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

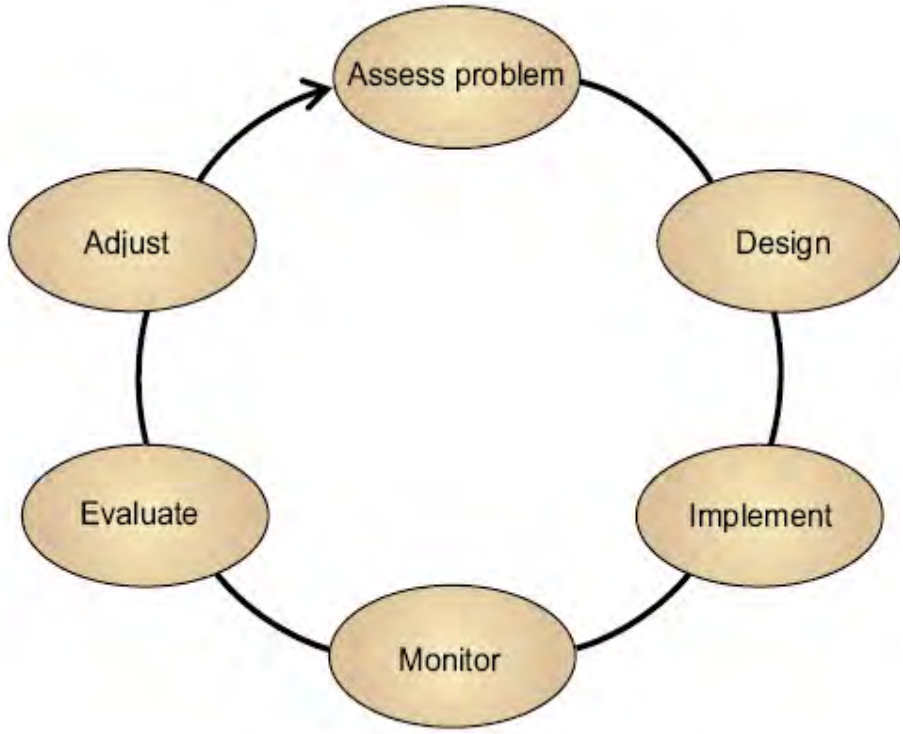
The adaptive management approach for this MSHCP includes the adaptive management framework, types of performance measures, how decision-making is to proceed, and the inclusion of any safeguards built into the adaptive management framework should objectives not be achieved. Adaptive management will allow 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 within one year, in accordance with the terms of Chapter 9; and,

6) evaluate whether any change to the ITP or operating conservation program contemplated in response to adaptive management complies with the biological opinion issued for this ITP/MSHCP pursuant to 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 consistent evidence from effectiveness monitoring or other credible sources (e.g., the local Service Field Office) documenting failure that results in additional take[3], the MSHCP, and if necessary, the Service will require ITP amendment 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. Nothing in this section affects NiSource's right to surrender the ITP at any time, recognizing that NiSource shall remain obligated for any outstanding minimization and mitigation measures required under the terms of the ITP

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

[3] NiSource and Regional lead staff will determine the sufficiency of the documented evidence.

for take that occurs prior to surrender of the ITP and such minimization and mitigation measures as may be required pursuant to the termination provisions of the Implementing Agreement, the MSHCP, or the ITP.

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.

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 within one year, discard AMM #4 and follow steps in 7.6.3 to amend the ITP/MSHCP, as needed.

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. In the event that steps A-D do not work, NiSource and the Service will implement steps in 7.6.3 within one year.

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 hypothesis be rejected:

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.

D. Follow steps in Section 7.6.3 to amend ITP/MSHCP within one year, if needed.

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 and amend ITP/MSHCP within one year, as needed.

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) within one year. 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 and amend ITP/MSHCP within one year, as needed.

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.

F. If measures A-E are unsuccessful, NiSource and the Service will agree on an alternate approach within one year or follow steps in 7.6.3 to amend ITP/MSHCP.

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, through scientific studies, 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 may 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. The Service will determine whether the ITP and MSHCP must be amended, consistent with Chapter 9.

C. Within one year, develop a new model to estimate lethal take and harm and harassment zones for stream crossings, and follow steps in 7.6.3 to determine whether revision/amendment of the MSHCP is required.

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 in accordance with the Implementing Agreement resolution process (IA, Section 12.3), AMM#3 will be eliminated and the ITP/MSHCP will be amended following 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 to amend ITP/MSHCP within one year, if needed.

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.

D. Follow steps outlined in section 7.6.3.

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.

C. If propagation and reintroduction proves unsuccessful as a mitigation strategy after two attempts to follow steps A and B, follow steps prescribed in 7.6.3 to amend the ITP/MSHCP as needed.

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 determined appropriate by NiSource and the Service, 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 interested stakeholders. 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. By at least the fifth annual meeting, NiSource will also prepare a detailed analysis of whether the MSHCP is meeting all the business values included in its decision to commence this program. This analysis, including any recommendations to address shortcomings, will be discussed with the Service. Proposed resolutions will be discussed with NiSource management to reaffirm that the MSHCP is meeting all of its intended goals.

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.

8.0 Funding Assurances

8.1 Introduction

This chapter provides a discussion of costs to implement the MSHCP, and the financial mechanisms that NiSource will use to assure funding. Although NiSource will have the ability to directly undertake mitigation activities through its operating budget, mitigation and associated tasks will primarily be assured through a trust account established by NiSource into which NiSource will make scheduled payments (Mitigation Account). Mitigation and other costs also will be assured through a secondary trust fund account established by NiSource that will serve as a replenishing reserve in the event that the primary fund becomes overdrawn (Reserve Account) or emergency funds are needed for any other reason. Both accounts will be administered by the National Fish and Wildlife Foundation (NFWF) and are collectively called the "MSHCP Fund."[1] NiSource will be obligated to annually ensure that both accounts contain sufficient monies to compensate for mitigation cost increases for such circumstances as underestimates, changed circumstances, and adaptive management measures. All other costs of implementing the MSHCP will be assured through NiSource's credit facility, or, as necessary, through a letter of credit. *See* Section 8.4.2, below.

8.2 Costs to Implement MSHCP

NiSource's cost to implement the MSHCP will vary from year to year depending on the nature and extent of the covered activities undertaken. MSHCP implementation expenses fall into five general categories:

- Administrative;
- Mitigation;
- MSHCP project costs;
- Adaptive management; and
- Changed circumstances.

Each of these categories is discussed in more detail below.

8.2.1 Administrative Costs

The administrative costs associated with this MSHCP include program management and oversight, training, general compliance monitoring, and software costs. The administrative costs are listed specifically in **Table 8.2.1-1**.

Most of the administrative costs associated with the MSHCP are personnel costs. NiSource intends to administer the MSHCP using existing staff and does not expect personnel cost increases. The NiSource employees who will manage and oversee

[1] NFWF is a private, non-profit, tax exempt organization chartered by Congress in 1984 that sustains, restores, and enhances the Nation's fish, wildlife, plants and habitats through leadership conservation investments with public and private partners.

MSHCP and ITP compliance (HCP Coordinators) already spend their time working on natural resources permitting and compliance issues, including ESA compliance through Section 7. Although the nature of the staff's ESA related tasks will change from compliance through Section 7 to compliance through Section 10, NiSource does not expect a significant increase in the number of hours the HCP Coordinators will spend on tasks relating to ESA compliance. In addition to the HCP Coordinators, numerous other NiSource employees will attend the required MSHCP training programs. The costs associated with this training are already included in NiSource's existing staff overhead expenses.

A generalized estimate of non-personnel administrative expenses is $370,000 in the first year of MSHCP implementation and $120,000 annually thereafter (Table 8.2.1-1). This includes required compliance monitoring for all AMMs and mitigation projects as well as certain, but not all, effectiveness monitoring.[2] Another non-personnel administrative expense is NFWF's administrative fee to administer and manage the Mitigation and Reserve Accounts.

8.2.2 Mitigation Costs

NiSource's greatest MSHCP implementation expense will be for compensatory mitigation, which will be funded through NiSource's funding budget, i.e., for mitigation activities directly undertaken by NiSource and from the Mitigation Account or the Reserve Account, if such becomes necessary. A summary of the mitigation type, amount, cost and funding schedule is provided in **Tables 8.2.2-1 and -2.** NiSource's mitigation obligations are more specifically described in Chapter 6 and will include, among other things, some or all of the following:

- Conservation/protection of habitat through acquisition and/or easements;
- Habitat restoration;
- Propagation, augmentation and reintroduction of certain take species; and
- Mitigation effectiveness monitoring and adaptive management.

The compensatory mitigation is divided into two components; *O&M/Aggregate* (O&M) and *Project-Specific*. The O&M mitigation is designed to compensate for impacts from ongoing operations of existing facilities (e.g., ROW maintenance, minor erosion for the ROW, vehicles traveling on the ROW, etc.). Since ROW maintenance activities typically occur on a seven-year cycle and the location of the existing ROW is known, the mitigation debt for these activities can be more readily estimated. Therefore, all of the compensatory mitigation for these activities over the entire 50-year term of the ITP is scheduled to be accounted at the beginning of the permit term with

[2] In most cases, existing NiSource personnel and contractors with expertise in wildlife issues will be responsible for compliance monitoring. Compliance monitoring is part of NiSource personnel's ordinary job functions and will continue to be when the ITP becomes effective. Compliance monitoring may also be a component of mitigation costs where third parties undertake mitigation projects. Similarly, effectiveness monitoring also may constitute an administrative cost or fall within the category of mitigation costs. For instance, tracking the take of species or habitat is an administrative cost but evaluating the efficacy of AMMs may be part of a project cost for large capital projects. Likewise, monitoring the effectiveness of mitigation measures is categorized as a mitigation cost.

NiSource paying the costs of this mitigation within the first seven years of MSHCP implementation. *See* Section 8.4.1, Step 1.A., below, for more details. It is anticipated that the species will accrue benefits early and often long before impact or take occurs through this funding schedule and thus heighten the probability of a net benefit to the various species.

As shown in **Tables 8.2.2-1** and **8.2.2-2**, a large number of the proposed mitigation projects involve NiSource obtaining conservation easements. Estimated costs for these easements were developed in conjunction with input from state department of natural resources personnel and Service staff. Other costs, such as bog turtle mitigation sites, are based on NiSource's past experience in wetland mitigation projects and estimates provided by the Service from similar past mitigation projects.

As shown in **Table 8.2.2-1**, NiSource estimates that O&M mitigation funding in 2010 dollars will be $799,595 total with NiSource providing the funding for such amount over the first seven years of MSHCP implementation by depositing an estimated $112,085 annually (the year 2 amount has an additional $15,000 to account for American burying beetle mitigation) into the Mitigation Account. Due to the potential for inflation and the changes in land values, the actual amount deposited in each of the first seven years will vary based on the then-current costs of the identified mitigation projects.

Project-Specific mitigation is designed to compensate for impacts resulting from certain construction or non-recurring maintenance activities. Examples include impacts to MSHCP mussels during installation of a stream crossing or the clearing of potentially suitable habitat for Indiana bats while the bats are present during a pipeline looping project. The specific impacts, and thus the amount of compensation required, will be measured on a project-by-project basis and any required mitigation ratio will be applied to determine the overall amount of mitigation required for that project. These impacts, mitigation ratios, and mitigation project types are described in detail by species in Chapter 6. A number of the mitigation projects may involve NiSource obtaining conservation easements. Funding for this compensatory mitigation component will be paid into the Mitigation Account annually prior to the impact occurring. A summary of the mitigation type, amount, and cost is provided in **Table 8.2.2-2.** As shown, NiSource expects that the total Project-Specific mitigation funding over the life of the permit would range from $0 to $27,848,800. The estimated cost is in 2010 dollars, based upon 2010 land and transaction costs. The actual mitigation costs to NiSource, however, will vary with inflation, the price of land, and various mitigation transaction and project costs. To account for these fluctuations, NiSource will calculate its mitigation obligations on an annual basis using land values that are current for the evaluated year. NiSource would then estimate costs and make deposits into the MSHCP Fund before work could be taken on any project as provided in Section 8.4.1.

8.2.3 MSHCP Project Costs

Project costs include MSHCP compliance costs associated with individual O&M or construction projects, such as expenses associated with AMMs, surveying and certain effective monitoring. The cost of implementing projects and their associated AMMs is expected to be generally equivalent to existing project costs and their associated ESA

compliance obligations under Section 7. The MSHCP program will create significant program efficiencies for NiSource that should more than offset the small costs associated with surveying, monitoring, and implementation of the AMMs that are different than existing obligations. (Most of the AMMs are already being implemented on a project-by-project basis as part of NiSource's ESA and other environmental compliance programs.)

8.2.4 Adaptive Management

NiSource's adaptive management program is described in detail in Chapter 7. Adaptive management refers to potentially needed changes in the MSHCP occasioned by new information gathered during the implementation of the MSHCP, improved modeling and new technology. Adaptive management may impact MSHCP compliance by:

- Changing the way that AMMs are implemented during the course of the project according to what is learned;
- Altering mitigation projects; or
- Requiring other changes to the MSHCP program.

Other than effectiveness monitoring and species surveys, costs due and any funding needed for adaptive management are, by their very nature, impossible to estimate because they are dependent on future events and on information that will not be available until after the MSHCP is implemented and performance is monitored. The financial assurances used to secure funding for adaptive management will vary depending on whether they relate to mitigation or other aspects of MSHCP implementation, such as AMMs or the take calculations.

8.2.5 Changed Circumstances

Changed circumstances refer to external circumstances that could impact the MSHCP's operating conservation program. Changed circumstances are described in detail in Chapter 10. Examples of changed circumstances include certain droughts, floods, invasive species, and change in knowledge about species range. The costs associated with changed circumstances are difficult to predict because they are dependent on future events. The financial assurances used to secure funding for changed circumstances will vary depending on whether they relate to mitigation or other aspects of MSHCP implementation, such as AMMs or the take calculations.

8.3 NiSource Gas Transmission and Storage Funding

NiSource's projects are financed using cash on hand or corporate bonds and then are reimbursed by NiSource's natural gas customers. Obtaining an ITP should not alter the means by which NiSource finances its projects. As explained below, regardless of whether take is authorized under ESA Section 7 or 10, the costs associated with the authorization will always be incorporated into NiSource's operational costs.

NiSource's parent, NiSource Inc., is a Fortune 500 energy holding company whose subsidiaries provide natural gas, electricity, and other products and services to approximately 3.8 million customers located within a corridor that runs from the Gulf

Coast through the Midwest to New England. Operating income for NiSource Inc.'s Gas Transmission and Storage Operations segment (the entity referred to throughout this document as "NiSource" and the applicant for the ITP) were $388.5 million for 2009, $369.7 million for 2008, and $362.0 million for 2007.

NiSource operates an interstate natural gas transmission and storage business. All aspects of this business, including the funding of projects, are heavily regulated by Federal law. FERC is the lead agency for all matters of constructing and operating interstate natural gas facilities pursuant to the Natural Gas Act. FERC requires NiSource to provide cost estimates and financing plans as part of any application for a Certificate of Public Convenience and Necessity. Thus, it is not possible for NiSource to proceed without assurance that adequate funding is in place for the entire project (including environmental compliance). 18 C.F.R. § 157.14. The costs described in the narrative above are not new expenses for NiSource. Over the years, NiSource has complied with the ESA on a project-by-project basis, typically through Section 7. The cost to conduct surveys and implement species conservation measures are currently included in NiSource's project budget along with other project expenses. Obtaining an ITP and implementing the MSHCP will not alter this practice.

8.4 Funding Assurances

In addition to being required to provide adequate funding assurances to FERC prior to engaging in any project requiring a Certificate of Public Convenience and Necessity, NiSource can demonstrate its ability to adequately fund its MSHCP program as required by the ESA and the Service's implementing regulations.

NiSource has chosen a suite of mechanisms to cover its various obligations under the MSHCP. Foremost, it has elected to use trust funds to assure funding for mitigation as well as for adaptive management and changed circumstances associated with mitigation. *See* Section 8.2.2 and **Table 8.4-1**, below. Unlike a letter of credit or a performance bond, which serve as contingencies in the event there is a failure to perform an obligation, a trust fund maintains the corpus in its entirety with the expectation that the funds will be available and used for specified purposes. NiSource chose this mechanism to assure that the required funds would be set aside and available in the most efficient way possible. In addition, NiSource has built in safeguards to ensure that the amount of available funds is commensurate with the mitigation tasks to be undertaken.

NiSource will establish the MSHCP Fund with two subaccounts. The Reserve Account will be funded in the amount of at least $100,000 in case the Primary fund is overdrawn or some emergency arises.

All MSHCP costs (Section 8.2.1 and 8.2.3), including administrative costs, project costs, as well as some of the adaptive management and changed circumstances costs, will be assured through a NiSource's corporate credit facility, and if it becomes necessary, through a Service-approved letter of credit. *See* Section 8.4.2, below, for more details. The credit facility or letter of credit will assure that these obligations are satisfied in the unlikely event that the operation budget is not sufficient.

As discussed below, if NiSource fails to maintain the appropriate balances in the trust accounts, the Service may, among other things, suspend all or part of the ITP. The Service may also take such actions if the minimum criteria for NiSource's credit facility are not met, or if the required letter of credit is not secured. *See* Section 8.4.2, below.

