

FINAL

ENVIRONMENTAL IMPACT STATEMENT (EIS)

Book ONE

EXCESS SPOIL MINIMIZATION STREAM BUFFER ZONES

Proposed Revisions to the Permanent Program Regulations Implementing the Surface Mining Control and Reclamation Act of 1977 Concerning the Creation and Disposal of Excess Spoil and Coal Mine Waste and Stream Buffer Zones

OSM-EIS-34
September 2008



Prepared by:
US Department of the Interior
Office of Surface Mining Reclamation & Enforcement

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Final Environmental Impact Statement
Excess Spoil Minimization – Stream Buffer Zones

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Prepared by the

U.S. Department of the Interior

Office of Surface Mining Reclamation and Enforcement

September 2008


Brent Wahlquist, Director

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COVER SHEET

ACTION:

The Office of Surface Mining Reclamation and Enforcement is considering revising the Federal regulations implementing the Surface Mining Control and Reclamation Act of 1977 (SMCRA or the Act), 30 U.S.C. 1201-1328, that pertain to stream buffer zones, excess spoil generation and disposal, and coal mine waste disposal.

TYPE OF STATEMENT:

Environmental impact statement: OSM-EIS-34.

LEAD AGENCY:

The Office of Surface Mining Reclamation and Enforcement (OSM), U.S. Department of the Interior

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ABSTRACT:

OSM is considering revising the Federal regulations implementing the SMCRA that pertain to stream buffer zones, excess spoil generation and disposal, and coal mine waste disposal. Alternatives for those revisions, including not revising the regulations, are analyzed in this environmental impact statement (EIS).

Both the initial and permanent regulatory programs under SMCRA have always included a regulation that incorporated the concept of a 100-foot buffer zone around intermittent and perennial streams. That regulation, which is known as the stream buffer zone rule, went through three iterations between 1977 and 1983. The last of those iterations was intended in part to make it easier to determine when and to which streams the rule applied.

There is considerable controversy over the proper interpretation of OSM's existing rules concerning the stream buffer zone at 30 CFR 816.57 and 817.57. Some interpretations appear to be at odds with the underlying provisions of SMCRA. Because of these conflicting interpretations, there is a need to clarify what buffer zone requirements apply to surface coal mining and reclamation operations under SMCRA. Therefore, one purpose of this Federal action is to eliminate the uncertainty as to the requirements for a stream buffer zone, consistent with underlying statutory authority.

There is also a related controversy over the environmental impacts of fills, refuse piles, slurry impoundments, and other structures associated with the disposal of excess spoil and coal mine waste, largely because these structures may involve the filling of substantial portions of headwater stream

valleys, especially in central Appalachia. This controversy has highlighted the need to ensure that the adverse impacts of the disposal of excess spoil and coal mine waste on fish, wildlife, and related environmental values are effectively minimized. Thus, another purpose of this Federal action is to ensure that excess spoil fills, refuse piles, and slurry impoundments are designed, located, and constructed to prevent additional contributions of suspended solids to stream flow or runoff outside the permit area, and to minimize disturbances and adverse impacts on fish, wildlife, and related environmental values, as required by SMCRA.

OSM's evaluation of these concerns also identified a similar need with respect to coal mine waste disposal facilities (refuse piles and impoundments). Therefore, yet another purpose of this Federal action is to develop similar measures to ensure that coal mine waste disposal facilities and impoundments are located, designed, and constructed to meet the requirements of SMCRA for preventing additional contributions of suspended solids to stream flow or runoff outside the permit area and minimizing disturbances and adverse impacts on fish, wildlife, and related environmental values.

After briefly considering a range of seventeen alternatives, including an alternative of not making changes to the applicable regulations or policies (i.e., the "no action alternative"), OSM focused this environmental analysis on four reasonable alternatives plus the "no action" alternative in this final EIS. The four alternatives that the final EIS examines in detail are described below

Alternative 1 is OSM's preferred alternative and is the most environmentally protective alternative.

Excess spoil

This alternative would revise 30 CFR 780.35 and 784.19 to require that a permit application in which the applicant proposes to generate excess spoil include a demonstration, to the satisfaction of the regulatory authority, that the operation is designed to minimize, to the extent possible, the volume of excess spoil that the operation will generate, thus ensuring that spoil is returned to the mined-out area to the extent possible, taking into consideration applicable regulations concerning restoration of the approximate original contour, safety, stability, and environmental protection and the needs of the proposed postmining land use. The revised regulations would also require a demonstration, prepared to the satisfaction of the regulatory authority that the designed maximum cumulative volume of all proposed excess spoil fills within the permit area is no larger than the capacity needed to accommodate the anticipated cumulative volume of excess spoil that the operation will generate, as approved by the regulatory authority.

The revised regulations also would provide that the applicant must design the operation to avoid placement of excess spoil in or within 100 feet of a perennial or intermittent stream to the extent possible. The purpose of this provision is to minimize adverse impacts on fish, wildlife, and related environmental values. If avoidance is not possible, the applicant would have to explain, to the satisfaction of the regulatory authority, why an alternative that does not involve placement of excess spoil in or within 100 feet of a perennial or intermittent stream is not reasonably possible. In addition, the applicant would have to identify a reasonable range of alternatives that vary with respect to the number, size, location, and configuration of proposed fills. The applicant would have to identify only those alternatives that are reasonably possible and that are likely to differ in terms of impacts on fish, wildlife, and related environmental values.

An alternative would be reasonably possible if it conforms to the safety, engineering, design, and construction requirements of the regulatory program and is capable of being done after consideration of cost, logistics, and available technology. The fact that one alternative may cost somewhat more than a different alternative would not necessarily warrant exclusion of the more costly alternative from consideration. However, an alternative generally could be considered unreasonable if its cost was substantially greater than the costs normally associated with this type of project. In addition, to be considered reasonable, a potential alternative would have to be consistent with the coal recovery provisions of 30 CFR 816.59 and 817.59, which provide that mining activities must be conducted so as to

maximize the utilization and conservation of the coal, while utilizing the best appropriate technology currently available to maintain environmental integrity, so that reffecting the land in the future through surface coal mining operations is minimized.

The applicant would have to analyze the impacts of each of the identified alternatives on fish, wildlife, and related environmental values, taking into consideration both terrestrial and aquatic ecosystems. For every alternative that would involve placement of excess spoil in a perennial or intermittent stream, the analysis is required to include an evaluation of impacts on the physical, chemical, and biological characteristics of the stream downstream of the proposed fill, including seasonal variations in temperature and volume, changes in stream turbidity or sedimentation, the degree to which the excess spoil may introduce or increase contaminants, and the effects on aquatic organisms, and the effects on wildlife that is dependent upon the stream. If the applicant prepared an analysis of alternatives for the proposed fill under 40 CFR 230.10 to meet Clean Water Act requirements, the applicant could initially submit a copy of that analysis with the application in lieu of complying with the analytical requirements detailed in the preceding sentence. The regulatory authority would determine whether and to what extent the analysis prepared for Clean Water Act purposes satisfies the analytical requirements under this alternative.

The applicant would be required to select the alternative with the least overall adverse environmental impact on fish, wildlife, and related environmental values, including adverse impacts on water quality and aquatic ecosystems.

Finally, under the preferred alternative, we would revise the performance standards concerning excess spoil at 30 CFR 816.71 and 817.71 by adding a requirement that the permittee construct the fill in accordance with the design and plans approved in the permit. We also would add a provision requiring the permittee to place excess spoil in a location and manner that would minimize disturbances and adverse impacts on fish, wildlife, and related environmental values to the extent possible, using the best technology currently available.

Coal mine waste

This alternative would revise coal waste disposal regulations in a similar fashion. The permitting regulations at 30 CFR 780.25 and 784.16 would be revised to provide that the applicant must design the operation to avoid placement of coal mine waste in or within 100 feet of perennial or intermittent streams to the extent possible. If avoidance is not reasonably possible, the applicant would have to identify a reasonable range of alternative locations or configurations for any proposed refuse piles or coal mine waste impoundments. The applicant would have to identify only alternatives that are reasonably possible and that are likely to differ in terms of impacts on fish, wildlife, and related environmental values.

An alternative is reasonably possible if it conforms to the safety, engineering, design, and construction requirements of the regulatory program and is capable of being done after consideration of cost, logistics, and available technology. The fact that one alternative may cost somewhat more than a different alternative would not necessarily warrant exclusion of the more costly alternative from consideration. However, an alternative generally could be considered unreasonable if its cost is substantially greater than the costs normally associated with this type of project. In addition, to be considered reasonable, a potential alternative would have to be consistent with the coal recovery provisions of 30 CFR 816.59 and 817.59, which provide that mining activities must be conducted so as to maximize the utilization and conservation of the coal, while utilizing the best appropriate technology currently available to maintain environmental integrity, so that reffecting the land in the future through surface coal mining operations is minimized.

The applicant would have to analyze the impacts of each of the identified alternatives on fish, wildlife, and related environmental values, taking into consideration both terrestrial and aquatic ecosystems. For every alternative that would involve placement of coal mine waste in a perennial or intermittent stream, the analysis would be required to include an evaluation of the impacts on the physical, chemical, and

biological characteristics of the stream downstream of the proposed refuse pile or slurry impoundment, including seasonal variations in temperature and volume, changes in stream turbidity or sedimentation, the degree to which the coal mine waste may introduce or increase contaminants, and the effects on aquatic organisms and the wildlife that is dependent upon the stream. If the applicant prepared an analysis of alternatives for the proposed refuse pile or slurry impoundment under 40 CFR 230.10 to meet Clean Water Act requirements the applicant could initially submit a copy of that analysis with the application in lieu of complying with the analytical requirements detailed in the preceding sentence. The regulatory authority would then determine whether and to what extent the analysis prepared for Clean Water Act purposes satisfies the analytical requirements under this alternative.

The applicant would be required to select the alternative with the least overall impact on fish, wildlife, and related environmental values, including adverse impacts on water quality and aquatic and terrestrial ecosystems.

Stream buffer zones

This alternative would add new regulations at 30 CFR 780.28 and 784.28 to establish permit application requirements and regulatory authority review responsibilities if mining or related regulated activities are proposed in or within 100 feet adjacent to a perennial or intermittent stream. The new requirements, which would reflect the SMCRA provisions upon which the stream buffer zone rule is based, would replace the findings that the regulatory authority must make under existing 30 CFR 816.57(a)(1) and 817.57(a)(1) before authorizing activities within 100 feet of a perennial or intermittent stream. This alternative would remove requirements in the existing rule for findings related to several Clean Water Act provisions.

When an applicant proposes to conduct activities in the stream itself, the preferred alternative would require that the applicant demonstrate that avoiding disturbance of the stream is not reasonably possible. The applicant also would have to demonstrate that the activities will comply with all applicable regulations concerning use of the best technology currently available to prevent contributions of additional suspended solids to streamflow or runoff outside the permit area to the extent possible and to minimize disturbances and adverse impacts on fish, wildlife, and related environmental values to the extent possible. Before approving the proposed activities in the stream, the regulatory authority would have to prepare written findings concurring with those demonstrations.

When an applicant proposes to conduct activities within the buffer zone but not within the stream itself, the preferred alternative would require that the applicant demonstrate that avoiding disturbance of the stream buffer zone either is not reasonably possible or is not necessary to meet the hydrologic balance and fish and wildlife protection requirements of the regulatory program. The applicant also would have to identify any lesser buffer zone that he or she proposed to maintain and explain how the lesser buffer zone, together with any other protective measures proposed, constitute the best technology currently available to prevent contributions of additional suspended solids to streamflow or runoff outside the permit area to the extent possible and to minimize disturbances and adverse impacts on fish, wildlife, and related environmental values to the extent possible. Before approving the applicant's proposed activities in the stream buffer zone, the regulatory authority would have to prepare written findings concurring with the demonstration and explanation in the application.

In all cases, the new rules would require that the applicant identify the authorizations and certifications that will be needed under the Clean Water Act and its implementing regulations. The preferred alternative would clarify that, while the SMCRA permit may be issued in advance of any necessary Clean Water Act authorization, issuance of a SMCRA permit does not allow the permittee to initiate any activities for which Clean Water Act authorization or certification is needed.

Under the preferred alternative, we would revise the stream buffer zone performance standards at 30 CFR 816.57 and 817.57 to provide that the requirement to maintain an undisturbed buffer around a perennial or intermittent stream does not apply to those stream segments for which the regulatory authority approves

one or more of the following activities:

- Diversion of a perennial or intermittent streams;
- Placement of bridge abutments, culverts, or other structures in or within 100 feet of a perennial or intermittent stream to facilitate crossing of the stream by roads, railroads, conveyors, pipelines, utilities, or similar facilities;
- Construction of sedimentation pond embankments in a perennial or intermittent stream, including the pool or storage area created by the embankment; and
- Construction of excess spoil fills and coal mine waste disposal facilities in a perennial or intermittent stream.

Each of these activities remains subject to all other existing performance standards including standards that regulate the environmental impacts of the activities. Thus, for example, all surface activities conducted in or within 100 feet of a perennial or intermittent stream are required to comply with SMCRA sections 515(b)(10)(B)(i) and 515(b)(24) and various regulations implementing those statutory provisions.

Alternative 2 – This alternative would change the excess spoil regulations to minimize the volume of excess spoil and the adverse effects of excess spoil fill construction. In addition, it would change the stream buffer zone regulations at 30 CFR 816.57 and 817.57 as described in the January 7, 2004, Federal Register notice of the previous proposed stream buffer zone rule (see 69 FR 1036).

Under this alternative, the revised stream buffer zone regulations would retain the prohibition on disturbance of land within 100 feet of a perennial or intermittent stream for surface coal mining operations but allow the regulatory authority to grant a variance to this requirement if the regulatory authority finds in writing that the activities would, to the extent possible, use the best technology currently available to:

- 1) Prevent additional contributions of suspended solids to the section of stream within 100 feet downstream of the mining activities, and outside the area affected by mining activities; and
- 2) Minimize disturbances and adverse impacts on fish, wildlife, and other related environmental values of the stream.

Essentially, Alternative 2 differs from Alternative 1 in the following respects: Under Alternative 2, an alternatives analysis would be required in every case in which an operation would generate excess spoil, not just for those operations that propose to place excess spoil in or within 100 feet of a perennial or intermittent stream. In addition, Alternative 2 would not amend the coal mine waste disposal rules. With respect to the stream buffer zone rule, Alternative 2, unlike Alternative 1, would not establish separate permitting requirements for proposed activities in or within 100 feet of a perennial or intermittent stream. Unlike Alternative 1, Alternative 2 provides no exception from the requirement to either avoid the buffer zone or obtain a variance from the regulatory authority. The findings required for a variance also differ. Most significantly, under Alternative 2, applicants would not need to demonstrate—and the regulatory authority would not need to find—that it is not reasonably possible to avoid disturbing the stream or its buffer zone.

Alternative 3 – This alternative would revise the excess spoil generation regulations as discussed above in alternative 1. No changes would be made to the stream buffer zone rule under this alternative.

Alternative 4 – This alternative would revise the stream buffer zone regulation as described in alternative 1. OSM would not change the regulations applicable to excess spoil regulations.

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Summary

The Office of Surface Mining Reclamation and Enforcement (OSM) is considering revising the Federal regulations implementing the Surface Mining Control and Reclamation Act of 1977 (SMCRA or the Act), 30 U.S.C. 1201-1328, that pertain to stream buffer zones, excess spoil generation and disposal, and coal mine waste disposal. Alternatives for those revisions, including not revising the regulations, are analyzed in this environmental impact statement (EIS).

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There is also a related controversy over the environmental impacts of fills and other structures associated with the disposal of excess spoil from surface coal mining operations, largely because the construction of excess spoil fills may involve the filling of substantial portions of headwater stream valleys, especially in central Appalachia. This controversy has highlighted the need to ensure that the adverse impacts of excess spoil disposal on fish, wildlife, and related environmental values are effectively minimized. Thus, another purpose of this Federal action is to ensure that excess spoil fills are designed, located, and constructed to meet the requirements of SMCRA for preventing contributions of suspended solids to streamflow or runoff outside the permit area and minimizing disturbances and adverse impacts on fish, wildlife, and related environmental values.

OSM's evaluation of these concerns also identified a similar need with respect to coal mine waste disposal facilities (refuse piles and impoundments). Therefore, yet another purpose of this Federal action is to develop similar measures to ensure that coal mine waste disposal facilities and impoundments are located, designed, and constructed to meet the requirements of SMCRA for preventing additional contributions of suspended solids to streamflow or runoff outside the permit area and minimizing disturbances and adverse impacts on fish, wildlife, and related environmental values.

Beginning in the spring of 2003, OSM initiated extensive outreach on the concept of revising our regulations to address concerns regarding excess spoil generation, fill construction, and confusion regarding the stream buffer zone regulatory requirements. OSM published a proposed "excess spoil / stream buffer zone" rule in the Federal Register on January 7, 2004. 69 FR 1036. In the same notice, OSM also announced the availability of a draft environmental assessment for the proposed rule, which was prepared in accordance with NEPA to examine the environmental effects of the rule and other alternatives. OSM concluded preliminarily that the changes it was proposing would have no significant impacts on the human environment and that a finding of no significant impact (FONSI) would likely be prepared upon finalizing of the environmental assessment.

After consideration of the many comments received on the draft environmental assessment, OSM concluded that further analysis of the effects on the human environment was warranted. On June

16, 2005, OSM announced in the Federal Register (70 FR 35112) that the agency would prepare an environmental impact statement (EIS) to analyze the effects of the rulemaking initiative, and asked for the public's suggestions on the issues and alternatives to be examined.

Public participation was actively sought in the development of this EIS. The Notice of Intent for the EIS was published in the Federal Register dated June 16, 2005 (70 FR 25112) and posted on OSM's website. OSM invited comments and suggestions on the scope of the analysis, including the important issues and additional reasonable alternatives to this rulemaking that should be addressed in the EIS. OSM received approximately 160 comments in writing.

OSM also afforded the opportunity to the public to meet and discuss the preparation of the EIS. In response to eighteen requests, four public "scoping" meetings were held: Knoxville, Tennessee on August 22, 2005; Hazard, Kentucky on August 23, 2005; Charleston, West Virginia on August 24, 2005; and Pittsburgh, Pennsylvania on August 25, 2005. In all, approximately 150 people attended the four meetings and provided oral comments and suggestions for issues and additional alternatives.

On August 24, 2007, OSM announced in the Federal Register the availability of the proposed excess spoil minimization-stream buffer zone rule and its associated draft EIS. Approximately 400 hardcopies and compact discs were mailed directly to government, libraries, special interest groups, and interested citizens. In addition, the draft EIS was made available over the internet. Over 43,000 comments were received on the proposed rule and approximately 2,000 written comments were received on the draft EIS during the 88-day comment period. Additionally, on October 24, 2007, four public hearings were held in the following locations: Knoxville, Tennessee; Hazard, Kentucky; Charleston, West Virginia; and Washington, Pennsylvania. We also held public meetings in Big Stone Gap, Virginia on October 24, 2007, and Alton, Illinois on November 1, 2007. Approximately 750 people attended the hearings and meetings and 212 of the attendees provided testimony.

After briefly considering a range of seventeen alternatives, including an alternative of not making changes to the applicable regulations or policies (i.e, the "no action alternative"), OSM focused this environmental analysis on four reasonable alternatives plus the "no action" alternative in this final EIS. The four alternatives that are examined in detail are described below

Alternative 1 is OSM's preferred alternative and is the most environmentally protective alternative.

Excess spoil

This alternative would revise 30 CFR 780.35 and 784.19 to require that a permit application in which the applicant proposes to generate excess spoil include a demonstration, to the satisfaction of the regulatory authority, that the operation is designed to minimize, to the extent possible, the volume of excess spoil that the operation will generate, thus ensuring that spoil is returned to the mined-out area to the extent possible, taking into consideration applicable regulations concerning restoration of the approximate original contour, safety, stability, and environmental protection and the needs of the proposed postmining land use. The revised regulations would also require a demonstration, prepared to the satisfaction of the regulatory authority, that the designed maximum cumulative volume of all proposed excess spoil fills within the permit area is no larger than the capacity needed to accommodate the anticipated cumulative volume of excess spoil that the operation will generate, as approved by the regulatory authority.

The revised regulations also would provide that the applicant must design the operation to avoid placement of excess spoil in or within 100 feet of a perennial or intermittent stream to the extent possible. The purpose of this provision is to minimize adverse impacts on fish, wildlife, and related environmental values. If avoidance is not possible, the applicant would have to explain, to the satisfaction of the regulatory authority, why an alternative that does not involve placement of

excess spoil in or within 100 feet of a perennial or intermittent stream is not reasonably possible. In addition, the applicant would have to identify a reasonable range of alternatives that vary with respect to the number, size, location, and configuration of proposed fills. The applicant would have to identify only those alternatives that are reasonably possible and that are likely to differ in terms of impacts on fish, wildlife, and related environmental values.

An alternative would be reasonably possible if it conformed to the safety, engineering, design, and construction requirements of the regulatory program and is capable of being done after consideration of cost, logistics, and available technology. The fact that one alternative may cost somewhat more than a different alternative would not necessarily warrant exclusion of the more costly alternative from consideration. However, an alternative generally could be considered unreasonable if its cost was substantially greater than the costs normally associated with this type of project. In addition, to be considered reasonable, a potential alternative would have to be consistent with the coal recovery provisions of 30 CFR 816.59 and 817.59, which provide that mining activities must be conducted so as to maximize the utilization and conservation of the coal, while utilizing the best appropriate technology currently available to maintain environmental integrity, so that re-affecting the land in the future through surface coal mining operations is minimized.

The applicant would have to analyze the impacts of each of the identified alternatives on fish, wildlife, and related environmental values, taking into consideration both terrestrial and aquatic ecosystems. For every alternative that would involve placement of excess spoil in a perennial or intermittent stream, the analysis is required to include an evaluation of impacts on the physical, chemical, and biological characteristics of the stream downstream of the proposed fill, including seasonal variations in temperature and volume, changes in stream turbidity or sedimentation, the degree to which the excess spoil may introduce or increase contaminants, and the effects on aquatic organisms and the wildlife that is dependent upon the stream. If the applicant prepared an analysis of alternatives for the proposed fill under 40 CFR 230.10 to meet Clean Water Act requirements, the applicant could initially submit a copy of that analysis with the application in lieu of complying with the analytical requirements detailed in the preceding sentence. The regulatory authority would determine whether and to what extent the analysis prepared for Clean Water Act purposes satisfies the analytical requirements under this alternative.

The applicant would be required to select the alternative with the least overall adverse impact on fish, wildlife, and related environmental values, including adverse impacts on water quality and aquatic ecosystems.

Finally, under the preferred alternative, we would revise the performance standards concerning excess spoil at 30 CFR 816.71 and 817.71 by adding a requirement that the permittee construct the fill in accordance with the design and plans approved in the permit. We also would add a provision requiring the permittee to place excess spoil in a location and manner that would minimize disturbances and adverse impacts on fish, wildlife, and related environmental values to the extent possible, using the best technology currently available.

Coal mine waste

This alternative would revise our coal mine waste disposal regulations in a fashion similar to what we are proposing for excess spoil disposal. The permitting regulations at 30 CFR 780.25 and 784.16 would be revised to provide that the applicant must design the operation to avoid placement of coal mine waste in or within 100 feet of perennial or intermittent stream to the extent possible. If avoidance is not reasonably possible, the applicant would have to identify a reasonable range of alternative locations or configurations for any proposed refuse piles or coal mine waste impoundments. The applicant would have to identify only alternatives that are reasonably possible and that are likely to differ in terms of impacts on fish, wildlife, and related environmental values. The fact that one alternative may cost somewhat more than a different alternative would not necessarily warrant exclusion of the more costly alternative from

consideration. However, an alternative generally could be considered unreasonable if its cost is substantially greater than the costs normally associated with this type of project. In addition, to be considered reasonable, a potential alternative would have to be consistent with the coal recovery provisions of 30 CFR 816.59 and 817.59, which provide that mining activities must be conducted so as to maximize the utilization and conservation of the coal, while utilizing the best appropriate technology currently available to maintain environmental integrity, so that re-affecting the land in the future through surface coal mining operations is minimized.

The applicant would have to analyze the impacts of each of the identified alternatives on fish, wildlife, and related environmental values, taking into consideration both terrestrial and aquatic ecosystems. For every alternative that would involve placement of coal mine waste in a perennial or intermittent stream, the analysis would be required to include an evaluation of the impacts on the physical, chemical, and biological characteristics of the stream downstream of the proposed refuse pile or slurry impoundment, including seasonal variations in temperature and volume, changes in stream turbidity or sedimentation, the degree to which the coal mine waste may introduce or increase contaminants, and the effects on aquatic organisms and the wildlife that is dependent upon the stream. If the applicant prepared an analysis of alternatives for the proposed refuse pile or slurry impoundment under 40 CFR 230.10 to meet Clean Water Act requirements, the applicant could initially submit a copy of that analysis with the application in lieu of complying with the analytical requirements detailed in the preceding sentence. The regulatory authority would then determine whether and to what extent the analysis prepared for Clean Water Act purposes satisfies the analytical requirements under this alternative.

The applicant would be required to select the alternative with the least overall adverse impact on fish, wildlife, and related environmental values, including adverse impacts on water quality and aquatic and terrestrial ecosystems.

Stream buffer zones

This alternative would add new regulations at 30 CFR 780.28 and 784.28 to establish permit application requirements and regulatory authority review responsibilities if mining or related regulated activities are proposed in or within 100 feet of a perennial or intermittent stream. The new requirements, which would reflect the SMCRA provisions upon which the stream buffer zone rule is based, would replace the findings that the regulatory authority must make under existing 30 CFR 816.57(a)(1) and 817.57(a)(1) before authorizing activities within 100 feet of a perennial or intermittent stream. The findings in the existing rule include several Clean Water Act-related provisions that would be removed under this alternative.

When an applicant proposes to conduct activities in the stream itself, the preferred alternative would require that the applicant demonstrate that avoiding disturbance of the stream is not reasonably possible. The applicant also would have to demonstrate that the activities will comply with all applicable regulations concerning use of the best technology currently available to prevent contributions of additional suspended solids to streamflow or runoff outside the permit area to the extent possible and to minimize disturbances and adverse impacts on fish, wildlife, and related environmental values to the extent possible. Before approving the proposed activities in the stream, the regulatory authority would have to prepare written findings concurring with those demonstrations.

When an applicant proposes to conduct activities within the buffer zone but not within the stream itself, the preferred alternative would require that the applicant demonstrate that avoiding disturbance of the stream buffer zone either is not reasonably possible or is not necessary to meet the hydrologic balance and fish and wildlife protection requirements of the regulatory program. The applicant also would have to identify any lesser buffer zone that he or she proposes to maintain and explain how the lesser buffer zone, together with any other protective measures proposed, constitute the best technology currently available to prevent contributions of additional suspended solids to streamflow or runoff outside the permit area to the extent possible.

and to minimize disturbances and adverse impacts on fish, wildlife, and related environmental values to the extent possible. Before approving the applicant's proposed activities in the stream buffer zone, the regulatory authority would have to prepare written findings concurring with the demonstration and explanation in the application.

In all cases, the new rules would require that the applicant identify the authorizations and certifications that will be needed under the Clean Water Act and its implementing regulations. The preferred alternative would clarify that, while the SMCRA permit may be issued in advance of any necessary Clean Water Act authorization, issuance of a SMCRA permit does not allow the permittee to initiate any activities for which Clean Water Act authorization or certification is needed.

Under the preferred alternative, we also would revise the stream buffer zone performance standards at 30 CFR 816.57 and 817.57 to provide that the requirement to maintain an undisturbed buffer around a perennial or intermittent stream does not apply to those stream segments for which the regulatory authority approves one or more of the following activities:

- Diversion of a perennial or intermittent stream;
- Placement of bridge abutments, culverts, or other structures in or within 100 feet of a perennial or intermittent stream to facilitate crossing of the stream by roads, railroads, conveyors, pipelines, utilities, or similar facilities;
- Construction of sedimentation pond embankments in a perennial or intermittent stream, including the pool or storage area created by the embankment; and
- Construction of excess spoil fills and coal mine waste disposal facilities in a perennial or intermittent stream.

Each of these activities remains subject to all other existing performance standards, including standards that regulate the environmental impacts of the activities. Thus, for example, all surface activities conducted in or within 100 feet of a perennial or intermittent stream are required to comply with SMCRA sections 515(b)(10)(B)(i) and 515(b)(24) and various regulations implementing those statutory provisions.

Alternative 2 – This alternative would change the excess spoil regulations to minimize the volume of excess spoil and the adverse effects of excess spoil fill construction. In addition, it would change the stream buffer zone regulations at 30 CFR 816.57 and 817.57 as described in the January 7, 2004 Federal Register notice of the previous proposed stream buffer zone rule (see 69 FR 1036).

Under this alternative, the revised stream buffer zone regulations would retain the prohibition on disturbance of the surface of lands within 100 feet of a perennial or intermittent stream, but would allow the regulatory authority to grant a variance to this prohibition if the regulatory authority finds in writing that the activities would, to the extent possible, use the best technology currently available to:

- 1) Prevent additional contributions of suspended solids to the section of stream within 100 feet downstream of the mining activities, and outside the area affected by mining activities; and
- 2) Minimize disturbances and adverse impacts on fish, wildlife, and other related environmental values of the stream.

Essentially, Alternative 2 differs from Alternative 1 in the following respects: Under Alternative 2, the changes to the excess spoil regulations would be generally analogous to the changes described in Alternative 1, with the exception that an alternatives analysis would be required in every case in which an operation generated excess spoil, not just for those operations that propose to place excess spoil in or within 100 feet of a perennial or intermittent stream. In

addition, Alternative 2 would not amend the coal mine waste disposal rules. With respect to the stream buffer zone rule, Alternative 2, unlike Alternative 1, would not establish separate permitting requirements for proposed activities in or within 100 feet of a perennial or intermittent stream. Unlike Alternative 1, Alternative 2 provides no exception from the requirement to either avoid the buffer zone or obtain a variance from the regulatory authority. The findings required for a variance also differ. Most significantly, under Alternative 2, applicants would not need to demonstrate—and the regulatory authority would not need to find—that it is not reasonably possible to avoid disturbing the stream or its buffer zone.

Alternative 3 – This alternative would revise the excess spoil generation regulations as discussed above in alternative 1. No changes would be made to the stream buffer zone rule under this alternative.

Alternative 4 – This alternative would revise the stream buffer zone regulation as described in alternative 1. OSM would not change the regulations applicable to excess spoil generation and placement.

Environmental consequences

Because this proposed Federal action potentially has national implications, the descriptions of environmental consequences are appropriately broad and generic. The information obtained in the course of preparing this EIS indicates that the proposed Federal action may have the most significant effects in the central Appalachian coal fields, particularly eastern Kentucky, southwestern Virginia, and southern West Virginia. The steep-slope terrain, ample rainfall, and abundant surface-minable reserves of high quality bituminous coal in these areas help explain why 98% of all excess spoil fills nationally and approximately 61 percent of the stream miles directly impacted by mining have occurred in these areas.

Alternatives 1, 2, and 3 revise the excess spoil regulations to enhance consideration of the environmental effects of fill construction by requiring that applicants minimize the volume of excess spoil generated, design and construct fills to reduce the size of the areas directly affected outside the mined-out area, and configure fills to minimize adverse impacts on fish, wildlife, and related environmental values. States in the central Appalachian coalfields— Kentucky, Virginia, Tennessee, and West Virginia—have taken various steps in accordance with approved programs to implement similar actions, so the impacts that might result from the Federal action, if implemented, are likely limited by the changes already made by those States.

Alternatives 1, 2, and 4 would revise the stream buffer zone regulation to make the requirements clear and consistent with the underlying statutory authority in SMCRA. OSM would not anticipate a major shift in on-the-ground consequences from any of the action alternatives. A considerable number of stream miles and considerable adjacent riparian land has been directly impacted by past surface mining. The estimated stream miles directly impacted by coal mining in the central Appalachian coal fields from 1992 to 2002 is 1,208 miles, which constitutes 2.05 percent of the total stream miles in the central Appalachian coal fields. If this rate continued for ten years, 4.1 % of the total stream miles in central Appalachia would be subject to direct impact (EPA 2003, p.IV.B-1). The miles of stream directly impacted by excess spoil fills for permits issued between 1985 and 2001 is 724 miles, which is approximately 1.2 percent of the streams in central Appalachia. If valley fill construction continued at this rate, an additional 724 miles of headwater streams would be buried in the next 17 years (by 2018). *Id.*, p. IV.B-2. This trend would continue into the future, but would likely shift regionally as surface-minable coal reserves in central Appalachia are depleted in the next few decades.

Alternative 1 is uniquely different from the other alternatives in that it incorporates changes to reduce the adverse environmental impacts of coal mine waste disposal facilities (refuse piles and impoundments). We anticipate that these changes would positively impact the environment. Coupled with the changes in excess spoil regulations, Alternative 1 would result in slight positive

effects on the human environment with respect to direct hydrologic impacts, water quality, and aquatic fauna when compared to the “no action” alternative. It is both the most environmentally protective alternative and the preferred alternative.

The table below compares the anticipated impacts of key indicators of the four possible alternatives with the “No Action” alternative.

Table S-1 – Summary comparison of the impacts of four alternatives with the impacts of the “No Action” alternative

Impacts	Relative Effects of Four Alternatives as Compared to the Effects of the No Action Alternative [†]			
	Alternative 1 (Preferred)	Alternative 2	Alternative 3	Alternative 4
1. Hydrology				
a. Direct impacts	Slight +	Negligible +	Negligible +	No change
b. Water quality	Slight +	Negligible +	Negligible +	No change
c. Flooding	Minor to no change + or -	Minor to no change + or -	Minor to no change + or -	No change
2. Aquatic fauna				
a. Direct impacts	Slight +	Negligible +	Negligible +	No change
b. Indirect impacts	Slight +	Negligible +	Negligible +	No change
3. Terrestrial fauna	Slight +	Negligible +	Negligible +	No change
4. T & E Species	No change	No change	No change	No change
5. Geotechnical	No change	No change	No change	No change
6. Economics	Slight -	Negligible -	Slight -	No change
7. Culture	No change	No change	No change	No change
8. Environ. justice	Negligible +	Negligible +	Negligible +	No change
9. Cumulative	Negligible +	Negligible +	Negligible +	No change

[†] Positive environmental changes indicated by a “+” sign and negative environmental changes indicated by a “-“ sign.

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I. Introduction

A. Proposed Federal Action

The Office of Surface Mining Reclamation and Enforcement (OSM) is considering revising the Federal regulations implementing the Surface Mining Control and Reclamation Act of 1977 (SMCRA or the Act), 30 U.S.C. 1201-1328, that pertain to stream buffer zones, excess spoil generation and disposal, and coal mine waste disposal. Alternatives for those revisions, including not revising the regulations, are analyzed in this environmental impact statement (EIS).

B. Purpose and Need

Both the initial and permanent regulatory programs under SMCRA have always included a regulation that incorporated the concept of a 100-foot buffer zone around intermittent and perennial streams. That regulation, which is known as the stream buffer zone rule, went through three iterations between 1977 and 1983. The last of those iterations was intended in part to make it easier to determine when and to which streams the rule applied.

As discussed in the subsequent background section, there is considerable controversy over the proper interpretation of OSM's existing rules concerning the stream buffer zone at 30 CFR 816.57 and 817.57. Some interpretations appear to be at odds with the underlying provisions of SMCRA. Because of these conflicting interpretations, there is a need to clarify what buffer zone requirements apply to surface coal mining and reclamation operations under SMCRA. Therefore, one purpose of this Federal action is to eliminate the uncertainty as to the requirements for a stream buffer zone, consistent with underlying statutory authority.

For some years, there has also been a related controversy over the environmental impacts of fills and other structures associated with the disposal of excess spoil and coal mine waste, largely because the construction of excess spoil fills, refuse piles, and slurry impoundments may involve the filling of substantial portions of headwater stream valleys, especially in central Appalachia. See discussion in the background section, below. This controversy has highlighted the need to ensure that the adverse impacts of the disposal of excess spoil and coal mine waste on fish, wildlife, and related environmental values are effectively minimized. Thus, another purpose of this Federal action is to ensure that, to the extent possible using the best technology currently available, excess spoil fills, refuse piles, and slurry impoundments are designed, located, and constructed to meet the requirements of SMCRA for preventing additional contributions of suspended solids to streamflow or runoff outside the permit area and to minimize disturbances and adverse impacts on fish, wildlife, and related environmental values, as required by SMCRA.

C. Organization of this Document

The remaining sections of this chapter (Chapter 1) provide additional background on the need for the proposed Federal action, NEPA compliance and public outreach. In Chapter 2, the alternatives examined in detail are described along with additional alternatives considered but not carried forward for detailed analyses.

In Chapter 3, the general environmental setting of the five regions where the bulk of future coal mining is anticipated in the United States is described. Those five regions are: Northern Rocky Mountains and Great Plains, Appalachian Basin, Colorado Plateau, Illinois Basin, and Gulf Coast. In this chapter, the central Appalachian Basin is identified as the predominant location where

excess spoil is generated and causes headwater stream impacts. This chapter also discusses the most relevant issues raised during public scoping. The functions of riparian buffer zones and headwater streams are described.

In Chapter 4, the environmental consequences of each of the alternatives are discussed.

Chapter 5 contains the list of references cited.

Chapter 6 is a list of preparers of this EIS.

Chapter 7 sets out the distribution list of the EIS.

Chapter 8 contains a glossary of terms used throughout this final EIS.

Book 2 of this EIS contains three appendices: Appendix A--public hearing and meeting transcripts; Appendix B--comments letters and electronic messages; and Appendix C--OSM response to comments.

D. Background

SMCRA requirements

Section 201(c)(2) of SMCRA directs the Secretary to publish and promulgate such rules and regulations as may be necessary to carry out the purposes and provisions of SMCRA. Section 501(b) requires the Secretary to promulgate and publish in the Federal Register regulations covering a permanent regulatory procedure for surface coal mining and reclamation operations performance standards. Section 702(d) provides that the adoption of regulations under section 501(b) constitutes a major action within the meaning of section 102(2)(c) of the National Environmental Policy Act of 1969 (NEPA). SMCRA section 515(b)(10)(B)(i) requires, among other things, that surface coal mining operations be conducted so as to prevent, to the extent possible using the best technology currently available, additional contributions of suspended solids to streamflow or runoff outside the permit area. SMCRA section 515(b)(24) provides that to the extent possible using the best technology currently available, surface coal mining and reclamation operations must minimize disturbances and adverse impacts of the operation on fish, wildlife, and related environmental values, and achieve enhancement of such resources where practicable. Sections 516(b)(9)(B) and (b)(11) contain similar requirements for operations with underground mine permits. In the remainder of this EIS and response to comments, we will refer only to the section 515 citations with the understanding that the discussion also refers to their section 516 counterparts unless otherwise indicated.

Stream buffer zone rule

To implement these SMCRA provisions, both the initial and permanent regulatory programs under SMCRA have always included regulations that provide for a 100-foot buffer zone around certain streams. Those regulations, which are known as the stream buffer zone rule, went through three iterations between 1977 and 1983. The history of these regulations is discussed at length in OSM's January 7, 2004, proposed stream buffer zone rule at 69 FR 1036. The existing rules are codified at 30 CFR 816.57 and 817.57.

Historically, both OSM and the State regulatory authorities have applied the stream buffer zone rule as allowing the placement of excess spoil fills, refuse piles, slurry impoundments, and sedimentation ponds in intermittent and perennial streams. However, as discussed at length in the preamble to the January 7, 2004, proposed rule (69 FR 1038-1042), and as discussed below, there is considerable controversy over the proper interpretation of the existing stream buffer zone

rule as it applies to the placement of fill material in and near perennial and intermittent streams. Some interpretations of the existing rule are at odds with the underlying provisions of SMCRA.

OSM first placed its interpretation of the 1983 stream buffer zone rule in writing in a document entitled "Summary Report-West Virginia Permit Review-Vandalia Resources, Inc. Permit No.S-2007-98." According to OSM's annual oversight reports for West Virginia for 1999 and 2000, that document stated that the stream buffer zone rule does not apply to the footprint of a fill placed in a perennial or intermittent stream as part of a surface coal mining operation. On June 4, 1999, in *West Virginia Highlands Conservancy v. Babbitt*, Civ. No. 1:99CV01423 (D.D.C.), the plaintiffs challenged the validity of that document, alleging that it constituted rulemaking in violation of the Administrative Procedure Act. In an order filed September 23, 1999, the court approved an unopposed motion to dismiss the case as moot.

In a lawsuit filed in the U.S. District Court for the Southern District of West Virginia in July 1998, plaintiffs asserted that the stream buffer zone rule allows mining activities through or within the buffer zone for a perennial or intermittent stream only if the activities are minor incursions. They argued that the rule did not allow substantial segments of the stream to be buried underneath excess spoil fills or other mining-related structures. On October 20, 1999, the district court ruled in favor of the plaintiffs on this point, holding that the stream buffer zone rule applies to all segments of a stream, including those segments within the footprint of an excess spoil fill, not just to the stream as a whole. The court also stated that the construction of fills in perennial or intermittent streams is inconsistent with the language of 30 CFR 816.57(a)(1), which provides that the regulatory authority may authorize surface mining activities within a stream buffer zone only after finding that the proposed activities "will not adversely affect the water quantity and quality or other environmental resources of the stream." *Bragg v. Robertson*, 72 F. Supp. 2d 642, 660-663 (S.D. W. Va., 1999).

The U.S. Court of Appeals for the Fourth Circuit ultimately reversed the district court on other grounds (lack of jurisdiction under the Eleventh Amendment to the U. S. Constitution) without reaching the merits of the district court's holding on the applicability of the stream buffer zone rule. *Bragg v. West Virginia Coal Association*, 248 F.3d 275, 296 (4th Cir. 2001), cert. denied, 534 U.S. 1113 (2002).

In a different case, the same district court stated that SMCRA and the stream buffer zone rule do not authorize disposal of overburden in streams: "SMCRA contains no provision authorizing disposal of overburden waste in streams, a conclusion further supported by the buffer zone rule." *Kentuckians for the Commonwealth, Inc. v. Rivenburgh*, 204 F. Supp. 2d 927, 942 (S.D. W. Va. 2002).

The U.S. Court of Appeals for the Fourth Circuit subsequently rejected the district court's interpretation, stating that "SMCRA does not prohibit the discharge of surface coal mining excess spoil in waters of the United States." *Kentuckians for the Commonwealth, Inc. v. Rivenburgh*, 317 F.3d 425, 442 (4th Cir. 2003). The court further stated that "it is beyond dispute that SMCRA recognizes the possibility of placing excess spoil material in waters of the United States even though those materials do not have a beneficial purpose." *Id.* at 443.

The court explained the basis for its statements as follows:

Section 515(b)(22)(D) of SMCRA authorizes mine operators to place excess spoil material in "springs, natural water courses or wet weather seeps" so long as "lateral drains are constructed from the wet areas to the main underdrains in such a manner that filtration of the water into the spoil pile will be prevented." 30 U.S.C. § 1265(b)(22)(D). In addition, § 515(b)(24) requires surface mine operators to "minimize disturbances and adverse impacts of the operation on fish, wildlife, and related environmental values, and achieve enhancement of such resources where practicable," implying the placement of fill in the waters of the United States. 30 U.S.C. § 1265(b)(24). It is apparent that SMCRA

anticipates the possibility that excess spoil material could and would be placed in waters of the United States, and this fact cannot be juxtaposed with § 404 of the Clean Water Act to provide a clear intent to limit the term “fill material” to material deposited for a beneficial primary purpose.

Id.

Excess spoil fill construction

When coal is mined by surface mining methods, soil and rock that overlie the coal are temporarily removed and stored outside of the immediate mining area. If available in sufficient quantities, topsoil is removed and segregated. The underlying rock is fractured by drilling and blasting, or by ripping with bulldozers and is removed. This broken rock is referred to as “spoil”. Because the broken rock incorporates voids and air, spoil is less dense than undisturbed rock, and the volume of spoil removed during mining becomes greater than the volume of rock that was in place prior to mining. After coal removal, the mine operator returns the spoil to the mined-out area for reclamation.

The operator typically grades the spoil so that it closely resembles the premining topography. This is referred to as restoring the reclaimed mine to the approximate original contour (AOC). There are situations, particularly in steep terrain, where the volume of spoil exceeds the amount that is more than sufficient and technically feasible to return to the mined-out area when reclaiming the site. Surplus spoil material disposed of in locations other than the mined-out area, except for material used to blend spoil with surrounding terrain in achieving AOC in non-steep slope areas, is referred to as “excess spoil”.

Excess spoil is also generated in steep slope terrain when the operator proposes to reclaim the mining area to a flatter or more gently rolling topography in lieu of AOC so that a more economically viable land use may result. In these situations, the regulatory authority must approve the use of a technique called mountaintop removal mining if mining will extract an entire coal seam or seams running through the upper fraction of a mountain, ridge or hill, or grant a steep slope AOC variance if the extraction of coal is more limited in extent.

Prior to the passage of more rigorous State surface mining laws and SMCRA, many surface coal mines simply shoved spoil indiscriminately over the steep slopes below the outcrop of coal with little regard for stability or erosion. Landslides and erosion were widespread. Congress recognized this as a major issue and mandated through SMCRA that that excess spoil placement occur in stable and carefully constructed disposal areas. If springs, seeps, and natural water courses were present in the disposal area, large French drains called underdrains are required to ensure the stability of the excess spoil fill.

Consequently, in steep terrain, excess spoil is placed either in adjacent valleys or on previously mined sites. In areas where precipitation is ample, even small drainage areas harbor small streams; so many of these excess spoil fills placed in valleys are often constructed over small headwater streams.

As the number and the cumulative extent of surface mines and excess spoil fills increased, especially in the Appalachian coalfields due to market forces and larger and more efficient earth-moving equipment, so have the concerns regarding the adverse environmental effects of these activities. In 1997, OSM, the U.S. Environmental Protection Agency (EPA), the U.S. Army Corps of Engineers (COE), and the U.S. Fish and Wildlife Service (FWS) began discussing issues related to excess spoil fills and began a series of studies to examine the excess spoil fills in the Appalachian coal fields.

As part of routine oversight activities, OSM conducted studies in Kentucky, Virginia, and West Virginia to determine how the regulatory authorities were administering the SMCRA programs

regarding AOC and postmining land use requirements. [USDOI-OSM, 2000; USDOI-OSM, 1999a; USDOI-OSM, 1999b] When permit files and reclaimed mines were examined, OSM found it difficult to distinguish between the reclamation configuration of mines that were not reclaimed to AOC and the reclamation configuration of mines that were reclaimed to AOC. There were no clear differences in the number and size of the excess spoil fills, and non-AOC mines should typically have larger or more numerous fills. OSM determined that typically, coal mine operators could have retained more spoil on mined-out areas under applicable AOC requirements than they were actually retaining. OSM also found that in many instances coal mine operators were overestimating the anticipated volume of excess spoil. As a result, OSM concluded that coal companies were designing fills larger than necessary to accommodate the anticipated excess spoil. Where fills are larger than needed, more land outside the coal extraction area is disturbed. OSM attributed these problems, in part, to lack of or inadequate regulatory guidance. The current SMCRA regulations at 30 CFR 780.35, 816.71 through 816.74, and 817.71 through 817.74, concerning excess spoil placement are primarily focused on ensuring that fills are safe and stable; they do not explicitly require consideration and minimization of the environmental effects of fill construction.

Following the oversight review, Kentucky, Virginia, and West Virginia developed new guidance to address AOC and issues regarding excess spoil. Because excess spoil is generated and fills constructed anywhere that coal mining occurs in steep slope terrain, OSM determined that there was still a strong need to initiate rulemaking to revise the Federal regulations to explicitly require that the volume of excess spoil be minimized by returning as much mine spoil to the mined out area as practicable, and that excess spoil fills be designed and constructed to minimize adverse impacts on the hydrologic balance, fish, wildlife, and related environmental values.

E. NEPA Compliance

1. Previous Environmental Impact Statements

After the passage of SMCRA in August 3, 1977, the Secretary of the Interior, through OSM, began writing permanent program regulations. OSM prepared a programmatic environmental impact statement [OSM EIS-1] to analyze the environmental consequences of the permanent program regulations [30 CFR Part 700 *et seq.*]. OSM completed and released OSM EIS-1 as a final EIS on January 1979, and the permanent program regulations were published as a final rule in the Federal Register on March 13, 1979 [44 FR 15313].

After several years of implementing the permanent program regulations, and a series of legal challenges to specific regulations, OSM proposed a large number of changes to the permanent program regulations. To support these actions, OSM prepared a supplemental EIS to analyze their effects on the human environment. OSM finalized and released OSM EIS-1 Supplement in January 1983. The regulatory changes were published in the Federal Register in a series of final rule notices published on and subsequent to March 4, 1983.

After publication of the 1979 programmatic EIS and the 1983 supplement, OSM relied on the comprehensive analyses contained in those documents, and focused subsequent NEPA compliance for individual rulemakings on the effects on the human environment from individual actions. Reliance in part on the analyses of one or more previously prepared broader EIS's is encouraged under CEQ's regulations implementing NEPA, and is referred to as "tiering" [40 CFR 1508.28].

In this environmental impact statement, we are considering the effects on the human environment of alternatives for a Federal action that is only a very narrow component of a comprehensive Federal surface coal mining regulatory program. Where applicable and appropriate, we intend to

rely on and refer specifically or in general to previous programmatic environmental impact statements:

- U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement. Permanent Regulatory Program Implementing Section 501(b) of the Surface Mining Control and Reclamation Act of 1977, Final Environmental Statement USOSM-EIS-1, Jan. 1979.
- U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement. Supplement to Final Environmental Statement on Proposed Revisions to the Permanent Program Regulations Implementing Section 501(b) of the Surface Mining Control and Reclamation Act of 1977, Final Environmental Statement USOSM-EIS-1: Supplement v.1. 1983.

Other environmental impact statements were prepared by OSM or in cooperation with OSM. These documents may contain more current or specific information that is also relevant to the analysis or characterization of the environmental setting. This EIS may incorporate by reference relevant information or analysis, or refer the reader to specific or general sections of those documents when appropriate. The final statements and associated draft statements that are incorporated by reference into this document are listed below:

- U.S. Department of the Interior, Bureau of Land Management, Wyoming State Office, North Jacob Ranch Coal Lease Application, Federal Coal Lease Application WYW1467444, Final Environmental Impact Statement, June 2001.
- U.S. Department of the Interior, Bureau of Land Management, Wyoming State Office, Pittsburgh and Midway Coal Company Coal Exchange Proposal, Final Environmental Impact Statement, July 2003.
- U.S. Department of the Interior, Bureau of Land Management, Wyoming State Office, South Powder River Basin Coal, Final Environmental Impact Statement, Dec. 2003.
- U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement (OSM). Comprehensive Impacts of Permit Decisions under Tennessee Federal Program. OSM-EIS-18, 1985.
- U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement. Valid Existing Rights: Proposed Revisions to Section 522(e) of the Surface Mining Control and Reclamation Act of 1977 and Proposed Rulemaking Clarifying the Applicability of Section 522(e) to Subsidence from Underground Mining, Final Environmental Impact Statement OSM-EIS-29. July 1999.
- U.S. Environmental Protection Agency, Mountaintop Mining/Valley Fills in Appalachia Draft Programmatic Environmental Impact Statement (MTM-VF DPEIS), EPA 9-03-R-00013, EPA Region 3, June 2003.
- U.S. Environmental Protection Agency, Mountaintop Mining/Valley Fills in Appalachia Final Programmatic Environmental Impact Statement (MTM-VF FPEIS), EPA 9-03-R-00013, EPA Region 3, October 2005.

NEPA compliance for 2004 stream buffer zone and excess spoil rulemaking

Beginning in the spring of 2003, OSM initiated extensive outreach on the concept of revising regulations to address concerns regarding excess spoil generation, fill construction, and

confusion regarding the stream buffer zone regulatory requirements. OSM published a proposed “excess spoil / stream buffer zone” rule in the Federal Register on January 7, 2004. 69 FR 1036. In the same notice, OSM also announced the availability of a draft environmental assessment for the proposed rule, which was prepared in accordance with NEPA to examine the environmental effects of rule and other alternatives. OSM concluded preliminarily that the changes it was proposing would have no significant impacts on the human environment and that a finding of no significant impact (FONSI) would likely be prepared upon finalizing of the environmental assessment.

After receiving many comments on the draft environmental assessment and further consideration, OSM concluded that further analysis of the effects on the human environment was warranted. On June 16, 2005, OSM announced in the Federal Register [70 FR 35112] that the agency would prepare an environmental impact statement (EIS) to analyze the effects of the rulemaking initiative, and asked for the public’s suggestions on the issues and alternatives to be examined.

2. Public Participation

Public participation was actively sought in the development of this EIS. The Notice of Intent for the EIS was published in the Federal Register dated June 16, 2005 [70 FR 25112] and posted on OSM’s website. OSM invited comments and suggestions on the scope of the analysis, including the important issues and additional reasonable alternatives to this rulemaking that should be addressed in the EIS. OSM received approximately 160 comments in writing.

OSM also afforded the opportunity to the public to meet and discuss the preparation of the EIS. In response to eighteen requests, four public “scoping” meetings were held: Knoxville, Tennessee on August 22, 2005; Hazard, Kentucky on August 23, 2005; Charleston, West Virginia on August 24, 2005; and Pittsburgh, Pennsylvania on August 25, 2005. In all, approximately 150 people attended the four meetings and provided oral comments and suggestions for issues and additional alternatives.

On August 24, 2007, OSM announced in the Federal Register the availability of the proposed excess spoil minimization–stream buffer zone rule and its associated draft EIS. Approximately 400 hardcopies and compact discs were mailed directly to government, libraries, special interest groups, and interested citizens. In addition, the draft EIS was made available over the Internet. Over 43,000 comments were received on the proposed rule and approximate 2000 written comments were received on the draft EIS during the 88-day comment period. Additionally, on October 24, 2007, four public hearings in the following locations: Knoxville, Tennessee; Hazard, Kentucky; Charleston, West Virginia, and Washington, Pennsylvania., We also held two public meetings: one on October 24, 2007 in Big Stone Gap, Virginia, and one on November 1, 2007, in Alton, Illinois, respectively. Approximately, 750 people attended and 212 people spoke.

3. Issues Raised During Scoping

Issues of concern expressed during the scoping process have been summarized, consolidated and organized into the following categories: Geographic scope, biological, hydrological, engineering, public health, economic, social, atmospheric, stream buffer zone enforcement, cumulative effects, and other regulatory programs.

a) Geographic Scope

Commenters suggested that OSM –

Analyze the exploration and developmental activities in the Nation's coalfields (Gulf Coast, Appalachian Basin, Illinois Basin, Colorado Plateau, Northern Rocky Mountain and Great Plains).

Examine the spoil generating practices throughout the Nation's coalfields.

Include a detailed economic impact statement supplement from every potential State that may or may not be impacted. The commenter suggested that the economic impact study is necessary to provide information on the potential economic "harm" or "benefits" to local communities and States

b) Hydrology

The following summarizes issues concerning hydrology. Principally, these issues include water quality, quantity, and flooding. The commenters suggested that OSM consider the effects of the proposed Federal action on --

Water quality. One commenter specifically suggested examining the effects of changing topography and ephemeral stream morphology on water quality. Several commenters suggested that OSM study the chemistry (aluminum, calcium, manganese, mercury, nitrate/nitrite, potassium, selenium, sulfate, total dissolved solids, hardness, acidity, alkalinity) of water below valley fills. Similarly, another commenter suggested that we determine whether toxic waste buried in fills and leaching out into streams such as selenium, heavy metals. One commenter suggested that OSM examine old water tanks to determine the kind of metals that are being accumulated in the system. One commenter suggested that OSM study the effects of removing riparian vegetation on water quality.

Thermal pollution.

Sedimentation. Several commenters suggested that OSM examine the direct, indirect, and cumulative effects of sedimentation and metal pollution during unusual storm events.

Channel Stability.

Stream buffer zone width and the adequacy of the 100-foot buffer zone to protect springs, seeps, ground water, and streams. Another commenter suggested that OSM examine how close one can mine to a stream without causing hydrologic damage.

Drinking water. The commenter pointed out that less than 1/2 of 1 percent of the Earth's water is available for drinking. Another commenter pointed out that mining is ruining drinking water in Appalachia and water systems cannot remove pollutants.

Outstanding national resource waters: i.e. a Clean Water Act designation for river related areas of exceptional ecological significance worthy of protection and/or restoration.

Acid mine water seeps. The commenter points out that reclaimed surface mine sites constitute artificial, porous geological recharge areas; where infiltrating water percolates through the fill and emerges as acid or toxic seeps.

Ephemeral streams and "zero order streams". (The term "zero order streams" refers to swales and hollows that lack distinct stream banks but still serve as conduits of water, sediment, nutrients, and other materials during rainstorms and snowmelt).

Landslides and the potential effect on downstream water quality.

Ground water contamination. One commenter specifically suggested that OSM examine the effects on Appalachia's karst underground water supply. The commenter pointed out that many people in the region depend upon this supply which is particularly sensitive to contamination due to the lack of a natural filtrations system and a rapid flow rate. One commenter suggested that OSM study the diminution on water wells. One commenter suggested that OSM examine the direct, indirect, and cumulative impacts on ground water as it relates to various types of mining techniques: cross ridge, contour, and mountaintop removal. Similarly, another commenter suggested that OSM examine the impact on underground mining.

Aquifer recharge zones that supply springs and wells.

Blasting residue in water.

Flooding. One commenter specifically suggested that OSM examine how the changes in topography and ephemeral stream morphology impact water quantity. Similarly, one commenter suggested that OSM study whether the loss of streams contributes to increase flooding. Another commenter suggested that OSM examine the effects on removing riparian vegetation on flooding.

Stream storage capacity. The commenter suggested that OSM examine whether sediment-loaded streams below mining operations have lost their storage capacity and are now shallow channels that flash and flood. Similarly, a commenter suggested that OSM examine if man-made lakes, such as Fish Trap Lake in Kentucky, have lost storage capacity at an accelerated rate due to mining.

Riparian zone functions: i.e., slowing flood waters and reducing the amount of water through root absorption, improving water quality by filtering runoff and promoting sediment deposition, recharging ground-water aquifers, bank stabilization, providing a canopy cover which shades and cools stream, and improves the habitat conditions for stream organisms and a provides a terrestrial habitat for birds and small animals. One commenter suggested that OSM discuss the size of the riparian zone and the ability to carryout all ecological functions.

Reconstructed riparian buffer zones. One commenter suggested that OSM examine the ability of a reclaimed riparian buffer zone to carryout its hydrological and ecological functions. Similarly, several commenters suggested that OSM study the effectiveness or ineffectiveness of mitigation approved by the Corps of Engineers or others to offset the adverse impacts caused by valley fills.

Riparian Maintenance and Restoration Goals. Specifically, one commenter suggested that OSM examine how the proposed action will effect several riparian zone related goals in the Upper Tennessee River: (1) Reduce access to streams by livestock by 90%, (2) establish riparian zones on 90% of streams, (3) establish healthy forests and native vegetation on 90% of stream corridors, (4) gain the cooperation of landowners, and (5) educate youths and adults on the benefits of riparian areas.

Functions of headwater streams; that is a) the maintenance of natural discharge regimes, b) the regulation of sediment transport, c) the retention of nutrients, d) the processing of terrestrial organic matter, and e) the establishment of the chemical signature for water quality in the landscape. One commenter suggested that OSM analyze the impacts of ephemeral streams in addition to intermittent and perennial headwater streams.

Restoration of headwater streams. Specifically, the commenter suggested that OSM examine how effective current techniques are in restoring stream functions. One commenter pointed out that the Corps' Eastern Kentucky Stream Assessment Protocol does not evaluate ecological functions on structural and physical components. Similarly, several commenters asked OSM to examine the extent of irreversible loss of streams and habitats due to mining.

Extent of headwater streams impacted. Specifically, the commenter suggested OSM analyze whether more headwater streams would be impacted under the proposal.

Headwater streams contributions to overall watershed health. One commenter suggested that OSM analyze the effects on lowland sites since the goal of protecting the long-term ecological integrity and ecosystem services of the natural system, whether aquatic or terrestrial, cannot succeed without a foundation of intact and functional headwater streams.

Long term reduction of large woody debris. Similarly, one commenter asked OSM to evaluate whether the loss of sediment and fine particulate organic matter (FPOM) storage capacity in small streams caused by reduced debris frequently greatly lessens the capacity of the streams to biologically process organic matter and ultimately make the energy of terrestrial plant materials available to fishes. One commenter suggested that OSM evaluate the effects of diminishing the storage and processing capabilities of streams when simplified channels route sediment and organic matter much more quickly downstream to larger streams. One commenter suggested that OSM evaluate the relationship between wood size and distribution and its function in headwater stream processes. One commenter suggested that OSM investigate the effects on "slash" (i.e. an open place in a forest, cluttered with branches, chips, or other debris, as from the cutting of timber) in very small headwater streams and its effect on dissolved oxygen and runout distances.

c) Biological

Commenters suggested that OSM consider the effects of the proposed Federal action on --

Threatened and endangered species and species of concern throughout the potential impact area. One commenter specifically expressed concern with the impacts to the Blackside Dace, Cumberland elktoe, Oyster mussel, Cumberlandian combshell, Tan riffleshell, Littlewing pearlymussel, and Cumberland bean pearly mussel.

Species diversity. One commenter suggested examining whether smaller stream buffers zones result in less biological diversity. Another commenter suggested examining the loss of pollution sensitive taxa as a cause of less diversity. Other commenters suggested OSM examine the effects of deforestation on this issue. Another commenter suggested OSM examine the effects on biological productivity and reduced diversity due to increased sedimentation on the clean gravel substrate for spawning. One commenter suggested that OSM identify the attributes of headwater systems that drive species (fish and amphibians) composition, diversity, and persistence.

Population of aquatic species amphibians (salamanders, toads, frogs), mussels, and fish population, viability, distribution, and recovery as result of habitat loss and fragmentation. One commenter suggested that OSM specifically analyze the spatial population dynamics of species with the stream network and associated matrices of small watersheds that make up headwater systems. The design of ecological reserves

for biodiversity protection is largely dependent on understanding the population structure and dispersal patterns of resident species. Knowledge of the spatial structure of populations informs estimates of the minimum area required to prevent local extinction. Maintaining inter-population dispersal enhances ecological resilience by increasing the likelihood of re-colonization if local extinctions occur. Using a combination of direct and indirect methods (e.g. mark-recapture and population genetic analyses) this analysis would provide critical information on the minimum area and configuration of protected headwater areas required for species persistence in the proposed EIS. One commenter suggested that OSM investigate the effects of forest management on invertebrate survival and the importance of headwaters streams in contributing to downstream populations.

Fish contamination. One commenter specifically suggested examining the effects of selenium pollution. Another commenter suggested that OSM extend earlier research by (1) identifying selenium hotspots; (2) gathering data on selenium in water, sediment, benthic macroinvertebrates, whole fish or fish eggs, and aquatic bird eggs or bird livers (if appropriate); (3) performing a whole body/liver to egg conversion if necessary; (4) compiling a hazard assessment to predict toxic threats; and (5) following up with an actual field-assessment of impacts by evaluating teratogenic deformities in very young fish. The commenter further suggests that the studies should also assess the impacts on any adjacent wetlands or other areas downstream from potential hotspots.

Aquatic habitat, particularly the removal of shade and food sources for leaf shredders (damselfly nymphs, caddisfly nymphs) which convert leaf matter to protein. The commenter expressed concern regarding the effect on the food chain. One commenter suggested that OSM review the effects on micro-habitat.

Migrating aquatic and riparian species.

Aquatic life in cases where "in stream" sediment basins have been authorized.

Native populations resulting from the introduction and/or encouragement of non-native species of plants and animals.

Plants and wildlife stemming from the removal of riparian vegetation.

Herbs used for medicine, particularly ginseng, ramps, and goldenseal.

Terrestrial animals and birds. One commenter suggested that OSM evaluate the effects on the food supply for hummingbirds and butterflies with watersheds of Appalachia. One commenter suggested that OSM specifically examine the effects on black bear habitat. Another commenter suggested that OSM evaluate the impacts on cerulean warblers, stating that mining is projected to cause the loss of 137,862 warblers in the next ten years. One commenter suggested that OSM specifically analyze the effects of habitat fragmentation upon the population of terrestrial species: reptiles (snakes, turtles, and lizards), mammals (shrews, voles, fishers, otters, and beavers) population, viability, distribution, and recovery. Another commenter suggested OSM examine the effects on bats.

The hardwood forest ecosystem. The commenter pointed out that these communities are interdependent with headwater streams and that studies have shown that mountaintop mining causes extensive permanent damage to once healthy and sustainable forests and their rich and diverse ecosystems.

d) Engineering

The following summarizes engineering related issues. The commenters suggested that OSM consider the effects of the proposed Federal action on --

Success of reclamation. Specifically, the commenter suggested that OSM examine whether currently used reclamation techniques or more novel techniques are more appropriate.

Volume of excess spoil. One commenter suggested that OSM examine whether the constraints of returning spoil back to the mined-out area is technical or economic. One commenter asked OSM to examine whether excess spoil in streams is unavoidable. One commenter suggested OSM examine the practicality of placing excess spoil on previously mined benches.

Stability of the backfill and excess spoil fill. One commenter was particularly concerned with landslides burying streams in Tennessee and suggested that OSM take a hard look of the cause and would the proposal affect these occurrences. One commenter suggested that OSM look at the practice of cross ridge mining and whether the proposal will increase the use of this mining technique. The commenter points out that the practice can rely on fewer and smaller fills, but it may increase the risk of erosion, slope failure, and adverse impacts to the hydrology of the mountain. One commenter asked OSM to examine several landslides in West Virginia involving valley fills under construction to determine the cause and the effect of this proposal. One commenter was concerned that the proposal with excess spoil minimization may adversely affect public safety. Another commenter suggested that OSM examine the potential of structural failures of sediment basins and spoil storage areas built on headwater streams. One commenter expressed concern regarding the impacts of landslides on recreation values from mining on steep slopes.

Effectiveness of sedimentation ponds and silt fences. The commenter specifically suggested that OSM to examine the effectiveness of these structures under extreme weather, slope, and mining conditions.

e) Economic

The following summarizes economic issues. The commenters suggested that OSM consider the effects of the proposed Federal action on –

Long-term economic development. One commenter suggested that OSM examine the cost of losing Appalachian coal on the economy. Another commenter asked that OSM to analyze the effects of the proposal on residential development. One commenter suggested that OSM evaluate the effects of the coal field communities and regions ability to attract new industry, residents, and schools during and after mining: particularly relative to flooding and blasting caused by valley-fill-in-stream mining.

Tourism and outdoor recreation. One commenter was particularly interested in the effects on recreational fishing; another, paddling; another, camping in Tennessee. Another commenter was concerned that pollution prevents swimming in Kentucky.

Property values. One commenter was specifically concerned about the loss of property values and tax revenue due to mining.

Economic potential due to the loss or added costs of decontaminating of water. One commenter specifically suggested that OSM examine the costs associated with filling high quality streams with excess spoil. Another commenter was particularly concerned with water availability for agriculture. One commenter was concerned with the increased costs to rural water treatment systems. One commenter suggested that OSM examine the effect of the proposed rule on the increased cost of water used by power plants.

Costs of mitigating damage caused by mining. Several commenters requested that OSM examine the effects of this proposal on flood insurance costs. Several commenters suggested that OSM study the social costs and the costs of roads damaged by coal haulage. In particular, the cost of maintaining the accessibility of community roads as it relates to school buses and emergency vehicle (fire, police, homeland security, rescue squads) access. One commenter suggested that OSM compare the amount of FEMA monies that are spent in mined versus non-mined mountainous areas. Another commenter asked that OSM study the cost to property owners without flood insurance.

Long term economic outlook of the price of coal and electricity.

Costs associated with communities and schools as people leave the area.

Coal employment. One commenter that OSM look specifically at wage and fringe benefits associated with mining. One commenter requested that OSM examine the cost/benefits of retraining coal miners should they lose their jobs over this proposal.

Ability to mine coal. One commenter was concerned particularly with the extraction of metallurgical coal and the affect on the steel industry. Another commenter was concerned with effects on underground mining.

Long term implications of timber loss.

Economic, health, and social impacts of loss of habitat for medicinal and ornamental plants (i.e. ginseng, black cohosh, goldenseal, mosses, ferns, molly moochers (morel mushrooms) and ramps). These plants are collected by some coalfield citizens for selling and personal use.

U.S. Army Corps of Engineers projects in the coal field watersheds. The commenter was particularly concerned with added costs for hydropower production, navigation, and flood control, maintaining and improving water quality, and recreational opportunities. Similarly, another commenter was concerned with the potential effects on Tennessee Valley Authority dams and reservoirs.

Feasibility of alternative energy supplies. The commenter suggested that OSM examine other alternatives to impacting streams such as clean renewable energy (solar panels, wind, biomass, and fuel cells).

f) Social

The following summarizes social issues. The commenters suggested that OSM consider the effects of the proposed Federal action on –

People's heritage (local culture and traditions) and sense of place. One commenter expressed concern with the loss of religious activities (such as baptismal springs); one, the

loss of fishing holes. Another commenter expressed concern with his ability to engage in recreational activities such as hiking, biking, and camping.

Quality of life. Several commenters suggested that OSM examine the social costs of blasting noise. Another asked OSM to consider the ability of future generations to maintain the current quality of life and culture. One commenter suggested that OSM study the impacts on the quality of life resulting from diminution of water systems, increased traffic and dust, and impaired or destroyed aesthetic conditions.

Visual impacts. One commenter was concerned with impacts associated with forest removal and topographic changes. Another commenter was concerned with aesthetic appearance of streams.

Local, state, and national parks and natural areas.

Trash / litter problems.

Unique areas. One commenter pointed out that the Fall Creek Falls, Tennessee EIS determined the unique importance of adjacent streams outside the park's boundary that supply the waters for this unique area

Environmental justice. One commenter argued that valley fills and mountaintop removal mining would not be allowed in areas outside Appalachia.

Access to cemeteries.

