6.4.6 Madison Cave Isopod

7.6.4.6.1 Take Calculation

There are several areas of uncertainty with respect to the current take calculation for Madison Cave isopods. For example, there is a lack of information on the actual number of additional Madison Cave isopod populations and the extent of known (and potential additional) Madison Cave isopod populations. In addition, the distance sedimentation and contaminant impacts flow from NiSource activities is not well understood and the actual impacts to Madison Cave isopods from exposure to sedimentation and contaminants are unclear. There is also uncertainty associated with the impacts of NiSource earth-disturbing activities (e.g., trenching and blasting) on the underlying karst formations especially the potential for earth-disturbing activities to cause a vector for the introduction of sediments and contaminants into Madison Cave isopod habitat.

The hypothesis relevant to the impacts of earth-disturbing activities is:

NiSource earth-disturbing activities will infrequently encounter karst features that may have connections to phreatic water. The assumption is that if the activities have any impact to phreatic waters, there is a likelihood of impacts to Madison Cave isopod.

Adaptive management will be employed to evaluate how frequently NiSource earth-disturbing activities either encounter previously undocumented surface or subsurface karst features (*see* Chapter 6 for definitions of karst features) that are reasonably likely to connect to the groundwater, or impact the karst such that a vector to the groundwater is opened (or made more direct) where one did not previously exist. NiSource will report to the Service whenever these features are encountered during earth-disturbing activities, maintain a record of the location of those features and do the following: (a) immediately stop work in the area of the feature and stabilize it to avoid potential sediment or other contaminant flow into the area and (b) within 24 hours conduct an initial inspection of the feature(s) to determine if there is an opening beyond one to two feet. Whenever a feature is encountered, AMM #5 will be followed (s*ee* Section 6.2.4.3) (geologist inspection and remediation measures). This process will be followed for all karst features encountered during earth-disturbing activities within the Madison Cave isopod range. The results will be used to appropriately adjust the compensatory mitigation requirements identified elsewhere in this MSHCP.

The trigger to implement adaptive management is the identification of more than three karst features that require remediation.

Alternatives to evaluate if the trigger occurs:

A. Follow steps in 7.6.3.

There also is uncertainty associated with the impacts of NiSource earth-disturbing activities (e.g., trenching and blasting) destabilizing visible surface karst

features (e.g., closed sinkholes, depressions, etc.) within or immediately adjacent to the ROW.

The hypothesis relevant to the impacts of earth-disturbing activities is:

NiSource pipeline construction activities (excavation, blasting, and presence of pipeline) will not result in destabilization of karst features that result in long-term impacts to Madison Cave isopod habitat.

Adaptive management will be employed to evaluate whether NiSource construction activities over the course of five years cause destabilization of karst features. NiSource will employ qualified geologists to monitor (*see* **Appendix L** for protocols) all karst features on or immediately adjacent to the pipeline ROW for years one and two post-construction for the development of subsidence and all areas where subsidence has occurred for a minimum of five years post-construction to determine if destabilization has occurred (that creates an increased likelihood of contaminants entering Madison Cave isopod habitat from the evaluated features).

The trigger to implement adaptive management relevant to destabilization is if monitoring determines that any of the karst features exhibit a level of destabilization that results in a higher risk of Madison Cave isopod habitat contamination.

Alternatives to evaluate if the trigger occurs:

A. Further evaluate the karst feature and any other similar features to determine the cause and scope (is it likely to happen to similar or other types of karst features) of the destabilization problem.

B. Remediate the destabilized sites to reduce the risk of contamination of Madison Cave isopod habitat.

C. Follow steps in 7.6.3.

7.6.4.6.2 Avoidance and Minimization Measures

There are three key areas of uncertainty identified with respect to implementation of avoidance and minimization measures for the Madison Cave isopod. These are associated with the ability to identify recharge areas for Madison Cave isopod and the potential for impacts from blasting (AMM #6).

AMM #6: There is uncertainty associated with the potential effects of blasting within mapped Madison Cave isopod potential habitat zone.

The hypothesis relevant to AMM #6 is:

Known Madison Cave isopod sites within the covered lands will not be impacted from blasting activities within the existing ROW.

Adaptive management will be employed to determine if the blasting at locations within the mapped Madison Cave isopod potential habitat zone is causing take of Madison Cave isopod. NiSource will contract with qualified biologists to monitor the nearest known populations to blasting activities. These studies, which will be coordinated with the Service prior to implementation, will be performed for the first three blasting activities that NiSource conducts within the 250 feet of a known Madison

Cave isopod population. If the blasting does not result in modification to the nearest known population or cause immediate disturbance to their habitat, the adaptive management requirement is complete. If this threshold is exceeded, alternative adaptive management measures will be evaluated and additional adaptive management actions will be implemented such as:

A. NiSource will determine the distance from known and/or presumed hibernacula that activities may occur without modifying Madison Cave isopod habitat and ensure that all future activities that might result in the destabilization occur at least that distance from known sites.