Table 8.4-1 below summarizes the funding assurances for the financial obligations in the MSHCP:

Table 8.4-1 Funding Assurances

Funding Assurance	MSHCP Obligation For Which Assurance is Required
Mitigation Trust Fund + Reserve Fund	Mitigation [8.2.2] Adaptive Management related to Mitigation [8.2.4] Changed Circumstances related to Mitigation [8.2.5]
Credit Facility or Letter of Credit	Personnel Administrative Costs [8.2.1] Non-Personnel Administrative Costs [8.2.1] Project Costs [8.2.3] Mitigation [8.2.2] Adaptive Management related to AMMs or take calculations [8.2.4] Changed Circumstances related to AMMs or take calculations [8.2.5]

8.4.1 National Fish and Wildlife Foundation (NFWF) Mitigation and Reserve Accounts

Upon issuance of the ITP and before implementation of the MSHCP, NiSource will execute an agreement with the NFWF to establish two associated subaccounts and to identify NFWF as an administrative fiduciary with respect to the funds. A copy of the proposed trust agreement with NFWF is provided as **Appendix I**. The primary subaccount will be the Mitigation Account. It will largely be drawn upon to fund future mitigation efforts undertaken by third parties in conjunction with the Mitigation Panel (Chapter 5).[3] The secondary subaccount will be the Reserve Account, which will be used by NiSource or, if necessary, the Service, should the Mitigation Account become overdrawn or to finance any unfunded obligations for mitigation, monitoring, adaptive management, or changed circumstances. *See* Step 3, below. All of NFWF's costs and fees to administer the Accounts will be borne by NiSource independent of the costs or mitigation criteria specified in Chapter 6. In other words, the payment of the administrative fees shall be in addition to, and not deducted from, the amounts that will

[3] As described in Chapter 6, NiSource can directly undertake selected mitigation activities through its operating budget. In such cases, NiSource is not obligated to contribute that amount to the Mitigation Account because doing so would be duplicative. Alternatively, NiSource could include these costs as part of its annual estimate for the Mitigation Account and make any necessary adjustment under Step 2, to account for mitigation activities it undertakes directly.

be deposited into the accounts to implement the MSHCP. NiSource will contribute to the Mitigation Account and Reserve Account using the following three-step process.

STEP 1: NiSource will make deposits to the Mitigation Account for O&M and Project-Specific mitigation costs. *See* Table 8.4.1-1.

A. **Annual deposits for O&M mitigation**: As discussed more fully in Section 6.2 of Chapter 6 and 8.2.2, above, NiSource has agreed to fund mitigation projects totaling an estimated $799,595 in actual 2010 dollars to compensate for the impacts from ongoing operations of existing facilities over the life of the ITP. Although the proposed permit term and, thus the period of impact, is 50 years, NiSource will make all O&M mitigation payments in the first seven years of the permit issuance. O&M projects are intended to be executed near the time the funding is deposited. Thus, incremental cost increases will be dealt with during this seven-year time span to fully fund the required mitigation for the permit duration. NiSource will provide financial assurances for the O&M mitigation for the entire 50-year term of the permit with seven cash deposits as shown in **Table 8.2.2-1**. These deposits will be made into the Mitigation Account on or before January 15 of the first seven years of the permit.

B. **Annual deposits for non-Section 7(c) project mitigation**: On or before March 31 of every year that the ITP is in effect, NiSource will deposit money into the Mitigation Account to provide financial assurances for mitigation that is expected to arise from the small capital and O&M projects that do not require a certification under Section 7(c) of the Natural Gas Act. Projects that fall into this category include the following:

- Short-age and condition replacements of existing facilities;
- Relocations forced by government agencies (e.g., transportation departments);
- Projects conducted under NiSource's FERC blanket certificate; and
- Safety/integrity related projects.

NiSource will determine the amount of mitigation required by these non FERC Section 7(c) projects and the anticipated cost of this mitigation using the following process:

1. By fall of each year, NiSource will provide its Natural Resources Permitting Department with a list of projects planned for the following year. Each project will include a completed *Project Environmental Information Form* (PEIF), which describes the project and expected effects on the landscape.
2. A review of each project will be conducted through the use of IPaC (or other means if IPaC is not available) and species-specific information contained in Section 6.2 of Chapter 6 to determine if any take will occur for MSHCP species.

3. If, after implementation of mandatory AMMs, there still will be take of species, the use of available non-mandatory AMMs will be considered as described in Section 5.2.1 of Chapter 5. Decisions regarding not using non-mandatory AMMs will be documented.
4. Any take remaining after these steps are completed will then be totaled and the appropriate type and amount of compensatory mitigation will be determined using the species-specific information provided in Section 6.2 of Chapter 6.
5. The costs for this mitigation will be estimated in accordance with the guidance provided in **Table 8.2.2-2.**
6. By March 31 of each year, NiSource will send the Service, by certified mail, a report documenting the results of the review described in steps 1-5, the estimated take from its annual projects, its anticipated mitigation obligations by type, and the expected cost of mitigation and monitoring obligations.
7. Prior to commencing construction on the project, NiSource shall deposit into the Mitigation Account money sufficient to cover anticipated mitigation for the year's construction.

C. **Deposits for mitigation associated with Section 7(c) projects**: Examples of Section 7(c) projects include the following:

- Pipeline loops and/or compressor station modifications to increase system capacity;
- Pipeline replacements with larger or smaller size pipeline to increase/decrease system capacity;
- New facilities to provide natural gas service to existing or new customers; and
- Storage field enhancements to increase service for existing and/or new customers.

Prior to beginning construction on any Section 7(c) project, NiSource will estimate the amount and type of take and mitigation associated with the project and the cost of those mitigation obligations. Steps 2-5 above will be used for this estimate. NiSource will prepare a report documenting these obligations and will send this report to the Service by certified mail no less than 15 days after receiving its Section 7(c) certificate from FERC, and no less than 15 days before commencement of construction on the project. If the project involves construction over multiple years, NiSource will break out its expected take, mitigation obligations, and mitigation/monitoring costs on an annual basis. Prior to commencing construction on the project, NiSource shall deposit into the Mitigation Account money sufficient to cover anticipated mitigation and monitoring obligations for the first year's construction. If the project involves construction over multiple years, NiSource will deposit into the Mitigation Account money adequate to cover mitigation obligations for the second and each subsequent year at least 15 days prior to when the obligations are expected to arise.

STEP 2: NiSource will make necessary and regular adjustments to ensure the Mitigation Account is fully funded.

If NiSource becomes aware of new or increased costs for mitigation because of changed circumstances, adaptive management, refined estimates, increased project impacts, documentation of take, or any other cause, as discussed in Chapters 7, 10, and elsewhere in this MSHCP, NiSource will prepare a report documenting these new or additional obligations and will send this report to the Service by certified mail no less than 60 days after learning of the new obligation. Within this same time period, NiSource shall deposit into the Mitigation Account money sufficient to cover new or increased mitigation obligations because of changed circumstances, adaptive management, refined estimates, increased project impacts, documentation of additional take or any other cause. If the newly identified obligation is a continuing obligation, it will be incorporated into the appropriate category above and dealt with as described for that category. If the Service determines that new or increased costs for mitigation are required because of changed circumstances, adaptive management, refined estimates, increased project impacts, documentation of take or any other cause, as discussed in Chapters 7, 10 and elsewhere in this MSHCP, the Service may notify NiSource and request a report from NiSource concerning these new or additional obligations. NiSource will respond to this request within 60 days by certified mail. However, not every change due to adaptive management is expected to have a cost impact.

Within this same time period, if NiSource agrees with the request, NiSource shall deposit into the Account money sufficient to cover the new or increased costs for mitigation, project impacts, documentation of additional take, or any other cause. The time frames identified in this paragraph may be shortened by mutual agreement of the parties in the event of an emergency affecting the purpose or values of the intended mitigation or the affected species.

Failure of the Service and NiSource to agree about new or additional obligations could result in, among other things, the suspension of all or a portion of the permit by the Service. On the other hand, if NiSource's mitigation obligations have been fully satisfied for a given year at a lower cost than was anticipated at the beginning of the year, NiSource shall have the right to withdraw the remaining balance of that annual mitigation deposit from the Account on or after January 1 of the subsequent year, or NiSource may elect to leave the balance in the Account as contribution toward the next year's annual mitigation estimate.

STEP 3: NiSource will establish a secondary Reserve Account with NFWF that will be perpetually maintained in the amount of at least $100,000, as adjusted for inflation.

NFWF will require an initial payment of $100,000 to establish the Reserve Account. This amount will be deposited into a secondary subaccount, separate from the Mitigation Account. NiSource agrees that funds in the Reserve Account will be maintained at this amount to be used by NiSource or, if necessary, the Service, to finance any unfunded obligations for mitigation, monitoring, adaptive management, or changed circumstances. The initial $100,000 will provide a pool of cash for NiSource to draw upon if an unexpected situation develops or an underestimate becomes evident.

However, it is possible that the $100,000 will never be used during the life of the permit. Additionally, every five years, NiSource will deposit a sum of money into the Fund to account for inflation, as reflected by the consumer price index. The goal shall be to maintain a balance of $100,000 in 2010 dollars.

Before utilizing any portion of the $100,000 balance (as adjusted for inflation) in the Reserve Account, the Service or NiSource will provide one another 14 days' notice of its respective intent to do so. As part of its notice, or in response to one it receives, the Service will inform NiSource of its obligation to replenish the Reserve Account within 45 days of any withdrawal. The Service will also inform NiSource that failure to do so would provide valid grounds to suspend and\or revoke the permit in accordance with 50 C.F.R. §§ 13.27 and 13.28.

8.4.2 NiSource Credit Facility; Letter of Credit

The NiSource Credit facility also provides assurance that funds for mitigation and non-mitigation obligations will be available. If the credit facility lapses or the amount becomes too low, NiSource will obtain a letter of credit of sufficient duration and amount to assure its obligations.

During May 2012, NiSource Finance amended its $1.5 billion revolving credit facility with a syndicate of banks led by Barclays Capital. The amendment extended the termination date of the facility to May 15, 2017 and reduced the borrowing costs under the facility. As of September 30, 2012, $1.439 billion of credit was available under the credit facility. The facility provides a reasonable cushion of short-term liquidity for general corporate purposes, including meeting cash requirements driven by volatility in natural gas prices. NiSource Inc. anticipates that it will maintain large credit facilities throughout the term of the ITP, absent a significant structural change in the natural gas industry.

If NiSource obtains an ITP from the Service, NiSource Inc. agrees to guarantee all funding obligations under this MSHCP. If necessary, NiSource Inc. will borrow from its $1.5 billion credit facility to secure funding for the MSHCP. NiSource Inc. further agrees that, should the available balance in NiSource Inc.'s credit facility ever fall below $25 million or should the credit facility be allowed to lapse, NiSource will notify the Service in writing within 7 days and will obtain a $250,000 letter of credit,[4] in a form acceptable to the Service, within 30 days of such fall or lapse. Should NiSource fail to obtain this letter of credit, such failure would provide valid grounds to suspend and\or revoke the permit in accordance with 50 C.F.R. §§ 13.27 and 13.28.

[4] $250,000 is the approximate amount that NiSource expects to spend annually on MSHCP-related mitigation during the initial years of the permit. A $25 million threshold was chosen because $25 million is one hundred times the $250,000 annual expenses (100:1 ratio). Every five years, NiSource will reevaluate its expected mitigation costs and the adequacy of the financial assurances. If actual mitigation costs differ from what is presented here, NiSource will change the credit facility threshold and the amount of the letter of credit to maintain the 100:1 ratio. For example, should future annual costs be estimated to be $500,000 annually, the minimum threshold for the credit facility would be $50 million and the amount of the letter of credit would be $500,000.

Table 8.2.1-1 Estimated Implementation, Training, Monitoring and Reporting Costs

Description	Notes	One Time Costs	Annual Costs
Personnel			
Manager – NRP	1	-	$12,500
Environmental Specialist	2	-	$10,000
Other EHS personnel	3	-	$2,500
Corporate EHS Staff consultation	4	-	$5,000
Audit	5	-	-
Training			
Trainers	6		$15,000
Training Materials	7		$2,730
Travel & Meetings	8	$15,000	$8,270
Trainee Time			Covered by existing overhead
Hardware	10	$5,000	
Monitoring and Reporting			
MSHCP annual report	11		$1,500
Monitoring	12		$50,000
Indiana bat monitoring	13		$150,000
Indiana bat monitoring	14		$100,000
NFWF Trust Account	15		$10,000
Total		**$20,000**	**$370,000**

Notes: All costs furnished are only estimates. Actual costs may vary.

(1) 1/12 FTE initially with more involvement should FERC 7(c) projects be contemplated.
(2) 10% of FTE, staff time for data base entry and tracking, reporting.
(3) 5% involvement of other EHS personnel.
(4) Corporate EHS involvement as needed.
(5) Potential internal EHS audit for compliance every five years.
(6) Two trainers conducting 10 sessions to implement, 3 annual sessions average following initial year.
(7) 150 copies @ $8/copy, 300 flip books for field use @ $3/copy, and 10 data base training materials in years 1, 10, 25, and 40 @$1.80/copy and other miscellaneous training materials at $586.80
(8) One time cost for Learning Management System (LMS) module training and training sessions. After initial year a continuing cost for maintaining LMS training and other computer training. This also includes minor cost for any "tailgate" field meetings for training purposes.
(9) New software for staff to implement and use IPAC and other software systems.
(10) New hardware that may be required to maintain compliance and use of systems.
(11) Estimated cost of production of annual report.
(12) Estimated cost for activity monitoring species specialists (e.g. bog turtle expert). Does not include environmental compliance inspections.
(13) Indiana bat effectiveness monitoring as described in Section 7.4.1,'Indirect Effects' of Chapter 7.
(14) Indiana bat effectiveness monitoring as described in Section 7.4.1,'Direct and Indirect Effects' of Chapter 7.
(15) Estimated internal cost for fees and maintenance of trust fund.

Table 8.2.2-1 Cost and Funding Schedule for Aggregate/O&M Mitigation Projects

Species	Mitigation[b]	Aggregate or O&M Mitigation Cost by Year[a]						
		2011	2012	2013	2014	2015	2016	2017
Indiana bat	None	$0	$0	$0	$0	$0	$0	$0
Bog turtle	restore up to 20 habitat sites (funding for 13 known sites shown)	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$50,000
Madison cave isopod	None	$0	$0	$0	$0	$0	$0	$0
Clubshell	streambank conservation easement (8.1 ac)	$2,314	$2,314	$2,314	$2,314	$2,314	$2,314	$2,314
Northern riffleshell	streambank conservation easement (6.1 ac)	$1,743	$1,743	$1,743	$1,743	$1,743	$1,743	$1,743
Fanshell	streambank conservation easement (11.1 ac)	$3,171	$3,171	$3,171	$3,171	$3,171	$3,171	$3,171
James spinymussel	streambank conservation easement/restoration[c] (1.5 ac)	$429	$429	$429	$429	$429	$429	$429
Sheepnose	streambank conservation easement (15.1 ac)	$4,314	$4,314	$4,314	$4,314	$4,314	$4,314	$4,314
Nashville crayfish	streambank conservation easement (0.4 ac)	$114	$114	$114	$114	$114	$114	$114
American burying beetle	Propagation and release	$0	$15,000	$0	$0	$0	$0	$0
Total		**$112,085**	**$127,085**	**$112,085**	**$112,085**	**$112,085**	**$112,085**	**$112,085**

a. Funding to be provided by January 15th of specified year.
b. Acquisition of conservation easements valued at $2,000/acre. Actual costs may vary. However, in 2009 NiSource acquired such easements for less than $1,000 per acre.
c. Streambank restoration and tree planting valued at $500/acre per discussion with Service staff. Actual costs may vary.

Table 8.2.2-2 Cost and Funding Schedule for Project Specific Mitigation Projects

Species	Project Specific Mitigation Total (50 years)[a]	Estimated Total Cost Range for 50 Year ITP Duration[b]
Indiana bat	Conserve 8,907 to 10,960 ac of suitable Indiana bat (including 1 hibernacula)	$0 - $20,000,000[c]
Bog turtle	Restore and protect 5 habitat sites	$0 - $250,000
Madison cave isopod	Conserve/restore karst surface features near 2 known isopod occurrences	$0 - $100,000
Clubshell	streambank conservation easement and restoration (187.5 ac protect, 187.5 ac protect/restore)	$0 - $843,750[d]
Northern riffleshell	streambank conservation easement and restoration (442.2 ac protect, 442.2 ac protect/restore)	$0 - $1,989,900[d]
Fanshell	streambank conservation easement and restoration (477.9 ac protect, 477.9 ac protect/restore)	$0 - $2,150,550[d]
James spinymussel	streambank conservation easement and restoration (57.6 ac protect, 19.2 ac protect/restore)	$0 - $316,800[e]
Sheepnose	streambank conservation easement and restoration (486.4 ac protect, 486.4 ac protect/restore)	$0 - $2,188,800[d]
Nashville crayfish	streambank conservation easement and restoration (2.0 ac protect, 2.0 ac protect/restore)	$0 - $9,000[d]
American burying beetle	None	$0
Total		**$0 to $27,848,800**

a. Mitigation projects listed represent only one of several options for each species. Other mitigation alternatives are presented in Section 6.2.
b. Range represents reasonable worst-case scenario as used to calculate total amount of requested take (*see* Chapter 6). NiSource anticipates total cost to trend towards the lower end of range through the use of non-mandatory AMMs, avoidance through enhanced project planning, and due to the conservative approach used to calculate the effect of potential activities.
c. Acquisition of conservation easements valued at $2,000/acre. Actual costs may vary. However, in 2009 NiSource acquired such easements for less than $1,000 per acre.
d. Acquisition of conservation easements valued at $2,000/acre. Actual costs may vary. However, in 2009 NiSource acquired such easements for less than $1,000 per acre. Streambank restoration and tree planting valued at $500/acre per discussion with Service staff.
e. Acquisition of conservation easements valued at $4,000/acre. Streambank restoration and tree planting valued at $500/acre per discussion with Service staff. Actual costs may vary.

9.0 Amendment Process

The MSHCP and/or ITP may be modified in accordance with the ESA, the Service's implementing regulations, the IA, and this chapter. MSHCP and permit modifications are not anticipated on a regular basis; however, modifications to the MSHCP and/or ITP may be requested by either NiSource or the Service. The Service also may amend the ITP at any time for just cause, and upon a written finding of necessity, during the permit term in accordance with 50 C.F.R. § 13.23(b). The categories of modifications are administrative changes, minor amendments, and major amendments.

9.1 Administrative Changes

Administrative changes are internal changes or corrections to the MSHCP that may be made by NiSource, at its own initiative, or approved by NiSource in response to a written request submitted by the Service. Requests from the Service shall include an explanation of the reason for the change as well as any supporting documentation. Administrative changes on NiSource's initiative do not require preauthorization or concurrence from the Service.