Public health in the coal fields. Several commenters suggested that OSM examine the cause of higher cancer rates. One commenter was particularly concerned with the incidence of cancer in the wives of miners and suggested that the cause may be linked to contaminated clothing. Another commenter asked that OSM examine the cause of premature death in the coal fields. One commenter was concerned that the proposal could potentially increase the incidence of West Nile virus due to increase mosquito population. One commenter expressed concern regarding the effects of this proposal on infectious disease and rabid animals. Another commenter suggested that OSM review the effects of this proposal on septic / sewage systems. One commenter was concerned with the increase in hepatic cases in Buckhorn and Carfork Lakes in Kentucky. One commenter suggested that OSM examine the increase rate of asthma in the coalfields. Several commenters asked OSM to study the mental health of coalfield residents. Similarly, another commenter suggested that OSM examined the psychological effects to residents due to the obliteration of mountains and streams, loss of the aesthetic and visual impacts, and loss of forested mountains.

Safe drinking water. One commenter was particularly concerned with frequency and effects of diesel spills. Another commenter was concerned with selenium pollution. One commenter suggested OSM examine the effects of this proposal on local reservoirs and dams. One commenter requested OSM examine the impact to regional drinking water supplies (including the loss, damage, or impairment) of wells and springs, and the infrastructure cost of laying new water lines in remote Appalachian counties and the elimination of water pipeline projects to regions that need additional drinking water access.

g) Atmospheric Impacts

The following summarizes atmospheric issues. The commenters suggested that OSM consider the effects of the proposed Federal action on –

Air quality. Several commenters suggested that OSM evaluate the effects of this proposal on pollution from burning coal. Another commenter expressed concern with dust emanating from blasting, coal haulage, and heavy equipment.

Climate change. One commenter requested that OSM examine the micro-climate changes due to mountaintop mining / valley fills. The commenter pointed out that the valleys where mountaintop mining occurred no longer cool at night like they once did. One commenter suggested that OSM examine effects of the proposal on the loss of forests from the standpoint of carbon sinks. Another commenter asked OSM to evaluate the proposal in light of seasonal impacts (winter v. summer), thunderstorms, and increased storm intensity (high winds, increased frequency of straight-line winds, and flash floods).

h) Stream Buffer Zone Enforcement

Several commenters suggested that OSM consider the effects of the proposed Federal action on stream buffer zone enforcement. These commenters requested that the EIS examine the following –

Past waivers and the resulting impacts. One commenter suggested that OSM examine previous waivers to ascertain compliance with Section 515(b)(10) of SM CRA (i.e., did the coal operation prevent material damage to the prevailing hydrologic balance). One commenter suggested that OSM examine the assumptions of historically granted waivers and use monitoring data to discern if the assumptions were realized.

Historic administration of the stream buffer zone rule.

Violations of the stream buffer zone regulation.

Application of 100-foot buffer. One commenter pointed out that some regulatory agencies have used 50 feet in lieu of 100 feet. The commenter suggested that OSM examine the effect of this change in the stream buffer zone width has on sediment, pH, metals, and biological criteria.

i) Cumulative Effects

The commenters suggested that OSM consider the cumulative effects of the proposal on--

Multiple valley fills across the region over time. One commenter asked OSM to examine the effects of constructing fewer larger excess spoil fills as opposed to multiple smaller fills.

Multiple surface mines within a watershed. One commenter suggested that OSM specifically look at segmentation. One commenter asked OSM to consider fragmentation within the ecosystem.

Coal traffic and haul roads.

Global effects of pollution stemming from mining. The commenter pointed out that the pollution from mining extends to the ocean.

Number or length of streams impacted.

Number or extent of surface mining activities or type of surface mining operation.

Land use. The commenter suggested that OSM examine the cumulative effect of all riparian buffer zone incursions due to mining, residential, commercial, and industry land activities.

j) Other Federal, State, and Local Programs

The following summarizes issues raised regarding the impact of this proposal on other Federal, State, and local programs. The commenters suggested that OSM consider the effects of the proposed Federal action on --

General compliance with the Clean Water Act. A commenter suggested that OSM examine whether the proposal will conflict with significant environmental legislation such as the Clean Water Act. One other commenter asked that OSM consider the confusion that the proposal may cause if OSM allows a stream buffer zone variance that is not allowed by the Clean Water Act authority or vice versa.

State and Federal water quality standards. One commenter asked OSM to evaluate the potential impacts on the States' ability to carry out all state water quality standards, protect watershed quality zones, and to meet all required regulations pursuant to stream protection found in the Clean Water Act. One commenter suggested that OSM examine whether new standards for assessing water quality and watershed health, which actually measure the impacts of valley fills, are needed. Similarly, another commenter asked OSM to examine whether new water quality standards and additional monitoring for selenium and heavy metals are needed to protect against adverse downstream impacts of valley fills and mining through headwater streams. One commenter pointed out that for activities that involve the discharge of fill material in waters of the U.S., a CWA determination must also be made that the project is consistent with EPA's Section 404(b)(1) Guidelines. This commenter suggested that OSM evaluate the potential effects of the alternatives on streams including, but not limited to, the linear stream length, ecosystem impacts from biota lost from fill activities, upstream energy, downstream thermal regime, downstream flow regime, downstream chemistry, downstream bed characteristics, and downstream biota. The commenter also suggested that relevant portions of the MTM/VF (mountaintop mining – valley fill) DPEIS would provide a helpful basis for the evaluation.

Total maximum daily load program. The commenter suggested that OSM analyze whether impacts of the proposal conflict with Tennessee's initiative to reduce pollution from non-point sources.

State antidegradation provisions. The commenter requested that OSM examine the effects of the proposal on individual States' ability to carry out the State antidegradation provision of the Clean Water Act. Several other commenters suggested that OSM examine whether filling of streams is a violation of the anti-degradation provisions of CWA since the chemical and biological integrity of streams is mandated to be protected not obliterated.

Tennessee water supply and Aquatic Resource Alteration Permit laws.

Tennessee Valley Authority's programmatic EIS–Reservoir or the Watts Bar Reservoir Integrated Land Plan.

Tennessee's Abandoned Mine Lands program.

Tennessee's Special Rivers and Scenic River System program.

Various State cave protection laws.

Various State, county, and city water quality buffer provisions.

Tennessee's stream mitigation guidelines.

Tennessee biological diversity policy.

Tennessee Rivers Assessment Project.

Tennessee Department of Environment and Conservation (TDEC) scenic rivers program.

TDEC Recreational Services planning. The commenter points out that TDEC works with communities in planning greenways and trails along river corridors. Data from the assessment of environmental conditions helps to evaluate the suitability of rivers.

Tennessee Rivers Assessment Project.

Superfund eligibility. The commenter points out that the eligibility of candidate toxic sites for Superfund mitigation depends on such factors as aquatic characteristics such as recreational use, sports fishing, presences of wetlands, and listing in the National Rivers Inventory.

F. Scope of Analysis

The OSM interdisciplinary team responsible for preparing the EIS considered all the issues raised during scoping, and evaluated whether an issue warranted a direct specific response, a broad response, or no response. Several issues raised were so specific that they are more appropriate and more feasibly addressed in review and processing of specific surface mining permits or similar actions.

The EIS relies primarily on published and previously released information, particularly previous EIS's. In preparing this document, the team (we) also considered a host of published relevant current research especially in the area of "stream buffer zones." As one of the prominent researchers on riparian zones pointed out, only a few studies on water quality buffer effects of vegetated riparian zones were published in the early 1970's, but now there is plethora of such studies and these studies continue as there is still much to know [Correll 1997, p.7]. The research studies that OSM relied on in preparing this EIS are available in the administrative record for this EIS. Updated factual information on the policies, guidance, and activities involving excess spoil fills and stream buffer zone incursions were obtained from OSM field offices and State regulatory agencies. This information is also available in the administrative record. No additional on-the-ground studies were conducted in preparing the EIS.

Since this Federal action has nation-wide implications, we focused on the five most productive coal bearing regions of the United States. Consequently, the potential complexities of this EIS are enormous. Each coal bearing region has its own unique set of circumstances with regard to geology, hydrology, flora, fauna and geomorphology among others. In addition the various mining scenarios that could play out in the differing regions are subject to variables that are difficult to quantify specifically. In some of these regions there is a wealth of specific data regarding the various impacts of mining as analyzed under the various alternatives reviewed, while in other regions such data may be of limited availability. OSM has attempted to utilize all available relevant data whenever possible, and to the extent feasible has extrapolated such data for the various alternatives as appropriate. For example, we obtained data on water quality effects of

mining and valley fill construction. We assume that these effects would be similar nation-wide. OSM has noted throughout this EIS those areas where data is lacking or of limited availability in accordance with 40 CFR 1502.22. Gathering and analyzing site-specific information nationwide on all aspects of the resources that could be affected by this Federal action would require an exorbitant amount of funding, which is not available. For example, it is not feasible for us to collect specific information nationwide on coal seams thickness and the size of mineable reserve blocks, rights to mineral and surface ownership, the coal market, sufficiency of investment capital, and all potential site specific environmental and public safety issues. Over \$5 million was spent over a 3-year period on studies investigating various aspects of mountaintop mining/valley fill activities in Appalachian coalfields as part of 2005 MTM/VF FPEIS. . While those studies served as indications of the effects of mining and were useful in identifying areas needing additional study, they were insufficient to serve as a basis for a bright-line threshold of minimal impacts. Based on extrapolations from funds expended, the agencies estimated that approximately \$20 million over a minimum 5- to 10-year period would be required to collect data that might be sufficient just to develop alternatives involving categorical fill restrictions on mountaintop mining/valley fill activities. Fortunately most of the available studies and data relevant to this EIS are concentrated in the region most likely to be impacted by the proposed rulemaking, specifically the Appalachian coal fields. Therefore OSM is confident that the available data and studies are sufficient to fully analyze the alternatives and the reasonably foreseeable adverse impacts of those alternatives in those areas most likely to be affected by this rulemaking.

Substantive comments received on the draft EIS and relevant written comments and testimony on the proposed rule were used to prepare this final document. The substantive written comments, the transcripts from the four hearings and one meeting, and our responses to the comments are placed in the appendices to this final EIS.

II. Alternatives

A. Alternatives Fully Analyzed

No Action Alternative

OSM would not adopt any new rules or policies to further minimize the generation of excess spoil and the adverse impacts stemming from excess fills and coal processing waste facilities and impoundments. Similarly, OSM would not adopt any new rules or policies to clarify the requirements when coal mining activities are proposed or approved to be conducted within 100 feet of an intermittent or perennial stream. The current regulations applicable to excess spoil generation and fill construction, coal processing waste, and the stream buffer zone would remain unchanged. The “No Action” alternative would reflect the current conditions described in Chapter III of this EIS.

The term “excess spoil” is currently defined at 30 CFR 701.5 as:

[S]poil material disposed of in a location other than the mined-out area; provided that spoil material used to achieve the approximate original contour or to blend the mined-out area with the surrounding terrain in accordance with Sections 816.102(d) and 817.102(d) of this chapter in non-steep slope areas shall not be considered excess spoil.

There are three situations in which excess spoil generation is likely in steep terrain: first, when the overburden is thick relative to thickness of the coal seams extracted and the volume of spoil material exceeds the amount necessary to backfill the mined-out area to the approximate original contour (30 CFR 816.105 and 817.107); second, when conducting mountaintop removal mining

and the reclaimed mine topography is intentionally left flatter or more gently rolling than the original topography in order to support one or more of the five postmining land uses specified in 30 CFR 785.14; and third, when mining in steep slope terrain and a variance from the requirement to backfill a mine site to the approximate original contour (AOC) is approved to support one or more of the postmining land uses specified in 30 CFR 785.16.

In these three situations, the existing regulations provide general guidance on how much spoil must be returned to the mined-out area. In thick overburden situations, the excess spoil volume is the volume of the overburden and other waste material multiplied by a swell factor minus the volume of coal prior to mining. In mountaintop removal mining or steep slope variance mining, excess spoil is simply the amount not necessary to achieve the postmining land use. While, as a general matter, these three situations will generate excess spoil, most surface coal mining operations will unavoidably have excess spoil. Unless abandoned mine benches or adjacent previously reclaimed areas are available, in steeper slope areas, these disposal sites are valley fills; in more gentle terrain the spoil may be blended into surrounding topography.

The current performance standards applicable to excess spoil disposal are found at 30 CFR 816.71 through 816.74 for surface mining activities and 30 CFR 817.71 through 817.74 for underground mining activities. These regulations primarily focus on ensuring that excess spoil fills are safe and stable structures. There are no explicit environmental considerations in these regulations. However, excess spoil fills, like all other coal mining activities, are subject to all of the other environmental requirements of the surface mining regulatory program that protect resources such as, but not limited to, the hydrologic balance and fish and wildlife,

Similar to the excess spoil regulation, the existing permitting requirements for coal mine waste disposal (30 CFR 780.25 for surface mining activities and 30 CFR 784.16 for underground mining activities) and performance standards (30 CFR 816.81 through 816.84 for surface mining activities and 30 CFR 817.81 through 817.84 for underground mining activities) focus on safety and stability and not environmental concerns. However, coal mine waste disposal, like all other coal mining activities, is subject to all of the other statutory and regulatory requirements of the surface mining program that protect resources such as, but not limited the hydrologic balance and fish and wildlife.

The current stream buffer zone regulations at 30 CFR 816.57 and 817.57 have been in effect since August 1, 1983. These regulations prohibit disturbance of the surface of lands within 100 feet of a perennial or intermittent stream by surface mining activities, or by activities conducted on the surface of lands in connection with an underground coal mine, unless the regulatory authority specifically authorizes activities closer to, or through, such a stream. The regulatory authority can authorize activities within a stream buffer zone only upon finding that those activities will not cause or contribute to the violation of applicable State or Federal water quality standards and will not adversely affect the water quantity and quality or other environmental resources of the stream.

The preamble to the 1983 rule states that “[i]t is impossible to conduct surface mining without disturbing a number of minor natural streams, including some which contain biota” and it clarifies that “surface coal mining operations will be permissible as long as environmental protection will be afforded to those streams with more significant environmental-resource value.” 48 FR 30313, June 30 1983. Furthermore, neither OSM nor the State SMCRA regulatory authorities have applied or interpreted the stream buffer zone rule as an absolute prohibition on the construction of excess spoil fills, refuse piles, slurry impoundments, stream crossing structures, or sedimentation ponds in streams when those activities inherently must be conducted in the stream, as is the case in many situations involving coal operations in steep slope terrain. In those cases, maintenance of an undisturbed stream buffer zone clearly makes no sense because the stream segments either will be buried or directly disturbed.

Alternative 1 – Changing the Excess Spoil and Stream Buffer Zone Regulations (OSM’s Preferred Alternative and the Most Environmentally Protective Alternative)

Excess spoil

This alternative would revise 30 CFR 780.35 and 784.19 to require that a permit application in which the applicant proposes to generate excess spoil include a demonstration, to the satisfaction of the regulatory authority, that the operation is designed to minimize, to the extent possible, the volume of excess spoil that the operation will generate, thus ensuring that spoil is returned to the mined-out area to the extent possible, taking into consideration applicable regulations concerning restoration of the approximate original contour, safety, stability, and environmental protection and the needs of the proposed postmining land use. The revised regulations would also require a demonstration, prepared to the satisfaction of the regulatory authority, that the designed maximum cumulative volume of all proposed excess spoil fills within the permit area is no larger than the capacity needed to accommodate the anticipated cumulative volume of excess spoil that the operation will generate, as approved by the regulatory authority.

The revised regulations also would provide that the applicant must design the operation to avoid placement of excess spoil in or within 100 feet of a perennial or intermittent stream to the extent possible. The purpose of this provision is to minimize adverse impacts on fish, wildlife, and related environmental values. If avoidance is not possible, the applicant would have to explain, to the satisfaction of the regulatory authority, why an alternative that does not involve placement of excess spoil in or within 100 feet of a perennial or intermittent stream is not reasonably possible. In addition, the applicant would have to identify a reasonable range of alternatives that vary with respect to the number, size, location, and configuration of proposed fills. The applicant would have to identify only those alternatives that are reasonably possible and that are likely to differ in terms of impacts on fish, wildlife, and related environmental values.

An alternative is reasonably possible if it conforms to the safety, engineering, design, and construction requirements of the regulatory program and is capable of being done after consideration of cost, logistics, and available technology. The fact that one alternative may cost somewhat more than a different alternative would not necessarily warrant exclusion of the more costly alternative from consideration. However, an alternative generally could be considered unreasonable if its cost is substantially greater than the costs normally associated with this type of project. In addition, to be considered reasonable, a potential alternative would have to be consistent with the coal recovery provisions of 30 CFR 816.59 and 817.59, which provide that mining activities must be conducted so as to maximize the utilization and conservation of the coal, while utilizing the best appropriate technology currently available to maintain environmental integrity, so that re-affecting the land in the future through surface coal mining operations is minimized.

The applicant would have to analyze the impacts of each of the identified alternatives on fish, wildlife, and related environmental values, taking into consideration both terrestrial and aquatic ecosystems. For every alternative that would involve placement of excess spoil in a perennial or intermittent stream, the analysis would be required to include an evaluation of the impacts on the physical, chemical, and biological characteristics of the stream downstream of the proposed fill, including seasonal variations in temperature and volume, changes in stream turbidity or sedimentation, the degree to which the excess spoil may introduce or increase contaminants, and the effects on aquatic organisms and the wildlife that is dependent upon the stream. If the applicant prepared an analysis of alternatives for the proposed fill under 40 CFR 230.10 to meet Clean Water Act requirements, the applicant could initially submit a copy of that analysis with the application in lieu of complying with the analytical requirements detailed in the preceding sentence. The regulatory authority would determine whether and to what extent the analysis prepared for Clean Water Act purposes satisfies the analytical requirements under this

alternative.

The applicant would be required to select the alternative with the least overall adverse impact on fish, wildlife, and related environmental values, including adverse impacts on water quality and aquatic ecosystems.

Finally, under the preferred alternative, we would revise the performance standards concerning excess spoil at 30 CFR 816.71 and 817.71 by adding a requirement that the permittee construct the fill in accordance with the design and plans approved in the permit. We also would add a provision requiring the permittee to place excess spoil in a location and manner that would minimize disturbances and adverse impacts on fish, wildlife, and related environmental values to the extent possible, using the best technology currently available.

Coal mine waste

This alternative would revise the coal mine waste disposal regulations in a similar fashion to what we proposed for excess spoil disposal. The permitting regulations at 30 CFR 780.25 and 784.16 would be revised to provide that the applicant must design the operation to avoid placement of coal mine waste in or within 100 feet of a perennial or intermittent stream to the extent possible. If avoidance is not possible, the applicant would be required to explain to the satisfaction of the regulatory authority, why an alternative coal mine waste disposal method or an alternative location or configuration that would not involve the placement of coal mine waste in or within 100 feet of a perennial or intermittent stream is not reasonably possible. If avoidance is not reasonably possible, the applicant would have to identify a reasonable range of alternative locations or configurations for any proposed refuse piles or coal mine waste impoundments. The applicant would have to identify only those alternatives that are reasonably possible and that are likely to differ in terms of impacts on fish, wildlife, and related environmental values.

An alternative would be reasonably possible if it conforms to the safety, engineering, design, and construction requirements of the regulatory program and is capable of being done after consideration of cost, logistics, and available technology. The fact that one alternative may cost somewhat more than a different alternative would not necessarily warrant exclusion of the more costly alternative from consideration. However, an alternative generally could be considered unreasonable if its cost is substantially greater than the costs normally associated with this type of project. In addition, to be considered reasonable, a potential alternative would have to be consistent with the coal recovery provisions of 30 CFR 816.59 and 817.59, which provide that mining activities must be conducted so as to maximize the utilization and conservation of the coal, while utilizing the best appropriate technology currently available to maintain environmental integrity, so that re-affecting the land in the future through surface coal mining operations is minimized.

The applicant would have to analyze the impacts of each of the identified alternatives on fish, wildlife, and related environmental values, taking into consideration both terrestrial and aquatic ecosystems. For every alternative that would involve placement of coal mine waste in a perennial or intermittent stream, the analysis would be required to include an evaluation of the impacts on the physical, chemical, and biological characteristics of the stream downstream of the proposed refuse pile or slurry impoundment, including seasonal variations in temperature and volume, changes in stream turbidity or sedimentation, the degree to which the coal mine waste may introduce or increase contaminants, and the effects on aquatic organisms and the wildlife that is dependent upon the stream. If the applicant prepared an analysis of alternatives for the proposed refuse pile or slurry impoundment under 40 CFR 230.10 to meet Clean Water Act requirements, the applicant could initially submit a copy of that analysis with the application in lieu of complying with the analytical requirements detailed in the preceding sentence. The regulatory authority would determine whether and to what extent the analysis prepared for Clean Water Act purposes satisfies the analytical requirements under this alternative.

The applicant would be required to select the alternative with the least overall adverse impact on fish, wildlife, and related environmental values, including adverse impacts on water quality and aquatic and terrestrial ecosystems.

Stream buffer zones

This alternative would add new regulations at 30 CFR 780.28 and 784.28 to establish permit application requirements and regulatory authority review responsibilities if mining or related regulated activities are proposed in or within 100 feet adjacent to a perennial or intermittent stream. The new requirements, which reflect the SMCRA provisions upon which the stream buffer zone rule is based, would replace the findings that the regulatory authority must make under existing 30 CFR 816.57(a)(1) and 817.57(a)(1) before authorizing activities within 100 feet of a perennial or intermittent stream. The findings in the existing rule include several Clean Water Act-related provisions that would be removed under this alternative.

When an applicant proposes to conduct activities in the stream itself, this alternative would require the applicant to demonstrate that avoiding disturbance of the stream is not reasonably possible. The applicant also would have to demonstrate that the activities will comply with all applicable regulations concerning use of the best technology currently available to prevent contributions of additional suspended solids to streamflow or runoff outside the permit area to the extent possible and to minimize disturbances and adverse impacts on fish, wildlife, and related environmental values to the extent possible. Before approving the proposed activities in the stream, the regulatory authority would have to prepare written findings concurring with those demonstrations.

When an applicant proposes to conduct activities within the buffer zone but not within the stream itself, this alternative would require that the applicant demonstrate that avoiding disturbance of the stream buffer zone either is not reasonably possible or is not necessary to meet the hydrologic balance and fish and wildlife protection requirements of the regulatory program. The applicant also would have to identify any lesser buffer zone that he or she proposes to maintain and explain how the lesser buffer zone, together with any other protective measures proposed, constitute the best technology currently available to prevent contributions of additional suspended solids to streamflow or runoff outside the permit area to the extent possible and to minimize disturbances and adverse impacts on fish, wildlife, and related environmental values to the extent possible. Before approving the applicant's proposed activities in the stream buffer zone, the regulatory authority would have to prepare written findings concurring with the demonstration and explanation in the application.

In all cases, this alternative would require that the applicant identify the authorizations and certifications that will be needed under the Clean Water Act and its implementing regulations. The alternative would clarify that, while the SMCRA permit may be issued in advance of any necessary Clean Water Act authorization, issuance of a SMCRA permit does not allow the permittee to initiate any activities for which Clean Water Act authorization or certification is needed.

Under the preferred alternative, we would revise the stream buffer zone performance standards at 30 CFR 816.57 and 817.57 to provide that the requirement to maintain an undisturbed buffer around a perennial or intermittent stream does not apply to those stream segments for which the regulatory authority approves one or more of the following activities:

- Diversion of a perennial or intermittent stream;
- Placement of bridge abutments, culverts, or other structures in or within 100 feet of a perennial or intermittent stream to facilitate crossing of the stream by roads, railroads, conveyors, pipelines, utilities, or similar facilities;
- Construction of sedimentation pond embankments in a perennial or intermittent stream, including the pool or storage area created by the embankment; and

- Construction of excess spoil fills and coal mine waste disposal facilities in a perennial or intermittent stream.

Each of these activities would remain subject to all other existing performance standards including standards that regulate the environmental impacts of the activities. Thus, for example, all surface activities conducted in or within 100 feet of a perennial or intermittent stream would be required to comply with SMCRA sections 515(b)(10)(B)(i) and 515(b)(24) and the various regulations implementing those statutory provisions.

Alternative 2 – January 7, 2004 Proposed Rule

This alternative would change the excess spoil regulations to minimize the volume of excess spoil and the adverse effects of excess spoil fill construction. In addition, it would change the stream buffer zone regulations at 30 CFR 816.57 and 817.57 as described in the January 7, 2004 Federal Register notice of the previous proposed stream buffer zone rule (see 69 FR 1036).

The stream buffer zone regulations would be revised but OSM would retain the prohibition on disturbance of land within 100 feet of a perennial or intermittent stream for surface coal mining operations and allow the regulatory authority to grant a variance to this requirement if the regulatory authority finds in writing that the activities would, to the extent possible, use the best technology currently available to:

- 1) Prevent additional contributions of suspended solids to the section of stream within 100 feet downstream of the mining activities, and outside the area affected by mining activities; and
- 2) Minimize disturbances and adverse impacts on fish, wildlife, and other related environmental values of the stream.

Essentially, Alternative 2 differs from Alternative 1 in the following respects: Under Alternative 2, the changes to the excess spoil regulations would be generally analogous to the changes described in Alternative 1, with the exception that an alternatives analysis would be required in every case in which an operation generated excess spoil, not just for those operations that propose to place excess spoil in or within 100 feet of a perennial or intermittent stream. In addition, Alternative 2 would not amend the coal mine waste disposal rules. With respect to the stream buffer zone rule, Alternative 2, unlike Alternative 1, would not establish separate permitting requirements for proposed activities in or within 100 feet of a perennial or intermittent stream. Unlike Alternative 1, Alternative 2 provides no exception from the requirement to either avoid the buffer zone or obtain a variance from the regulatory authority. The findings required for a variance also differ. Most significantly, under Alternative 2, applicants would not need to demonstrate—and the regulatory authority would not need to find—that it is not reasonably possible to avoid disturbing the stream or its buffer zone.

Alternative 3 – Change Only the Excess Spoil Regulations

This alternative would revise the excess spoil regulations as described in Alternative 1. No changes would be made to the stream buffer zone regulations.

Alternative 4 – Change Only the Stream Buffer Zone Regulations

This alternative would revise the stream buffer zone regulations as described in Alternative 1. No changes would be made to the excess spoil regulations.

B. Alternatives Not Carried Forward for Detailed Consideration

During the public scoping, OSM received numerous specific suggestions for additional ways that the requirements for excess spoil fill construction and stream buffer zones could or should be changed. Many of the concepts contained in the suggestions were incorporated into the preferred alternative. As discussed below, some suggestions conflict with existing SMCRA provisions or are not authorized under SMCRA. Those suggestions, while possibly viable if SMCRA were revised, are not reasonable alternatives for the purposes of this EIS because they are not consistent with the purpose and need for the Federal action covered by this EIS.

Below are eleven additional alternatives suggested by the public during scoping that OSM considered but dismissed from further detailed consideration.

- ***Alternative 5 – Delete the stream buffer zone regulations at 30 CFR 816.57 and 817.57 because they are redundant of other regulations that expressly require prevention of excessive sedimentation outside the permit area and minimization of adverse effects on water quality and quantity, fish, wildlife, and other environmental resources.***

This alternative would remove the stream buffer zone rule at 30 CFR 816.57 and 817.57 from the Federal rules. There are no provisions in SMCRA establishing a stream buffer zone. In fact, neither the term nor the concept appears anywhere in SMCRA. However, the legislative history of the Act indicates that Congress recognized that vegetative filter strips are an effective means to keep sediment from reaching streams:

Similarly, technology exists to prevent increased sediment loads resulting from mining from reaching streams outside the permit area. Sediment or siltation control systems are generally designed on a mine-by-mine basis which could involve several drainage areas or on a small-drainage-area basis which may serve several mines. There are a number of different measures that when applied singly or in combination can remove virtually all sediment or silt resulting from the mining operation. A range of individual siltation control measures includes: erosion and sediment control structures, chemical soil stabilizers, mulches, mulch blankets, and special control practices such as adjusting the timing and sequencing of earth movement, pumping drainage, and establishing vegetative filter strips.

H.R. Rep. No. 95-218, at 114 (1977) (emphasis added).

OSM continues to believe that stream buffer zones are one of the most effective means available for preventing excessive sedimentation in streams. As reflected in the scientific research referenced in and evaluated for this EIS, we also recognize that vegetative riparian buffers serve valuable ecological functions and that maintenance of stream buffer zones is an effective way to minimize the environmental harm to streams and riparian habitat. Thus, in general, stream buffer zones are the best technology currently available (BTCA) for implementation of SMCRA Sections 515(b)(10)(B)(i) and (b)(24). The concept of a stream buffer zone has been part of the Federal SMCRA regulatory program since its inception.

One of the reasons that we initiated this action was to clarify the scope and meaning of the stream buffer zone rule. Alternative 5 would not reduce regulatory uncertainty; rather, it would eliminate a provision that specifies as BTCA an effective and proven means of reducing environmental harm. Eliminating this provision would increase regulatory uncertainty because it would remove the default assumption under the Federal regulatory program that stream buffer zones are BTCA for purposes of the SMCRA provisions. For these reasons, this alternative is not

consistent with the purpose and need for this action. Therefore, we do not consider this alternative viable and will not further analyze or consider it.

- **Alternative 6 – Change the stream buffer zone regulation by eliminating the discretion to authorize variances. The 100-foot buffer between intermittent and perennial streams and surface mining activities would be absolute. No changes would be made to the excess spoil regulations.**

This alternative would amend the stream buffer zone rules at 30 CFR 816.57 and 817.57 to prohibit all surface coal mining and reclamation operations within 100 feet of a perennial or intermittent stream. During the process of adopting the current stream buffer zone regulation, OSM analyzed the effect of a similar proposal in the 1983 EIS. The alternative was rejected as not viable:

OSM could eliminate the exemption from the general stream buffer zone requirements (section 816.57), and all mining would be prohibited within 100 feet of any perennial or intermittent stream. Although this would provide maximum protection to streams, the potential impacts on coal recovery could be significant in those areas with large coal reserves and extensive water resources.

[OSM, 1983, p. IV-84].

In a variation of this alternative, the stream buffer zone rules at 30 CFR 816.57 and 817.57 would not be revised, but OSM would issue a policy interpreting the stream buffer zone rule in a manner that would not allow any major mining activity within 100-feet of a perennial or intermittent stream if that activity would have any adverse effects on the water quantity and quality or other environmental resources of the stream. This interpretation is similar to an interpretation in an October 20, 1999 opinion in *Bragg v. Robertson*, 72 F.Supp. 2d 642 (S.D. W.Va.) (reversed on appeal) (“*Bragg*”). That opinion held that the regulatory authority “has a nondiscretionary duty under the buffer zone rule to deny variances for valley fills in intermittent and perennial streams because they necessarily adversely affect stream flow, stream gradient, fish migration, related environmental values, water quality and quantity, and violate state and federal water quality standards.” 72 F.Supp. 2d 662. As noted, this decision was reversed on appeal, on jurisdictional grounds.

A study done in conjunction with the MTM/VF DPEIS indicates that restricting excess spoil fills to ephemeral streams would result in a significant reduction in coal resources recovered even when using every available fill site and alternative mining methods. The original plans for 11 mining operations reviewed would have produced 186 million tons of coal. Restricting fills to ephemeral streams would reduce total coal recovery to 16.8 million tons, a 90.9 percent reduction. [Sandberg et al. 2000, pp.1-4]

In March 2000, the Marshall University Center for Business and Economic Research prepared a special report for the West Virginia Senate Finance Committee to analyze the impact of the October 1999 *Bragg* decision. In that report, the authors stated that by “limiting the locations in which valleys may be filled by overburden from mountaintop mining, the Haden decision is likely to reduce the size of many surface operations or eliminate some entirely.” [Marshall 2000, p.23]

Approximately 235 million tons of the 1.1 billion tons of coal produced domestically in 2005 came from central Appalachia. Central Appalachian coal has a high heating value and low sulfur content. Central Appalachian provides most of the 23 million tons of metallurgical grade coal necessary for the iron and steel industry. Production of coal from this region is significantly diminished if this Alternative was implemented.

Prohibiting all surface activities in the stream buffer zone is not a viable alternative because it would significantly affect coal recovery in areas with extensive water resources in a way not

required or authorized by SMCRA. In addition, it would be inconsistent with SMCRA Section 102(f), which states that one of the purposes of the Act is to:

assure that the coal supply essential to the Nation's energy requirements, and to its economic and social well-being is provided and strike a balance between protection of the environment and . . . the Nation's need for coal as an essential source of energy.

30 U.S.C. 1202(f).

Excess spoil generation and fill construction is addressed in section 515(b)(22) of SMCRA, 30 U.S.C. 1265(b)(22), which acknowledges that some surface coal mining operations will generate excess spoil. Therefore, that section of the Act establishes requirements applicable to the construction of excess spoil fills. It was not the intent of Congress in SMCRA to prohibit this activity. In fact, Congress recognized that the controlled placement of excess spoil in stable structures such as fills was much better for the environment than disposing of this excess spoil downslope of the coal seam being mined, which was a technique often used before the passage of SMCRA. H. Rep. 95-493, 107 (1977); S. Rep. 95-128, 51, 115 (1977); H. Rep. 95-218, 67, 157 (1977). H.R. 6482, the 1972 precursor to SMCRA, included a provision that would have prohibited excess spoil fills. Congress ultimately deleted that provision from successor legislation. Thus an alternative that effectively prohibits excess spoil fills is inconsistent with the intent of Congress, as documented in the legislative history of SMCRA.

In addition, the legislative history of section 515(f) indicates that Congress anticipated that coal mine waste impoundments would be constructed in perennial and intermittent streams:

In order to assure that mine waste impoundments used for the disposal of liquid or solid waste material from coal mines are constructed or have been constructed so as to safeguard the health and welfare of downstream populations, H.R. 2 gives the Army Corps of Engineers a role in determining the standards for construction, modification and abandonment of these impoundments.

Thus, the Corps' experience and expertise in the area of design, construction, maintenance, et cetera, which were utilized for carrying out the congressionally authorized surveys of mine waste embankments in West Virginia following the disastrous failure of the mine waste impoundments on Buffalo Creek, is to be applied in order to prevent similar accidents in the future.

H.R. Rep. No. 95-218, at 125 (1977).

Section 515(f) of the Act provides that—

The Secretary, with the written concurrence of the Chief of Engineers, shall establish within one hundred and thirty-five days from the date of enactment, standards and criteria regulating the design, location, construction, operation, maintenance, enlargement, modification, removal, and abandonment of new and existing coal mine waste piles referred to in section 515(b)(13) and section 516(b)(5).

Sections 515(b)(13) and 516(b)(5) concern "all existing and new coal mine waste piles consisting of mine wastes, tailings, coal processing wastes, or other liquid and solid wastes and used either temporarily or permanently as dams or embankments." Nothing in sections 515(f), 515(b)(13), or 516(b)(5) specifically mentions streams or watercourses. However, the reference to dams and embankments, the requirement for the concurrence of the U.S. Army Corps of Engineers (for its expertise in dam construction and flood control), and the legislative history documenting that the 1972 Buffalo Creek flood and impoundment failures were the driving force behind adoption of

these provisions demonstrate that Congress was aware that coal mine waste impoundments had been constructed in perennial and intermittent streams in the past and construction is anticipated there in the future. Furthermore, the fact that all three paragraphs specifically apply to both new and existing structures (rather than just to existing structures) implies that new structures will and could occur in streams under SMCRA. As mentioned in the legislative history, Congress' intent was to prevent a recurrence of the Buffalo Creek impoundment failure and to ensure that all coal mine waste impoundments either are or were constructed in a manner that protects the safety of downstream residents. There is no indication that Congress intended to prohibit construction of those structures in perennial or intermittent streams.

Finally, sections 515(b)(11) and 516(b)(4) of the Act govern the construction of coal mine refuse piles that are not used as dams or embankments. While those paragraphs do not mention constructing refuse piles in watercourses, neither do they prohibit such construction. Because of the similarity of those piles to excess spoil disposal facilities, the regulations implementing sections 515(b)(11) and 516(b)(4) incorporate language similar to that of SMCRA Section 515(b)(22)(D) for the construction of excess spoil disposal facilities. Specifically, the regulations at 30 CFR 816.83 (a)(1) and 817.83(a)(1) allow the construction of non-impounding coal mine refuse piles on areas containing springs, natural or man-made watercourses, or wet weather seeps if the design includes diversions and underdrains. Thus, these provisions reflect OSM's recognition that Congress did not intend to prohibit these structures in streams.

Because this alternative is not authorized by SMCRA, and is inconsistent with one of Congress' explicit purposes for SMCRA, OSM does not consider this alternative consistent with the purpose and need for this action, and it is not further analyzed in this document.

- ***Alternative 7 – No changes would be made to either the excess spoil or stream buffer zone regulations, but OSM would develop policy directives and guidelines to minimize both the volume of excess spoil and the adverse environmental effects of excess spoil fill construction.***

Under this alternative, OSM would develop and distribute technical guidance and policy directives to address the generation and disposal of excess spoil and clarify the regulatory requirements regarding the stream buffer zone rule. In fact, OSM has developed such technical guidance for the Tennessee Federal program and has worked with the Kentucky, Virginia, and West Virginia state SMCRA regulatory authorities to draft guidance to minimize the volume of excess spoil generated. Under this alternative, OSM would also develop similar guidance related to the disposal of excess spoil, and policy directives to help clear up confusion regarding the stream buffer zone requirements.

Technical guidance is helpful but is unlikely to resolve the controversy surrounding interpretation of the stream buffer zone rule because guidance documents do not have the force and effect of regulations. Further, issuance of a guidance document would not significantly improve the stability and predictability of implementation of the stream buffer zone rule because guidance documents are often revised without notice and comment. Further, guidance that is deemed to establish requirements that are not clearly spelled out in the statute or regulations is subject to legal challenge under the Administrative Procedure Act. For the above reasons, OSM does not believe that this alternative satisfies the purpose and need for this action. Therefore, this alternative was not considered further.

- ***Alternative 8 – Prohibit excess spoil fills in perennial streams***

This alternative would amend the stream buffer zone rule at 30 CFR 816.57 and 817.57 to prohibit the placement of excess spoil in all perennial streams. As a variation of this alternative, excess spoil fills would be restricted to ephemeral streams; thus excess spoil would not be allowed to be placed in intermittent streams or perennial streams.

The premise of this alternative is that fills confined to stream segments in the upper reaches of watersheds would likely have fewer or less adverse aquatic impacts than fills placed lower in the watersheds. This presumes that an aquatic ecosystem, where flow only occurs in response to rainfall or where stream base flow may not persist year-round, is not as extensive or well-established as the aquatic ecosystem farther down the watershed where there is a greater stream base flow.

From an ecological standpoint, however, some stream segments in the upper reaches of watersheds are important aquatic habitats. Restricting fills to the uppermost stream segments does not recognize the importance of some upper stream segments as ecologically established aquatic habitats. Prohibiting placement of excess spoil in perennial streams would place an arbitrary and inflexible limitation on the ability of the regulatory authority and the mining operation to make site-specific determinations on how best to avoid or minimize placement of excess spoil in higher value intermittent and ephemeral streams. This alternative would preclude consideration of all relevant factors and their relative significance when designing fills to minimize adverse impacts of excess spoil on streams, aquatic resources, and related environmental values. Therefore, it does not appear that this alternative is consistent with SMCRA. Also, OSM has not identified a logical basis for prohibiting only excess spoil fills in areas where all other surface activities would be allowed. For the above reasons, OSM does not believe that this alternative satisfies the purpose and need for this action and this alternative is not considered further.

□ ***Alternative 9 – Prohibit excess spoil fills in intermittent and perennial streams***

This alternative would amend the stream buffer zone rule at 30 CFR 816.57 and 817.57 to prohibit excess spoil fills in intermittent and perennial streams but other mining activities are allowed if they complied with the conditions of that rule. This alternative would be significantly more restrictive than Alternative 8. It has the same defects that we identified in our discussion of Alternative 8. Therefore, for the same reasons that we identified with respect to that alternative, we do not consider this alternative consistent with the purpose and need for this action. This alternative is not further analyzed in this document. Please read the explanation provided in the discussion of Alternative 8.

□ ***Alternative 10 – Prohibit excess spoil fills in ephemeral, intermittent, and perennial streams***

This alternative would amend the stream buffer zone rule at 30 CFR 816.57 and 817.57 to prohibit excess spoil fills in ephemeral, intermittent, and perennial streams but other mining activities could be allowed if they complied with the conditions of that rule. This alternative would be more restrictive than Alternatives 8 and 9. It has the same defects that we identified in our discussion of Alternative 8. Therefore, for the same reasons that we identify with respect to that alternative, we do not consider this alternative consistent with the purpose and need for this action, and this alternative will not be further analyzed in this document.

□ ***Alternative 11 – Prohibit excess spoil placement in all valleys***

This alternative would amend the stream buffer zone rule at 30 CFR 816.57 and 817.57 to prohibit excess spoil fills in all valleys whether or not those valleys contained streams, but other mining activities are allowed if they complied with the conditions of that rule. This alternative is more restrictive than Alternatives 8, 9 and 10. The alternative is similar to Alternative 6 and the reader is referred to the explanation provided in the discussion of Alternative 6 and Alternative 10.

There are no performance standards in SMCRA that provide a basis for this limitation. Moreover, such a limitation would restrict the mine operator's ability to comply with SMCRA section 515(b)(22), which provides that surface coal mining and reclamation operations must—

Place all excess spoil material resulting from coal surface mining and reclamation activities in such a manner that ... spoil is transported and placed in a controlled manner in position for concurrent compaction and in such way to assure mass stability and to prevent mass movement.

30 U.S.C. 1265(b)(22)(A).

It is clear from this provision that SMCRA does not prohibit excess spoil fills. Rather, Congress recognized that the controlled placement of excess spoil in stable structures such as fills was much better for the environment than disposing of this excess spoil downslope of the coal seam being mined, which, as noted above, was a technique often used before the passage of SMCRA. H. Rep. 95-493, 107 (1977); S. Rep. 95-128, 51, 115 (1977); H. Rep. 95-218, 67, 157 (1977). H.R. 6482, the 1972 precursor to SMCRA, included a provision that would have prohibited excess spoil fills. Congress ultimately deleted that provision from successor legislation. Thus an alternative effectively prohibiting excess spoil fills would be inconsistent with the intent of Congress, as reflected in the legislative history of SMCRA.

There are no provisions in SMCRA that authorize prohibiting excess spoil fills in valleys in general or by a specific watershed size. In steep slope terrain, excess spoil fills constructed in valleys adjacent to mining areas frequently provide the only viable method of controlled placement of the large volume of excess spoil generated by these operations to achieve mass stability and prevent mass movement. Prohibiting placement of valley fills in all valleys could result in placing excess spoil material in less suitable locations. It also could reduce or curtail coal recovery. To the extent that this alternative would make surface mining infeasible, it could adversely affect national energy supplies. Such a result would be inconsistent with SMCRA section 102(f), which provides that one of the purposes of the Act is to--

assure that the coal supply essential to the Nation's energy requirements, and to its economic and social well-being is provided and strike a balance between protection of the environment and . . . the Nation's need for coal as an essential source of energy.

30 U.S.C. 1202(f).

Therefore, we do not consider this alternative consistent with the purpose and need for this action, and it is not further analyzed in this document.

Alternative 12 – Restrict excess spoil fills by providing a limitation based on fill size

This alternative would amend the regulations applicable to excess spoil to incorporate a maximum fill size threshold. This alternative assumes that OSM would limit the size of excess spoil fills by area or volume.

There are no performance standards in SMCRA that provide a basis for this limitation. Moreover, such a limitation would restrict the mine operator's ability to comply with SMCRA section 515(b)(22) which provides that surface coal mining operations must:

Place all excess spoil material resulting from coal surface mining and reclamation activities in such a manner that ... spoil is transported and placed in a controlled manner in position for concurrent compaction and in such way to assure mass stability and to prevent mass movement.

30 U.S.C. 1265(b)(22) (emphasis added).

In steep slope terrain, the excess spoil fills constructed in valleys adjacent to mining areas frequently provide the only viable method of controlled placement for the large volume of excess spoil that these operations generate to achieve mass stability and prevent mass movement. Limiting the size of valley fills would result in placing excess spoil material in less suitable locations or reduce or curtail coal recovery. To the extent that the alternative would make surface mining infeasible, it would adversely affect national energy supplies. Such a result would be inconsistent with SMCRA section 102(f), which provides that one of the purposes of the Act is to:

assure that the coal supply essential to the Nation's energy requirements, and to its economic and social well-being is provided and strike a balance between protection of the environment and . . . the Nation's need for coal as an essential source of energy.

30 U.S.C. 1202(f).

OSM has identified no sound scientific basis for restricting the size of excess spoil fills. To impose such a restriction without a sound scientific basis would ignore relevant site-specific factors and operational considerations, and would not give due consideration to actual environmental effects of the fill or of any alternatives. The 2005 MTM/VF FPEIS, which was the most comprehensive study of mountaintop mining and valley fills ever done on these mining practices, concluded:

Streams in watersheds where mountaintop mining – valley fills exist are characterized by an increase of minerals in the water as well as less diverse and more pollutant-tolerant macroinvertebrates and fish species. Questions still remain regarding the correlation of impacts to the age, size, and number of valley fills in a watershed, and effects on genetic diversity. Some streams below fills showed biological assemblages and water quality of good quality comparable to reference streams.

EPA 2005, p.4.

The 2005 MTM/VF FPEIS in addressing a public comment on why an alternative imposing strict limits on mountaintop mining–valley fills was not carried forward for detailed analysis stated:

Scientific data collected for this PEIS do not clearly identify a basis (i.e., a particular stream segment, fill or watershed size applicable in every situation) for establishing programmatic or absolute restrictions that could prevent “significant degradation.”

Id, p. 18.

The 2005 MTM/VF FPEIS primarily relied on the study “Ecological assessment of streams in the coal mining region of West Virginia using data collected by the U.S. EPA and environmental consulting firms” as the basis for the above conclusions [Fulk and others 2003, p. 53].

We have found no subsequent studies to refute or call into question these conclusions.

Because this alternative finds no authority in SMCRA, would impair implementation of SMCRA section 515(b)(22), and could frustrate implementation of one of Congress' explicit purposes for SMCRA, OSM does not consider this alternative consistent with the purpose and need for this action, and it is not further analyzed in this document.

- ***Alternative 13–Restrict excess spoil fills by providing a limitation based on watershed size.***

This alternative would amend the applicable excess spoil regulations to establish a maximum watershed size limit in which valley fills could be constructed. The watershed threshold is measured from the toe of the fill or possibly the outlet of the sedimentation pond below the fill,

and would encompass the entire watershed up gradient from this point. Variations of this alternative could consider watershed size thresholds (such as 640-, 250-, 150-, 75-, or 35-acre watersheds). This watershed size threshold is used as a surrogate for differentiating stream segments (i.e., ephemeral, intermittent, perennial flow) when determining the applicability of the stream buffer zone rule, or it could simply act as a threshold for applicability of excess spoil regulations. The rationale is that fills confined to smaller watersheds would generally have less aquatic impact than larger fills placed in larger watersheds.

While this alternative is viable, there is no scientific basis for establishing such a “bright line” watershed size threshold. As explained in the discussion of Alternative 12, the 2005 MTM/VF FPEIS on mountaintop mining–valley fills found that scientific data collected in preparation of the 2005 programmatic EIS found no clearly identified basis for establishing a programmatic or absolute restriction based on a particular stream segment, fill or watershed size applicable to every situation. [U.S. EPA 2005, p. 18]. Some streams below mountaintop mining operations with valley fills showed increased mineralization and less diverse macroinvertebrates and fish species, but some streams below those operations showed biological assemblages and good water quality compared to reference streams. [Id, p.4] Moreover, an inventory of excess spoil fills constructed in central Appalachia indicates that few fills would be affected by larger watershed size thresholds. Of the 6698 fills constructed in that region between 1985 and 2001, 97 percent of the fills were constructed in watersheds of less than 250 acres; and 76 percent of the fills were constructed in watersheds of less than 75 acres. [U.S.EPA 2003, D.II-4]

On the other hand, a sensitivity study of the economic effects of such watershed restriction indicated that a significant loss of coal reserves (45.0 percent) and surface mine capacity (31.6 percent) in central Appalachia would occur if the 75-acre watershed threshold was applied in the central Appalachia. [Hill & Associates 2003, p.12] The resulting impairment of coal recovery would be inconsistent with SMCRA Section 102(f), which states that one of the purposes of the Act is to:

assure that the coal supply essential to the Nation’s energy requirements, and to its economic and social well-being is provided and strike a balance between protection of the environment and . . . the Nation’s need for coal as an essential source of energy.

30 U.S.C. 1202(f).

OSM has found no environmental benefit and no scientific basis for restricting excess spoil fills by watershed size. And a restriction based on watershed size would unnecessarily impair the ability to implement the statutory directive to assure an adequate coal supply for our Nation’s energy requirements. Therefore, OSM does not consider this alternative consistent with the purpose and need for this action, and it is not further analyzed in this document.

- ***Alternative 14 – Restrict excess spoil fills by providing a limitation based on a percentage of streams in the watershed that can be impacted.***

This alternative would place an upper limit on the construction of new valley fills once a certain percentage of streams in a watershed are directly impacted by valley fills or other types of mining activities with similar impacts. There are a number of variations on this alternative. For example, it is possible to establish a threshold preserving 50 percent of headwater streams by prohibiting fills in one out of every two first-order streams; or preserving a stream length equal to the length of stream impacted by fills. This same alternative was considered and dismissed from further consideration in the MTM/VF FPEIS:

The existing data do not show that an across-the-board cumulative impact threshold could replace case-specific evaluations of all MTM/VF and other disturbances within a defined CIA/watershed.

U.S.EPA 2003, p.II.D-6.

That EIS further explained the difficulty based on current scientific data of establishing an across-the-board threshold to prevent “significant degradation”:

Scientific data collected for this EIS do not clearly identify a basis (i.e., particular stream segment, fill or watershed size applicable in every situation) for establishing programmatic or absolute restrictions that could prevent “significant degradation”. The data indicate that impacts may (or may not) be linked to the presence of mining, and not necessarily related to the size of fills...

The chemical and biological studies conducted for the EIS and the statistical analyses of those studies document that streams with both valley fills and residences in their watershed appeared to be impacted more than streams with only valley fills and no residences in their watersheds. Biological conditions in the streams with only valley fills represented a gradient of conditions from poor to very good; streams with valley fills and residences were most impacted. Impacts could include several stressors such as valley fills, residences, and/or roads. Therefore, a causal relationship between the impacts and particular stressors could not be established with the available data. Further, the EIS studies did not conclude that impacts documented below MTM/VF operations cause or contribute to significant degradation of waters of the U.S. [40 CFR 230.10(c)].

The overall aquatic impacts attributable to fills is highly site-dependent and a “one-size-fits-all” fill restriction standard is not justified at this time.

Id. p. II.D-9.

The basis for these conclusions in the programmatic EIS was the preliminary analysis stream data collected by EPA and environmental consulting firms. This conclusion was later reaffirmed in the report “Ecological assessment of streams in the coal mining region of West Virginia using data collected by the EPA and environmental consulting firms” [Fulk and others 2003, p. 53].

We have found no subsequent studies to refute these conclusions. In the preparation of this EIS, OSM has not found any scientific data to support substituting any of the above approaches for the case-by-case cumulative hydrologic impact assessment (CHIA) currently required under SMCRA Section 510(b)(3) and the Federal regulations at 30 CFR 780.21(g) and 784.14(f). A CHIA considers the effects of all existing and anticipated mining on surface- and ground-water quality and quantity within a watershed. The CHIA is used for the purposes of permit approval to ensure that the proposed operation is designed to prevent material damage to the hydrologic balance outside the permit area.

Because establishing a threshold as discussed in this alternative is not scientifically supported and is inconsistent with the case-by-case cumulative hydrologic impact assessment required by SMCRA and the Federal regulations, OSM does not consider this alternative consistent with the purpose and need for this action, and it is not further analyzed in this document.

- ***Alternative 15 – Restrict excess spoil fills by providing a limitation on the length of stream in a watershed that can be impacted.***

This alternative would impose a limit on the length of stream in a watershed that can be impacted by excess spoil fills. This alternative would establish a “bright line” threshold, but would ignore the complexities and variables that occur both in nature and in mining operations. OSM has identified no scientific data that would support such a threshold. Please read the discussion of Alternative 14 for additional reasons why this alternative will not be further analyzed in this document.

- **Alternative 16 – Increase the size of the stream buffer zone to 200, 300, 400, 1000, 2000 feet.**

OSM received several suggestions to consider increasing the current 100-foot width of the stream buffer zone by various distances. To the extent that commenters provided scientific data to support their suggestions, they did so primarily in the context of the value of buffers for terrestrial species. However, the width of the buffer established in our existing rules is based on sediment control and protection of aquatic ecosystems. We evaluated the adequacy of the current width by a review of current scientific research. Based on the review, discussed in Section III.I.1 of this EIS, that research generally supports the current 100-foot width.

In initially developing the stream buffer zone rule, we selected the 100-foot width based primarily on sediment control considerations. As we stated at 42 FR 62652, December 13, 1977, “The 100-foot limit is based on typical distances that should be maintained to protect stream channels from abnormal erosion.” Preambles to subsequent versions of the stream buffer zone rule mention the benefits that buffer zones provide to wildlife, but those benefits are ancillary to the primary purpose of the buffer zone, which is to protect the integrity of the stream.

In the preamble to the 1983 version of the stream buffer zone rule, we rejected comments suggesting buffer widths other than 100 feet, stating that—

The 100-foot width is used to protect streams from sedimentation and help preserve riparian vegetation and aquatic habitats. Since the 100-foot zone provides a simple and valuable standard for enforcement purposes, OSM has chosen not to change the general rule.

48 FR 30314, June 30, 1983.

Expanding the stream buffer zone based on the needs of terrestrial species has no sound scientific basis, for the purpose of the stream buffer zone rule, which focuses on protection of water quality and aquatic habitats. Furthermore, establishing a buffer zone width based on the needs of terrestrial species is not practical because the optimal width of the buffer zone for each species will vary considerably. In addition, as discussed in section III.I.1.a) of the EIS, a 100-foot buffer zone has considerable value as a connecting corridor for terrestrial species:

Very wide buffers of 300 feet or more are needed to protect diverse terrestrial communities; but even buffers of 50 feet, which contribute substantially to water quality and aquatic habitat goals, can offer good habitat to terrestrial species. [McNaught 2003, p. 8] A 100-foot riparian buffer zone may not provide adequate habitat for neotropical songbirds, but would provide a corridor for movement along patches of remaining forest. [Palone and Todd 1998, p. 6-11]

Other existing rules, including those at 30 CFR 780.16, 784.21, 816.97, and 817.97, are the standards for protection of fish and wildlife in general, including terrestrial wildlife. Those rules include special provisions for the protection of threatened and endangered (T&E) species, such as the Indiana bat, and their habitats.

Therefore, we decided not to carry this alternative forward for further analysis because there is no sound scientific basis for doing so with respect to sediment control and protection of aquatic habitats.

III. Existing Environment

A. General Setting – The Physical Environment

This Federal action is national in scope. It may have an effect anywhere that coal occurs in the United States and has the potential to be mined. Figure III-1 shows the known coal bearing areas of the United States. The human and natural environment where coal occurs varies widely.

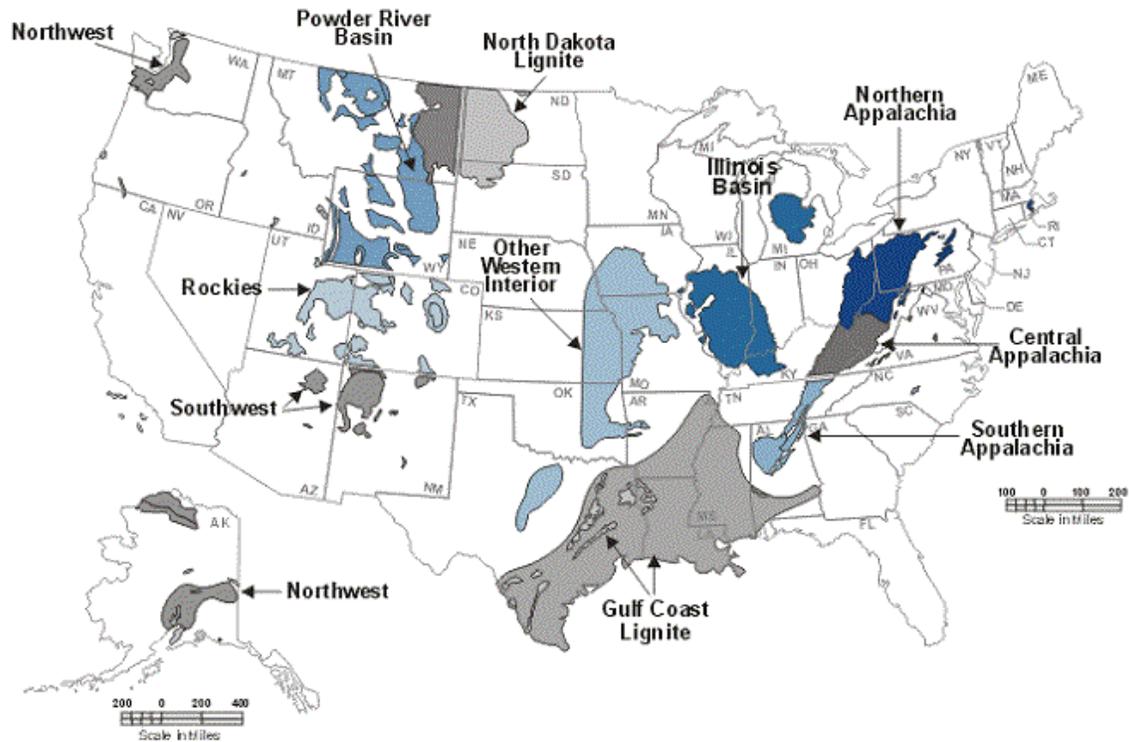
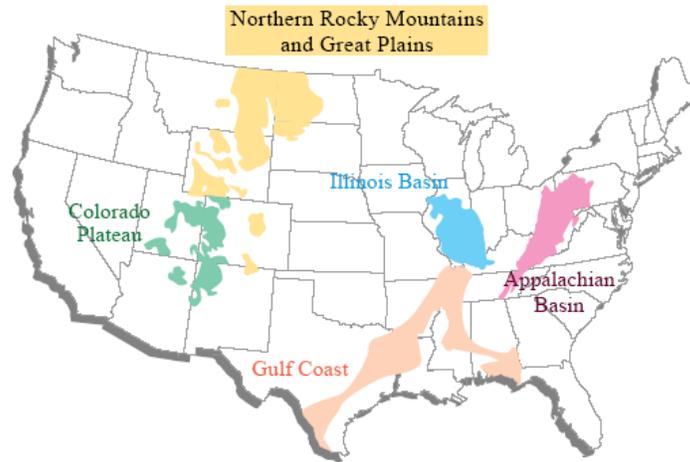


Figure III-1 – Distribution of U.S. coal resources (DOE-EIA)

In 2005, coal was mined within 26 states. The top ten coal producing states in 2004 by tonnage include: Wyoming (404.3 million tons), West Virginia (153.7 million tons), Kentucky (119.7 million tons), Pennsylvania (67.5 million tons), Texas (45.9 million tons), Montana (40.4 million tons), Colorado (38.5 million tons), Indiana (34.5 million tons), Illinois (32.0 million tons), and North Dakota (30.0 million tons). [EIA 2006]

This analysis will focus on five coal bearing areas of the United States where most of the coal is currently mined and where mining is likely to continue by surface mining methods in the next 20 – 30 years: Northern Rocky Mountains and Great Plains, the Appalachian Basin, the Colorado Plateau, the Illinois Basin, and the Gulf Coast. Figure III-2 shows the location of these areas.



Map source: Ruppert, L.F., 2001, Chapter A—Executive summary—Coal resource assessment of selected coal beds and zones in the northern and central Appalachian Basin coal regions, in Northern and Central Appalachian Basin Coal Regions Assessment Team, 2000 resource assessment of selected coal beds and zones in the northern and central Appalachian Basin coal regions: U.S. Geological Survey Professional Paper 1625-C, CD-ROM, version 1.0., Figure 1.

Figure III-2 – Identification of five major coal resources assessment areas

B. Northern Rocky Mountains and Great Plains

Of the five coal bearing areas, the Northern Rocky Mountains and Great Plains contain the most coal resources, over 655 billion tons [Flores and Nichols 1999, p.3]: a significant tonnage of which is extracted and will continue to be extracted by surface mining. Based on current knowledge, most of this coal, approximately 570 billion tons, is located in a coal field referred to as the Powder River Basin. [Id.] This coal field straddles northeastern Wyoming and eastern Montana.

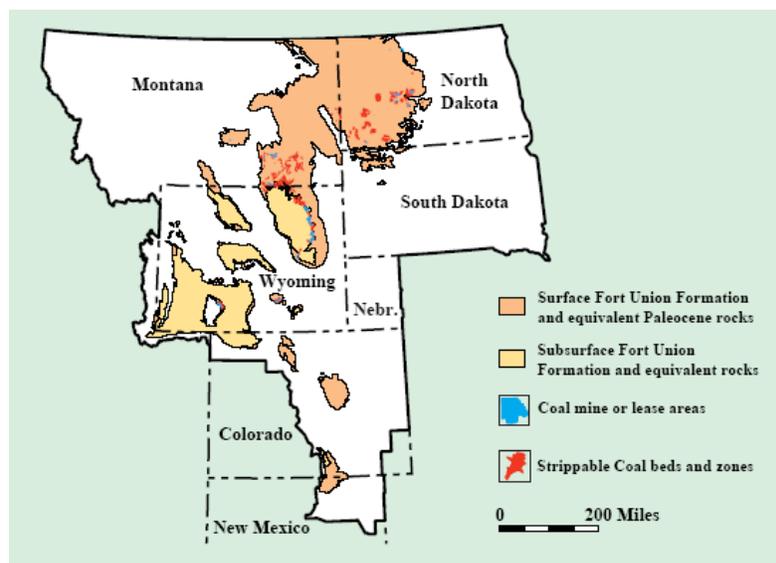


Figure III-3 – Distribution of coal resources in the Northern Rocky Mountains and Great Plains

The Northern Rocky Mountains and Great Plains coal bearing area is ecologically diverse, encompassing 24 very distinct ecological areas. Because most the coal resources occur in the Powder River Basin, this assessment will describe and focus on the ecological resources of this distinct ecological area shown in figure III-4 below.

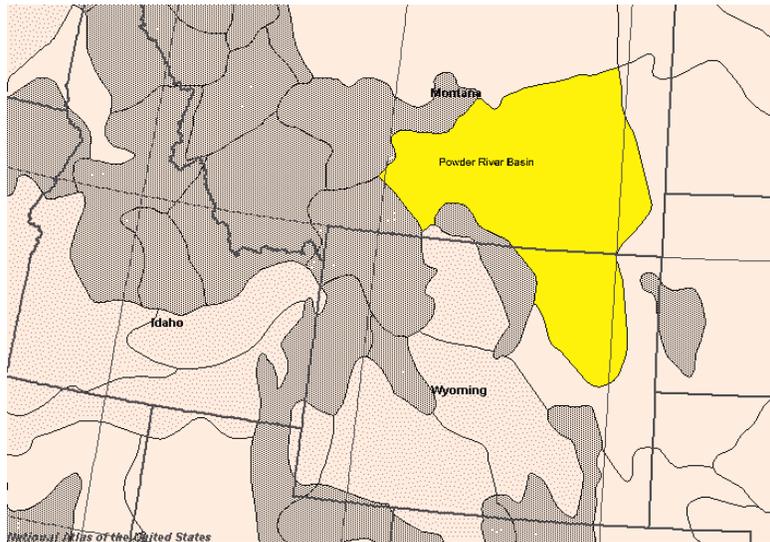


Figure III-4 – Location the Powder River of ecological area

1. The Powder River Basin

The Powder River Basin ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 41, Section 331G) consists of gently rolling to steep dissected plains on the Missouri Plateau. Wide belts of steeply sloping badlands border a few of the larger river valleys. In places, flat-topped, steep-sided buttes rise sharply above the surrounding plains. Elevation ranges from 3,000 to 6,000 feet. Low to medium density drainages¹ occur on more permeable surfaces. Large, shallow head basins underlain by coal or scoria are water collection areas. Much of the drainage pattern is structurally controlled. Streams are typically ephemeral or intermittent, and do not provide year-round water resources. [U.S. BLM 2003]

The climate is semi-arid, with average annual precipitation of just over 11 inches. June and May are the wettest months and February the driest. Snowfall averages 25.1 inches per year with the most occurring in March. The average daily mean temperature is 44.2 degrees F. July is the warmest month, with daily temperature of 70 degrees F, and January is the coldest (20.5 degrees F). [Id.]

Soils include Orthents, Orthids, Argids, Borolls, and Fluvents. Temperature regimes are generally frigid in the north and mesic in the south. These soils are mostly medium to fine textured and range from shallow to deep.

Natural vegetation consists predominantly of grama-needlegrass-wheatgrass. About 20 percent of the area supports eastern ponderosa forest. Dominant grassland species include western

¹ Drainage density is simply a length of stream per unit of area. Drainage density ranges from one to 1000 in nature. [Leopold et al.1964, p.143]

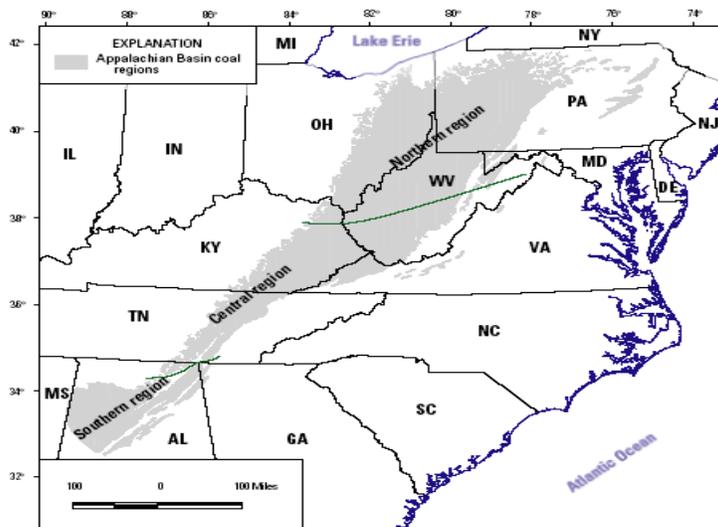
wheatgrass, blue grama, green needlegrass, bluebunch wheatgrass, and needleandthread. Little bluestem replaces bluebunch wheatgrass in the eastern part of the area. Basin wild rye and sagebrush occur along streams and on bottomlands.

Typical birds inhabiting the Powder River area include sagebrush obligates or specialists, such as sage grouse, sage thrasher, and sage and Brewer's sparrows; sage thrasher and sage sparrow near the edge of their ranges in this ecological area. Other specialists are ferruginous and Swainson's hawks, golden eagle, Say's phoebe, and McCown's longspur. Typical riparian species include Lewis' woodpecker, yellow warbler, and lazuli buntings. Several bird species that reach or nearly reach the extent of their ranges in this area are eastern screech-owl, red-headed woodpecker, Cassin's kingbird, pinyon jay, green-tailed towhee, and clay-colored sparrow. Typical herbivores and carnivores include white-tailed deer, mule deer, pronghorn, bobcat, and cougar. Smaller common herbivores include the white-tailed jackrabbit, white-tailed prairie dog, and black-tailed prairie dog. Less common is the black-tailed jackrabbit. The black-footed ferret is a rare species within this area. Bison are historically associated with this area. Herpetofauna include the Great Plains toad, snapping turtle, spiny softshell turtle, smooth green snake and prairie rattlesnake.

Fire and drought are the principal natural sources of disturbance.

C. The Appalachian Basin

The Appalachian Basin is one of the most important coal producing regions in the Nation and the world. Appalachian Basin bituminous coal has been mined throughout the last three centuries. The Basin has historically been subdivided into three coal regions -- the northern region, the central region, and the southern region -- based on geologic structure and stratigraphy. See figure III-5 below.



Map source: Ruppert 2001

Figure III-5 – Distribution of coal resources in the Appalachian Basin

Historically, the northern and central regions have played the dominant role in coal production. Of the estimated 34.5 billion tons of coal extracted from the Appalachian Basin, 18.4 and 14.4 billion tons were mined from the northern region and central region, respectively. The southern region is accountable for 5 percent of the production [Ruppert 2001, p.A1-3]. Coal quality issues,

especially sulfur content, play an increasingly important future role in Appalachian Basin coal production trends. The 2000 sulfur-dioxide-emission regulations [Clean Air Act Amendments of 1990, Public Law 101-549], which mandate maximum emissions of 1.2 lbs of sulfur dioxide (SO₂) per million Btu, favor production of central Appalachian Basin coal region coal beds and coal zones over northern Appalachian Basin coal region coal beds, because the northern region coal beds (Pittsburgh, Upper Freeport, and Lower Kittanning) are higher in ash and sulfur than the central region coal beds and zones (Fire Clay, Pond Creek, and Pocahontas No. 3). [Ruppert 2001, p.A13] The central Appalachian Basin region also contains the large remaining reserves of surface minable coal.

The central Appalachian Basin encompasses five distinct ecological areas: The Southern Unglaciaded Allegheny Plateau, the Allegheny Mountain, the Northern Cumberland Mountain, the Northern Cumberland Plateau, and Southern Cumberland Mountain. These areas are shown on figure III-6 and will be described below.