B. Follow steps in 7.6.3.

7.6.5 Feedback Mechanism and Implementation

NiSource, the Service, and other stakeholders, as appropriate, will convene as needed during the first year of implementation of the MSHCP, at least annually until the fifth year of implementation, and at least every five years thereafter, unless the Service determines that more frequent meetings are needed. Representatives at these meetings will be the NiSource MSHCP Coordinator, Service representatives, and other stakeholders as needed. NiSource and Service representatives will have the responsibility to notify the parties of the meeting and set the time and date. In addition to these set periodic meetings, NiSource and the Service may convene stakeholder meetings as needed throughout the life of the permit. Such meetings may be in person or by conference call.

The purpose of these meetings will be (1) to review the data provided in the annual reports, (2) to address any issues with implementation of the MSHCP, (3) to consider whether implementation could be streamlined, whether the avoidance, minimization, and mitigation measures have been effective, whether effectiveness goals have been achieved, and whether any adaptive management triggers were met, and (4) other MSHCP-related concerns. There will be a summary report of these meetings, including discussion of all issues addressed, presentation of all perspectives offered, and any agreements or conclusions reached at the meeting. This summary report will be prepared by the NiSource MSHCP Coordinator, but the Service will be given the opportunity to review and concur with the report. This review cycle does not preclude the use of adaptive management in the interim if circumstances indicate changes are warranted.

7.7 Reports

NiSource will file an annual report by March 31st that will provide the results of effectiveness and compliance monitoring of the conservation program (AMM, mitigation, and adaptive management) and a description of activities covered under the MSHCP.

The report will include information on the following areas:

1. Number and type of covered activities completed;
2. Annual acreage of land subject to disturbance, land use, or management activities;

3. Pre-construction surveys (e.g., habitat assessments, preconstruction surveys to relocate individuals) and the person(s) conducting the activities consistent with MSHCP;
4. AMMs implemented (frequency and type) and number of covered activities for which non-mandatory AMMs could not be implemented;
5. Non-mandatory AMMs that could not be implemented along with the specific reasons why;
6. An assessment of AMM implementation and any changes made to improve implementation of AMMs;
7. Take calculation for each species;
8. A calculation of the compensatory mitigation for anticipated take in the coming year, the resulting mitigation debt, and quantification of required deposits into the NiSource mitigation fund; and
9. A ledger sheet that includes information on mitigation projects and status of the mitigation fund, including an accounting of any credits from previous mitigation efforts that may be applied toward future take impacts.

NiSource has not included emergency response activities as covered activities under the MSHCP, and will address any ESA compliance issues for such emergency response activities through separate Section 7 emergency consultation procedures with the Service and the appropriate action agency(ies). However, NiSource will include details in the annual report regarding any emergency events and NiSource's response to such events that have or may have affected take species.

7.8 Maintaining the MSHCP as a Living Document

7.8.1 New Information Regarding Newly Listed Species

In order to help maintain the MSHCP as a living document, NiSource will request annually the names of any newly listed species that may be affected by the covered activities. These requests will go to the Service as well as the state heritage agencies. NiSource will determine how to address ESA compliance for such newly listed species, which may or may not include amending this MSHCP and the ITP.

7.8.2 Maintaining Current Data for MSHCP Species

NiSource will annually check the Service's online database Environmental Conservation Online System (ECOS) to determine whether any species included in the MSHCP have had a change in listing status. NiSource will also use the ECOS database to determine whether critical habitat has been designated within or adjacent to the covered lands area.

NiSource will annually check the ECOS database to determine whether any new or revised recovery plans or 5-year reviews have been developed for the MSHCP species. The Service will provide annually (through e-mail or website links) (1) updated county lists of listed and candidate species for the covered lands, and (2) other information pertaining to MSCHP species that specifically may inform the

implementation of the MSHCP. This provision in no way obligates the Service to undertake any surveys, expend any funds, or otherwise develop information regarding the species beyond the agency's existing responsibilities.

In addition, on an annual basis, NiSource plans to obtain and provide to the Service any new information regarding the MSHCP species from state natural heritage databases or other appropriate species databases. Current data sharing agreements do not allow the direct sharing of information from NiSource to the Service but NiSource will work with the state heritage programs to update these agreements. The Service and NiSource will coordinate to determine whether any of the information warrants consideration in the adaptive management process or as a changed circumstance.