Administrative changes are those that will not (a) result in effects on a MSHCP species that are new or different than those analyzed in the MSHCP, EIS, or the Service's BO, (b) result in take beyond that authorized by the ITP, (c) negatively alter the effectiveness of the MSHCP, or (d) have consequences to aspects of the human environment that have not been evaluated. NiSource will document each administrative change in writing and provide the Service with a summary of all changes, as part of its annual report, along with any replacement pages, maps, and other relevant documents for insertion in the revised document.

Administrative changes include, but are not limited to, the following:

- Corrections of typographical, grammatical, and similar editing errors that do not change intended meanings;
- Corrections of any maps or exhibits to correct minor errors in mapping; and
- Corrections of any maps, tables, or appendices in the MSHCP to reflect approved amendments, as provided below, to the MSHCP, IA, or ITP.

9.2 Minor Amendments

Minor amendments are changes to the MSHCP whose effects on MSHCP species, the conservation strategy, and NiSource's ability to achieve the biological goals and objectives of the MSHCP are either beneficial or not significantly different than those described in this MSHCP. Such amendments also will not increase impacts to species, their habitats, and the environment beyond those analyzed in the MSHCP, EIS, and the BO or increase the levels of take beyond that authorized by the ITP. Minor amendments may require an amendment to the ITP or the IA. A proposed minor amendment must be approved in writing by the Service and NiSource before it may be implemented. A proposed minor amendment will become effective on the date of the joint written approval.

NiSource or the Service may propose minor amendments by providing written notice to the other party. Such notice shall satisfy the provisions of 50 C.F.R. § 13.23 as well as include a description of the proposed minor amendment; the reasons for the proposed amendment; an

analysis of the environmental effects, if any, from the proposed amendment, including the effects on MSHCP species and an assessment of the amount of take of the species; an explanation of the reason(s) the effects of the proposed amendment conform to and are not different from those described in this MSHCP ; and any other information required by law. When NiSource proposes a minor amendment to the MSHCP, the Service may approve or disapprove such amendment, or recommend that the amendment be processed as a major amendment as provided below. The Service will provide NiSource with a written explanation for its decision. When the Service proposes a minor amendment to the MSHCP, NiSource may agree to adopt such amendment or choose not to adopt the amendment. NiSource will provide the Service with a written explanation for its decision. The Service retains its authority to amend the ITP, however, consistent with 50 C.F.R. § 13.23.

Provided a proposed amendment is consistent in all respects with the criteria in the first paragraph of this section, minor amendments include, but are not limited to, the following:

- Updates to the land cover map or to take species occurrence data;
- Decreasing the scope of the covered lands in the MSHCP;
- Minor changes to the biological goals or objectives;
- Modification of monitoring protocols for MSHCP effectiveness not in response to changes in standardized monitoring protocols from the Service;
- Modification of existing, or adoption of new, incidental take avoidance measures;
- Modification of existing, or adoption of additional, minimization and mitigation measures that improve the likelihood of achieving MSHCP species objectives;
- Discontinuance of implementation of conservation measures if they prove ineffective;
- Modification of existing or adoption of new performance indicators or standards if results of monitoring and research, or new information developed by others, indicate that the initial performance indicators or standards are inappropriate measures of success of the applicable conservation measures;
- Modification of existing or the adoption of additional habitat objectives for MSHCP species, where such changes are consistent with achieving MSHCP species and habitat goals as well as the overall goals of the MSHCP;
- Minor changes to survey or monitoring protocols that are not proposed in response to adaptive management and that do not adversely affect the data gathered from those surveys;
- Day-to-day implementation decisions, such as maintenance of erosion and sediment control devices;
- Modifying the design of existing research or implementing new research;
- Conducting monitoring surveys in addition to those required by the MSHCP and ITP;

- Modifying MSHCP monitoring protocols to align with any future modifications to the protocols by the Service;
- Adopting new monitoring protocols that may be promulgated by the Service in the future;
- Updating construction windows for MSHCP species in the event that standard construction windows established for such species are revised by the Service and agreed to by NiSource; and
- Minor changes to the reporting protocol.

9.3 Major Amendments

A major amendment is any proposed change or modification that does not satisfy the criteria for an administrative change or minor amendment. Major amendments to the MSHCP and ITP are required if NiSource desires, among other things, to modify the projects and activities described in the MSHCP such that they may affect the impact analysis or conservation strategy of the MSHCP, affect other environmental resources or other aspects of the human environment in a manner not already analyzed, or result in a change for which public review is required. Major amendments must undergo the same formal review process as the original MSHCP and ITP, including appropriate NEPA analysis, a Federal Register notice, and an intra-Service Section 7 consultation.

In addition to the provisions of 50 C.F.R. § 13.23(b), which authorize the Service to amend an ITP at any time for just cause and upon a finding of necessity during the permit term, the MSHCP and ITP may be modified by a major amendment upon NiSource's submission of a formal permit amendment application and the required application fee to the Service, which shall be processed in the same manner as the original permit application. Such application generally will require submittal of a revised Habitat Conservation Plan, a revised IA, and preparation of an environmental review document in accordance with NEPA. The specific document requirements for the application may vary, however, based on the substance of the amendment. For instance, if the amendment involves an action that was not addressed in the original MSCHP, IA, or NEPA analysis, the documents may need to be revised or new versions prepared addressing the proposed amendment. If circumstances necessitating the amendment were adequately addressed in the original documents, an amendment of the ITP might be all that would be required.

Upon submission of a complete application package, the Service will publish a notice of the receipt of the application in the Federal Register, initiating the NEPA and HCP public comment process. After the close of the public comment period, the Service may approve or deny the proposed amendment application. NiSource may, in its sole discretion, reject any major amendment proposed by the Service.

Changes that would require a major amendment to the MSHCP and/or ITP include, but are not limited to:

- Revisions to the covered lands that do not qualify as a minor amendment:
- Addition of a species to the ITP where such species was not adequately analyzed in the MSHCP, EIS and the BO ;

- Addition of a new species to the ITP that was not addressed in the MSHCP;
- Increases in the amount of take allowed for covered activities or adding new covered activities to the MSHCP;
- Modifications of any action or component of the conservation strategy under the MSHCP, including AMMs, mitigation, funding or schedule, that may increase the levels of take authorized by the ITP or substantially change the effects of the covered activities on MSHCP species, the nature or scope of the conservation program, or consequences to the human environment;
- A major change in performance standards if monitoring or research indicates that existing performance standards are not attainable because technologies to attain them are either unavailable or infeasible, and the new performance standards were not contemplated in this original MSHCP and the associated NEPA document; and
- A renewal or extension of the permit term beyond 50 years, where the criteria for a major amendment are otherwise met, and where such request for renewal is in accordance with 50 C.F.R. § 13.22.

9.4 Treatment of Changes Resulting from Adaptive Management or Changed Circumstances

Unless explicitly provided in Chapters 7 or 10 of this MSHCP, the need for and type of amendment to deal with Adaptive Management or Changed Circumstances will be determined by the Service, in coordination with NiSource, at the time such responses are triggered.

10.0 Assurances

10.1 Introduction

NiSource recognizes that circumstances can change during the term of the MSHCP. Those changes, some due to natural events or factors outside the control of NiSource, could merit changes in the MSHCP's operating conservation program. This chapter describes NiSource's obligations in the event of changed circumstances. Specifically, it identifies and defines the circumstances (e.g., climate change, drought, flooding, etc.), the triggers, and the responses that NiSource has planned for and has assured funding for (i.e., funding described in Chapter 8) to address possible effects that a changed circumstance could have on a species or geographic area covered by the MSHCP.

10.2 Federal "No Surprises" Assurances

The Federal "No Surprises" Rule, 63 Fed. Reg. 8859 (Feb. 23, 1998) (codified at 50 C.F.R. §§ 17.3, 17.22(b)(5), 17.32(b)(5)) provides assurances to Section 10 permit holders that, as long as the permittee is properly implementing the HCP, the IA, and the ITP, no additional commitment of land, water, or financial compensation will be required with respect to covered species, and no restrictions on the use of land, water, or other natural resources will be imposed beyond those specified in the HCP without the consent of the permittee. The "No Surprises" Rule has two major components: changed circumstances and unforeseen circumstances.

10.2.1 Changed Circumstances

Changed circumstances are defined in the "No Surprises" Rule as "changes in circumstances affecting a species or geographic area covered by [an HCP] that can reasonably be anticipated by [plan] developers and the Service and that can be planned for (e.g., the listing of new species, or a fire or other natural catastrophic event in areas prone to such events)." (50 C.F.R. § 17.3). If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances, and such measures were provided for in the HCP, the permittee will be required to implement such measures. (50 C.F.R. §§ 17.22(b)(5)(i), 17.32(b)(5)(i)). If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances, and such measures were not provided for in the HCP, the Service will not require any additional measures beyond those provided for in the HCP, without the consent of the permittee, provided the HCP is being properly implemented. (50 C.F.R. §§ 17.22(b)(5)(ii), 17.32(b)(5)(ii)).

The HCP Handbook notes that "with respect to anticipated and possible changed circumstances, the HCP should discuss measures developed by the applicant and the Service to meet such changes over time, possibly by incorporating adaptive management measures for covered species in the HCP" (HCP Handbook at 3-28). The Handbook further provides that "HCP planners should identify potential problems in advance and identify specific strategies or protocols in the HCP for dealing with them, so that adjustments can be made as necessary without having to amend the HCP."

Consistent with this direction, the MSHCP identifies specific protocols that NiSource will ensure are implemented to address changed circumstances associated with the MSHCP's operating conservation program, which has two main components: (1) the conservation strategies

associated with NiSource's covered activities (e.g., avoidance and minimization measures); and (2) the mitigation projects described in Chapter 6.

10.2.2 Unforeseen Circumstances

Unforeseen circumstances are defined as changes in circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by plan developers and the Service at the time of the negotiation and development of the plan and that result in a substantial and adverse change in the status of the covered species. (50 C.F.R. § 17.3).

The Service bears the burden of demonstrating that unforeseen circumstances exist using the best available scientific and commercial data available while considering certain factors. (50 C.F.R. §§ 17.22(b)(5)(iii)(C) and 17.32(b)(5)(iii)(C)). In deciding whether unforeseen circumstances exist, the Service shall consider, but not be limited to, the following factors (50 C.F.R. §§ 17.22(b)(5)(iii)(C) and 17.32(b)(5)(iii)(C)):

1. The size of the current range of the affected species;
2. The percentage of the range adversely affected by the covered activities;
3. The percentage of the range that has been conserved by the MSHCP;
4. The ecological significance of that portion of the range affected by the MSHCP;
5. The level of knowledge about the affected species and the degree of specificity of the conservation program for that species under the MSHCP; and
6. Whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the species in the wild.

In negotiating unforeseen circumstances, the Service will not require the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water or other natural resources beyond the level otherwise agreed upon for the species covered by the HCP without the consent of the permittee. (50 C.F.R. §§ 17.22(b)(5)(iii)(A)). If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, the Service may require additional measures of the permittee where the HCP is being properly implemented only if such measures are limited to modifications within conserved habitat areas, if any, or to the HCP's operating conservation program for the affected species, and maintain the original terms of the plan to the maximum extent possible. (50 C.F.R. §§ 17.22(b)(5)(iii)(B) and 17.32(b)(5)(iii)(B)). Additional conservation and mitigation measures will not involve the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the conservation plan without the consent of the permittee.

Notwithstanding these assurances, nothing in the "No Surprises" Rule "will be construed to limit or constrain the [Service], any Federal agency, or a private entity, from taking additional actions, at its own expense, to protect or conserve a species included in a conservation plan." (50 C.F.R. §§ 17.22(b)(6) and 17.32(b)(6)).

10.3 Circumstances Addressed in the MSHCP

NiSource requests regulatory assurances (No Surprises) for those listed and non-listed species that have been "adequately covered" in the MSHCP and for which NiSource seeks take authorization (Table 4-1 for species for which NiSource seeks take authorizations and requests assurances; *see* also, 50 C.F.R. §17.3, defining "adequately covered"). As such, in accordance with the "No Surprises" Rule and the Service's regulations, NiSource will be responsible for implementing remedial measures in response to those changed circumstances addressed in this chapter. If a changed circumstance occurs within a geographic area specified in this chapter, the Service and NiSource will coordinate and determine if additional conservation and mitigation measures are necessary. In such event, the Service may determine that additional measures are necessary. Pursuant to the "No Surprises" Rule and regulations, if such measures are addressed in this MSHCP, implementation is required. If additional measures are deemed necessary to respond to a changed circumstance and such measures are not provided for herein, the Service will not require any additional conservation or mitigation measures without the consent of the Permittee, as long as the MSHCP is being properly implemented. "Properly implemented" means that the commitments and the provisions of the MSHCP, IA, and permit have been or are being fully implemented by NiSource. (50 C.F.R. § 17.3).

The following circumstances, which are addressed later in this chapter, are reasonably anticipated and planned for in this MSHCP: (1) Climate Change; (2) Droughts; (3) Floods; (4) Fires; (5) Tornados; (6) Disease; (7) Invasive Species; (8) Species Range Expansion/Contraction; and (9) Species Listing/Delisting.

Climate change, manifested as water temperature increase, droughts, and floods, may affect not only habitat, but the populations of the aquatic species covered in the MSHCP (sheepnose, northern riffleshell, clubshell, fanshell, James spinymussel, and the Nashville crayfish). The potential impact of the changed circumstances is unknown. In particular, where effects are small, it will likely be difficult to differentiate the effects of a changed circumstance (e.g., droughts) on a mitigation site population from fluctuations related to other factors. Populations of mussels and crayfish will not be static and will vary particularly over short periods based on predation, habitat quality, and other variables (Jones 2009 and Rabeni 1992). NiSource will address the confounding effects of other variables by assessing population change in the presence of a documented occurrence of the changed circumstance and by employing a multi-year evaluation of a mitigation site's population.

For mussels, NiSource will use the average population-growth rate (lamda) to assess the effects of a changed circumstance on a mitigation site population. A threshold of lamda < 1.0 over five years in conjunction with the occurrence of the changed circumstance will be used to determine the need for action on the MSHCP mussel species (lamda of 1.0 indicates a stable mussel population and < 1.0 indicates a declining population). NiSource and the Service would expect in the absence of changed or unforeseen circumstance that the mitigation would lead to an increase in the target mussel population at the mitigation site in a five-year period. This metric incorporates both survival and recruitment of the population and thus provides a useful method for assessing impacts in conjunction with a changed circumstance (*see* Villella et al. 2004). NiSource will use the best available monitoring protocols designed to detect juvenile mussels and mussels occurring at low densities. For Nashville crayfish, NiSource will employ a similar mark-recapture approach (*see* Nowicki et al. 2008). NiSource and the Service would expect

population growth at Nashville crayfish mitigation sites if the population is not impacted by a changed or documented unforeseen circumstance.

When a determination is made that an aspect of the MSHCP's operating conservation program is not meeting its intended objective due to changed circumstances, NiSource will evaluate the causal factors and determine whether or not that change was planned for in the MSHCP. For those circumstances that were planned for in this chapter, unless otherwise stated, NiSource will initiate the remedial measures set forth in this chapter (i.e., planned responses) as soon as possible, but not longer than one year from the time NiSource receives notice that a changed circumstance has occurred.

Changed Circumstances and Mitigation Success Criteria

Each mitigation project funded through the Mitigation Fund or directly by NiSource will include specific criteria for determining when the project is deemed successful. NiSource acknowledges that, when the Service approves the funding of a mitigation proposal, it must also approve the specific completion or success criteria that must be achieved for the mitigation proposal so that the substantive success in achieving the expressed goals of the MSHCP can be measured. When the criteria are satisfied for the mitigation project, whether funded through the Mitigation Fund or directly by NiSource, NiSource will have fully compensated for the associated take that the mitigation project was designed to address. At that point, NiSource will not be required to commit any additional funds, beyond the initial funds committed for long-term maintenance of the mitigation project in response to changed circumstances. However, even when the specified success criteria have been met for a mitigation project, NiSource would be willing to enter into discussions with the Service concerning specific issues associated with the scientific data related to a changed circumstance. As a result of such discussions, NiSource might be willing to voluntarily assist with, fund, or otherwise undertake certain remedial actions with the Service and other interested parties that are directed at a particular species or in an area where the change has occurred. On the other hand, for any ongoing mitigation project that had not satisfied its success criteria but where the trigger for implementation of measures in response to the changed circumstance had occurred, NiSource would implement the identified response, even if such response requires additional funds beyond those initially committed for the project.

For example, suppose NiSource funds a mitigation project that involves the restoration of riparian habitat in Year 4 of the permit term and the success criteria for that restoration project would be met by Year 7 of the permit term under normal circumstances. If a flood occurred in Year 6 of the permit triggering implementation of measures in response to a changed circumstance, NiSource would commit the funds necessary to implement the measures identified in this chapter. On the other hand, if a flood occurred in Year 40 of the permit term triggering implementation of measures in response to the changed circumstances some 33 years after the success criteria had been satisfied in Year 7, NiSource would not be obligated to respond to the changed circumstances beyond the funds already committed for long-term maintenance of the mitigation project.

Triggers Indicating Changed Circumstances

This Chapter identifies triggers for changed circumstances resulting from (1) climate change; (2) droughts; (3) floods; (4) fires; (5) tornados; (6) disease; (7) invasive species; (8) species range expansion/contraction; and (9) species listing/delisting. For each of these triggers, the observed change that qualifies the circumstance as a "changed circumstance," e.g., a change

in the bog turtle active periods, must be (1) identified by a qualified professional; (2) confirmed by another, independent qualified professional; and (3) based on objective, scientifically sound data. Also, the time period over which the data are collected must be statistically relevant, i.e., of a sufficient length that scientifically supportable conclusions can be drawn. If NiSource and the Service disagree as to whether a trigger has occurred, they will meet to discuss the issue in an attempt to reach a mutually acceptable solution. Resolution must be reached within 1 year of the disagreement or procedures set forth in Section 7.6.3 apply.