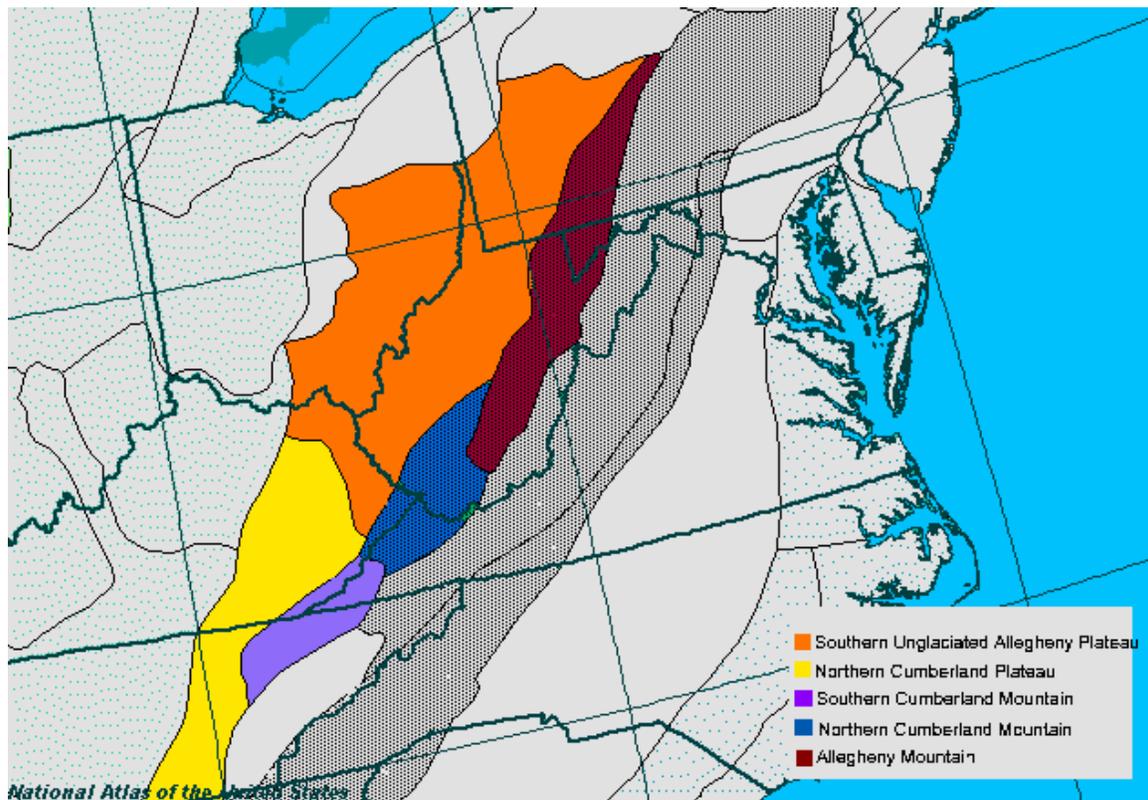


Figure III-6 – Locations of ecological areas with the Central Appalachian Basin

1. The Southern Unglaciaded Allegheny Plateau

The Southern Unglaciaded Allegheny Plateau ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 16, Section 221E) is part of the Appalachian Plateaus geomorphic province. It is a maturely dissected plateau characterized by high hills, sharp ridges, and narrow valleys. An exception is the broad Teays Valley, created by a major, preglacial river. Local relief exceeds 2000 ft along the New River Gorge, but is generally much less. Drainage is dendritic; mass wasting, karst solution, and fluvial erosion, and transport and deposition are the primary geomorphic processes operating. A notable but very minor landform is anthropogenic lands that were surface mined and exhibit hummocky or gouged topography. Elevation ranges from 650 to

1,300 ft. Local relief is generally about 160 to 325 ft.

Soils consist of Udalfs, Udults, and Ochrepts, in combination with mesic soil temperature regime, an udic soil moisture regime, and mixed or illitic mineralogy. Soils formed in parent materials divided into five groups: residual material, which developed in place by the weathering of underlying bedrock; colluvial material which weathered from bedrock strata transported by water and gravity to the lower slopes; alluvium, lacustrine sediments, and outwash deposited by water; loess deposited by wind; and mine spoil in areas that were surface mined for coal.

Natural vegetation is mixed mesophytic forest and Appalachian oak forest. Other recognized communities include mixed oak forest, oak-hickory-chestnut forest, oak-pine forest, hemlock forest, beech forest, floodplain forest and swamp forest.

Current mammal populations are typified by the white-tailed deer, gray fox, woodchuck, opossum, gray squirrel, white-footed mouse, and short-tailed shrew; more rare are the hairy-tailed mole, smoky shrew, and the rare eastern woodrat. The bison, elk, black bear, mountain lion, timber wolf, and bobcat, once common historically, were extirpated (except for small numbers of black bear and bobcat). Birds include the wild turkey, ruffed grouse, barred owl, pileated woodpecker, eastern phoebe, blue-gray gnatcatcher, Acadian flycatcher, white-eyed vireo, ovenbird, Kentucky warbler, yellow-breasted chat, and summer tanager. Some amphibians and reptiles include the red-spotted newt, dusky salamander, fence lizard, American toad, wood frog, box turtle, snapping turtle, painted turtle, ringneck snake, northern water snake, black rat snake, and copperhead. Rare reptiles include the timber rattlesnake and green salamander.

Southern redbelly dace, creek chub, barred fantail darter, and greenside darter are common in smaller streams. Black basses, sunfish, sauger, and catfish, the hybrid saugeye, and striped bass are common in the Ohio River and lower portions of its tributaries. Largemouth bass, bluegill, channel catfish, and crappie are found in the large, man-made reservoirs. This area contains mussel populations that have decreased greatly; many are on State and Federal threatened and endangered species lists.

The Southern Unglaciaded Allegheny Plateau is characterized by a relatively high density of streams, with gradients ranging from high, steep headwaters streams to low gradient rivers that flow into the Ohio River and larger tributaries. Some streams are underlain by relatively shallow silt, sand, or gravel alluvium, while others in the preglacial valleys are filled with deep glacial deposits. Bedrock is frequently exposed and consists of limestone, siltstone, sandstone, shale, and numerous coal seams. Small springs are numerous, but most are ephemeral. Natural streamflow and water quality characteristics were greatly modified by oil, gas, and coal extraction activities.

Historically, low-intensity fires probably occurred at a given site at five- to 10-year intervals. Fires of higher intensity occurred at intervals of up to 50 years. Dry ridges and slopes facing south to west burned more frequently than moist creek bottoms and slopes facing north to east. Annual spring flooding occurred annually to some degree along major rivers. The forests were probably affected locally by insect and tree diseases. Climatic-influenced disturbances included winter ice storms, occasional tornadoes, and periodic flooding along major river floodplains. Natural disturbances to the streams and rivers include floods and droughts. Man-made disturbances to streams include channelization, construction of locks and dams, and input of industrial waste, sewage, mining wastes, and soil.

About half of this area is forested, and the sale of wood fiber is important in some parts. Urban expansion, including industrial developments, is increasing along the Ohio River and its major tributaries. Since the time of settlement, lands which are level enough for agriculture have been cleared, especially on ridge tops and creek bottoms. Sites with either or both poor soils and severe erosion were abandoned and left to natural succession or planted with trees or grasses and forbs. Most slopes have been repeatedly logged. Surface mining for coal and oil and gas

exploration and production continue.

2. The Allegheny Mountains

The Allegheny Mountains ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 18, Section 221B) is in the Appalachian Plateaus geomorphic province. It is a maturely dissected plateau characterized by high, sharp ridges, low mountains, and narrow valleys. It has a prominent structural and topographic grain created by broad, northeast to southwest trending folds in the bedrock. Drainage is dendritic to trellis, but primarily the former. Mass wasting, karst solution, and fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 1,000 to 4,500 ft, with a few peaks higher, notably Spruce Knob (4,861 ft), the highest point in West Virginia. Local relief generally ranges from 1,000 to 2,500 ft.

Soils are dominantly Ultisols, Inceptisols, and Alfisols, with mesic temperature regime and udic moisture regime. They are derived from heavily weathered shales, siltstones, sandstone residuum and colluvium, and limestone residuum. Spodosols with frigid temperature regime and aquic moisture regime occur in isolated pockets at the highest elevations.

Natural vegetation is predominantly northeastern spruce-fir, northern hardwoods, mixed mesophytic, and oak-hickory-pine. Strongly influenced by elevation and aspect, the vegetation of the Allegheny Mountains is placed in four broad groups: red spruce, northern hardwoods, mixed mesophytic, and oaks. Red spruce is characteristic above 3,500 ft and includes stands of American beech and yellow birch. Beech is more common on northerly aspects, and yellow birch on southerly. The northern hardwood group features sugar maple occurring with beech and black cherry. The mixed mesophytic represents a transition to drier types and presents a wide variety of successional pathways. Characteristic species are red oak, basswood, white ash, and tulip poplar. The productive, diverse cove hardwoods are included in this group. Oak sites occur mostly on foothills.

The black bear is the sole representative of large carnivores. Fishers have been reintroduced with modest success. White-tailed deer are abundant and can impact understory flora. Varying hare, red squirrel, and the endangered Virginia northern flying squirrel are associated with the red spruce vegetation zone (above 3,500 ft). Elsewhere gray and fox squirrels are more abundant. Smaller mammals include the deer mouse, meadow jumping mouse, and various weasels, and bats. Birds include a wide variety of both residents and neotropical migrants. Ruffed grouse and wild turkey are prominent game species. Fish include brook trout and sculpins at higher elevations, with the addition of smallmouth bass, rock bass, minnows, and darters at lower elevations. The Cheat minnow is listed as a sensitive species, and some minnow and darter species in the New River basin are endemic. Amphibians and reptiles are abundant. The threatened Cheat Mountain salamander is found on high elevation red spruce and northern hardwood sites. Insect life is highly diverse. New butterfly and moth species are still being identified. Gypsy moths have impacted this area.

Surface water drainage pattern is well established, dendritic to trellis, but primarily the former. This area contains headwaters of the Cheat and Greenbrier Rivers, both of which eventually feed through other tributaries into the Ohio River. Wetlands are scarce.

Erosional processes over eons have been the primary disturbance agents. In the pre-European settlement era, fire was not a significant element of change because of the relatively high precipitation. The current forest was largely shaped by logging and associated fires from about 1880 to 1920. In some areas, notably those in the red spruce zone above 3,500 ft elevation, some areas burned so severely that soil was removed to the bedrock. These areas are now stunted forests with blueberry understories. Gypsy moths have impacted the oak trees in this area.

Timber production of high-valued hardwoods is a major industry. Agricultural pastures and hay meadows are common on river and stream flood plains and on limestone soils. Recreation use is relatively light but extensive, and includes hunting, fishing, camping, and hiking. Tourism is a growing industry. Settlements are small and dispersed. Surface mining for coal is and will continue as an important activity.

3. The Northern Cumberland Mountains

The Northern Cumberland Mountains ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 18, Section 221C) is in the Appalachian Plateaus geomorphic province. Synclinal structure resulting from folding, faulting, and uplift, followed by differential erosion, has resulted in long monoclinical mountains and dissected uplands. Landforms are mainly low mountains where less than 20 percent of the area is gently sloping. Drainage is dendritic to trellis; mass wasting, karst solution, and fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 2,000 to 2,600 ft. Local relief ranges from 100 to 300 ft.

Soils are mainly Ochrepts, Udults, and Aquults. On plateaus and upper slopes, Dystrochrepts, Hapludults, and Fragiudults have formed in material weathered from sandstone, siltstone, and shale on nearly level surfaces. Ochraquults are along foot slopes in weathered shale. Dystrochrepts have formed in alluvium. Soils have a mesic temperature regime, an udic or aquic moisture regime, and mixed mineralogy.

Natural vegetation is mixed mesophytic forest, Appalachian oak forest, and northern hardwoods. The predominant vegetation form is cold-deciduous broad-leaved forest with a mixture of evergreen needle-leaved trees. Existing forest types consist of oak-hickory. The component consists of white, black, scarlet, and blackjack oaks; common hickories include mockernut and pignut.

White-tailed deer occur throughout much of this area. The oak forest and the openings and farms within it provide food and cover for a varied fauna. The black bear is present in many areas. The wolf is no longer common, but the red fox and gray fox are widespread, as is the bobcat. Several species of squirrels are in the forest, and a number of smaller rodents inhabit the forest floor. The turkey, ruffed grouse, bobwhite, and mourning dove are game birds that inhabit this area. Songbirds include the ovenbird, red-eyed vireo, hermit thrush, scarlet tanager, blue jay, black-capped chickadee, wood pewee, magnolia warbler, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake, and timber rattlesnake.

Surface water consists of moderate density of small to medium intermittent and perennial streams and associated rivers, most with low to moderate rates of flow. A dendritic drainage pattern has developed with influence from the underlying bedrock.

Fire is probably the principal historical source of disturbance. Climatic influences include occasional summer droughts and ice storms. Natural vegetation has been cleared for agriculture and surface coal mining has disturbed about 5 percent of this area.

4. The Northern Cumberland Plateau

The Northern Cumberland Plateau ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 16, Section 221H) is in the Appalachian Plateaus geomorphic province. Broad uplift of gently-dipping strata to a level-bedded plateau, followed by fluvial erosion and

mass wasting, has resulted in a moderately dissected region of dendritic drainages. Landforms on about 80 percent of the area consist of high hills. Tablelands and open low mountains occur in the southern part of this area. Elevation ranges from 1,270 to 2,000 ft. Local relief ranges from 50 to 100 ft.

Soils are mostly Udults, with about 20 percent of the area in Ochrepts. Hapludults and Fragiudults are on side slopes and ridges. Dystrochrepts are in colluvium and Fluvaquents are on flood plains. These soils have a mesic temperature regime, an udic moisture regime, and mixed or siliceous mineralogy. Soils are medium to fine textured, shallow to deep, and generally have adequate moisture supply to support vegetation during the growing season.

Natural vegetation cover consists of mixed mesophytic forest and Appalachian oak forest. The predominant vegetation form is cold-deciduous broad-leaved forest with evergreen needle-leaved trees. The shortleaf pine-oak forest cover type dominates much of the area in Kentucky. The oaks on drier sites include post, southern red, scarlet, and blackjack; on moister sites, white and black oaks predominate. In Tennessee, the same oaks are present, but pines are not a dominant overstory component. Hickories, including pignut, mockernut, shagbark, and bitternut, are a common but minor component.

The primary game animals and furbearers in the Northern Cumberland Plateau are the white-tailed deer, gray fox, bobcat, raccoon, mink, muskrat, and gray squirrel. Black bears are now beginning to return after many years of absence. Some common and characteristic small mammals of forested habitats include the smoky shrew, pygmy shrew, short-tailed shrew, white-footed mouse, pine vole, and woodland jumping mouse. The sandstone cliff lines and associated rock shelters are used by the eastern spotted skunk, Allegheny wood rat, northern long-eared bat, Rafinesque's big-eared bat, and the Virginia big-eared bat. The wild turkey and ruffed grouse are the two principal game birds; songbirds include the solitary vireo, blue-winged warbler, black-throated green warbler, cerulean warbler, black and white warbler, American redstart, worm-eating warbler, ovenbird, and hooded warbler. The reptile fauna is quite varied; the northern copperhead, eastern garter snake, northern ringneck snake, black rat snake, five-lined skink, and eastern box turtle are frequently seen. Common amphibian species are the green salamander, Kentucky spring salamander, Black Mountain salamander, seal salamander, slimy salamander, spotted salamander, American toad, mountain chorus frog, green frog, pickerel frog, and wood frog. An endemic caddisfly lives on dripping cliffs at several locations.

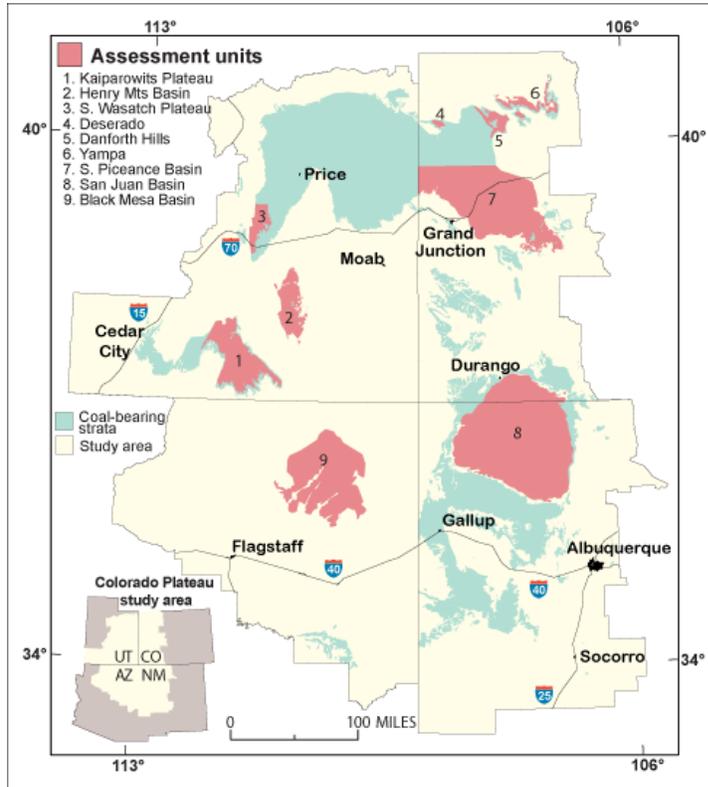
Fish are fairly common, with the exceptions of the eastern sand darter, spotted darter, tippecanoe darter, and the redbreast dace. The dace only occurs abundantly within a small range in Kentucky. Only a few small populations of Dace occur outside of Kentucky. The paddlefish and sturgeon, which were once fairly common in these larger waters, were impeded from most of their migration waters by impoundments and locks. These fish are by no means the only ones affected, but are good examples of the migration problems. Mussels include the elktoe, snuffbox, long-solid, sheepsfoot, and salamander. Mussel habitat and populations are hindered by impoundments.

Surface water consists of moderate to high density of small and medium perennial streams and associated rivers, most with moderate rates of flow and velocity. A dendritic drainage pattern has developed, with some influence from the underlying bedrock.

Fire is probably the principal historical source of disturbance, previously burning over moderately sized areas between natural barriers with moderate frequency and low intensity. Climatic influences include occasional summer droughts, winter ice storms, and tornadoes. Forests have been cleared for agriculture on about 20 percent of the area.

D. The Colorado Plateau

The third of the major coal bearing areas in the United States is the Colorado Plateau. The Colorado Plateau region contains a substantial quantity of high-quality, low-sulfur coal resources. The United States Geologic Survey estimates that over a half trillion tons of coal are present. A significant amount of this coal is mined by surface mining methods. Coal mining will continue in this region for the next 20 to 25 years. The exact locations of projected mining are not known but will likely occur within existing active mines or in adjacent leased areas of high-quality, low-sulfur coal resources. See figure III-7 below.



MAP SOURCE: Kirschbaum, M.A., Geologic Assessment of Coal in the Colorado Plateau: Arizona, Colorado, New Mexico, and Utah, U.S. Geological Survey Professional Paper 1625-B, Figure 2.

Figure III-7 – Distribution of coal resources in the Colorado Plateau

The estimated coal resources for the twelve specific assessment areas are shown in the table III-1.

Assessment area	Resources	Ash yield* (percent)	Sulfur* (percent)	Calorific value* (Btu/lb)
Bisti	1,600	22.9	0.5	8,130
Black Mesa	***	7.7	0.5	11,050
Danforth Hills	21,000	6.5	0.4	10,010
Henry Mountains	1,700	13.7	0.7	10,050
Kaiparowits Plateau	61,000	9.2	0.7	9,360
Lower White River	370	10.0	0.5	10,830
S. Wasatch Plateau	6,800	8.1	0.6	12,480
San Juan Basin	230,000	20.1	0.6	8,940
S. Piceance Basin	120,000	10.1	0.6	11,090
N. Wasatch Plateau	9,200	**	**	**
Somerset	3,100	10.6	0.6	11,730
Yampa	76,000	7.3	0.5	11,190
Grand total	530,000	10.2	0.6	10,790

* Median values on as-received basis ** N. Wasatch is combined with S. Wasatch *** not calculated

Table III-1 – Estimated coal resources within the Colorado Plateau

TABLE SOURCE: Kirschbaum, M.A., Geologic Assessment of Coal in the Colorado Plateau: Arizona, Colorado, New Mexico, and Utah, U.S. Geological Survey Professional Paper 1625-B, Figure 6. The quantity of coal resources is given in terms of millions of short tons and has been rounded to two significant digits. Note that the resources of the Black Mesa area are not included. The Arizona Bureau of Mines estimates the Black Mesa area contains 21 billions short tons of coal resources of which one billion may be surface mined.

The creation of the Grand Staircase-Escalante National Monument in 1996 will likely preclude mining of the Kaiparowits Plateau in Utah, and so it is not considered further in this EIS. The assessment will focus on the areas that are underlain by the most significant quantities of coal resources in this region: Black Mesa, Danforth Hills, San Juan Basin, S. Piceance Basin, and Yampa. These coal fields are located within six distinct ecological areas: Navajo Canyonlands, Tavaputs Plateau, White Mountain – San Francisco Peaks – Mongollon Rim, South-Central Highland, North-Central Highlands and Rocky Mountains, and Green River Basin. These ecological areas are shown in figure III-8 and are described below.

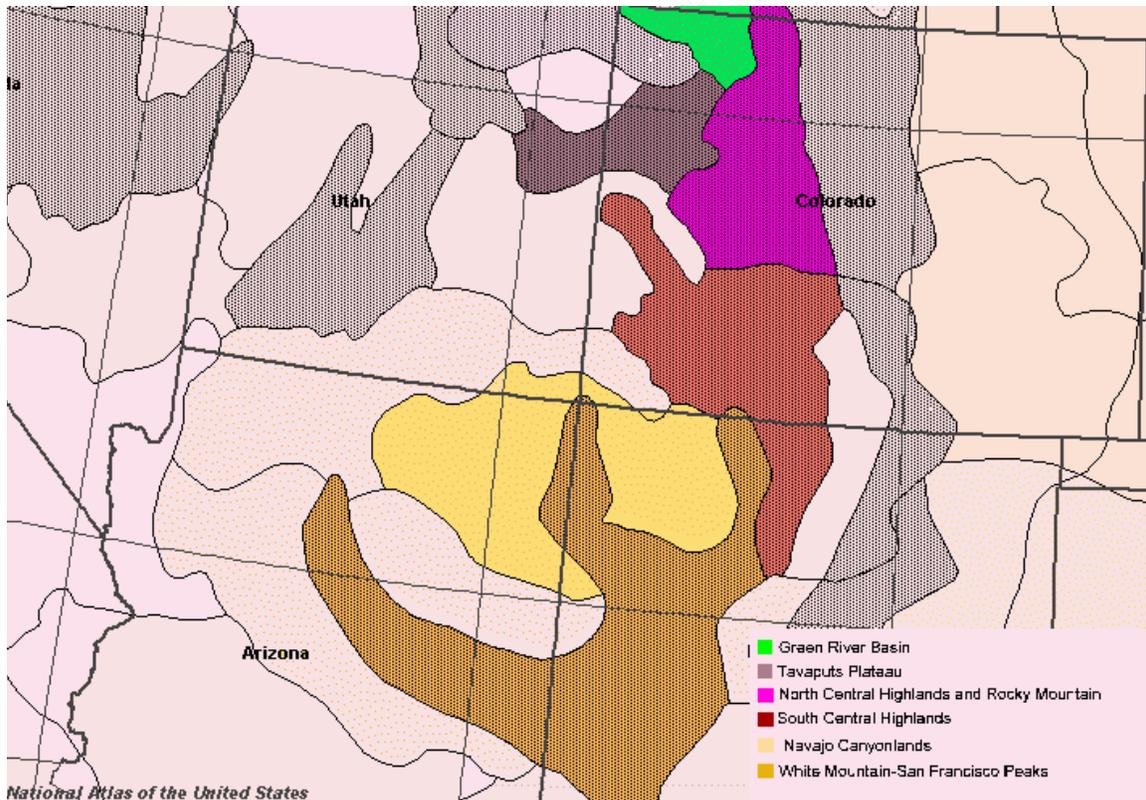


Figure III-8 – Location of ecological areas in the Colorado Plateau

1. The Navajo Canyonlands

The Navajo Canyonlands ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 36, Section 313B) in northwestern Arizona encompasses the Black Mesa coalfield. This area is in the Colorado Plateaus physiographic province. Geomorphic processes active in this area are deep canyon formations as the result of plateau dissection. Volcanic mountains also exist, but block-fault structural mountain ranges do not. Major landforms are canyonlands, plateaus, plains, and hills. Major landform features are the Painted Desert, Vermillion and Echo Cliffs, Glen Canyon Recreation Area, and Canyonlands National Park. Elevation ranges from 4,000 to 8,000 ft.

Soils include Haplustalfs, Calciorthids, Haplargids, and Ustochrepts, and a few Haplustolls, Calciustolls, and Argiustolls in combination with mesic soil temperature regimes, and ustic and aridic soil moisture regimes.

Natural vegetation consists of pinyon-juniper woodlands at higher elevations. Grama and galleta grasses are found at lower elevations; greasewood and saltbrush are found on calcareous and salt affected soils.

Fauna include pronghorn antelope, jackrabbits, desert mouse, and rattlesnakes.

Water is scarce. The Little Colorado River drains most of the area, but its flow is intermittent; water is commonly stored in small reservoirs.

Fires are variable in frequency and intensity. Flash floods and drought are common.

Approximately 90 percent of this area is rangeland. It is grazed by both cattle and sheep.

Although Paleo-Indian and Archaic hunting and gathering people utilized this area for thousands of years, it was the Anasazi farmers who left the most striking marks upon the land. Their settlements were located near water in or adjacent to pinyon-juniper woodlands, which offered abundant plant and animal resources used to supplement their crops. Most areas were somewhat marginal for agriculture, and communities continued to utilize nearby mountains and lower elevation areas for hunting and gathering activities. Eventually the Anasazi constructed impressive towns such as those in Chaco Canyon, Mesa Verde, and Tsegi Canyon. Paleontological studies indicate that the short duration of many sites is likely related to the need to re-locate due to depletion of wood resources needed for fuel and building materials. Local population pressure and a long period of drought are considered factors in the abandonment of most of this unit by the early 1300's and the subsequent aggregation of pueblo populations at Hopi, Zuni, and along the Rio Grande.

At the time of Spanish contact, the area was largely uninhabited except for the Hopi villages. Early Navajo and Apache and Ute peoples used the area for hunting, gathering, and some horticulture. Spanish use of the area was limited, and it was not until the mid 1800's that the American government led campaigns against the Navajo people and opened the area for settlement. Eventually, much of this area was included in the Hopi and Navajo Reservations. Overgrazing by sheep and a natural period of stream erosion around the turn of the century contributed to the landform characteristics visible today. Coal, oil, and gas commercial ventures in the northern portions of the area have historically operated intermittently. Since the early 1970s, two surface coal mines -- the Black Mesa mine and the Kayenta mine -- continue to operate. The vast majority of the area continues to be largely rural, with a few sizable towns. Grazing, agriculture, mineral development, and tourism contribute to the economy.

2. The Tavaputs Plateau

Tavaputs Plateau ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 49, Section M341B) is located in eastern Utah and western Colorado. The Danforth Hills coal bearing area occurs in the eastern boundary of the Tavaputs Plateau. The entire ecological area is contained in the Colorado Plateau physiographic province. Elevation in the Dansforth Hills area ranges from 6,200 to 8,700 ft.

Soils consist of Entisols and Aridisols in combination with mesic and frigid soil temperature regimes, along with aridic soil moisture regimes. Most soils have concentrations of calcium.

Vegetation in the area of the Dansforth Hills includes juniper-pinyon, black sagebrush, big sagebrush, mountain brush, Salina wild rye grasslands, ponderosa pine, aspen, Douglas fir, and spruce-fir.

Though moose probably are not indigenous, their range is now expanding into suitable habitat. Mountain bighorn sheep have been introduced in localized areas. Ring-necked pheasants, also introduced, are becoming more abundant. Fauna representative of desert shrub communities include rock wren, lark sparrow, sage sparrow, loggerhead shrike, horned lark, green-tailed towhee, Brewer's sparrow, red-tailed hawk, golden eagle, northern harrier, and kestrel. Pinyon-juniper and mountain brush communities support a variety of species, including mountain bluebird, blue-gray gnatcatcher, red breasted nuthatch, flycatcher, great horned owl and red-tailed hawk; obligate species include the pinyon jay and pinyon mouse. Fauna representative of high elevation sagebrush communities include sage grouse, mule deer, antelope, cougar, black bear, California myotis, and faded pygmy rattlesnake. Species representative of aspen and coniferous forest include brown creeper, western wood peewee, warbling vireo, MacGillivray's warbler, Townsend's solitaire, three-toed woodpecker, red-naped sapsucker, hairy and downy

woodpeckers, red-tailed hawk, goshawk, Cooper's hawk, and sharp-shinned hawk; red squirrel, northern flying squirrel, deer, elk, cougar, bear, coyote, and hoary bat; and milk snakes. Species representative of riparian areas include yellow warbler, tree swallow, western kingbird, house wren, rufous-sided towhee, song sparrow, loggerhead shrike, hairy woodpecker, red-tailed hawk, and golden eagle; deer, elk, moose, cougar, bear, beaver and silver-haired bat; and Utah tiger salamander.

Water is scarce over most of the area and is generally confined to steep canyons such as the White River, which forms the southern border of the Dansforth Hills. Lakes and reservoirs are few, and many water developments have been put on public lands to distribute to livestock and to provide water for wildlife.

Fires are common, with large grass and shrub areas burning rapidly. At higher elevations, small fires are common, generally caused by lightening. They are usually confined to aspect and vegetation type. These fires are generally not extensive.

Grazing, mining, recreation, and wildlife habitat are the major land uses. Hay and pasture land also occur to a very limited extent along drainage ways.

3. The White Mountain-San Francisco Peaks-Mogollon Rim

The White Mountain-San Francisco Peaks-Mogollon Rim ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 38, Section M313A) forms a large band that stretches across the entire width of Arizona into western New Mexico and southern Colorado. The band is narrowest in the west and broadens in the east. In New Mexico and Colorado, the White Mountain-San Francisco Peaks-Mogollon area encompasses much of the rim of the San Juan Basin coal field. The inner core of the San Juan Basin is primarily included in the South Central Highlands ecological area (a discussion of which will follow the White Mountain-San Francisco Peaks-Mogollon Rim description).

The White Mountain-San Francisco Peaks-Mogollon Rim ecological area is located in the Colorado Plateau physiographic province. Geomorphic processes active in this area include Cenozoic volcanism, including basaltic lava flows, cinder cone eruptions, and volcanic ash. Major landforms include mountains, plains, plateaus, and hills. Major landform features include the San Francisco Mountains, White Mountains, and Jemez and Mogollon Mountains. Elevation ranges from 6,000 to over 12,600 ft.

Soils include Eutroboralfs and Ustochrepts with frigid soil temperature regimes and ustic soil moisture regimes. There are Glossoboralfs, Dystrochrepts, and Udic Argiborolls in frigid-udic regimes and Cryoboralfs, and Cryochrepts in cryic-udic regimes. There is a limited amount of pergelic-udic Cryumbrepts.

Predominant vegetation consists of ponderosa pine and gambel oak in frigid soil temperature and ustic soil moisture regimes, and white fir and Douglas fir in frigid-udic regimes. Engelmann spruce and corkbark fir are in cryic-udic regimes and mountain avens are in pergelic-udic regimes.

This area is the primary watershed for much of Arizona and western New Mexico. Several large streams are perennial. Much of the water is stored in reservoirs, and small artificial lakes are common. Ground water is limited and usually occurs at great depths.

Natural fires occurred in ponderosa pine about every 3 to 10 years, but have been prevented recently. This has led to a higher canopy cover and increased fuel loads, resulting in a less resilient ecosystem and increased hazard of wildfire. Much of this area is covered with timber,

with rangeland and recreation being secondary uses. The northern part of the San Juan Basin is extensively drilled and produces coal methane. Surface coal mining occurs on the western and southern rim of the basin.

The White Mountain-San Francisco Peaks-Mogollon Rim ecological area encompasses primarily the mountainous ponderosa pine and transition zones of central Arizona and western New Mexico. Human groups have utilized this area's well-watered upland valleys and meadows, high mesas, and more sparsely forested basins and ranges for the full extent of human prehistory in the Southwest. Paleo-Indian and Archaic peoples utilized the mountains seasonally for hunting and gathering, as did later populations. Early agriculturalists made use of a wide variety of settings, including upland valleys, for their pithouse villages and planting areas. In later times, settlements concentrated more in the bottomlands of major drainages, but shifts to higher elevations occurred at various times and in various places in response to climatic fluctuations, population growth, and defensive concerns. The uplands include manifestations of a wide range of cultural traditions, including the Sinagua, Mogollon, Mimbres, and eastern and western Anasazi. By the mid-1300's, however, most of the area was abandoned as permanent or seasonal settlements. Sometime around or before the Spanish entrada into the Southwest, Athabascan speakers, such as the Apache and Navajo, made their appearance and continued to use the mountains for sustenance and for refuge well into the 19th century.

Spanish and Mexican use of most mountain areas was limited due to the presence of Apache and Navajo. In New Mexico, the Jemez Mountains were used by both Pueblos and Hispanic villagers for hunting, grazing, and fuel wood gathering in Colonial times. The discovery of mineral resources in the mid-1800's greatly increased American interest in the mountains, and military campaigns eventually removed the Apache and Navajo to reservations. The coming of the railroads in the 1880's made large-scale logging possible, especially evident in the White Mountains and Zuni Mountains. Ranching, mining, and logging were important pursuits in the early part of the 20th century, and continue today. Recreation and wilderness values are equally important on public lands. The mountains, particularly peaks like the San Francisco Peaks and Mt. Taylor, hold special cultural and religious significance for many contemporary Pueblos and tribes who continue to use the mountains for economic and ceremonial purposes. This area includes portions of the White Mountain Apache, Navajo, and Jicarilla Apache Reservations, as well as Acoma, Laguna, Jemez, and Zia pueblos.

4. The South-Central Highlands

The South-Central Highlands ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 43, Section M331G) contains the inner core of the San Juan Basin. The South-Central Highlands includes areas in northwest New Mexico and southwest Colorado. This area is characterized as having steeply sloping to precipitous mountains dissected by many narrow stream valleys with steep gradients. Upper mountain slopes and crests may be covered by snowfields and glaciers. High plateaus and steep walled canyons are common, especially in the west. Elevation ranges from 7,545 to 14,110 ft. While the South-Central Highlands includes the Fenneman and Johnson's Southern Rocky Mountains in the west, the San Juan Basin is located in the eastern half of the areas, which is part of the Colorado Plateau physiographic province.

Soils are frigid, cryic and pergelic temperature regimes, and aridic, ustic, and udic moisture regimes. Mollisols, Alfisols, Inceptisols, and Entisols are most dominant on the uplands. Great groups and suborder combinations at the higher elevations would include Cryoborolls, Cryochrepts, Cryumbrepts, Cryoboralfs. Haploborolls, Argiborolls, Haplustalfs, and Eutroboralfs are dominant at lower elevations. Valley bottoms and riparian areas have moist versions (aquic) of Mollisols and Entisols, and certain amounts of Histisols. Valley bottoms often contain Fluvaquents, Cryaquents, Cryaquolls, Haplaquolls, and Borohemists.

Vegetation-type includes shrub and grasslands, forests, and alpine tundra. Natural vegetation includes southwestern spruce--fir forest; pine--Douglas-fir forest; mountain mahogany--oak scrub; Great Basin sagebrush; juniper-pinyon woodland; and alpine meadows and barren.

Elk, mule deer, black bear, and mountain lion are common large mammals. Rocky Mountain bighorn sheep inhabit higher elevations, and moose have been recently introduced. Smaller mammals include beaver, marmot, snowshoe hare, pine marten, and pika. Common forest-dwelling birds are Steller's jay, grey jay, and Clark's nutcracker, and blue grouse. Mountain bluebird, broad-tailed hummingbird, and Swainson's hawk are typical summer residents. Herpetofauna present include western garter snake, chorus frog, and leopard frog. Native cutthroat trout have been displaced in parts of their former range by brook, rainbow, and brown trout.

Water from streams and lakes is abundant. Ground water is plentiful.

Fire, insects, and disease are principal sources of natural disturbance.

Agricultural land consists of farms and ranches. Most of the grassland and much of the open woodland is grazed. Some small valleys are irrigated. Recreation, mining, and timber harvest are also important land uses.

5. The North-Central Highlands and Rocky Mountain

North-Central Highlands and Rocky Mountain ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 43, Section 331H) contains the southeastern portion of the South Piceance coal basin, which is located in northwest Colorado. The remaining portion of the South Piceance coal basin occurs in the Tavaputs Plateau ecological area, which was previously described. While the North-Central Highlands and Rocky Mountain ecological area contains three physiological divisions: Fenneman and Johnson's Wyoming Basin in the north, Southern Rocky Mountains in the center, and the Colorado Plateaus in the south. The South Piceance coal field is limited to the eastern part of the Colorado Plateau. This area consists of gently rolling mountain parks, mountain ridges, and foothills. Elevation ranges from 5,600 to 12,000 ft.

Soils include Mollisols, Alfisols, Inceptisols, and Entisols, including Boralfs, Borolls, Ochrepts, Orthids, and Orthents. Natural vegetation includes the western spruce--fir forest, pine--Douglas-fir forest, juniper--pinyon woodland, mountain mahogany--oak scrub, and sagebrush steppe. Above timberline, alpine tundra predominates. At higher elevations types include Engelmann spruce, subalpine fir, Douglas-fir, ponderosa pine--Douglas-fir, aspen, and meadows of grass and sedge. At lower elevations, there are pinyon pine, shrubs, grass, and shrub-grass vegetation.

Large mammals include elk, mule deer, black bear, and mountain lion. Rocky Mountain bighorn sheep inhabit the higher elevations. Common smaller mammals include marmot, beaver, snowshoe hare, pika, and pine marten. Typical forest-dwelling avifauna include Clark's nutcracker, grey jay, northern flicker, and Steller's jay. White-tailed ptarmigan inhabit the higher elevations. Mountain bluebirds are common summer nesters. Herpetofauna include chorus frogs, leopard frogs, and western garter snakes. Native cutthroat trout were displaced in much of their former range by brook, rainbow, and brown trout.

In the mountains, water from streams and lakes is abundant, and ground water is plentiful. Snowfields exist on upper slopes and crests. The White River flows in north, the Colorado River through the center of the Piceance basin, and the Gunnison River borders the south.

Fire, insects, and disease are the principal sources of natural disturbance. The landuse in the South Piceance area is predominantly farms, ranches, and or grazing of cattle and sheep.

Recreation, mining, gas extraction and timber harvest are lesser land uses in this area.

6. The Green River Basin

The Green River Basin ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 48, Section 342G) contains the Yampa coal field which crops out along the Yampa River in northwestern Colorado. The area includes rugged hills and low mountains, with narrow valleys having steep gradients. Broad flood plains and fans are present on major rivers. Alluvial fans, piedmont plains, and piedmont slopes from the surrounding mountains join to form broad intermountain basins. Elevation ranges from 3,610 to 7,875 ft. This area is within Fenneman and Johnson's Wyoming Basin geomorphic physical division.

The temperature regime is frigid. Soils include Mollisols, Aridisols, and Entisols, including Borolls, Orthents, Fluvents, and Argids.

Natural vegetative communities include grasses to grass-shrub to forests. The area is classified as sagebrush steppe (sagebrush-wheatgrass), saltbush-greasewood, and wheatgrass-needlegrass shrub steppe.

Pronghorn use parts of the sagebrush ecosystem is rangeland throughout the year. Mule deer prefer to use sagebrush rangeland only during the winter. The Utah prairie dog is an endangered species of this ecosystem. Other mammals that use this ecosystem are the Great Basin coyote, black-tailed jackrabbit, pygmy cottontail, Ord's kangaroo rat, and the Great Basin kangaroo rat. Bird populations are low during the breeding season, averaging only about 25 per 100 acres. The major birds include the marsh hawk, red-tailed hawk, Swainson's hawk, Cooper's hawk, golden eagle, bald eagle, prairie falcon, burrowing owl, and the long-eared owl. The sage grouse and chukar are the important game birds found in this ecosystem. The fauna that are found in the desert shrub ecosystem (saltbush-greasewood community) are the cactus mouse, long-tailed pocket mouse, desert kangaroo rat, black-tailed jackrabbit, and the antelope ground squirrel.

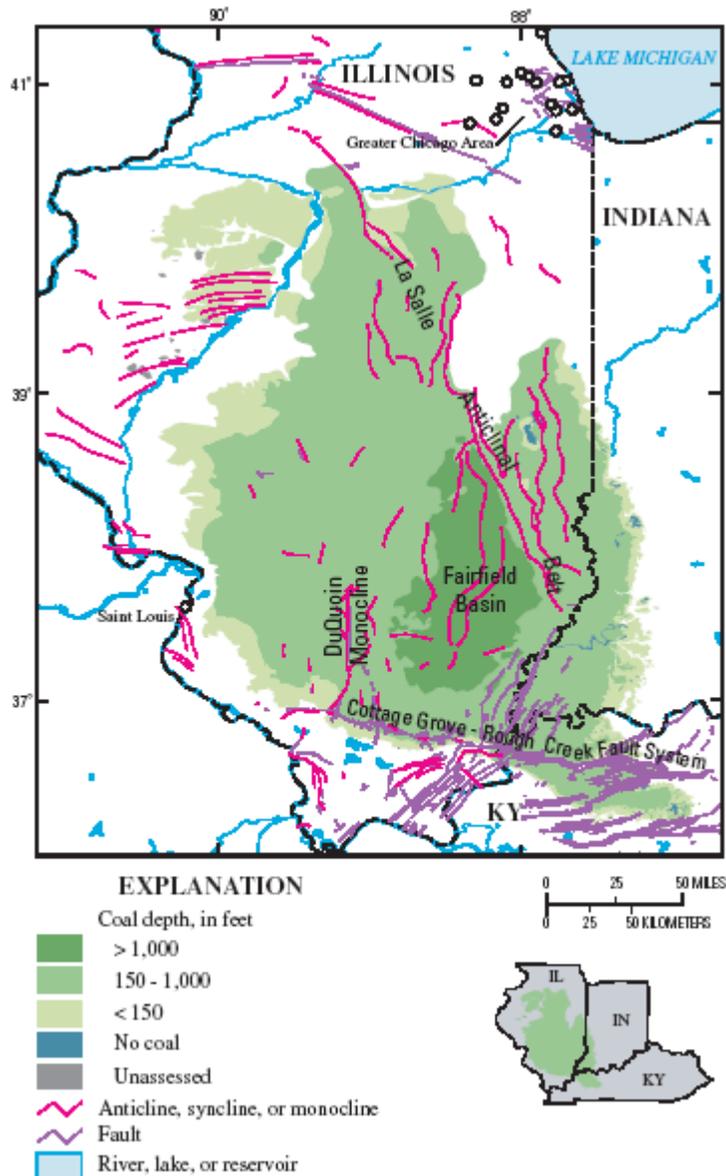
Water is scarce, but Yampa River and some major rivers and small streams flow through the area. Generally, ground water is meager or lacking in most areas, but it is abundant in the fill in some valleys. The Green and Lower Snake Rivers flow through here. Part of the Flaming Gorge Reservoir lies in this Section.

Primary sources of disturbance are fire, insects and disease. About 80 percent of the area is farms or ranches. About 50 percent of the area is grazed by sheep and cattle. Many of the valleys and tracts along a few large streams are irrigated, but they make up only 1 to 5 percent of the total area. About 20 percent of the area is dry farmed.

E. The Illinois Basin

The fourth major coal bearing area of the United States is the Illinois basin. Coal production in Illinois Basin began in the early 1800's. From 1890 to 1998, about 5.6 billion short tons of coal were produced from all mineable coals in Illinois, about 2.5 billion short tons in western Kentucky, and about 2.1 billion short tons in Indiana. A maximum of about 148 million short tons was produced from the basin in 1984. [USGS 2002, p.1] About 92.9 million short tons and 90.3 million short tons were produced in 2005 and 2004, respectively. [USDOE-EIA 2006, table 1]

The Illinois Basin contains approximately 145 billion short tons of remaining, identified coal resources of coal seams greater than 42 inches thick. Of which, 13.4 billion short tons are less than 150 feet from the surface. [USGS 2002, p.3] A map showing the distribution of coals in the Illinois basin is shown below.



Source: U.S. Geological Survey. 2002. Resource Assessment of the Springfield, Herrin, Danville, and Baker Coals in the Illinois Basin, U.S. Geological Survey Fact Sheet FS-072-02, Figure 2.

Figure III-9 – Distribution of coal resources in the Illinois Basin

The Illinois Basin encompasses three distinct ecological areas: The Central Loess Plains section in the northern portion of basin, the Central Till Plains Oak-Hickory section in the middle, and the Interior Low Plateau – Shawnee Hills section bordering the southern and extreme eastern part of the basin. Each ecological area is located in figure III-10 and will be discussed on the following pages.

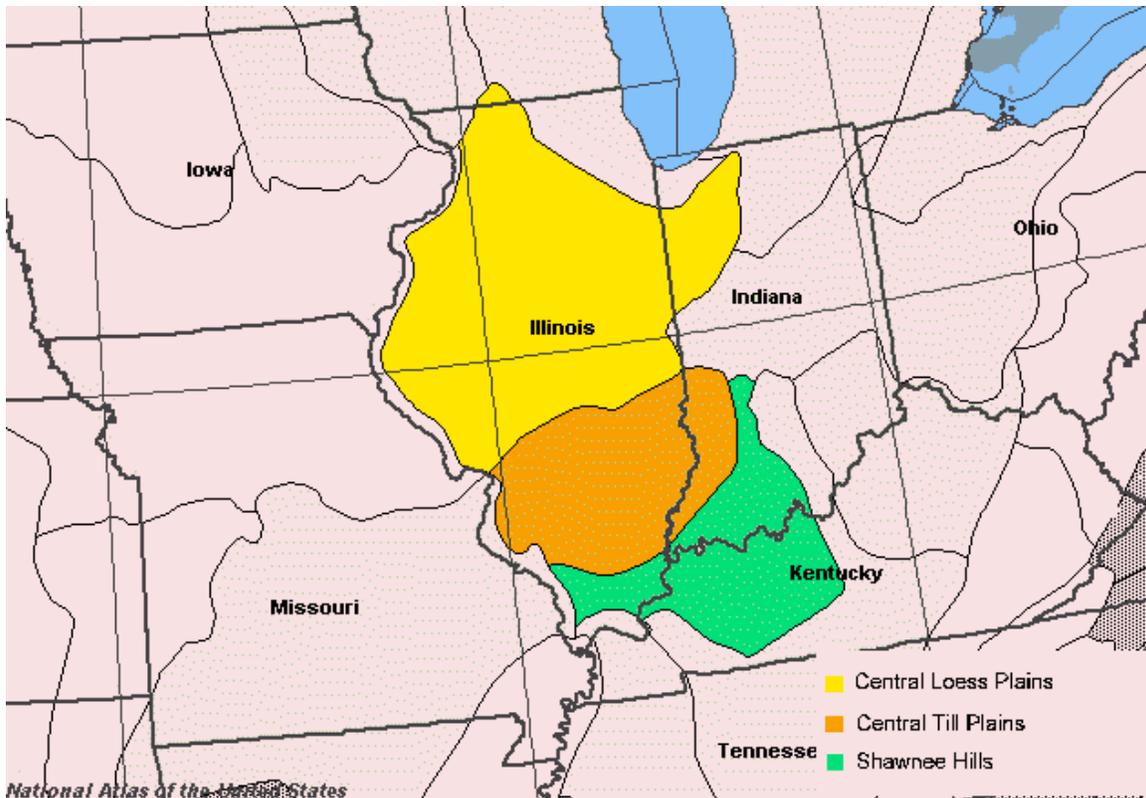


Figure III-10 – Location of the ecological areas within the Illinois Coal Basin

1. Central Loess Plains

Central Loess Plains ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 28, Section 251G) is characterized as being gently rolling smooth, and irregular plains mantled by loess. Drainage pattern cuts into upper loess mantle and exposes older Loveland loess. Stream valleys are narrow, not deeply incised. Local relief ranges from tens to hundreds of feet. The section is part of the Central Lowlands and Great Plains geomorphic provinces. Elevation ranges from 600 to 1,970 ft.

Soils include dry Mollisols and Entisols, Mesic Ustolls, and Udolls. Entisols, Mollisols, and Alfisols with udic and aquic moisture regimes occur along major drainages. The natural vegetation type consists of bluestem prairie with northern flood plain forest along major drainages.

White-tailed deer are now the most common large mammal. Smaller mammals include jack rabbits, cottontails, opossum, and many small rodents. Swift foxes, kit foxes, bobcats, and coyotes are predators. Bobwhites, horned larks, and meadowlarks are plentiful. Cooper's hawks, barred owls, and long-eared owls are year-round residents. Herpetofauna include snapping turtles, box turtles, bullfrogs, ringneck snakes, and bull snakes. Catfish species, largemouth bass, and black crappie are typical fish of the area.

Hard ground water is abundant in sand and gravel, but is scarce in areas where shale and clay are near the surface. There is a relatively low frequency of shallowly entrenched, slow flowing, and meandering streams. Also characteristic of this area are small marshes and prairie potholes, many of which were drained.

Drought and fire are probably the principal sources of natural disturbance. This area is highly productive farmland; about 60 percent is in crops and about 25 percent is used for grazing.

2. Central Till Plains

Central Till Plains ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 28, Section 251D) is part of the Central Lowlands geomorphic province. It is a level to gently rolling till-plain (glacial ground moraine), with broad bottomlands and associated terraces and meander scars along major river valleys. The plain is overlain by a series of low, undulating ridges (glacial end moraines). Relief along flood plain margins of major rivers and their larger tributaries can exceed 150 ft. Lands that were surface mined prior to SMCRA may exhibit humocky or ridge-swale topography. The dominant geomorphic processes operating in the area are fluvial erosion, transport and deposition, with minor mass wasting. Elevation ranges from 600 to 1,000 ft. Local relief is dominantly 3 to 100 ft, but ranges up to 165 ft along bedrock bluffs along some major streams.

Soils are mostly Udolls and Aquolls, with mesic temperature regime. Moisture regimes are udic and aquic. Soils tend to have relatively thick surface layers, darkened by decomposed organic matter. They are very productive for agricultural crops.

Natural vegetation type is principally tall grass prairie: variations of the big bluestem-indiangrass-prairie dropseed-switchgrass community; cord grass-sedge-blue jointgrass communities on wet sites; and little bluestem-side oats-grama on drier sites. Forest communities occur along stream valleys, white oak-black oak-shagbark hickory community on slopes, with basswood-sugar maple-elm-ash community on wetter, shaded sites. The area was mapped as oak savanna and oak-hickory forest.

Coyotes and bobcats prey upon small mammals such as the masked shrew, meadow vole, and western harvest mouse. Avian species such as the black-capped chickadee, northern harrier, upland sandpiper, long-eared owl, and Henslow's sparrow occupy the forest and grasslands; sora, black-crowned night herons, and the veery are found in the sedge meadows and swamps. The Illinois chorus frog, Kirtland's snake, the Plains leopard frog, and Illinois mud turtle typify present day herpetofauna. The yellow perch, striped shiner, silver jaw shiner, quiltback and silver redhorse are found in the major rivers and their tributaries.

There is a relatively low frequency of shallowly entrenched, slow-flowing, meandering streams. A few small marshes and prairie potholes remain.

Historically, major natural disturbances were prairie fires and grazing ungulates. Since settlement, most of the wetlands, marshes, and "prairie potholes" have been drained for agriculture, and virtually all prairie habitats were replaced with row crops or pasture. This area is largely highly productive agricultural land. Other land uses include roads, towns, and villages; minor amounts of coal and aggregate mining, and oil and gas production.

Prehistoric populations generally occupied the major river valleys; their subsistence and tool technologies relied on forest edge, riparian, aquatic and prairie habitats. Transportation and settlement were largely restricted to the major waterways. Population numbers continued to increase throughout prehistory; the pressure caused the most recent prehistoric (400 to 1450 A.D.) and historic (about 1450 to 1840) Native American groups to expand into the prairie interior. Early 19th century Euro-American settlement was also generally restricted to the major river valleys. Completion of the Illinois-Michigan Canal and the Illinois Central Railroad by the mid-1800's funneled increasing numbers of European immigrants into unsettled areas of the prairie. New technology and innovation enabled settlers to drain the extensive prairie wetlands (remnants of broad, shallow glacial lakes) and bring the black prairie soils into cultivation. This land is some

of the most fertile and, therefore, most valuable land in the Midwestern farm belt.

3. The Interior Low Plateau – Shawnee Hills

The Interior Low Plateau - Shawnee Hills ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 17, Section 222D) is part of the Interior Low Plateaus geomorphic province. Extensive sandstone bluffs, cuestas, rise up to 100 ft above the terrain in front of them and dip gently down the back slope. Other landforms include steep-sided ridges and hills, gentler hills and broader valleys, karst terrain, gently rolling lowland plains, and bottom lands along major rivers, with associated terraces and meander scars. Lands that were surface mined prior to SMCRA may exhibit hummocky or ridge-swale topography. Current geomorphic processes are fluvial erosion, transport and deposition; mass-wasting; and karst solution. Elevation ranges from 325 to 1,060 ft.

Soils were formed under deciduous forests from loess, residuum, and alluvium. The area is dominated by Ultisol and Alfisol soil orders. However, recent investigations indicate inclusions of the Inceptisol order. Soils are generally well drained to moderately well drained; the drainage for a few soils varies in degree but is generally poor. They have a mesic temperature regime, and predominantly an udic moisture regime.

Natural vegetation types include oak-hickory forest in the uplands of Illinois and Kentucky, and joined by maple-beech-birch in Indiana; oak-gum-cypress forest occupies the bottom lands throughout the section. Uplands are dominated by the white oak, black oak, shagbark hickory community; the black jack oak, scarlet oak, pignut hickory community occupies drier sites; the beech, tuliptree, bitternut hickory, sugar maple, white ash community occupies deep, mesic ravines. The southern flood plains along the Ohio and Wabash rivers are dominated by the sycamore, Kentucky coffee tree, sugarberry, and honey locust community, with local tupelo and cypress swamp communities.

Eastern gray squirrel and white-tailed deer are common. The marsh rice rat, cotton mouse, golden mouse, and Rafinesque's big-eared bat also occur. Canada geese and other waterfowl winter in large concentrations in the broader valleys and flat low lands of the region. Wintering populations of Ring-billed gulls are unique. Forest-interior birds such as the Cerulean warbler and the wood thrush live in the forested uplands, while the Swainson's warbler nests in the bottom land forests. The central newt, zigzag salamander, eastern mud turtle, and worm snake are prevalent present-day herptofauna. The clear rocky creeks are habitat for the least brook lamprey, black spottedtop minnow, and the spottail darter.

There is a moderate density of medium to large perennial streams and associated rivers, most with moderate volume of water at low velocity. Dendritic drainage has developed on a maturely dissected plateau, essentially without bedrock structural control, except where intense faulting occurs. There are few natural lakes except along the Ohio River, where oxbow lakes occur in flood plains. Uplands have some clear, rocky streams and creeks. Streambank and channel erosion and mass wasting can be observed along segments of some streams.

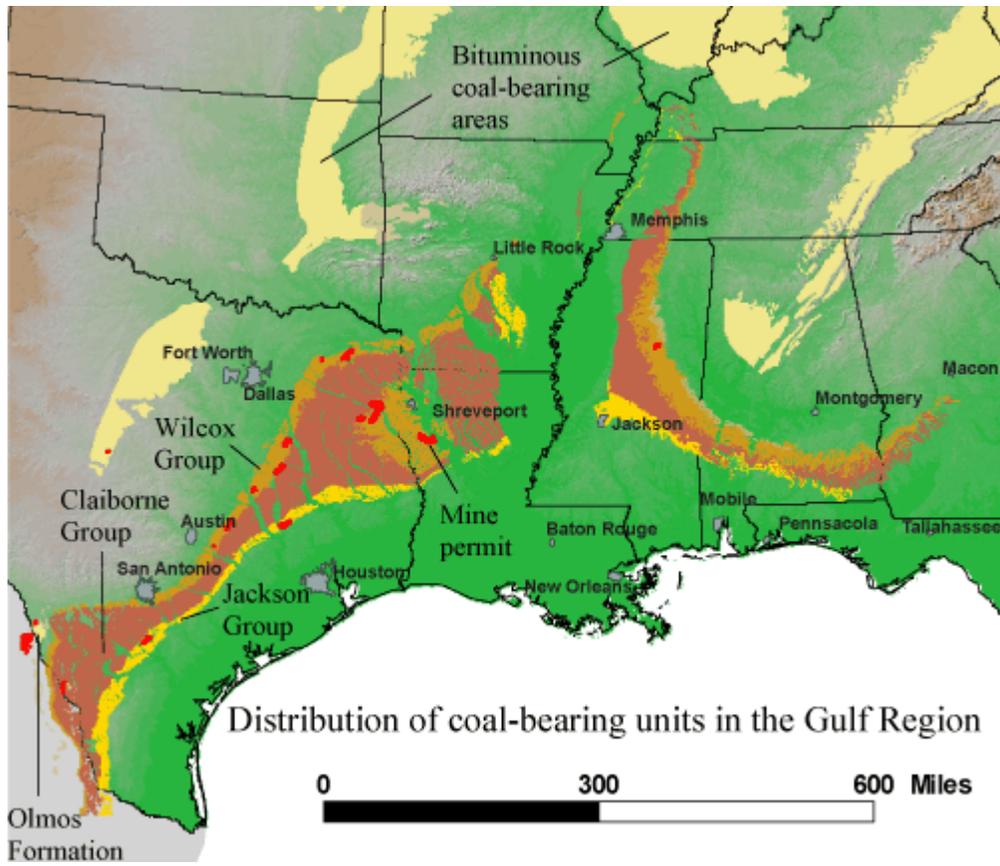
The natural communities were influenced by large herbivores such as elk, by insects and tree diseases, by windstorms, and by drought and fire. Drastic environmental influences on the generally forested hills discouraged trees and maintained openings, glades, on slopes; extensive, bushy grasslands, called barrens, occur on some of the drier sites. Large herbivores, drought, windstorms, insects, and tree diseases kept the forest canopy open and similar to a savanna on ridges. Occasional wildfires helped to maintain the hill-prairies, glades, and barrens. Most communities were affected by mass wasting, due to shale bedrock outcrops, thin soils, and frequent freeze-thaw conditions. Beaver affected timber in narrow flood plains. Anthropogenic disturbances dominate today (see below).

Prehistoric Native American activities had little effect on the area. After 1800, approximately 50 percent of the landscape was cleared and most wetlands drained by Euro-Americans for farming. Fires became more frequent during this period, as did erosion, as the hillslopes were denuded for timber and fuel. The landscape is now a patchwork of forest and agricultural lands, the former used for recreation, ecosystem maintenance, and wood-fiber production, the latter for grazing and row crops. Energy and mineral production have affected and continue to affect small portions of the landscape; coal, iron, lead, zinc, fluorite, limestone, sand, and gravel were mined since the mid-1800's. Oil and gas production began in the early 1900's.

The earliest inhabitants of the area (around 10,000 to 8,000 B.C.) were restricted to the higher elevations surrounding the remnants of the glacial lakes. Later prehistoric populations roamed across the Shawnee Hills, seasonally collecting plant foods such as nuts, seeds, fresh greens, and tubers, exploiting a rich faunal resource, and utilizing local minerals (ochre, clay, salt, chert, and fluorite). Due to agricultural innovations, latest prehistoric populations (900 to 1400 A.D.) largely inhabited the bottom lands of the Mississippi and Ohio Rivers although they continued to exploit the mineral, floral, and faunal resources of the interior hill region. Earliest Euro-American settlements (about 1700-1830) were generally located along the major transportation routes, including both overland trails and river corridors. Later settlers were attracted by the wooded hills of southern Illinois. The area was visually very similar to the lands they were migrating from, uplands of the southeastern United States. Their technology relied heavily on wood. Forested areas were necessary for housing, tools, food, fodder, and fuel, both for personal use and to supply charcoal to local iron works. This and their diversified agricultural methods created eroded hillsides characteristic of the early 20th century Shawnee Hills. As the population increased and the amount of arable land decreased, the ridge tops and hillsides were increasingly cleared for agriculture. This continued until the land was so depleted it was not possible to produce a viable crop.

F. The Gulf Coast

The Gulf Coast region (see the map below) is the fifth major coal producing area that is examined in this assessment. In 2005, the region produced about 53.7 million short tons of coal [USDOE – EIA, 2006, table ES-2], which is about one twentieth of coal produced in the United States. Most of this coal, approximately 45.9 million tons was extracted in Texas. [Id.] Coal is mined exclusively by surface mining methods. In Texas, resource estimates of near surface (20 to 200 feet deep) bituminous coal is 786 million tons and for lignite 23.4 billion tons. For deeper resources (200 feet to 2000 feet), it is estimated that 4.7 billion tons of bituminous coal may exist and 27.5 trillion tons of lignite. The resource estimates are based on limited information. The resources estimates for lignite are based on comprehensive geologic evaluations made by the Texas Bureau of Economic Geology, and the bituminous estimate is based on a 1967 study of bituminous coal resources by the U.S. Geological Survey (USGS). [Kaiser 2001, p. 616] USGS is currently updating an assessment of coal resources in the Gulf Coast. Lesser amounts of lignite resources occur and/or mined in Louisiana, Mississippi, Alabama, Arkansas, Tennessee, and Georgia.



Map Source: USGS, Gulf Coast Assessment Region, http://energy.er.usgs.gov/ncra/Gulf_Coast_A.htm

Figure III-11 – Distribution of coal resources in the Gulf Coast

The Gulf Coast coal region falls within six distinct ecological areas: The Rio Grande Plain, the Oakwood and Prairies, the Coastal Plains and Flatwoods – Western Gulf Section, Mid Coastal Plains – Western section, Coastal Plains – Middle Section, and the Coastal Plains and Flatwoods - Lower Section. These ecological areas are shown in figure III-12 and will be described on the subsequent pages.

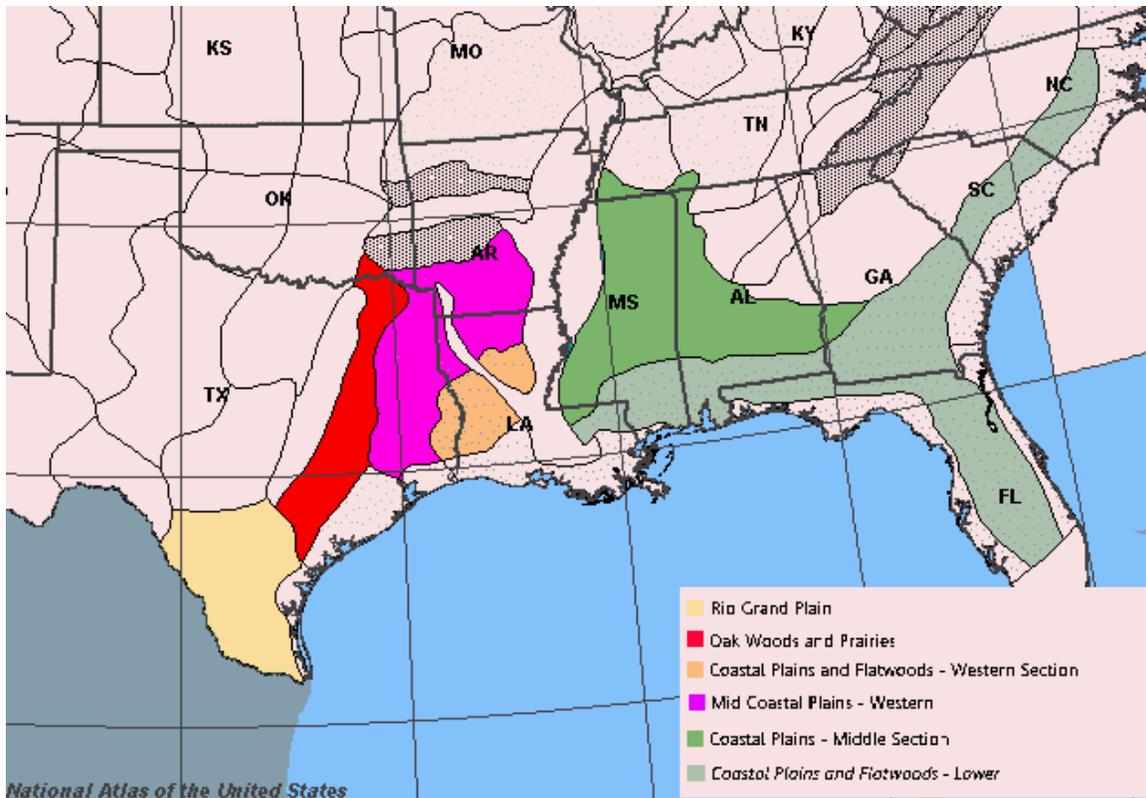


Figure III-12 – Location of relevant ecological areas in the Gulf Coast region

1. The Rio Grande Plain

The Rio Grande Plain ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 37, Section 315E) is the Coastal Plains geomorphic province. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Elevation ranges from 80 to 1,000 ft. Local relief ranges from 100 to 300 ft.

Soils are Usterts, Torrerts, and Ustalfs. Pellusterts are on plains over clayey marine sediments. Paleustalfs are on eolian plains. Torrerts, Haplustolls, Calciustolls, Paleustalfs, and Haplustalfs are on plains. Calciustolls and Calciorthids are on plains over marine sediments. Soils have a hyperthermic temperature regime, a ustic or aridic moisture regime, and mixed mineralogy. Soils are mostly deep, fine to coarse textured, well drained, and have limited soil moisture for use by vegetation during the growing season.

Natural vegetation is classified as mesquite-acacia-savanna and ceniza shrub. The predominant vegetation form is short grassland with a sparse cover of drought deciduous shrubs. Species include mesquite, cactus, and tall and mid grasses. Live oaks and cottonwoods may be present along stream banks.

Typical large to medium size herbivores and carnivores include coyote, ringtail, hog-nosed skunk, and ocelot. Smaller herbivores include Mexican ground squirrel, Texas pocket gopher, and southern plains woodrat. Bats include the ghost-faced and Sanborn's long-nosed. Bison, jaguar, and jaguarundi are historically associated with this area. This area forms the northern range of a number of birds common to Mexico and South America. Typical birds include chachalaca, green

kingfisher, pauraque, elf owl, white-winged dove, red-billed pigeon, black-headed oriole, kiskadee flycatcher, yellow-green vireo, Lichtenstein's oriole, tropical kingbird, beardless flycatcher, buff-bellied hummingbird, green jay, long-billed thrasher, and white-collared seedeater. Amphibians include Mexican burrowing toad, Rio Grande leopard frog, sheep frog, giant toad, spotted chorus frog, Mexican tree frog, Rio Grande chirping frog, and Berlandier's tortoise. Reptiles include Texas banded gecko, reticulate collared lizard, spot-tailed earless lizard, keeled earless lizard, blue spring lizard, mesquite lizard, rose-bellied lizard, Laredo striped whiptail, black-striped snake, indigo snake, speckled racer, and cat-eyed snake.

A sparse density of small to medium intermittent streams is present in a dendritic drainage pattern.

Drought was probably the principal historical disturbance. Natural vegetation has been converted to dry-land pasture for cattle grazing on about 90 percent of the area.

2. The Oak Woods and Prairies

The Oak Woods and Prairies ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 29, Section 255C) is in the Coastal Plains geomorphic province. The predominant landform on about 80 percent of this area consists of irregular plains. Other landforms include plains with hills and smooth plains. This area is an elevated sea bottom that has been shaped by marine and shore-zone processes resulting from repeated episodes of submergence and emergence of the land from the ocean. Some geomorphic processes currently active throughout the area are gentle gradient valley stream erosion, transport and deposition. Elevation ranges from 650 to 1,310 ft. Local relief ranges from 100 to 300 ft.

Soils are mostly Ustalfs. Paleustalfs and Albaqualfs are on uplands and other areas with thick sandy surface. Pelluderts, Pellusterts, and Hapludolls are on flood plains and clayey terraces along major rivers. These soils have a thermic temperature regime, an ustic moisture regime, and montmorillonitic mineralogy. Soils are deep, medium textured, and generally have a slowly permeable, clayey subsoil. Moisture may be limiting for plant growth during parts of the year.

Natural vegetation community is oak-hickory forest, cross timbers (*Quercus-Andropogon*), and juniper-oak savanna. The predominant vegetation type is cold-deciduous, broad-leaved forest. The oak-hickory cover type consists of scarlet, post, and blackjack oaks, and pignut and mockernut hickories. Forests of elm, pecan, and walnut are in bottomlands. Little bluestem is the dominant grass.

Common large herbivores and carnivores include coyote, ringtail, ocelot, and collared peccary. Smaller herbivores include plains pocket gopher, fulvous harvest mouse, northern pygmy mouse, southern short-tailed shrew, and least shrew. Birds include many wide-spread species, such as eastern bluebird, eastern meadowlark, grasshopper sparrow, mourning dove, Cooper's hawk, and mockingbird. Amphibians and reptiles include eastern spadefoot toad, Great Plains narrow-mouthed frog, green toad, yellow mud turtle, Texas horned lizard, Texas spiny lizard, and Texas blind snake.

There is a low density of small to medium size perennial streams and associated rivers, most with moderate volume of water flowing at low velocity.

Fire and drought have probably been the principal historical disturbances. Natural vegetation was converted to agricultural crops on about 75 percent of the area.

3. The Coastal Plains and Flatwoods – Western Gulf

The Coastal Plains and Flatwoods - Western Gulf ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 21, Section 232F) is in the Coastal Plains geomorphic province. The predominant landform consists of weakly to moderately dissected irregular plains of alluvial origin formed by deposition of continental sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. About 80 percent of this area consists of irregular plains. Other landforms include flat plains and plains with hills. Elevation ranges from 80 to 660 ft. Local relief mostly ranges from 100 to 300 ft on irregular plains; however, relief ranges from 0 to 100 ft on flat plains and 300 to 500 ft where plains with hills are present.

Soils are mostly Udults. Paleudults, Hapludults, Hapludalfs, Paleudalfs, and Albaqualfs are on uplands. Fluvaquents, Udifluvents, Eutrochrepts, and Glossaqualfs are along major streams. Soils are mostly derived from weathered sandstone and shale. Soils have a thermic temperature regime, a udic moisture regime, and siliceous or mixed mineralogy. Soils are deep, coarsely textured, mostly well drained, and have an adequate supply of moisture for use by vegetation during the growing season.