10.3.1 Climate Change

According to the EPA, long-term observations indicate that our climate may be changing. As reported, greenhouse gases are at increased levels in the atmosphere. Global mean temperatures have increased 1.2 to 1.4ºF in the last 100 years according to NOAA and NASA, with most of the warming occurring in recent decades. Other aspects of the climate also appear to be changing, such as rainfall patterns, snow and ice cover, and sea level (EPA 2009). Global and regional climate models predict warming and increased variability in the timing and type of precipitation. As a consequence of these changes, fire regimes are likely to be altered, which, in some parts of the country, may result in increased fire frequency and intensity. Climate change may also have some direct effects on productivity and biogeography as well as indirect effects on vegetation through changes in fire, insect, and disease disturbances (Carroll et al. 2003; Dale et al. 2001; Parry et al. 2007). Some ecological communities are projected to move upward in both elevation and latitude (Walther et al. 2002). Therefore, since climate change is likely to manifest itself through other changed circumstances like flooding (as discussed in detail below), this MSHCP will discuss climate change as it relates to the accelerated rate of warming. Other potential consequences of climate change are discussed as stand-alone issues.

According to the American Meteorological Society, there are local and regional considerations that come into play when trying to project a pattern of global warming onto weather or climate conditions in a specific region. The American Meteorological Society explains that there are regional variations in the signature of climate change, with warming in the western U.S. but little or no annual temperature change occurring in the southeast U.S. in recent decades. Evidence for warming is also observed in seasonal changes with earlier springs, longer frost-free periods, longer growing seasons, and shifts in natural habitats and in migratory patterns of birds (American Meteorological Society 2007).

Most climate change-related impacts to species covered in this MSHCP are likely to manifest through species life history changes. The following criteria are used to help in determining which species may be susceptible to climate change-related impacts:

1. Species with highly specialized habitat needs;
2. Species with narrow environmental tolerances;
3. Species dependent on specific environmental triggers or cues; and
4. Species that lack the ability to disperse and/or colonize new or more suitable areas.

Climate Change – Changed Circumstances

Scientists are working hard to produce reliable models to predict the potential effects of climate change to species and ecosystems at global, regional, and local levels. Although the

evidence for global average temperature increases is strong, its effect on a local or regional climate or ecological conditions is much less certain, and has not provided a clear response to date. The year-to-year variability in weather and climate conditions can and has always been substantial, including seasonal average temperatures and rainfall patterns. As such, until more conclusive information is available on regional and local levels, specific impacts to species and ecosystems (and needed responses) are difficult to determine; therefore, available historic data and trends in combination with available climate change data or a rigorous monitoring and adaptive management strategy must be relied upon. Most projections for future climate impacts are based on a range of low emission and high emission scenarios. Since measured CO2 levels are currently exceeding the projected high emission scenarios (Canadell 2007), it is reasonable to use the high emission scenarios as the basis for evaluation of potential climate change impacts to the covered lands during the 50-year duration of the requested permit (Canadell, 2007). The remedial measures below have been identified to respond to climate change-related impacts (i.e., warming) to species covered by this MSHCP and/or their habitats. Due to the unpredictable nature of effects due to climate change, NiSource will treat all climate-change-related triggers identified below as changed circumstances, as opposed to unforeseen circumstances, that warrant the responses identified below.

Bog Turtle

Habitats and life-requisite activities critical to the survival of bog turtles may be threatened by climate change impacts, primarily through shifts in temperature regimes and hydrological cycles, including changes in precipitation, evaporation, transpiration, runoff, and groundwater recharge and flow (the latter are discussed in their respective sections below). Reptiles are sensitive to and respond strongly to changes in air and water temperature, precipitation, and hydroperiod (length of time and seasonality of water presence) (Carey and Alexander 2003). This is partly because reptiles are ectothermic (their body temperatures and activity cycles are dependent on the presence of optimal environmental conditions). Temperatures outside of their thermal optima cause physiological stresses to reptiles. Some reptile species exhibit temperature-dependent sex determination during egg incubation that could be influenced by changes and variability in global climates (Gibbons et al. 2000, Hawkes et al. 2007). The timing of key ecological events is also influenced by air and water temperatures. The timing of reproduction (breeding/egg laying), metamorphosis, dispersal, and migration may shift in response to higher temperatures and changes in rainfall (Beebee 1995). If changes in reptile activities occur inconsistent with other ecological events (e.g., emergence of primary insect prey), growth and survival could be affected. Changes in climatic regimes are likely to increase pathogen virulence and amphibian and reptile susceptibility to pathogens. Similarly, warm-water invasive species are a concern to native species and may expand their ranges given warming trends.

Bog turtle active periods begin in late March to late April, depending upon latitude, elevation, and seasonal weather conditions and continue to mid-October (Service 2001). The species hibernates from October to April, often just below the upper surface of frozen mud or ice (Service 1997), and generally retreats into more densely vegetated areas to hibernate (Service 2001). Bog turtles have been found to over-winter with spotted turtles and to demonstrate strong fidelity to their hibernacula (Service 2001). Over the long term, the frequency and duration of extreme temperature events may influence the persistence of local bog turtle populations, dispersal capabilities and, consequently, the structure of metapopulations on the landscape. The

ability of bog turtles to adapt to changes in climate depends in-part on their ability to move to more suitable habitat or in human ability to manage sites to respond to alterations in the habitat (e.g., vegetation management or water level management). However, because key habitats and species ranges have already been altered and fragmented by human use and development, the pathways to connect animals with suitable habitats (e.g., upwards in latitude or elevation) may not exist. In summary, bog turtle response to climate change will primarily be influenced by the following factors:

1. Expected changes in local environmental and habitat conditions;
2. The timing of life-requisite activities;
3. Interactions with pathogens and invasive species; and
4. Interactions with other environmental stressors (i.e., toxicity levels of pollutants may decrease, etc).

Climate Change Alters Bog Turtle Active Periods

NiSource has agreed to specific timing restrictions for certain activities to coincide with either active or inactive bog turtle periods (*see* Chapter 6). Climate change (i.e., warming/cooling) may trigger changes to bog turtle active periods.

Trigger - Climate Change Alters a Bog Turtle Active Period

To facilitate implementation of the MSHCP, NiSource and the Service will develop an IPaC module which, among other things, maintains species AMMs and associated environmental windows. If and when there is an observed change to the bog turtle's active period, NiSource will, in consultation with the Service, update its AMMs to reflect a change to the bog turtle active period.

Response

In response to an identified change in bog turtle active periods, NiSource will adjust the environmental windows in which it operates to accommodate any changes to bog turtle active periods. Corrective action will be implemented immediately upon notification from the Service.

Indiana Bat

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates in mines and caves in the winter and summers in wooded areas (Service 1999). The key stages in the annual cycle of Indiana bats are: hibernation, spring staging, pregnancy, lactation, volancy/weaning, migration and swarming. While varying with weather and latitude, generally bats begin winter torpor in mid-September through late-October and begin emerging in April. Females depart shortly after emerging and are pregnant when they reach their summer area. Birth of young occurs between mid-June and early July and then nursing continues until weaning, which is shortly after young become volant in mid- to late-July. Migration back to the hibernacula may begin in August and continue through September. Males depart later from the hibernacula and begin migrating back earlier than females (Service 2007a).

To date, very little information is available that assesses potential impacts of climate change on Indiana bats. Humphries et al. (2002) developed a bioenergetic model for hibernating little brown bats. Integrating projections of climate change into the model resulted in the prediction of a pronounced northward range expansion of hibernating little brown bats within the

next 80 years. This model may also provide insight into potential winter distribution shifts of Indiana bats that could result from climate change. Climate change may be implicated in the disparity of population trends in southern versus northern hibernating populations of Indiana bats that were noted by Clawson (2002). Similarly, climate change could impact the summer range, summer distribution, and reproductive success of the Indiana bat. Reproductive success in mammals is often related to climatic conditions, such as temperature and rainfall (Isaac 2008). Climate change may also directly influence reproductive success through mistiming of reproduction with peak food availability or through effects on prey populations (Isaac 2008). In bats, climate change may also disrupt important annual events, such as mating and migration, by altering the seasonal cues that trigger these behaviors (Weller et al. 2009). For additional discussion of potential effects of climate change on bats, *see* Weller et al. (2009). Assessments of the potential effects of climate change on Indiana bat populations and recommendations for management actions that may buffer negative effects are needed.

Climate Change Alters Indiana Bat Active Periods

NiSource has agreed to timing specific restrictions for certain O&M and new construction activities that coincide with Indiana bat active/inactive periods (i.e., life-requisite activities such as hibernation, spring staging/fall swarming, presence, breeding) (*see* Chapter 6). Climate change (i.e., warming/cooling) may trigger changes to Indiana bat active periods.

Trigger - Climate Change Alters an Indiana Bat Active Period

To facilitate implementation of the MSHCP, NiSource and the Service will develop an IPaC module. If and when there is an observed change to any Indiana bat active period, NiSource will update the data in the IPaC to reflect this change.

Response

In response to an identified change in Indiana bat active periods, NiSource will adjust the environmental windows in which it performs covered activities to accommodate any changes to Indiana bat active periods. Corrective action will be implemented immediately upon notification from the Service.

Climate Change Adversely Affects an Indiana Bat Mitigation Site

One mitigation option available to NiSource is to protect, maintain, and/or restore high-quality Indiana bat winter habitat at select hibernacula (existing and newly restored), including establishing and maintaining protective wooded buffers for impacted Indiana bats. However, as stated above, climate change (i.e., warming) has the potential to adversely impact habitats protected and restored for Indiana bats. Warming as a result of climate change may make some winter habitats (i.e., hibernacula) unsuitable for basic life history requirements by significantly altering the air temperatures inside the hibernacula. If this occurs, some or all of the Indiana bats may disperse to more suitable habitat, but it is possible, if not likely, that the new hibernacula used by the bats would not be protected from other threats. In response to this potential threat, NiSource will identify habitat mitigation projects that span elevational and altitudinal boundaries, so that in the event existing or restored habitats become unsuitable because of warming, NiSource can relocate mitigation efforts to hibernacula with suitable microhabitat regimes.

Warming could impact the habitat mitigation projects that NiSource establishes for Indiana bats in two ways. First, it could impact the bats at the mitigation site that the mitigation

is intended to protect. Should the animals at a NiSource mitigation site be impacted significantly, the mitigation would no longer serve to compensate for the impact of the take because there would be fewer Indiana bats or in extreme cases no bats for the mitigation to impact. Since the compensatory mitigation is designed to fully compensate for the impact of the take, changes to the Indiana bat population that the mitigation is designed to address, or changes in the effectiveness of the mitigation itself, would both require corrective action. Therefore, it is essential that the Indiana bats and the habitat remain in place and that the habitat functions as designed for the life of the permit. The loss of area or quality as defined below would reduce the effectiveness of the habitat to mitigate impacts to Indiana bats. If those impacts are caused by changed circumstances as defined above, NiSource will replace, restore, or otherwise correct the problems (within one year) so that the habitat continues to provide mitigation.

Trigger – Climate Change Affects Hibernacula Temperature and Indiana Bat Population Numbers at a Mitigation Site

The trigger for NiSource to implement corrective action where a hibernacula temperature increase adversely affects Indiana bats at a NiSource mitigation site is an increase of the average annual and seasonal air temperature within the hibernacula due to climate change, and a 25% or more reduction in the number of the Indiana bats at the mitigation site at the time of implementation of the mitigation. The population decrease within the hibernacula must be documented as a sole product of the warming air temperatures and not a product of other impacts to the hibernacula that could result in changes in internal temperatures (e.g., disturbance of the karst windows connected to the underground karst system). NiSource and the Service expect that in the absence of changed or unforeseen circumstances, the mitigation would lead to an increase in the Indiana bat population at the mitigation site over time, but a 25% reduction is provided to allow for some background variation in the population.

Responses

In response to an increase in hibernacula temperature and confirmed reduction in population at a NiSource mitigation site, NiSource will coordinate with the Service to either develop a hibernacula restoration plan to lower the temperature inside the hibernacula to the level necessary to support hibernating Indiana bats or identify a new mitigation project that would replace the failed mitigation site and fully compensate for the impact of the take, consistent with the requirements of Section 6.2.1.6.

Mussels

NiSource has agreed to restore and maintain high-quality mussel habitat in select streams including establishing and maintaining protective riparian buffers for impacted mussel species. However, as stated above, climate change (i.e., stream temperature increase) has the potential to adversely impact habitats restored and protected for mussels. Warming as a result of climate change may make some stream habitats less suitable or under extreme conditions, unsuitable for basic life history requirements. If either of these occurs, some mussels may be able to disperse (via host fish) to more suitable habitat, but it is possible that some would be negatively affected by the stress brought on by the effects of rising water temperatures. In response to this potential threat, NiSource will work with the Service and the States to identify habitat mitigation projects that span hydrologic and altitudinal boundaries (within the limits of the species ranges) in the event that existing or restored habitats become unsuitable due to climate change.

Climate Change Adversely Affects a Mussel Mitigation Site

Rising stream water temperatures may have adverse effects to mussels and other aquatic species. The AR4 Report of the IPCC predicts a warming of 0.2o C each decade over the next 20 years with a best estimate increase of from 1.8 to 4o C over 100 years (depending on the model). It also concludes as very likely an increase in "hot extremes and heat waves" (IPCC 2007). Kaushal et al. (2010) found water temperature increases in half of the streams and rivers they examined across the United States. In addition, they found that air temperature and stream temperature are closely correlated, a finding confirmed by (Bartholow 2005) who worked in the Klamath River basin in Oregon and California. Thus, an increase in air temperature and associated water temperature of MSHCP mussel streams of 2°C over the next 50 years is possible.

A sustained increase in water temperature could affect mussels in the following ways. There may be reproductive effects associated with their complex life history. Basic functions in mussels such as metabolic rate and associated functions (heart rate, oxygen uptake rate and feeding rate), although species specific, are controlled by temperature. McMahon and Bogan (2001) found that metabolic rate increases two to ten-fold in some mussels (L. siliquoidea 1.88 to 4.98; P. grandis 1.27 to 10.35) with a 5.0°F temperature increase and that neither of these species has the ability to acclimate its metabolic rate with an increase in temperature. Dimock and Wright (1993) found Pyganodon cataracta metabolic rate (measured as oxygen uptake) varied directly with water temperature. Juvenile metabolism may increase to the point that they cannot survive. Feeding, growth, and burrowing behavior in unionids are temperature dependent and appear affected by both a thermal minimum and maximum. Stuart et al. (2000) found Elliptio complanata's maximum feeding rate to increase between 56.3 to 64.9°F, while Vanderploeg et al. (1995) found L. siliquoidea's maximum feeding rate was at temperatures of 69.8 to 75.2°F. At high temperatures, adult mussels become inactive, stop feeding, and burrow into the substrate.

NiSource did not find any lethal or sublethal upper temperature limits reported in the literature for the mussel species included in this MSHCP. Pandolpho et al. (2009) looked at the effects of water temperature increase on three species (Lampsilis siliquoidea, Potamilus alatus, and Ligumia recta) of juvenile mussels; juveniles are generally regarded as more sensitive to environmental changes. The experiment was complex using three acclimation water temperatures associated with mean and median spring and summer temperatures in the southern and midwestern United States. During the experiment, the water temperature was increased to predetermined levels where the LT 50s (median time to death under the treatment) were calculated both with and without the presence of the harmful contaminant copper. For the three acclimation temperatures of 62.6°F, 71.6°F, and 80.6°F, they tested the LT 50s at the following experimental temperatures respectively: 20, 23, 26, 29 and 32°C; 25, 28, 31, 34, and 37°C; and 30, 33, 36, 39, and 42°C. These represent the upper range of water temperatures to which mussels might be exposed in the southern and midwestern United States. Their results showed that there was not enough mortality using the 17°C starting point even at the highest experimental water temperature of 89.6°F to calculate LT 50s. Without copper, the LT 50s at 96 hours for the other two acclimation temperatures ranged from 90.5°F to 96.1°F with a mean of 93.2°F.

The ecological significance of a 2°C temperature increase and how that increase occurs on streams and MSHCP mussels is not entirely clear, but NiSource and the Service expect that increased temperatures are most likely to impact mussels during times when stream temperatures

are already high (summer months). Urbanization in a watershed may exacerbate climate change impacts on stream water temperatures. It is also likely, as discussed above, that impacts to mussels from increased stream temperatures could manifest themselves in a variety of ways and that many of those manifestations (e.g., increased metabolism) would be difficult to assess in situ. Temperature impacts on MSHCP mussels must be considered in relation to the ecological adaptations of the species. The MSHCP mussels are found primarily in the warm-water streams of the Ohio River basin in Ohio, Kentucky, Tennessee, West Virginia, and southwestern Pennsylvania and in the James River basin in Virginia. Sustained high water temperatures in the upper ranges of the current normal summer temperatures would, based on laboratory experiments, cause mortality in juvenile mussels.

Trigger

The trigger for NiSource to implement corrective action where a water temperature increase affects mussels at a mitigation site is a combination of a global average surface air temperature increase of greater than 1°C for at least two consecutive years (as reported by the IPCC) based on 2011 levels, and an increase in the average afternoon summer (July, August, September) water temperature of at least 2°C for two consecutive years, plus data indicating a lamda (*see* average population growth rate above) of less than 1.0 of the MSHCP mussel(s) over a five-year period after documentation of the water temperature increase. The monitoring sequence would be: (1) track official government reports on air temperature until an increase greater than 1°C has occurred for at least two consecutive years relative to 2011 levels; (2) if a mitigation site(s) is in place, NiSource would begin monitoring afternoon summer water temperatures to identify increase over the baseline documented at the time mitigation was implemented – (this could occur every other year until a 2°C increase directly related to climate change is detected then annually to document two consecutive years); and (3) begin monitoring the mussel populations using the best available technology to determine change in the population growth rate over five years (*see* Villella et al. 2004 for one approach). If at the end of five years the average growth rate is < 1.0, the following responses are required.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Implement additional work at the mitigation site in coordination with the Service to provide conditions suitable to stability and recruitment within the population at the site (e.g., additional riparian plantings, beneficial changes in stream morphology, reducing or eliminating off-site stressors).

(2) Reintroduce the affected population of mussel to a more suitable existing site within the species range implementing all Service and other applicable protocols for augmentation, enhancement, or reintroduction of the mussel species.

(3) Work with the Service to place the affected population into a captive facility for maintenance until a suitable site for reintroduction into the wild becomes available.

Nashville Crayfish

NiSource has agreed to restore and maintain high-quality Nashville crayfish habitat in select streams including establishing and maintaining protective riparian buffers for impacted Nashville crayfish. However, as stated above, climate change (i.e., stream temperature increase)

has the potential to adversely impact habitats restored and protected for Nashville crayfish. Warming as a result of climate change may make some stream habitats less suitable or, under extreme conditions, unsuitable for basic life history requirements. If either were to occur, Nashville crayfish may be able to move to more suitable habitat, but it is possible that some would be negatively affected by the stress brought on by the effects of rising water temperatures. In response to this potential threat, NiSource will work with the Service and the States to identify habitat mitigation projects that span hydrologic boundaries (within the limits of the species' range) in the event that existing or restored habitats become unsuitable due to climate change.

Climate Change Adversely Affects a Nashville Crayfish Mitigation Site

Rising stream water temperatures may have adverse effects to Nashville crayfish and other aquatic species. As discussed above, the AR4 Report of the IPCC predicts a warming of 0.2°C each decade over the next 20 years with a best estimate increase of from 1.8 to 4°C over 100 years (depending on the model). An increase in air temperature and associated water temperature of Nashville crayfish streams of 2°C over the next 50 years is possible.

Khan et al. (2006) evaluated the effects of water temperature increase on juveniles of the crayfish species (O. immunis) focusing particularly on the interaction of temperature and heavy metals on respiration. They indicated that aquatic contaminants can compromise the ability of poikilotherms, including crayfish, to tolerate natural fluctuations in temperature. The LT 50 at the same sub-lethal level of four contaminants (cadmium, copper, zinc, and lead) declined universally as water temperature was increased from 20 to 27°C. The synergistic effects of increased water temperature and contaminants might be particularly important in an urbanizing watershed like the Mill Creek basin on the edge of Nashville.

Miranda and Dimock (1985) looked at the thermal tolerance of the crayfish Cambarus acuminatus faxon. Their results indicate that thermal tolerance is in part dependent on acclimation temperature. They looked at LT 50 temperatures for times varying from 10 minutes (instantaneous death) to 46 hours. They also identified a Critical Thermal Maxima (CTM), which was a temperature at which the individual could not right itself in 30 seconds. For C. acuminatus, the CTM for individuals acclimated at 22°C was 91.2°F and for individuals acclimated at 30°C, CTM was 96.8°F with standard deviations of plus or minus 1.20 and 0.83°C, respectively.

The ecological significance of a 2°C temperature increase, and how that increase occurs on streams and the Nashville crayfish is not entirely clear, but NiSource and the Service expect that increased temperatures are most likely to impact crayfish during times when stream temperatures are already high (summer months). Urbanization and the previously mentioned associated contaminants might exacerbate climate change impacts on stream water temperatures. Sustained high water temperatures particularly in conjunction with other factors would negatively impact Nashville crayfish.

Trigger

The trigger for NiSource to implement corrective action where a water temperature increase affects Nashville crayfish at a mitigation site is a combination of a global average surface air temperature increase of greater than 1°C for at least two consecutive years (as reported by the IPCC) based on 2011 levels, and an increase in the average afternoon summer (July, August, September) water temperature at the mitigation site of at least 2°C for two

consecutive years, plus data indicating an average population growth rate of < 1.0 of the Nashville crayfish population over a five-year period after the advent of the water temperature increase. The monitoring sequence would be: (1) track official government reports on air temperature until an increase of between 1°C and 2°C has occurred for at least two consecutive years relative to 2011 levels; (2) if a mitigation site(s) is in place, NiSource would begin monitoring afternoon summer water temperatures to identify increase over the baseline documented at the time mitigation was implemented–(this could occur every other year until a 2°C increase due solely to climate change is detected then annually to document two consecutive years); and (3) begin monitoring the Nashville crayfish populations using the best available technology to determine change in the population growth rate over five years (*see* Nowicki et al. 2008 for one approach). If at the end of five years the average growth rate is < 1.0, the following responses are required.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Implement additional work at the mitigation site in coordination with the Service to provide conditions suitable to stability and recruitment within the population at the site (e.g., additional riparian plantings, beneficial changes in stream morphology, reducing or eliminating off-site stressors).

(2) Reintroduce the affected population of Nashville crayfish to a more suitable existing site within the species range implementing all Service and other applicable protocols for augmentation, enhancement, or reintroduction of Nashville crayfish.

(3) Work with the Service to place the affected population into a captive facility for their maintenance until a suitable site for reintroduction into the wild becomes available.

10.3.2 Drought

Common to all types of drought is the fact that they originate from a deficiency of precipitation resulting from an unusual weather pattern. The Standardized Precipitation Index (SPI) is an index based on the probability of recording a given amount of precipitation, and the probabilities are standardized so that an index of zero indicates the median precipitation amount (half of the historical precipitation amounts are below the median, and half are above the median). The index is negative for drought and positive for wet conditions. As the dry or wet conditions become more severe, the index becomes more negative or positive (NCDC 2009).

While climate change is expected to increase the amount of precipitation in the Northeast[1] and the amount of land area experiencing drought appears to be decreasing (NAST 2001), droughts are nonetheless anticipated to increase in both frequency and duration into mid-century (NECIA 2007). Short-term droughts are a recurrent feature of climate for the MSHCP planning area.[2] Over the 50-year permit term, these short-term droughts are projected to occur as

[1] Defined as CT, NJ, DE, MA, ME, NH, NY and RI (NECIA 2007); PA and WV (USGCRP 2009).

[2] Due to the landscape-based approach to conservation utilized by the MSHCP, the "planning area" referred to in this chapter encompasses all of the states crossed by the MSHCP covered lands because mitigation efforts may be undertaken outside the covered lands to maximize conservation benefits.

frequently as once each summer in the Catskill and Adirondack Mountains. These events will exacerbate low flow situations in rivers and streams by extending low flow periods as well as by causing the low flow periods to begin earlier in the season than previously. Seasonal decreases in water tables, impacts to wetlands, and decreases in soil moisture also are likely (NECIA 2007).

For the Midwest region,[3] it is predicted that, with increasing temperatures and evaporation rates and longer periods between rainfalls, the likelihood of drought will increase and water levels in rivers, streams, and wetlands are likely to decline (USGCRP 2009).

For the Southeast region,[4] despite the increase in overall precipitation, the percentage of the region experiencing moderate to severe drought increased over the past three decades. Even in the fall months, when precipitation tended to increase in most of the region, the extent of drought increased (USGCRP 2009). Increased temperatures will cause more evaporation and evapotranspiration leading to increases in the frequency, duration, and intensity of droughts (USGCRP 2009).

Drought – Changed vs. Unforeseen Circumstances

Droughts have the potential to impact both NiSource's minimization and mitigation efforts. When a drought occurs and damages or destroys a minimization and/or mitigation effort, NiSource will implement conservation measures appropriate to remediate the circumstance, as described below for each species. This would include evaluation of the affected site, implementing corrective action, and implementing additional monitoring (if appropriate). Based on predictions for drought as described above, and the fact that droughts are a recurrent feature in the MSHCP planning area, NiSource has planned for droughts that could affect species and geographic areas covered by the MSHCP. These include droughts (a negative SPI) lasting less than five consecutive years. Therefore, changed circumstances includes droughts that last less than five years. Droughts lasting longer than five consecutive years will be considered unforeseen. Additionally, if a mitigation effort is destroyed by drought three or more times in a five year period, it will be considered an unforeseen circumstance.

Bog Turtle

Drought Adversely Affects a Bog Turtle Mitigation Site

Droughts have the potential to adversely impact the implementation and success of NiSource's operating conservation program for bog turtles. Bog turtles require specialized wetland habitats that include shallow, spring-fed fens, sphagnum bogs, swamps, marshy meadows, and pastures that have soft, muddy bottoms; clear, cool, slow-flowing water, often forming a network of rivulets; and open canopies (Service 1997, 2001). Bog turtle wetlands are a mosaic of micro-habitats that include dry pockets, saturated areas, and areas that are periodically flooded (Service 1997, 2001). Bog turtles depend on a variety of micro-habitats for foraging, nesting, basking, hibernation, and shelter; they utilize shallow water in the spring and return to deeper water in the winter (Service 1997, 2001). Modifications to the hydrology of bog turtle wetlands can change wetland vegetation and many of the micro-habitats that bog turtles rely on. Specifically, droughts or manmade alterations of hydrology that permanently dry out the

[3] Defined as OH, MI, IN, IL, MO, IA, WI, and MN (USGCRP 2009).

[4] Defined as AL, FL, GA, KY, LA, NC, MS, SC, TN, and VA (USGCRP 2009).

site would likely result in a transition of the site into closed-canopy, wooded swamplands. Invasive plant species (e.g., purple loosestrife) may more readily expand into bog turtle habitats during periods of drought or as well as during other types of disturbance.

One mitigation option available to NiSource is to protect, restore, and maintain wetland habitat for the benefit of bog turtle populations. As stated above, droughts have the potential to adversely impact bog turtle wetlands and influence the persistence of local bog turtle populations. During short periods of drought, bog turtles are likely to remain at the site with reduced survival and recruitment. During periods of long-term drought, bog turtles are likely to disperse the area in search of suitable habitats or succumb to the stress brought on by the long-term drought. All bog turtle mitigation sites will be monitored for the life of the permit to ensure they are providing suitable habitats for bog turtles.

Triggers - Drought Affects Bog Turtle Habitat at a Mitigation Site

Triggers for NiSource to implement corrective action are:

(1) Reduction by 25 percent in core fen habitat with appropriate hydrology from the acreage restored and/or protected as part of the mitigation; and/or

(2) Reduction by 25 percent in nesting habitat from the acreage restored and/or protected as part of the mitigation.

Response

In the event either the preceding triggers occurs, NiSource will identify and implement appropriate corrective action, which would likely include conducting vegetation management at the site (*see* Chapter 7 Adaptive Management strategies for bog turtle habitat restoration/management).

Trigger – Drought Affects a Protective Upland Buffer at a Mitigation Site

The trigger for NiSource to implement corrective action where drought affects establishment and/or maintenance of a protective upland buffer around a bog turtle wetland is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses at any time during the life of the permit.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Mussels

Like many other endangered species, populations of freshwater mussels are often small and isolated from other populations. Even well-protected populations are vulnerable to extinction through loss of genetic variability, chance fluctuations in reproduction and survivorship, and environmental disturbance. Drought is one of the most pervasive forms of environmental disturbance in small stream ecosystems. While large stream ecosystems and their

mussel fauna usually escape the severe adverse effects of drought, the impact of drought on small streams can be severe. While NiSource and the Service would expect James Spinymussel populations to be at particular risk from this type of changed circumstance, any species occurring in a small stream could be particularly vulnerable. Several studies have shown that droughts impact both the overall mussel abundance and species richness in small stream ecosystems. Mussels that typically survive droughts in small streams do so by burying themselves in the substrate and/or finding sections of the stream channel that remain wet. Haag and Warren (2008) found that in some small streams, overall mussel density before and after the drought declined by 65–83%, and the magnitude of the decline did not differ among streams regardless of whether the channel dried or remained wet.

Drought Adversely Affects a Mussel Mitigation Site

Drought could affect the success of the designed compensatory mitigation by killing or stressing mussels. The mechanism would be the dewatering of the stream or reduction in flow. Drought could also affect the establishment and maintenance of protective riparian buffers by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism for this would be the destruction or interference with the growth of the trees, shrubs, and grasses through lack of sufficient water for survival.

Trigger – Drought Affects Mussel Population Numbers at a Mitigation Site

The trigger for NiSource to implement corrective action where drought affects a mussel population at a mitigation site is documentation of a six-month drought event plus data indicating a lamda (*see* average population growth rate above) of less than 1.0 of the MSHCP mussel(s) over a five-year period after documentation of the six-month drought. The monitoring sequence would be: (1) document that six-month drought impacted the stream, and (2) begin monitoring the mussel populations using the best available technology to determine change in the population growth rate over five years (*see* Villella et al. 2004 for one approach). If at the end of five years the average growth rate is < 1.0, the following responses are required.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Re-establish the original compensatory mitigation (riparian corridor) at another location where the mussel species is present and deemed secure; and/or

(2) Reintroduce additional mussels to the original mitigation site implementing all Service and other applicable protocols for augmentation, enhancement, or reintroduction of mussels.

Trigger – Drought Affects a Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action is where, at any time during the life of the permit, drought affects establishment and/or maintenance of a protective riparian buffer for mussels is documentation of a six-month drought event and survival of fewer than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event that either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the target species.

Indiana Bat

Droughts have the potential to adversely impact the implementation and success of NiSource's operating conservation program for Indiana bats. Indiana bats require wooded habitats for summer as well as spring staging and fall swarming near hibernacula. However, as stated above, droughts have the potential to adversely impact wooded habitats protected and restored for Indiana bats. Droughts may make some restored wooded habitats unsuitable for basic life history requirements by significantly reducing the survival of planted vegetation.

Drought Adversely Affects an Indiana Bat Mitigation Site

One mitigation option available to NiSource is to protect, maintain, and restore high-quality Indiana bat wooded habitat at known summer and staging/swarming areas near hibernacula. Drought can impact the establishment and maintenance of protective herbaceous and wooded habitat.

Trigger – Drought Affects the Establishment of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where drought affects the establishment of these wooded habitats is survival of fewer than 75% of the planted trees, shrubs, and grasses after the third growing season of the mitigation. In the event that fewer than 50% of the planted trees, shrubs, and grasses are alive after the first year of implementation of the MSHCP, the mitigation will be deemed a failure and corrective action under changed circumstances will be required during the next growing season. If by the third growing season, greater than 75% of the trees, shrubs, and grasses survive, but the Service determines that greater than 50% will be permanently impaired (e.g., inordinately subject to disease, blow-down, etc.), corrective action is required.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site; or

(2) Reestablish the original level of mitigation at a new site for the species.

Trigger – Drought Affects the Maintenance of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where drought affects the maintenance of the wooded habitats is survival of fewer than 75% of the planted trees, shrubs, and grasses at any time during the life of the ITP.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Nashville Crayfish

Drought Adversely Affects a Nashville Crayfish Mitigation Site

One mitigation option available to NiSource is to restore and maintain high quality in-stream habitat for Nashville crayfish, including establishing and maintaining riparian buffers. Droughts have the potential to adversely impact Nashville crayfish and habitat restored for Nashville crayfish. Drying as a result of drought may make some habitat unsuitable for Nashville crayfish survival. If this occurs, Nashville crayfish may either disperse from the area to find more suitable habitat, or potentially succumb to the stress brought on by habitat loss. Drought can also impact the establishment and maintenance of protective herbaceous and forested riparian buffers. The mechanism for this would be the destruction or interference with the establishment and growth of the trees, shrubs, and grasses through lack of sufficient water for survival. In response to this potential threat, NiSource will identify habitat mitigation projects that span hydrologic boundaries (within the limits of the species' range) in the event existing or restored habitats become unsuitable, NiSource can re-establish a riparian buffer elsewhere and/or relocate affected Nashville crayfish to environments with suitable hydrologic regimes.

Trigger - Drought Affects Nashville Crayfish Population Numbers at a Mitigation Site

The trigger for NiSource to implement corrective action where drought affects a Nashville crayfish population at a mitigation site is documentation of a six-month drought event plus data indicating an average population growth rate of less than 1.0 of the Nashville crayfish population over a five-year period after the beginning of the drought event. If at the end of five years the average population growth rate is < 1.0, the following responses are required.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Perform additional work at the mitigation site in coordination with the Service to provide conditions suitable to stability and recruitment within the population at the site (e.g., additional riparian plantings, beneficial changes in stream morphology, reducing or eliminating off-site stressors).

(2) Re-establish the original compensatory mitigation (riparian corridor) at another location where the Nashville crayfish are present and deemed secure.

(3) Reintroduce the affected population of Nashville crayfish to a more suitable existing site within the species' range implementing all Service and other applicable protocols for augmentation, enhancement, or reintroduction of Nashville crayfish.

Trigger – Drought Affects a Nashville Crayfish Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action where drought affects the establishment and/or maintenance of a protective riparian buffer during the life of the permit is documentation of a drought event and survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

10.3.3 Floods

Floods are a naturally occurring component of the ecosystems in the MSHCP planning area. Their frequency and magnitude can be anticipated by reviewing historic information on specific bodies of water. Floods can have considerable adverse impacts on several of the MSHCP species and their habitats.

For the Northeast region, precipitation shows strong increases, with trends greater than 20% over the last 100 years occurring in much of the region. Precipitation extremes appear to be increasing under most climate change scenarios and are expected to continue increasing in amount, frequency, and intensity through mid-century. Such are expected to result in increased local and regional flooding events with damage to infrastructure as well as increases in erosion and sediment loading causing increased turbidity and pollutants to enter streams and rivers (NECIA 2007). Additionally, precipitation will increase during winter months in much of the Northeast; however, during the winter, there may be an increasing amount falling as rain, rather than snow, which will affect runoff and infiltration rates. More frequent storm surge flooding and permanent inundation of coastal ecosystems and communities is likely during the 50-year permit term in some low-lying areas in the northeast (USGCRP 2009).

For the Midwest region, annual precipitation has increased, up to 20% in some areas, with much of this coming from more heavy precipitation events (NAST 2001). Similar to the Northeast, these heavy precipitation events will result in increased local and regional flooding events with damage to infrastructure, as well as increases in erosion and sediment loading causing increased turbidity and pollutants to enter streams and rivers (NECIA 2007; USGCRP 2009). Also, the Midwest has experienced two record-breaking floods in the past 15 years (NOAA 2008).