Natural vegetation communities are southern mixed forest, oak-hickory-pine forest, and southern flood plain forest. The predominant vegetation form is evergreen needle-leaved forest with a small area of cold-deciduous alluvial forest. The slash pine and longleaf pine cover type dominates most of the area. The loblolly pine-shortleaf pine cover type is common in the northern parts of the area. A bottomland type is prevalent along most major rivers and consists of cottonwood, sycamore, sugarberry, hackberry, silver maple, and red maple.

The endangered Florida panther may be encountered rarely. Presently, the fauna include white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, striped skunk, swamp rabbit, and many small rodents and shrews. The presence of turkey, bobwhite, and mourning dove is widespread. Resident and migratory nongame bird species are numerous, as are species of migratory waterfowl. In flooded areas, ibises, cormorants, herons, egrets, and kingfishers are common. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The endangered red-cockaded woodpecker and bald eagle inhabit this Section. The herpetofauna include the box turtle, common garter snake, eastern diamondback rattlesnake, timber rattlesnake, and American alligator.

This area has a moderate density of small to medium size perennial streams and associated rivers. Dendritic drainage pattern has developed without bedrock structural control.

Fire has probably been the principal historical disturbance. Climatic influences include occasional summer droughts and winter ice storms and infrequent hurricanes. Insect disturbances are often caused by southern pine beetles. Natural vegetation was cleared for agriculture on about 60 percent of the area.

4. The Mid Coastal Plains - Western

The Mid Coastal Plains – Western ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 20, Section 231E) is in the Coastal Plains geomorphic province. The predominant landform occupying about 80 percent of the area consists of moderately dissected irregular plains of marine origin. The plains were formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Other landforms consist of plains with hills and smooth plains. Elevations range from 80 to 650 ft. Local relief

ranges from 100 to 300 ft.

Soils are predominantly Udults. Paleudults, Hapludults, Hapludalfs, Paleudalfs, and Albaqualfs are on uplands. Fluvaquents, Udifluvents, Eutrochrepts, and Glossaqualfs are on bottom lands along major streams. Soils have a thermic temperature regime, a udic moisture regime, and siliceous or mixed mineralogy. Most soils have formed from sandstone and shale parent materials. Soils are generally coarse textured, deep, and have adequate moisture for plant growth during the growing season.

Natural vegetation communities are oak-hickory-pine forest, southern mixed forest, and southern floodplain forest. The predominant vegetation form consists of needle-leaved evergreen trees. Belts of cold deciduous, broad-leaved hardwoods are prevalent along rivers. The principal forest cover type is loblolly and longleaf pines. Where hardwoods are prevalent, species consist of post, white, blackjack, and southern red oaks. Species of bottom lands are red maple, green ash, Nuttall oak, sweetgum, and swamp hickory.

The fauna include white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, striped skunk, swamp rabbit, and many small rodents and shrews. The turkey, bobwhite, and mourning dove are game birds in various parts of this area. In flooded areas, ibises, cormorants, herons, egrets, and kingfishers are common. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake, and timber rattlesnake.

There is a moderate density of small to medium size perennial streams and associated rivers, most with moderate volume of water flowing at low velocity. Dendritic drainage pattern has developed.

Fire was probably the principal historical disturbance. Climatic influences include occasional summer droughts and winter ice storms, and infrequent hurricanes. Insect disturbances are often caused by southern pine beetles. Natural vegetation was cleared for agriculture on about 25 percent of the area. Much of the non-cleared land is managed for forestry.

5. The Coastal Plains – Middle Section

The Coastal Plains – Middle Section ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 20, Section 231B) is in the Coastal plains geomorphic province. The predominant landform on about 80 percent of the area consists of moderately dissected, irregular plains of marine origin formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Elevation ranges from 80 to 650 feet. Local relief ranges from 100 to 300 feet.

Soils are mostly Udults. Paleudults and Hapludults are on level to strongly sloping uplands. Loamy Fragiudults and Paleudults are present on less sloping, moderately well drained areas. Small but significant areas of Quartzipsamments, Paleudalfs, and Glossaqualfs are present in localized areas. Albaquults and Paleaquults are found on low wetlands. Bottom land soils may be dominated by Fluvaquents and Dystrochrepts. The soils have a thermic temperature regime, an udic moisture regime, a loamy or sandy surface layer, and loamy or clayey subsoil. Soils generally are deep, well to poorly drained, and have adequate moisture for use by vegetation during the growing season.

Natural vegetation communities are oak-hickory-pine forest, blackbelt, and oak-hickory forest. Predominate vegetation form is evergreen, needle-leaved forest with cold-deciduous, broad-leaved trees. The principal forest cover type consists of loblolly and shortleaf pine with

hardwoods, including sweetgum, flowering dogwood, elm, red cedar, southern red oak, and hickories. In central Mississippi and Alabama the hardwood component may be dominant, depending on soil moisture regime and past disturbance. A narrow band of oak-hickory forest type occurs along the extreme western edge of this ecological area, adjacent to flood plains of the Mississippi River and along major river bottoms.

Fauna includes white-tailed deer, black bear, bobcat, gray fox, raccoon, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole, short-tailed shrew, and cotton mouse. The turkey, ruffed grouse, bobwhite, and mourning dove are game birds. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake and timber rattlesnake.

There is a moderate density of small to medium perennial streams and associated rivers, most with moderate volume of water at low velocity. Dendritic drainage pattern has developed on this moderately dissected plain, largely without bedrock structural control.

Fire was probably the principal historical disturbance. Climatic influences include occasional summer droughts and winter ice storms, and infrequent tornadoes. Insect disturbances are often caused by southern pine beetles. Natural vegetation was cleared for agriculture on about 30 percent of the area.

6. The Coastal Plains and Flatwoods - Lower

The Coastal Plains and Flatwoods - Lower ecological area (unless noted, adopted from McNab and Avers 1996, Chapter 21, Section 232B) is in the Coastal Plain geomorphic Province. The predominant landform is a flat, weakly dissected alluvial plain was formed by deposition of continental sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. About 90 percent of this area consists of irregular or smooth plains. Other landforms include open hills. Elevation ranges from 80 to 660 ft. Local relief ranges from 10 to 30 ft on smooth plains, and from 30 to 50 ft in areas of hills.

Soils are mostly Udults. Paleudults and Hapludults are on uplands. Fragiudults and Fragiudalfs are associated soils on sites that range from well drained to poorly drained. Localized areas of Quartzipsamments occur in the southern part of the Section, along with Paleudalfs and Glossaqualfs. Ochraquults, Albaquults, and Paleaquults are locally common on low wetlands. Udifluvents, Fluvaquents, and Dystrochrepts are present in bottom lands. These soils have a thermic temperature regime, a udic moisture regime, and are deep with loamy or clayey subsoil. Soils range from well drained to poorly drained and are fine to moderately fine textured.

Natural vegetation communities are southern mixed forest and oak-hickory-pine forest, with smaller areas of southern flood plain forest and pocosin (*Pinus-Ilex*). The predominant vegetation form is evergreen needle-leaved trees with scattered areas of cold-deciduous and evergreen broad-leaved forest. Slash and longleaf pines are prevalent throughout the area, but loblolly pine is common in the northern areas. Sand pine is prevalent in xeric, deep-sand areas of Florida. The oak-gum-cypress forest cover type is common along flood plains of major rivers and includes Nuttall oak, laurel oak, water tupelo, sweetbay, bald cypress, and pond cypress. Localized areas of mostly hardwoods occur, especially in central Florida; types include laurel oak, water oak, sweetbay, sweetgum, live oak, red maple, and spruce pine.

The endangered Florida panther may be encountered rarely. Presently, the fauna include white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, striped skunk, swamp rabbit, and many small rodents and shrews. The turkey, bobwhite, and mourning dove are widespread. Resident and migratory nongame bird species are numerous, as

are species of migratory waterfowl. In flooded areas, ibises, cormorants, herons, egrets, and kingfishers are common. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, ruby-throated hummingbird, eastern towhee, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The endangered red-cockaded woodpecker and bald eagle inhabit this area. The herpetofauna include the box turtle, common garter snake, eastern diamondback rattlesnake, timber rattlesnake, and American alligator.

There is a moderate density of small to medium size perennial streams and associated rivers, most with moderate volume of water flowing at low velocity.

Fire was the principal historical disturbance, previously burning over medium to large size areas between natural barriers, generally with moderate frequency and low intensity. Fire occurrence is common in areas dominated by sand pine and is frequent in areas of longleaf pine. Fire intensity can range from moderate to high. Climatic influences include frequent hurricanes. Insect disturbances are often caused by southern pine beetles. Natural vegetation was cleared for agriculture on about 40 percent of the area in much of the area.

G. An Overview of Coal Mining Industry

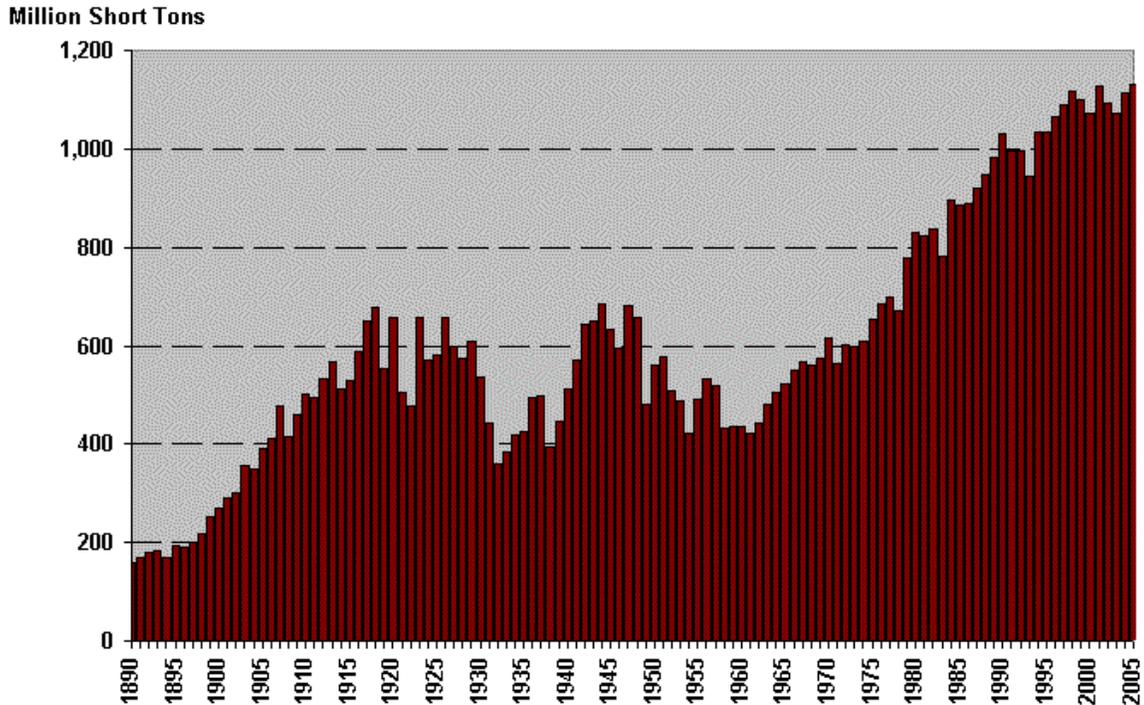
1. Current and Projected Coal Demand ²

Coal production in the United States grew steadily from the colonial period, fed the Industrial Revolution, and supplied industrial and transportation fuel during the two World Wars (figure III-13). Around 1950, coal consumption was distributed among the consuming sectors - industrial, residential and commercial, metallurgical coke ovens, electric power, and transportation - with each sector accounting for 5 to 25 percent of total consumption. From the end of World War II to 1960, coal use for rail and water transportation and for space heating declined. Coal demand grew, however, with the post-War growth in American industry and increased electricity generation starting in the early 1960's.

In 1950, U.S. coal production was 560 million tons of which 93.6 percent was produced from mines east of the Mississippi River. In 2003, U.S. coal production was 1.07 billion tons, an average annual increase in coal production of 1.2 percent per year. Production from the eastern mines dropped to 469 million tons (39 percent of domestic production).

The 1973 Oil Embargo renewed interest in the vast U.S. coal reserves, as the nation strived to achieve energy independence. The number of coal mines and new mining capacity burgeoned. Between 1973 and 1976, coal production increased by 14.4 percent, or 86.3 million tons. In 1978, the Power Plant and Industrial Fuel Use Act mandated conversion of most existing oil-burning power plants to coal or natural gas. New research on coal liquefaction and gasification technologies was aimed at replacing imported petroleum and supplementing domestic gas supplies. Those high-cost projects were put on hold when crude oil prices fell several years later, making synthesized coal liquids and gases uneconomic.

² Unless specifically noted the text on the history of coal production that immediately follows was incorporated from DOE-EIA 2006b, which is available over the internet at: http://www.eia.doe.gov/cneaf/coal/page/coal_production_review.pdf



Sources: Annual Coal Report, (and predecessor report titles), DOE/EIA-0584 (years 1993-2003) and DOE/EIA-0118 (years 1976-1992); Energy Information Administration: Washington, DC. In-house file data from U.S. Bureau of Mines, Annual Coal Production surveys by Bureau of Mines and by U.S. Geological Survey (years 1890-1975): Washington, DC.

Figure III-13 - United States coal production, 1890 – 2005

The shift of coal production from traditional eastern coalfields to the western United States is the most important development affecting coal markets in the last 30 years. Thick beds of low-sulfur coal with low mining cost are extensive in the Northern Great Plains states of Wyoming, Montana, and North Dakota. Starting in the 1970's increasingly more stringent restrictions on atmospheric emissions of sulfur dioxide at power plants made this coal often the most cost effective choice for meeting sulfur dioxide limits without the installation of expensive equipment retrofits. In a matter of a few decades, a localized western resource grew to more than half of all U.S. production, from just over 60 short tons in 1973 to 549 short tons in 2003. This growth was accomplished through the deployment of long distance coal haulage in unit trains (of more than 100 railcars moving only coal to a single destination) and the exploitation of scale economies in the form of immense western surface coal mines. Average U.S. mine size in 2003 at 814 thousand short tons per year far exceeded mine size in 1973 of 126 thousand short tons per year. The largest U.S. mine, the North Antelope Rochelle Complex in Wyoming, alone produced over 80 million short tons in 2003.

In the United States today, coal demand is driven by the electric power sector, which accounts for 90 percent of consumption, compared to the 19 percent it represented in 1950. As demand for electricity grew, demand for coal to generate it rose and resulted in increasing coal production. There were years in which coal production declined from the prior year but, excluding years affected by a major unionized coal strike, annual increases in coal production between 1950 and 2003 outnumber decreases by almost two to one.

In the period since 1973, four distinct trends dominated U.S. coal mining technology. The overall

growth in surface coal mining at the expense of underground coal mining is the first. In 1973, underground and surface mines each accounted for 50 percent of total coal production. In the next 30 years, the production share from underground mines declined by a third:

Share of production from underground and surface coal mines

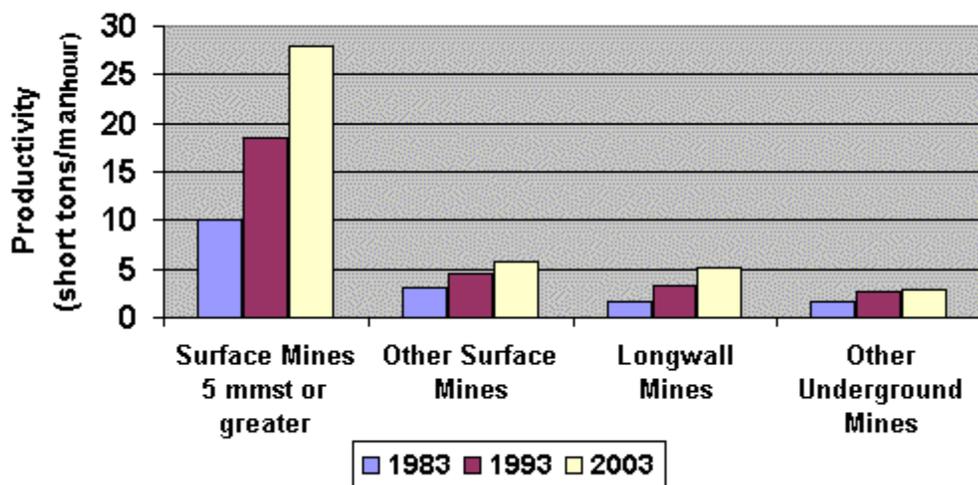
Year	Underground Percentage	Surface Percentage
1973	50	50
1983	38	62
1993	37	63
2003	33	67

Growth in surface coal mining was accompanied by a second trend: the accelerated application of surface mining technology in large-scale area mines in the western region, characterized in optimal locations by box cut pits a mile or greater in length and about 200 feet wide concentrated in the western states of Wyoming, Montana, North Dakota, Texas, Arizona, and New Mexico. In 1973, these six states accounted for 52 million tons out of a total of 599 million tons of U.S. coal mined, representing 9 percent of the total. By 2003, coal produced in those six western states accounted for 49 percent of all U.S. coal mined. No surface mines operating anywhere in the United States in 1973 had an annual output exceeding 5 million tons. By 2003, 64 percent of surface-mined coal was mined in the six western states in area mines exceeding 5 million tons per year of output.

The third technological trend for the 1973-2003 period was the shift within underground mining from conventional room and pillar mining to longwall underground mining. Coal from longwall mining grew from 10 million short tons in 1973 to 184 million short tons in 2003, representing 52 percent of total U.S. underground production by 2003. States with substantial longwall production in 2003 included Alabama, Colorado, Pennsylvania, Utah, and West Virginia.

Due to superior productivity, large-scale surface and longwall technologies expanded faster than other mining methods. In 1983, large surface mines (greater than 5 million short tons per year) had productivity higher than other surface mines and in the next 20 years they experienced higher rates of productivity growth. In 1983, longwall mines had about the same productivity as other underground mines; however, their productivity growth far outpaced other underground mines in the next 20 years. In the periods 1983 to 1993 and 1993 to 2003, large-scale surface technology and longwall technology saw about equal gains in productivity, decade over decade. See figure III-14.

In 1973 productivity was in decline. It had fallen 10 percent since 1969, when the Coal Mine Safety and Health Act initiated or strengthened nationwide mine safety standards and their enforcement. This Act increased mine permitting and design requirements, added new safety and health standards in existing mines, and imposed new permitting and Black Lung fees on existing operations. The Mine Safety and Health Act of 1977 added additional safety, dust-control, and mine ventilation requirements. Further, the federal government imposed strict new regulations on pollution and disruptions from mining through the Federal Water Pollution Control Act of 1972 and the Surface Mining Control and Reclamation Act of 1977. It can be argued that eventually these regulations improved productivity through safer, better-planned mines. The increasingly stringent controls of sulfur dioxide emissions under the Clean Air Act of 1970 and its amendments in 1977 and 1990 caused a shift to mining in low-sulfur coal regions.



Sources: Annual Coal Report, (and predecessor report titles), DOE/EIA-0584 (years 1993-2003), DOE/EIA-0118 (years 1976-1992) Energy Information Administration: Washington, DC.

Figure III-14 -- U.S. coal mining productivity

Underground coal mine productivity continued to decline through 1978, before starting a slow recovery. Underground productivity in 1973 was 1.45 tons per hour. It fell to 1.04 tons per hour in 1978 and then recovered to 1.61 tons per hour by 1983. Productivity increased another 83 percent by 1993. By 2003, underground productivity had increased another 37 percent, to 4.04 tons per hour. The annual average percentage increase in underground mining productivity for the last 30 years is nearly 4 percent.

Surface coal mining is less labor-intensive and its productivity is inherently higher than underground mining. Surface productivity in 1973 was 4.56 tons per hour. It decreased in 1983 by 16 percent to a level of 3.81 tons per hour – a temporary result of attributed to SMCRA which diverted some employees to reclamation as opposed to production. By 1993, surface productivity had recouped the earlier loss, increasing by 90 percent, to 7.23 tons per hour. By 2003, surface productivity had increased another 49 percent, to 10.76 tons per hour. The average annual percentage increase in surface mining productivity for the last 30 years is 3 percent.

Regional geology, together with type of mining, influences productivity. Appalachia has the highest number of mines, while the West has the least. As discussed earlier, coal production and mine size grew in tandem with shifts to more surface mining and toward the West. Keen price competition motivated productivity improvements accomplished through increased mine size and production.

Appalachian productivity did not increase between 1973 and 1983, primarily because of productivity declines in surface mining. Between 1983 and 2003, both surface and underground mining in Appalachia improved. The annual average percentage increase in productivity in Appalachia over those 30 years was 2.6 percent. The backsliding in surface productivity from 1973 to 1983 corresponds with closure of more than a thousand small contour mines (many were inefficient or seasonal operations), tightening of surface mine permitting and reclamation requirements, and greater public resistance to surface mining. Some production shifted to larger surface mines and mountaintop removal operations, but their costs and workforce requirements

have been relatively high in Appalachia.

Productivity in the Interior region also declined between 1973 and 1983, before picking up over the next 20 years. Most surface mines in the Interior are medium or large box cut area mines. Underground mines tend to be either shaft mines or drift mines entering the coal seam beneath the final highwall. The Interior region has never supported thousands of small surface mines as had Appalachian topography. In 1983, 247 Interior region surface mines produced almost as much coal (84 percent) as was mined in Appalachia's 1,445 mostly contour mines. From 1973 to 2003, the annual average percentage increase in surface productivity was 1.6 percent and in underground productivity it was 1.8 percent.

The increased productivity in the West between 1973 and 1983 is attributed to increases in surface mining. Surface productivity from 1973 to 1983 did not in itself improve, but new mines opened and the tonnage mined from the surface quadrupled. Those gains in surface mining production share boosted overall productivity. During that time western underground mining, working in reserves that tended to be thick-bedded, was slightly more efficient than in thinner-bedded eastern coal. In all regions, limited longwall experience and early mine development were insufficient to significantly boost productivity or increase average mine size until after 1983. Overall, productivity of the huge surface mines, principally in Wyoming and Montana, led the productivity growth between 1983 and 2003. The average annual increase in western mine productivity from 1973 to 2003 was 3.9 percent. Underground productivity gains averaged 4.0 percent annually. Little changed in surface productivity during the 1980's and early 1990's, but by 2003 ten mines were producing more than 15 million tons per year, with great economies of scale. Productivity of western surface mining improved from 9.64 tons per hour in 1973 to 25.0 tons per hour in 2003, an average annual increase of 3.2 percent.

The fourth important trend was improvement in mining equipment durability and capability. Improvements to equipment, like the broad technology shifts described above, continue to raise productivity and keep coal mining costs low.

The notable improvements in mining equipment from 1983 through 2003 include:

- Bigger and stronger longwall face coal belt conveyors
- Conversion to belt conveyors to move coal out of underground mines
- Better roof bolting equipment including combination continuous-miner/bolters
- More powerful and durable longwall cutting bits
- Better sensors for and automation of longwall roof shields
- More powerful and more durable electric drive motors used in many applications
- Continuous scale-up of haul trucks, loaders, and excavators for surface mining

A feature of the improvements listed above is that significant benefits resulted from advances in materials and technology applied to existing mining techniques, not from pioneering entirely new mining machinery. That process continues. Roof bolting was a seminal change in underground coal mining. It allowed passageways to be secured with substantially fewer timbers and "cribs" (the pillars constructed of stacked short beams used to shore up million-pound roof loads). Roof bolting – a safety standard, mandated in the 1969 Coal Mine Safety and Health Act – resulted in safer, more open mine passages and led to single-operator roof-bolting machinery far more productive than the previous, labor-intensive manual timbering and cribbing. For areas subject to tangential forces, steel cable roof bolts, with higher tensile strength and resistance to shear failure, give superior results. Those same qualities, along with new flexible, sprayed rock coatings, are expected to attract more proponents as mines go deeper. Though cable bolts and coatings add cost, some mines have found that fewer are needed per unit area.

The DOE-EIA annually provides the current status of the domestic coal industry and makes reasonable forecasts based upon relevant events and conditions. The following is relevant information taken from various DOE-EIA reports which provide the most current information and significant events that have significant influence on energy forecasts. We excerpt the information

most relevant to coal production and forecasts. As DOE-EIA states:

Trends in energy supply and demand are affected by many factors that are difficult to predict, such as energy prices, U.S. economic growth, advances in technologies, changes in weather patterns, and future public policy decisions. It is clear, however, that energy markets are changing gradually in response to such readily observable factors as the higher energy prices that have been experienced since 2000, the greater influence of developing countries on worldwide energy requirements, recently enacted legislation and regulations in the United States, and changing public perceptions of issues related to the use of alternative fuels, emissions of air pollutants and greenhouse gases, and the acceptability of various energy technologies, among others. [DOI-EIA 2007 p.3]

Coal production in the United States in 2007 totaled 1,145.6 million short tons according to preliminary data from the Energy Information Administration, a decrease of 1.5 percent, or 17.2 million short tons from the 2006 record level of 1,162.7 million short tons. Although coal production declined in 2007, U.S. total coal consumption increased for the year. Coal consumption in 2007 in the electric power sector was higher by 1.9 percent, while coking coal consumption decreased by 1.1 percent and the other industrial sector declined by 5.0 percent. (Note: All percentage change calculations are done at the short-tons level.) U.S. coal exports were significantly higher in 2007, while coal imports remained at about the same level. Total coal stocks increased slightly during the year, as some consumers continued to rebuild their stockpiles that had been seriously depleted in 2005 due to transportation issues. [DOE-EIA, 2008, p.1]

The growth in coal consumption during the year was primarily a result of the weather-related increases in the demand for electricity in 2007. Preliminary data show that total generation in the electric power sector (electric utilities and independent power producers) in the United States grew in 2007. Coal-based generation also increased, resulting in a 19.8-million-short-ton increase in coal consumed in the electric power sector. Coal use in the non-electricity sector decreased by 3.8 percent to a level of 82.4 million short tons. [Id, p.1]

In the international markets in 2007, U.S. coal exports increased to levels not seen in recent years while coal imports were mostly static. U.S. coal exports totaled 59.2 million short tons, an increase of 9.5 million short tons over 2006. Coal imports in 2007 ended the year at 36.3 million short tons, 0.1 million short tons higher than in 2006. [Id, p.1]

Coal production in the Appalachian Region declined for the second consecutive year in 2007, decreasing by 14.0 million short tons, to end the year at 377.1 million short tons, a decline of 3.6 percent, a level only slightly greater than the 2003 production total. The decrease in 2007 in coal production in the Appalachian Region was primarily driven by two different issues. One issue was the production problems at a few of the larger mines in the region; and the other was ongoing lawsuits, principally in the central portion of the Appalachian Region, concerning the issuing of Federal permits that regulate the excavation and discharge of dredged and fill material into the waters of the United States. As a consequence of these lawsuits, new permits are issued as quickly as they had in the past, thereby limiting some possible additional production. [Id, p.3]

The Interior Region experienced a decrease in coal production in 2007 of 4.8 million short tons, or 3.2 percent, to end the year at a total of 146.6 million short tons. The decline in coal production in the Interior Region was primarily a result of the lower coal production in Texas, the largest coal-producing State in the region. In 2007 coal production in Texas was 41.9 million short tons, a decline of 3.6 million short tons from the 2006 level. [Id, p.4]

The Western Region was the only one of the three regions to show an increase in coal production in 2007. Coal production rose by 0.3 percent to reach a total of 621.0 million short tons, over 54 percent of total U.S. coal production for the year. The slight increase of 1.6 million short tons resulted in another record level for the region, the fourth year in a row. Even though there was a record level of coal production in 2007, only three States in the Western Region had higher

production levels from the previous year, Colorado, Montana, and Wyoming. [Id, p.6]

Wyoming is the largest coal-producing State in the Nation, a position it has held since 1988. In 2007, Wyoming produced 453.6 million short tons of coal, an increase of 1.5 percent, or 6.8 million short tons for the year. Although nine of the twenty-one mines in Wyoming had decreases in coal production in 2007, the increased production levels at the rest of the mines pushed the state to a new production record for the year. Wyoming has dominated U.S. coal production since 1995 when it first accounted for more than one-quarter of total U.S. production. Examples of how much Wyoming dominates the U.S. coal supply include that for 2007, its production accounted for 73 percent of the Western Region production total; was 76.4 million short tons more than the entire Appalachian Region production; was more than three times the Interior Region production; and was only slightly less than 40 percent of the total U.S. coal production for the year. Also, if the 25 States that produced coal in 2007 were ranked by descending total production levels, Wyoming produced only 1.4 million short tons less than the sum of the next six largest coal-producing States (West Virginia, Kentucky, Pennsylvania, Montana, Texas, and Colorado) and 217.4 million short tons more coal than the summation of the States ranked 8th through 25th. Peabody's North Antelope Rochelle mine was the largest coal mine in Wyoming and the United States in 2007, producing a total of 91.5 million short tons, an increase of 3.0 million short tons. This one mine produced more coal than 22 of the 24 other coal-producing States in 2007. [Id, p.6]

Despite the rapid growth projected for biofuels and other non-hydroelectric renewable energy sources and the expectation that orders will occur for new nuclear power plants for the first time in more than 25 years, oil, coal, and natural gas still are projected to provide roughly the same 86-percent share of the total U.S. primary energy supply in 2030 that they did in 2005 (assuming no changes in existing laws and regulations). [DOE-EIA 2007, p.3]

Coal is projected to continue to play a major role in electricity generation. Coal consumption is projected to increase from 22.9 quadrillion Btu (1,128 million short tons) in 2005 to more than 34 quadrillion Btu (1,772 million short tons) in 2030, with significant additions of new coal-fired generation capacity over the last decade of the projection period, when rising natural gas prices are projected. The reference case projections for coal consumption are particularly sensitive to the underlying assumption that current energy and environmental policies remain unchanged throughout the projection period. Recent EIA service reports have shown that steps to reduce greenhouse gas emissions through the use of an economy-wide emissions tax or cap-and-trade system could have a significant impact on coal use. [Id, p.3-4]

Typically, trends in U.S. coal production are linked to its use for electricity generation, which currently accounts for more than 90 percent of total coal consumption. Projected coal consumption in the electric power sector is 1,570 million tons. Another fast-growing market for coal is coal-to-liquid energy (CTL). Coal use in CTL plants is projected to grow from 26 million short tons in 2020 to 112 million short tons in 2030. By 2025, coal use for CTL production becomes the second largest use of coal in the AEO2007 reference case, after electric power generation. [Id, p. 12] In December 2007, the Energy Independence and Security Act of 2007 was enacted. Because of the ramifications of this act, DOE-EIA scaled back on its projections of the use of coal for CLT. [DOE-EIA 2008, p.2]

Western coal production, which has grown steadily since 1970, continues to increase through 2030. Much of the projected growth is in output from the Powder River Basin, where producers are well positioned to increase production from the vast remaining surface-minable reserves. Constraints on rail capacity limited growth in coal production from the Basin during 2005 and 2006, but recent and planned maintenance and investment in the rail infrastructure serving the region should allow for substantial growth in future production. Appalachian coal production declines slightly in the reference case. Although producers in Central Appalachia are well situated to supply coal to new generating capacity in the Southeast, the Appalachian basin was mined extensively, and production costs are increasing more rapidly than in other regions.

The eastern portion of the Interior coal basin (Illinois, Indiana, and western Kentucky) with extensive reserves of mid- and high-sulfur bituminous coals benefits from the new coal-fired generating capacity in the Southeast. [DOE-EIA 2007, p. 98] Eastern coal fire power plants will use more western coal by 2030. Coal supply from Appalachian producers to markets east of the Mississippi River remains close to current levels, but increases in shipments from mines in the Eastern Interior region and in coal imports contribute to the overall decline in Appalachia's share of the market east of the Mississippi, from 61 percent in 2005 to 42 percent in 2030. [Id, p. 99]

The Department of Energy – Energy Information Administration (EIA) states that U.S. coal production has remained near 1,100 million tons annually since 1996. EIA anticipates that coal use for electricity generation will increase at a rate of 1.1 percent per year from 2004 to 2015, when the total production will be 1,272 tons. The growth of coal use is expected to be even greater thereafter increasing 2.0 percent per year from 2015 to 2030 as new coal fired electric generating facilities are brought on line. [DOE-EIA 2006, p. 98]

EIA projects that this increased demand will be met with increased production from western coal mines, especially those in the Power River Basin. Appalachian coal production will remain nearly flat. While production from the central Appalachia is geographically advantageous to new power plants that are projected to be constructed in the southeastern United States, in light of increased production costs and diminishing reserves, growth is projected to be less than that of other regions. EIA projects a moderate increase in production from the Interior basin, with its extensive reserves of mid- and high-sulfur bituminous coals [Id. p. 98].

Coal use in the non-electricity sector decreased by 3.2 percent to a level of 85.7 million short tons. [Id, p.1] DOI-EIA reported that approximately 23 million tons of coal is extracted domestically for making coke for the iron and steel industry, foundries, and other industries. The presence of large domestic deposits of coking coal, or metallurgical coal, played an important role in the development of the U.S. iron and steel industry. Coke is used chiefly to smelt iron ore and other iron bearing materials in blast furnaces, acting both as a source of heat and as a chemical reducing agent, to produce pig iron, or hot metal. Domestic production of metallurgical coal comes primarily from the central Appalachian coalfields.

2. Underground and Surface Mining Techniques

The U.S. coal mining industry uses a variety of underground and surface mining techniques and equipment to recover coal. The coal extraction technique is dependent upon the geology, topography, property ownership, and the company's current available equipment and capitalization. These techniques are described in detail in three previous EIS's and will not be repeated herein:

- U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement. 1979. *Permanent Regulatory Program Implementing Section 501(b) of the Surface Mining Control and Reclamation Act of 1977, Final Environmental Statement*. USOSM-EIS-1. Available at most OSM offices and Federal government document repositories.
- U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement. 1983. *Supplement to Final Environmental Statement on Proposed Revisions to the Permanent Program Regulations Implementing Section 501(b) of the Surface Mining Control and Reclamation Act of 1977, Final Environmental Statement*. USOSM-EIS-1: Supplement v.1. Available at most OSM offices and Federal government document repositories.

- U.S. Environmental Protection Agency. 2003. *Mountaintop Mining/Valley Fills in Appalachia Draft Programmatic Environmental Impact Statement*. U.S. EPA Region 3, Philadelphia, PA, EPA 9-03-R-00013. Available at: http://www.epa.gov/region3/mtn_top/eis.htm

A summary of U.S. production for 2005 and 2004 and number of mines by state and mine type are shown in table III-2.

Table III-2 – Coal production and number of mines by state and mine type, 2005-2004

Coal-Producing State and Region	2005		2004	
	# Mines	Production (1000 tons)	# Mines	Production (1000 tons)
Alabama	53	21,339	49	22,271
Underground	9	13,295	8	16,114
Surface	44	8,044	41	6,156
Alaska	1	1,454	1	1,512
Surface	1	1,454	1	1,512
Arizona	2	12,072	2	12,731
Surface	2	12,072	2	12,731
Arkansas	1	3	2	7
Underground	-	-	1	1
Surface	1	3	1	6
Colorado	13	38,510	13	39,870
Underground	8	28,439	8	29,608
Surface	5	10,071	5	10,262
Illinois	20	32,014	19	31,853
Underground	12	26,343	12	26,907
Surface	8	5,671	7	4,946
Indiana	29	34,457	29	35,110
Underground	8	11,189	7	10,092
Surface	21	23,268	22	25,018
Kansas	1	171	1	71
Surface	1	171	1	71
Kentucky Total	432	119,734	419	114,244
Underground	224	73,702	223	71,765
Surface	208	46,032	196	42,478
Eastern	404	93,322	397	90,871
Underground	211	52,054	212	52,445
Surface	193	41,269	185	38,426
Western	28	26,412	22	23,373
Underground	13	21,648	11	19,321
Surface	15	4,763	11	4,052
Louisiana	2	4,161	2	3,805
Surface	2	4,161	2	3,805
Maryland	16	5,183	19	5,225
Underground	3	3,175	3	3,339
Surface	13	2,009	16	1,886
Mississippi	1	3,555	1	3,586
Surface	1	3,555	1	3,586
Missouri	2	598	3	578
Surface	2	598	3	578
Montana	6	40,354	6	39,989
Underground	1	162	1	158
Surface	5	40,192	5	39,831

Coal-Producing State and Region	2005		2004	
	# Mines	Production (1000 tons)	# Mines	Production (1000 tons)
New Mexico	4	28,519	4	27,250
Underground	1	7,905	1	7,685
Surface	3	20,613	3	19,565
North Dakota	4	29,956	4	29,943
Surface	4	29,956	4	29,943
Ohio	54	24,718	52	23,222
Underground	10	15,823	8	14,270
Surface	44	8,896	44	8,952
Oklahoma	9	1,856	8	1,792
Underground	1	465	1	409
Surface	8	1,391	7	1,383
Pennsylvania Total	266	67,494	260	65,996
Underground	53	54,563	58	53,224
Surface	213	12,931	202	12,772
Anthracite	68	1,645	66	1,679
Underground	14	264	20	271
Surface	54	1,380	46	1,408
Bituminous	198	65,849	194	64,317
Underground	39	54,298	38	52,953
Surface	159	11,551	156	11,364
Tennessee	28	3,217	32	2,887
Underground	13	1,224	12	826
Surface	15	1,993	20	2,061
Texas	13	45,939	13	45,863
Surface	13	45,939	13	45,863
Utah	13	24,521	13	21,746
Underground	13	24,521	13	21,746
Virginia	132	27,743	123	31,420
Underground	83	16,386	77	20,437
Surface	49	11,357	46	10,983
Washington	1	5,266	1	5,653
Surface	1	5,266	1	5,653
West Virginia Total	277	153,650	261	147,993
Underground	166	91,009	152	90,932
Surface	111	62,641	109	57,061
Northern	50	42,628	49	40,646
Underground	29	37,590	27	36,082
Surface	21	5,037	22	4,564
Southern	227	111,022	212	107,347
Underground	137	53,419	125	54,851
Surface	90	57,603	87	52,497
Wyoming	18	404,319	20	396,493
Underground	1	410	1	43
Surface	17	403,908	19	396,450

Coal-Producing State and Region	2005		2004	
	# Mines	Production (1000 tons)	# Mines	Production (1000 tons)
Appalachian Total	1,230	396,666	1,193	389,884
Underground	548	247,528	530	251,588
Surface	682	149,139	663	138,297
Northern	386	140,023	380	135,089
Underground	95	111,151	96	106,915
Surface	291	28,873	284	28,174
Central	790	235,297	764	232,525
Underground	443	123,075	426	128,559
Surface	347	112,222	338	103,966
Southern	54	21,347	49	22,271
Underground	10	13,303	8	16,114
Surface	44	8,044	41	6,156
Interior Total	106	149,165	100	146,038
Underground	34	59,645	32	56,729
Surface	72	89,520	68	89,309
Illinois Basin Total	77	92,883	70	90,336
Underground	33	59,180	30	56,319
Surface	44	33,703	40	34,016
Western Total	62	584,970	64	575,186
Underground	24	61,438	24	59,240
Surface	38	523,532	40	515,946
Powder River Basin	16	429,996	17	420,992
Underground	-	-	-	-
Surface	16	429,996	17	420,992
Uinta Region	24	62,145	24	60,744
Underground	20	52,495	20	50,896
Surface	4	9,650	4	9,848
East of Miss. River	1,308	493,105	1,264	483,806
West of Miss. River	90	637,697	93	627,303
U.S. Subtotal	1,398	1,130,802	1,357	1,111,109
Refuse Recovery	17	696	22	990
U.S. Total	1,415	1,131,498	1,379	1,112,099

Note: Totals may not equal sum of components because of independent rounding.

Source: U.S. Department of Energy, Energy Information Administration / Annual Coal Report 2005, DOE/EIA-0584 (2005).

3. Excess Spoil Generation

When coal is mined by surface mining methods, rock and soil that overlie the coal are first temporarily removed and stored outside of the immediate mining area. If available in sufficient quantity, topsoil is removed and segregated. The underlying rock is fractured by drilling and blasting, or by ripping with bull dozers. The rock is broken as it is removed, and the broken rock is referred to as “spoil”. Because the broken rock incorporates voids and air, spoil is less dense than undisturbed rock. Therefore, the volume of spoil removed during mining becomes greater than the volume of rock that was in place prior to mining. After coal removal, the mine operator returns the spoil to the mined-out area for reclamation.

The operator grades the spoil so that it closely resembles the pre-mining topography. This is referred to as returning the reclaimed mine to the approximate original contour, or simply AOC.

There are situations, particularly in steep terrain, where the volume of spoil is more than sufficient to return the reclaimed land to AOC and it is not technically feasible to return all the spoil to the mined-out area when reclaiming the site. Surplus spoil material disposed of in locations other than the mined-out area, except for material used to blend spoil with surrounding terrain in achieving AOC in non-steep slope areas, is referred to as “excess spoil”.

In steep terrain, the mine operator may place the excess spoil either in adjacent valleys, or on previously mined sites, and in any of several types of steep-slope fills: “valley,” “head-of-hollow,” and “durable rock.” These various types of fills are referred to as “excess spoil fills.”

For more a more detailed description of excess spoil generation, the reader is referred to Chapter III.K of the U.S. Environmental Protection Agency, Mountaintop Mining/Valley Fills in Appalachia Draft Programmatic Environmental Impact Statement (MTM/VF DPEIS), EPA 9-03-R-00013, EPA Region 3, June 2003, which is available at <http://www.epa.gov/region3/mtntop/eis.htm>.

4. Excess Spoil Disposal

The predominant valley fill construction technique in steep-sloped Appalachia is the durable rock fill method. Because of this, the proper design of stable excess spoil fill structures is dependent upon accurate characterization of rock strength and durability [30 CFR 816 / 817.73]. Excess spoil consists of overburden or interburden (soil and rock excavated during the mining operation) not needed to reclaim the disturbed area to the approximate original contour of the land. The excess spoil material forming the rock fill is generally made up of angular blast rock. Before the enactment of the SMCRA, excess spoil disposal structures were generally constructed with minimal engineering guidance. Often these structures were placed at locations selected merely for the convenience of the mining operation. Since the passage of SMCRA, regulations require increased engineering efforts directed toward design and construction of excess spoil disposal areas to improve safety.

In general, methods of excess spoil placement in valleys that are recognized by the Federal regulations include: (a) the ‘conventional’ lift-type construction method (figure III-15); (b) the head-of-hollow fill method (figure III-16); and, (c) the durable rock (gravity segregated) fill method (figure III-17). Each type is described below.

Conventional valley fills: This type of valley fill is constructed in lifts from the toe of the fill upwards. Excess spoil is deposited in uniform and compacted horizontal lifts or layers (four feet or less in thickness). Prior to placement of the spoil, the foundation (i.e. valley floor and sides where the spoil will be placed) are prepared and rock underdrains installed to accommodate ground water seepage and surface-water infiltrations. OSM regulations at 30 CFR 816 /

817.71(f)(3), require that the rock underdrain is durable (rock that will not slake in water nor degrade to soil material); non-acid or toxic forming; and free of coal, clay or other non-durable material.

Head of hollow fills: The Federal regulations [30 CFR 816 / 817.72(b)(1)] also provide for another method for excess spoil disposal, which involves the placement of spoil in lifts up to the valley head, i.e. at elevations approximating the adjacent ridge lines of the watershed. This "head-of-hollow fill" method originated in West Virginia in the early 1970's, and combines the lift-placement technique described above and a rock chimney drain in the center, or core, of the fill. The "rock core chimney drain" results from mechanical segregation of larger, durable rock during spreading of spoil material and lift compaction. All surface and subsurface drainage is controlled by this rock core to minimize the phreatic surface or water level within the fill mass. This type of fill must crest as close as possible to the ridge line to minimize the surface drainage entering the rock core. The chimney drain is also used in lift fills lower in the watershed, provided the fill volume does not exceed 250,000 cubic yards and upstream drainage is diverted around the fill.

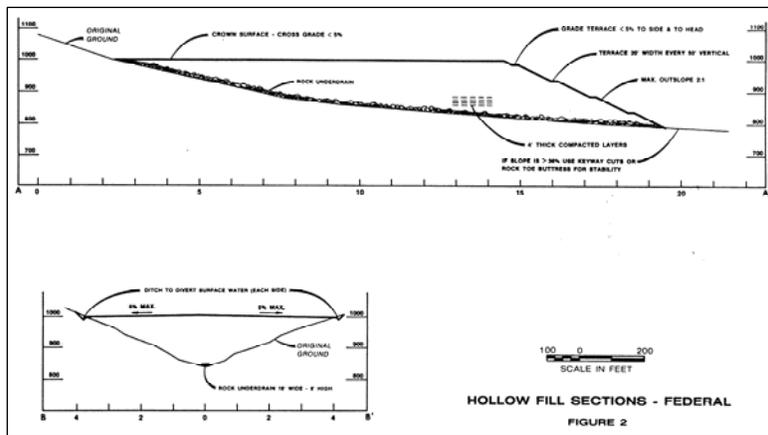


Figure III-15 - Sections of a conventional-lift valley fill (after Loy et al. 1978)

Durable rock fill: The durable rock fill method [30 CFR 816 / 817.73] consists of end-dumping spoil into valleys in a single lift or multiple lifts. The fill construction begins at an elevation where the crown or top of the completed fill will occur. Dump trucks haul spoil to the center of the hollow and dump the material down slope. This continues to take place, allowing a platform of spoil to lengthen down the hollow, and ends when the toe or bottom of the fill approaches its as-designed final location. Lifts of existing fills are known to range between 30 to over 400 feet in thickness. At the completion of spoil placement, the face of the fill is graded from its dumped angle of repose (the natural slope of spoil material under its own weight) into a less steep, terraced configuration. The durable rock fill method is used if durable rock overburden is present and will comprise at least 80 percent (by volume) of the fill. A designed rock drain is not required for this type of fill, since the gravity segregation during dumping forms a highly permeable zone of large-sized durable rock in the lower one-third of the fill.

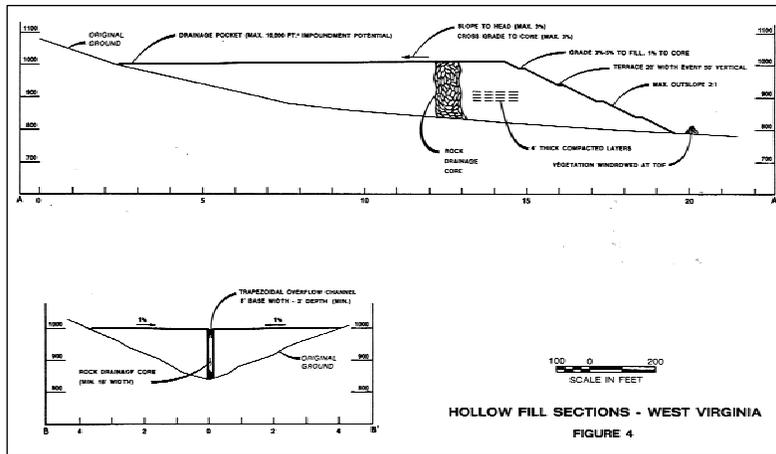


Figure III-16 - Sections of a head of hollow fill [Loy et al. 1978]

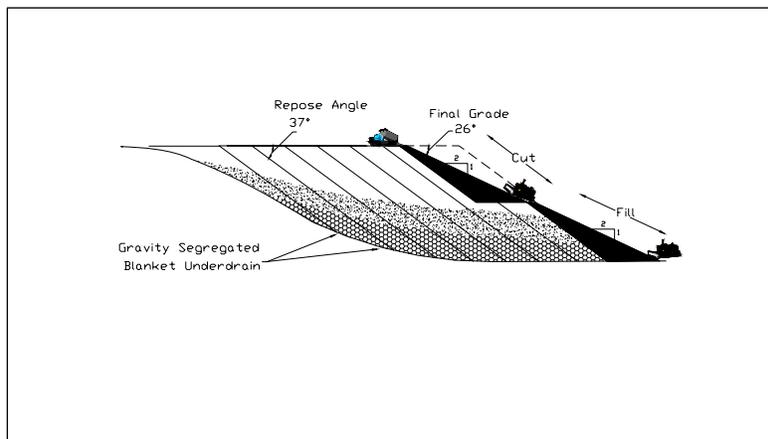


Figure III-17 - Diagram of a durable rock fill

Among these different methods of valley-fill construction, end-dumping to build a durable rock fill is, by far, the most common technique applied since 1980. It is less expensive than lift construction; and, with the sampling and testing practices commonly in use, most permits demonstrate excess spoil volumes of at least 80 percent durable rock.

Excess spoil fills on pre-existing benches: 30 CFR 816 / 817.73 provides for disposal of excess spoil on preexisting mine benches. Requirements in the interest of stability and AOC include: controlled placement and compaction of the spoil on the solid portion of a bench to attain a long-term static safety factor of 1.3; placement and compaction above old fill material to attain a static safety factor of 1.5; elimination of the highwall to the maximum extent technically practical; and construction of diversions and underdrains to control surface and subsurface drainage. The regulation also has specific provisions for gravity transportation of excess spoil to a pre-existing bench directly below the current mine operation.

Past surface mining operations have resulted in many miles of abandoned benches throughout the Appalachian coal region. One of the objectives of the SMCRA is the reclamation of these previously mined areas [SMCRA Section 102(h)]. Reclamation of these abandoned mine lands through disposal of excess spoil on preexisting (i.e., previously mined) benches is one method that will help to achieve this objective, with a corresponding reduction in erosion, surface-water degradation, flood hazards, and damage to fish and wildlife. Disposal of excess spoil on

preexisting benches would also help protect the environment by reducing both the size and number of valley, head-of-hollow, and durable-rock fill structures in areas not disturbed by previous or active mining operations.

Regulatory provisions for disposal of excess spoil on preexisting benches are found at 30 CFR 816 / 817.74. The benches to which the rule is applicable are those remaining from mining operators conducted prior to the currently permitted operation. These rules encourage the use of excess spoil for the purpose of backfilling these preexisting benches, but OSM does not require the use of preexisting benches for the disposal of excess spoil. The rules are intended to provide operations with another option for the handling of excess spoil -- an option which would help to achieve the important goal of reclaiming abandoned mine lands and which would, in many circumstances, prove to be economically and technologically attractive to operators.

Fill types recognized by the States: In general State regulations recognize the fill types listed in Federal rules, albeit some of the OSM-approved design and construction requirements are unique to their programs. For example, the Kentucky and West Virginia definitions of durable rock are more specific than the Federal definition. The Kentucky regulations require a Slake Durability Index (SDI) of at least 90%, or similar result using another test that's equivalent to the SDI to the State's satisfaction [405 KAR 16:130 Section 4 (1)(a)2].³ The West Virginia regulations reject soil-like material in the durable rock definition: rock capable of degrading to a material, of which at least 50% is finer than 0.074 millimeter, has plasticity, and is classified as ML, CL, OL, MH, CH, or OH (under ASTM D-2487), is considered to be soil [38 CSR 2-14.14.g.1.B]. The West Virginia rules also have a construction limitation: the final toe of the fill is not allowed to rest on a natural slope greater than 20 percent.⁴

Other fill types not specifically listed in the Federal regulations are recognized in the regulations of several state regulatory agencies and approved by OSM. One of these is the "side hill fill" in West Virginia [38 CSR 2 14.14.f]. Construction requirements and limitations include; that the toe of the fill rest on a natural slope no steeper than 36 percent; the construction of lateral underdrains to control subsurface drainage; total organic removal in "critical foundation areas;" and placement of the excess spoil in compacted lifts not exceeding four feet in thickness. Another fill type is the "zoned concept" in Virginia [4 VAC 25-130-816.75]. This fill comprises structural and nonstructural zones in which the former is located in the toe area and constructed in compacted lifts with densities and strengths to support the entire structure. Surface and subsurface drainage systems are also required.

5. Trends in Excess Spoil Disposal

Based on permits issued during the period October 1, 2001, to June 30, 2005, over 1600 new excess spoil fills were approved to be constructed (see table III-3). The data in this table was derived from information provided by the respective regulatory authorities in each of the coal producing states and Indian lands. The fills are almost exclusively limited to the coal mining operations in the Appalachian Basin. Within that region, most of the fills are located in Kentucky (1079) [Koppe 2006], Virginia (125) [Virts 2006], and West Virginia (372) [Matt 2006]. OSM approved 13 excess spoil fills in Tennessee during that time period [Coker 2006]. About a dozen fills were also permitted in the southern and northern Appalachian Basin coal fields: Alabama (6), Ohio (7), and Pennsylvania (1) [Best 2006; Schrum 2005; and Sherfy 2006, respectively].

³ The SDI test for durability is generally used in all states, regardless of whether the test is mentioned in the regulations.

⁴ More recent regulatory or programmatic changes in Kentucky and West Virginia pertaining to durable rock fills are covered in Section 3.8.7.3.

Table III-3 – Excess spoil fills by region permitted between October 1, 2001 and June 30, 2005

Region	Number of Excess Spoil Fills
Northern Rocky Mountains and Great Plains	0
Appalachian Basin*	1603
Colorado Plateau	5
Illinois Basin	0
Gulf Coast	0
Other Areas**	4

* Kentucky, Virginia, and West Virginia account for over 98 percent of the excess spoil fills permitted to built in the Appalachia Basin

** Washington and Alaska

Recent information shows a trend towards less numerous fills and smaller fills. Permit information indicates that from 2002 to 2005 the number of fills permitted in Kentucky and West Virginia declined (from 262 to 92 and 86 to 56 fills, respectively). The average footprint acreage of proposed excess spoil fills in West Virginia shows an erratic trend over these years. However, the average size of the Kentucky fills continues to show a general decline (from 19 to 7 acres).

The reader is referred to Chapter K.2 of U.S. Environmental Protection Agency, Mountaintop Mining/Valley Fills in Appalachia Draft Programmatic Environmental Impact Statement, EPA 9-03-R-00013, EPA Region 3, June 2003 (available at <http://www.epa.gov/region3/mtntop/eis.htm>) to review additional historic information regarding the construction trend of excess spoil fills in the central Appalachian coal fields prior to October 2001.

Certain important changes in several state regulatory programs in regards to durable rock fill stability are also noted. In general, the state regulations still reflect the Federal rules in that they recognize the same fill types and similarly require measures to ensure stability through site investigation, material strength testing, foundation preparation, underdrains, surface drains, regrading, and revegetation. Kentucky and West Virginia, however, have augmented their stability-related requirements through rule and policy changes.

Kentucky, through the 2002 promulgation of RAM No. 135 and Procedure No. 36, require designated zones near the toe and near the top of the fill where underdrains are constructed instead of dumped. This is to ensure: (1) the placement of adequate underdrains at the top of the fill footprint where the slope of the developing fill face is too short for effective gravity segregation; and (2) prevention of underdrain plugging near the bottom of the structure during fill-face regrading. They further require the mine operator to identify (in the field by flagging) a “stability point” upslope of the designed toe location, above which it is not possible to demonstrate a static safety factor of at least 1.5. If the completed fill is smaller than initially designed, its toe must still at least reach the stability point. Finally, wing dumping is controlled by requiring the operator to flag the design “crest limit” of the structure (defined by the length of the fill’s top bench). The operator is not allowed to end dump material anywhere down valley of the crest limit.

While the changes in Kentucky were made for the primary purpose of ensuring fill stability, changes in the West Virginia regulations respond to erosion and flooding problems below unfinished durable rock fills. The current regulations stipulate, among other requirements, that the fills are constructed in one of two ways: (1) by establishment (prior to end-dumping) of an “erosion protection zone” of mechanically placed and graded durable rock reaching a specified distance downslope of the final toe of the designed fill; or (2) construction of the fill from the toe upwards with dumping increments not exceeding 100 feet [38 CSR 2 14.14.g.2 and g.3]. The erosion protection zone is intended to reduce siltation down gradient of the toe of the fill by dissipating runoff energy, but the erosion protection zone would likely enhance stability as well.

Because the West Virginia requirements were only recently instituted and because new permits incorporating the requirements have only recently been approved, few if any durable rock fills have yet been constructed with erosion protection zones.

The toe-upward construction may allay the risk of severe flooding and siltation downstream, but it is uncertain as to whether the method would have a positive influence on long-term stability. Regrading the fill face to a 50 percent slope contemporaneously with the lift placement should ensure stability during the construction process.

6. Stability of Excess Spoil Fills

The objective of most of the Federal regulatory requirements pertaining to excess spoil fills is to ensure long-term stability. The long-term stability of the fills is of great importance because the structures are not monitored or maintained by the mining industry or government following final bond release. Required steps to achieve stability include:

- A site investigation for each proposed excess spoil fill, specifically an investigation of the terrain and materials that will form the foundation of the fill. Important concerns include soil depth, the engineering strength of the soil or rock foundation materials, and the occurrence of seeps or springs.
- A stability analysis of the designed fill based on (1) accurate values representing the engineering strengths (i.e. internal friction angle and cohesion) of the placed spoil and foundation material and (2) anticipated pore-water pressures in the fill mass. The analysis must demonstrate a static safety factor (SF) of 1.5 and dynamic SF of 1.1.
- Professional engineer's certifications during the construction of the fills to document that certain critical construction phases are being carried out according to the permit plan. These phases include: foundation preparation; underdrain construction; surface drain construction; grading; and revegetation.

In the case of durable rock fills, additional information is required in the design phase to demonstrate in the permit that the structures will comprise 80 percent durable rock by volume. The successful long-term performance of the fills is directly related to the strength and durability of the rock in the fill mass and rock drains. Durable rock is defined in Federal regulations at 30 CFR 816 / 817.73(b) as rock which does not slake in water and will not degrade to soil material. The regulatory intent is to selectively obtain rock that can withstand surface mining conditions, and natural forces affecting the fill mass after final placement, without significant degradation. The intent is that, over the long term, the durable rock fill behaves as a mass of broken rock and not as soil. In all states, the industry and State agencies have relied upon the Slake Durability Index (SDI) as the primary method to evaluate rock durability. This testing protocol has received much critical attention over the years. Several State and Federal inspectors, engineers, and geologists have considered that the SDI may not accurately discriminate durable and non-durable rock. Whether a lack or absence of true durable rock in a durable rock fill would result in instability depends in large part on the amount of subsurface drainage that must be conveyed beneath the structure. To-date, the occurrence of significant mass movements on all types of valley fills is minimal.

Summary of OSM report: Long-Term Stability of Valley Fills: The long-term stability of excess spoil fills in steep-sloped Appalachia (in parts of Kentucky, Tennessee, Virginia, and West Virginia) was evaluated in preparation of the MTM/VF DPEIS. Among other tasks, the 2002 study included permit and field reviews of 128 excess spoil fills. The sample included all fills known to have experienced incidences of significant instability. For detailed information, please read Chapter III.K.1.c and Appendix H of the MTM/VF DPEIS, which is available at

<http://www.epa.gov/region3/mtntop/eis.htm>.

For the purposes of the 2002 study, fill instability was defined as evidence that (1) part of the fill's mass had separated from the rest of the fill; (2) the separation occurred along a continuous slip surface, or continuous sequence of slip surfaces, intersecting the fill's surface; and (3) some vertical displacement took place. Cases of instability identified with those criteria were further distinguished between "major" and "minor" occurrences. Major slope movements were those judged to have occurred over a large fraction of the fill face (e.g. over at least a few outslope benches) and/or required a major remediation effort (redistribution of the spoil from one part of the fill to another, construction of rock-toe buttresses, extensive reworking or augmenting of the drainage systems etc.). Because of the potential dangers they presented and the difficulty of their repair, major instabilities were a major focus of the study. Minor slope movements were those that occurred over a small area on the fill (e.g. not more than one bench on the fill face) and only necessitated minor reworking of the fill material (i.e. without significantly changing the original fill configuration). Minor movements were quickly repaired, with no need for further documentation beyond the mine inspection report.

The observation from the study indicated that major slope movements on valley fills were neither commonplace nor widespread. Only 20 occurrences of major valley fill instability were recorded out of more than 4,000 fills constructed over a 23-year period. None of occurrences resulted in the loss of life or significant property damage. All occurrences took place on active permits and all but one were repaired prior to bond release. One instability remained unreclaimed following bond forfeiture.

The twenty slope movements resulted from improper design or construction practices or inadequately-investigated foundation conditions. More specifically, the study attributed instability to: inadequate subsurface drains; non-durable rock; underground mine drainage; inadequate surface drains; steep foundation slope; thick soil foundation; and/or construction in a landslide-prone area. Some of these factors are interrelated. For example, an underdrain system of a durable rock fill is likely inadequate when insufficient amount of durable rock and/or unaccounted-for subsurface drainage. An existing thick soil foundation can result from accumulations of colluvial sediment in landslide-prone topography.

Most of the factors attributing to instability were not quantitatively analyzed with the exception of foundation slope inclination. Whereas the average foundation slope at the toe of fills was approximately 10 percent, the average of the 20 unstable fills was approximately 16 percent. Six out of nine sampled fills with toe foundation slopes in excess of 20 percent were unstable (figure III-18).

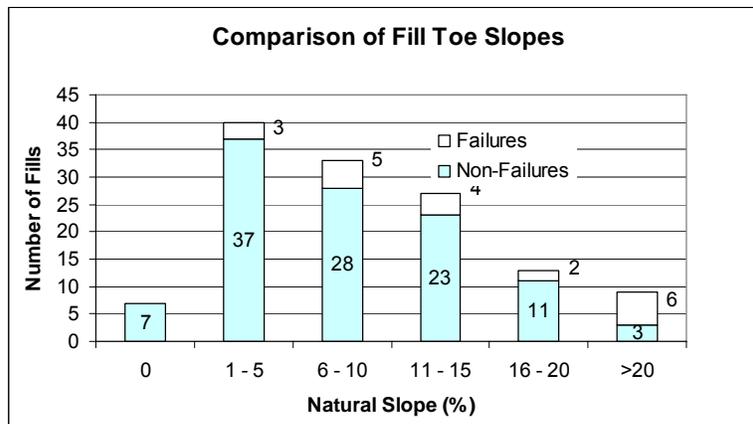


Figure III-18 - Frequency distribution of toe foundation slope

Although the study found only a very small percentage of excess spoil fills that experienced significant instability over the 23-year period, the study identified areas of fill design, construction, and documentation that are possibly for improvement to better ensure long-term stability. Some of the following recommendations were already implemented by State regulatory authorities: (1) more discriminating methods for determining rock durability; (2) consideration of alternative fill construction techniques to assure optimal foundation and drainage control ; (3) better guidance on requirements for foundation investigations and stability analyses; (4) better documentation and record keeping for critical construction phase certifications; (5) prohibition of "wing dumping" excessive distances beyond the fill face; (6) additional assurances for fill foundations on steep slopes; (7) consideration of limits on fill-construction temporary cessation periods before requiring face completion; (8) additional studies of completed fills; and, (9) diligence in assuring a prohibition of impoundment construction on fills.

7. Stability of Backfill

Historically, spoil returned to mining area in accordance with the SMCRA requirements is stable, or typically is limited to minor and easily repairable slope movements. With one exception, which will be discussed below, OSM is unaware of significant or widespread backfill stability issues.

One case of significant instability occurred in Tennessee and was discovered in January 2005. The landslide, referred to as the High Point slide, covers approximately 25 acres. The slide affected both pre- and post-SMCRA mined land, and previously undisturbed terrain. Conclusions attribute the likely cause of the slide to over-stacking of spoil material on the backfill portion of the mine site and improper drainage controls.

8. Coal Mine Waste

Both underground and surface mine coal may contain excessive clay, shale, other rock-types, and other impurities, such as pyrite. These impurities may make this run-of-the-mine coal unsuitable for immediate use by the consumer in its state at the mine mouth. This coal is processed to remove impurities or blend with higher quality coal before delivery to the shipping point. Coal processing is increasingly important in coal fields with medium and high-sulfur coals since the enactment of the Clean Air Act Amendments of 1990, which require power plants to lower their emissions of sulfur dioxide.

Typical processing facilities range from fairly simple, consisting of crushing and screening equipment to more complex if impurities are tightly bond to the coal matrix. In the latter situation, crushed coal is separated into coarse and fine coal factions. The course coal is generally sent through high density (heavy media) separators, where lower density clean coal is separated from higher density impurities. The coarse reject from this process is referred to as coal refuse or gob and may be transported by truck, conveyors, or by other means to permanent disposal areas. The fine coal faction is also further separated into various sizes whereby the larger fractions are sent though hydrocyclones and the smaller factions through flotation tanks. The reject material is sent to thickeners to remove a portion of some of the processing water which is recycled within the plant. The remaining material referred to as "slurry" still contains considerable water. This slurry is pumped via pipelines to large permanent impoundments, where water decants over time from the fine reject material for reuse in the preparation plant.

Coal processing facilities are sometimes associated with older underground mines and may pre-date the surface operations from which they receive coal. Most older coal mine waste disposal facilities are a large impoundment formed by constructing a berm across an existing hollow or valley, and essentially become "valley fills" by the time refuse disposal is completed. The berm is

often constructed from the coarse refuse material in a series of lifts as new material accumulates behind the berm. The slurry is discharged in an impoundment behind the berm. Anecdotal evidence indicates that few new facilities of this type have been permitted in the last 15 years. One reason is that existing impoundments maintain many decades of storage capacity and are expanding in stages, which negated the necessity for permitting new facilities. Combined refuse disposal is more common today [EPA 2003, p. III-I-28].

Coal refuse disposal facilities are most often operated by the attendant processing facility. Coal refuse disposal facilities are long-term investments because of their size, support facilities, and reclamation requirements. The typical life of a coal refuse disposal facility is approximately 20 years. [Id.]

Approximately half of the bituminous coal mined annually in the United States is processed [Greb et al. 2006, p. 36]. Increased market specifications for higher quality coal led to greater percentages of material considered waste, and approximately 20 to 50 % of the mine production is rejected during processing [Lucas, et al. 1979, p. 17-45]. Of this, approximately 70 to 90 millions tons of preparation slurry are produced annually [Greb et al. 2006, p.37]. In 2001, there were 713 fresh-water and coal waste impoundments associated with coal processing facilities in the United States [Id.]

In addition to coal preparation waste, the definition of coal mine waste at 30 CFR 701.5 also includes underground developing waste, which consists of rock that must be excavated from an underground mine to facilitate the development of a mine. Examples of activities that create underground development waste include, but are not limited to: sinking a vertical or inclined mine shaft, driving ventilation and utility boreholes, and excavation of oversized haulageways within the mine.

In the steep terrain of central Appalachian coal field, most coal mine waste disposal areas are, by necessity, located in valleys similar to excess spoil fills. As is discussed in the succeeding section, there are rigorous requirements to ensure that these permanent coal mine waste disposal facilities are designed and constructed as stable and safe structures.

H. Regulatory Environment

The following discussion is intended to provide brief summaries that generally describe statutory and regulatory requirements related to the Federal action. The actual requirements are set forth in the documents cited.

1. Applicable SMCRA Statutory Provisions

Title V of SMCRA establishes comprehensive and detailed requirements with respect to the regulation of surface coal mining operations. The statutory provisions are applicable to activities conducted on the surface of lands in connection with surface coal mining and to activities conducted on the surface in connection with surface operations and surface impacts incident to underground coal mines. See 64 FR 70838, December 17, 1999. In the sections that follow, OSM discusses a few selected provisions of SMCRA that are especially relevant to this rulemaking initiative. For additional information and perspective, OSM suggests that the reader refer to the complete text of SMCRA, which is available at <http://www.osmre.gov/smcra.htm>.

a) Protection of the Prevailing Hydrologic Balance

Sections 515(b)(10) and 516(b)(11) establish the general performance standard for protecting the prevailing hydrologic balance for surface mining and for underground mining, respectively. These sections require surface coal mining and reclamation operations to:

[M]inimize the disturbances to the prevailing hydrologic balance at the mine site and in associated offsite areas and to the quality and quantity of water in surface and ground-water systems both during and after surface coal mining operations and during reclamation by -

(A) avoiding acid or other toxic mine drainage by such measures as, but not limited to -

(i) preventing or removing water from contact with toxic producing deposits;

(ii) treating drainage to reduce toxic content which adversely affects downstream water upon being released to water courses;

(iii) casing, sealing, or otherwise managing boreholes, shafts, and wells and keep acid or other toxic drainage from entering ground and surface waters;

(B)(i) conducting surface coal mining operations so as to prevent, to the extent possible using the best technology currently available, additional contributions of suspended solids to streamflow, or runoff outside the permit area, but in no event shall contributions be in excess of requirements set by applicable State or Federal law;

(ii) constructing any siltation structures pursuant to subparagraph (B)(i) of this subsection prior to commencement of surface coal mining operations, such structures to be certified by a qualified registered engineer or a qualified registered professional land surveyor in any State which authorizes land surveyors to prepare and certify such maps or plans to be constructed as designed and as approved in the reclamation plan;

(C) cleaning out and removing temporary or large settling ponds or other siltation structures from drainways after disturbed areas are revegetated and stabilized; and depositing the silt and debris at a site and in a manner approved by the regulatory authority;

(D) restoring recharge capacity of the mined area to approximate premining conditions;

(E) avoiding channel deepening or enlargement in operations requiring the discharge of water from mines;

(F) preserving throughout the mining and reclamation process the essential hydrologic functions of alluvial valley floors in the arid and semiarid areas of the country; and

(G) such other actions as the regulatory authority may prescribe;

The legislative history of SMCRA gives insight as to the expectations of Congress in maintaining the hydrologic balance:

The total prevention of adverse hydrologic effects from mining is impossible and thus the bill sets attainable standards to protect the hydrologic balance of impacted areas within the limits of feasibility...

H.R. Rep. No. 95-218, at 110 (1977).

Moreover, the legislative history of SMCRA indicates Congressional expectations concerning mining impacts on the hydrologic balance within and outside the area of mining activities:

Concern has been expressed that the bill's hydrology provisions somehow require that the hydrologic characteristics of the site prior to mining must be maintained in the actual working mine excavation. Such an interpretation is not justified. . . The committee is

concerned about how extensive the secondary effects could be . . . in surrounding areas. The bill requires that the operator will take such measures as are necessary to minimize the disturbance to the hydrologic balance in the surrounding areas.

Id.

b) Protection of Fish, Wildlife and Related Environmental Values

Section 515(b)(24) of the SMCRA establishes the general performance standard for protecting fish, wildlife, and related environmental values. It requires surface coal mining and reclamation operations to:

to the extent possible using the best technology currently available, minimize disturbances and adverse impacts of the operation on fish, wildlife, and related environmental values, and achieve enhancement of such resources where practicable (Emphasis added).

Although SMCRA is replete with the use of the term 'best technology currently available' (BTCA), Congress did not define this term. OSM defined BTCA at 30 CFR 701.5, which is discussed in a subsequent section.

c) Excess Spoil Creation and Control

Congress recognized the importance of returning mine spoil to the mined area as an integral part of reclamation but also recognized that there are situations where this is not desirable or possible. Section 515(b)(3) of SMCRA requires that all surface coal mining and reclamation operations backfill, compact (where advisable to ensure stability or to prevent leaching of toxic materials), and grade to restore the approximate original contour (AOC) of the land except when an approved alternative post mining land use is proposed for land reclaimed to a level or gently rolling contour after mountaintop removal mining. Section 515(b)(3) also provides for certain other exceptions to the AOC requirement, in recognition that there are situations when it is not possible to return all the spoil to the mined area, particularly if the volume of overburden is large relative to the thickness of coal. In those situations, the operator is required to demonstrate that due to volumetric expansion the amount of overburden and other spoil and waste material is more than sufficient restore the AOC. The operator is also required to backfill, grade, and compact (where advisable) any excess overburden and other spoil and waste material to obtain the lowest grade but not more than the angle of repose in order to achieve an ecologically sound land use compatible with the surrounding region and to prevent slides, erosion and water pollution.

Prior to the passage of SMCRA and State surface mining laws, many coal mines were not reclaimed. The broken rock (spoil) above the coal seam was indiscriminately shoved over the steep slopes below the outcrop of coal with little regard for stability or erosion. Landslides and siltation were widespread. Congress addressed this issue in Section 515(b)(21), which requires the protection of offsite areas from slides and damage, and includes requirements not to deposit spoil material outside the permit area.

Congress also directed that spoil not returned to the mining area is placed in stable locations. In Section 515(b)(22), Congress imposed specific controls for the disposal of excess spoil to assure mass stability and to prevent mass movement and erosion. Among the various controls, Section 515(b)(22)(D) requires that the excess spoil disposal area should not contain springs, natural water courses, or wet weather seeps unless lateral drains are constructed from the wet areas to

the main underdrain.

Special requirements for spoil handling are also provided for those surface coal mining operations located in steep slope areas. Section 515(d)(1) requires:

Insure that when performing surface coal mining on steep slopes, no . . . spoil material . . . be placed on the downslope below the mine bench or mining cut: Provided, That spoil material in excess of that required for the reconstruction of the approximate original contour under the provisions of paragraphs 515(b)(3) or 515(d)(2) shall be permanently stored pursuant to Section 515(b)(22).

d) Coal Mine Waste Disposal

There are several provisions in SMCRA that address the design, construction, and placement of coal mine waste. Section 515(b)(11) establishes the performance standards for “dry” coal mine waste embankments affiliated with coal surface coal mining and reclamation operations:

with respect to surface disposal of mine wastes, tailings, coal processing wastes, and other wastes in areas other than the mine working or excavations, stabilize all waste piles in designated areas through construction in compacted layers including the use of incombustible and impervious materials if necessary and assure the final contour of the waste pile will be compatible with natural surroundings and that the site can and will be stabilized and revegetated according to the provisions of this Act

Similarly, Section 516(b)(4) establishes the performance standards for dry coal mine waste disposal affiliated with underground mining operations:

with respect to surface disposal of mine wastes, tailings, coal processing wastes, and other wastes in areas other than the mine workings or excavations, stabilize all waste piles created by the permittee from current operations through construction in compacted layers including the use of incombustible and impervious materials if necessary and assure that the leachate will not degrade below water quality standards established pursuant to applicable Federal and State law surface or ground waters and that the final contour of the waste accumulation will be compatible with natural surroundings and that the site is stabilized and revegetated according to the provisions of this section

Sections 515(b)(13) and 516(b)(5) are applicable to all existing and new coal mine waste piles consisting of mine wastes, tailings, coal processing wastes, or other liquid and solid wastes and used either temporarily or permanently as dams or embankments:

design, locate, construct, operate, maintain, enlarge, modify, and remove, or abandon, in accordance with the standards and criteria developed pursuant to subsection [515](f), all existing and new coal mine waste piles consisting of mine wastes, tailings, coal processing wastes, or other liquid and solid wastes and used either temporarily or permanently as dams or embankments

Section 515(f) instructs the Secretary of the Interior, with written concurrence of the Chief of Engineers of the Corps of Engineers, to promulgate regulations applicable to coal mines waste:

The Secretary, with the written concurrence of the Chief of Engineers, shall establish within one hundred and thirty five days from the date of enactment, standards and criteria regulating the design, location, construction, operation, maintenance, enlargement, modification, removal, and abandonment of new and existing coal mine

waste piles referred to in section 515(b)(13) and section 516(b)(5). Such standards and criteria shall conform to the standards and criteria used by the Chief of Engineers to insure that flood control structures are safe and effectively perform their intended function. In addition to engineering and other technical specifications the standards and criteria developed pursuant to this subsection must include provisions for: review and approval of plans and specifications prior to construction, enlargement, modification, removal, or abandonment; performance of periodic inspections during construction; issuance of certificates of approval upon completion of construction; performance of periodic safety inspections; and issuance of notices for required remedial or maintenance work.

The legislative history provides insight into the roles of the Secretary of the Interior and the Chief of Engineers of the Corps of Engineers expected by Congress in regulating coal mine waste impoundments under SMCRA:

In order to assure that mine waste impoundments used for the disposal of liquid or solid waste material from coal mines are constructed or have been constructed so as to safeguard the health and welfare of downstream populations, H.R. 2 gives the Army Corps of Engineers a role in determining the standards for construction, modification and abandonment of these impoundments.

Authority for the issuance of regulations and inspections of impoundments rests with the Secretary of the Interior; however, such regulations should be developed by the Chief of Engineers. It is the intent of the conferees that the safety, engineering and design standards of the Corps of Engineers will apply, through the rules and regulations of the Secretary, to such structures and waste disposal banks which may serve as temporary or permanent impoundments. However, it is not the intent that the Chief of Engineers must therefore monitor or sign off on every such structure. That duty belongs to the Secretary of Interior

H.R. Rep. No. 95-218, at 125 (1977).

2. Applicable SMCRA Regulations

References below to sections in 30 CFR Part 816 are intended to include references to corresponding sections in Part 817, as applicable.

a) Stream Buffer Zones

There are no provisions in SMCRA requiring establishment or protection of a stream buffer zone. In fact, neither the term nor the concept are used anywhere in SMCRA. Congress did not mandate the establishment of stream buffer zones although they did recognize that it is one method among many that is used to keep sediments from streams:

Similarly, technology exists to prevent increased sediment loads resulting from mining from reaching streams outside the permit area. Sediment or siltation control systems are generally designed on a mine-by-mine basis which could involve several drainage areas or on a small-drainage-area basis which may serve several mines. There are a number of different measures that when applied singly or in combination can remove virtually all sediment or silt resulting from the mining operation. A range of individual siltation control measures includes: erosion and sediment control structures, chemical soil stabilizers, mulches, mulch blankets, and special control practices such as adjusting the timing and sequencing of earth movement, pumping drainage, and establishing vegetative filter strips.

H.R. Rep. No. 95-218, at 114 (1977) (emphasis added).

OSM adopted the concept of a “buffer zone” around intermittent and perennial streams as a means “to protect stream channels from abnormal erosion” from nearby upslope mining activities. 42 FR 62652 (December 13, 1977). The initial program regulations establishing the stream buffer zone requirements provide:

No land within 100 feet of an intermittent or perennial stream shall be disturbed by surface coal mining and reclamation operations unless the regulatory authority specifically authorizes surface coal mining and reclamation operations through such a stream. The area not to be disturbed shall be designated a buffer zone and marked as specified in Section 715.12.

30 CFR 715.17(d)(3).

The 1977 initial program regulation did not specify the conditions under which the regulatory authority could waive the stream buffer zone requirement. OSM confirmed in the preamble to the 1977 rule that, “if operations can be conducted within 100 feet of a stream in an environmentally acceptable manner, they may be approved.” 42 FR 62652 (December 13, 1977).

OSM published the permanent program regulations in the Federal Register on March 13, 1979. Those regulations retained a revised stream buffer zone concept as a means to implement various SMCRA provisions, in particular, Sections 515(b)(10) and 515(b)(24). 44 FR 15176 (March 13, 1979). As noted in the previous section, Section 515(b)(10) requires that mining operations “minimize the disturbances to the prevailing hydrologic balance at the mine-site and in associated offsite areas” by, among other things, preventing, to the extent possible, additional contributions of suspended solids to stream flow or runoff outside of the permit area. Section 515(b)(24) requires operations to “minimize disturbances and adverse impacts of the operation on fish, wildlife, and related environmental values.”

OSM explained in the preamble to the 1979 final rule: “Buffer zones are required to protect streams from adverse effects of sedimentation and from gross disturbance of stream channels.” 44 FR 15176 (March 13, 1979). The bulk of the discussion in that preamble focused on protecting streams from sedimentation. *Id.* OSM stated that the stream buffer zone rule “protects stream channels, but contemplates that the regulatory authority may allow surface mining activities to be conducted within ‘the stream buffer zone.’ Thus, if operations can be conducted within 100 feet of a stream in an environmentally acceptable manner, they may be approved.” *Id.*

The 1979 stream buffer zone rule specified conditions under which the regulatory authority could grant an exemption to the stream buffer zone restriction. The permanent program rule also replaced the term “intermittent stream” with “stream with a biological community.” The 1979 permanent program rule provided that, in order to grant an exemption from the stream buffer zone restriction, the regulatory authority had to find:

- (1) That the original stream channel will be restored; and
- (2) During and after the mining, the water quantity and quality from the stream section within 100 feet of the surface mining activities shall not be adversely affected.

The finding required by the 1979 rule expressly applied to water quantity and quality of the stream section “within 100 feet” of the mining activity, rather than applying to the segment of stream disturbed by mining activity. Therefore, it did not require a finding related to water quantity or quality within the segment of stream to be disturbed by mining activities.

On March 30, 1982, the current stream buffer zone regulations were published in the Federal

Register as proposed rules. 47 FR 13466. OSM published the final regulations on June 30, 1983. 48 FR 30327. In the preamble to the proposed rule in March 1982, OSM stated that the 1979 regulations were changed because they had proved excessive and too confusing to implement. 47 FR 13467. This characterization primarily stemmed from the 1979 rule's reference to protecting "streams with a biological community," but was also based on the agency's recognition that one of the conditions for granting an exemption to the stream buffer zone restriction – to restore the original stream channel – was too impractical. *Id.*

In the June 30, 1983, Federal Register notice [48 FR 30315], OSM discussed a suggestion by several commenters to delete or clarify a new phrase in the March 1982 proposed rule "as determined by State or Federal water quality standards." To address the commenters' concerns and to eliminate regulatory uncertainty, OSM adopted the phrase "will not cause or contribute to violation of applicable State or Federal water quality standards." OSM explained that operators are required to comply with all "non-Act requirements for water" protection under proposed hydrologic balance protection regulations at Section 816.41.

In the preamble to the 1983 final rule, OSM's response to a comment indirectly elaborated on the requirement that SMCRA mining operations "will not adversely affect the water quantity and quality or other environmental resources of the stream." OSM implicitly recognized that this condition does not require that "no adverse" effects occur, but rather that these effects be minimized:

Alteration of streams may have adverse aquatic and ecological impacts on both diverted stream reaches and other downstream areas. However, final Section 816.57(a) will minimize these impacts ...

48 FR 30315 (June 30, 1983).

Finally, in response to a comment on the 1983 stream buffer zone rule, OSM explained that the clause "will not adversely affect ... environmental resources of the stream" was added to the conditions for a stream buffer zone exemption to more accurately reflect the objectives of Sections 515(b)(10) and (24) of SMCRA. 48 FR 30316 (June 30, 1983).

The January 1983 final environmental statement "OSM-EIS-1: Supplement" provided the NEPA analysis for the 1983 stream buffer zone rule. The following excerpt illustrates OSM's expectation that some small streams are unavoidably impacted by mining:

The draft final regulations on the stream buffer zone (Section 816.57) would provide essentially the same protection to water quality of streams as the current regulations. The draft final regulations, however, would provide protection to perennial and intermittent streams, whereas, the current regulations protect perennial streams and streams with a biological community... Many such streams are found in the Appalachian coal region and support biological communities or serve as fish spawning areas. In most cases, impact of mining on those streams would be temporary because of the requirement to design and construct permanent diversions or stream channels to restore or approximate the premining characteristics of the original stream channel and natural riparian vegetation (draft final Section 816.41(f)). In some cases, such as small headwater drainages, the original stream channel might not be restored. Where this happens, the disruption of the stream channel could potentially alter the hydrologic balance downstream, with subsequent impacts on fish. Requirements to protect the hydrologic balance would tend to limit this, and such impacts are not considered significant.

[OSM 1983, p. IV-37]

In the 1983 EIS, OSM went on to discuss the impacts of more environmentally protective

alternatives to the 1983 stream buffer zone rule:

OSM could eliminate the exemption from the general stream buffer zone requirements (Section 816.57), and all mining would be prohibited within 100 feet of any perennial or intermittent stream. Although this would provide maximum protection to streams, the potential impacts on coal recovery could be significant in those areas with large coal reserves and extensive water resources.

[OSM, 1983, p. IV-83]

The 1983 amendments reinstated use of the term "intermittent stream" in place of "streams with a biological community." The amended regulation also changed the conditions for authorizing an exemption to the stream buffer zone restriction, to require that:

- (1) Surface mining activities will not cause or contribute to the violation of applicable State or Federal water quality standards, and will not adversely affect the water quantity and quality or other environmental resources of the stream; and
- (2) If there will be a temporary or permanent stream channel diversion, it will comply with Section 816.43.

OSM reaffirmed the basic purpose of the stream buffer zone rule in the preamble to the June 30, 1983, amendments: to protect streams from sedimentation and from gross disturbances of the stream channel. OSM said that stream buffer zones are effective means, in conjunction with sediment ponds and other measures, to prevent excessive sedimentation of streams by runoff from disturbed surface areas. OSM also said that the new rules recognize that intermittent and perennial streams have environmental resource values worthy of protection under Section 515(b)(24) of SMCRA. 48 FR 30312 (June 30, 1983).

The 1983 stream buffer zone rule was challenged in the U.S. District Court for the District of Columbia, by both the coal industry and the National Wildlife Federation, and was successfully defended by OSM. *In Re Permanent Surface Mining Regulation Litigation*, 21 ERC 1724, 1741-1742 (D.D.C. 1984).

The current Federal stream buffer zone rule was in effect since August 1, 1983. See the Federal Register at 48 FR 30312 (June 30, 1983). State regulatory programs include similar requirements. Neither OSM nor the State SMCRA regulatory authorities have interpreted or implemented the stream buffer zone rule as an absolute prohibition of placement of excess spoil fills or any other surface mining activity within the stream buffer zone. Coal permit applicants could conduct surface mining or related activities closer than 100 feet from an intermittent or perennial stream if they could show that they would meet the conditions set forth in 30 CFR 816.57 for a stream buffer zone waiver.

b) Best Technology Currently Available

While SMCRA is replete with the use of the term "best technology currently available" (BTCA), Congress did not define this term. OSM defined BTCA in the permanent program regulations at Section 701.5 to mean:

. . . equipment, devices, systems, methods, or techniques which will (a) prevent, to the extent possible, additional contributions of suspended solids to stream flow or runoff outside the permit area, but in no event result in contributions of suspended solids in excess of requirements set by applicable State or Federal laws; and (b) minimize, to the

extent possible, disturbances and adverse impacts on fish, wildlife and related environmental values, and achieve enhancement of those resources where practicable. ...Within the constraints of the permanent program, the regulatory authority shall have the discretion to determine the best technology currently available on a case-by-case basis, as authorized by the Act and this chapter.

In response to comments on the proposed rule, OSM alluded to the fact that the requirements for BTCA in the regulations were intended to implement the statutory provisions of both Sections 515(b)(24) and 515(b)(10)(B)(i):

Comments recommended the phrase "achieve enhancement of such fish and wildlife resources where practicable" should be deleted from the definition. These comments are also rejected as the language is a statutory mandate taken from Section 515(b)(24) of the Act. Comments also were submitted suggesting that the phrase "but in no event shall such technology result in contributions of suspended solids in excess of requirements set by applicable State or Federal laws," be stricken from the definition. The comments are rejected as the phrase is taken from Section 515(b)(10)(B)(i) of the Act, and as such is a legal requirement of operators...

44 FR 14926 (March 13, 1979)

OSM also stated in response to comments on the proposed definition of BTCA that the regulatory authority has discretion to determine on a case-by-case basis what BTCA methods are most effective and appropriate:

Comments were received regarding the division of responsibility for determining best technology currently available (BTCA). The definition allows the State regulatory authority to determine BTCA within the constraints of the Offices' permanent regulatory program regulations and the Act...

Id.

The association between BTCA and the stream buffer zone rule is evident. In the preamble to final permanent program regulations, OSM stated that the stream buffer zone regulation "is promulgated to implement Sections 515(b)(10) and 515(b)(24) of the Act." 44 FR 15176 (March 13, 1979). OSM went on to say: "The general rule of Section 816.57 recognizes that buffer zones are an effective method to be used, in conjunction with sedimentation ponds and other techniques, to prevent sedimentation of streams by runoff from disturbed surface areas..."

Id.

In addition, OSM's regulations at 30 CFR 816.45(a) and 816.97(a), which implement SMCRA Sections 515(b)(10)(B)(i) and 515(b)(24), specify that BTCA is to be applied to achieve the purposes of those particular regulations. Discussions of these regulations will follow.

The U.S. Forest Service also uses the term "BTCA" for mine reclamation, and references a handbook published by the Utah Oil, Gas, and Mining (Wright, 2000) as a practical guide for reclamation. The handbook describes the use of vegetative belts to act as sediment filters (similar to our stream buffer zones) and other practical means of minimizing erosion, including: surface roughening, mulch, matting, slope shaping, straw bales, and sedimentation ponds. The handbook also discusses excess spoil, which it refers to as "excess material." The handbook recognizes that this excess material is a source of adverse environmental effects and can increase surface disturbance, cover up protective habitat, and is a potential source of sediment. The BTCA techniques described in the handbook are more general than but consistent with our regulations and the preferred alternative in this EIS. The reader may refer to the handbook for examples of BTCA techniques suggested by the Forest Service.

c) Hydrologic Information

The Federal regulations at 30 CFR 780.21 require inclusion of baseline hydrologic information in the mining permit application. Ground-water baseline data includes the location and ownership of all existing water wells on the permit and adjacent areas, springs and other ground-water resources, seasonal quality and quantity of the ground water, and its usage. Water quality descriptions include, at a minimum, total dissolved solids or specific conductance, pH, total iron, and total manganese. Ground water quantity descriptions include, at minimum, approximate rate of discharge or usage and depth to the water in the coal seam, and each water-bearing stratum above, and potentially impacted stratum below the coal seam.

Section 780.21(b) requires a description of surface water information. Surface water data includes: Name, location, ownership, and description of all surface-water bodies such as streams, lakes, and impoundments, the location of any discharge into any surface-water body in the proposed permit and adjacent areas, and information on surface water quality and quantity sufficient to demonstrate seasonal variation and water usage. Water quality descriptions include, at a minimum, baseline information on total suspended solids, total dissolved solids or specific conductance, pH, total iron, and total manganese. Baseline acidity and alkalinity information must be provided if there is a potential for acid drainage from the proposed mining operation. Water quantity descriptions include, at a minimum, baseline information on seasonal flow rates.

Section 780.21(f) requires that a permit application contain a determination of the probable hydrologic consequences (PHC) of the proposed operation upon the quality and quantity of surface and ground water under seasonal flow conditions for the proposed permit and adjacent areas. The PHC determination is required to include a discussion of whether the proposed operation may result in contamination, decrease or interruption of an underground or surface source of water within the proposed permit or adjacent areas which is used for domestic, agricultural, industrial or other legitimate purpose; and what impact the proposed operation will have on (A) sediment yields from the disturbed area; (B) acidity, total suspended and dissolved solids, and other important water quality parameters of local impact; (C) flooding or streamflow alteration; (D) ground water and surface water availability; and (E) other characteristics as required by the regulatory authority.

Section 780.21(b)(2) states that if the PHC indicates that adverse impacts on or off the proposed permit area may occur to the hydrologic balance, or if acid forming or toxic-forming material is present that may result in contamination of ground-water or surface-water supplies, then supplemental information is provided to evaluate the PHC and to plan remedial and reclamation activities. Such supplemental information is based upon drilling, aquifer tests, hydrogeologic analysis of water bearing strata, flood flows, or analysis of other water quality or quantity characteristics.

Section 780.21(c) requires that hydrologic and geologic information for the cumulative impact area necessary to assess the probable cumulative hydrologic impacts of the proposed operation and all anticipated mining on surface- and ground-water systems be provided to the regulatory authority.

The regulatory authority is required under Section 780.21(g) to assess the probable cumulative hydrologic impacts (CHIA) of the proposed operation and all anticipated mining upon surface- and ground-water systems in the cumulative impact area. The CHIA is to determine, for the purposes of permit approval, whether the proposed operation design will prevent material damage to the hydrologic balance outside of the permit areas.

Section 780.21(h) requires that an application include a plan, with maps and descriptions, indicating how the relevant requirements of the performance standards (including Sections 816.41-816.43) are met. The plan is specific to the local hydrologic conditions. It must contain

the steps to be taken during mining and reclamation through bond release to minimize disturbances to the hydrologic balance within the permit and adjacent areas; prevent material damage outside the permit area; meet applicable Federal and State water quality laws and regulations; and protect the rights of present water users. The plan must include measures to avoid acid or toxic drainage; prevent, to the extent possible using the best technology currently available, additional contributions of suspended solids to stream flow; provide water treatment facilities when needed; control drainage; restore the approximate premining recharge capacity; and, protect or replace rights of present water users. The plan must also address potential adverse effects identified in the PHC determination.

Section 780.21(i) requires the mining permit application to contain a ground-water monitoring plan based on the PHC determination. The plan must provide for the monitoring of parameters that relate to the suitability of the ground water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance set forth in Section 780.21(h). It must identify the quantity and quality parameters to be monitored, sampling frequency, and site locations. It must describe how the data may be used to determine the impacts of the operation upon the hydrologic balance. At a minimum, total dissolved solids or specific conductance corrected to 25°C, pH, total iron, total manganese, and water levels are monitored and data submitted to the regulatory authority at least every 3 months for each monitoring location. The regulatory authority may require additional monitoring.

Section 780.21(j) requires the mining permit application to contain a surface-water monitoring plan based on the PHC determination and the analysis of all baseline hydrologic, geologic, and other information in the permit application. The plan must provide for the monitoring of parameters that relate to the suitability of the surface water for current and approved post-mining land uses and to the objectives for protection of the hydrologic balance as well as the effluent limitations found at 40 CFR Part 434. The plan must identify the surface water quantity and quality parameters monitored, sampling frequency and site locations. It must describe how the data is used to determine the impacts of the operation upon the hydrologic balance. Monitoring locations are established in the surface-water bodies such as streams, lakes, and impoundments, that are potentially impacted or into which water discharges and at upstream monitoring locations; and the total dissolved solids or specific conductance corrected to 25°C, total suspended solids, pH, total iron, total manganese, and flow, are monitored. For point-source discharges, monitoring is conducted in accordance with 40 CFR Parts 122, 123 and 434 and as required by the National Pollutant Discharge Elimination System permitting authority. Monitoring reports are submitted to the regulatory authority every 3 months. The regulatory authority may require additional monitoring.

d) Performance Standard – Protecting the Hydrologic Balance

The general performance standards for the protection of the hydrologic balance from surface mining and reclamation operations are found at 30 CFR 816.41(a):

All surface mining and reclamation activities shall be conducted to minimize disturbance of the hydrologic balance within the permit and adjacent areas, to prevent material damage to the hydrologic balance outside the permit area, to assure the protection or replacement of water rights, and to support approved postmining land uses in accordance with the terms and conditions of the approved permit and the performance standards of this part. The regulatory authority may require additional preventative, remedial, or monitoring measures to assure that material damage to the hydrologic balance outside the permit area is prevented. Mining and reclamation practices that minimize water pollution and changes in flow shall be used in preference to water treatment . . .

The remainder of 30 CFR 816.41 prescribes the performance standards for ground-water protection, ground-water monitoring, surface-water protection, surface-water monitoring, acid- and toxic-forming materials handling, transfer of wells, water rights and replacement, and discharge into underground mines.

Section 816.42 specifies the performance requirements for water quality standards and effluent limitations. This regulation requires that all discharges of water from areas disturbed by surface mining activities are in compliance with all applicable State and Federal water quality laws and regulations and with the effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency set forth in 40 CFR Part 434.

Section 816.43 specifies the performance standards for diversions. This regulation allows the coal mine operator, with the approval of the regulatory authority, to divert flow from mined areas abandoned before May 3, 1978, and any flow from undisturbed areas or reclaimed areas by means of temporary or permanent diversions. It specifies that all diversions are designed to minimize adverse impacts to the hydrologic balance within the permit and adjacent areas, to prevent material damage outside the permit area and to assure the safety of the public. Specifically, the diversion and its appurtenant structures are designed, located, constructed, maintained and used to be stable, provide protection against flooding and resultant damage to life and property, prevent, to the extent possible using the best technology currently available, additional contributions of suspended solids to streamflow outside the permit area, and comply with all applicable local, State, and Federal laws and regulations. The remaining part of this regulation establishes specific performance standards for temporary diversions, diversions of perennial and intermittent streams, and diversion of miscellaneous flows (such as ground-water discharges and ephemeral streams). Among those standards, one requirement is especially pertinent to mitigating the effects of permanently or temporarily diverting intermittent and perennial streams. That provision requires that a permanent stream diversion or a stream channel restored after the completion of mining be designed and constructed so as to restore or approximate the premining characteristics of the original stream channel including the natural riparian vegetation. The purpose of this requirement is to promote the recovery and enhancement of aquatic habitat.

Section 816.45 specifies the performance for sediment control measures. This regulation establishes that appropriate sediment control measures must be designed, constructed, and maintained using the best technology currently available to:

- (1) Prevent, to the extent possible, additional contributions of sediment to streamflow or to runoff outside the permit area,
- (2) Meet the more stringent of applicable State or Federal effluent limitations, and
- (3) Minimize erosion to the extent possible.

Paragraph (b) of Section 816.45 characterizes 'sediment control measures' as practices carried out within and adjacent to the disturbed area. The sedimentation storage capacity of practices in and downstream from the disturbed area must reflect the degree to which successful mining and reclamation techniques are applied to reduce erosion and control sediment. Sediment control measures consist of the utilization of proper mining and reclamation methods and sediment control practices, singly or in combination. Sediment control methods include but are not limited to:

- (1) Disturbing the smallest practicable area at any one time during the mining operation through progressive backfilling, grading, and prompt revegetation;
- (2) Stabilizing the backfill material to promote a reduction in the rate and volume of runoff;

- (3) Retaining sediment within disturbed areas;
- (4) Diverting runoff away from disturbed areas;
- (5) Diverting runoff using protected channels or pipes through disturbed areas so as not to cause additional erosion;
- (6) Using straw dikes, riprap, check dams, mulches, vegetative sediment filters, dugout ponds, and other measures that reduce overland flow velocity, reduce runoff volume, or trap sediment; and
- (7) Treating with chemicals.

Section 816.46 establishes the performance standards for siltation structures. Paragraph (b) of this regulation prescribes the general performance standards. Among those standards, the regulation requires that additional contributions of suspended solids sediment to streamflow or runoff outside the permit area are prevented to the extent possible using the best technology currently available. The rest of Section 816.46 discusses the performance standards for sediment ponds, spillways, and other treatment facilities.

e) Fish, Wildlife and Related Environmental Values Information

Section 780.16 (a) requires that the application for a mining permit contain information on fish and wildlife for the permit and adjacent area. The scope and level and detail for such information are determined by the regulatory authority in consultation with State and Federal agencies responsible for fish and wildlife. Minimally, the information is of sufficient detail to design a protection and enhancement plan. Site-specific resource information necessary to address the respective species or habitats is required when the permit or adjacent areas is likely to include: Listed or proposed endangered or threatened species of plants or animals or their critical habitats listed under the Endangered Species Act of 1973, or those habitats and species protected by similar State statutes, or habitats of unusually high value for fish and wildlife such as important streams, wetlands, riparian areas, cliffs, migration routes, or reproduction and wintering areas, or habitats or other species identified through agency consultation as requiring special protection under State or Federal law.

Section 780.16 (b) requires that each permit application include a description of how, to the extent possible using best technology currently available, the operator will minimize disturbances and adverse impacts on fish, wildlife, and related environmental values, including compliance with the Endangered Species Act and how enhancement of these resources are achieved where practicable. The description is consistent with applicable performance standards [30 CFR 816.97], apply to species and habitat identified in paragraph (a), and include protective measures that are used during active phases of the mining operation. Such measures may include the establishment of buffer zones, selective location and special design of haul roads and power lines, and monitoring of surface water quality and quantity. The description must include a discussion of what enhancement measures are used during reclamation and the postmining phase of operation to develop aquatic and terrestrial habitat. Such measures may include, but are not limited to, the restoration of streams and other wetlands, retention of ponds and impoundments.

Section 780.16(c) affords the U.S. Fish and Wildlife Service the opportunity to review the information provided in paragraph (a) and the enhancement plan provided in paragraph (b).

f) Protection of Fish, Wildlife and Related Environmental Values

Section 816.97 establishes the performance standards to protect fish, wildlife, and related environmental values. Paragraph (a) requires that the operator shall, to the extent possible using the best technology currently available, minimize disturbances and adverse impacts on fish, wildlife, and related environmental values and shall achieve enhancement of such resources where practicable.

In response to comments on proposed Section 816.97, OSM re-emphasized that the regulatory authority has the discretion to specify BTCA to minimize adverse impact on fish, wildlife, and related environmental values:

Under final Section 816.97(a), the regulatory authority will determine what will constitute an acceptable minimization of harm.

48 FR 30317 (June 30, 1983)

Paragraph (b) requires that no surface mining activity is conducted which is likely to jeopardize the continued existence of endangered or threatened species listed by the Secretary or which is likely to result in the destruction or adverse modification of designated critical habitats of such species in violation of the Endangered Species Act of 1973, as amended [16 U.S.C. 1531 et seq.]. The operator shall promptly report to the regulatory authority any State- or federally-listed endangered or threatened species within the permit area of which the operator becomes aware. Upon notification, the regulatory authority shall consult with appropriate State and Federal fish and wildlife agencies and, after consultation, shall identify whether, and under what conditions, the operator may proceed.

Paragraph (c) requires that no surface mining activity is conducted in a manner which would result in the unlawful taking of a bald or golden eagle, its nest, or any of its eggs. The operator shall promptly report to the regulatory authority any golden or bald eagle nest within the permit area of which the operator becomes aware. Upon notification, the regulatory authority shall consult with the U.S. Fish and Wildlife Service and also, where appropriate, the State fish and wildlife agency and, after consultation, shall identify whether, and under what conditions, the operator may proceed.

Paragraph (d) requires that nothing in this chapter shall authorize the taking of an endangered or threatened species or a bald or golden eagle, its nest, or any of its eggs in violation of the Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq., or the Bald Eagle Protection Act, as amended, 16 U.S.C. 668 et seq.

Paragraph (e) states that each operator shall, to the extent possible using the best technology currently available--

(1) Ensure that electric power lines and other transmission facilities used for, or incidental to, surface mining activities on the permit area are designed and constructed to minimize electrocution hazards to raptors, except where the regulatory authority determines that such requirements are unnecessary;

(2) Locate and operate haul and access roads so as to avoid or minimize impacts on important fish and wildlife species or other species protected by State or Federal law;

(3) Design fences, overland conveyors, and other potential barriers to permit passage for large

mammals, except where the regulatory authority determines that such requirements are unnecessary; and

(4) Fence, cover, or use other appropriate methods to exclude wildlife from ponds which contain hazardous concentrations of toxic-forming materials.

(f) Wetlands and habitats of unusually high value for fish and wildlife. The operator conducting surface mining activities shall avoid disturbances to, enhance where practicable, restore, or replace, wetlands, and riparian vegetation along rivers and streams and bordering ponds and lakes. Surface mining activities shall avoid disturbances to, enhance where practicable, or restore, habitats of unusually high value for fish and wildlife.

Paragraph (g) specifies that where fish and wildlife habitat is to be a postmining land use, the plant species used on reclaimed areas are selected on the basis of the following criteria:

(1) Their proven nutritional value for fish or wildlife.

(2) Their use as cover for fish or wildlife.

(3) Their ability to support and enhance fish or wildlife habitat after the release of performance bonds. The selected plants shall be grouped and distributed in a manner which optimizes edge effect, cover, and other benefits to fish and wildlife.

Paragraph (h) requires that where cropland is the postmining land use, and where appropriate for wildlife- and crop-management practices, the operator shall intersperse the fields with trees, hedges, or fence rows throughout the harvested area to break up large blocks of monoculture and to diversify habitat types for birds and other animals.

Paragraph (i) requires that where residential, public service, or industrial uses are the postmining land use, and where consistent with the approved postmining land use, the operator shall intersperse reclaimed lands with greenbelts utilizing species of grass, shrubs, and trees useful as food and cover for wildlife.

g) Excess Spoil

The term “excess spoil” is currently defined at 30 CFR 701.5 as:

[S]poil material disposed of in a location other than the mined-out area; provided that spoil material used to achieve the approximate original contour or to blend the mined-out area with the surrounding terrain in accordance with Sections 816.102(d) and 817.102(d) of this chapter in non-steep slope areas shall not be considered excess spoil.

Originally, the definition of “excess spoil” was included in the permanent regulation at 30 CFR 816.71(a), and that definition differed from the current definition:

Spoil not required to achieve the approximate original contour with the area where overburden has been removed . . .

44 FR 1979 (March 13, 1979)

On June 8, 1982, OSM published in the Federal Register at 47 FR 24954 a proposed definition of ‘excess spoil’ and sought public comment. On July 19, 1983, OSM promulgated in the Federal Register, at 48 FR 30312, the final rule that includes the current definition, which appears in 30 CFR 701.5. The following preamble discussions from the July 19, 1983, Federal Register notice

[46 FR 32911] discuss the meaning of the term:

Proposed Section 701.5 would have defined "excess spoil" to mean "spoil material disposed of in a location other than the mined out area, except material used to blend spoil from the mined out area with the surrounding terrain after achieving the approximate original contour (AOC) in nonsteep slope areas." In the preamble to the proposed rule, OSM . . . requested comments on whether excess spoil should simply be defined as any spoil not required to return the mined-out area to AOC, without regard to "where" the spoil is deposited.

In response to comments received on the proposed definition, OSM stated:

OSM agrees . . . that the location of the disposal site was the most important factor . . . and has retained the language of the proposed definition with minor revision, in the final rule. In recognition of the fact that Congress has authorized variances from the AOC restoration requirement the final rule does not specify that excess spoil be spoil in excess of that required to achieve the approximate original contour. Authorized variances from AOC would make the spoil, normally required to restore AOC, excess spoil (e.g., mountaintop removal mining). The final rule specifically recognizes, however, that spoil used to achieve AOC is not excess spoil.

Id.

Finally, OSM discussed the relationship of the definition of excess spoil to "box cut" or "first cut" spoil:

In the final rule, spoil used to merely blend the mined out area with the surrounding terrain need not be treated as excess spoil. Thus, spoil from box cuts or first cuts in nonsteep slope areas would not be excess spoil when it is used to achieve approximate original contour, i.e., to blend the mined-out area into the surrounding terrain according to Section 816.102 of the backfilling and grading rules. Even though the spoil in these cases is disposed of in a location other than the mined out area, specifically around the box cut or first cut to blend it into the terrain, the rules for excess spoil would not be applicable. Rather, the standards for backfilling and grading would govern. The reference to the standards of Section 816.102 has been added to the definition in the final rule for clarity. If, however, the spoil from a box cut or a first cut is deposited on slopes with angles defined as steep slopes, the box cut or first cut spoil must be handled as excess spoil in accordance with Sections 816.71 and 817.71. This complies with Section 515(d) of the Act.

Id.

h) Backfilling and Grading

OSM's regulations at 30 CFR 780.18(b)(3) require that each application contain:

A plan for backfilling, soil stabilization, compacting, and grading, with contour maps or cross sections that show the anticipated final surface configuration of the proposed permit area, in accordance with 30 CFR 816.102 through 816.107.

No substantive revisions of this regulation occurred since it was promulgated as part of the permanent regulatory program on March 13, 1979. In the preamble of the Federal Register notice of that final rule [44 FR 15055], in the discussion of 30 CFR 780.18, OSM stated that:

Each of these Sections is intended to provide information in the degree of detail necessary to enable the regulatory authority to determine whether the proposed mining and reclamation operation will be conducted in compliance with Subchapter K of these regulations.

Section 816.102, which is referenced in Section 780.18(b)(3), establishes the general performance requirements for backfilling and grading. Section 816.102(a)(1) requires that the disturbed area be backfilled and graded to achieve the approximate original contour, except as provided in Section 816.102(k). Section 816.102(k) provides that:

The postmining slope may vary from the approximate original contour when--

- (1) The standards for thin overburden in Section 816.104 are met;
- (2) The standards for thick overburden in Section 816.105 are met; or
- (3) Approval is obtained from the regulatory authority for--
 - (i) Mountaintop removal operations in accordance with Section 785.14 of this chapter;
 - (ii) A variance from approximate original contour requirements in accordance with Section 785.16 of this chapter; or
 - (iii) Incomplete elimination of highwalls in previously mined areas in accordance with Section 816.106.

Only Sections 816.102(k)(2), 816.102(k)(3)(i) and 816.102(k)(3)(ii) concern situations in which AOC variations are allowable because of excess spoil. These provisions concern surface coal mining and reclamation operations extracting coal where the overburden is thick, mountaintop removal operations, and operations in steep slope regions where an approximate original contour variance is approved by the regulatory authority. These three types of situations when variances from AOC are allowed for excess spoil disposal are discussed below.

i) Excess Spoil - Thick Overburden

On March 13, 1979, OSM published the notice promulgating permanent regulatory program regulations. The performance standards for backfilling and grading of thick overburden were adopted at 30 CFR 816.105. 44 FR 15412-15413. In Section 816.105(a), the criteria for applicability of the regulation were described:

The provisions of this Section apply only where the final thickness is greater than 1.2 of the initial thickness. Initial thickness is the sum of the overburden thickness and the coal thickness prior to removal of coal. Final thickness is the product of the overburden thickness prior to removal of coal, times the bulking factor to be determined for each mine plan area. The provisions of this Section apply only when surface mining activities cannot be carried out to comply with Section 816.101 to achieve the approximate original contour.

Section 816.105(b) prescribes the manner in which spoil and wastes not required to achieve the approximate original contour are handled. Section 816.105(b)(2) specified that the excess material is hauled or conveyed, backfilled, and graded in accordance with Sections 816.71-816.74. Section 816.105(b)(3) specified that this excess spoil material is hauled or conveyed, backfilled, and graded to maintain the hydrologic balance in accordance with Sections 816.41-816.57.

On June 21, 1982, OSM proposed amending Section 816.105 to eliminate the numerical standard of the 1979 regulation because the mathematical limit proved too impractical, and to apply a standard more consistent with Section 515(b)(3) of SMCRA:

In surface coal mining where the thickness of the overburden is large relative to the thickness of the coal deposit and where the operator demonstrates that the volume of the spoil and other waste material is more than sufficient to restore the disturbed area to approximate original contour ...

47 FR 26760.

The proposed rule also proposed to delete Section 816.105(b)(3) on the grounds that it duplicated the requirements of Section 816.102. This change would have deleted a reference to Section 816.57 (the stream buffer zone regulation). The final rule for Section 816.105 was published on May 24, 1983 [48 FR 23365], substantively as proposed. In the discussion of public comments, OSM stated that one commenter objected to the proposal to adopt a "more than sufficient" standard to describe the amount of spoil material that would be deemed excess spoil, because the term was unenforceable and provided too much discretion. The commenter also said this change would require the regulatory authority to develop specific guidelines for mining coal in a thick overburden area.

OSM responded that:

In a thick-overburden situation, the operator must meet all of the performance standards of the rules except that the operator, after achieving AOC, may exceed the AOC requirement. The amount of excess overburden is a site-specific condition and easily documented. Therefore, each permit application requesting consideration under this section should be evaluated by the regulatory authority.

48 FR 23365.

The National Wildlife Federation challenged the 1983 final rule at 30 CFR 816.105(a), arguing that the Secretary of the Interior was obligated to provide more detailed guidance to flesh out the statutory requirements. The court agreed stating:

Although the Secretary offers no explanation as to why a precise definition is impracticable, this court will accept his assertion. This does not justify, however, the mere restatement of the statutory standard. . . [T]he secretary has a duty to provide guidance to the regulatory authorities in enforcing the statute. The Secretary has not attempted to do this . . . his actions are arbitrary and capricious.

In re Permanent Surface Mining Regulation Litigation [In re Permanent II (Round II)], 21 ERC 1724, 1746 (D.D.C. 1984).

As a result, the U.S. district court remanded Section 816.105. OSM appealed the district court ruling, and the court of appeals affirmed the remand. *National Wildlife Federation v. Hodel*, No. 84-5743, 27 ERC 1153, 1189 (D.C. Cir. 1988). The court of appeals said:

We hold, in accord with the Secretary, that the Act does not automatically and inevitably require him to 'flesh out' the prescriptions of sections 515(b)(3) . . . Nonetheless, we affirm the remand of the . . . thick and thin overburden regulations, for only with respect to terracing did the Secretary adequately explain why guidance beyond the statutory requirements sensibly could not be given to local regulators.

We note that the Act expressly commands the Secretary to flesh out certain statutory provisions. . . Nothing in the Act, however, expressly requires the Secretary to flesh out Sections 515(b)(3) . . .

Id. at 1189.

The court of appeals continued:

In short, OSM read the Act, in light of its legislative history . . . to afford the Secretary discretion, absent an express statutory instruction to regulate, to decide whether fleshing out is appropriate in light of other concerns. Chief among those concerns is the need to accommodate widely varying local conditions that will not admit of a single, nationwide rule . . .

Id. (Footnote omitted).

On the issue of whether the Secretary is required to promulgate rules that elucidate or elaborate upon the general environmental performance standards of the Act, the court of appeals stated further:

The Secretary . . . determines there is no need to “flesh out” the statute, must “flesh out” his explanation so that we can review the rationality of his decision.

Id. at 1191.

In support of its affirmation of the remand of Section 816.105, the court of appeals stated:

In 1983, the Secretary eliminated the numerical definition, permitting a variance whenever the mine operator demonstrates that spoil is . . . “more than sufficient” to restore land to its approximate original contour. . . . The sole support we have found for this revision is the Secretary’s cryptic observation that “[t]he mathematical limit . . . has proved to be impractical because of its preciseness.” . . . we do not know from this unadorned statement why no adjusted (less precise) or alternate nationwide rule was ordered in place of the one found impractical. Absent a fuller statement of the reason for the revision, we cannot intelligently determine whether the Secretary has a “satisfactory explanation” for his action.

Id. at 1192.

On October 31, 1988 [53 FR 43970], OSM proposed a revised Section 816.105 to conform to the district court and court of appeals decisions. The final version was published in the Federal Register on December 17, 1991 [56 FR 65612]:

Section 816.105 Backfilling and grading: Thick overburden.

(a) *Definition.* Thick overburden means more than sufficient spoil and other waste materials available from the entire permit area to restore the disturbed area to its approximate original contour. More than sufficient spoil and other waste materials occur where the overburden thickness times the swell factor exceeds the combined thickness of the overburden and coal bed prior to removing the coal, so that after backfilling and grading the surface configuration of the reclaimed area would not:

- (1) Closely resemble the surface configuration of the land prior to mining; or
- (2) Blend into and complement the drainage pattern of the surrounding terrain.

(b) Performance standards. Where thick overburden occurs within the permit area, the permittee at a minimum shall:

- (1) Restore the approximate original contour and then use the remaining spoil and other waste materials to attain the lowest practicable grade, but not more than the angle

of repose;

(2) Meet the requirements of Section 816.102(a)(2) through (j) of this part; and

(3) Dispose of any excess spoil in accordance with Sections 816.71 through 816.74 of this part.

j) Excess Spoil - Mountaintop Removal Mining

The permitting requirements for mountaintop removal mining appear at 30 CFR 785.14. The term 'mountaintop removal mining' is defined in Section 785.14(b) to mean:

[S]urface mining activities, where the mining operation removes an entire coal seam or seams running through the upper fraction of a mountain, ridge, or hill, except as provided for in 30 CFR 824.11(a)(6), by removing substantially all of the overburden off the bench and creating a level plateau or a gently rolling contour, with no highwalls remaining, and capable of supporting postmining land uses in accordance with the requirements of this section.

For mountaintop removal mining, Section 785.14(c) states that the proposed postmining land use is the determining factor on how the post mining topography is to be reconstructed:

The regulatory authority may issue a permit for mountaintop removal mining, without regard to the requirements of Sections 816.102, 816.104, 816.105, and 816.107 of this chapter to restore the lands disturbed by such mining to their approximate original contour, if it first finds, in writing, on the basis of a complete application, that the following requirements are met:

(1) The proposed postmining land use of the lands to be affected will be an industrial, commercial, agricultural, residential, or public facility (including recreational facilities) use ...

Section 785.14(c)(2) also requires the applicant to demonstrate that in place of restoring the land to be affected to the approximate original contour, the operation will be conducted in compliance with the performance standards of 30 CFR Part 824. Several requirements of Part 824 are especially important for excess spoil generation and control. Section 30 CFR 824.11(a)(7) requires that, in order to obtain a variance from AOC requirements, the operator must ensure that:

The final graded slopes on the mined area are less than 1v:5h, so as to create a level plateau or gently rolling configuration, and the out slopes of the plateau do not exceed 1v:2h except where engineering data substantiates, and the regulatory authority finds, in writing, and includes in the permit under 30 CFR 785.14, that a minimum static safety factor of 1.5 will be attained.

Section 824.11(a)(8) requires the operator to ensure that:

The resulting level or gently rolling contour is graded to drain inward from the out slope, except at specified points where it drains over the out slope in stable and protected channels. The drainage shall not be through or over a valley or head-of-hollow fill.

Section 824.11(a)(9) requires that:

Natural watercourses below the lowest coal seam mined are not damaged.

Finally, Section 824.11(a)(11) requires that:

Spoil is placed on the mountaintop bench as necessary to achieve the postmining land use approved under paragraphs (a)(3) and (a)(4) of this section. All excess spoil material not retained on the mountaintop shall be placed in accordance with 30 CFR 816.41 and 816.43 and 816.71 through 816.74.

k) Excess Spoil - Steep Slope Mines

Excess spoil is generated from mines operating in steep slope terrain in which an AOC variance is granted by the regulatory authority. The permitting requirements for this type of operation are set out at 30 CFR 785.16. Paragraph (a) of this regulation describes these operations:

The regulatory authority may issue a permit for non-mountaintop removal, steep slope, surface coal mining and reclamation operations which includes a variance from the requirements to restore the disturbed areas to their approximate original contour ...

The requirements for granting an AOC variance are specified in the remainder of Section 785.16. Section 785.16(a)(2) states that the requirements of Section 816.133 are met. Paragraph (d)(8) of Section 816.133 requires that:

Only the amount of spoil as is necessary to achieve the postmining land use, ensure the stability of spoil retained on the bench, and meet all other requirements of the Act and this chapter is placed off the mine bench. All spoil not retained on the bench shall be placed in accordance with Sections 816.71-816.74 of this chapter.

l) Reclamation Plan – Disposal of Excess Spoil

Section 780.35 requires that an application for a permit for surface mining activities in which excess spoil is generated, contain a description, including maps and cross section drawings, of the proposed disposal site and design of the spoil disposal structures according to 30 CFR 816.71 – 816.74. The regulation further specifies that the plan shall describe the geotechnical investigation, design, construction, operation, maintenance, and removal, if appropriate, of the site and structures. Section 780.35(b)(2) requires that the description contain:

A survey identifying all springs, seepage, and ground-water flow observed or anticipated during wet periods in the area of the disposal site.

In accordance with 30 CFR 816.71(f), if the survey reveals that the disposal site contains springs, natural or manmade water courses, or wet weather seeps, the fill design must include diversions and underdrains as necessary to control erosion, prevent water infiltration into the fill, and ensure stability.

With a few minor exceptions, Section 780.35 is the same as the regulation promulgated in March 13, 1979 [44 FR 15357]. The regulation requires that excess spoil disposal structures are designed for stability. Environmental considerations for the placement and design of the excess spoil disposal structure are not specified, although environmental considerations are an impetus behind the excess spoil disposal regulations. As described in the preamble of the July 19, 1983, final rulemaking:

Spoil disposal practices in surface mining over the years have had a major impact on

the environment. Prior to the passage of the Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. 1201 et seq. (the Act), mine operators in steep slope areas often disposed of overburden material by pushing it downslope of the bench. The practice destroyed vegetation and caused erosion, slides and increased sedimentation of streams. To rectify this problem, Section 515(b)(22) of the Act required the controlled placement of all excess spoil material from surface coal mining operations using sound engineering practices to ensure the long term stability of the fill.

48 FR 32910.

m) Performance Standards – Disposal of Excess Spoil

The excess spoil disposal performance standards for surface mining activities are found in 30 CFR 816.71 – 816.74. These standards serve as both operating standards and flexible design standards, because they are cross referenced at 30 CFR 780.35.

Section 816.71 establishes the general requirements applicable to all excess spoil disposal structures. This regulation was promulgated in its current form on July 19, 1983 [48 FR 32925]. Minor editorial corrections were made in September 30, 1983 [48 FR 44780]. This version of the performance standards is much different from the original version of the performance standards promulgated on March 13, 1979 [44 FR 15395], which contained many more design standards than performance standards. We are not going to discuss the differences between the 1979 and 1983 versions of the rule, except for one difference discussed below.

The March 13, 1979, version of the regulation at 30 CFR 816.71(a)(1) required spoil placement in a controlled manner to ensure “that leachate and surface runoff from the fill will not degrade surface or ground waters or exceed the effluent limitations of 30 CFR 816.42.” At that time, Section 816.42 contained specific numerical standards for total iron, total manganese, total suspended solids, and pH. The July 19, 1983 final rule revised 30 CFR 816.71(a)(1) to require excess spoil placement in designated disposal areas within the permit area, in a controlled manner to –

Minimize the adverse effects of leachate and surface-water runoff from the fill on surface and ground waters.

One commenter was concerned about this change. In response to comments, OSM stated the following:

One commenter asserted that OSM weakened the rule by requiring that the effect of leachate and runoff from the fill on surface and ground water be "minimized" in lieu of the previous requirement that allowed no degradation to occur. OSM disagrees. As a practical matter, it is impossible to absolutely prevent runoff or leachate from a fill. In such cases, the word minimize more accurately reflects the realities of excess spoil disposal. Additionally, Section 515(b)(10) of the Act requires that disturbances to the hydrologic balance be "minimized." The proposed rule is consistent with the language in Section 515(b)(10) of the Act and therefore, as final Sec. 816.71(a)(1), it is adopted as proposed with only a slight editorial change.

42 FR 32913 (July 19, 1983).

This excerpt further illustrates that OSM has long realized that it is not possible to construct excess spoil disposal structures to completely eliminate adverse effects on surface and ground water, but OSM has long required minimizing these effects.

n) Coal Mine Waste Definitions

The following terms are defined in 30 CFR 701.5.

'Coal mine waste' means:

[C]oal processing waste and underground development waste.

'Coal processing waste' means:

[E]arth material which are separated and wasted from the product coal during cleaning, concentrating, or other processing or preparation of coal.

'Underground development waste' means:

[W]aste-rock mixtures of coal, shale, claystone, siltstone, sandstone, limestone, or related materials that are excavated, moved, and disposed of from underground workings in connection to underground mining activities.

o) Coal Mine Waste Permitting Requirements

Currently, the permitting requirements specifically applicable for 'coal mine waste' are 30 CFR 780.25 (coal processing waste related to surface mining operations), 784.16 (coal processing waste related to underground mining operations), and 784.19 (underground development waste). The requirements of Section 780.25 are intended to produce a thorough, well-planned design of the structures and facilities covered by this section with proper maintenance, operational and emergency procedures provided for all aspects of the project [44 FR 15058].

Section 780.25(a) outlines a two-phase plan submission process where limited general data is requested at the time of the original permit application and detailed design plans are required at some later date, but before construction of the structure:

Each application shall include a general plan and a detailed design plan for each proposed each proposed siltation structure, water impoundment, and coal processing waste bank, dam, or embankment within proposed permit area.⁵

Paragraph 780.25(a)(1) specifies the general plan requirements that are submitted with the original permit application. The information requested is the minimum necessary for the regulatory authority to assess the cumulative hydrologic impact resulting from structures constructed as part of the surface mining operation and to determine the feasibility of the operations and reclamation plan insofar as impoundments and waste banks are concerned. *Id.*

Section 780.25(d) specifies the detailed design plan requirements for coal waste banks to meet the standard engineering requirements of the applicable performance standards:

Coal processing waste banks shall be designed to comply with the requirements of 30 CFR 816.81--816.84.

⁵ On September 26, 1983 [48 FR 44006], OSM revised the definitions and performance standards in the regulations relating to coal mine waste consistent with the terminology used by the Mine Safety and Health Administration (MSHA). OSM did not revise the permitting in a similar fashion. OSM anticipates revising the permitting regulations consistent with the performance standards.

Section 780.25(e) specifies the detailed design plan requirements for coal processing waste dams and embankments and reflects items necessary to determine the adequacy of the structure as specified in the Act and the performance standards of these regulations:

Coal processing waste dams and embankments shall be designed to comply with the requirements of 30 CFR 816.81--816.84. Each plan shall comply with the requirements of the Mine Safety and Health Administration, 30 CFR 77.216-1 and 77.216-2, and shall contain the results of a geotechnical investigation of the proposed dam or embankment foundation area, to determine the structural competence of the foundation which will support the proposed dam or embankment structure and the impounded material. The geotechnical investigation shall be planned and supervised by an engineer or engineering geologist, according to the following:

(1) The number, location, and depth of borings and test pits shall be determined using current prudent engineering practice for the size of the dam or embankment, quantity of material to be impounded, and subsurface conditions.

(2) The character of the overburden and bedrock, the proposed abutment sites, and any adverse geotechnical conditions which may affect the particular dam, embankment, or reservoir site shall be considered.

(3) All springs, seepage, and ground-water flow observed or anticipated during wet periods in the area of the proposed dam or embankment shall be identified on each plan.

(4) Consideration shall be given to the possibility of mudflows, rock-debris falls, or other landslides into the dam, embankment, or impounded material.

Section 30 CFR 784.19 establishes the permit requirements for the surface disposal of mine wastes in areas other than underground workings in accordance with Section 516(b)(4) of the Act:

Each plan shall contain descriptions, including appropriate maps and cross-section drawings of the proposed disposal methods and sites for placing underground development waste and excess spoil generated at surface areas affected by surface operations and facilities, according to 30 CFR 817.71 through 817.74. Each plan shall describe the geotechnical investigation, design, construction, operation, maintenance and removal, if appropriate, of the structures and be prepared according to 30 CFR 780.35.

p) Coal Mine Waste Performance Standards

The performance standards for coal mine waste generated from surface mining operations are located 30 CFR 816.81, 816.83, 816.84, and 816.87; and parallel performance standards for underground mining operations are located at 30 CFR 817.81, 817.83, 817.84, and 817.87.

Section 816.81 prescribes the general requirements that apply to all coal waste facilities:

(a) General. All coal mine waste disposed of in an area other than the mine workings or excavations shall be placed in new or existing disposal areas within a permit area, which are approved by the regulatory authority for this purpose. Coal mine waste shall be hauled or conveyed and placed for final placement in a controlled manner⁶ to--

⁶ At 51 FR 41961, Nov. 20, 1986, in § 816.81 paragraph (a) was suspended insofar as it allows

- (1) Minimize adverse effects of leachate and surface-water runoff on surface and ground water quality and quantity;
- (2) Ensure mass stability and prevent mass movement during and after construction;
- (3) Ensure that the final disposal facility is suitable for reclamation and revegetation compatible with the natural surroundings and the approved postmining land use;
- (4) Not create a public hazard; and
- (5) Prevent combustion.

(b) Coal mine waste material from activities located outside a permit area may be disposed of in the permit area only if approved by the regulatory authority. Approval shall be based upon a showing that such disposal will be in accordance with the standards of this section.

(c) Design certification. (1) The disposal facility shall be designed using current, prudent engineering practices and shall meet any design criteria established by the regulatory authority. A qualified registered professional engineer, experienced in the design of similar earth and waste structures, shall certify the design of the disposal facility.

(2) The disposal facility shall be designed to attain a minimum long-term static safety factor of 1.5. The foundation and abutments must be stable under all conditions of construction.

(d) Foundation. Sufficient foundation investigations, as well as any necessary laboratory testing of foundation material, shall be performed in order to determine the design requirements for foundation stability. The analyses of the foundation conditions shall take into consideration the effect of underground mine workings, if any, upon the stability of the disposal facility.

(e) Emergency procedures. If any examination or inspection discloses that a potential hazard exists, the regulatory authority shall be informed promptly of the finding and of the emergency procedures formulated for public protection and remedial action. If adequate procedures cannot be formulated or implemented, the regulatory authority shall be notified immediately. The regulatory authority shall then notify the appropriate agencies that other emergency procedures are required to protect the public.

(f) Underground disposal. Coal mine waste may be disposed of in underground mine workings, but only in accordance with a plan approved by the regulatory authority and MSHA under Sec. 784.25 of this chapter.

Coal mine waste may consist entirely of solid material, or it may be a liquid or semi-liquid form. The regulations at 30 CFR 701.5 makes this distinction concerning the facilities that must handle these two forms of coal waste. Section 701.5 defines 'refuse pile' to mean:

a surface deposit of coal mine waste that does not impound water, slurry, or other liquid or semi-liquid material.

It defines 'impounding structure' to mean:

end dumping or side dumping of coal mine waste.

a dam, embankment, or other structure used to impound water, slurry, or other liquid or semi-liquid material.”

Section 816.83 prescribes the specific performance standards for handling coal mine waste consisting of entirely solid material:

Refuse piles shall meet the requirements of Section 816.81, the additional requirements of this section, and the requirements of Sections 77.214 and 77.215 of this title.

(a) Drainage control. (1) If the disposal area contains springs, natural or manmade water courses, or wet weather seeps, the design shall include diversions and underdrains as necessary to control erosion, prevent water infiltration into the disposal facility and ensure stability.

(2) Uncontrolled surface drainage may not be diverted over the outslope of the refuse piles. Runoff from the areas above the refuse pile and runoff from the surface of the refuse pile shall be diverted into stabilized diversion channels designed to meet the requirements of Section 816.43 to safely pass the runoff from a 100-year, 6-hour precipitation event. Runoff diverted from undisturbed areas need not be commingled with runoff from the surface of the refuse pile.

(3) Underdrains shall comply with the requirements of Section 816.71(f)(3).

(b) Surface area stabilization. Slope protection shall be provided to minimize surface erosion at the site. All disturbed areas, including diversion channels that are not riprapped or otherwise protected, shall be revegetated upon completion of construction.

(c) Placement. (1) All vegetative and organic materials shall be removed from the disposal area prior to placement of coal mine waste. Topsoil shall be removed, segregated and stored or redistributed in accordance with Section 816.22. If approved by the regulatory authority, organic material may be used as mulch, or may be included in the topsoil to control erosion, promote growth of vegetation or increase the moisture retention of the soil.

(2) The final configuration of the refuse pile shall be suitable for the approved postmining land use. Terraces may be constructed on the outslope of the refuse pile if required for stability, control or erosion, conservation of soil moisture, or facilitation of the approved postmining land use. The grade of the outslope between terrace benches shall not be steeper than 2h:1v (50 percent).

(3) No permanent impoundments shall be allowed on the completed refuse pile. Small depressions may be allowed by the regulatory authority if they are needed to retain moisture, minimize erosion, create and enhance wildlife habitat, or assist revegetation, and if they are not incompatible with stability of the refuse pile.

(4) Following final grading of the refuse pile, the coal mine waste shall be covered with a minimum of 4 feet of the best available, nontoxic and noncombustible material, in a manner that does not impede drainage from the underdrains. The regulatory authority may allow less than 4 feet of cover material based on physical and chemical analyses which show that the requirements of Sections 816.111 through 816.116 will be met.

(d) Inspections. A qualified registered professional engineer, or other qualified professional specialist under the direction of the professional engineer, shall inspect the refuse pile during construction. The professional engineer or specialist shall be experienced in the construction of similar earth and waste structures.

(1) Such inspections shall be made at least quarterly throughout construction and during critical construction periods. Critical construction periods shall include at a minimum:

(i) Foundation preparation including the removal of all organic material and topsoil; (ii) placement of underdrains and protective filter systems; (iii) installation of final surface drainage systems; and (iv) the final graded and revegetated facility. Regular inspections by the engineer or specialist shall also be conducted during placement and compaction of coal mine waste materials. More frequent inspections shall be conducted if a danger of harm exists to the public health and safety or the environment. Inspections shall continue until the refuse pile has been finally graded and revegetated or until a later time as required by the regulatory authority.

(2) The qualified registered professional engineer shall provide a certified report to the regulatory authority promptly after each inspection that the refuse pile has been constructed and maintained as designed and in accordance with the approved plan and this chapter. The report shall include appearances of instability, structural weakness, and other hazardous conditions.

(3) The certified report on the drainage system and protective filters shall include color photographs taken during and after construction, but before underdrains are covered with coal mine waste. If the underdrain system is constructed in phases, each phase shall be certified separately. The photographs accompanying each certified report shall be taken in adequate size and number with enough terrain or other physical features of the site shown to provide a relative scale to the photographs and to specifically and clearly identify the site.

(4) A copy of each inspection report shall be retained at or near the mine site.

The performance standards that specifically apply to facilities that will handle liquid and semi-liquid coal waste are found at 30 CFR 816.84:

New and existing impounding structures constructed of coal mine waste or intended to impound coal mine waste shall meet the requirements of Section 816.81.

(a) Coal mine waste shall not be used for construction of impounding structures unless it has been demonstrated to the regulatory authority that the stability of such a structure conforms to the requirements of this part and the use of coal mine waste will not have a detrimental effect on downstream water quality or the environment due to acid seepage through the impounding structure. The stability of the structure and the potential impact of acid mine seepage through the impounding structure shall be discussed in detail in the design plan submitted to the regulatory authority in accordance with Section 780.25 of this chapter.

(b)(1) Each impounding structure constructed of coal mine waste or intended to impound coal mine waste shall be designed, constructed and maintained in accordance with Section 816.49 (a) and (c). Such structures may not be retained permanently as part of the approved postmining land use.

(2) Each impounding structure constructed of coal mine waste or intended to impound coal mine waste that meets the criteria of Section 77.216(a) of this title shall have sufficient spillway capacity to safely pass, adequate storage capacity to safely contain, or a combination of storage capacity and spillway capacity to safely control, the probable maximum precipitation of a 6-hour precipitation event, or greater event as specified by the regulatory authority.

(c) Spillways and outlet works shall be designed to provide adequate protection against erosion and corrosion. Inlets shall be protected against blockage.

(d) Drainage control. Runoff from areas above the disposal facility or runoff from surface of the facility that may cause instability or erosion of the impounding structure shall be diverted into stabilized diversion channels designed to meet the requirements of Section 816.43 and designed to safely pass the runoff from a 100-year, 6-hour design precipitation event.

(e) Impounding structures constructed of or impounding coal mine waste shall be designed so that at least 90 percent of the water stored during the design precipitation event can be removed within a 10-day period.

(f) For an impounding structure constructed of or impounding coal mine waste, at least 90 percent of the water stored during the design precipitation event shall be removed within the 10-day period following the design precipitation event.

The performance standards at 30 CFR 816.87 pertain to coal mine waste fires and are not pertinent to discussions in the EIS.

3. Federal-State Relationship

SMCRA provides a system of cooperative federalism in which each State has the option of self-regulation (primacy) of surface coal mining activities with federal oversight. States that elect to apply for primacy must have State laws and regulations and adequate resources to ensure that requirements comparable to those of SMCRA and implementing Federal regulations would be carried out in a no less effective manner. Most states may adopt laws and regulations that are more stringent than the Federal SMCRA program; however, ten states are restricted through State law from adopting or maintaining more stringent provisions. Table III-4 lists the surface coal mining regulatory programs administered by States, and indicates which States contain "no more stringent" provisions.

Table III-4 -- Approved state programs and limitations on authority to promulgate or enforce regulations more restrictive than SMCRA

State	NMS Provisions *	Repealer Clause **
Alabama	Ala. Code 9-16-74(1)	Ala. Code 9-16-74(21)c.
Alaska	None	A.S. 27.21.960(b)
Arkansas	§ 15-58-202(a)(1), A.C.A.	None
Colorado	C.R.S. 34-33-108(1)	C.R.S. 34-33-108(2)
Illinois	225 ILCS 720, §§ 1.02(c) and 4.11(a)	None
Indiana	I.C. 13-4.1-1-5	None
Iowa	None	None
Kansas	None	None
Kentucky	K.R.S. 350.028(5), K.R.S. 350.465(2)	None
Louisiana	None	None
Maryland	None	None
Mississippi	None	None
Missouri	RSMo 444.800.4	None
Montana	None	None
North Dakota	None	None
New Mexico	None	None
Ohio	None	None
Oklahoma	45 O.S. § 789	45 O.S. § 790
Pennsylvania	None	Numerous cites
Texas	None	None
Utah	§ 40-10-6.5, U.C.A.	None
Virginia	None	None ***
West Virginia	WVC § 22-1-3a	None
Wyoming	None	None

* NMS (No More Stringent Than) Provisions: Either prohibit the State rulemaking authority from promulgating rules that are more stringent than Federal requirements, or restrict the State's ability to do so.

** Repealer Clause: Automatically invalidates or requires review of those provisions of State laws or regulations corresponding to provisions of Federal laws or regulations that are declared unconstitutional or otherwise invalidated pursuant to judicial or Congressional action.

*** Notes attached to the 1980 and later versions of the Virginia Code imply that a repealer clause included in the 1979 version of the law is still in effect even though it does not appear in succeeding versions of the law.

If a State elects not to regulate coal mining or if the State's program in whole or in part is not administered accordance with the approved State program and SMCRA, then pursuant to SMCRA and the implementing Federal regulations, OSM may implement or enforce a regulatory program in the State. OSM administers SMCRA regulatory programs in Arizona, California, Georgia, Idaho, Massachusetts, Michigan, North Carolina, Oregon, Rhode Island, South Dakota, Tennessee, and Washington.

Congress established a process in SMCRA that authorizes States to administer approved state regulatory programs. Most coal producing States have elected to take on the responsibility of regulating surface coal mining activities. State primacy and the States' cooperative relationships with OSM have worked well. The quote below found on the American Coal Foundation website, describes this relationship from an industry perspective:

In directing the states to enforce the federal surface mining law, Congress recognized that effective coal mining regulation must take into account local conditions and problems unique to certain areas. To a large degree that process has worked well. Where problems exist, they are generally caused by a handful of irresponsible operators, who flout the law and take the coal without preserving the land or water. In addition, each state which has coal mining may have its own set of environmental laws beyond the federal laws.

[American Coal Foundation 2006]

4. SMCRA-Clean Water Act Relationship

SMCRA was enacted by Congress in 1977 to provide a comprehensive program to regulate surface coal mining and reclamation operations. A variety of programs under the Clean Water Act (33 U.S.C. 1251 et seq.) (CWA) may also apply to surface coal mining and reclamation operations, particularly if these operations impact the chemical, physical, and biological integrity of the nation's waters. Section 404 of the CWA regulates the discharge of dredged or fill material into waters of the United States. Section 402 regulates all other point source discharges of pollutants into waters of the U.S. Technology-based effluent limits for the NPDES program are established by EPA to restrict the concentration of particular pollutants associated with a particular industry (e.g., iron for coal mining discharges). Section 401 provides states with the authority to review and either deny or grant certification for any activities requiring a Federal permit or license, to ensure that they will not violate applicable state water quality standards.

Specific provisions within SMCRA address the relationship between SMCRA and the CWA:

- SMCRA Section 501(a)(B) requires that the Secretary of Interior obtain the written concurrence of the Administrator of EPA prior to promulgating and publishing permanent program regulations which relate to water quality standards promulgated under the CWA.
- SMCRA Section 702(a)(3) states that nothing in SMCRA shall be construed as superseding, amending, modifying, or repealing the CWA or any rule or regulation promulgated there under. The courts have addressed the provisions of Section 702 of SMCRA, 30 U.S.C 1292, and the relationships between SMCRA and Clean Water Act programs:

We hold that EPA variances and exemptions . . . are substantive elements of regulation under the Federal Water Pollution Control Act . . . and that the Secretary, pursuant to section 702(a)(3) may not alter these variances and exemptions by promulgating more stringent provisions insofar as the variances

and exemptions apply to surface coal mining operations.

In re Permanent Surface Mining Regulation Litigation, 627 F.2d 1346, 1369 (D.C. Cir. 1980))

- SMCRA Section 713(a) requires the President, to the extent appropriate, and in keeping with the particular enforcement requirements of each Act, to insure the coordination of regulatory and inspection activities between the agencies responsible for SMCRA and CWA. To further this coordination, on February 8, 2005, the U.S. Army Corps of Engineers (COE), EPA, OSM and the U.S. Fish and Wildlife Service (FWS) signed a Memorandum of Understanding for the purpose of providing concurrent and coordinated review and processing of surface coal mining applications proposing the placement of dredged and/or fill material into waters of the United States. This is a national umbrella document for surface coal mining designed to improve decision-making using the SMCRA regulatory authority as the suggested focal point for the initial data collection and conducting joint pre-application meetings, public meetings, public notices and site visits. Each agency retains its statutory authorities and independent decision making responsibilities. A State or Federal SMCRA authority proposing to take this lead role as the focal point for processing will develop specific procedures and sign a local agreement with the appropriate EPA regional offices, FWS field or regional offices and COE districts.