For the Southeast region, annual rainfall trends show very strong increases of 20-30% or more over the past 100 years across Mississippi, Tennessee, and parts of Louisiana, with mixed changes across most of the remaining area. The percentage of the Southeast landscape experiencing severe wetness increased approximately 10% between 1910 and 1997 (NAST 2001). There has been an increase in heavy downpours in many parts of the Southeast region. Similar to the Northeast and Midwest, these heavy precipitation events will result in increased

local and regional flooding events with damage to infrastructure as well as increases in erosion and sediment loading causing increased turbidity and pollutants to enter streams and rivers (NECIA 2007) (USGCRP 2009). More frequent storm surge flooding and permanent inundation of coastal ecosystems and communities is likely during the 50-year permit term in some low-lying areas, particularly along the central Gulf Coast USGCRP 2009).

Flood events that could affect the MSHCP's day-to-day conservation strategies and mitigation projects would likely be temporary in nature. When such floods occur, NiSource could experience a temporary inability to gain access to covered lands (as described within this MSHCP), to conduct covered activities (as also described within this MSHCP). Such covered activities would be postponed until the flood waters diminished and normal activities could resume (unless an activity qualified as an "emergency" as defined by the USDOT that must be carried out under all conditions). These flood events will likely be of duration of less than 30 days.

Floods - Changed Circumstances vs. Unforeseen Circumstances

Severe floods have the potential to damage both minimization and mitigation efforts. When a flood occurs and damages or destroys a minimization and/or mitigation effort covered by the MSHCP, NiSource will implement conservation measures appropriate to remediate the circumstance. This would include evaluation of the affected site, implementing corrective action, and implementing additional monitoring (if appropriate). For day-to-day conservation strategies, any inundation of a portion of the covered lands by flood waters that lasts for more than 60 days will be considered an unforeseen circumstance. If a mitigation effort is destroyed by flooding three or more times in a five-year period, it also will be considered an unforeseen circumstance.

Bog Turtle

Flooding Adversely Affects a Bog Turtle Mitigation Site

One mitigation option available to NiSource is to protect, restore, and maintain high-quality wetland habitat and associated upland buffers for bog turtles. Flooding has the potential to adversely impact habitat restored for bog turtle, including the establishment and maintenance of protective vegetative buffers around bog turtle wetlands. Some flood events may cause wetland habitats protected and restored as mitigation for bog turtles to become unsuitable. If this occurs, bog turtles may either disperse the area to find more suitable habitat, or potentially succumb to the stress brought on by habitat loss and/or degradation. In response to this potential threat, NiSource will identify and design bog turtle mitigation projects that are resistant to or least likely to be affected by the adverse impacts caused by flood events. In addition, NiSource will develop management safeguards for maintaining productive bog turtle habitats in the event that mitigation habitats become degraded or destroyed by floods. Were degradation or destruction to occur, NiSource can either relocate affected bog turtles to environments with suitable hydrologic regimes and/or restore the habitat through active habitat management. All mitigation sites will be monitored for the life of the permit to ensure they provide suitable habitat for bog turtles.

Trigger – Flooding Affects a Bog Turtle Wetland at a Mitigation Site

Triggers to initiate a NiSource response are:

(1) Reduction in core fen habitat with appropriate hydrology from the acreage restored as part of the mitigation; and/or

(2) Reduction in nesting habitat from the acreage restored as part of the mitigation.

Response

In the event either of the preceding triggers occurs, NiSource will identify and implement appropriate corrective action, which would likely include conducting vegetation management at the site (*see* Chapter 7 Adaptive Management strategies for bog turtle habitat restoration/management). If corrective action is ineffective after monitoring for 2 years, NiSource will request a permit amendment to incorporate needed protocols.

Trigger – Flooding Affects a Bog Turtle Protective Upland Buffer at a Mitigation Site

Triggers to initiate a NiSource response are:

(1) Reduction of upland buffer for core fen habitat with appropriate hydrology from the acreage restored as part of the mitigation; and/or

(2) Reduction in upland buffer for nesting habitat from the acreage restored as part of the mitigation. If corrective action is ineffective after monitoring for 2 years, NiSource will request a permit amendment to incorporate needed protocols.

Response

In the event either of the preceding triggers occurs, NiSource will identify and implement appropriate corrective action, which would likely include conducting vegetation management at the site after the flooding is over (*see* Chapter 7 Adaptive Management strategies for bog turtle habitat restoration/management).

Mussels

Some floods can adversely affect riverine ecosystems by re-arranging river bed habitats, scouring away aquatic/riparian vegetation, and increasing the drift of aquatic invertebrates. This, in turn, can cause mortality by desiccation of mussels stranded when stream water levels fall, crushing of mussels by large deposits of substrata on the river bed and by mussels being washed out to sea. Flooding could affect the establishment of protective riparian buffers by killing or interfering with the growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism for this would be that floodwaters wash away, drown, or severely impact the growth of the trees, shrubs, or grasses planted as part of the restoration. Flooding could also wash away the land on which the mitigation buffer was planted. Flooding could also negatively impact in-stream habitat restored for mussels (i.e., gravel or cobble to enhance or restore habitat in the construction zone of a pipeline crossing or other in-channel work). The mechanism would be the energy of a large flood silting-in or washing away the material placed as a substrate for mussels.

Flooding Adversely Affects a Mussel Site

One mitigation option available to NiSource is to restore and maintain mussel habitat in select streams, primarily by establishing and maintaining protective riparian buffers. As stated

above, floods may adversely impact mussels and habitat restored and established for them as part of NiSource's proposed mitigation. Flooding may also destroy new riparian plantings (i.e., trees, shrubs and ground cover), while prolonged inundation of the riparian area may have similar effects. In response to the potential for a large and prolonged flood event to adversely affect mussels and habitat restored for the benefit of mussels, NiSource will identify mussel mitigation projects that span multiple regions (within the limits of the species' ranges). In the event that existing or restored habitats become degraded or destroyed, NiSource can relocate the affected mussels to environments with suitable habitats.

Trigger – Flooding Affects Mussel Population Numbers at a Mitigation Site

The trigger for NiSource to implement corrective action where flooding affects a mussel population at a mitigation site is documentation of a flood event plus data indicating a lamda (*see* average population growth rate above) of less than 1.0 of the MSHCP mussel(s) over a five-year period after documentation of the flood. The monitoring sequence would be: (1) document that the flood impacted the stream, and (2) begin monitoring the mussel populations using the best available technology to determine change in the population growth rate over five years (*see* Villella et al. 2004 for one approach). If at the end of five years the average growth rate is < 1.0, the following responses are required.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Relocate the mitigation to another site where it will positively impact the target mussel species; and/or

(2) Restore habitat mitigation damaged by the flood, if any, and reintroduce the target species to the site by implementing all Service and other applicable protocols for augmentation, enhancement, or reintroduction of the species.

Trigger - Flooding Affects a Mussel Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action is where, at any time during the life of the permit, flooding affects establishment and/or maintenance of a protective riparian buffer is documentation of a flood event and survival of fewer than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Acquire easements or fee title to additional area landward of the existing site and restore or replace the riparian buffer on-site;

(2) Restore or replace the riparian buffer on-site; and/or

(3) Acquire sufficient easements or fee titles at a new site to reestablish the original level of mitigation for the target species.

Trigger – Flooding Affects In-Stream Habitat at a Mussel Mitigation Site

The trigger for NiSource to implement corrective action where flooding impacts substrate placed for mussels is documentation of a flood event with greater than 25% of the area of the enhanced or restored habitat either silted-in or washed away from its original placement or where there is a combination of both impacts to greater than 25% of the area of habitat enhancement/restoration. NiSource suggests that, while there is no data indicating the ecological significance of 25% habitat loss, such a loss would likely represent an ecologically significant loss of individuals at the mitigation site, beyond which corrective action would be warranted. Such a quantification also has practical advantages with respect to assessment of impacts to a site after a flood event (in a large flood event, the actual channel size, location, or morphology could be changed).

Responses

In the event that either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the damaged area of the in-stream enhancement/restoration; and/or

(2) Implement an in-stream enhancement/restoration at another mussel construction site equal to the total area of the one impacted. This will be added on to either the up-stream or downstream end of the mitigation implemented at this new site, whichever would be more beneficial to the species.

Indiana Bat

Floods have the potential to adversely impact the implementation and success of NiSource's operating conservation program for Indiana bats. Indiana bats require stable microclimates inside hibernacula as well as high-quality wooded habitats for summer and spring staging and fall swarming near hibernacula. However, floods have the potential to adversely impact hibernacula and wooded habitats protected and restored for Indiana bats. Floods may destroy protective and/or restoration measures (i.e., air dams, gates, etc.) at hibernacula as well as significantly reduce the survival of protected and/or restored vegetation in wooded habitats, thereby making these habitats unsuitable for basic life history requirements of the species. If this were to occur, some or all Indiana bats may disperse to more suitable habitat, but it is possible, if not likely, that the new hibernacula and/or wooded habitats used by the bats would not be protected from other threats.

Flooding Adversely Affects an Indiana Bat Mitigation Site

Mitigation options available to NiSource include the protection, maintenance, and restoration of high-quality Indiana bat winter habitat (i.e., hibernacula) as well as wooded habitat at known summer and staging/swarming areas near hibernacula.

Trigger – Flooding Affects Indiana Bat Winter Habitat (i.e., hibernacula) at a Mitigation Site

The trigger for NiSource to implement corrective action where flooding at a hibernacula adversely affects Indiana bats at a mitigation site is a 25% or more reduction in the number of the Indiana bats at the mitigation site at the time of implementation of the mitigation. The population decrease within the hibernacula must be documented as a sole product of the flooding

and not a product of other impacts to the hibernacula that could result in population changes (e.g., disturbance of the karst windows connected to the underground karst system). NiSource and the Service expect that in the absence of changed or unforeseen circumstances, the mitigation would lead to an increase in the Indiana bat population at the mitigation site over time, but a 25% reduction is provided to allow for some background variation in the population.

Responses

If the preceding trigger occurs, NiSource will either develop a hibernacula restoration plan to correct the damage to the protective and/or restoration measures implemented at the hibernacula or identify a new mitigation project that would replace the failed mitigation site and fully compensate for the impact of the take.

Trigger – Flooding Affects Establishment of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where flooding affects the establishment of wooded habitats restored and/or managed for the benefit of Indiana bats is survival of fewer than 75% of the planted trees, shrubs, and grasses after the third growing season of the mitigation. In the event that fewer than 50% of the planted trees, shrubs, and grasses are alive after the first year, the mitigation will be deemed a failure and corrective action under changed circumstances will be required during the next growing season. If by the third growing season, greater than 75% of the trees, shrubs, and grasses survive, but the Service determines that greater than 50% will be permanently impaired (e.g., inordinately subject to disease, blow-down, etc.), corrective action is required.

Response

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site; and/or

(2) Reestablish the original level of mitigation at a new site for the species.

Trigger – Flooding Affects the Maintenance of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where flooding damages or destroys the maintenance of wooded habitats restored and\or managed for the benefit of Indiana bats is survival of fewer than 75% of the planted trees, shrubs, and grasses at any time during the life of the permit.

Response

In the event the preceding trigger occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Nashville Crayfish

Flooding Adversely Affects a Nashville Crayfish Mitigation Site

As discussed above, large flood events can adversely affect riverine ecosystems by rearranging river bed habitats, scouring away aquatic/riparian vegetation, and increasing the drift of aquatic invertebrates. Like mussel species, flood events have the potential to adversely affect implementation and success of NiSource's operating conservation program for Nashville crayfish. Floods could negatively impact slab rock placed by NiSource to enhance or restore in-stream habitat in the construction zone of a pipeline crossing or other in-channel work. The mechanism would be the energy of a large flood silting-in or washing away the material placed as cover habitat for crayfish.

One mitigation option available to NiSource is to restore and maintain high-quality in-stream habitat for Nashville crayfish, including establishing and maintaining protective riparian buffers. Floods may adversely impact Nashville crayfish and habitat restored and established for the species, including protective riparian buffers. Severe flooding could also wash away the land on which the riparian buffer was planted. In response to this potential threat, NiSource will identify habitat mitigation projects that span hydrologic boundaries, in the event existing or restored habitats become unsuitable for the species. NiSource can re-establish a riparian buffer in such areas and/or relocate affected Nashville crayfish to environments with suitable habitat.

Trigger – Flooding Affects In-Stream Habitat at a Nashville Crayfish Mitigation Site

The trigger for NiSource to implement corrective action where flooding impacts habitat placed to serve as cover habitat for Nashville crayfish is documentation of a flood event with greater than 25% of the enhanced and\or restored area either silted-in or washed away from its original placement, or where there is a combination of both impacts to greater than 25% of the area of habitat enhancement/restoration.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the damaged area of the in-stream enhancement/restoration; and/or

(2) Implement an in-stream enhancement/restoration equal to the total area of the one impacted at another Nashville crayfish construction site. This will be added on to either the up-stream or downstream end of the mitigation implemented at this new site, whichever would be more beneficial to the species.

Trigger – Flooding Affects a Protective Riparian Buffer at a Nashville Crayfish Mitigation Site

The trigger for NiSource to implement corrective action is where, at any time during the life of the permit, flooding affects establishment and/or maintenance of a protective riparian buffer is documentation of a flood event and survival of fewer than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Acquire easements or fee title to additional area landward of the existing site and restore or replace the riparian buffer on-site;

(2) Restore or replace the riparian buffer on-site; and/or

(3) Acquire sufficient easements or fee titles at a new site to reestablish the original level of mitigation for the species.

10.3.4 Fire

Fire is a naturally occurring component of the ecosystems in the planning area. In reviewing data on historic natural fire regimes (Fire Sciences Lab 2000), while a fire regime characterized by 0-35 year frequency and low severity predominates, there is a range of historic fire return rates and severity in the MSHCP planning area. In most of Ohio, West Virginia, New York, and part of Kentucky, there was a historic fire regime in which fire frequencies of every 35-100 years and mixed severity were more common. Southern Louisiana and small portions of Tennessee, Indiana, and Pennsylvania historically had more frequent fires (every 0 to 35 years) of stand replacement severity. The IPCC noted in its 2007 report that for the southeast region, there was a higher likelihood that change in forest character could occur as disturbances (e.g., fire and insect outbreaks) may increase in the future.

Fire - Changed Circumstances vs. Unforeseen Circumstances

While fire events can have considerable impact on the local structure and function of vegetation found at a minimization or mitigation site, the likelihood that a fire will occur at a specific site chosen for mitigation is low. Fires do, however, occur and have the potential to destroy both minimization and mitigation efforts. As such, NiSource is anticipating that fires could adversely affect minimization or mitigation projects for several of the species. When a fire occurs and damages or destroys a minimization and/or mitigation effort covered by the MSHCP, NiSource will treat such fire as a changed circumstance and implement conservation measures appropriate to remediate the circumstance. This would include evaluation of the affected site, implementing corrective action, and implementing additional monitoring (if appropriate). However, fires that damage or destroy a minimization or mitigation effort three or more times within a five-year period will be considered an unforeseen circumstance and will not require a NiSource response.

Bog Turtle

Fire Adversely Affects a Bog Turtle Mitigation Site

One mitigation option available to NiSource is to protect, restore and maintain wetland habitat for the benefit of bog turtle populations. Fire has the potential to adversely affect a bog turtle mitigation site. Fires may injure or destroy bog turtle nests, hatchlings, and adults, and adversely impact the vegetation within the wetland and any upland vegetative buffers. In response to this potential threat, NiSource may work with landowners and others to protect against potential wildfires occurring within and around bog turtle mitigation sites. This could also include working with local fire agencies to identify fire suppression strategies.

Trigger

The trigger to initiate a NiSource response is notification that a fire has impacted a bog turtle mitigation site during one of the species' active periods.

Response

In the event that a fire goes through a bog turtle site during the species' active period, the site will be surveyed for dead or injured turtles, and any injured turtles will be sent to an appropriate rehabilitation facility. In the event that a fire damages the habitat at a bog turtle mitigation site, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the target species.

Mussels

Fire Adversely Affects a Mussel Mitigation Site

One mitigation option available to NiSource is to restore and maintain high-quality in-stream habitat for mussels, including establishing and maintaining protective riparian buffers. Fires have the potential to adversely affect mussel mitigation sites, primarily through damage or destruction to the riparian vegetation established and maintained to protect the species and their habitat. If such were to occur, mussels and the in-stream habitats restored and maintained for their benefit could be adversely affected. To alleviate these potential threats, NiSource may work with landowners and others to protect against potential wildfires occurring within and around mussel mitigation sites. This could also include working with local fire agencies to identify fire suppression strategies.

Trigger – Fire Affects a Protective Riparian Buffer

The trigger for NiSource to implement corrective action where fire affects establishment and/or maintenance of a protective riparian buffer at any time during the life of the permit is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the target species.

Indiana Bat

Fire Adversely Affects an Indiana Bat Mitigation Site

Fire has the potential to adversely impact the implementation and success of NiSource's operating conservation program for Indiana bats. Indiana bats require stable microclimates inside hibernacula as well as high-quality wooded habitats for summer and spring staging and fall swarming near hibernacula. However, fires have the potential to adversely impact hibernacula and wooded habitats protected and restored for Indiana bats. Fires (i.e., smoke) may injure or kill Indiana bats at hibernacula. Fires may also destroy Indiana bat roosts, pups, and adults in wooded habitats as well as significantly reduce the survival of protected and/or planted vegetation in wooded habitats thereby making these habitats unsuitable for basic life history requirements of the species. If such were to occur, some or all Indiana bats may disperse to more suitable habitat, but it is possible, if not likely, that the new hibernacula and/or wooded habitats used by the bats would not be protected from other threats. Indiana bats could also disperse to less suitable habitats with other threats. To alleviate this potential threat, NiSource may work with landowners and others to protect against potential wildfires occurring within and around Indiana bat mitigation sites. This could also include working with local fire agencies to identify fire suppression strategies.

Trigger – Fire Affects the Establishment of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where fire affects the establishment of these wooded habitats is survival of less than 75% of the planted trees, shrubs, and grasses after the third growing season of the mitigation. In the event that less than 50% of the planted trees, shrubs, and grasses are alive after the first year, the mitigation will be deemed a failure and corrective action under changed circumstances will be required during the next growing season. If by the third growing season, greater than 75% of the trees, shrubs, and grasses survive, but the Service determines that greater than 50% will be permanently impaired (e.g., inordinately subject to disease, blow-down, etc.), corrective action is required.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Trigger – Fire Affects the Maintenance of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where fire affects the maintenance of the wooded habitats is survival of fewer than 75% of the planted trees, shrubs, and grasses at any time during the life of the permit.