The SMCRA-CWA relationship was examined in detail in the MTM/VF DPEIS. Additional information on this subject is provided in Sections I.F.3.a; II.B.1.a-b; II.C.1.a.1-2 and b; II.C.2-8 and 10,;and II.D.2 of the MTM/VF DPEIS, which is available at <http://www.epa.gov/region3/mtntop/eis.htm>.

5. Other Notable Laws

Besides the CWA and related regulations, the proposed action would interact with and/or would be affected by a number of other notable laws and programs at the Federal, State and local levels. As noted in OSM's 1979 Final Environmental Impact Statement:

“A number of Federal agencies have programs and responsibilities which relate to the preferred alternative. The preferred alternative must be considered in the context of these other agency programs and responsibilities. Certain regulations included in the preferred alternative may not depart substantially from requirements imposed by other Federal agencies, may expand the scope of existing regulations, or may fill gaps from existing Federal agency regulations.”

[U.S. DOI OSM 1979, p. BI-1]

This applies as well to State statutes and regulations, as well as local requirements that apply independent of SMCRA, including local land use regulations.

Many of these existing laws and regulations address specific concerns raised by the public during scoping for this EIS. Nothing in the Federal action being considered diminishes the importance of and the responsibility to comply with these other statutes.

a) Federal Laws

Below are very brief summaries of notable Federal statutes with particular relevance to this Federal action and issues raised concerning this action. The reader should refer to each statute

to determine its actual terms.

National Environmental Policy Act of 1969, 42 U.S.C. Sections 4321 *et seq.* (NEPA). This act requires a systematic analysis of major federal actions that includes a consideration of reasonable alternatives as well as an analysis of short-term and long-term, irretrievable, irreversible, and unavoidable impacts.

Antiquities Act of 1906, 16 U.S.C. Sections 431-433. This act provides for the protection of historic or prehistoric remains and sites of scientific value on Federal lands, establishes criminal sanctions for unauthorized destruction or removal of antiquities, authorizes the president to establish national monuments by proclamation, and authorizes the scientific investigation of antiquities on federal lands, subject to permit and regulations. Passage of the Archeological Resources Protection Act (1979) superseded the Antiquities Act as an alternative Federal tool for prosecution of antiquities violations in NPS areas.

Historic Sites, Buildings, and Antiquities Act of 1935, 16 U.S.C. Section 461. This act directs the Secretary of the Interior to carry out wide-ranging programs in the field of history and places with the Secretary the responsibility for national leadership in the field of historic preservation. It authorizes the Historic American Buildings Survey, Historic American Engineering Record, and National Survey of Historic Sites and Buildings.

Archaeological Resources Protection Act of 1979, 16 U.S.C. Sections 470, 470aa, 470bb, 470cc (ARPA). This act secures the protection of archeological resources on public or Indian lands by regulating the excavation and collection of resources and fostering increased cooperation and exchange of information between private, governmental, and professional communities. The act defines archeological resources to be any material remains of past human life or activities that are of archeological interest and are at least 100 years old. It also requires the notification of Indian tribes prior to issuing permits for activities at sites which may be of religious or cultural importance to them.

National Historic Preservation Act of 1966, 16 U.S.C. Sections 470 *et seq.* (NHPA). This act establishes additional programs for the preservation of historic properties throughout the nation and establishes a system to classify properties on or eligible for inclusion on the National Register of Historic Places. This act establishes that prior to approval of an undertaking that will adversely affect resources eligible for or listed in the National Register, the approving federal agency must evaluate the effects of the undertaking and afford the State Historic Preservation Officer and the Advisory Council on Historic Preservation an opportunity to comment on the undertaking. The act also provides for reviews at the State and Federal level. It was amended by P.L. 94-422 (Land and Water Conservation Fund Act of 1965, as amended, to establish the National Historic Preservation Fund) to require the development of professional standards for preservation of historic properties, require the heads of all Federal agencies to assume responsibility for the preservation of historic properties that they own or control, direct agencies to use historic properties, allow agencies to lease a historic property to ensure preservation, restructure the Advisory Council, and direct the Council to promulgate regulations for any exemption from requirements.

Endangered Species Act of 1973, 16 U.S.C. Sections 1531 *et seq.*. This act requires federal agencies to ensure that any action authorized, funded or carried out does not jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat.

Fish and Wildlife Coordination Act of 1934, 16 U.S.C. Sections 661 *et seq.* This act authorizes the Secretaries of Agriculture and Commerce to provide assistance to and cooperate with Federal and State agencies to protect, rear, stock, and increase the supply of game and fur-bearing animals, as well as to study the effects of domestic sewage, trade wastes, and other polluting substances on wildlife. The Reorganization Plan No. II of 1939 transferred the Bureau of

Fisheries, and responsibility for protection of furbearing animals, as well as certain functions related to conservation of wildlife, game, and migratory birds, to the Department of the Interior. Amendments enacted in 1946 require consultation with the Fish and Wildlife Service and the fish and wildlife agencies of States where the "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified" by any agency under a Federal permit or license. Consultation is to be undertaken for the purpose of "preventing loss of and damage to wildlife resources."

Migratory Bird Conservation Act of 1929, 16 U.S.C. Sections 661 *et seq.* This act established a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds. The Secretary of the Interior is authorized to cooperate with local authorities in wildlife conservation and to conduct investigations, to publish documents related to North American birds, and to maintain and develop refuges. The Act provides for cooperation with States in enforcement. It established procedures for acquisition by purchase, rental or gift of areas approved by the Commission for migratory birds.

Agricultural Risk Protection Act of 2000, 7 U.S.C. Sections 7712 *et seq.* – This act governs the Federal program to control the spread of noxious weeds. Under this statute, the Secretary of Agriculture may designate plants as noxious weeds by regulation, and may restrict entry or interstate movement, or require treatment or destruction of such weeds. The Secretary may seize or quarantine as necessary to prevent the spread of such weeds. The Secretary may cooperate with other national governments, Federal, State and local agencies, domestic or international organizations, and other persons to implement the Act.

The Resource Conservation and Recovery Act of 1976, 42 U.S.C. Sections 6901 *et seq.* (RCRA) – This act is our nation's primary law governing the disposal of solid and hazardous waste.

Safe Drinking Water Act of 1974, 42 U.S.C. Sections 300f *et seq.* This act was established to protect the quality of drinking water in the U.S. This law focuses on all waters actually or potentially designed for drinking use, whether from above ground or underground sources. The Act authorized EPA to establish safe standards of purity and required all owners or operators of public water systems to comply with primary (health-related) standards. State governments, which may be authorized to assume this power from EPA, also may encourage attainment of secondary standards (nuisance-related).

Clean Air Act of 1970, 42 U.S.C. Sections 7401 *et seq.* This act establishes a nationwide program for the prevention and control of air pollution and establishes National Ambient Air Quality Standards. Under the Prevention of Significant Deterioration provisions, the act requires Federal officials responsible for the management of Class I Areas (national parks and wilderness areas) to protect the air quality-related values of each area and to consult with permitting authorities regarding possible adverse impacts from new or modified emitting facilities.

Noise Control Act of 1972, 42 U.S.C. Sections 4901 *et seq.* This act establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. To accomplish this, the Act establishes a means for the coordination of Federal research and activities in noise control, authorizes the establishment of Federal noise emissions standards for products distributed in commerce, and provides information to the public respecting the noise emission and noise reduction characteristics of such products.

Land and Water Conservation Fund Act of 1965, 16 U.S.C. Sections 4601-4 and 4601-5 (LAWCON). This act establishes a fund, administered by the National Park Service, "to assist the States and Federal agencies in meeting present and future outdoor recreation demands and needs of the American people."

National Trails System Act of 1968, 16 U.S.C. Sections 1241 *et seq.* This act establishes a

national system of recreational, scenic, and historic trails and prescribes the methods and standards for adding components to the system.

Outdoor Recreation Act of 1963, 16 U.S.C. Sections 4601 *et seq.* This act lays out the role of the Department of the Interior as coordinator of all Federal agencies for programs affecting the conservation and development of recreation resources. The Secretary of the Interior is directed to prepare a nationwide recreation plan and provide technical assistance to States, local governments and private interests to promote the conservation and utilization of recreation resources.

Wild and Scenic Rivers Act of 1968, 16 U.S.C. Sections 1271 *et seq.* This act establishes a system of areas distinct from the traditional park concept to ensure the protection of each river's unique environment. It also provides for preservation of certain rivers that possess outstanding scenic, recreational, geological, cultural, or historic values; and maintenance of their free-flowing condition.

Wilderness Act of 1964, 16 U.S.C. Sections 1131 *et seq.* The Wilderness Act establishes the National Wilderness Preservation System. In this act, wilderness is defined by its lack of noticeable human modification or presence; it is a place where the landscape is affected primarily by the forces of nature and where humans are visitors who do not remain. Wilderness Areas are designated by Congress and are composed of existing federal lands that have retained a wilderness character and meet the criteria found in the act. Federal officials are required to manage Wilderness Areas in a manner conducive to retention of their wilderness character and must consider the effect upon wilderness attributes from management activities on adjacent lands.

Federal Cave Resources Protection Act of 1988 16 U.S.C. Sections 1301-1302, 16 U.S.C. Sections 4303 *et seq.* This act directs the Secretaries of the Department of the Interior and the Department of Agriculture to inventory and list significant caves on Federal lands and to provide management and dissemination of information about caves. A current, nationwide assessment of significant Federally owned caves is cataloging the known caves on Federal land and further increasing the impetus for cave management and research.

b) State Laws and Regulations

States generally have their own set of environmental and mining laws that complement Federal mining laws or address other related specific concerns within that State. Some State laws are more stringent or protective than the Federal laws. As noted earlier, nothing in this OSM initiative diminishes the importance of complying with these State programs. If a change is effected as the result of this Federal initiative, any State with an approved program will be examined to determine if the change in Federal regulations render the State program less effective than the Federal program. If a State program is determined to be less effective, OSM will require the State to change or to demonstrate why no change is necessary.

OSM received many specific concerns regarding the effect of the rulemaking initiative on Tennessee State laws, regulations, and programs. Tennessee is a Federal program state. Any changes to the Tennessee Federal program would not affect the State laws, regulations, and programs.

Below are Tennessee statutes and regulations specifically identified.

- Rules of Tennessee Department of Environment and Conservation – Water Quality Control Board – Division of Water Pollution Control [Chapter 1200-4-7, revised Nov. 2000]

- Rules of the Tennessee Department of Conservation – Division of Surface Mining – Abandoned Mine Lands Reclamation Program [Chapter 0400-1-24, revised June 2000]
- Tennessee Water Control Act of 1977
- Rules of Tennessee Department of Conservation – Division of State Parks – Management of Tennessee Natural Resource Areas [Chapter 0400-2-8, revised June 1999]
- Watts Bar Reservoir Integrated Land Plan, Loudon, Meigs, Rhea, and Roane Counties, Tennessee
- Tennessee Rivers Assessment Project
- Total Maximum Daily Load Section 303(d) Listing for Tennessee.
- Tennessee Cave Protection Law (1991). Other State cave protection laws were also identified.
- Tennessee MS4 Working Group Water Quality Buffer Zone Policy

c) Local Ordinances and Rules

In addition, several commenters from Tennessee identified several local land use ordinances and policies that are likely to interact with the proposed action. These local ordinances are listed below:

- City of Knoxville, Tennessee – Land Development Manual – Policy 22 – Stream buffer zone (Restricted Use) - This policy states that stream buffer zones are required for all new site development and redevelopment projects which are adjacent to or near a blue line stream, or as determined by Tennessee Department of Environment and Conservation.
- City of Morristown, Tennessee – Storm Water Program – Water Quality Buffer Zone Ordinance No. 3193.
- City of Farragut, Tennessee – Aquatic Buffer Zone Ordinance (draft)

Other unidentified local ordinances likely occur in other parts of the nation. The following applies to those ordinances as well. These restrictions can, where written to do so and on a much localized level, affect mining in a given area, subject to valid existing rights, but do not trump, or supersede, any Federal law.

I. Special Considerations

1. Stream Buffer Zones

The vegetated area immediately adjacent to a natural watercourse, such as a stream, serves as a transitional buffer (ecotone) between lotic (flowing) aquatic and terrestrial ecosystems. The character of a stream buffer zone (hereafter referred to a “riparian buffer zone” or “riparian zone”

in this section, which is the term more commonly used in scientific literature) is dependent upon both external and internal factors, making the functions of riparian buffer zone variable and site dependent. Typical external attributes of the drainage basin or the stream channel, which include, but are not limited to, such variables as the watershed size and gradient, soil mineralogy and texture, bedrock type and depth, volume and composition of ground water inputs, channel morphology [Correll 1997, p. 7] land use and vegetative cover, gradient of the riparian zone, and climate. Internal factors include soil physics and chemistry, width and slope, land use and vegetation within the riparian buffer zone.

Before the 1970's, only a few studies were published regarding vegetated riparian buffer zones. Since then, several thousand applicable papers have been published which have furthered science in this regard [Wenger 1999, p. 9] but there still is not an adequate understanding of basic mechanisms involved in the processes or controls over the rates of these processes [Correll 1997, p. 7]. The ability to accurately predict system behavior and response to major changes in inputs is improved but is still limited. Considerable attention worldwide has been given to studying the functions of riparian buffer zones but we acknowledge as 40 CFR 1502.22 requires a full knowledge of the functions of riparian zones is lacking and that considerable time and money is needed to advance the science to more accurately determine the its functions. Nevertheless, scientists generally agree that riparian buffer zones are beneficial to the environment.

There is no ideal width of a riparian buffer zone for all applications in all areas [Tjaden and Weber 1997. p. 4]. The principal intended functions of the riparian buffer zone are the overriding criteria for its maintenance or its restoration. Figure III-19 shows riparian buffer zone widths needed to carry out various functions within the conditions of the Chesapeake Bay watershed.

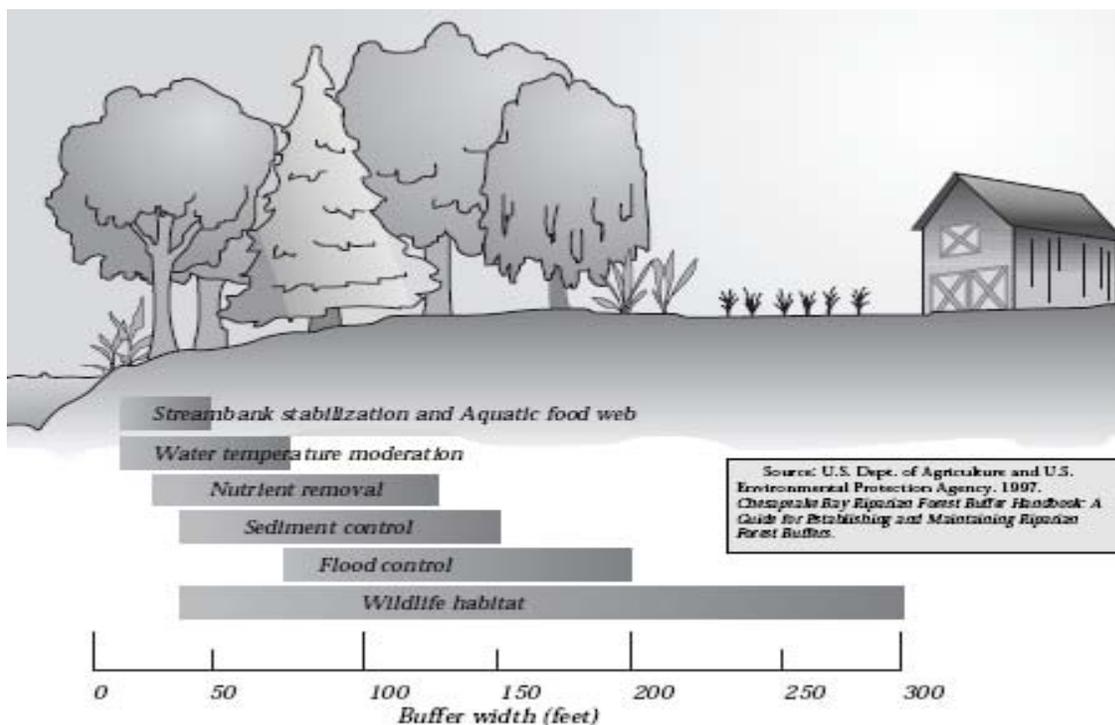


Figure III-19 – General riparian zone width needed to adequately perform

a) Functions

Riparian buffer zones are ecologically important and may serve numerous functions including: sediment control from upland areas; stream bank stabilization; nutrient removal; nutrient supply; wildlife habitat; temperature moderation; and flood control. These functions along with factors that may influence these functions will be discussed in more detail below.

Sediment Control from Upland Areas: Natural and man-induced erosion from upland areas contributes to sediment in the surface water (runoff). As this runoff passes through the riparian buffer zone, increased friction with riparian vegetation and organic litter slows the velocity of surface water. Coarse sediment particles settle, and finer clay-like particles adhere to the vegetation. In addition, because of the slower speed, water infiltration increases; this further induces the trapping of sediments.

The effectiveness to trap sediment is dependent upon many factors including, but not limited to the following: size distribution of incoming sediments, water depth relative to vegetation height, vegetation type, slope, width, and flow characteristics.

How does the size distribution of incoming sediments affect the riparian zone's trapping efficiency? As the velocity of runoff entering a riparian buffer zone slows, coarse particles falling from suspension are deposited in the first few feet of the riparian zone so long as sheet flow is maintained. Finer particles are carried further into the riparian zone for a greater distance [Lowrance et al. 1995, p. 16]. While rapid deposition is beneficial in the short term, it may ultimately render the riparian buffer zone ineffective if the sediment buries the riparian vegetation or if a natural barrier forms at the upland area-riparian zone interface. In these situations, channelized flow, opposed to sheet wash flow, would likely occur and would considerably reduce the efficiency to trap sediment. On the other hand, if sediment from the upland is extremely fine, a riparian buffer zone of a sufficient width is necessary before deposition indeed occurs.

How does water depth relative to vegetation height effect sedimentation within the riparian buffer zone? Karr and Schlosser summarizing a finding of the Black Creek Study in Indiana stated that when water depths are much less than grass height as much as 54 percent reduction in sediment loads were recorded, but when vegetation is clipped filtering efficiency ultimately declines to zero [Karr and Schlosser 1978, p. 229-230].

How do natural forest buffers compare to grass vegetated strips? Natural forest buffers are also effective in removing sediments, but it is generally conceded that when riparian buffer zones are the same width, grass filters are more effective in sediment removal [Gilliam, J.W. et al. 1997, p. 55]. Grass and dense herbaceous vegetation are more effective at trapping particulates from overland storm flows than woody vegetation [Osborne and Kovacic 1993; Parsons et al. 1994]. Yet, the efficiency of forested buffers to control sediment is high. Cooper et al., found a forested buffer in the Coastal Plain to remove 84 to 90 percent of the sediment from cropland runoff [Cooper et al. 1987]. Lowrance et al. also reported similar trapping efficiencies (80 to 90 percent) in forested buffer zones in the Coastal Plain [Lowrance et al. 1995, pp 28-29]. Several studies have found grass to be an even more effective filter of overland flow. For example, Neibling and Alberts using a rainfall simulator on long grass plots ranging in width from 2 to 16 feet and a 7 percent slope reduced sediment by over 90 percent [Neibling and Alberts 1979]. Young et al. measure efficiencies of 66 to 82 percent on a 4 percent slope for a 90-foot grass filter [Young, R.A. et al., 1980].

How does slope affect the efficiency of the riparian buffer zone in controlling sediment? Efficiency in trapping sediments is greater on gentle slopes than steeper slopes [Dillaha and Inamdar 1997; Peterjohn and Correll 1984; Jordan et al. 1993; and Karr and Schlosser 1978, p. 229]. Steeper topography promotes greater velocities of overland flow. This higher velocity

increases the ability of the flow to transport higher concentrations of sediment. Exceedingly high volumes of sediment may bury the vegetation and overwhelm the capacity of the riparian buffer zone to trap sediment. Higher velocity also reduces infiltration time resulting in more overland flow. Gentle slopes are generally more uniform than hill slopes. Consequently, overland flow on steeper slopes tends to concentrate (channelized). All these factors may contribute to less sediment trapping efficiency. Some researchers believe that certain slopes are too steep to be effective sediment traps. However, there is no consensus on this critical angle [McNaught et al. 2003, p. 22] which is thought to generally range from 10 to 40%. After an extensive review of current research, Wegner suggested that the critical angle for an effective buffer was 25% [Wenger, S. 1999, p.44]. Swift suggested that vegetative buffers are effective in trapping sediment (>0.05 mm) on 80 % slopes [Swift 1986, p. 34].

How wide must the riparian buffer zone be to efficiently trap most of the sediment from the upland area? Early research by the U.S. Environmental Protection Agency on environmental protection in surface coal mining [Grim and Hill 1974, p.102] suggested a minimum width of 100 feet although conceding that the required filter zone width varies with steepness and length of the outslope between the toe and the drainage channel. More recently, researchers for the Chesapeake Bay Program suggested that as long as sheet wash flow is maintained, a buffer width of 50 to 100 feet is adequate for the removal of sediment. [Palone and Todd 1998, p. 6-9] Peterjohn and Correll studied the effectiveness of a 164-foot riparian zone with a 5% slope in the Mid-Atlantic Coastal Plain and found that 94% efficiency in sediment removal, but also found 90% of the sediment was removed in the first 62 feet. [Peterjohn and Correll 1984] Based on research in the 1950's by the U.S. Forest Service in the White Mountains in New Hampshire, a simple formula, which included adjustment for slope, was adopted as a means to establish a sediment buffer between forest roads and streams:

$25 \text{ feet} + (2.0 \text{ feet})(\% \text{ slope})$ [Trimble and Sartz 1957].

Trimble and Sartz suggested a more stringent formula to prevent sedimentation of municipal watersheds. More recent work by Swift in Nantahala National Forest in North Carolina suggested that this formula should be adjusted:

$43 \text{ feet} + (1.39 \text{ feet})(\% \text{ slope})$ [Swift 1986, p.32].

He also suggested that if a brush barrier was used that this formula should be further adjusted:

$43 \text{ feet} + (0.40 \text{ feet})(\% \text{ slope})$ [Id].

After a review of numerous studies and recognizing that vegetated buffer zones as narrow as 15 feet were found to efficiently trap sediment, Wegner recommended that 100-feet is generally adequate for the removal of sediment [Wegner S. 1999, p. 20].

How does the way surface-water flows through the stream buffer zone affect the zone's ability to trap sediment? Buffers are most effective when uniform sheet flow through the buffer zone is maintained. Dillaha et al. (1988) studied efficiency of orchardgrass (*Dactylis glomerata*) plots for controlling sediment and nutrients from feedlots on slopes of 11 to 16 percent. He found in plots with uniform flow 81 to 91 percent of sediment and soluble solids were effectively trapped, but the efficiency was much less where concentrated flow occurred. [Dillaha et al. 1988] Channelization of surface runoff is a natural process. It has a heightened tendency to occur with increased precipitation, reduced infiltration, lack of or reduced ground cover, increased slope and distance. Once flow becomes channelized, the ability to trap sediment is significantly reduced. [Karr and Schlosser 1977; Dillaha et al.1989; Osborne and Kovacic 1993; Daniels and Gilliam 1996]

Channelized flow reduces the efficiency of vegetation and litter to slow the runoff velocity to promote suspended particles to settle. It also reduces the time needed for surface flow to infiltrate into the buffer zone, which would cause further filtering of very fine particles. Daniels and Gilliam

reported that ephemeral channels are ineffective sediment traps during high-flow. [Daniels and Gilliam 1996] Lowrance et al. concluded that buffer zones are most effective in trapping sediment in ephemeral and headwater streams because there is a greater proportion of surface runoff that enters the buffer zone as shallow sheet wash [Lowrance 1995].

Stream Bank Stabilization: Another potential source of sediment is from the stream bank. Wenger reported that a 1990 study by Grissinger et al. (1991) found that “better than 80% of the total sediment yield for a stream in northern Mississippi originates as channel and gully erosion.” Likewise, Rabeni and Smale (1995), Cooper et al. (1993) and Lowrance et al. (1985) found that the channel can be a significant source of sediment. [Wenger 1999, p. 18]

One of the most important roles of riparian buffer zones is to stabilize banks. A study by Beeson and Doyle (1995) found that non-vegetated banks were more than 30 times as likely to suffer exceptionally severe erosion as fully vegetated banks. Barling and Moore (1994) note that buffers can prevent the formation of rills and gullies in riparian areas that are otherwise highly susceptible to erosion. Vegetation [Palone and Todd 1998] in the riparian area exerts a strong control over the condition and stability of the stream and its banks. In the eastern United States, trees often define the physical characteristics of stream channels. Trees anchor stream bank soils through dense root masses, and large roots provide physical resistance to flow energy. Woody debris anchors channel substrate and determines bar formation, stores large amounts of streambed sediment and gravel, helps control sinuosity, and provides channel structure through pool/riffle or step formation. Until recently, the value of large woody debris was misunderstood and much was removed throughout the country. It is likely that the direct effect of buffer width on this function is limited. Only vegetation within 25 feet of the stream channel would provide a powerful role in stabilization. However, increasing buffer width would continue to indirectly enhance stream stability by providing additional protection and stability during extreme flood events, allowing stability during channel migration, and as a physical barrier to human impact [Palone and Todd 1998, p. 6-10].

To be effective, bank vegetation [Wegner 1999, p. 19] should have a good, deep root structure which holds soil. Shields et al. (1995) tested different configurations of vegetation and structural controls in stabilizing banks. They found that native woody species, especially willow, are best adapted to re-colonizing and stabilizing banks. Wegner noted that the persistent exotic vine kudzu are likely the most serious barrier to vegetation restoration because it can out-compete native vegetation [Wegner 1999, p.19]. Other restoration ecologists still believe that kudzu and certain other exotics may still have a role in stream bank restoration because they can provide good root structure. Artificial methods of stream bank stabilization, such as applying riprap or encasing the channel in cement, are effective in reducing bank erosion on site but would increase erosion downstream and have negative impacts on other stream functions. Artificially stabilized banks lack the habitat benefits of forested banks and are expensive to build and maintain. Overall, the negative consequences of artificial bank stabilization generally outweigh the benefits.

Few studies have attempted to correlate stream bank stability with riparian buffer zone width [Wegner 1999, p.19]. Common sense suggests that relatively narrow vegetative buffers are effective in the short term [USACE 1991]. As long as banks are stabilized and damaging activities are kept away from the channel, width of the riparian buffer zone would not appear as a major factor in preventing bank erosion. However, it is important to recognize that some erosion is inevitable and stream channels would migrate laterally, which could eventually move the stream outside the protected area. Therefore, a buffer zone wide enough to permit channel migration is recommended.

Nutrient Removal: Riparian buffer zones may also perform the function of removing nutrients such as nitrates and phosphates that would otherwise enter stream, rivers, and lakes. Excessive nutrient loads imbalance natural aquatic systems and can lead to algae blooms, conditions with little or no oxygen dissolved in the water, and fish kills. This function is especially important in agricultural and urban settings to maintain the quality of the surface water but is considered

important if fertilizer is used to reclaim a mine site or in consideration of the post-mining land use. In addition, the process involved may also help reduce sulfate [Correll and Weller 1989; Jordan et al. 1993], which is often associated as pollutant when coal or overburden contains pyrite.

Basically, nutrients may be solid or dissolved. As solids, these nutrients are often affixed to sediment. As previously discussed, riparian zones are effective in reducing the amount of particulate matter that enters a stream; so, those same processes would apply. In a dissolved form, these nutrients enter the buffer zone as surface- or ground water. Riparian buffer zones effectively remove nutrients in the dissolved form, but there is no consensus on which processes are most responsible. Few studies have accurately measured the amount of nitrate removed by any one of these mechanisms at a given site and no study has measured the removal rate by all three mechanisms [Correll 1997, p.11].

Candidate mechanisms include denitrification (microbial reduction of nitrate to nitrogen gas), assimilation and retention by the vegetation, and transformation to ammonium and organic nitrogen followed by retention in the soils of the riparian buffer zones. Denitrification is most often invoked as the primary mechanism of nitrate removal; however, the extreme spatial and temporal variability of denitrification rates in riparian buffer zones make it very difficult to determine accurate fluxes [Correll 1991; Weller et al., 1994]. Phosphates are not effectively removed by this process because of the lack of an analogous microbial activity [Lowrance 1997, p. 128].

Some scientists conclude that assimilation by the vegetation is the primary mechanism of nitrate removal (e.g. Fail et al. 1986). This mechanism would account for the uptake of phosphorus as well. Studies have shown that amount of nitrogen in the biomass only accounts for 30% of the nitrate removal [Peterjohn and Correll 1984; Correll and Weller 1989]. Correll suggests that the assimilation by the vegetation and recycling to the forest floor as litter is important in unraveling the overall primary mechanism [Correll, 1997, p. 13]. This flux of organic nitrogen delivered to the forest floor as litter could be gradually mineralized and denitrified at the soil surface [Id]. While vegetation may be very important in explaining nutrient removal within the riparian buffer zone, nutrients removal continue in the winter at sites where hardwood deciduous forests are dormant [Id].

Some scientists believe that nitrate removal is accomplished by chemical rather than biological denitrification [Mariotti et al., 1988]. The below ground conditions in riparian buffer zone are often anaerobic or of low oxidation/reduction potential (Eh) at least for parts of the year. The vegetation within the riparian zone is important in maintaining this low Eh. The below-ground processes that result in this low Eh are composed of a series of biogeochemical reactions that occur in a defined order [Billen, 1976]. These reactions transfer electrons from organic matter, released from the plants, to various terminal electron acceptors. The availability of terminal electron acceptors determines which level in the series would dominate below-ground processes at any one time and place in the riparian zone. Some of the more commonly important reactions are manganate ion reduction, denitrification, ferric iron reduction, sulfate reduction, and methanogenesis. None of these reactions can take place in the presence of molecular oxygen. Despite the relative ease of measuring soil Eh, few studies have reported this critical parameter [Correll, 1997, p. 10].

What characteristics of the riparian buffer zone affect its ability to retain nutrients? Nutrients, especially phosphorus, are likely in solid form and are subjected to the same processes and limitation as other suspended solids. However, the long-term effectiveness of riparian buffer zones to trap phosphorus is highly questionable. Whereas nitrate can be denitrified and released to the atmosphere, phosphorus is either taken up by vegetation, adsorbed into the soil or organic matter, precipitated with metals, or released into the stream- or ground water [Lowrance 1998].

The effectiveness of the riparian buffer zone to trap dissolved nutrients is highly dependent on the hydrology, soils, and vegetation. To illustrate, the volume and pathway of the ground water passing through the riparian buffer zone would influence its ability to effectively retain nutrients. If

the local ground water passes beneath the riparian buffer zone or the whole system is at too great a depth, the riparian zone cannot interact [Correll 1997, p.8]. In diverse topography, in gentle slope areas and broad alluvial floodplains, the depth of ground water is near the surface, but in steep terrain the water table in the riparian zone typically is much deeper. In the latter case, the interaction between the saturated zone and the root zone is quite small [USEPA 1995, p.31].

Along with hydrology, soil characteristics are important in determining the potential for removal of nitrogen and pollutants carried by sediment such as phosphorus and some pesticides. Primary considerations are soil texture, depth to water table, microbial activity and organic matter content. Moderate- to well-drained soils have the greatest permeability and intercept large amounts of water that may enter the buffer as surface flow, thus promoting deposition of sediment and related pollutants. Conversely, moderate- to fine-textured soils have superior potential to create conditions favorable for extensive denitrification [Palone and Todd 1998, p. 6-6]. Soil microorganisms have the capacity to process nitrate at high concentrations. Riparian buffer zones support a variety of microbial degradation mechanisms, though the specific conditions that promote them are not yet well understood [Palone and Todd 1998, p. 6-8]. Dissolved organic carbon promotes denitrification. Many soils are carbon limited or become carbon limited at high nitrate levels [Wenger 1999, p. 28].

Both grass and forested riparian buffer zones are effective at reducing nutrients but there is very little agreement among researchers regarding which is more effective. In situations, where ground-water flow is relatively deep, trees would appear to be more effective in that the roots would be more likely to penetrate into the zone of lateral ground-water flow. Regardless of whether the riparian buffer zone consists of grass or trees, harvesting of the vegetation appears necessary to maintain the sustainability of the buffer zones' trapping ability.

Nutrient Supply: Leaf litter is the base food source in most stream ecosystems and streamside trees are critical in establishing this aquatic food web. Leaf litter and other organic matter from riparian forests, including terrestrial invertebrates that drop into the water, are an important source of food and energy to stream systems [Wenger 1999, p.34]. Small fish, some amphibians, and most aquatic insects rely primarily on leaf detritus (dead leaf material) from trees as food. Studies have shown that when streamside trees are removed, many aquatic insects decline or even disappear, and with them, native fish, birds, and other species that may depend on them. Some insects are adapted to specific tree species and are unable to reproduce or even survive when fed the leaves of grasses that are non-native or exotic species [Palone and Todd 1998, p. 6-10].

Habitat: Large woody debris from the trees in the riparian buffer zone also creates cover and habitat structure for fish and other aquatic species. Although the portion of the buffer nearest the water body exerts the greatest influence over this function, increasing buffer width provides support and sustainability. This is especially true when considering the need to provide long-term woody debris recruitment, diversity of vegetation for leaf detritus, and refuge for species during high water. The presence of trees is directly related to greater biodiversity in the stream ecosystem. [Palone and Todd 1998, p.6-11] Forested stream corridors are necessary to provide regular inputs of larger woody debris and removal of riparian forest can have long-term negative effects [Wenger 1999, p.34]. Collier et al. recommended a buffer zone width of at least one tree height to maintain the purposes of larger woody debris and suggested for stability purposes that a width of equal to three tree heights. [Collier, K.J. et al. 1995]

Riparian buffer zones are important terrestrial habitats in themselves. These zones have the potential to provide rich habitats for a wide variety of birds, mammals, reptiles and amphibians. Most habitat research on riparian areas has focused on animals, but some studies have documented the important role of riparian corridors for plant diversity and dispersal. Native plant communities support healthy populations of native animals and help maintain stream hydrology. Very wide buffers of 300 feet or more are needed to protect diverse terrestrial communities; but

even buffers of 50 feet, which contribute substantially to water quality and aquatic habitat goals, can offer good habitat to terrestrial species. [McNaught 2003, p. 8] A 100-foot riparian buffer zone may not provide adequate habitat for neotropical songbirds but would provide a corridor for movement along patches of remaining forest. [Palone and Todd 1998, p. 6-11] The width and character of the riparian buffer zone would vary to meet the needs of a particular species. A mixture of grasses and forbs, especially tall species will provide suitable habitat for some game birds. In all cases, maintaining forests as a component of the riparian buffer zone greatly enhances diversity and abundance of birds and other wildlife [Id]. Narrow riparian buffer zones also can act as wildlife corridors, connecting larger tracts of upland forests.

Temperature Modification: Forested riparian buffers provide shade cover, thereby helping to lower water temperatures during summer and lessen temperature decreases in winter. Lack of shade has a direct effect on water quality and aquatic life. Elevated temperatures are a catalyst for water quality problems by accelerating or increasing the impacts of non-point source pollution and robbing oxygen from the system. Small streams flowing through exposed reaches can increase as much as 1.5 degrees Fahrenheit for every 100 feet of exposure to summer sun. Maximum temperature fluctuations for daily peaks can be as much as 12 to 15 degrees higher, and ambient temperatures of 6 to 8 degrees higher are not uncommon. The evapotranspiration process of forests also contributes to lower water temperatures. The removal of streamside trees is one of the most significant causes of degradation for streams in the United States. The ability of a buffer to provide shade is directly proportional to height of the vegetation and bank full width of the stream. Even 15- to 25-foot buffers can provide adequate shade for small streams. Fifty- to 75-foot forest buffers are sufficient to ensure favorable conditions for trout, and buffer widths along slopes can decrease with increasing tree height with no loss of shading. Aspect is also an important consideration. Grass filter strips along streams are generally unable to provide cover sufficient to moderate water temperature. [Palone and Todd 1999, p. 6-9]

Flood Control: Stream corridors and natural forest vegetation help to reduce the downstream effects of floods by dissipating stream energy, temporarily storing flood waters, and helping to remove sediment loads through incorporation in the flood plain. On a given site, a vegetated buffer that resists channelization is effective in decreasing the rate of flow, and in turn, increasing infiltration. Forests provide as much as 40 times the water storage of a cropped field and 15 times that of grass turf. These increases in storage are largely due to the forest's ability to capture rainfall on the vast surface area of the leaves, stems, and branches; the porosity and water holding capacity of organic material stored on the forest floor and in the soil; and the greater transpiration rates common to the community of forest vegetation. Increasing width to incorporate the flood plain also increases the potential efficiency of water storage from upstream flow during storm events. Providing flood storage buffers where possible along smaller streams in a watershed may provide a valuable approach to downstream flood reduction. However, once the entire flood plain is included within the buffer area, the effect of buffer width on flood peak reductions is negligible [Palone and Todd 1999, p. 6-10].

b) Restoration

As indicated in the discussion of the regulatory environment, the Federal regulations provide general guidance for the restoration of wetlands, riparian vegetation, and fish and wildlife habitat, as well as other lands in a stream buffer zone. However, OSM recognizes that successful restoration depends upon regional conditions and site specific factors. As OSM indicated in the preamble to its June 30, 1983 rule to protect fish and wildlife resources, because conditions vary according to site and region, only the regulatory authority is in a position to determine how land is restored to a condition capable of supporting postmining fish or wildlife habitat. The regulatory authority would specify the minimum percentage of lands that are restored to support wetlands, riparian vegetation, and other uses to support postmining fish or wildlife habitats, on the basis of site- or State-specific factors [48 FR 30326, June 30, 1983].

Most states allow mining to occur in and near streams. In Kentucky for example, the number of stream buffer zone waivers that were granted by the Kentucky Department of Surface Mining Reclamation and Enforcement (DSMRE) from 2001 thru 2006 is shown in table III-5.

Table III-5 – Number of permits issued by Kentucky with a buffer zone waiver

Year	Total # DSMRE Permits Issued by KDNR	Total # DSMRE Permits Issued with a SBZ Variance	Total # DSMRE Permits Issued with a SBZ size requirement of 0 (zero) feet.
2006	247	177	63
2005	205	136	84
2004	221	144	98
2003	224	172	101
2002	246	185	105
2001	256	179	102
Totals	1399	993	553

As one would expect, the amount of land in and near streams disturbed by mining is much greater in the Appalachian coalfields and least in the arid Western states. In most of the Appalachian coalfield States, the regulatory authorities have developed guidelines and procedures beyond their program requirements for specifying the manner in which riparian buffer zones would be restored. These procedures sometime involve discussions among the regulatory agency, the coal operator, the State fish and wildlife agencies and the U.S. Fish and Wildlife Service. Often regulatory agencies also involve the U.S. Army – Corps of Engineers in these discussions and worked out detailed procedures to enhance the permitting process.

2. Headwater Streams

Generally, headwater streams originate at high elevations. Substrate patterns in headwater streams channels are typically comprised of coarser material such as boulders, cobble rubble and bedrock. Large, woody debris often contribute to the substrate complexity in headwater streams. Small pools with finer sediments may also be found along headwater streams. Typical substrate patterns in larger rivers are comprised of finer material such as silt and sand. Mid-sized rivers typically contain a blend of cobble and gravel with some finer sediment interspersed in areas of slower flow.

There is no universally accepted definition of headwater streams. Some define headwater streams through a system called stream ordering [Strahler 1957, p. 914]. As shown in figure III-20 below, this system classifies a stream based on its position within the drainage network. A first-order stream is defined as not having tributaries. The confluence of two streams of the same order produces the next highest order. For example, the joining of two first-order streams results in a second-order stream. The joining of two second-order streams produces a third-order stream, etc. Headwaters are usually classified as first- through third-order streams, mid-sized streams as fourth-through sixth-order streams, and larger rivers as seventh- through twelfth-order streams.

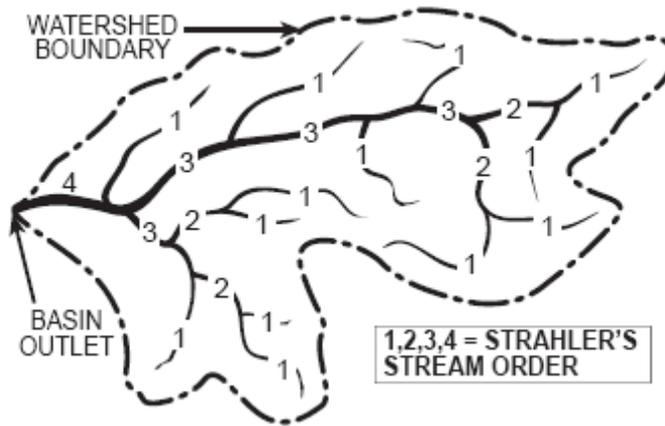


Figure III-20 – An illustration of Strahler's stream classification

Others use watershed size and other characteristics to classify headwaters streams. For example, Ohio Environmental Protection Agency defines headwater streams as a stream with a watershed less than or equal to 20 square miles [Ohio EPA 2001, p. 1]. They classify streams with a watershed less than one square mile as "primary headwater" streams [Id].

For the purpose of this environmental impact statement, the term "headwater streams" includes all intermittent and small perennial streams at the higher elevations of the drainage basin.

Most headwater streams join together to form larger streams and rivers or run directly into still larger streams and lakes. In desert and karst areas, headwater streams typically emerge, flow for short distances, and then vanish underground.

Many headwater streams do not show up on the relatively detailed 1:24,000 topographic maps published by the U.S. Geological Survey. The detail of the drainage net is dependent upon the scale of the map used to trace the channels [Leopold et al. 1964, p.131]. In almost all situations, the cumulative length of headwater streams in a given watershed is much greater than the cumulative length of larger streams and rivers [Hamblin 1975, p.141; Leopold et al. 1964, p.142]. To give perspective for this statement, the Mississippi River is approximately 1800 miles long. There are approximately 3.2 million miles of streams greater than a mile in length in the United States; there may be over 17 million miles when smaller headwater streams are also considered [Hamblin 1975, p.141].

To give further perspective, the estimated length of headwater streams anticipated to be directly impacted, either temporarily or permanently, by surface coal mining pursuant to permits issued from October 1, 2001 to June 30, 2005, is provided by region in table III-6. The data in this table was derived from information provided by the respective regulatory authorities in each of the coal producing states and Indian lands.

Table III-6 – Estimated stream miles permanently or temporarily anticipated to be affected by surface coal mining operations permitted between October 1, 2001 and June 30, 2005

Region	Miles of Streams Anticipated to be Temporarily or Permanently Affected
Northern Rocky Mountains and Great Plains	< 50
Appalachian Basin	> 367
Colorado Plateau	< 10
Illinois Basin	≈ 10
Gulf Coast*	> 100

* Nearly 90 % of affected streams are in Texas

a) Functions

Headwater streams serve a number of important ecological functions including attenuating floods, maintaining water supplies, and improving water quality. These streams also provide a rich diversity of habitats that provide shelter, food, protection from predators, spawning sites and nursery areas, and travel corridors between terrestrial and aquatic habitats for many animal species at different stages in their life history. [Karr and Schlosser 1978, p.231] These small ecosystems also provide a steady supply of food resources to downstream ecosystems by recycling organic matter. [Meyers et al. 2003, p.22] These functions will be discussed below.

How do headwater streams reduce flooding? When small streams and wetlands are in their natural state, they absorb significant amounts of rainwater, runoff, and snowmelt before flooding. Unlike a concrete drainage ditch, natural stream beds are laden with rocks, roots, standing and fallen trees, natural pools and riffles, and other obstructions. Natural streams broaden and narrow, and frequently change directions. These features tend to increase friction and to reduce the velocity of water. [Ohio DNR 2004, p.4] Flooding is natural and occurs when the discharge of runoff and base flow from the upland areas exceed the stream's capacity to convey water within its channels. This out-of-bank flooding in headwater streams displaces water over a much broader area into adjacent riparian area and reduces the severity of flooding downstream.

How do headwater streams maintain water supplies? Headwater streams play a crucial role in ensuring a continual flow of water to downstream ecosystems. Headwater streams have a particularly important role to play in ground-water discharge. These up-stream components of a river network have the largest surface area of soil in contact with available water, thereby providing the greatest opportunity for recharge of ground water. Moreover, water level in headwater streams is often higher than the water table, allowing water to flow through the channel bed and banks into the soil and ground water. Such situations occur when water levels are high, such as during the spring snowmelt or rainy season. During dry times, the situation in some reaches of the stream network, particularly those downstream, may reverse, with water flowing from the soil and ground water through the channel banks and bed into the stream. This exchange of water from the soil and ground water into the stream maintains stream flow. [Meyer et al. 2003, p.11]

Natural streams are dynamic systems that convey, store, and transform water, sediment, and organic matter. The transformations involve: physical processes— aeration, dispersion currents, sedimentation; chemical processes— photosynthesis, metabolism; and biological processes— biological flocculation and precipitation that act in concert to naturally purify the water. Aerobic purification processes require free oxygen and are dominant in natural streams, although important anaerobic processes occur as well where free oxygen is absent. [Ohio DNR 2004, p.4]

How do headwater streams help to improve water quality? Headwater streams and associated wetlands both retain and transform excess nutrients, thereby preventing them from traveling downstream. Physical, chemical and biological processes in headwater streams interact to provide this ecosystem service. [Meyers et al. 2003, p.13]

Compared with larger streams and rivers, the waters in small streams, especially shallow ones, have more physical contact with the stream channel. Therefore, the average distance traveled by a particle before it is removed from the water column is shorter in headwater streams than in larger ones. In headwater streams, more water is in direct contact with the streambed, where most of the processing takes place. Bacteria, fungi, and other microorganisms living on the bottom of a stream consume inorganic nitrogen and phosphorus and convert them into less harmful, more biologically beneficial compounds. Meyers et al. reported that research on 14 headwater streams in various locations in the United States shows that 64 percent of inorganic nitrogen entering a small stream is retained or transformed within 1000 yards [Id, 14].

The processes that consume these nutrients deplete dissolved oxygen in the water. Without adequate oxygen, fish and other aquatic organisms suffocate. Riffles and other natural turbulence in headwater streams enhance aeration and increase oxygen in the stream water. Aquatic plants add oxygen to the water through transpiration [Ohio DNR 2004, p. 5].

How do headwater streams provide a diverse habitat for fish and wildlife? Headwater streams are probably the most varied of all running-water habitats; they range from icy-cold brooks tumbling down steep, boulder field channels to outflows from desert springs that trickle along a wash for a short distance before disappearing into sand. Headwater systems offer an enormous array of habitats for plant, animal, and microbial life. This variation is due to regional differences in climate, geology, land use, and biology. For example, streams in limestone or sandy regions have very steady flow regimes compared with those located in impermeable shale or clay soils. Plants or animals found only in certain regions can also lend a distinctive character to headwater streams. Regionally important riparian plants, such as alder or tamarisk, exercise a strong influence on headwater streams. With this variety of influences, headwater streams present a rich mosaic of habitats, each with its own characteristic community of plants, animals, and microorganisms [Meyer et al. 2003, p.16].

The species in typical headwater streams include bacteria, fungi, algae, higher plants, invertebrates, fish, amphibians, birds, and mammals. Headwater streams are rich feeding grounds. Large amounts of leaves and other organic matter that fall or blow into streams, the retention of organic matter in a channel or debris dams, and the high rates of plant and algal growth in unshaded headwaters all supply food sources for animals such as caddis flies, snails, and crustaceans. These animals become food for predators such as fish, salamanders, crayfish, birds, and mammals, which in turn become prey for larger animals, including herons, raccoons and otters. Many widespread species also use headwaters for spawning sites, nursery areas, feeding areas, and travel corridors. Thus, headwater habitats are important to species like otters, flycatchers, and trout, even though these species are not restricted to headwaters. The rich resource base that headwaters provide causes the biotic diversity of headwater streams to contribute to the productivity of both local food webs and those further downstream [Id, p.16-17].

Diversity of headwater systems results in diverse headwater plants and animals. Many of these species are headwater specialists and are most abundant in or restricted to headwaters. For example, water shrews live along small, cool streams, feed on aquatic invertebrates, and spend their entire lives connected to headwaters streams. Headwater specialists often have small geographic ranges. These species, many of which are imperiled, include: species of minnows, darters, and topminnows in southeastern springs and brooks; aquatic snails in spring-fed headwaters in the Great Basin, the Southeast, Florida, and the Pacific Northwest; crayfish in small streams from Illinois and Oklahoma to Florida; and salamanders and tailed frogs in small streams, springs, and seeps in the Southeast and Pacific Northwest [Id, p.17].

Animals may use headwater streams for all or part of their lives. Although many fish species live exclusively in headwater systems, others use headwaters on for key parts of their life cycle. For example, headwaters are crucial for the diversity of salmon stocks in the Pacific Northwest because salmon spawn and rear in headwater streams. In other parts of the country, trispot darters, brook trout and rainbow trout spawn in small streams. Young cutthroat trout use shelter formed by streams debris dams but move onto larger portions of a stream network as they mature. Intermittent streams can offer special protection for young fish, because the small pools that remain in such streams often lack predators. Still other fish species use headwater streams as seasonal feeding areas [Id].

Both permanent and intermittent streams provide valuable habitat for micro-organisms, plants, and animals. Generally, biodiversity is higher in permanent streams than intermittent streams, but intermittent streams often provide habitat for different species. Some species that occur in both types of streams may be more abundant in predatory-free intermittent streams. For example, because of the lack of larger predatory fish, salamanders and crayfish are sometimes more abundant in fishless intermittent streams rather than those with permanent flow. In contrast, for animals such as brook trout that require steady water temperatures and constant water flow, perennial streams provide better habitat [Id].

The movement of plants and animals between headwater and streamside ecosystems boosts biodiversity in both areas. Headwater streams are tightly linked to adjacent riparian ecosystems, the zones along a stream bank. Riparian ecosystems have high species diversity, particularly in arid environments where the stream provides a unique micro-climate. Typical riparian vegetation depends upon moist streamside soils. Some plants must have "wet feet," meaning their roots have to stretch into portions of soil that are saturated with water. Seeds of some riparian plants, such as those of cottonwood trees found along rivers in the Southwest, require periodic floods to germinate and take root [Id., p. 18].

b) Restoration

In coordination with other State and Federal agencies, several State regulatory agencies have adopted detailed guidance on the restoration of streams affected by coal mining. While proven methods exist for larger stream channel restoration and creation, the state of the art in creating smaller headwater streams onsite has not reached the level of reproducible success [EPA 2003, p.II.C-49]. A natural stream channel is a complex system which is difficult to re-create. Many abiotic factors (e.g. channel configuration, gradient, substrate type, and hydrology) influence the biological community structure of a stream. [EPA 2005] In addition to the difficulty of re-creating the physical aspects of a stream, there is the problem of supplying organic matter to the system. There will be a period of time in which little or no allochthonous material enters a reconstructed stream channel if all riparian vegetation has been removed. Riparian plantings will also take many years to reach maturity and begin to return allochthonous material to the stream at pre-disturbance levels, if this is ever achieved. The type of plantings can influence the productivity of a stream also. Sweeney (2002) showed that a stonefly on a mixed deciduous leaf diet had higher productivity than when fed a single species diet. Invertebrate communities may begin to re-appear relatively soon in a reconstructed stream but it is unlikely they would resemble pre-disturbance communities.

c) Overall Conditions of Headwater Streams

In May 2006, the U.S. EPA published the results summary of the nation's streams and small rivers. [EPA 2006] The study, which is referred to as the Wadeable Stream Assessment (WSA), entailed collecting chemical, physical, and biological data at 1,392 wadeable perennial streams in

the continental United States. The EPA estimates that 90% of all perennial streams and rivers in the United States are small, wadeable streams. Intermittent and ephemeral streams were not included in WSA because there are no well-developed indicators to assess these waterbodies.

The results of this survey showed that 42% of the U.S. wadeable streams miles are in poor condition compared to best available reference sites in their ecological regions, 25% are in fair condition, and 28% are in good condition, and 5% are not assessed. [Id., p.27] Three major regions were outlined in the assessment: the Eastern Highlands, the Plains and Lowlands, and the West. See figure III-21 below. Of these regions, the West is in the best condition, with 45% of the length of wadeable flowing waters in good condition. The Eastern Highlands region presents the most concerns, with only 18% of the length of streams and rivers in good condition, and 52% in poor condition. In the Plains and Lowlands region, 30% of the length of wadeable streams and rivers are in good condition and 40% are in poor condition. [Id., p.2]

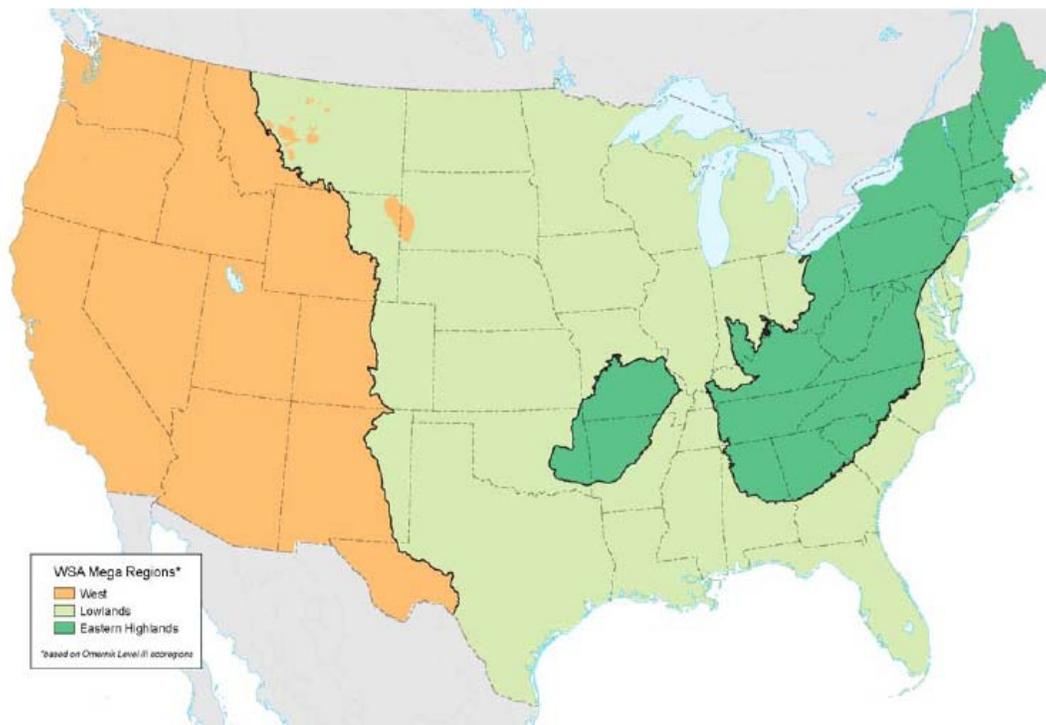


Figure III-21 – Climate and landform reporting regions for the Wadeable Stream Assessment (copied from EPA, 2006, figure 1-7)

The assessment examined the key factors most likely responsible for diminishing biological quality, as determined by aquatic macroinvertebrate communities. Stressors are the chemical, physical, biological components of the ecosystem that have the potential to degrade stream biology. Some stressors are naturally occurring, and some result only from human activities, but most come from both sources. Examples of chemical stressors include toxic compounds (e.g., heavy metals, pesticides), excess nutrients (e.g., nitrogen and phosphorus), or acidity from acidic deposition or mining. Biological stressors are characteristics of biota that can influence biological integrity, such as proliferation of non-native or invasive species (either in the streams and rivers, or in the riparian areas adjacent to these waterbodies). [Id., p. 22] The most widespread stressors observed across the country and in each of the three major regions are phosphorus, nitrogen, riparian disturbance, and streambed sediments. Increases in nutrients (e.g., nitrogen and phosphorus) and streambed sediments have the highest impact on biological condition; streams scoring poor for these stressors were at 2 to 4 times higher risk of having poor biological

conditions than streams that scored in the good range for the same stressors. [Id., p. 46]

Phosphorus is usually considered the most likely nutrient limiting algal growth in U.S. freshwater waterbodies. Because of the naturally low levels of phosphorus in stream systems, even small increases in phosphorus levels can impact a stream's water quality. Some areas of the country have naturally higher levels of phosphorus, such as streams originating from ground water in volcanic areas like eastern Oregon and Idaho. Phosphorus influx leads to increased algal growth, which reduces dissolved oxygen levels and water clarity within the stream. Phosphorus is a common component of fertilizers, and high concentrations in streams may be associated with poor agricultural practices, urban runoff, or point-source discharges (e.g., effluents from sewage treatment plants). Approximately 31% of stream length nationwide has high levels of phosphorus, 16% has medium levels, and 49% has low levels. Of the three climatic and landform regions, the Eastern Highlands has the greatest proportion of stream miles with high levels of phosphorus (43%), followed by the Plains and Lowlands (25%) and the West (19%). [Id. 32]

Nitrogen is the primary limiting nutrient in many regions of the United States, particularly in granitic or basaltic geology found in parts of the Northeast and the Pacific Northwest. Increased nitrogen inputs to a stream can stimulate growth of excess algae, such as periphyton, which results in low dissolved oxygen levels, a depletion of sunlight available to the streambed, and degraded habitat conditions for benthic macroinvertebrates and other aquatic life. Common sources of nitrogen include fertilizers, wastewater, animal wastes, and atmospheric deposition. A significant portion of stream miles (32%) have high levels of nitrogen compared to least-disturbed reference conditions. Another 21% have medium levels, and 43% of stream miles have relatively low levels. As with phosphorus, the Eastern Highlands region exhibits the highest proportion of stream length with high levels of nitrogen (42%), followed by the Plains and Lowlands (27%) and the West (21%). [Id., p. 33].

Excessive salinity occurs in areas with high evaporative losses of water and can be exacerbated by repeated use of water for irrigation or by water withdrawals. Both electrical conductivity and total dissolved solids (TDS) can be used as measures of salinity; however, conductivity was used for the WSA. Roughly 3% of stream length nationwide has high levels of salinity, 10% has medium levels, and 83% has low levels compared to the levels found in least-disturbed reference sites. The Plains and Lowlands region has the highest proportion of stream length with high levels of salinity (5%), followed by the West (3%). In the Eastern Highlands, high levels of salinity are found in about 1% of stream length. [Id., p. 34-35].

Streams and rivers can become acidic through the effects of acid deposition (e.g., acid rain) or mine drainage, particularly from coal mining. Previous studies have shown that these issues, while of concern, are likely focused in a few geographic regions of the country. Streams and rivers are also acidic because of such natural sources as high dissolved organic compounds. [Id., p. 35] Acid rain forms when smokestack and automobile emissions (particularly sulfur dioxide and nitrogen oxides) combine with moisture in the air, forming dilute solutions of sulfuric and nitric acid. Acid deposition can also occur in dry form, such as the particles that make up soot. When wet and dry deposition fall on sensitive watersheds, they can have deleterious effects on soils, vegetation, and streams and rivers. [Id., p. 36].

Acid mine drainage also forms when water moves through mines and mine tailings, combining with sulfur-bearing minerals to form strong solutions of sulfuric acid and mobilizing many toxic metals. As in the case of acid rain, the acidity of waters in mining areas is assessed by using their acid neutralization capacity values. Mine drainage also produces extremely high concentrations of sulfate—much higher than those found in acid rain. Although sulfate is not directly toxic to biota, it serves as an indicator of mining's influence on streams and rivers. [Id., p. 36]

About 2% of the stream length is impacted by acidification from anthropogenic sources. This includes acid deposition (0.7%), acid mine drainage (0.4%), and stream miles likely are episodically acidic during high runoff events (1%). Although these numbers appear relatively

small, they reflect a significant impact in certain parts of the United States (particularly in the Eastern Highlands region). [Id]

A number of human activities can potentially impact the physical habitat of streams upon which the biota rely. Soil erosion from road construction, poor agricultural practices, and other disturbances can result in increases in the amount of fine sediments on the stream bottom, which negatively impact macroinvertebrates and fish. Physical alterations to vegetation along the stream banks, alteration to the physical characteristics within the stream itself, and changes in the flow of water all have the potential to impact stream biota. Although many aspects of stream and river habitats can become stressful to aquatic organisms when altered or modified, the WSA focuses on four specific aspects of habitat: streambed sediments, in-stream habitat complexity, riparian vegetation, and riparian disturbance. [Id., p. 37-38]

The supply of water and sediments from drainage areas affects the shape of river channels and the size of streambed particles in streams and rivers. One measure of the interplay between sediment supply and transport is relative bed stability (RBS). The measure of RBS used in the WSA is a ratio that compares the particle size of observed sediments to the size of sediments that each stream can move or scour during its flood stage (based on the size, slope, and other physical characteristics of the stream channel). The expected RBS ratio differs naturally among regions, depending upon landscape characteristics that include geology, topography, hydrology, natural vegetation, and natural disturbance history. [Id., p. 38]

Values of the RBS ratio are either substantially lower (e.g., finer, more unstable streambeds) or higher (e.g., coarser, more stable streambeds) than those expected, based on the range found in least-disturbed reference sites. Both high and low values are considered to be indicators of ecological stress. Excess fine sediments on the streambed can destabilize streams when the supply of sediments from the landscape exceeds the ability of the stream to move them downstream. This imbalance results from a number of human uses of the landscape, including agriculture, road building, construction, and grazing. The WSA focuses on increase in streambed sediment, represented by lower than expected streambed stability as the indicator of concern. [Id.]

Lower than expected streambed stability may result either from high inputs of fine sediments (e.g., erosion) or increases in flood magnitude or frequency (e.g., hydrologic alteration). When low RBS results from fine sediment inputs, stressful ecological conditions can occur as fine sediments begin filling in the habitat spaces between stream cobbles and boulders. The instability (low RBS) resulting from hydrologic alteration is sometimes a precursor to channel incision and gully formation. [Id.]

Approximately 25% of the nation's stream miles have streambed sediment characteristics in poor condition compared to regional reference conditions. Streambed sediment characteristics are rated fair in 20% of stream miles and rated good in 50% of stream miles compared to reference. The two regions with the highest percentage of streams in poor condition are the Eastern Highlands (28%) and the Plains and Lowlands (26%), while the West region has the lowest percentage (17%) of streams in poor condition. Streams with significantly more stable streambeds than reference (e.g., evidence of hardening and scouring, streams that are lined with concrete) were not included in this indicator. These stream conditions occurred so rarely in the survey that it was not necessary to separate them from the overall population. [Id]

The most diverse fish and macroinvertebrate assemblages are found in streams and rivers that have complex forms of habitat, such as large wood within the stream banks, boulders, undercut banks, and tree roots. Human use of streams and riparian areas often results in the simplification of this habitat, with potential effects on biological integrity. The WSA used a habitat complexity measure that sums the amount of in-stream fish concealment features and habitat consisting of undercut banks, boulders, large pieces of wood, brush, and cover from overhanging vegetation within a stream and its banks. [Id., p. 39]

In-stream fish habitat is in poor condition in 20% of stream miles across the United States. Twenty-five percent of stream miles are in fair condition, and 52% of stream miles are in good condition. The highest proportion in poor condition is in the Plains and Lowlands (37%); only 12% of stream miles in the West and 8% in the Eastern Highlands rated poor for in-stream fish habitat. [Id., p. 40]

The presence of a complex, multi-layered vegetation corridor along streams and rivers is a measure of how well the stream network is buffered against sources of stress in the watershed. Intact riparian areas can help reduce nutrient and sediment runoff from the surrounding landscape, prevent stream bank erosion, provide shade to reduce water temperature, and provide leaf litter and large wood that serve as food and habitat for stream organisms. The presence of large, mature canopy trees in the riparian corridor indicates its longevity, whereas the presence of smaller woody vegetation typically indicates that riparian vegetation is reproducing and suggests the potential for future sustainability of the riparian corridor. The WSA uses a measure of riparian vegetative cover that sums the amount of woody cover provided by three layers of riparian vegetation: the ground layer, woody shrubs, and canopy trees. [Id., p. 41]

Nineteen percent of stream length nationally is in poor condition due to severely simplified riparian vegetation. About 28% of stream miles are in fair condition and almost half (48%) are in good condition. The West (12%) and Eastern Highlands (18%) have similar proportions of stream length with riparian vegetation in poor condition, though this equates to greater numbers of stream miles in the east where water is more abundant. In the Plains and Lowlands region, a larger proportion of stream length (26%) has riparian vegetation in poor condition. [Id.]

The vulnerability of the stream network to potentially harmful human activities increases with the proximity of those activities to the streams. The WSA used a direct measure of riparian human disturbance that tallies 11 specific forms of human activities and disturbances along the stream reach and weights them according to how close they are to the stream channel. The index generally varies from 0 (no observed disturbance) to 6 (four types of disturbance observed in the stream, throughout the reach; or six types observed on the banks, throughout the reach). [Id., p. 42].

Nationally, 26% of stream length has high levels of human influence along the riparian zone that fringes stream banks, and 24% has relatively low levels of disturbance. The highest proportion of stream length with high riparian disturbance is in the Eastern Highlands region (29%), followed by the Plains and Lowlands (26%) and the West (19%). One of the striking findings of the WSA is the widespread distribution of intermediate levels of riparian disturbance: 47% of United States streams have intermediate levels of riparian disturbance when compared to reference sites, and similar percentages are found in each of the three climatic and landform regions. [Id.]

Although most of the factors identified as stressors to streams and rivers are either chemical or physical, there are biological factors that also create stress in wadeable streams. Biological assemblages can be stressed by the presence of non-native species that can either prey on, or compete with, native species. In many cases, non-native species have been intentionally introduced to a waterbody; for example, brown trout and brook trout are common inhabitants of streams in the higher elevation areas of the western mountains and deserts, where they have been stocked as game fish. [Id., p. 44]

When non-native species become established in either vertebrate or invertebrate assemblages, their presence conflicts with the definition of biological integrity that the Clean Water Act is designed to protect (i.e., “having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region”). Therefore, to the extent that non-native species compete with — and potentially exclude — native species, they might be considered a threat to biological integrity. These indicators were not included in this initial assessment of streams, but may be included in future assessments. [Id.]

d) Coal Mining Effects on Headwater Streams

There are two principal coal mining related activities that affect headwater streams directly: the temporary impacts of mining through streams, and the permanent impacts of placing spoil, coal mine waste or other materials in the channels of these streams. While mining through streams occurs throughout the nation's coal fields, this impact most often occurs in areas with ample precipitation and large-scale surface mining. The permanent impacts occur primarily in areas with ample precipitation, steep terrain, relatively thick overburden, and large-scale surface mining. This latter condition is found in principally in central Appalachian coal fields. There are approximately 59,000 stream miles within central Appalachian coal fields [EPA 2003, p. IV.B-1], and 17 million miles of stream nationwide [see Chapter III, I, 2].

Based on permits issued between October 1, 2001 and June 30, 2005, disturbance of about 535 miles of stream by surface coal mining activities is expected. This length of stream and the data that follows are derived from information provided by the respective regulatory authorities in each of the coal producing states and Indian lands. Approximately two thirds of this length is permanent disturbance based on information derived from permits issued in West Virginia. Of this length, 68.6 percent of the total (or 367 miles) are attributed to mining in Appalachian Basin coal fields [see Section III.I.2], primarily from excess spoil fills and coal waste disposal planned for construction in eastern Kentucky, southern West Virginia, and southwestern Virginia. For this same period, approximately 100 miles of temporary stream impacts are associated with surface mining in Texas. Considerably less direct effects are anticipated in other States.

The estimated length of streams directly impacted from mining in central Appalachian coal fields from 1992 to 2002 based on permit information was 1,208 miles (2.05 % of streams in central Appalachian coal fields). If this rate would continue for ten years, 4.1 % of the streams in Appalachia are directly impacted. [EPA 2003, p.IV.B-1] The miles of stream directly impacted by excess spoil fills for permits issued between 1985 and 2001 is 724 miles, which is approximately 1.2 percent of the streams in central Appalachia. If valley fills continues construction at this rate, an additional 724 miles of headwater stream are buried in 17 years or by 2018. [Id., p. IV.B-2]

Based on recent permitting information, the number and size of planned excess spoil fills are becoming smaller. Average valley fill and watershed acreages for Kentucky generally increased from 1985, but steadily declined starting in 1998 to 2001 (from approximately 18 to 11 acres [EPA 2003, Table III.K.2] and 74 to 50 acres [Id, Table III.K.3], respectively). More recent information shows that this trend towards smaller and less numerous fills continue. Available data for 2002 to 2005 show the number of fills permitted in Kentucky and West Virginia declined (from 262 to 92 and 86 to 56 fills, respectively). The average footprint acreage of proposed excess spoil fills in West Virginia shows an erratic trend over these years. However, the average size of the Kentucky fills continues to show a general decline (from 19 to 7 acres).

Every two years the Administrator of the EPA is required to submit to Congress a report of conditions of all navigable waters as required under Section 305(b) of the CWA. In addition, the report must include:

1. An analysis of the extent to which the navigable waters provide for the protection and propagation of a balanced population of shellfish, fish, wildlife, and allow recreational activities in an on the water
2. An analysis of the extent to which the elimination of the discharge of pollutants and a level of water quality which provides for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allows recreational activities in and on the water, have been or will be achieved by the requirements of this Act, together with recommendations as to additional action necessary to achieve such objectives and for

- what waters such additional action is necessary.
3. An estimate of (i) the environmental impact, (ii) the economic and social costs necessary to achieve the objective of this Act in such State, (iii) the economic and social benefits of such achievement; and (iv) an estimate of the date of such achievement; and
 4. A description of the nature and extent of nonpoint sources of pollutants, and recommendations as to the programs which must be undertaken to control each category of such sources, including an estimate of the costs of implementing such programs.

We will use the most current National Water Quality Inventory -Report to Congress for the 2002 Reporting Cycle as the basis for this section. The report along with the associated data is the best information available regarding current domestic water conditions and activities that may be contributing to water impairment. The report is available at:

<http://www.epa.gov/305b/2002report/report2002305b.pdf>

Data collected by the States as part of the National Water Quality Report is available over the internet at: <http://www.epa.gov/waters/305b>.