Responses

In the event the preceding trigger occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Nashville Crayfish

Fire Adversely Affects a Nashville Crayfish Mitigation Site

One mitigation option available to NiSource is to restore and maintain high-quality in-stream habitat for Nashville crayfish, including establishing and maintaining protective riparian buffers. Fires have the potential to adversely affect a Nashville crayfish mitigation site, primarily through damage or destruction to the riparian vegetation established and maintained to protect the species and its habitat. If such were to occur, Nashville crayfish and the in-stream habitats restored and maintained for their benefit could be adversely affected. To alleviate these potential threats, NiSource may work with landowners and others to protect against potential wildfires occurring within and around Nashville crayfish mitigation sites. This could also include working with local fire agencies to identify fire suppression strategies.

Trigger – Fire Affects a Protective Riparian Buffer Mitigation Site

The triggers for NiSource to implement corrective action where fire affects establishment and/or maintenance of a protective riparian buffer at any time during the life of the permit is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses .

Responses

In the event that either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

10.3.5 Tornados

While tornados are known to occur throughout the MSHCP planning area, it is important to understand the likelihood that any particular place will be struck by a tornado is low. One measure is the annual average number of tornadoes per 10,000 square miles by state. In the fourteen states crossed by the MSHCP planning area, the average number of tornadoes per 10,000 square miles ranged from 0.8 in West Virginia to 6.1 in Indiana. Annual average number of tornados during the same period of time ranged between 1 in Delaware to 27 in Mississippi and Louisiana, with the average number of tornados in the fourteen states being 12.7. On

average in the U.S., the frequency that any particular square mile of land may be hit by a tornado is about every thousand years (NOAA 2008).

Tornados – Changed vs. Unforeseen Circumstance

When a tornado occurs and damages or destroys a minimization and/or mitigation effort covered by the MSHCP, NiSource will implement conservation measures appropriate to remediate the circumstance. This would include evaluation of the affected site, implementing corrective action, and implementing additional monitoring (if appropriate). NiSource is anticipating and planning for one tornado to adversely affect every mitigation site over the life of the 50-year permit. If a mitigation site is destroyed by a tornado more than once, it will be considered an unforeseen circumstance.

Mussels

Tornado Affects a Mussel Mitigation Site

One mitigation option available to NiSource is to restore and maintain high-quality in-stream habitat for mussels, including establishing and maintaining protective riparian buffers. Tornados could damage or destroy riparian vegetation established and maintained to protect in-stream mussel habitat. Were such to occur, in-stream habitats restored and maintained for the benefit of mussels could be adversely affected.

Trigger – Tornado Affects a Protective Riparian Buffer at a Mussel Mitigation Site

The triggers for NiSource to implement corrective action where a tornado affects establishment and/or maintenance of a protective riparian buffer for mussels at any time during the life of the permit is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site; and/or

(2) Clean-up the mitigation site to allow for normal growth of the newly established trees, shrubs, and grasses.

Indiana Bat

Tornado Adversely Affects an Indiana Bat Mitigation Site

Mitigation options available to NiSource include the protection, maintenance, and restoration of high-quality Indiana bat winter habitat (i.e., hibernacula) as well as wooded habitat at known summer and staging/swarming areas near hibernacula. Tornados have the potential to adversely impact habitat restored for Indiana bats. Tornados may destroy protective and/or restoration measures at hibernacula as well as significantly reduce the survival of protected and/or planted vegetation in wooded habitats thereby making these habitats unsuitable for basic life history requirements of the species.

Trigger – Tornado Affects Indiana Bats in Winter Habitat (i.e., hibernacula) Mitigation Site

The triggers for NiSource to implement corrective action is where a tornado at a mitigation hibernacula adversely affects the Indiana bat population with a 25% or more reduction in the number of the bats at the site at the time of implementation of the mitigation. The population decrease within the hibernacula must be documented as resulting solely from the tornados and not a product of other impacts to the hibernacula that cause population changes (e.g., disturbance of the karst windows connected to the underground karst system). NiSource and the Service expect that in the absence of changed or unforeseen circumstances, the proposed mitigation would lead to an increase in the Indiana bat population at the mitigation site over time, but a 25% reduction is provided to allow for some background variation in the population.

Responses

In response to a confirmed reduction in population as a result of a tornado at a NiSource mitigation site, NiSource will either develop a hibernacula restoration plan to correct the damage to the protective and/or restoration measures already implemented at the hibernacula or identify a new mitigation project that would replace the failed mitigation site and fully compensate for the impact of the take.

Trigger – Tornado Affects the Establishment of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where a tornado affects the establishment of these wooded habitats is survival of less than 75% of the planted trees, shrubs, and grasses after the third growing season of the mitigation. In the event that less than 50% of the planted trees, shrubs, and grasses are alive after the first year, the mitigation will be deemed a failure and corrective action under changed circumstances will be required during the next growing season. If by the third growing season, greater than 75% of the trees, shrubs, and grasses survive, but the Service determines that the greater than 50% will be permanently impaired (e.g., inordinately subject to disease, blow-down, etc.), corrective action is required.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Trigger – Tornado Affects the Maintenance of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where a tornado affects the maintenance of the wooded habitats is survival at any time during the life of the ITP of fewer than 75% of the planted trees, shrubs, and grasses.

Responses

In the event the preceding trigger occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Nashville Crayfish

Tornados Affect a Nashville Crayfish Mitigation Site

One mitigation option available to NiSource is to restore and maintain high quality in-stream habitat for Nashville crayfish, including establishing and maintaining protective riparian buffers. Tornados may adversely impact habitat restored and established for Nashville crayfish, particularly the protective riparian buffers. The mechanism for this would be blowing down or uprooting trees, shrubs, and associated grasses, or distributing debris across the site that interferes with normal growth.

Trigger – Tornado Affects a Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action where a tornado affects establishment and/or maintenance of riparian buffer at any time during the life of the permit is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site; and/or

(2) Clean-up the mitigation site to allow for normal growth of the newly established trees, shrubs, and grasses.

10.3.6 Disease

During the term of the requested permit, it is anticipated that disease may affect some of the MSHCP species or their habitat.

Disease – Changed vs Unforeseen Circumstance

When a disease occurs that adversely affects a NiSource mitigation effort, NiSource will implement conservation measures appropriate to remediate the circumstance. This would include evaluation of the affected site, implementing corrective action, and implementing additional monitoring (if appropriate). Diseases also have the potential to impact populations of species that extend beyond mitigation sites and result in a changed circumstance. It is not possible to predict with any certainty the frequency of disease outbreaks. However, as a component of this MSHCP, any disease that damages or destroys a minimization or mitigation effort three or more times within a five-year period will be considered an unforeseen circumstance and will not require a NiSource response.

Bog Turtle

Disease Affects a Bog Turtle Mitigation Site

Disease could affect the establishment of a riparian buffer by killing or interfering with the growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by some pathogen that could be a synergistic effect with drought or flooding. Disease could also affect the maintenance of a protective riparian buffer by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by any pathogen or the result of synergistic effects with drought or flooding.

Trigger – Disease Affects Bog Turtle Population Numbers at a Mitigation Site

Any confirmed disease outbreak that results in mortality to adult bog turtles at any mitigation site (greater than two adults in one year).

Response

NiSource will promptly inform the Service, assist the Service with transport of bog turtles (dead or injured) to a rehabilitation facility or lab as requested, and identify and implement decontamination protocols, as appropriate.

Trigger – Disease Affects Protective Upland Buffer at Bog Turtle Mitigation Site

The trigger for NiSource to implement corrective action where disease affects establishment and/or maintenance of a protective upland buffer around a bog turtle wetland at any time during the life of the permit is survival of less than 75% of the planted trees and shrubs or less than 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Mussels

Disease Adversely Affects a Mussel Mitigation Site

Disease could affect the establishment of a riparian buffer by killing or interfering with the growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by some pathogen that could be a synergistic effect with drought or flooding. Disease could also affect the maintenance of a protective riparian buffer by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by any pathogen or the result of synergistic effects with drought or flooding.

Trigger – Disease Affects a Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action where disease affects establishment and/or maintenance of a protective riparian buffer for mussels at any time during the life of the permit is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Indiana Bat

White-nose syndrome

White-nose syndrome (WNS) was first documented in 2006 at a cave in upstate New York. It is named for the white fungal growth present on the noses of affected hibernating bats. Since then, WNS has been confirmed in 7 bat species (including Indiana bat, little brown bat, big brown bat, tri-colored bat (Eastern pipistrelle), northern long-eared bat, small-footed bat, and gray bat) and 19 states (New York, Maine, Vermont, New Hampshire, Massachusetts, Connecticut, New Jersey, Pennsylvania, Virginia, West Virginia, Tennessee, Kentucky, Indiana, Ohio, Maryland, Delaware, North Carolina, Missouri, Alabama) and 4 Canadian provinces (Quebec, Nova Scotia, New Brunswick, and Ontario). The Service, in partnership with federal and state agencies, and various conservation groups, has been monitoring bat hibernacula throughout the United States to determine the distribution and impact of WNS. It is estimated that greater than 5.5 million bats perished from WNS in eastern states since 2006 (Service 2012b). In caves where the WNS is confirmed, mortality based on direct counts during winter appears to range from 80 - 100% of hibernating bats.

It has recently been demonstrated that the fungus *Geomyces destructans* is the causative agent of WNS (Warnecke et al., 2012). Hibernating bats infected with *G. destructans* often exhibit abundant fungal growth on exposed membranes and develop additional signs of the disease, including poor body condition, skin lesions, atypical behavior, and others prior to death. Ongoing efforts are investigating the proximate cause of death for WNS-positive bats, as well as possible interactions of the disease with environmental, physiological, and genetic factors.

The Service continues to lead a team of federal and state agencies and tribes in executing a national response plan for WNS to manage the disease and address associated threats to hibernating bats. The national plan provides an organizational framework and implementation strategy for coordinating research, communications, management and response to WNS(http://whitenosesyndrome.org/national-plan/white-nose-syndrome-national-plan).

As stated above, Indiana bat populations are affected by WNS in states that overlap with multiple states in NiSource covered lands; therefore, impacts associated with WNS are part of the baseline when considering the effects of NiSource covered activities. However, WNS is also

considered a changed circumstance as it is reasonable to assume that WNS will continue to spread to other states and potentially impact Indiana bats throughout all states in NiSource covered lands.

As WNS continues to impact Indiana bats, the likelihood of NiSource encountering Indiana bats may decrease but the importance of protecting Indiana bats that may be resistant to WNS (if any exist) increases. Fortunately, NiSource has developed many avoidance and minimization measures to reduce the impact of activities addressed in the MSHCP on the Indiana bat.

It should be noted that other diseases may also impact NiSource's operating conservation program for Indiana bats. NiSource and the Service would expect triggers and responses similar to those provided below to be implemented for WNS.

Trigger – Disease Affects Indiana Bat Populations within Recovery Units and/or Range-wide

Avoidance and minimization measures, as well as mitigation measures, may need to be reevaluated should impacts from WNS result in the reduction of any proposed recovery unit's population, or the reduction of the species' overall range-wide population to determine whether NiSource covered activities may jeopardize the continued existence of the species. It is premature, however, to arbitrarily assign a percentage reduction to be used as a trigger.

Responses

In response to an identified change in Indiana bat populations within the recovery units and/or range-wide as a result of WNS, NiSource and the Service will reevaluate NiSource's operating conservation program for Indiana bats (e.g., avoidance and minimization as well as mitigation measures) and, if possible, implement agreed upon revisions in order to ensure adequate compensation for the impact of take incurred as well as to remedy any inconsistency with Section 1539(a)(2)(B)(iv) of the ESA.

Disease to vegetation

Disease could also affect the establishment of a wooded habitats used by Indiana bats in summer and/or during spring staging/fall swarming near hibernacula by killing or interfering with the growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by some pathogen that could be a synergistic effect with drought or flooding. Disease could also affect the maintenance of this wooded habitat by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by any pathogen or could be the result of synergistic effects with drought or flooding.

Trigger – Disease Affects the Establishment of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action under this scenario is when there is survival of less than 75% of the planted trees, shrubs, and grasses after the third growing season of the mitigation. In the event that fewer than 50% of the planted trees, shrubs, and grasses are alive after the first year, the mitigation will be deemed a failure and corrective action under changed circumstances will be required during the next growing season. If by the third growing season, greater than 75% of the trees, shrubs, and grasses survive, but the Service

determines that the greater than 50% will be permanently impaired (e.g., inordinately subject to future disease, blow-down, etc.), corrective action is required.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Trigger – Disease Affects the Maintenance of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action under this scenario is survival of less than 75% of the planted trees, shrubs, and grasses at any time during the life of the permit.

Responses

In the event the preceding trigger occurs, NiSource will implement one of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Nashville Crayfish

Disease Adversely Affects a Nashville Crayfish Mitigation Site

Disease could affect the establishment of a riparian buffer by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by some pathogen or the result of a synergistic effect with drought or flooding. Disease could also affect the maintenance of a protective riparian buffer by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the destruction of the plants by any pathogen or the result of synergistic effects with drought or flooding.

Trigger – Disease Affects a Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action where disease affects establishment and/or maintenance of a protective riparian buffer at any time during the life of the permit is survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

10.3.7 Invasive Species

During the term of the requested permit, it is likely that a non-native plant or animal species may occur or be introduced in areas that could affect species or the suitability of their habitats. In addition, aggressive native species can be considered invasive in certain situations. The mitigation strategy is designed to take in new information and evaluate mitigation proposals such that the best available sites are selected and protected. While invasive-species control would be a part of management funding (provided as part of mitigation projects), there may be certain invasive species characteristics that present particular challenges.

In the event that an invasive species affects a mitigation site to the point where it is not performing as designed, NiSource will implement the following corrective actions:

1. Prepare a damage report;

2. Identify remedial actions to address the threat; and

3. Respond in ways that are consistent with permit obligations and with the consent of the Service.

4. Request a permit amendment pursuant to Section 7.6.3.

Invasive Species – Changed vs. Unforeseen Circumstance

Large infestations (e.g., affecting greater than 50% of the mitigation site) of a new or existing exotic plant or animal can become extremely expensive to control and heavily tax the operating budget of the MSHCP. For instance, the invasion of the zebra mussel poses a significant threat to other mussel species in many regions of the U.S., and species extinctions are expected as a result of its continued spread in the eastern United States. For the purposes of this MSHCP, an infestation of a new invasive species or the spread of an existing invasive species that results in the mitigation site not accomplishing its designed purpose for more than three out of five years is considered an unforeseen circumstance.

Bog Turtles

Invasive Species Adversely Affects a Bog Turtle Mitigation Site

One mitigation option available to NiSource is to protect, restore, and maintain wetland habitat for the benefit of bog turtle populations. Invasive plant species (e.g., purple loosestrife, phragmites, reed canary grass), which pose a threat to the majority of known bog turtle sites, are likely to be present at mitigation sites that would be established and maintained. NiSource's mitigation measures, which include habitat restoration and management to reduce the presence of invasive species in bog turtle wetlands, are addressed in Chapters 6 (Section 6.2.2.6) and 7 (Adaptive Management).

Trigger – Invasive Species Affects Establishment and Maintenance of Bog Turtle Mitigation Site

The trigger for NiSource to implement corrective action where invasive plant species affects establishment and/or maintenance of a protective riparian buffer is encroachment of more than an estimated 25% of the area at the bog turtle mitigation site.

Response - Follow measures described in Chapter 7.

Mussels

Invasive Species Adversely Affects a Mussel Mitigation Site

A number of invasive species or nonnative species of aquatic organisms are firmly established in the range of mussel species. Zebra mussels attach to the shells of native mussels in great masses, effectively smothering them. The mechanisms by which zebra mussels impact native mussels have been reviewed in detail (Service 2002a). The invasion of the zebra mussel and its congener the quagga mussel (Dreissena rostriformis bugensis) pose a significant threat to mussel species in many regions, and species extinctions are expected as a result of their continued spread in the eastern United States.

One mitigation option available to NiSource is to restore and maintain high-quality in-stream habitat for mussels, including establishing and maintaining protective riparian buffers. Invasive species, particularly zebra mussels, could significantly affect mussel populations at NiSource mitigation sites. The mechanism would be direct impacts to native mussels (e.g., zebra mussels) or competition for food, space, or other resources. Invasive species could also affect establishment and maintenance of the protective riparian buffers at mussel mitigation sites by killing or interfering with growth of vegetation (e.g., trees or native grasses) that is planted as part of the mitigation. The mechanism would be the direct destruction (e.g., defoliation) of the vegetation by some invasive species.

Trigger – Invasive Species Affects Mussel Population Numbers at a Mitigation Site

The trigger for NiSource to implement corrective action where an invasive species affects a mussel population at a mitigation site is the documented presence of an invasive species plus data indicating a lamda (*see* average population growth rate above) of less than 1.0 of the MSHCP mussel(s) over a five-year period after occupation by the invasive species. The monitoring sequence would be: (1) document that invasive species occur in the stream, and (2) begin monitoring the mussel populations using the best available technology to determine change in the population growth rate over five years (*see* Villella et al. 2004 for one approach). If at the end of five years the average growth rate is < 1.0, the following responses are required.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Re-establish the original compensatory mitigation (riparian corridor) at another location where the mussel species is present and deemed secure; and/or

(2) Correct the invasive species problem at the mitigation site and reintroduce mussels to the original mitigation site following all Service and other applicable protocols for augmentation, enhancement, or reintroduction of mussels.

(3) Amend the MSHCP and permit pursuant to Section 7.6.3.

Trigger – Invasive Species Affects a Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action where an invasive species affects establishment and/or maintenance of riparian buffer at any time during the life of the permit is the documented presence of an invasive species affecting the mitigation site and the survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the riparian buffer on-site;

(2) Destroy the invasive species and restore or replace the riparian buffer on-site; and/or

(3) Acquire easement or fee title to a new site to reestablish the original level of mitigation for the target species.