EPA warns the user of data: "Although the information in the National Assessment Database provides a picture of state assessment results, these data should not be used to compare water quality conditions between states or to identify trends in statewide or national water quality.

Overall for 2002, states assessed 695,540 miles of rivers and streams, or 19% of the nation's approximately 3.7 million stream miles. States identified 45% of the assessed miles as being impaired or not supporting one or more of their designated uses. The remaining 55% of assessed miles fully supported all uses, and of these, 4% were considered threatened (i.e., water quality supported use, but exhibited a deteriorating trend). [EPA 2007, p. 7] These findings were similar to the U.S. EPA study – the Wadeable Stream Assessment, which found that 42% of the wadeable streams in the U.S. are in poor condition [p. III-116]

While this information represents a significant sample of domestic stream, we acknowledge in accordance with 40 CFR 1502.22 that a large percentage of streams (81 percent), are not included in this inventory. An inventory of all domestic streams will take considerable time and resources far beyond what we are capable of collecting for this EIS.

Individual use support assessments also provide important details about the nature of water quality problems in rivers and streams. The top five assessed uses in rivers and streams and their current condition is shown in table III-7.

Table III-7 -- Individual Use Support in Assessed River and Stream Miles [Id, p.8]

Designated Use	Assessed Miles	Percent of Total U.S. Stream Miles	Percent of Waters Assessed		
			Good	Threatened	Impaired
Fish, Shellfish, and Wildlife Protection/ Propagation	596,433	16%	55%	4%	41%
Recreation	321,750	9%	64%	3%	33%
Agriculture	189,332	5%	92%	<1%	7%
Aquatic Life Harvesting	186,721	5%	57%	16%	27%
Public Water Supply	150,492	4%	81%	2%	18%

Note: Waterbodies can have multiple designated uses, resulting in overlap of assessed miles.

The top activities that were the source of impairment to streams and rivers were attributed to:

- Agriculture – 113,663 miles
- Unknown/Unspecified – 91,824 miles
- Hydromodification - 79,400 miles
- Habitat Alterations – 51,298 miles
- Natural – 41,724 miles.

The leading criteria for impairment included: Sediment/siltation (100,446 miles), pathogens (82,133 miles), habitat alterations (80,974 miles), metals (52,809 miles), and nutrients (52,228 miles). [Id. p. 9]

The stream miles impacted that were attributed to coal mining were not identified in the 2002 EPA report but this information is available in the 305(b) data base which is associated with the report and which is available over the internet for each of 24 coal mining states. The results are presented in table III-8.

Table III-8 -- Stream miles impaired due to mining

	Stream Miles Impaired		
	Underground Mining	Abandoned Mines	Surface Mining
Alabama	17	275	114
Alaska	n/a	33	354
Arizona	n/a	n/a	180
Arkansas	n/a	n/a	n/a
Colorado	n/a	n/a	n/a
Illinois	n/a	25	515
Indiana	n/a	24	159
Kansas	n/a	83	n/a
Kentucky	n/a	0	0
Louisiana	n/a	n/a	17
Maryland	n/a	n/a	n/a
Mississippi	n/a	n/a	n/a
Missouri	n/a	n/a	250
Montana	102	710	8
New Mexico	n/a	16	96
North Dakota	n/a	n/a	0
Ohio	n/a	496	1354
Oklahoma	n/a	8	22
Pennsylvania	n/a	3118	39
Tennessee	n/a	391	27
Texas	n/a	n/a	n/a
Utah	n/a	31	0
Virginia	n/a	28	91
Washington	n/a	n/a	n/a
West Virginia	n/a	4142	46
Wyoming	n/a	n/a	7
IMPAIRMENT OF PERCENT ASSESSED	0.02 %	1.35 %	0.47 %

A caveat regarding the above table: EPA warns that it is not appropriate to use the information in this database to make statements about national trends in water quality. The methods states use to monitor and assess their waters and report their findings vary from state to state and even over time. Many states target their limited monitoring resources to waters they suspect are impaired and, therefore, assess only a small percentage of their waters. These may not reflect conditions in state waters as a whole. States often monitor a different set of waters from cycle to cycle. Even weather conditions - such as prolonged drought - can have an impact on whether waters meet their standards from one year to the next.

In addition, we caution that sources of impairment above were not consistent among the states and additional categories involving mining may or may not overlap with other categories were occurred within the database. There is likely some overlap in the above stream mileage. Lastly, in most cases it was difficult to differentiate between coal mining and other forms of mining.

The trend toward less numerous and smaller fills could be attributable to the policies implemented in the central Appalachian coal region to minimize excess spoil and the size of excess spoil fills, compensatory mitigation required under the Clean Water Act 404 program by the Corps of Engineers, litigation risks, and other factors.

When segments of headwater streams are buried permanently by excess spoil or mine waste fills, those segments no longer exist and all stream functions are lost. In these situations, the buried stream segment functions as a ground-water conveyance. Attempts to reestablish the functions of the headwater streams on the groin ditches on the sides of fills have achieved little success to date. [Id., p. III.D-19] However, recently more innovative approaches establish functional streams on the down dip side of valley fills drainage ditches are being tried. To date, more successful restoration of headwater functions were achieved when stream segments were temporarily impacted by mining activities.

The principal indirect impacts to headwater streams downstream of the surface coal mining activities include increased sedimentation, increased dissolved chemical constituents, decreased organic nutrients such as leaf litter particulates, changes in thermal character of the stream, and changes in flow regime and response to storms. Each of these indirect impacts is discussed in more detail below.

Hartman and other (2005) examined four pairs of streams in southern West Virginia. Each characteristics of each stream in the pair was similar except that one stream upland area contained a completed valley fill and the other reference stream did not. The results of study showed that macroinvertebrate collections stream pairs were not significantly different with respect to most simple water quality and habitat variables measured. Streams within pairings did not differ in pH, dissolved oxygen, or temperature. Significant differences were noted in all stream pairings for specific conductance with higher specific conductance in fill streams. Fills had significantly higher pH, alkalinity, calcium, sodium, and potassium than reference streams. In addition, the metals magnesium, copper, nickel, manganese and iron were significantly higher than in the reference streams. The four reference streams had higher levels of aluminum than filled streams.

Increase sedimentation

Hartman and other (2005) also found that the substrate analyses failed to detect differences in fine sediment composition (percent<0.5mm) between pairs of fill and reference streams. Valley fills did not appear to significantly increase fine sediment bedloads in the study streams.

In a September 2000 report, OSM examined the cumulative impact of large-scale areas mining on two streams in southeastern Ohio. Using Ohio Environmental Protection Agency's Qualitative Habitat Evaluation Index, the conditions of stream habitat in 1987 and 1999 were compared. The

1987 evaluation indicated impairments from heavy to moderate silt cover and substrate embeddedness in both streams. The 1999 evaluation showed that the streams were impaired but had improved sufficiently to support warm-water biota. [USDOI OSM 2000b]

In 1999 and 2000, the U.S. Geological Survey (USGS) examined the stream geomorphology and other features of streams in the coal mining region of southern West Virginia. [Wiley et al, 2001] The USGS measured the bed material of 54 stream sites: 18 sites were unmined watersheds, 9 sites were in mined watersheds, and 28 were in a mined watershed downstream from an excess spoil fill. The size of watersheds ranged from 26 to 1,527 acres. The USGS found that the bed material of streams below excess spoil fills had a greater number of small particles (less than two millimeters), but that at the 84th percentile of sampled data, bed material for all streams had about the same size particles.

In the 1998 National Water Quality Assessment (NAWQA) study (Paybins, K.S., T. Messenger, J. Eychaner, D.B. Chambers, and M. Kozar 2003), the authors reported similar information involving sediment particle size in the bedload material. The relationship between the predominance of fine-grained sediment was then related to the impairment of the invertebrate benthic communities. They found that differences in land use, stream habitat, and stream chemistry between the groups of sites suggest possible causes for the different invertebrate communities. The less impaired group of sites drained basins that were unmined, or only slightly mined (< 10,000 ton/mi²) during the period between 1980–95. Most (but not all) basins in the more impaired group of sites were mined within the last 20 years by both surface and underground methods; most contained abandoned mines that pre-dated SMCRA and produced 100,000 to 1,000,000 ton/mi² of coal. Coal production during 1980–95 is not an ideal indicator of the environmental disturbance caused by coal mining, but it related better to environmental measurements than did production over a shorter interval, number of abandoned mines, or mine discharge permits (Chambers and Messinger, 2001). At the more impaired sites, the proportion of total land area as surface mines, quarries, disturbed land, or gravel pits was significantly greater than at the less impaired sites. Effects on stream benthic-invertebrate communities caused by coal mining were of similar magnitude to the effects caused by urban development and agriculture elsewhere in the Nation.

Similar results on sediment particle size at stream sampling stations below fills were obtained from USEPA (2000). Valley fill sites had a greater number of particles less than two millimeters in size and a smaller mean particle size. However, the mean substrate size class was found to be very similar between unmined, filled, filled residential and mined EIS class sites. The authors stated that these data indicate that the valley fills do not seem to be causing excessive sediment deposition in the first and second order streams that were sampled but cautioned against generalizing this finding to higher order streams or to reaches downstream in these watersheds. In contrast, sampling downstream of mountaintop mining/valley fill sites in Kentucky revealed greater sediment deposition and smaller substrate particle sizes than in reference streams [USEPA 2001].

Increase in Dissolved Chemical Constituents

The USEPA (2002) conducted a study of the stream chemistry associated with sites classified as mined, unmined, filled and filled/residence. Detailed descriptions of each of these three classes were presented in the report. In summary, unmined sites were not located downstream from mines or fills. Mined sites were located downstream of older mine project with no fills, filled sites were located downstream from mined sites with valley fills and filled/residence sites were located downstream from mined, filled sites with residential dwellings in the watershed. The data from this report indicate that excess spoil fills associated with coal mining increase concentrations of several chemical parameters in streams. Sites in the filled category had increased concentrations of sulfate, total dissolved solids, total selenium, total calcium, total magnesium, hardness, total manganese, dissolved manganese, specific conductance, alkalinity total potassium, acidity and

nitrate/nitrite. There were increase concentrations of sodium at sites in the filled/residence category which are likely caused by road salt and /or sodium hydroxide treatment of mine discharges. Results for all other parameters were inconclusive in comparing among three classes.

Comparisons to ambient water quality criteria (AWQC) were performed with a subset of the total data set as explained in USEPA (2002). Selenium concentrations from the “filled” category sites were found to exceed AWQC for selenium at most (13 of 15) sites in this category. No other site categories had violations of the selenium limit. No other constituents exhibited violations of the AWQC for any category.

As part of the NAWQA, [Paybins, et al., 2003] study, surface-water quality was sampled to measure changes in water quality from baseline conditions that had previously been monitored in 1979-81. The original coal hydrology basin assessments included 12 study areas within the Appalachian Coal Region. Each sample collected during the July-September 1998 sampling period was matched to a 1979-81 sample considered to be most similar in discharge and season. [Eychaner, 1999] According to the Kanawha-New River Basin NAWQA report [Paybins, et al., 2003], 170 sites were sampled to assess changes. Sites were selected for sampling on the basis of a three-factor categorical design of geology, mining method, and mining date within the surface drainage basin above each site. Geology was represented by the contrast between the Allegheny-Monongahela River and the Kanawha River Drainage basins. (This corresponds roughly to the northern and southern coal fields in West Virginia.) The mining method was identified as underground, surface, or both. The mining date was identified as before the historical sample, after the historical sample, or both. The reference conditions in both study areas were identified as basins that had never been mined, and particular effort was spent in identifying these basins. [Eychaner, 1999]

In the Kanawha New River Basin (Kanawha) NAWQA Report (Paybins, et.al., 2003) the median concentrations of total iron and total manganese were found to be lower in 1998 than during 1979-81 in 33 basins that had both pre-law and post-SMCRA mining, but sulfate concentration and specific conductance were higher. In 1998, median total manganese, specific conductance, sulfate, and pH were higher in 37 basins mined since 1980 than in 20 basins unmined since then; median total iron was lower in the mined basins, possibly reflecting aggressive treatment of permitted discharges.

Regulations, therefore, were targeted at decreasing mining-related acidification and concentrations of iron and manganese, but were not designed to decrease sulfate concentrations. Sulfate concentrations less than 59 mg/L (milligrams per liter; study median) were measured only from basins where less than 142,000 ton/mi² of coal were produced during 1980-95. In contrast, manganese concentrations less than 32 µg/L (micrograms per liter; study median) were measured at several heavily mined basins. Sulfate concentration in streams draining mined areas does not correlate strongly with coal production because sulfate production depends on local geology, mining practice, and possibly results from activities in addition to mining. Sulfate concentration is higher than background, however, in basins with the greatest coal production. Background sulfate concentration was less than 25 mg/L in 16 of 20 basins not mined since 1980. In contrast, sulfate concentration was greater than 250 mg/L in 8 of 15 mined basins drained by streams tributary to the Coal River. The USEPA guideline for sulfate in drinking water is 250 mg/L.

The Monongahela-Allegheny River Basin (Mon) was also evaluated through the NAWQA program including the current and historic impacts of coal mining. The USGS combined the data for the Kanawha and Mon studies, analyzed it as a single dataset, and concluded the following. During low-flow conditions, sulfate in more than 70 percent of samples from streams downstream from coal mines in both coal regions exceeded the regional background concentration. Background was calculated as about 21 mg/L sulfate from data for basins with no history of coal mining. The highest concentrations were measured in basins with the greatest coal production.

One fourth of all samples exceeded 250 mg/L, the USEPA drinking-water guideline. Total iron, total manganese, and total aluminum also exceeded regional background concentrations (129, 81, and 23 $\mu\text{g/L}$, respectively) in many streams in mined basins. The median concentrations of total iron in the northern coal region were about equal between mined and unmined basins, but in the central region, concentrations of median total iron among mined basins were lower than among unmined basins. In both regions, median concentrations of total manganese among mined basins were about double that among unmined basins. Median pH increased, and median concentrations of total iron and total manganese decreased among mined basins between 1979–81 and 1998 in both regions, reflecting that regulations restricting these constituents in mine drainage are effective. Even so, stream sites downstream from mines more commonly exceeded drinking-water guidelines for sulfate, iron, manganese, and aluminum concentrations than streams in unmined basins

A study was also conducted by OSM on the cumulative off-site impacts from a large area mine in southeastern Ohio over a twelve year period. OSM used the 1980 data submitted by the coal company and data collected between 1987 and 1999 by the Ohio Environmental Protection Agency to evaluate the impacts. The chemical analysis of the impacted streams indicated similarly elevated levels of hardness, sulfates and conductivity as did the EPA 2002 study. [USDOI OSM 2000b]

Decrease in Organic Nutrients

The extent to which valley fills eliminate energy resources that is likely used by downstream aquatic communities is not well documented. There is a lack of information on the degree to which length of stream directly correlates with the amount of energy in the form of fine-particle organic material or coarse-particle organic material leaving a particular reach of headwater stream. Forest leaf litter is particularly important to macroinvertebrates that process organic matter for downstream reaches. Experiments demonstrate the reliance of stream biological communities on energy inputs from the surrounding forests. When leaf litter was excluded from a stream, the primary consumer biomass in the stream declined, as did invertebrate predators and salamanders. Leaf litter exclusion had a profound effect on aquatic productivity, illustrating the direct importance of terrestrial-aquatic ecotone. [EPA 2003, p. III.D-4] In accordance with 40 CFR 1502.22, we acknowledge that information to ascertain the impacts of organic nutrients are limited, but to analyze this information in sufficient detail will take considerable time and resources beyond the capability of OSM.

Simmons, et. al, 2008, evaluated 3 watersheds to quantify the changes to ecosystem structure and function associated with a conversion from forest to reclaimed mine grassland. The study compared a small watershed containing a 15-year-old reclaimed mine with a forested, reference watershed in western Maryland. Major differences were apparent between the two watersheds in terms of biogeochemistry. Total C, N, and P pools were all substantially lower at the mined site, mainly due to the removal of woody biomass but also, in the case of P, to reductions in soil pools. Mineral soil C, N, and P pools were 96%, 79%, and 69% of native soils, respectively. Although annual runoff from the watersheds was similar, the mined watershed exhibited taller, narrower storm peaks as a result of a higher soil bulk density and decreased infiltration rates. Stream export of N was much lower in the mined watershed due to lower net nitrification rates and nitrate concentrations in soil. However, stream export of sediment and P and summer stream temperature were much higher. Stream leaf decomposition was reduced and macroinvertebrate community structure was altered as a result of these changes to the stream environment. This land use change leads to substantial, long-term changes in ecosystem capital and function.

We have documented both local (within-watershed) and downstream impacts 15 years after a forest to reclaimed mine conversion. Effects on biogeochemical cycles were profound and in some cases long-lasting. Soil C, N, and P pools were recovering at non-uniform rates that could lead to nutrient limitations over decades and centuries. Hydrologic impacts were also apparent in the form of taller, narrower storm peaks which caused increased risks of flooding and increased

loads of sediment and particulate P. In the mined stream, N concentrations and litter decomposition were reduced, but P concentrations and temperature were higher. These fundamental changes in the stream environment will affect stream nutrient cycling and carbon processing with impacts on aquatic flora and fauna downstream. [Simmons, et.al, 2008].

Changes in Thermal Character

A study of thermal impacts of valley fills was performed by the USGS [Wiley et al, 2001] on one stream below a valley fill site – the unnamed tributary to Ballard Fork in West Virginia and one stream below an unmined site – Spring Branch near Mud, West Virginia. This study recorded stream temperature on a daily basis during the period December 22, 1999 to November 30, 2000. The temperature monitor at unnamed tributary to Ballard Fork is approximately 400 feet downstream from a valley fill.

Water temperatures from the unnamed tributary to Ballard Fork exhibited lower daily fluctuations and less seasonal variation than water temperatures from an unmined site. Water temperatures were warmer in the winter and cooler in the summer than water temperatures from Spring Branch. The average water temperature of the unnamed tributary to Ballard Fork and Spring Branch in January 2000 was 8.7°C, and 1.9°C, respectively. On the other hand, the average water temperature of the unnamed tributary to Ballard Fork and Spring Branch in August 2000 was 16.0°C and 18.6°C, respectively.

The water temperature at Unnamed Tributary to Ballard Fork showed a lesser seasonal range than the seasonal range observed at Spring Branch. The daily-mean water temperature at Unnamed Tributary to Ballard Fork was greater than the daily-mean water temperature at Spring Branch during winter, and the daily-mean water temperature at Unnamed Tributary to Ballard Fork was less than the daily-mean water temperature at Spring Branch during summer. While the USGS study provides an indication of the impacts on valley fills on temperature, additional monitoring in other streams would have bolstered the confidence in these findings. It is also difficult to predict the possible impacts of this moderated thermal regime on the downstream aquatic communities. In accordance with 40 CFR 1502.22, we acknowledge that information to ascertain the impacts of water temperature is based on limited studies, but to collect and analyze this information on water temperature by excess spoil fills will take years and significant resources.

Changes in Flow Regime

Valley fills have the potential to alter the flow regime of streams downstream from fill areas. One study of the impact of valley fills on stream flows was performed by the USGS [Wiley et al, 2001] on one stream below a valley fill site and one stream below an unmined site, and comparing one flow parameter at many streams with and without filling in the watershed. Low stream flows were investigated by comparing 90-percent flow durations, daily stream flow records, base-stream flows and storm flows. Generally, the 90-percent flow durations at valley fill sites were 6 to 7 times greater than the 90-percent flow durations at unmined sites. Some valley fill sites, however, exhibited 90-percent flow durations similar to unmined sites and some unmined sites exhibited 90-percent flow durations similar to valley fill sites. Daily stream flows from the one valley fill site evaluated generally were greater than daily stream flows from the one unmined site evaluated during periods of low stream flow. The valley fill site evaluated had a greater percentage of base-stream flows and lower percentage of storm flows than did the one unmined site evaluated. This study included only two streams except for the evaluation of 90-percent flow durations, so we cannot determined if the observations made would be true for a number of streams below valley fills. It is also difficult to predict the possible impacts of this moderated and elevated flow regime on the downstream aquatic communities. [EPA 2003, p. III.D-5] In accordance with 40 CFR 1502.22, we acknowledge that information to ascertain the impacts of flow is based on

limited studies, but to collect and analyze this information on water temperature by excess spoil fills will take years and significant resources.

Phillips (2003) studied the possible impacts of valley fills on headwater floods in Kentucky. He concluded that there are numerous variables and controls that affect hydrologic response, and significant variation in those controls and variables. Additionally, drainage basins are strongly influenced by historical factors ranging from their geological evolution to contemporary land management (or mining and reclamation practices). Thus, it is difficult to state with confidence that valley fills does, or does not, increase or even tend to increase peak flows downstream.

IV. Environmental Consequences

A. Introduction

Chapter IV describes the effects on the human environment of the no action and proposed action alternatives described in Chapter II. Chapter III describes the affected environment both geographically and functionally. Because this Federal rulemaking initiative potentially has national implications, the descriptions are appropriately broad and generic. The information obtained in the course of preparing this EIS indicates that the proposed Federal action may have the most significant effects in the central Appalachian coal fields, particularly eastern Kentucky, southwestern Virginia, and southern West Virginia. The steep slope terrain, ample rainfall, and abundant surface minable reserves of high quality bituminous coal in these areas help explain why 98% of all excess spoil fills nationally and approximately 61 percent of the length of all streams directly impacted by mining have occurred in these areas. A description of the existing environment of the central Appalachian coal fields is contained in the MTM/VF DPEIS, which is available at <http://www.epa.gov/region3/mtntop/eis.htm>. Considerable data from that EIS is referenced and used in this analysis.

As described in more detail above, the purpose of revising the excess spoil regulations is to enhance consideration of the environmental effects of fill construction by reducing the volume of excess spoil generated, designing and constructing fills to reduce the size of the areas directly affected, and configuring fills to minimize adverse environmental effects. States of central Appalachian coalfields have taken various steps in accordance with approved programs to implement similar actions; so, the impacts that might result from the Federal action, if implemented, are likely limited by the changes already made by those States.

The purpose of revising the stream buffer zone regulation is to make the requirements clear and consistent with the underlying statutory authority in SMCRA. OSM would not anticipate a major shift in on-the-ground consequences from any of the alternatives. A considerable length of streams and adjacent riparian lands was directly impacted by surface mining in the past. The estimated length of streams directly impacted from mining in central Appalachian coal fields from 1992 to 2002 based on permit information was 1,208 miles (2.05 % of streams in central Appalachian coal fields). If this rate would continue for ten years, 4.1 % of the streams in Appalachia are subject to direct impact. [EPA 2003, p.IV.B-1] The miles of stream directly impacted by excess spoil fills for permits issued between 1985 and 2001 is 724 miles, which is approximately 1.2 percent of the streams in central Appalachia. If valley fills construction continues at this rate, an additional 724 miles of headwater stream are potentially buried in 17 years or by 2018. [Id., p. IV.B-2] This trend would continue into the future but would likely shift regionally as surface-minable coal reserves in central Appalachia are depleted in the next few decades.

Table IV-1 is a comparison of the anticipated impacts of key indicators of the four possible alternatives with the "No Action" alternative. Alternative 1 represents the most protective alternative and the impacts of Alternative 4 would closely mimic the "No Action" alternative.

Section IV.B, discusses the rationale behind these summary table in more detail.

Table IV-1 – Summary comparison of the impacts of four alternatives with the impacts of the “No Action” alternative

Impacts	Relative Effects of Four Alternatives as Compared to the Effects of the No Action Alternative [†]			
	Alternative 1 (Preferred)	Alternative 2	Alternative 3	Alternative 4
1. Hydrology				
a. Direct impacts	Slight +	Negligible +	Negligible +	No change
b. Water quality	Slight +	Negligible +	Negligible +	No change
c. Flooding	Minor to no change + or -	Minor to no change + or -	Minor to no change + or -	No change
2. Aquatic fauna				
a. Direct impacts	Slight +	Negligible +	Negligible +	No change
b. Indirect impacts	Slight +	Negligible +	Negligible +	No change
3. Terrestrial fauna	Slight +	Negligible +	Negligible +	No change
4. T & E Species	No change	No change	No change	No change
5. Geotechnical	No change	No change	No change	No change
6. Economics	Slight -	Negligible -	Slight -	No change
7. Culture	No change	No change	No change	No change
8. Environ. justice	Negligible +	Negligible +	Negligible +	No change
9. Cumulative	Negligible +	Negligible +	Negligible +	No change

[†] Positive environmental changes indicated by a “+” sign and negative environmental changes indicated by a “-” sign

Many comments advocated that the existing stream buffer zone rule must be interpreted to prohibit conducting any mining activities within a stream buffer zone under the “no action” alternative. These comments asserted that this EIS must consider in detail the impacts of this interpretation and evaluate the impact of the proposed action alternatives accordingly.

As discussed above, OSM has never applied the existing stream buffer zone rule as an absolute prohibition of mining activities with the stream buffer zone. As we note in Section II.A and in the proposed rule, such an interpretation would not be consistent with SMCRA. OSM did develop a similar option, Alternative 6, which would have generated a similar result. Under that alternative, the stream buffer zone prohibition would be absolute, and no variances could be granted by the regulatory authority to mine within 100 feet of an intermittent or perennial stream. The specific reasons for rejecting this alternative are described in Section II.B.

Adopting such an interpretation could result in significant negative effect on coal resource extraction and environmental benefit to headwater streams and associated riparian areas, especially within the Central Appalachian coal fields. Under such that interpretation, OSM projects that most of the future direct impacts on intermittent and perennial streams projected in this EIS from mining activities in and near those streams would not occur. Mining activities in and near those streams would no longer be allowed, irrespective of the ability to restore the streams to their pre-mining condition; and the streams could not be covered by disposal of excess spoil or coal mine waste. Thus, the projected direct impact to approximately 370 miles of headwater streams in Appalachia over the next five years would essentially not occur. In addition, other projected temporary and/or permanent mining impacts, affecting about 170 miles of headwater

streams in other regions of the country in the next five years would likely also not occur.⁷

Similarly, there would likely be a reduction in the projected indirect impacts associated with loss of headwater streams. For example, potential changes in chemistry, water temperature, flow regime and geomorphological features downstream would be less likely, but could be influenced by underground mining activities and other non-coal related activities. As discussed in subsequent sections, streams typically exhibit increased mineralization and a shift in macroinvertebrate assemblages from pollution-intolerant to pollution-tolerant species downstream of excess spoil fills. Studies indicate that water temperature downstream of valley fill sites typically exhibits lower daily fluctuations and less seasonal variation than water temperature from reference sites. Daily stream flows from studied valley fill sites exhibited greater base flow than reference sites. Smaller sediment particle sizes were found in downstream substrate. Most of these indirect impacts should be reduced if a stream buffer zone rule prohibited all mining activities within 100 feet of intermittent/perennial streams.

Even if direct coal mining activities were prohibited from headwater streams, impacts would not be likely to ameliorate all projected indirect coal mining impacts. The data analyzed in previous studies often did not differentiate between areas mined with fills and areas mined without fills upstream. In some studies, it appears that changes in chemistry, associated with the removal of overburden and coal, and the exposure of such materials to air and water, are likely to occur on most mining operations, irrespective of construction of fills in streams. In addition changes in flow regimes, resulting from increased infiltration into mined spoils, would likely continue even without the filling of stream valleys. Finally the presence of smaller sediment particles in downstream substrate would depend on many site specific conditions, such as the effectiveness of sediment ponds, pond removal, and the specific spoil and soils, and vegetation on a reclaimed mine site. The fact that a stream was not filled may not eliminate smaller sediment particles from reaching downstream areas. Perhaps the most significant benefit regarding indirect impacts would occur through the prohibition of placing coal mine waste within the stream valley or within 100 feet of an intermittent or perennial stream. Coal mine waste disposal sites often generate significant changes in chemistry and temperature of waters discharging from such areas. Therefore, prohibiting the placement of such material in or near streams might significantly reduce both direct and indirect environmental impacts.

Even if indirect impacts are not completely prevented from strict prohibition of direct impacts on streams, indirect impacts related to changes in water quality would continue to be regulated to protect offsite downstream areas from damage. All water discharging from mine areas, surface or underground, must meet applicable CWA effluent limits, or be treated to meet such limits for as long as necessary. In addition, discharges from reclaimed mining operations must also be controlled or treated so as to prevent material damage to the hydrologic balance on an individual or cumulative basis. Thus other existing provisions of SMCRA would continue to play a significant role in preventing long-term adverse environmental impact downstream of all mining operations.

B. Environmental Impacts

1. Consequences of the No Action Alternative and Alternatives 1, 2, 3, and 4 on Hydrology

Coal mining and reclamation operations, if not properly planned and conducted, can have major impacts on the hydrologic balance of the mine site and surrounding area. Mining can interfere

⁷ This is the projection in the approximately 367 miles of streams were anticipated to directly impacted by mining in the Appalachian coalfields and 170 miles elsewhere in the U.S. based on permits issued between October 1, 2001 and June 30, 2005. See Table III-6 of this EIS.

with the natural equilibrium of ground- and surface-water flow systems. Some of the components of these systems are: flow patterns of ground water within aquifers; the quantity of surface water as measured by the rate and duration of flows of streams; the erosion, transport, and deposition of sediment by surface runoff in stream flow; the quality of both ground and surface water, including both suspended and dissolved materials; and the connection between ground and surface waters. The interrelationships between these components are complex and depend upon a number of physical, chemical, and biological factors, which, in turn, are dependent upon meteorological, geological and physiographic conditions. The impact of mining on any one of these factors can trigger changes throughout the hydrologic system. Surface and underground coal mining methods affect the hydrologic system in different ways.

Although impacts to the hydrologic balance are unavoidable, the permitting process is designed to prevent most impacts that cannot be mitigated or that would materially damage a significant surface- or ground water resource outside the permit area. See the discussion of the applicable regulation in section III.2.C. Hydrologic impact assessment and the development of material damage criteria (i.e., assigning numerical threshold values) are required for each individual mining operation. The operator is responsible for a probable hydrologic consequences (PHC) determination to evaluate the effects of the proposed operation on the surface- and ground-water systems of the permit and adjacent areas. The regulatory authority is responsible for preparing a cumulative hydrologic impact assessment (CHIA) that considers impacts to the surface- and ground-water systems that would result from the proposed operation and all anticipated mining in the area.

The process of surface mining alters the natural stratification and lithologic integrity of the rocks in the affected overburden. As a result, the water storage and transmissive properties of the reclaimed spoil will be different from the original rock. The reclaimed spoil may have a higher or lower storage capacity than the original material, and the transmissive properties of the reclaimed spoil may be higher or lower than in the original rock. These differences will alter the hydrodynamics of ground-water flow in the reclaimed spoil, and can affect neighboring aquifers that are hydraulically connected to the disturbed zone. Removal of water from the mine pit during mining can, at least temporarily, reduce the amount of water available to down-gradient wells in the immediate vicinity of the pit.

Surface-water flow in stream channels is fed by several sources. These include direct precipitation into the channel, inflow from the discharges of impoundments, inflow from overland runoff, baseflow from the ground water, and inflow from bank-storage discharge. Surface coal mining activities that result in alterations of channel geometry or gradient, filling in of the stream channel with spoil, changes in the composition of the channel banks, or changes in the amount of water contributed by impoundments can result in changes in the stream's flow characteristics, especially during critical periods, such as peak flow. Streams that are affected can become more flood-prone and are more likely to alter their channels and carry more suspended solids during periods of high flow. Surface-water flow is likely affected by changes in the water-retaining characteristics of the reclaimed spoil as a result of changes in infiltration rate and runoff.

Improperly reclaimed surface mines can result in contamination of ground and surface water. The breaking and crushing of overburden rock in the surface mining process can create an abundance of fresh, rock surfaces. These freshly broken rock surfaces can impart considerable mineralization to percolating water. The oxidation and hydrolysis of the spoil material could result in the production of acid/toxic drainage containing elevated concentrations of metals and sulfate. Recharge to the ground-water system from improperly handled spoil can affect underlying or down gradient aquifers. Spoil-water discharges and seeps that develop in backfill areas can also pollute surface-water bodies.

Many concerns that the public has expressed related to this action revolve around hydrology issues and the perception that the changes being considered for the stream buffer zone rule would relax the standards of the existing rule, which many commenters believe is not being

complied with or adequately enforced by the regulatory agencies. Many commenters expressed concerns with the direct, indirect, and cumulative hydrologic effects associated with conducting surface mining in or directly adjacent to streams.

OSM believes that the existing stream buffer zone rule is being enforced appropriately by OSM in Federal program states and on Indian lands and by the State regulatory authorities in those States with approved State surface coal mining regulatory programs. Protection of hydrologic values is an important component of SMCRA. There are many provisions in SMCRA and implementing regulations that address many of the concerns raised. OSM is not considering changing these statutory and regulatory requirements in this rulemaking initiative. Moreover, the Clean Water Act and complementary State and Federal programs address and mitigate many of those concerns where SMCRA may be silent.

The alternatives and the anticipated hydrologic impacts along with other mitigating factors are discussed below as direct, indirect, and cumulative impacts.

a) Direct Stream Impacts

As previously discussed, headwater streams serve a number of important ecological functions including attenuating floods, maintaining water supplies, and improving water quality. These streams also provide a rich diversity of habitats that provide shelter, food, protection from predators, spawning sites, nursery areas, and travel corridors for both aquatic and terrestrial animals [Chapter III, I, 2a and EPA 2003, p.III.C-1].

There are two principal coal mining related activities that affect streams directly: the temporary impacts of mining through and diverting streams, and the permanent impacts of placing spoil or other materials in the channels of these streams. While mining through streams occurs throughout the nation's coal fields, this impact most often occurs in areas with ample precipitation and large-scale surface mining. The permanent impacts occur primarily in areas with ample precipitation, steep terrain, relatively thick overburden, and large-scale surface mining. This latter condition is found in principally in central Appalachian coal fields. There are approximately 59,000 stream miles within 1 central Appalachian coal fields [EPA 2003, p.IV.B-1], and 17 million miles of stream nationwide [see Chapter III, I, 2].

Under the no action alternative, based on permits issued between October 1, 2001 and June 30, 2005, about 535 miles of stream are planned for disturbance by surface coal mining activities conducted pursuant to those permits. This length of stream and the data that follows has been derived from information provided by the respective regulatory authorities in each of the coal producing states and Indian lands. Approximately two thirds of this length will be permanent based on information derived from permits issued in West Virginia. Of this length, 68.6 percent of the total (or 367 miles) are attributed to mining in Appalachian Basin coal fields [see Section III.I.2], primarily from excess spoil fills and coal waste disposal anticipated to be constructed in eastern Kentucky, southern West Virginia, and southwestern Virginia. For this same period, approximately 100 miles of temporary stream impacts are associated with surface mining in Texas. Considerably less direct effects are anticipated in other States.

The estimated length of streams directly impacted from mining in central Appalachian coal fields from 1992 to 2002 based on permit information was 1,208 miles (2.05 % of streams in central Appalachian coal fields). It is estimated that if this rate would continue for ten years, 4.1 % of the streams in Appalachia would be directly impacted. [EPA 2003, p.IV.B-1] The miles of stream directly impacted by excess spoil fills for permits issued between 1985 and 2001 is 724 miles, which is approximately 1.2 percent of the streams in central Appalachia. If valley fills construction continues at this rate, an additional 724 miles of headwater stream would be buried in 17 years or by 2018. [Id., p. IV.B-2]

In fact, it appears that the number and size of excess spoil fills could be becoming smaller. Average valley fill and watershed acreages for Kentucky generally increased from 1985, but steadily declined starting in 1998 (from approximately 18 to 11 acres [EPA 2003, Table III.K.2 and 74 to 50 acres [Id, Tables III.K.3], respectively). More recent information shows that this trend towards smaller and less numerous fills continue. Available data for 2002 to 2005 show the number of fills permitted in Kentucky and West Virginia declined (from 262 to 92 and 86 to 56 fills, respectively). The average footprint acreage of proposed excess spoil fills in West Virginia shows an erratic trend over these years. However, the average size of the Kentucky fills continues to show a general decline (from 19 to 7 acres). The average fill length had also decreased over this period.

The trend toward less numerous and smaller fills may be attributable to the policies that have been implemented in the central Appalachian coal region to minimize excess spoil and the size of excess spoil fills, compensatory mitigation required by the USCOE, litigation risks, changing geological conditions, and other unknown factors.

Studies show that while invertebrates and microbiota in headwater streams are only a minute fraction of living plant and animal biomass, they convert leaf litter to coarse and fine particulate organic matter. Scientific literature, for studies in states outside the EIS region, estimate that about one kilogram of organic matter per meter length of stream transports downstream on an annual basis. This matter is transported downstream and is part of the food supply for invertebrate populations; which, in turn, become food for fish populations. Accordingly, the length of stream buried by mining or valley fills displaces the biomass and proportionate amount of energy provided by fine-and coarse-particle organic material leaving a particular reach of headwater stream. [EPA 2003, Chapter III.D.; Appendix I; Appendix D (Value of Headwater Streams Workshop); Wallace, 1992.]

No widely-accepted, standardized testing procedures exist for measuring the presence/absence of the fine and coarse organic matter and consequent energy contributions of stream. Thus, the stream chemistries studies in West Virginia and Kentucky as part of the MTM/VF DPEIS did not document the effect of stream loss on the downstream energy continuum.

The estimates of potential future stream loss are liberal, in that they do not take into account the focus on avoidance, minimization, and mitigation requirements in the 2007 NWP 21. Independent of any other future actions, the 2007 NWP 21 will likely reduce the rate of stream loss that occurred in the preceding ten-year time frame for permit footprints; or in the 17-year time frame for fill footprints.

Similar effects to headwater and larger streams occur from other human activities, such as road building and development for industrial/residential/commercial sites in steep-slope Appalachia. As discussed by Yuill in the post-mining land use report, suitable developable land is in short supply in some parts of the West Virginia study area [EPA 2003, Appendix G]. Consequently, creation of areas suited for roads and development often places fill materials in streams. Based on the current demographics in the EIS study region, coal mining operations are likely to have the consequences of disturbing more land than residential, industrial or commercial development in the coalfields. Nonetheless, the CWA requires consideration of the cumulative effects of all activities and SMCRA requires assessment of the hydrologic cumulative effects for all coal mining in a watershed. These evaluations are integral to decision making on authorizing MTM/VF projects and aid in minimizing the cumulative effects of direct stream loss. [USEPA 2003, p. IV.B-3]

The “No Action” alternative and action alternatives will not eliminate the loss of stream segments and reduction of organic matter transported downstream. OSM anticipates the impacts on streams would continue to decline and shift geographically as large tracts of surface-minable coal reserves in central Appalachia become depleted or less economically viable due to other factors

[see Section III.G.1]. Permanent impacts, such as the construction of excess spoil fills and coal waste facilities, will likewise decrease as mining shifts from the steep slope terrain of West Virginia. Temporary impacts associated with mining through streams, sediment ponds, road construction associated with surface mining in other areas of the coal regions is likely to increase in these other regions as production increases in these regions.

In the absence of standardized testing and research, it is not clear to what extent this direct stream loss indirectly affects downstream aquatic life. It is also not evident to what degree reclamation and mitigation (e.g., drainage control and revegetation) offset this organic nutrient reduction. The direct impacts of stream loss are permanent, but the downstream effect from organic energy loss may be temporary. [USEPA 2003, p.IV.B-3] As discussed, in Section III.I.2, we do not definitively know the outcome of reducing organic nutrients, and collecting and analyzing this information is beyond the capability of OSM.

The changes to the stream buffer zone regulation under Alternatives 1, 2, and 4 would cause no discernable changes to the direct stream impact trend. If the excess spoil regulations are changed as anticipated in Alternatives 1, 2, and 3, a slight decrease in length of stream impacted is likely as the footprints of excess spoil fills are reduced in size. In addition, the alternative fill configuration assessment associated with anticipated regulation changes would result in less adverse functional impacts. Because Alternative 1 would also change regulations that pertain to coal waste disposal so that the permit applicants consider alternative locations and configuration for the disposal of coal mine waste, additional environmental protection is afforded by Alternative 1 since less direct impacts to streams would occur.

Two related but independent mitigating factors would lessen the adverse effects of the direct stream impacts. First, for those temporary impacts of stream diversion, the regulations at 30 CFR 816/817.43 require that a permanent stream diversion or a stream channel restored after the completion of mining be designed and constructed to approximate the premining characteristics of the original channel, including the natural riparian vegetation. Second, the Clean Water Act Section 404 program requires that all temporary and permanent impacts to water of the United States be fully mitigated. The amount and type of compensatory mitigation is determined by a stream functional assessment of waters impacted by a specific project [EPA 2003, p.II.C-47]. The compensatory mitigation required by the CWA 404 program will further provide incentive for reducing the amount of streams impacted.

In addition, 30 CFR 816/817.97(f) requires that the operator restore or replace wetlands and riparian vegetation along rivers and streams. The operators are directed to enhance, where practicable, wetlands and habitats of unusually high value for fish and wildlife.

b) Indirect Stream Impacts

(1) Water Quality

The consequences of direct stream loss and energy transport reductions, discussed above, also indirectly affect downstream stream reaches. MTM/VF has the potential to alter the chemistry, water temperature, flow regime and geomorphological features downstream. Stream chemistry showed increased mineralization and a shift in macroinvertebrate assemblages from pollution-intolerant to pollution-tolerant species. Water temperatures from valley fill sites exhibited lower daily fluctuations and less seasonal variation than water temperatures from reference sites. Daily stream flows from studied valley fill sites exhibited greater base flow than reference sites. Smaller sediment particle sizes were found in downstream substrate. [EPA 2003, Chapter III.D; Appendix D]

Scientists postulate that stream thermal regimes, which can influence microbial activity,

invertebrate fauna, fish egg development, larval growth, and seasonal life cycles, may be affected by valley fills and sedimentation ponds at the base of the valley fills. Scientists also theorize that, as mining or other human development practices eliminate first order streams, unique biological diversity may be affected, especially if rare species occur in only one or two spring or seepage areas and are impacted. [EPA 2003, Chapter III.D; Appendix D]

Headwater stream systems do not have a tremendous capacity to provide purification functions. Although these ecological processes are not one requiring protection, the absence of streams to provide this function reflects the sensitivity of the system to inputs of a variety of potentially toxic materials. As groundwater and infiltration move through surface coal mining operations a variety of potentially toxic materials are released into the environment, including metals and mineral constituents such as sulfates which, if at high enough levels, may act by altering physical characteristics of water (e.g. pH or specific conductance). Headwater streams, with their innately limited buffering capacity and lack of ability to sequester and precipitate out contaminants, tend to be at risk from any input of toxic materials exceeding the streams limited capacity to assimilate. [EPA 2003, Chapter III.D.]

The EPA Water Chemistry Report prepared as part of the MTM/VF PEIS found elevated concentrations of sulfates, total and dissolved solids, conductivity, selenium and several other analytes in stream water at sampling stations below mined/filled sites [EPA 2003, Appendix D; USEPA, 2002b]. Other studies found elevated concentrations of sulfates, total and dissolved solids, conductivity, as well as other analytes in surface water downstream from MTM/VF sites. [USEPA 2003, p.IV.B-4]⁸ While these analytes provide some indication of water quality, these analytes are not currently regulated under Clean Water Act programs.

Aquatic communities downstream from MTM/VF differ from unmined headwater streams in several ways. In most cases, there were differences in biological assemblages. Generally, macroinvertebrate communities below mined areas were more pollution tolerant than those below unmined watersheds. However, biological conditions of filled sites represented a gradient of conditions from poor to very good, demonstrating a wide range of conditions that may be found in aquatic communities downstream from MTM/VF or other human disturbances [EPA 2003, Appendix D; USEPA 2000].⁹

The Aquatic Impacts Statistical Report prepared as part of the MTM/VF PEIS indicated that ecological characteristics of productivity and habitat are easily disrupted in headwater streams [USEPA 2003, Appendix D; USEPA, 2003]. Accepted indices and comparisons correlated chemical and biological (macroinvertebrates and fish) parameters in unmined, filled, filled/residential and mined sites. The analysis indicated that biological integrity is hampered by mining and that unmined sites have a higher biotic integrity with more taxa and more sensitive taxa. The strongest association with water chemistry suggested that zinc, sodium, and sulfate concentrations were negatively correlated with fish and macroinvertebrate impairments. Selenium and zinc were negatively correlated with the West Virginia Stream Condition Index (WVSCI). The potential drivers of these conditions are mining practices, material handling practices, and the geological factors associated with specific coal seams and overburden. However, the study also concluded that insufficient data existed to determine the temporal nature of the impact or the distance downstream that the impacts persist. Due to the limited scope of the studies performed for the EIS, no correlation could be made of downstream impacts with the age, number, and size

⁸ EPA and other agencies spent over \$5 million to conduct studies investigating various aspects of MTM/VF activities over an approximately 3-year period. These studies were included as appendices to the DPEIS. They characterized these studies as useful in identifying data gaps and needs for further study but insufficient to determine a bright-line threshold of minimal impacts. The agencies projected that it would cost approximately \$20 million and take a minimum 5- to 10-year period to render more definitive results. [EPA 2005, p. 27]

⁹ See previous footnote.

of mining disturbances and fills, nor could data differentiate impacts of mining, fills or other human activity in a watershed. [USEPA 2003, p.IV.B.5]

Wetlands are among the most effective ecosystems for removing pollutants and purifying wastes. Wetlands operate through a series of interdependent physical, chemical and biological mechanisms that include sedimentation, adsorption, precipitation and dissolution, filtration, biochemical interactions, volatilization and aerosol formation and infiltration [USEPA, 1999; USEPA 2003, Appendix D]. Constructing wetlands is a possible mitigation measure for impacts to headwater streams. While this issue is complex, there may be opportunities to construct wetlands at MTM/VF operations, including at the toe of fills where groundwater emerges to improve the water quality of streams downstream from fill areas. The success of these wetland systems to improve water quality would be highly dependent on the toxicity of the water initially. [USEPA 2003, p.IV.B.5]

Other human development activities, such as logging and other types of excavation, also pose potential threats to the nutrient cycling function, sedimentation, and other physical, chemical, and biological impacts to headwater streams. However, the permanent nature of filling discussed under direct loss, as compared to the more temporary impacts from forestry, would suggest that MTM/VF impacts (e.g., nutrient cycling function, biological diversity, mineralization, substrate composition, etc.) of headwater stream systems may have a longer-term impact on this system, although data do not currently suggest the duration of these impacts.

Under the “No Action” alternative, current measures required by OSM and the State regulatory agencies would continue to minimize disturbances to the hydrologic balance within the permit and adjacent areas, and to prevent material damage to the hydrologic balance outside the permit area. Mining activities such as the construction of excess spoil fills would result in some downstream changes in sediment load and water chemistry. As an example, the EPA determined that water chemistry emanating from excess spoil fills in the central Appalachian coal field generally had increased concentration of sulfate, total dissolved solids, total selenium, total calcium, total magnesium, hardness, total manganese, dissolved manganese, specific conductance, alkalinity, total potassium, acidity, and nitrate/nitrite [EPA 2003, p. III.D-6].

The changes to the stream buffer zone regulation under Alternatives 1, 2, and 4 would cause no discernable changes to water quality as compared to the “No Action” alternative. OSM anticipates that the proposed regulatory language changes to the stream buffer zone rule would essentially be “impact neutral.” There would be no net increase or decrease in stream buffer zone incursions. If the excess spoil regulations are changed as anticipated in Alternatives 1, 2, and 3, the footprint of excess spoil fills would be reduced. This minimizing would reduce the areas available for erosion and sediment loss. In addition, minimizing the footprint of the fill could change the amount of ground water stored and passing through the fill that could affect the amount and duration of baseflow downstream of the fill. More extensive or “longer” fill sequences will result in longer ground water flow paths allowing for greater residence time in the spoil material. This longer contact time will allow more dissolution of minerals from the spoil material. In mountain top mining areas of Appalachia, the stream channel gradient (stream bottom slope) flattens out. The stream gradient will have a significant impact on the configuration of the post mining water table within the fill. As the stream gradient lessens so will the resultant valley fill hydraulic gradient. The lower the hydraulic gradient the slower the ground water will move through the material resulting in increased dissolution. It is possible that a slight improvement in water quality could be realized by minimizing the footprint of the fills. A reduction of the footprint of the fill may also improve water quality and ground water because it would decrease the area of forest and riparian vegetation disturbed. The possible additional number of smaller side-hollow fills may impact more water quality and ground water in headwater areas; however, these are small areas which most often only have flows after precipitation events. Any potential changes in hydrology would need to be factored into the design of the fill(s) in order to minimize disturbances to the hydrologic balance within the permit and adjacent areas. The positive effects of the action alternatives are limited by the fact that almost all of the excess spoil fills are constructed in the

steep terrain in the central Appalachian coal fields. Further, West Virginia, Kentucky and Virginia have already implemented various measures to reduce the size of excess spoil fills; so that the "No-Action" alternative already reflects those State actions to reduce the size of the fills. Alternative 1 would also require more rigorous environmental analyses of placement of coal waste coupled with existing regulations. This should have an additional positive effect.

Finally, the action alternatives do not affect the applicable provisions of SMCRA or other implementing regulations which protect water quality and require that discharges meet applicable State and Federal water quality standards. Siltation devices, such as sedimentation ponds, would continue to be used as the preferred means of controlling sedimentation outside of the permit area. All point source discharges from sediment ponds would continue to be subject to limitations set forth in permits issued under the CWA's National Pollutant Discharge Elimination System (NPDES), Total Maximum Daily Loads, and Antidegradation programs.

c) Flooding

Surface water impacts, including flooding, from surface coal mining were recognized during the development and implementation of SMCRA. In Section 101 of SMCRA, Congress found that many surface mining operations result in disturbances to surface areas that contribute to flooding.

Wherever surface mining occurs it can have significant effects on surface hydrology. Removal of vegetation, new drainage patterns, storage of water on benches or in ponds, drainage of surface water into underground mines and alternate ground cover change the runoff characteristics. These changes in runoff may cause scouring and erosion of unprotected stream channels and can contribute to downstream flooding. Small tributaries with a high percentage of recently disturbed land may have somewhat higher flood levels as a result of the surface mining. Increased flooding might be attributed to inadequate reclamation or inadequate drainage control structures. [EPA 2003, p.III.G-1]

Mining has had significant effects on the hydrologic regime in surface-mined watersheds in the eastern United States because of steep slopes, the contour mining techniques used, and relatively high rainfall. [OSM 1979, p.BIII-33]

Flooding and its association with excess spoil fills constructed during surface mining operations in steep-sloped areas has been a significant concern of residents in the central Appalachian physiographic region. In such rugged terrain, people live near or adjacent to the streams and rivers, and they may consequently be flooded during large rainfall events.

The citizen complaint records for West Virginia, Kentucky, and Virginia were reviewed for allegation of flooding from coal mine operations. Of the thousands of citizen complaints received and investigated by these states, only a small percentage was related to flooding. Of those flooding-related complaints found to be mining-related, the problems were caused by improper maintenance of the approved drainage control facilities or by not following approved drainage control plans. The West Virginia Division of Environmental Protection records for 1995-99 were assembled and reviewed where citizens alleged flooding was caused by mining. A total of 126 complaints were investigated. Sixty-two (62) complaints were associated with surface coal mine sites. Eight (8) of these investigations resulted in enforcement actions being taken to require corrections to drainage control structures. The Kentucky Division of Surface Mining Reclamation and Enforcement flooding complaint records for 1996-99 were also reviewed. Thirty-five (35) investigations resulted in 5 enforcement actions to require corrections to drainage control structures. The Virginia Department of Mines, Minerals and Energy flooding complaint records for 1995-99 showed 3 complaints investigated for surface coal mining sites. None of the investigations resulted in enforcement actions. [EPA 1983, p. III.G.8]

The central Appalachian physiographic region is a highly dissected plateau characterized by high, tree-covered hills and deep, narrow valleys. Large watersheds often feed streams with narrow valleys and small flood plains. In such rugged terrain, people live near or adjacent to the streams and rivers, and they may consequently be flooded during large rainfall events. [EPA 2003, p.III.G-1]

The impacts of OSM regulations on flooding will vary from region to region and according to the mining methods employed. [OSM 1979, p.AIII-2]

Phillips (2003) studied the possible impacts of valley fills on headwater floods in Kentucky. He concluded that there are numerous variables and controls that affect hydrologic response, and significant variation in those controls and variables. Additionally, drainage basins are strongly influenced by historical factors ranging from their geological evolution to contemporary land management (or mining and reclamation practices). Phillips concluded that it is difficult to state with confidence that mountaintop mining/valley fills complexes increase or even tend to increase peak flows downstream.

The Federal regulations require that flooding potential be addressed in the design requirements of coal mine permits and the consideration of offsite impacts to the hydrologic balance. Water diversions are required to be designed and constructed to provide protection against flooding and resultant damage to life and property. [30 CFR 816/817.43(a)(2)(ii)] The regulations also require the application for surface mining permit contain a determination of the probable hydrologic consequences (PHC) of the proposed operation. [30 CFR 780.21(f) and 30 CFR 784.14(e)] Flooding and stream flow alterations are specifically required to be considered in the PHC. We refer the reader to Section III.H for details regarding the PHC requirements.

The regulations further require the regulatory authority provide an assessment of the probable cumulative hydrologic impacts (CHIA) of the proposed operation and all anticipated mining on surface and ground-water systems in the cumulative impact area. [30 CFR 780.21(g) and 30 CFR 784.14(f)] These regulations specify that the CHIA must be sufficient to determine, for the purpose of permit approval process, whether the proposed operation has been designed to prevent material damage to the hydrologic balance outside of the permit area. Currently, some but not all of the state regulatory agencies require a quantitative analysis of flooding impacts for proposed mine operations in either the PHC or CHIA assessments. [EPA 2003, p.III.G-2] We refer the reader to Section III.H for details regarding the CHIA requirements.

Under the “No Action” alternative, operations would be required to minimize disturbances to the hydrologic balance within the permit and adjacent areas, and to prevent material damage to the hydrologic balance outside the permit area. Mining and other mining activities such as the construction of excess spoil fills would continue to alter base flow and the hydrologic response to storm events due principally to changes in the topography, drainage patterns, increased infiltration of mine spoil and ground cover. [Id., p.III.G-1]

The U.S. Geological Survey (USGS) compared the hydrographs of streams during actual storm events in unmined watersheds with those with large-scale surface and excess spoil fills. The storm hydrographs for the mined watershed were distinctly different from the hydrographs for the unmined watershed. They found that most low intensity storms produce larger peak flows per unit area in unmined watershed compared to mined watersheds. USGS found the reverse was true during intense rainfall events. During most of the recorded storms (low intensity) the peak flows (per unit area) for the unmined watershed and the cumulative watershed were less than the mined watershed. [Id., p.III.G-7]

The changes to the stream buffer zone regulation under Alternatives 1, 2, and 4 would cause no discernable changes to the potential for flooding. OSM anticipates that the proposed regulatory language changes to the stream buffer zone rule would essentially be “impact neutral.” There would be no net increase or decrease in stream buffer zone incursions. If the excess spoil

regulations are changed as anticipated in Alternatives 1, 2, and 3, more spoil would be returned to the mined-out area, and the footprint of excess spoil fills would be reduced. The impacts of these regulatory changes are inconclusive: the on-the-ground changes may reduce or increase the potential of flooding as concluded in the various computer modeling simulations. Analysis must be done on a site specific basis. Alternative 1 would also require more rigorous environmental analyses of placement of coal waste but should have very little effect on flooding.

A computer simulation conducted by the U.S. Army – Corps of Engineers (USCOE) using modeling software HEC-HMS predicted the peak discharges downstream for large-scale surface mines in which excess spoil fills were anticipated. Among the various mines and conditions simulated, USCOE predicted and compared the post mining peak discharge of a surface mine as actually designed and a conceptual design in which more spoil would be returned to the mined-out area. The results varied. Comparing the actual to the conceptual design discharge, the discharge increased by 14.9 and 12.0 percent in one instance and decreased by 2.2 and 2.0 percent in the second for a 10-year and 100-year storm, respectively [EPA 2003, p.III.G-5]. A replica of the USCOE study was conducted by OSM using modeling software SECAD4, the peak for the same samples discharge decreased by 6.9 and 8.6 percent in the first instance, and increased by 10.5 and 8.1 percent in the second for a 10-year and 100-year storm, respectively. [Id.]

2. Aquatic Fauna

a) Direct Impacts

When streams are filled or mined through all biota living in the footprint of the fill or in the mined area are lost. There is little question that perennial streams support viable aquatic communities that could be lost from valley fills [EPA 2003, p.III.D-2]. Typical benthic macroinvertebrates found in headwater streams include insects such as mayflies (Ephemeroptera), stoneflies (Plecoptera), caddisflies (Trichoptera), dragonflies and damselflies (Odonata), beetles (Coleoptera), dobsonflies and alderflies (Megaloptera), true bugs (Hemiptera), springtails (Collembola), and true flies (Diptera). Other macroinvertebrates that have been collected include crayfish (Decapoda), isopods (Isopoda), worms (Oligochaeta and Annelida) and snails (Gastropoda). [Id., p. III.C-7]

Aquatic organisms can exist in streams with ephemeral and intermittent flow regimes as well. In western Oregon taxa richness of invertebrates (>125 species) in ephemeral and intermittent forest streams exceeded that in a permanent headwater stream (100 species). [Dietrich and Anderson 2000] Dietrich and Anderson (2000) also found that only 8% of the species in the total collection were only found in the permanent headwater. A total of 25% were restricted to the summer-dry streams and 67% were in both permanent and summer-dry streams. In other words, most aquatic life found in the temporary streams were also found in permanent streams, clearly indicating that the temporary streams support aquatic life similar to that found in permanent streams. These researchers concluded that the potential of summer-dry streams with respect to habitat function is still widely underestimated. [EPA 2003, p.III.D.3]

In several northern Alabama streams of varying flow permanence, including a stream that was normally perennial, Feminella (1996) found little differences in the invertebrate assemblages. Presence-absence data revealed that 75% of the species (171 total taxa, predominantly aquatic insects), were ubiquitous across the six streams or displayed no pattern with respect to permanence. Only 7% of the species were found exclusively in the normally intermittent streams. Again, this study clearly indicates that intermittent streams support aquatic life. [EPA 2003, p.III.D.3]

Many researchers have found that intermittent streams, spring-brooks and seepage areas contain

not only diverse invertebrate assemblages, but some unique aquatic species. Dieterich and Anderson (2000) found 202 aquatic and semi-aquatic invertebrate species, including at least 13 previously undescribed taxa. Morse et al. (1997) have reported that many rare invertebrate species in the southeast are known from only one of a few locations with pea-sized gravel or in spring brooks and seepage areas. Kirchner [Kirchner and Kondratieff 2000] reports 60 species of stoneflies from eastern North America are found only in first and second order streams, including seeps and springs. Approximately 50% of these species have been described as new to science in the last 25-30 years. [EPA 2003, p.III.D.3]

Williams (1996) reported that virtually all of the aquatic insect orders contain at least some species capable of living in temporary waters and that a wide variety of adaptations across a broad phylogenetic background have resulted in over two-thirds of these orders being well represented in temporary waters. This researcher goes on to say that "perhaps the concept of temporary waters constraining their faunas is based more on human perception than on fact". [EPA, 2003, p.III.D.3]

A study in West Virginia by OSM and the USGS found all eight of the target orders of insects selected were found within the uppermost headwater. Furthermore, the study found that a number of taxa that were found in the extreme headwaters have multi-year life cycles. This would suggest that sufficient water is present for long-lived taxa to complete their juvenile development prior to reaching the aerial adult stage in these areas. Although only continuous flow areas were considered for this study, the field work took place in the winter, and it was considered probable that these extreme headwaters were subject to annual drying. Similarly, as part of the work to describe stream conditions in southern West Virginia for this EIS, the EPA found that intermittent streams supported diverse, healthy and balanced invertebrate populations preceding and following a severe drought in the summer of 1999. [EPA 2003, p. III.D.4] Green et al. found all intermittent reference streams sampled in southern West Virginia were in either very good or good condition based on West Virginia Stream Condition Index scores. [Green et al. 2000, p. 2]

Fish species present in headwater streams tend to be representative of cold water species, and primarily sustained by a diet of invertebrates. [Vannote et al. 1980] According to Stauffer and Ferreri (2002), headwater streams in Appalachia contain fish unique and important in the evolution and speciation of North American freshwater fishes. Their study found fifty-six species of fish, including two hybrid sunfishes, within several watersheds. The study determined that small headwater streams harbor populations with unique genetic diversity. These headwater stream populations have the greatest potential for natural selection processes that may result in development of new species/subspecies. [EPA 2003, p. IV.D.5]

Many different kinds of amphibians and reptiles live in or near streams and wetlands. Many types of amphibians in particular are unique to the Appalachian regions. The West Virginia Division of Natural Resources has published a pamphlet, "Amphibians and Reptiles of West Virginia: A Field Checklist." This list mentions 46 amphibious species and 41 reptilian species, the vast majority of which are most likely located throughout the study area within suitable habitat of Kentucky, Tennessee, and Virginia. These species include mole, dusky, woodland, four-toed, green, spring, red, mud, and brook salamanders as well as newts, hellbenders, and mudpuppies, which can frequently be found near aquatic habitat. Skinks, a lizard species, can also be found in and near aquatic habitats. Toads as well as cricket, chorus, true, leopard, pickerel, and tree frogs are associated with aquatic habitats. Snapping, spotted, map, musk, mud, and painted turtles as well as sliders, cooters, redbellies, and softshells can also be found in these areas. Water, crayfish, brown, garter, ribbon, and kingsnakes are associated with aquatic habitats. Many of these amphibious and reptilian species may be primarily terrestrial, but live in proximity to aquatic areas such as streams and wetlands. In addition, several species rely on the presence of streams or wetlands for at least part of their life cycle. [Conant and Collins, 1991] Fills eliminate aquatic habitat for those species that require it as well as the aquatic/terrestrial interface required for many of those that are not strictly aquatic.

In a study of effects on vertebrates of timber harvest in riparian zones, amphibians were shown to be more sensitive to management activity than fish or birds. The management activity in this study was timber harvesting, which did not involve alteration of the stream itself. Amphibian numbers declined rapidly after logging and did not tend to recover quickly, with some species still at low numbers 60 years after timber harvest. Maintaining refugia of mature forest can provide a source for recolonization of amphibians. The type of riparian forest did not influence the abundance of fishes. [Duncan 2003, Raphael 2002]

Amphibians have limited dispersal ability; therefore effects of loss of habitat are somewhat predictable. It is more difficult to predict effects on terrestrial species with greater mobility. Birds and mammals, due to their superior dispersal ability, may be better able to recolonize after disturbance than amphibians.

Section 515(b)(24) of SMCRA requires that mining operations minimize the disturbances and adverse impacts on fish, wildlife, and related environmental values to the extent possible using best technology currently available, and achieve enhancement of such resources where practicable. Under the condition of complying with the stream buffer zone regulation, 30 CFR 816 / 817.43(b) allow perennial and intermittent streams to be diverted permanently or temporarily as deemed appropriate. In addition, 30 CFR 816/817.97(f) require that the operator restore or replace wetlands and riparian vegetation along rivers and stream. The operators are directed to enhance where practicable wetlands and habitats of unusually high value for fish and wildlife.

Under the "No Action" alternative direct impacts to the aquatic biota would continue at current trend. The proposed regulatory language changes to the stream buffer zone rule in Alternatives 1, 2, and 4 would essentially be "impact neutral." OSM anticipates that there would be no net increase or decrease in stream buffer zone incursions. If the excess spoil regulations are changed as anticipated in Alternatives 1, 2, and 3, more spoil would returned to the mined-out area, and the footprint of excess spoil fills would be reduced. There would slightly less direct adverse impacts correlating with the reduced size of excess spoil fills. As previously noted, the positive effects of Alternatives 1, 2, and 3 would be somewhat limited by the fact that the vast majority of excess spoil fills are constructed in eastern Kentucky, southwestern Virginia, and southern West Virginia. These states have already implemented measures to minimize the size of excess spoil fills, so there would be limited change from implementation of the alternatives for Federal action. Alternative 1 would also require more rigorous environmental analyses of placement of coal waste coupled with existing regulations. This should have a slightly positive effect on aquatic fauna.

b) Indirect Impacts

The changes in invertebrate communities from stream headwaters to mouth have been well documented. If uppermost headwaters are temporarily or permanently disturbed by coal mining, local conditions may exert as great or greater an influence on the biotic communities as can be seen by examining stream order alone. In general, major shifts in the relative abundance of macroinvertebrates considered to be shredders, scrapers and collector-gatherers are seen from headwaters to mouth. Collector-filterers and predators are generally found in all stream orders. However, differing species may occur to occupy these niches in different stream reaches. Shredders are generally relatively abundant in headwater areas where allochthonous inputs are high, and present in lower abundance in mid-order streams, where less of the organic matter input is allochthonous. Shredders may be absent or occur in only localized conditions in higher order streams. Scrapers tend to be present at a relatively low abundance in headwater streams owing to the relatively low amount of periphyton (periphyton inhabiting the surfaces of underwater vegetation, rocks, and other substrates) present in these stretches. The relative abundance of scrapers increases in mid-order streams in conjunction with an increase in periphyton abundance, but decreases again in high order streams owing to decreases in suitable habitat and

physical limitations. Collector-filters are present in all reaches of a stream. However, the species occupying these niches varies tremendously, from almost entirely arthropods in headwater streams to largely molluscs and arthropods, especially aquatic insects, in high-order rivers. [EPA 2003, p. III.C-11]

The extent to which excess spoil fills and other mining activities eliminate energy resources that may be used by downstream aquatic communities is not well documented. There is a lack of information on the degree to which length of stream directly correlates with the amount of energy in the form of fine-particle organic material or coarse-particle organic material leaving a particular reach of headwater stream. As a general matter, forest leaf litter is particularly important to macroinvertebrates that process organic matter for downstream reaches. Experiments demonstrate the reliance of stream biological communities on energy inputs from the surrounding forests. When leaf litter was excluded from a stream, the primary consumer biomass in the stream declined, as did invertebrate predators and salamanders [EPA 2003, p. III.D.4].

A study of thermal impacts of valley fills was performed by the USGS [Wiley et al, 2001] on one stream below a valley fill site – the unnamed tributary to Ballard Fork in West Virginia and one stream below an unmined site – Spring Branch near Mud, West Virginia. This study recorded stream temperature on a daily basis during the period December 22, 1999 to November 30, 2000. The temperature monitor at unnamed tributary to Ballard Fork is approximately 400 feet downstream from a valley fill.

Water temperatures from the unnamed tributary to Ballard Fork exhibited lower daily fluctuations and less seasonal variation than water temperatures from an unmined site. Water temperatures were warmer in the winter and cooler in the summer than water temperatures from Spring Branch. The average water temperature of the unnamed tributary to Ballard Fork and Spring Branch in January 2000 was 8.7°C, and 1.9°C, respectively. On the other hand, the average water temperature of the unnamed tributary to Ballard Fork and Spring Branch in August 2000 was 16.0°C and 18.6°C, respectively.

The water temperature at Unnamed Tributary to Ballard Fork showed a lesser seasonal range than the seasonal range observed at Spring Branch. The daily-mean water temperature at Unnamed Tributary to Ballard Fork was greater than the daily-mean water temperature at Spring Branch during winter, and the daily-mean water temperature at Unnamed Tributary to Ballard Fork was less than the daily-mean water temperature at Spring Branch during summer. While the USGS study provides an indication of the impacts on valley fills on temperature, additional monitoring in other streams would have bolstered the confidence in these findings. It is also difficult to predict the possible impacts of this moderated thermal regime on the downstream aquatic communities. As we have stated in Section III.I.2.d), we acknowledge that information to ascertain the impacts of water temperature is based on limited studies, but to collect and analyze this information on water temperature by excess spoil fills will take years and significant resources.

Forested riparian buffers provide shade, thereby helping to lower water temperatures during summer and lessen temperature decreases in winter. Lack of shade has a direct effect on water quality and aquatic life. Elevated temperatures are a catalyst for water quality problems by accelerating or increasing the impacts of non-point source pollution and robbing oxygen from the system. Small streams flowing through exposed reaches can increase as much as 1.5 degrees Fahrenheit for every 100 feet of exposure to summer sun. Maximum temperature fluctuations for daily peaks can be as much as 12 to 15 degrees higher, and ambient temperatures of 6 to 8 degrees higher are not uncommon. [see Section III.I.1.a)] A shift in temperature or increase in fluctuation in seasonal or diurnal temperatures would affect species found in the downstream from mining. The heating up of a stream reduces the oxygen carrying capacity of the waterway, harming stream life that is temperature-sensitive. Also, as water temperature increases above 60 degrees F, phosphorus (a nutrient) attached to sediment, is more readily released from its sediment hosts and dispersed into the stream as a pollutant. Increased water temperatures also

produce heavy growth of filamentous algae (from increases of 9 degrees F), encourage the growth of parasitic bacteria, and can adversely affect benthic organisms.

Mining activities upstream would likely affect the characteristics of flow. [see Section IV.B.1] The USGS studied the changes in stream flow below an excess spoil fill and an unmined watershed. [Wiley et al. 2001] Generally, daily stream flows below the excess spoil fill is greater than daily stream flows from the unmined site during periods of low stream flow. USGS attributes this to a greater percentage of base-stream flows and lower percentage of storm flows at the stream below the excess spoil fill. Because the study included only two streams, it cannot be determined if the observations made would be true for a number of streams. It is also difficult to predict the possible impacts of this moderated and elevated flow regime on the downstream aquatic communities [EPA p. III.D-5].

Coal mining and excess spoil fill construction appear to be associated with some downstream changes in surface-water chemistry. These changes include increases in a number of cations that are known to be associated with surface mining such as sulfate, total dissolved solids, total calcium, total magnesium, hardness, total manganese, dissolved manganese, specific conductance, alkalinity, and total potassium. In the USEPA (2002a) stream chemistry study in West Virginia, selenium was found at elevated levels below several streams where excess spoil fills were constructed. Elevated selenium concentrations may impact aquatic biota and possibly higher order organisms that feed on aquatic organisms [EPA 2003, p.III.D-7].

While changes in water chemistry downstream from mined, filled sites have been identified, it is not known if these changes are resulting in alterations to the downstream aquatic communities or whether functions performed by the areas downstream areas from mined, filled sites are being impaired [Id.].