Indiana Bat

Invasive Species Adversely Affects an Indiana bat Mitigation Site

Mitigation options available to NiSource include the protection, maintenance, and restoration of high-quality Indiana bat winter habitat (i.e., hibernacula) as well as wooded habitat at known summer and staging/swarming areas near hibernacula. Invasive species have the potential to adversely impact habitat restored for Indiana bats. Invasive species may destroy protective and/or restoration measures at hibernacula as well as significantly reduce the survival of protected and/or planted vegetation in wooded habitats thereby making these habitats unsuitable for basic life history requirements of the species.

Trigger – Invasive Species Affects Indiana Bat Winter Habitat (i.e., hibernacula) at a Mitigation Site

The trigger for NiSource to implement corrective action where invasive species adversely affects Indiana bats at an hibernacula on a mitigation site is a 25% or more reduction in the number of the Indiana bats at the mitigation site at the time of implementation of the mitigation. The population decrease within the hibernacula must be documented as the sole product of the invasive species and not as a product of other impacts to the hibernacula that could result in population changes (e.g., disturbance of the karst windows connected to the underground karst system). NiSource and the Service expect that in the absence of changed or unforeseen circumstances, the mitigation would lead to an increase in the Indiana bat population at the mitigation site over time, but a 25% reduction is provided to allow for some background variation in the population.

Responses

In response to the confirmed reduction in population as a result of invasive species at a mitigation site, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Trigger – Invasive Species Affects the Establishment of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where invasive species affects the establishment of these wooded habitats is survival of less than 75% of the planted trees, shrubs, and grasses after the third growing season of the mitigation. In the event that less than 50% of the planted trees, shrubs, and grasses are alive after the first year, the mitigation will be deemed a failure, and corrective action under changed circumstances will be required during the next growing season. If by the third growing season, greater than 75% of the trees, shrubs, and grasses survive, but the Service determines that greater than 50% will be permanently impaired (e.g., inordinately subject to disease, blow-down, etc.), corrective action is required.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Trigger – Invasive Species Affects the Maintenance of Wooded Summer and/or Spring Staging/Fall Swarming Habitats at a Mitigation Site

The trigger for NiSource to implement corrective action where invasive species affects the maintenance of wooded summer and/or spring staging/fall swarming habitat at a mitigation site is survival of less than 75% of the planted trees, shrubs, and grasses at any time during the life of the ITP.

Response

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the existing mitigation on-site;

(2) Establish additional mitigation at a new site to replace that portion of the original site which is damaged; and/or

(3) Reestablish the original level of mitigation at a new site for the species.

Nashville Crayfish

Invasive Species Adversely Affects a Nashville Crayfish Mitigation Site

One mitigation option available to NiSource is to restore and maintain high-quality in-stream habitat for Nashville crayfish, including establishing and maintaining protective riparian buffers. An alien invasive crayfish species, like rusty crayfish (Orconectes rusticus) or one of the other resident Orconectes species in the Mill Creek watershed (O. placidus or O. durrellii),

could adversely affect Nashville crayfish populations by causing mortality or stress in the Nashville crayfish for which the mitigation is designed (inter-specific competition with other crayfish). Other invasive species could also affect establishment and maintenance of the protective riparian buffers at Nashville crayfish mitigation sites by killing or interfering with growth of vegetation (e.g., trees or native grasses) planted as part of the mitigation. The mechanism would be the direct destruction (e.g., defoliation) of the vegetation by some invasive species.

Trigger – Invasive Species Affect Nashville Crayfish Population Numbers at a Mitigation Site

The trigger for NiSource to implement corrective action where an invasive species (e.g., rusty crayfish) affects Nashville crayfish at a mitigation site is the documented presence of an invasive species plus data indicating an average population growth rate of less than 1.0 of the Nashville crayfish population over a five-year period after the occupation of the invasive species. If at the end of five years the average population growth rate is < 1.0, the following responses are required.

Responses

In the event the preceding trigger occurs, NiSource will implement one or more of the following corrective actions:

(1) Re-establish the original compensatory mitigation (riparian corridor) at another location where the Nashville crayfish is present and deemed secure; and/or

(2) Correct the invasive species problem at the mitigation site and reintroduce Nashville crayfish to the original mitigation site following all Service and other applicable protocols for augmentation, enhancement, or reintroduction of the species.

Trigger – Invasive Species Affects a Protective Riparian Buffer Mitigation Site

The trigger for NiSource to implement corrective action where an invasive species affects the maintenance of riparian buffer at any time during the life of the permit is the documented presence of an invasive species that is affecting the mitigation site and survival of less than an estimated 75% of the planted trees and shrubs or less than an estimated 75% of the area of planted grasses.

Responses

In the event either of the preceding triggers occurs, NiSource will implement one or more of the following corrective actions:

(1) Restore or replace the riparian buffer on-site;

(2) Destroy the invasive species and restore or replace the riparian buffer on-site; and/or

(3) Acquire easement or fee title to a new site to reestablish the original level of mitigation for the species.

10.3.8 Newly-identified Species Occurrences/Range Expansion/Contraction

Trigger

Identification of MSHCP species in new locations or habitat. For the purpose of this trigger, new locations includes newly discovered occurrences or habitat, as well as historical occurrences that are later shown to be extant or reoccupied. It may also include newly-discovered occurrences or habitat outside the covered lands, but only to the extent that their proximity indicates species presence or habitat suitability on covered lands

Response

NiSource will implement AMMs to avoid and minimize adverse effects and take of new occurrences of habitat. To the extent that take cannot be avoided, NiSource will mitigate for the impact of any take consistent with Chapter 6. If it is determined that the amount of authorized take will be exceeded and/or that the impacts to any of the MSHCP species are greater than anticipated, the provisions of Chapter 9 will apply.

10.3.9 Species Listing/Delisting

MSHCP Species

If unlisted species that are "adequately covered" (as defined in 50 C.F.R. §17.3) in the MSHCP, i.e., "MSHCP species," are listed subsequent to issuance of the requested permit, the permit will afford NiSource protection against take liability for such species under Section 9 of the ESA and the Service's implementing regulations as of the effective date of such listing. No further conservation measures or other action will be required of NiSource under the ESA. NiSource has requested that all adequately covered "MSHCP species," whether listed or unlisted, be named on the requested permit. Under the terms of the permit, permit coverage for any unlisted MSHCP species will become effective upon the listing of such species under the ESA provided NiSource is properly implementing the MSHCP, permit conditions and IA.

Non-MSHCP Species

Unlisted species that are neither addressed as "MSHCP species" in the MSHCP nor "adequately covered" (50 C.F.R. §17.3) will not be included in the permit. The Service will notify NiSource of the potential listing of any unlisted species that is not covered by the MSHCP but that could be affected by NiSource activities within the covered lands, including, but not limited to, those activities listed as "covered activities" herein. The Service also will notify NiSource upon the listing of any such species. Upon receipt of such notice, NiSource may enter into negotiations with the Service regarding amending the MSHCP, ITP, and associated documents, in accordance with Chapter 9 of this MSHCP to obtain take coverage for the newly listed species. In the alternative, NiSource may consult with the Service under Section 7 of the ESA.

Species Delisting

In the event that any MSHCP species is delisted during the term of the ITP, NiSource and the Service will confer on a case-by-case basis to determine how such delisted MSHCP species will be addressed thereafter under the MSHCP and ITP. NiSource will continue all conservation measures specific to any delisted MSHCP species until the Service determines that the actions

are no longer needed for that species. In those cases, and for those species where NiSource's conservation activities may contribute to the recovery of the species, NiSource will complete its ongoing mitigation projects.

11.0 Alternatives to Take

11.1 Introduction

The ESA and the Service's implementing regulations require that Section 10 permit applicants specify in an HCP what alternatives to the take of take species were considered and the reasons why those alternatives were not selected. The Service has recognized that the common alternatives considered are the no-action alternative and alternatives "that would reduce such take below levels anticipated for the project proposal". HCP Handbook at p. 3-35. This chapter identifies alternatives considered in the development of the NiSource MSHCP. In addition to the proposed action, NiSource considered the no-action alternative, various configurations for the covered lands corridor, and "all-mandatory-AMMs" alternative. Each of these alternatives and the reasons they were not selected are discussed below.

11.2 No-Action Alternative

Under the No-Action Alternative, the MSHCP would not be implemented and the Service would not issue the requested ITP. As a result, NiSource would continue to address threatened and endangered species issues on a project-by-project basis thus maintaining the current status of ESA consultation and compliance.[1]

While NiSource would likely achieve the requisite regulatory compliance, the various Section 7 consultations and Section 10 applications for incidental take permits under the No-Action Alternative would require additional agency and NiSource staff time and more resources than would be required for implementation of this MSHCP and the requested ITP. Moreover, continuation of the project-by-project approach could result in inefficiencies, redundancies, and uncertainty for the Service and NiSource. It could also result in variable application of avoidance, minimization, and compensation measures and adversely affect NiSource's ability to schedule operation, maintenance, and minor construction activities.

More importantly, the No-Action Alternative's project-by-project method of ESA compliance would not provide the tools necessary to take the holistic, landscape approach to species conservation that is embodied by this MSHCP. As discussed in Chapter 1, the MSHCP addresses the needs of species and their habitats on a more regional, ecosystem-wide basis, where possible, thus providing significant conservation benefits to such species. Further, the MSHCP envisions that conservation activities will be coordinated and aggregated on a broader geographic scale more consistent with species population levels and focused on achieving species recovery goals. This

[1] It is important to note that NiSource operates its pipeline facilities in accordance with its FERC-issued Certificate of Public Convenience and Necessity and is subject to regulations promulgated by FERC and the Office of Pipeline Safety. NiSource's certificate and the agencies' regulations require that NiSource undertake certain operation and maintenance activities on its pipeline facilities. NiSource cannot cease performing these certificated activities without first obtaining an order from the FERC to abandon an operation. Thus, an alternative, whereby NiSource would cease all activities on its existing facilities, is neither feasible nor likely.

landscape-level approach is expected to provide greater benefits to species than the traditional Section 7 approach to ESA regulatory compliance currently used for NiSource's activities. The landscape approach may also benefit other species that utilize the same habitat as species included in this MSHCP.

11.3 Covered Lands Alternatives

Various alternatives for the MSHCP boundaries were examined in order to assess the most environmentally friendly approach that would allow for implementation of optimum landscape conservation practices as well as achieve the necessary flexibility for the NiSource business plan. In the process of deciding to utilize a one-mile-wide corridor, NiSource considered and evaluated the alternatives described below. While two of these covered lands alternatives would result in a smaller footprint of covered lands with less take and fewer species impacts than the MSHCP, they would address fewer of NiSource's annual operation, maintenance, and construction projects. Moreover, even though the alternatives would result in less take and fewer impacts to take species, NiSource still would need to perform the projects and activities necessary to protect the integrity of its pipeline system that historically occur outside these smaller footprints. Consequently, NiSource would be required to seek take authorization from the Service through Section 7 and Section 10 processes prior to engaging in its projects.

11.3.1 Existing Rights-of-Way and Fee-Title Properties Alternative

In this alternative, the MSHCP's covered lands would include only existing rights-of-way (typically 50 feet wide centered on the existing facility), and NiSource's current fee-title properties. Defining the covered lands in this manner would encompass approximately 75% or 300 of NiSource's 400 or so annual operation, maintenance, and construction projects, compared to the 95% or 380 of NiSource's annual projects that would be covered by the MSHCP. Under this alternative, NiSource would request take authorization for approximately 80 fewer annual projects than NiSource engages in on an annual basis, and the covered lands would be approximately 88,765 acres. Thus, the take and impacts to the species associated with this alternative would likely be less than the one-mile-wide corridor proposed in the MSHCP.

While such an alternative might result in less take of and impact to the take species, there are a number of reasons this alternative was not selected. First, as noted above, approximately 25% of NiSource's annual projects (about 100 projects) would not be covered by this alternative. Because these projects, which include additional workspace, additional ROW disturbance, and spoil placement outside the covered lands area, are vital to the operation of NiSource's pipelines, NiSource still would be required to engage in the necessary regulatory processes to receive additional ESA permitting and authorization to perform these projects. Thus, this alternative would not significantly alleviate the substantial administrative burden, time, and costs to NiSource and the Service as almost 100 projects per year would likely require additional ESA-related consultation and/or permitting prior to any construction or maintenance activity. Moreover, when taken together, this alternative and the additional regulatory processes that would occur over time, on a project-by-project basis, would not significantly reduce the take of species or impacts when compared to the MSHCP.

Limiting the covered lands to the existing ROWs also would not always afford necessary areas for spoil stockpile or additional work spaces required for safe and efficient repairs or installation. This alternative would not permit NiSource to utilize any areas adjacent to the ROWs even when the use of such areas would avoid, and thus protect, undisturbed or sensitive environmental and/or archaeological areas within the existing ROWs. In addition, restricting construction activities to the existing ROWs would not provide the space required to safely install new facilities. Under the MSHCP's holistic, landscape approach with comprehensive mitigation, NiSource would be able to achieve and provide more benefits to take species while reducing the significant administrative burden, time, and costs that would result from this alternative. For these reasons, NiSource rejected this alternative.

11.3.2 300-Foot-Wide Corridor Alternative

Under this alternative, the covered lands would extend approximately 150 feet on each side of the centerline of a NiSource pipeline ROW, for a total covered-lands corridor width of approximately 300 feet equivalent to approximately 443,041 acres. This footprint would cover approximately 88% of NiSource's annual projects, i.e., 352 out of 400. The remaining 48 projects per year would require additional workspace or rerouting that would occur outside the 300-foot-wide corridor. The take associated with this alternative would likely be less than the one-mile-wide corridor approach proposed in the MSHCP given that NiSource would request take authorization for approximately 48 fewer projects annually.

A 300-foot-wide total coverage area would afford benefits similar to those of the one-mile-wide corridor because it would encompass more of NiSource's annual projects than the previous alternative. It also would allow NiSource to use some areas outside its existing ROWs to avoid sensitive environmental and/or archaeological areas that are located within the existing ROWs. The remaining 48 or so annual projects that would fall outside the corridor would include, among other projects, miscellaneous facility rearrangements (e.g., relocation of facilities to respond to encroachment by highway, dam, or residential construction, changes in the course of waterbodies, or natural forces that have created a safety concern). These rearrangements would require a separate ROW outside the 300-foot-wide corridor that would disturb an area from 75 to 125 feet wide, depending on circumstances (e.g., severity of slope; soil types; karsts issues; agricultural areas with soil segregation requirements; presence of wetlands; or other terrain difficulties, geographic location, and sensitive areas).

Because the rearrangements are more substantial in terms of environmental and species effects than some of NiSource's other annual projects, the associated administrative burden of individual ESA Section 7 and/or Section 10 compliance for them would be greater and more time-consuming than other projects. This alternative and its non-inclusion of the 48 annual projects, many of which are rearrangements, would not reduce NiSource and the Service's annual administrative burden to the same extent as would the MSHCP's one-mile-wide corridor, which would cover rearrangements. In addition, the 300-foot-wide corridor would not provide NiSource as much opportunity to avoid sensitive resources when siting projects as would occur under the MSHCP. Finally, like the No-Action Alternative and the previous alternative, the 300-foot-wide corridor alternative would not provide the holistic,

landscape-level approach to species conservation proposed in the MSHCP because more of NiSource's annual projects would be handled on a project-by-project, piecemeal basis. Due to these considerations, NiSource rejected this alternative.

11.3.3 Corridor Greater Than One Mile Alternative

NiSource considered a covered area greater than the proposed one-mile corridor to cover all of its annual operation, maintenance, and construction projects. This alternative, which would have encompassed all of NiSource's 400 or so annual projects, would have resulted in a greater level of take and impacts than the proposed MSHCP. Because NiSource could not reasonably foresee how much additional space would be required to accommodate all of its future activities (e.g., large capital projects to new service areas), it found this alternative unreasonable and speculative. In addition, the sheer magnitude of expanding the covered area further would greatly diminish NiSource and the Service's ability to reasonably analyze and evaluate take of and impacts to listed species as well as the impacts such alternative would have on the human and physical environment. Moreover, in light of the uncertainties and inherent difficulties of such an alternative, it would have been unlikely that the Service would have issued an ITP on such an application. Thus, NiSource rejected this alternative as well as any alternative that would have involved a covered-lands corridor wider than the proposed one mile.

11.4 All AMMs Alternative

Because NiSource has designed the MSHCP to avoid and minimize impacts to, and thus proposed take of, the take species to the maximum extent practicable, the opportunities for reducing take further, aside from reconfiguring the covered lands, are limited. However, one alternative that would reduce the amount of take anticipated in the MSHCP is implementation of each of the AMMs.

Under the MSHCP, and as further described in Chapter 6, NiSource has committed to implementing numerous AMMs whenever they are applicable (mandatory AMMs) and an additional limited number of AMMs (non-mandatory AMMs) based on the requirements of the covered activity, which include consideration of customer and business needs, practicality, and effectiveness. Under this alternative, NiSource would be required to implement all AMMs identified in Chapter 6, whenever applicable, regardless of these considerations.

This all-mandatory-AMMs alternative was rejected because mandatory implementation of every AMM, where applicable, would not be practicable. As described in detail in Section 5.2.1, there are a variety of reasons that would prohibit or make it impractical for NiSource to implement the non-mandatory AMMs. For example, in some circumstances, required implementation of certain non-mandatory AMMs for all applicable covered activities would be impractical, such as those AMMs that require intensive surveys. For other non-mandatory AMMs, required implementation would not be feasible due to technology constraints, such as the practical limits of horizontal directional drilling under waterbodies. Other non-mandatory AMMs, such as construction-timing windows or in-place abandonment of pipe to avoid stream disturbance, cannot be implemented whenever applicable because

they are, at times, inconsistent with NiSource's business constraints and other regulatory requirements, such as those imposed by FERC or PHMSA. Furthermore, certain AMMs may be physically impossible to implement in certain circumstances, such as use of a lay barge or temporary work bridge for in-stream repair work. For these reasons, NiSource rejected this alternative.

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