Communities downstream of mine sites had a higher abundance of benthic macroinvertebrates, but diversity and evenness declined and there were more pollution tolerant species. [Maggard and Kirk 1999, Pen Coal 1998, 1999a, 1999b, 2000a, 2000b, 2000c] Multivariate analysis of sites in the Kanawha River basin (West Virginia, Virginia, and North Carolina) showed that effects of coal mining had a strong effect on downstream macroinvertebrate communities through habitat degradation due to decreasing substrate particle size as well as changes in stream water chemistry because of increased specific conductance and higher sulfate concentrations. [Messinger 2001] These changes resulted in fewer pollution sensitive taxa and more taxa tolerant of pollution.

A USEPA study compared sites below fills with sites below unmined areas. Filled residential sites were substantially different from unmined sites. Conductivity was the variable most strongly associated with biological condition. [USEPA 2000] A follow up study using data from coal companies as well as from the 2000 report found that filled sites had "lower biotic integrity than sites without valley fills." [Fulk et al. 2003]

In Ohio, macroinvertebrate communities in streams draining an area mine without valley fills were lacking virtually any mayflies. These streams had elevated levels of conductivity, sulfates and hardness. Numbers of pollution sensitive taxa were low as well. [USEPA 2005]

In a study of four small impoundments in eastern Tennessee, Everett (2005) found that macroinvertebrate taxa richness and number of less tolerant taxa were lower below the impoundments than above the impoundments. Impoundments were implicated in these effects; however, human caused modifications to the surrounding habitat may have also contributed to some of the impairment.

Hartman and others (2005) examined four pairs of streams in southern West Virginia. Six of the macroinvertebrate metrics were significantly different between valley fills and reference streams. The densities of Ephemeroptera, Coleoptera, Odonata, and non-insects were significantly lower

($p < 0.01$) below fills than in reference streams. In addition, the metrics scraper density and shredder density were also lower below fills than in reference streams ($p < 0.03$). There were no differences in total density of aquatic insects or any of the other macroinvertebrate metrics between filled and reference streams. Many of the macroinvertebrate metrics were negatively correlated with heavy metals. Ephemeroptera, Plecoptera, and Trichoptera (otherwise referred to collectively as EPT are pollution intolerant taxa) density were negatively related to calcium, manganese, and nickel ($p < 0.05$). Ephemeroptera density was particularly negatively related to calcium, copper, iron, manganese, and nickel ($p < 0.04$). Plecoptera density was negatively related to cadmium ($p < 0.04$).

The diversity of bivalves and gastropods in the southeastern United States is the highest in the world. [Neves et al. 1997] In the early part of the last century, the Clinch and Powell Rivers in Tennessee and Virginia had some of the richest mussel fauna in the upper Tennessee River drainage. [Ortmann 1918]. Today, these systems “contain more globally rare mussel and fish species than any river in North America.” [Ahlstedt et al. 2005]

Several Federally listed threatened and endangered species of mussels occur in the study area. These include: Appalachian monkeyface pearly mussel (*Quadrula sparsa*), Birdwing pearly mussel (*Conradilla caelata*), Clubshell (*Pleurobema clava*), Cumberland bean pearly mussel (*Villosa trabellii*), Cumberland combshell (*Epioblasma brevidens*), Cumberland monkeyface pearly mussel (*Quadrula intermedia*), Cumberland elktoe (*Alasmidonta atropurpurea*), Dromedary pearly mussel (*Dromus dromus*), Little-wing pearly mussel (*Pegias fabula*), Northern riffleshell (*Epioblasma torulosa rangiana*), Oyster mussel (*Epioblasma capsaeformis*), Pink mucket pearly mussel (*Toxolasma cylindrella*), Purple bean (*Villosa perpurpurea*), Rough rabbitsfoot (*Quadrula cylindrical strigillata*), Shiney pigtoe (*Fusconaia coredgariana*), and Tan riffleshell (*Epioblasma florentina walkeri*).

Mussels are bivalve filter feeders and are sensitive to increased sedimentation which may occur below fills. No studies, however, have looked at valley fills or mined-through streams in relation to their effects on mussels. However, several studies have found a relationship between coal-related contaminants and toxicity to mussels. [McCann and Neves 1992; Hull et al. 2006]

Beside sediment from surface mining, another threat to mussels from coal mining is blackwater releases from coal processing plants. The amount of coal fines in both the Clinch and Powell Rivers has increased and is now a major component of sediment at sites where some of the best populations of federally listed mussels occur on the Tennessee side of the Clinch River. [Ahlstedt et al. 2005]

Under the “No Action” alternative, direct impacts to the aquatic biota would continue at its current trend. The proposed regulatory language changes to the stream buffer zone rule in Alternatives 1, 2, and 4 would essentially be “impact neutral.” OSM anticipates that there would be no net increase or decrease in stream buffer zone incursions. If the excess spoil regulations are changed as anticipated in Alternatives 1, 2, and 3, more spoil would be returned to the mined-out area, and the footprint of excess spoil fills would be reduced. There would be slightly less direct adverse impacts correlating with the reduced size of excess spoil fills. As previously noted, the positive effects of Alternatives 1, 2, and 3 would be somewhat limited by the fact that the vast majority of excess spoil fills are constructed in eastern Kentucky, southwestern Virginia, and southern West Virginia. These states have already implemented measures to minimize the size of excess spoil fills so there would be limited change from implementation of the alternatives for federal action. Alternative 1 would also require more rigorous environmental analyses of placement of coal waste coupled with existing regulations. This should have a slightly positive effect.

3. Terrestrial Fauna

As a general matter as was discussed in section III.I.1.A.a), riparian buffer zones are important terrestrial habitats. These zones have the potential to provide rich habitats for a wide variety of birds, mammals, reptiles and amphibians. Most habitat research on riparian areas has focused on animals, but some studies have documented the important role of riparian corridors for plant diversity and dispersal. Native plant communities support healthy populations of native animals and help maintain stream hydrology. Very wide buffers of 300 feet or more are needed to protect diverse terrestrial communities; but even buffers of 50 feet, which contribute substantially to water quality and aquatic habitat goals, can offer good habitat to terrestrial species [McNaught 2003, p. 8]. A 100-foot riparian buffer zone may not provide adequate habitat for neotropical songbirds but would provide a corridor for movement along patches of remaining forest [Palone 1998, p. 6-11].

Changes in terrestrial biotic communities occur when mined areas are reclaimed. Even if forest is replaced with forest, there would be a period of time in which riparian dependent species would be absent from a reclaimed area. If grasslands are established, it is likely that riparian dependent species won't return. Wood and Edwards (2001) found that taxa dominance shifted from salamanders to snakes when intact forests were converted to grasslands through reclamation of mountaintop sites.

In 2002, the forest area in the United States was 749 million acres, or about one-third of the Nation's land area. This is a slight increase from 747 million acres in 1997 and a continuing slight upward trend since the late 1980's. [USDA, 2004b, p.3] For the last 100 years, the total forest area has been relatively stable, even though the U.S population has doubled. Today, conifer forests cover 412 million acres in the United States and are found predominantly in the West (315 million acres) and South (67 million acres). Broadleaf forests cover 273 million acres and are predominant in the North and South, and the remainder (64 million) is mixed forest is located in the South [USDA, 2004a, p.15] To put the impact of coal mining on forests in perspective, in central Appalachian coalfields from 1992 to 2002, approximately 380 thousand acres were impacted by mining. When adding past, present and future terrestrial disturbance, the estimated forest impact is 1.4 million acres through 2018 [EPA 2003, p.IV.C.1]. Unlike residential, industrial, and agriculture activities, the impact of mining on forest is a temporary land use. Within a relatively short period, reclaimed mine sites may once again return to productive forest.

Terrestrial species that depend on the riparian zone are most vulnerable to impacts from excess spoil fill construction and mining through streams. Habitat for these species is likely to be permanently or temporarily eliminated. These include strictly terrestrial animals such as the Louisiana waterthrush (*Seiurus motacilla*), Acadian flycatcher (*Empidonax vireescens*), Kentucky warbler (*Oporornis formosus*), prothonotary warbler (*Protonotaria citea*), and Swainson's warbler (*Lymnotherlypis swainsonii*), as well as amphibians. Keller et al. (1993) found that area sensitive neotropical migrants were more abundant in wider riparian forests. Uncut riparian areas provided habitat for mature forest birds that otherwise would not have been present [Conner et al. 2004]. Several species of birds listed as "birds of conservation concern" by the U.S. Fish and Wildlife Service [USFWS 2002] are dependent on riparian zones.

Concern has been expressed over possible impacts to the cerulean warbler (*Dendroica cerulea*) from these rule changes. A number of habitat descriptions have been published and are summarized by Hamel (2000). Cerulean warblers do not seem to be riparian zone dependent and can occupy a wide range of habitats. Their requirements are not thoroughly understood, but in the southeast they prefer mature forest with an irregular canopy. Tree size is thought to be more important than species, indicating a preference for mature forests [Hamel 2000]. Hamel (2000) concluded ceruleans are opportunists, their main requirement being mature forests in any region they inhabit. Although ceruleans occur in both upland and riparian areas, dry slope and ridge top habitats may have been overlooked in their importance in the past. [Rosenberg et al. 2000] Recent research by Weakland and Wood (2002) found that ceruleans have a preference for ridge tops, with 50% of all territories on ridges in mature forest. They also found fewer territories than expected in midslope and bottomland areas, given availability.

Impacts to cerulean warblers from mining would be due to loss of habitat that occurs when large areas of mature forest are cleared in advance of mining. Ceruleans are also negatively impacted by forest fragmentation and edges created by mines. [Weakland and Wood 2002]

The Royal Blue Wildlife Management Area in the Cumberland Mountains of Tennessee, managed by the Tennessee Wildlife Resources Agency, contained the highest number of breeding pairs of ceruleans found during the Cerulean Warbler Atlas Project. [Rosenberg et al. 2000] Bueler et al. (in the press) developed a model for predicting suitable habitat and populations for the cerulean. Their model suggests coal surface mining could remove 2,954 hectares (≈7,300 acres) of cerulean habitat in the management area and could displace 3,161 breeding pairs (23 % of the population of cerulean warblers in the management area).

While the change from forest may negatively influence interior forest species of bird, reclaimed mine lands has resulted in an increase in the abundance of edge and grassland bird species at reclaimed mountaintop mining sites in West Virginia (Wood and Edwards, 2001; Canterbury, 2001).

Indiana bats (*Myotis sodalis*), a federally listed endangered species, are known to utilize riparian zones for foraging and summer roosting. This habitat is lost when streams are mined though or filled. Protection plans that restrict tree cutting to the hibernation period for Indiana bats are in place or in development in several of the states. These plans also include requirements for movement corridors and riparian area conservation or replacement. Moreover, existing regulations ensure that consideration of threatened and endangered species and their habitat is adequate considered by the surface coal mining operation to ensure the continuing existence of the species are not jeopardized.

Under the “No Action” alternative, direct (habitat loss) and indirect impacts (edge effects and fragmentation) to the terrestrial biota would continue at its current trend. The proposed regulatory language changes to the stream buffer zone rule in Alternatives 1, 2, and 4 would essentially be “impact neutral.” OSM anticipates that there would be no net increase or decrease in stream buffer zone incursions as the result of changes to the stream buffer zone regulations. If the excess spoil regulations are changed as anticipated in Alternatives 1, 2, and 3, more spoil would returned to the mined-out area, and the footprint of excess spoil fills would be reduced. There would be slightly less direct adverse impacts on terrestrial fauna correlating with the reduced size of excess spoil fills due to the changes in the excess spoil regulations. Whether that translates to significantly fewer acres of cerulean warbler habitat lost to mining is doubtful, since the amount of mature ridge top forest cleared for mining would not likely change significantly as a result of the rule changes. Hence, negative effects to ceruleans would continue with the adoption of any of the alternatives. As previously noted, the positive effects of Alternatives 1, 2, and 3 would be somewhat limited by the fact that the vast majority of excess spoil fills are constructed in eastern Kentucky, southwestern Virginia, and southern West Virginia. These states have already implemented measures to minimize the size of excess spoil fills, so there would be limited change from implementation of the alternatives for Federal action. Alternative 1 would also require more rigorous environmental analyses of placement of coal waste coupled with existing regulations. This should have a slightly positive effect on terrestrial fauna.

4. Threatened and Endangered Species

The effect of surface coal mining and reclamation operations on plant and animal communities depends on the nature of the affected plant, animal, or critical habitat, the type of mining and its intensity, reclamation techniques and timing, the serial history of the site, and postmining land use. Generally, these improper operations can result in impacts such as changes in pH (acidification or alkalization of waters and/or soils); siltation of bodies of water such as lakes, ponds, rivers, streams and creeks; increased turbidity of water bodies, thus reducing primary

productivity; deposition of metals in water bodies; and synergistic effects of mining wastes with other pollutants. [Mason 1978] In some cases, surface coal mining and reclamation activities may have contributed to the endangerment of species. [USFWS 1996, p.6]

Direct effects of surface coal mining and reclamation operations on threatened, endangered, or proposed species or critical habitat consists primarily of habitat alteration by land clearing and earthmoving operations. While some of these effects are temporary, unique habitat features in such microenvironments as cliffs, caves, rock outcroppings, seeps, and old-growth forests are difficult and sometimes impossible to replace. [Thornburg 1982] Aquatic and wetland-dependent species also may be directly affected by adverse impacts on water availability and quality (e.g. increased levels of metals, sulfates, and dissolved or suspended solids), increased variations of streamflow and thermal gradients, and changes in ground water levels and spring flows. [USDA 1982] If a species of concern lacks individual mobility, land clearing and excavation activities may result in a direct take. Direct effects are often readily identifiable, but the magnitude of incidental take resulting from both direct and indirect effects is difficult to ascertain and not well-documented. [USFWS 1996, p. 6-7]

Surface coal mining and reclamation operations may indirectly affect threatened, endangered, or proposed species or proposed or designated critical habitats by increasing human access to species and/or their habitats and by causing or contributing to long-term changes in land use and the local ecology. Improved access can result in increased site disturbance, poaching, and invasion of species incompatible with the species of concern. Mining can interrupt migration corridors and habitat continuity [Mason 1978], thus isolating populations and threatening their long-term viability by increasing the susceptibility to genetic decline and catastrophic events. Forest fragmentation resulting from mining-related activities and subsequent changes in land use may cause increased predation and habitat degradation on adjacent, physically undisturbed sites and may threaten the ecological integrity of those lands with respect to species requiring extensive forest cover. Even if the land is restored to its premining use, the species composition and age structure would likely differ; this may have an adverse impact on species of concern. Hence, surface coal mining and reclamation operations may result in an indirect take of a protected species or significant disturbance and/or destruction of protected habitats. [USFWS 1996, p.7]

While recognizing that the aforementioned impacts could occur, the USFWS in the 1996 Biological Opinion and Conference Report (BO) stated that SMCRA and its implementing regulations set forth programmatic standards and procedures designed to minimize mining-related impacts on fish and wildlife in general and threatened and endangered species in particular (Id). Specifically, USFWS identified the following regulations within Title 30 of the Code of Federal Regulations as pertinent to the protection of fish, wildlife, and related environmental values:

Section 772.12 Permit requirements for exploration removing more than 250 tons of coal, or occurring on lands designated unsuitable for surface coal mining operations.

Paragraph (b)(9) requires a description of any endangered or threatened species listed pursuant to the Endangered Species Act of 1973 and identified with the proposed exploration area.

Paragraph (d)(2)(ii) requires that the regulatory authority (State or OSM) find in writing that the exploration and reclamation activities described in the application will not jeopardize the continued existence of an endangered or threatened species or result in the destruction or adverse modification of critical habitat of those species.

Section 815.15 Performance standards for coal exploration.

This section prohibits disturbance of habitats of unique or unusually high value for fish,

wildlife, and other related environmental values and critical habitats of threatened or endangered species during coal exploration.

Section 773.5 (previously Section 773.12) Regulatory coordination with requirements under other laws.

To avoid duplication, this section requires that each regulatory program provide for the coordination of review and issuance of permits with applicable requirements of the Endangered Species Act, the Fish and Wildlife Coordination Act, the Migratory Bird Treaty Act, and the Bald Eagle Protection Act.

Sections 780.16 and 784.21 Fish and wildlife information.

Paragraph (a) requires that each permit application include fish and wildlife resource information for the permit and adjacent areas, including site-specific information when the permit or adjacent area is likely to include listed or proposed endangered or threatened species. The scope and level of detail for the information must be determined by the regulatory authority in consultation with the State and Federal agencies with responsibilities for fish and wildlife.

Paragraph (b) requires that each permit application include a description of how the operator will minimize disturbances and adverse impacts on fish and wildlife and related environmental values, including compliance with the Endangered Species Act. The application must include a plan for enhancement of these resources where practicable.

Paragraph (c) provides that upon request by the USFWS, the regulatory authority must supply the information required under paragraph (a) and (b) to the USFWS for review.

Section 773.6 (previously Section 773.13) Public participation in permit processing.

Section 774.13 Permit revisions.

Section 774.15 Permit renewals.

These three sections require the regulatory authority (State or OSM) to provide written notification to State and Federal fish and wildlife agencies whenever the State or OSM receives an application for a new permit, significant revisions of a permit, or permit renewal. Further, the regulatory authority must document consideration of all comments received in response to these notifications.

Section 773.15 Review of permit applications.

As a precondition for approval of a permit application, paragraph (c) requires the regulatory authority to make a written finding that the proposed operation would not affect the continued existence of endangered or threatened species or result in destruction or adverse modification of their critical habitats, as determined under the Endangered Species Act.

Sections 816.97 and 817.97 Protection of fish, wildlife, and related environmental values.

Paragraph (a) requires the operator to minimize disturbance of and adverse impacts on fish, wildlife, and related environmental values.

Paragraph (b) prohibits the taking of an endangered or threatened species in violation of the Endangered Species Act and prohibits mining activity which is likely to jeopardize

the continued existence of endangered and threatened species. Under this rule, the operator must promptly notify the regulatory authority of the presence of protected species within the permit area. The regulatory authority must consult with appropriate State and Federal fish and wildlife agencies to determine whether and under what conditions the operation may proceed.

Paragraph (f) requires that the operator avoid disturbances to, enhance where practicable, and restore habitats of unusually high value for fish and wildlife.

Based on the review of SMCRA, compliance with the aforementioned regulations, and consideration of the effects and cumulative effects of the continuation and approval of surface coal mining and reclamation operations under State and Federal regulatory programs adopted under SMCRA, USFWS concluded in the 1996 BO that continuation and approval of operations would not likely jeopardize the continued existence of any threatened, endangered, or proposed species or result in adverse modification of designated or proposed critical habitat.

The action analyzed in this EIS is a narrow change to the comprehensive Federal regulatory program under SMCRA. This action would not determine whether surface coal mining and reclamation operations in existence can continue or whether future operations can be approved. Rather, the EIS evaluates the environmental effects of revising several specific regulations to establish permit application requirements and review procedures for applications that propose to place excess spoil from surface coal mining operations into intermittent and perennial streams. In addition, these regulatory changes would modify the backfilling and grading regulations to minimize the creation of excess spoil and revise the regulations governing surface coal mining operations within 100 feet of a perennial or intermittent stream to more closely track the underlying statutory provisions.

None of the alternatives being considered would change the regulations that were specifically identified in the USFWS's 1996 BO as pertinent to the non-jeopardy opinion. The regulatory protections identified in the 1996 BO continue to ensure the protection of listed endangered and threatened species, proposed species, and their critical habitats.

Currently, surface coal mining operations are being conducted in 26 states. These activities include the extraction of coal by various mining methods, reclamation, and other surface activities conducted in connection with coal mining including, but not limited to, the construction of access roads, impoundments, dams, ventilation shafts, entryways, refuse banks, spoil banks, coal stockpiles, and processing and shipping areas. While OSM is considering changes to its regulations that are national in scope, two factors may limit the significance of the changes. First, of the 26 coal producing states, only two -- Tennessee and Washington -- have federally administered SMCRA programs. The remaining 24 states have "primacy," which means that these states regulate coal mining in accord with their respective approved State regulatory programs. When OSM adopts changes in the Federal regulations implementing SMCRA, OSM determines whether any corresponding amendments to approved State regulatory programs are needed to ensure that those programs continue to be "no less effective" than SMCRA and the implementing Federal regulations. If OSM determines that changes are not required as a matter of law under SMCRA, the 24 states with approved State regulatory programs have the discretion to amend their State programs to reflect the changes OSM has made in the Federal regulations to make the stream buffer zone regulations more clear.

Second, excess spoil is typically generated where coal mining activities are conducted in steep terrain. Excess spoil and fill construction, with very limited exceptions, occur primarily in central Appalachian coal fields states. During the period October 1, 2001, to June 30, 2005, 1,589 (98.6%) of the 1,612 fills approved for construction nationwide were located in Kentucky (1,079), Tennessee (13), Virginia (125), and West Virginia (372), and only 23 fills were approved outside of central Appalachia. In recent years, Kentucky, Virginia, West Virginia, and OSM in Tennessee have implemented some controls to reduce the volume and thus the adverse

environmental effects of excess spoil.

We do not anticipate there will be any effect upon threatened and endangered species as the result of implementing the “No Action” alternative or Alternatives 1, 2, 3, and 4. Even if the changes to the excess spoil regulations considered under Alternatives 1, 2, and 3, would result in smaller fill footprints and less streams impacted, the current regulations under the SMCRA that address the protection of threatened and endangered species will be unaffected by this rulemaking action and protection of threatened and endangered species will continue. The changes to the stream buffer zone regulations considered in Alternatives 1, 2, and 4 would have no on-the-ground effect on threatened or endangered species or critical habitats.

5. Geotechnical

Stability of excess spoil fills and mine backfill is an important component of the SMCRA regulatory programs. As discussed in Section III.G.7, there is no indication that excess spoil fills are generally unstable: mass movement within fills is neither commonplace nor widespread. Only 20 out of more than 4000 fills constructed over a 23-year period have experienced incidences of instability and those fills occurred on active permits, and all but one were repaired prior to final bond release. Similarly, with isolated exceptions, the spoil returned to the mined-out area is stable [Section III.G.8].

Following the Buffalo Creek disaster in 1972, the Mine Safety and Health Administration (MSHA) promulgated regulations to ensure the stability of coal processing waste facilities. These regulations at 30 CFR 77.214, 77.215, and 77.216 address the design, review and monitoring of these facilities. These design plans must include information on the physical and engineering properties of the foundation materials and embankment construction materials. A stability analysis of all MSHA-class impoundments is required. Nearby surface and underground mining are also considered in the design.

Sections 515(b)(13), 515(f), and 516(b)(5), and the associated regulations at 30 CFR 780.25, 816.49, 816.81, and 816.84 establish requirements, which complement the MSHA regulations, to ensure coal mine waste processing facilities are stable and safe. For example, 30 CFR 816.81(d) require all waste disposal facilities to have a foundation investigation to determine design requirements for the foundation stability.

Since the failure of the coal processing waste facility in Buffalo Creek in 1972, no incidents of embankment instability, other than overtopping of starter dams during early construction have occurred in the United States (Committee on Coal Waste Impoundments and others, 2002, p.113). On October 11, 2000, a breakthrough of Martin County Coal Corporation's coal waste impoundment released 250 million gallons of slurry in stream near Inez, Kentucky. This incident did not result in failure of the embankment but rather a breach in the foundation of the impoundment that allowed slurry to reach an underground mine below the impoundment.

Under the “No Action” alternative, stable excess spoil fills and backfill would continue to be constructed. OSM anticipates that current measures undertaken in Kentucky, Tennessee, Virginia, and West Virginia to avoid and minimize the size of excess spoil fills would also continue. To date, we do not have any on-the-ground evidence that these measures would result in less stable excess spoil fills or backfill. Yet, the steepness of a valley fill's foundation slope is one of several important factors potentially affecting long-term stability [Section III.G.7]. Fill minimization in the interest of reducing environmental impacts such as stream loss can result in smaller fills placed in higher elevations where the slope of the valley bottom is steep. Absent the influence of other mitigating factors an increase in foundation slope unavoidably reduces fill stability. Whether the consequential failure of a greater proportion of newly constructed fills would be avoided in the future would depend on how carefully excess spoil sites are selected and

investigated, and on how carefully the fills would be designed and constructed. Recent changes in state regulations and policy (examples include Kentucky's RAM # 135 and West Virginia's environmental protection zone (EPZ) requirements [Section III.G.6]), and technology transfer activities promote better underdrain construction and stability. The effect of steep foundation slopes must be off-set by proper foundation preparation and placement of underdrains that efficiently convey seepage out of the valley fill.

Two factors would influence how the practice of excess spoil minimization would generally affect seepage rates in valley fills. First, minimized fills constructed in higher elevations would be influenced by smaller recharge and drainage areas and consequently lower amounts of seepage and runoff. Thus the water seeping through the fill mass should be relatively less than through un-minimized fills. However, we do not have the field data necessary to predict how much of a discharge difference this would make. Based on the limited amount of data obtained in the OSM stability study, it appears that less drainage in minimized valley fills would not completely compensate for relatively steep foundation slopes. Potential instability in minimized fills built on steep foundation slopes would still be a concern. One way in which reduction of seepage through a minimized fill can be made advantageous is to have in place a regulatory policy and practice that consistently ensures the placement of effective underdrains and surface water controls, such as diversions and terraces.

The second factor concerns situations in which excess spoil minimization results in contiguity between valley fills and backfills. Typically, an un-minimized valley fill is located far enough downslope from the mined bench or mountaintop pavement to where the crown of the fill is not in contact with backfill. Thus, drainage originating upslope of the valley fill can be intercepted, directed into constructed channels, and kept from entering the fill mass. This, however, is not necessarily the case when excess spoil minimization is required. The entry of subsurface flows from backfills into valley fills cannot be readily observed during the mining and reclamation process. Generally, the Federal and state regulations do not require construction of drainage structures on mine benches and mountaintop pavements. Without effective subsurface conveyance systems that are continuous with valley fill underdrains, unchecked drainage can elevate pore pressures in excess spoil fills and risk instability. While the preferred alternative does not specifically address this risk, existing regulations at 30 CFR 816/817.71(f) specify that "...the fill design shall include diversions and underdrains as necessary to control erosion, prevent water infiltration into the fill, and ensure stability." It is a requirement that a qualified registered professional engineer consider this risk and other factors in the design of the fill.

A potential benefit of excess spoil minimization concerning valley fill stability relates to the decrease in soil depth that typically occurs when one traverses from lower to higher elevations up a hollow in steep sloped Appalachia. Minimized excess spoil fills would be built overtop shallower, more stable soils compared to un-minimized fills. All else being equal, this should add stability to the former fill type. However, the limited amount of data we have on valley fill stability indicates that generally thinner soil layers beneath minimized fills would not completely compensate for the effect of steeper foundation slopes. Most natural soils at valley fill sites are composed of colluviums above weathered rock and they tend to thicken downslope towards valley level. However deep soils can occur locally in higher elevations where weak rock types (e.g. mud rocks like shale and claystone) are exposed. Also, in many cases of major fill instability resulting from weak foundations resulting in translational opposed to rotational mass movement; the thickness of the soil may not be an important factor.

Storage of excess spoil on old surface mine benches is already permitted by SMCRA regulations, although the practice has been limited by economic considerations (e.g. haulage costs). Alternatives 1, 2, and 3 may provide further incentive to place excess spoil on old mine benches. This would reduce the volume of excess spoil material needed to be placed in valley fills; thus, potentially resulting in smaller or less numerous fills. Smaller fills would be constructed higher in the valleys and have a steeper foundation slope. Careful design and construction of fills would have to be used to provide an adequate safeguard against instability.

In the interest of minimizing the volume of excess spoil generated, mining companies place as much spoil as possible above the area of coal extraction (i.e. above the pavement or strata below the coal) while adhering to certain limiting requirements such as maintenance of no more steeper than a 50 percent slope on the face of the backfill. Excess spoil minimization increases the size of already very large backfill structures atop mountains in very steep terrain. Mass movements in backfills of this nature can be extremely difficult to reclaim. Unlike excess spoil fills, much of the backfill surface area lies above mountain side slopes that are significantly steeper than the valley bottom slopes of even minimized fills. Slides on the steeper slopes would travel faster and further, and would potentially be more dangerous. Earth-moving equipment needed to stabilize the slide might be inoperable on such steep and precarious terrain.

Unlike valley fills, backfills are founded on the coal pavements. Slope steepness and engineering strength of materials in the structure's foundation should not be an issue. However, instability can result from an over-steepened fill face and unchecked subsurface drainage through the fill mass. Careful monitoring of the backfill construction process by the certification engineer and regulatory authority inspector can be crucial for such fills.

Under Alternatives 1, 2, and 3, OSM would initiate rulemaking to minimize the amount of excess spoil generated and the footprint of fills. These alternatives would codify in the Federal rules requirements for excess spoil fill minimization that are similar to those in place in the Kentucky, Tennessee, Virginia, and West Virginia. Because those states have already implemented such measures, the fill minimization measures in these alternatives would result in limited change in backfill or valley fill stability as compared to the "No Action" alternative. The revisions of the stream buffer zone rule being considered in Alternatives 1, 2, and 4 would not affect backfill or valley fill stability. Alternative 1 would also require more rigorous environmental analyses of placement of coal waste; this would likely have no effect on stability.

Regardless of which Alternative is ultimately implemented, an over arching requirement to design, construct, maintain a stable structure exists for backfill, excess spoil fills, and coal waste facilities will continue to exist.

6. Economics

This Federal action would have the greatest impact in the coal fields of central Appalachia, although there would be some mining activity outside this region to the extent that activity occurs in or near intermittent and perennial streams. OSM anticipates only slight increases in the cost of reclamation and preparing and reviewing mining permit applications from implementing any of the four alternatives. Kentucky, Virginia, West Virginia, and OSM (in Tennessee) have already initiated measures to minimize the volume of excess spoil fills; so, there would be only a limited impact on costs to regulated entities and regulatory authorities.

Coal production provides tax revenues to state and local government through severance taxes, royalty payments on public lands, income taxes, property taxes, and federal reclamation fees. A severance tax is essentially an excise tax imposed on removing, producing, or selling the coal. State and local governments generally levy severance taxes in the form of a percent of the value of the resources removed or sold. Severance tax receipts usually are dependent on energy prices, hydrocarbon production levels, and State and local severance tax rates. Coal severance taxes can be an important source of revenue for State and local governments and school districts, especially where coal mining is the dominant industry.

The costs associated with the treatment of municipal water supplies would be unaffected by the proposed Federal action. Municipal water supplies are protected in various ways by existing regulations and other laws, such as the Clean Water Act. There are special provisions in the

regulations which restrict long-term degradation in the quality of water available for municipal water supply systems by requiring restoration of the recharge capacity of aquifers. [OSM 1979, BIII-117]

It was acknowledged in the 1970s that there would be higher levels of resident populations trained to fill job needs to comply with water protection services, which will lead to a beneficial increase in socioeconomic stability. [OSM 1979, p.BIII-117]

Reclamation fees assessed under section 402 of SMCRA primarily support reclamation of abandoned mine lands and waters adversely impacted by mining conducted before the enactment of SMCRA. They also provide a source of funding for the repair or construction of water supply systems for communities impacted by mining.

The alternatives being considered would have negligible effects on coal production (table III-2); therefore, the impacts of the four alternatives on revenues from coal production would not differ from the "No Action" alternative.

As discussed in Section III.G.2, it is anticipated that there will be an increase of 27,000 coal mining jobs from 2004 to 2030, and a shift of where those jobs are located as coal reserves are depleted, technology allows the greater use of coal with a higher sulfur content, and emphasis shifts to more highly productive mining techniques. In addition, coal miners and operators purchase goods and services from a host of firms, many of which have little or no direct association with coal mining. These purchases have a multiplier effect on the regional, state, and local economies.

OSM anticipates each of the four possible alternatives considered in detail in this EIS would have a negligible impact on employment. Therefore, wages and taxes derived from direct or associated employment with the coal industry would not be impacted.

7. Culture

As discussed in Section III.A, coal mining occurs in wide variety of regions throughout the United States. Each of the regions has a unique cultural character which may further vary on a state, county or local level. It would not be possible to adequately describe the cultural characteristics of the Nation using a broad-brush approach. As discussed in the introduction to this section, impacts associated with the actions being considered in this EIS would be mostly limited to the steep slope terrain of the central Appalachian coal fields. The culture of this area is described in detail in Chapters III.P, R, S, T, and U of the MTM/VF DPEIS. [EPA 2003]

The changes to the stream buffer zone regulation under Alternatives 1, 2, and 4 would cause no discernable on-the-ground changes. OSM anticipates that the proposed regulatory language changes to the stream buffer zone rule would essentially be "impact neutral." If the excess spoil regulations were changed as anticipated in Alternatives 1, 2, and 3, more spoil would be returned to the mined-out area, and the footprint of excess spoil fills would be reduced. It is anticipated that by reducing the area impacted by excess spoil fills, a small number of cultural assets that would otherwise be adversely affected by mining might be left unaffected. Because Kentucky, Virginia, and West Virginia have already initiated controls to reduce the areas impacted by excess spoil fills, the benefits of Alternatives 1, 2, and 3 would be slight. Alternative 1 would also require more rigorous environmental analyses of placement of coal waste; this should have no effect on culture.

8. Environmental Justice

Pursuant to Presidential Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (February 11, 1994)," federal agencies are required to evaluate the impacts of any federal action to determine if the proposed actions will disproportionately affect a minority, low-income, or culturally distinct community or population. This Executive Order, commonly referred to as the environmental justice (EJ) order, is intended to ensure that no person or group of people shoulders a disproportionate share of the negative environmental impacts resulting from the execution of this country's domestic and foreign policy programs, and to ensure that those impacted have a meaningful role in the decision-making process. This rulemaking initiative is considered to be a federal action subject to the requirements of an environmental justice review.

OSM recognizes that environmental justice embraces the fundamental human desire for fairness and equity. OSM also acknowledges that coal mining permitting actions can have both beneficial and adverse impacts on the people they affect. Concern for protection of human health and safety is paramount under SMCRA, and minimizing or preventing adverse effects of coal mining on public health and safety were of primary importance in the enactment of SMCRA [30 U.S.C. 1202].

The location of coal mining is dependent upon the presence of coal, the geology of the area, and the economics of production; but generally coal mining activities occur in rural locations. The presence or absence of populations referenced in the EJ order does not influence the decision to authorize a coal mining operation, because SMCRA provides an equal level of protection to all coalfield citizens, regardless of social or economic status. Individual permitting decisions by OSM require a site-specific environmental analysis including a determination that specifically addresses the requirements of the EJ order.

In addition, State regulatory programs, while not specifically required to comply with the EJ order, must still comply with all federal laws that provide the statutory framework for environmental justice. To obtain Federal funding, State regulatory authorities must certify to OSM that they will comply with all Federal statutes relating to nondiscrimination. For example, States must certify compliance with Title VI of the Civil Rights Act of 1964 [P.L. 88-352] which "prohibits discrimination on the basis of race, color or national origin." Thus the regulatory authority commits to compliance with these statutes, ensuring that permitting actions by States incorporate the principles of non-discrimination found in the EJ order.

Impact Assessment

Coal mining causes adverse environmental impacts as discussed in Chapters III and IV. Coal mining activities may also temporarily and possibly permanently degrade the quality of life in the human environment for people living and working adjacent to the mines or along the coal transportation corridors by increasing noise, dust, traffic and degradation of surface and ground water and visual aesthetics. There are also positive effects on the human environment from coal mining. Two important positive impacts are increased employment and increased tax revenues. However, coal is a limited resource, and as coal resources are depleted, coal communities experience the "boom to bust" cycles associated with mineral resource extraction industries. In addition, as discussed in section III.G.1, mining productivity has increased significantly, particularly in surface mines. As a result, despite a significant increase in coal production, worldwide, domestic coal employment has decreased, particularly in areas where historically coal mining has been the sole industry. This is particularly true in the rural areas of the Appalachian coal fields. Both coal depletion and decreasing coal employment contribute to high poverty levels in areas where employment was once robust. Unemployment is not a recent phenomenon in the coal fields. Coal employment peaked in the United States in 1923 with 704,793 miners. Twenty years later, in 1953, coal employment was less than half of the peak at 293,106. By 1973,

148,121 miners were employed, and today, there are about 83,000 coal miners.

Coal mining has always provided an economic opportunity for gainful employment for less affluent populations, especially during the “boom” cycle or during labor disputes. This has resulted in certain communities being dominated by first, second, or third generation immigrants, which depending upon their ethnicity may or may not be considered members of a non-white minority group. Generally, in the rural counties of Appalachia and the Illinois coal basin the populations of non-white minorities are lower than the national average. By contrast, in the Colorado Plateau and the Northern Rockies and Great Plains, populations of Native Americans and Hispanics are relatively higher. And similarly, in mining communities in the Gulf coast, the populations of African-Americans and Hispanics are higher than the National average. See table IV-2 below.

Table IV-2 – Demographics of five major coal field basins

	Population (est.2006)	Percentage					Poverty (est.2004)
		White	Black	Indian	Asian	Hispanic	
U.S. Total	299,398,484	66.4	12.8	1.0	4.4	14.8	12.7
Appalachian Basin	9,371,287	88.1	8.5	0.2	1.0	2.6	14.0
Colorado Plateau	584,129	58.3	0.8	27.2	0.5	13.0	16.4
Gulf Coast	411,308	63.3	16.0	0.6	0.5	28.1	15.9
Illinois Basin	1,460,488	86.7	6.6	1.5	1.1	2.7	13.8
Northern Rocky and Great Plains	79,429	84.4	0.5	6.4	0.8	6.4	14.9

The analysis in this EIS indicates that selection of any of the action alternatives would result in no additional impacts to populations referenced in the EJ order. Confirming the presence of Environmental Justice populations in counties where mining is projected to occur, and predicting potential impacts on those populations, is possible in this EIS, but this is only the first step in ensuring environmental justice. The projection of probable actual impacts, including whether they are likely to disproportionately affect a particular community, can only be made once an operator submits a permit application. That is the first time information will be available on the actual location of the mining, the anticipated environmental impacts, and the identification of populations covered by the EO. All impacted persons, whatever their status under the EO, are afforded many protections and mitigation measures under the regulatory program. An important component of both State and Federal permit application procedures is the public outreach conducted in potentially affected communities. Outreach activities, such as public notifications of permit applications and environmental documents, provide consultation with the local environmental justice communities as required by the executive order. OSM’s regulatory program addresses EO 12898 issues. OSM’s permit application procedures require analysis under the National Environmental Policy Act to identify environmental impacts, and a component specifically addressing environmental justice is required by DOI policy. Environmental Compliance Memorandum (ECM) 95-3. OSM regulations ensure that for specific mining proposals, all affected persons, including those covered by EO 12898, are subject to outreach and have access to information. OSM’s regulations also ensure that adverse impacts are identified and avoided or minimized.

Under the “No Action” alternative, the environmental impacts currently associated with construction of excess spoil fills, coal mine waste facilities, and stream buffer zone incursions, which are described in this Chapter and Chapter III, would continue. These impacts may affect people living in surrounding coal field communities during and, at times, long after active coal mining.

These general observations about the programmatic impacts of this rule on a national level are intended to show relative differences among the identified alternatives. However, because Alternatives 1, 2, 3, and 4 are expected to cause relatively minor on-the-ground effects, none of these alternatives would result in disproportionate adverse impacts on minority, low-income, or culturally distinct populations if implemented. The data indicate that the potential for impacts on minority populations is low nationally. However, this can vary on a county-by-county basis. For example, McKinley County, New Mexico has a 78 percent nonwhite population. Thus, the potential for impacts on minority populations in McKinley County is relatively high compared to other coal producing regions. Site-specific analysis is necessary to adequately assess the impacts of a specific mining operation on populations referenced in EO 12898.

9. Cumulative Impacts

In addition to considering direct and indirect effects, the Council on Environmental Quality (CEQ) regulations require that an EIS consider “cumulative impacts.” Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. 40 CFR 1508.7. “Actions,” as used in CEQ regulations, may include a broad range of activities from an individual construction project to agency implementation of a new policy or program. See 40 CFR 1508.18. We are examining the impacts of a relatively small proposed change to the Federal regulatory program for surface coal mining operations under SMCRA. As CEQ’s 1997 guidance on how to consider cumulative effects states, “Many times there is a mismatch between the scale at which environmental effects occur and the level at which decisions are made. Such mismatches present an obstacle to cumulative effects analysis. For example, while broad scale decisions are made at the program or policy level ...the environmental effects are generally assessed at the project level.” [CEQ 1997, p.4]

This proposed Federal action will affect the human environment in the 26 states in which coal mining is occurring and likely to occur in the foreseeable future. For an action concerning Federal rules that are nation-wide in applicability, it is not feasible for us evaluate all specific cumulative effects in each specific state, ecoregion, or watershed in which mining occurs. Instead, we are providing general information on the existing environment that may be affected by this Federal action, primarily at the national and regional level. We discuss other programs and actions relatively broadly that may have beneficial or adverse impacts cumulative to the impacts of this proposed Federal action. Some related site-, state- or region-specific programs and actions are not considered as part of this cumulative impact evaluation because of their limited individual and cumulative significance for this EIS, and because this EIS cannot provide a meaningful analysis of their impacts. There are many actions that may affect the environmental resources that would also be affected by this Federal action and by coal mining in general. On most of those other actions, OSM has no information. Developing and analyzing information on those actions and their impacts would involve exorbitant costs. Because those actions and their impacts are not central to an informed evaluation of the impacts of this Federal action, the EIS does not address them. This is consistent with CEQ guidance, which advises, “Cumulative effects analysis should “count what counts”, not produce superficial analyses of a long laundry list of issues that have little relevance to the effects of the proposed action or eventual decisions.” [Id, p.12]

This cumulative impact analysis addresses significant impacts and trends from the following actions and sectors that may be cumulative to the impacts of this proposed Federal action:

- SMCRA Title V program (“Unaffected Title V SMCRA Program requirements”)
- SMCRA Title IV program (Abandoned Mine Land “AML” program)
- Clean Water Act section 303 program (Total Maximum Daily Load or “TMDL” program)
- Clean Water Act section 402 program (National Pollutant Discharge Elimination System or “NPDES” program)
- Clean Water Act section 404 program
- The Emergency Watershed Program (“EWP”)
- Coal mining and consumption
- Forestry
- Agriculture

This cumulative impact analysis focuses on impacts on seven categories of environmental resources. These resources were emphasized as a significant concern by commenters in the scoping process:

- Surface water quality
- Surface water flow
- Headwater streams
- Aquatic fauna
- Terrestrial fauna
- Threatened and endangered species

a) Description of Other Actions

Unaffected Title V SMCRA Program Requirements:

Title V of SMCRA establishes comprehensive and detailed requirements with respect to the regulation of surface coal mining operations. These statutory provisions and regulations set forth permitting and performance requirements to minimize the adverse effects stemming from coal mining activities. The statutory provisions and regulations discussed in detail in sections III.H.1 and 2 of this EIS are mere excerpts of the comprehensive SMCRA program requirements. The identified requirements are relevant to this proposed Federal action and pertinent to minimizing adverse effects on water quality and quantity, fish and wildlife and related values, and threatened and endangered species.

There are two Federal program States where mining is presently occurring – Tennessee and Washington. OSM also administers regulatory programs for Indian lands in Arizona, New Mexico, and Montana. There are 24 State primacy SMCRA programs. These State programs include State laws, regulations and policies. To receive primacy, these States had to demonstrate that their programs were no less effective than the Federal program. State program requirements are comparable to the Federal program. SMCRA allows a State program to be more stringent than the Federal requirements, to the extent authorized by State law. Both State and Federal regulatory program requirements are supplemented by materials such as guidelines, technical manuals, policies, procedures.

The Abandoned Mine Land Reclamation Program

The purpose of the SMCRA Title IV program is to promote the reclamation of mined areas left

without adequate reclamation prior to the passage of SMCRA (August 3, 1977) and that continue to substantially degrade the quality of the environment, prevent or damage the beneficial use of land or water resources, or endanger the health or safety of the public. 30 U.S.C 1202(h). The program is supported by a fee levied on each ton of coal produced.

Since its inception, this abandoned mine land (AML) program has reclaimed approximately 240,000 acres of high priority coal-related problems. In addition, safety and environmental hazards have been eliminated on 314,108 acres, including all three AML priorities categories and non-coal problems in 27 States and on the lands of three Indian Tribes. OSM has provided \$4.06 billion in grants to those States and Tribes to reclaim abandoned mine sites. Since 1999, OSM has also approved 161 Watershed Cooperative Agreements and amendments to clean up watersheds affected by past mining. Approximately, \$14 million has been awarded to the watershed groups.

There are 25 States and three Tribes that administer approved AML programs.

The authority to collect and distribute the abandoned mine land reclamation fee was revised by the Tax Relief and Health Care Act of 2006, which included the Surface Mining Control and Reclamation Act Amendments of 2006 (Public Law 109-432). Among other things, these amendments extended the authority for reclamation fee collection through September 30, 2021, and changed the way that State and Tribal reclamation grants are funded, beginning in FY 2008. State and Tribal grants, except for emergency grants under Section 410, are now mandatory appropriations derived from current reclamation fee collections and the general fund of the U.S. Treasury. In FY 2008, \$274.3 million was made available through grants to States and Tribes to restore abandoned mine land, treat acid mine drainage and other projects. This is more than double the \$132.0 million that was available in FY 2007. The very large increases in the distribution of mandatory appropriations beginning in FY 2008 are anticipated to greatly expedite the restoration of abandoned mine lands, thereby improving public health and safety and preventing further environmental degradation. On June 20, 2008, OSM published a proposed rule that would align current regulations with the SMCRA changes resulting from Public Law 109-432. The reauthorization of the AML program will result in an estimated \$4 billion towards AML reclamation and commensurate reduction of adverse impacts on health, safety, and the environment.

Total Maximum Daily Load Program

The Clean Water Act, section 303, establishes water quality standards and Total Maximum Daily Load (TMDL) programs. Under section 303(d) of the 1972 Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters that are not meeting water quality standards that states, territories, and authorized tribes have established. These waters fail to achieve the applicable water quality standards even after treatment systems have been installed to address point sources of pollution. Section 303(d) of the CWA requires that these jurisdictions establish priority rankings for waters on the lists and develop Total Maximum Daily Loads (TMDLs) for these waters. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. The TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the waterbody can be used for the purposes the State has designated. The calculation must also account for seasonal variation in water quality.

EPA must approve or disapprove lists and TMDLs established by states, territories, and authorized tribes. If a state, territory, or authorized tribe submission is inadequate, EPA must establish the list or the TMDL. EPA issued regulations in 1985 and 1992 that implement section 303(d) of the Clean Water Act - the TMDL provisions. While TMDLs have been required by the Clean Water Act since 1972, until recently states, territories, authorized tribes, and EPA have not

developed many. Several years ago citizen organizations began bringing legal actions against EPA seeking the listing of waters and development of TMDLs. To date, there have been about 40 legal actions in 38 states. Court orders or consent decrees ensure that TMDLs are established in many states, either by the state or by EPA. To date, there have been 33,908 TMDLs established nationwide to address 35,636 causes of impairment.

Before a new mining operation can occur in a 303(d) listed stream, it must demonstrate that it can operate without exceeding the TMDL limits for the affected watershed.

National Pollutant Discharge Elimination System Program

Water pollution degrades surface waters, making them unsafe for drinking, fishing, swimming, and other activities. As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

"Point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are, or may be discharged. Point source discharges of water from coal mining activities are regulated under the NPDES program. "Pollutant" means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into waters of the United States. An NPDES permit sets specific discharge limits for point sources discharging pollutants into waters of the United States and establishes monitoring and reporting requirements, as well as special conditions. For coal mining, effluent limits are based on the water quality standards of the receiving stream and technology based limits established under 40 CFR 434.

EPA is charged with administering the NPDES permit program, but can authorize states to assume many of the permitting, administrative, and enforcement responsibilities of the NPDES permit program. Authorized states are prohibited from adopting standards that are less stringent than those established under the Federal NPDES permit program, but may adopt or enforce standards that are more stringent than the Federal standards if allowed under state law. At the time of publication, 45 states and the Virgin Islands have assumed NPDES authority. Since its introduction in 1972, the NPDES permit program is responsible for significant improvements to our Nation's water quality.

Any existing or new coal mine must receive an NPDES authorization and comply with applicable discharge limits.

Clean Water Act Section 404 Program

The goal of the Clean Water Act (CWA) is to protect and restore the chemical, physical, and biological integrity of the nation's waters. CWA Section 404 helps to achieve this goal by establishing a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. Responsibility for administering and enforcing Section 404 is shared by the U.S. Army Corps of Engineers (USACE) and EPA. USACE administers the day-to-day program, including individual permit decisions and jurisdictional determinations; develops policy and guidance; and enforces Section 404 provisions. EPA develops and interprets environmental criteria used in evaluating permit applications, identifies activities that are exempt from permitting, reviews/comments on individual permit applications, enforces Section 404 provisions, and has authority to veto USACE permit decisions.

CWA Section 404 permit applications are evaluated using the Section 404(b)(1) Guidelines to assure this goal is met. The Guidelines require the identification of the aquatic resources

affected; avoidance and minimization of impacts; prediction of the level of unavoidable impacts for various project alternatives analyzed; as well as a description of the amount and type of mitigation required to offset the unavoidable impacts. The USACE is required by the Guidelines to make factual findings on chemical and physical impacts (substrate; suspended particulates/turbidity; changes in water; current patterns and water circulation; normal water fluctuations; and salinity gradients) and biological impacts (threatened or endangered species; fish, crustaceans, mollusks, and other aquatic organisms in the food web; and other wildlife).

With EPA approval and oversight, states and tribes can assume administration of the Section 404 permit program in certain "nonnavigable" waters within their jurisdiction. At the time of publication, only Michigan and New Jersey have done this. In those two states, USACE retains jurisdiction in tidal and navigable waters and their adjacent wetlands.

Fills in waters of the U.S. can be authorized by the USACE through either the general permit or individual permit process. If a mining permit would result in no more than minimal adverse impacts to aquatic systems, including mitigation, they may be authorized by a nationwide permit. The USACE does a functional analysis of the all streams that will be affected and requires some form of compensatory mitigation to address all unavoidable impacts.

Since 1999, environmental organizations and citizens groups have sued the USACE over its authorization of excess spoil fills and other mining-related incursions, such as sediment ponds, impoundments, and coal processing waste facilities, in waters of the U.S. While USACE has ultimately prevailed on most of these lawsuits, litigation is ongoing and may have a significant effect on coal mining particularly in central Appalachian coalfields.

The Emergency Watershed Protection Program

The purpose of the Emergency Watershed Protection (EWP) program is to undertake emergency measures, including the purchase of floodplain easements for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and products of erosion on any watershed whenever fire, flood, or any other natural occurrence is causing or has caused a sudden impairment of the watershed.

The U.S. Department of Agriculture – Natural Resource Conservation Service (NRCS) administers the program which is authorized under Section 216 of P.L. 81-516. NRCS may bear up to 75 percent of the construction cost of emergency measures or up to 90 percent in limited resource areas. The remaining cost-share must come from local sources and can be in the form of cash or in-kind services.

On April 4, 2005, NRCS published a final rule to improve the effectiveness of the EWP. Among the changes, NRCS would expand EWP by adding procedures for floodplain sediment deposition restoration, upland disaster debris removal, and repair of enduring (structural and long life) conservation structures. The new rule also implements provision of the 1996 Farm Bill which provided NRCS an expanded opportunity to purchase easements for flood prone lands. Lastly, NRCS would give greater weight to environmental impacts when evaluating projects, and NRCS would coordinate with other agencies to protect various resources and accelerate the use of more natural "green" practices opposed to traditional practices, such as armoring stream channels and constructing dikes.

Coal Mining and Consumption

Coal mining has been conducted in the United States since European settlers arrived. Uses of coal have progressed from simple home heating and cooking, to fuel for railroads and steamships and industrial processes, and now to a predominant share of the electric power generation market. To keep pace with increasing demand, methods of mining coal have advanced from pick-

and-shovel works to steam-powered equipment and now to mechanized deep mines and large-scale surface operations. National industry trends have favored surface operations over underground mining in recent decades, driven by the advent of very large earthmoving equipment, and surface methods now account for the majority of nationwide production. This trend is expected to continue, as surface mines generally provide better coal recovery than underground mines and have lower overall production costs per ton of coal. A detailed description of the history of domestic coal mining is presented in Section III.G.2. A brief summary of this information is presented below.

Coal production in the United States in 2007 totaled 1,145.6 million short tons according to preliminary data from the Energy Information Administration (EIA), a decrease of 1.5 percent, or 17.2 million short tons from the 2006 record level of 1,162.7 million short tons. In the international markets in 2007, U.S. coal exports increased to levels not seen in recent years while coal imports were mostly static. U.S. coal exports totaled 59.2 million short tons, an increase of 9.5 million short tons over 2006. Coal imports in 2007 ended the year at 36.3 million short tons, 0.1 million short tons higher than in 2006. [DOE-EIA, 2008, p.1] The EIA states that U.S. coal production has remained near 1,100 million tons annually since 1996. EIA anticipates that coal use for electricity generation will increase at a rate of 1.1 percent per year from 2004 to 2015, when the total production will be 1,272 tons. The growth of coal use is expected to be even greater thereafter increasing 2.0 percent per year from 2015 to 2030 as new coal fired electric generating facilities are brought on line. [DOE-EIA 2006, p. 98]

Coal production in the Appalachian Region declined for the second consecutive year in 2007, decreasing by 14.0 million short tons, to end the year at 377.1 million short tons, a decline of 3.6 percent, a level only slightly greater than the 2003 production total. The decrease in 2007 in coal production in the Appalachian Region was primarily driven by two different issues. One issue was the production problems at a few of the larger mines in the region; and the other was ongoing lawsuits, principally in the central portion of the Appalachian Region, concerning the issuing of Federal permits that regulate the excavation and discharge of dredged and fill material into the waters of the United States. As a consequence of these lawsuits, new permits have not been issued as quickly as they had in the past thereby limiting some possible additional production. [Supra, p.3] Appalachian coal production is projected to decline slightly by 2030. Although producers in Central Appalachia are well situated to supply coal to new generating capacity in the Southeast, the Appalachian basin has been mined extensively and the more economic coal reserves depleted, and production costs have been increasing more rapidly than in other regions because of more difficult mining conditions both physically and litigiously. [DOE-EIA 2007, p.99]

The Interior Region experienced a decrease in coal production in 2007 of 4.8 million short tons, or 3.2 percent, to end the year at a total of 146.6 million short tons. The decline in coal production in the Interior Region was primarily a result of the lower coal production in Texas, the largest coal-producing State in the region. [Id, p.4] The eastern portion of the Interior coal basin (Illinois, Indiana, and western Kentucky) with extensive reserves of mid- and high-sulfur bituminous coals benefits from the new coal-fired generating capacity in the Southeast. [DOE-EIA 2007, p. 98]

The Western Region was the only one of the three regions to show an increase in coal production in 2007. Coal production rose by 0.3 percent to reach a total of 621.0 million short tons, over 54 percent of total U.S. coal production for the year. [Supra, p.6] Wyoming is the largest coal-producing State in the Nation, a position it has held since 1988. In 2007, Wyoming produced 453.6 million short tons of coal, an increase of 1.5 percent, or 6.8 million short tons for the year. Wyoming produced only 1.4 million short tons less than the sum of the next six largest coal-producing States (West Virginia, Kentucky, Pennsylvania, Montana, Texas, and Colorado) and 217.4 million short tons more coal than the summation of the States ranked 8th through 25th. [Id] Western coal production, which has grown steadily since 1970, continues to increase through 2030. Much of the projected growth is in output from the Powder River Basin, where producers are well positioned to increase production from the vast remaining surface-minable reserves. Constraints on rail capacity limited growth in coal production from the Basin during 2005 and

2006, but recent and planned maintenance and investment in the rail infrastructure serving the region should allow for substantial growth in future production.

Despite the rapid growth projected for biofuels and other non-hydroelectric renewable energy sources and the expectation that orders will be placed for new nuclear power plants for the first time in more than 25 years, oil, coal, and natural gas still are projected to provide roughly the same 86-percent share of the total U.S. primary energy supply in 2030 that they did in 2005 (assuming no changes in existing laws and regulations). [DOE-EIA 2007, p.3]

Coal is projected to continue to play a major role in electricity generation, which currently accounts for more than 90 percent of total coal consumption. Coal consumption is projected to increase from 22.9 quadrillion Btu (1,128 million short tons) in 2005 to more than 34 quadrillion Btu (1,772 million short tons) in 2030, with significant additions of new coal-fired generation capacity over the last decade of the projection period, when rising natural gas prices are projected. These projections for coal consumption are particularly sensitive to the underlying assumption that current energy and environmental policies remain unchanged throughout the projection period. Recent, EIA service reports have shown that steps to reduce greenhouse gas emissions through the use of an economy-wide emissions tax or cap-and-trade system could have a significant impact on coal use. [Id, p.3-4]

Another fast-growing market for coal is coal-to-liquid energy (CTL). Coal use in CTL plants is projected to grow from 26 million short tons in 2020 to 112 million short tons in 2030. By 2025, coal use for CTL production becomes the second largest use of coal in the 2007 Annual Energy Outlook, after electric power generation. [Id, p. 12] To illustrate, the sensitivity of U.S. coal production and consumption is impacted by Federal legislation. In December 2007, the Energy Independence and Security Act of 2007 was signed by President George W. Bush. The Act encourages energy conservation and efficiency by promoting residential efficiency, increasing the efficiency of appliances and commercial products, reducing Federal government energy usage, modernizing domestic energy infrastructure, diversifying the Nation's energy supply with renewable sources, and supporting a new generation of energy-efficient vehicles.. Because of the ramifications of this Act, DOE-EIA significantly scaled back on its projections of the use of coal for CLT. [DOE-EIA 2008, p.2]

Coal use in the non-electricity sector decreased by 3.2 percent to a level of 85.7 million short tons. [Id, p.1] DOI-EIA reported that approximately 23 million tons of coal is extracted domestically for making coke for the iron and steel industry, foundries, and other industries. The presence of large domestic deposits of coking coal, or metallurgical coal, played an important role in the development of the U.S. iron and steel industry. Coke is used chiefly to smelt iron ore and other iron bearing materials in blast furnaces, acting both as a source of heat and as a chemical reducing agent, to produce pig iron, or hot metal. Domestic production of metallurgical coal comes primarily from the central Appalachian coalfields.

Why is coal production important in this cumulative effects analysis?

The direct and indirect impacts on headwater streams and adjacent riparian habitat stemming from coal mining correspond to how much and where coal is produced. Based on permits issued between October 1, 2001 and June 30, 2005, about 535 miles of stream will be directly affected by surface coal mining activities conducted pursuant to those permits. The miles of stream and the data that follows are derived from information provided by the regulatory authorities for the coal producing states and Indian lands. Impacts on approximately two-thirds of these stream miles will be permanent, based on information derived from permits issued in West Virginia. Of this length, 68.6 percent of the total (or 367 miles) are attributed to mining in Appalachian Basin coal fields [see Section III.I.2], primarily as a result of excess spoil fills and coal waste disposal facilities anticipated to be constructed in eastern Kentucky, southern West Virginia, and southwestern Virginia. For this same period, approximately 100 miles of temporary stream impacts are associated with surface mining in Texas. Considerably less direct effects are

anticipated in other States.

The estimated length of streams directly impacted from mining in central Appalachian coal fields from 1992 to 2002 based on permit information was 1,208 miles (2.05 % of streams in central Appalachian coal fields). It is estimated that if this rate would continue for ten years, 4.1 % of the streams in Appalachia would be directly impacted. [EPA 2003, p.IV.B-1] The miles of stream directly impacted by excess spoil fills for permits issued between 1985 and 2001 is 724 miles, which is approximately 1.2 percent of the streams in central Appalachia. If valley fills continue to be constructed at this rate, an additional 724 miles of headwater stream would be buried in 17 years or by 2018. [Id., p. IV.B-2]

Forestry

In 2004, the U.S. Department of Agriculture – Forest Service published a report entitled: National Report on Sustainable Forests - 2003. [USDA 2004a] In the Forest Service report, 67 indicators were examined to characterize the status of the 749 million acres of our Nation's forest as it relates to the environment, social, and economic concerns. Data was provided by the reporting regions shown in figure IV-1 below:

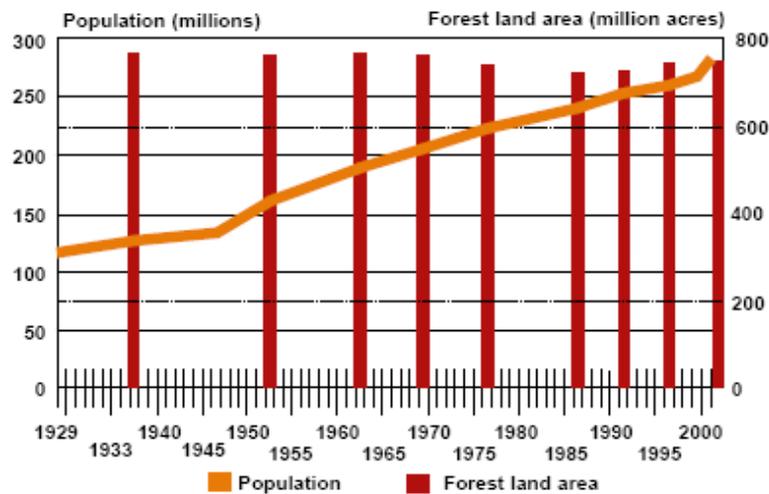


Figure IV-1 - Forest resource reporting regions and subregions of the United States

Among the strongest drivers of forestry condition in the United States are population and income. The U.S. population increased from 122 million people in 1929 to 285 million in 2001. Especially after World War II, gross domestic product (GDP) and disposable income increased in the United States. This increased income, coupled with the increasing population, increased demands for all outputs of the forest, including water, timber and non-timber products, scenic beauty, fish and wildlife, and a place to recreate.

After World War II, increasing population and income increased demand for and made possible a greatly enhanced transportation infrastructure. Better transportation for automobiles enabled suburbanization and led to land use change around existing cities. Better roads also enabled people to get to what had formerly been remote forests. Increasing populations and incomes around the world increased demands for U.S. agricultural products, such as soybeans, that led to large-scale clearing of forest land for growing crops. [Id, p.7]

In the evolution of the current U.S. forest resource situation, forestry and agriculture have a history of competing land use, but the competition has in a sense been benign in that the use of land for either purpose has not foreclosed its later use for the other purpose. Agricultural land, therefore, reverted to forest land in the Northeast in the 1800s (MacCleery 1993), and forest land was cleared for agricultural crops in the Mississippi River valley in the 1970s. Other competing uses of forest land are more likely to be irreversible. Between 1982 and 1997, 11.7 million acres of forest land were converted to developed land, while 7.9 million acres were converted to crop, pasture, or rangeland (USDA Natural Resources Conservation Service 2000). While urbanization and fragmentation of forest land may end the use of the land for timber production, some land may remain in forest cover as urban forest. In the humid East, forests are the natural land cover. Losses of forest land to agriculture and development were offset by natural reversion of abandoned agricultural lands to forests in the East and special tree-planting incentives in the 1960s and 1990s. Abandonment of pasture lands was especially important in the early 20th century as animals were replaced with machines for tilling the soil (MacCleery 1993). [Id] In addition, an initiative in Appalachia among citizens, the coal industry, landowners, government agencies and others has promoted the reforestation of reclaimed mined land. This initiative should further efforts to provide a sustainable forest. While the population of the United States more than doubled between 1929 and 2000, the area of forest land remained relatively stable. See the figure IV-2 below.



Source: Council of Economic Advisers annual report 2002 and Smith, et. al. 2003

Figure IV-2 – U.S. population and forest area [Id, p.8]

How has the forest cover varied by region?

While the 749 million acres of U.S. forest land are about equally distributed between the East (North and South regions; 384 million total acres of forest land) and the West (Rocky Mountain, Pacific Coast, and Alaska regions; 365 million total acres of forest land), timber lands make up 504 million acres (67 percent) of this total, with 361 million acres (72 percent) in the East and 143 million acres in the West. The largest areas of forest not classified as timber land are predominantly in the West. They are composed of low-density, slow-growing pinyon-juniper forests in the Rocky Mountain Region and the slow-growing mixed spruce-and-birch forests of interior Alaska. The total area of U.S. timber land has been stable over the past 50 years, with an overall loss of only 1 percent. [Id, p.24] The figure IV-3 below shows historic forest cover by region.

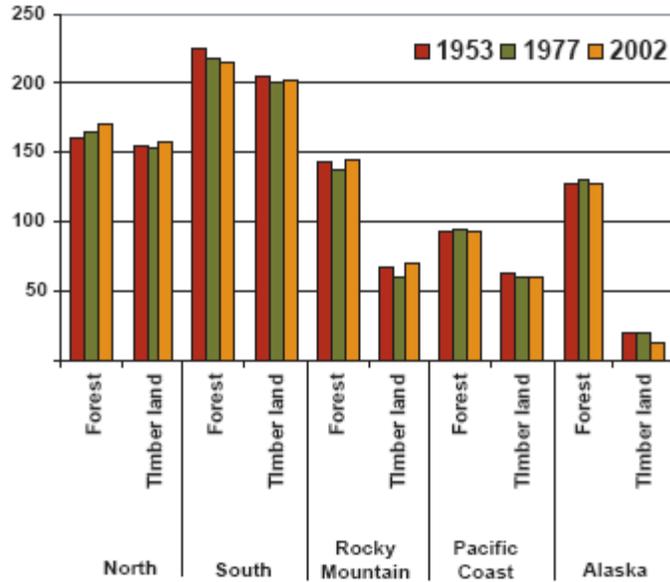


Figure IV-3 – Historic forest and timber land areas by region and year [Id, p.24]

How has forest removal compared by growth by region?

Growth has exceeded removals on U.S. timber lands for several decades, while the area of timber land has remained relatively stable. The result has been a substantial increase in the volume of growing stock on U.S. timber lands. In the 1990s, growth continued to exceed removals for both publicly and privately owned timber lands in the East (North and South regions) and West (Rocky Mountain, Pacific Coast, and Alaska regions). Trends in growth on timber land since 1952 are attributable to several factors. In general, positive growth trends reflect regrowth and maturation of forests on lands that had been harvested before 1952. Growth trends also reflect investments in fire protection, land owner education, and silviculture. Changes in harvest patterns in the 1990s resulted in shifts in growth and removals by ownership and region. Historically, most harvesting occurred on private timber lands in the East. Recent data shows a further shift of removals from public timber land in the West to private timber land in the East. Thus, growth has been exceeding removals by a wider margin in the West, while the gap has been decreasing in the East. Currently, total removals are 76 percent of net growth in the East and 45 percent of growth in the West. [Id, p.27]

Agriculture

Agriculture is extremely important and is ubiquitous throughout all regions of the United States. It is a major influence on water quality, riparian habitat, and, forest cover. Since 1950, approximately 148 million acres of farm land have been converted to other land uses in the 26 coal mining States. This is reduction of 18.9 percent. As shown in the table IV-3, the greatest reduction in farm land by percentage has occurred in the Appalachian States. While some farmland has been converted to residential uses, much has been allowed to return to woodlands and forest.

Table IV-3 -- Farm acreage in coal states 1950 to 2007

	Farm Acreage		
	1950 (1,000 acres)	2007 (1,000 acres)	Percent change between 1950 to 2007
Alabama	21,300	8,600	-59.7
Alaska	1,505	900	-40.2
Arizona	11,400	10,000	-12.3
Arkansas	19,100	14,300	-25.1
Colorado	39,000	30,700	-21.3
Illinois	31,700	27,300	-13.9
Indiana	20,200	15,000	-27.7
Kansas	50,500	47,200	-6.5
Kentucky	19,800	13,700	-30.8
Louisiana	11,600	7,800	-32.8
Maryland	4,225	2,035	-51.8
Mississippi	21,500	11,000	-48.8
Missouri	36,000	30,000	-16.7
Montana	65,000	60,000	-7.7
New Mexico	51,000	45,000	-11.8
North Dakota	42,700	39,400	-7.7
Ohio	21,800	14,200	-34.9
Oklahoma	37,500	33,700	-10.1
Pennsylvania	14,500	7,650	-47.2
Tennessee	19,100	11,400	-40.3
Texas	150,000	129,500	-13.7
Utah	12,000	11,600	-3.3
Virginia	16,500	8,510	-48.4
Washington	18,000	15,100	-16.1
West Virginia	8,550	3,600	-57.9
Wyoming	36,000	34,400	-4.4
TOTAL	780,480	632,595	-18.9

b) Cumulative Impact on Selective Resources

Cumulative Effects on Surface Water Quality

The following is a brief synopsis of the water quality conditions of streams and rivers in the U.S. As part of the Clean Water Act 305(b) program, in 2002, EPA prepared a report amassed from data collected by the States on water quality of 695,540 miles of rivers and streams, or 19% of the nation's approximately 3.7 million stream miles. States identified 45% of the assessed miles as being impaired or not supporting one or more of their designated uses. The remaining 55% of assessed miles fully supported all uses, and of these, 4% were considered threatened (i.e., water quality supported use, but exhibited a deteriorating trend). [EPA 2007, p. 7] These findings were similar to the U.S. EPA study – the Wadeable Stream Assessment, which found that 42% of the wadeable streams in the U.S. are in poor condition.

Individual use support assessments also provide important details about the nature of water quality problems in rivers and streams. The top five assessed uses in rivers and streams and their current condition is shown in table IV-4.

Table IV-4 -- Individual use support in assessed river and stream miles [Id, p.8]

Designated Use	Assessed Miles	Percent of Total U.S. Stream Miles	Percent of Waters Assessed		
			Good	Threatened	Impaired
Fish, Shellfish, and Wildlife Protection/ Propagation	596,433	16%	55%	4%	41%
Recreation	321,750	9%	64%	3%	33%
Agriculture	189,332	5%	92%	<1%	7%
Aquatic Life Harvesting	186,721	5%	57%	16%	27%
Public Water Supply	150,492	4%	81%	2%	18%

Note: Waterbodies can have multiple designated uses, resulting in overlap of assessed miles.

The top activities that were the source of impairment to streams and rivers were attributed to:

- Agriculture – 113,663 miles
- Unknown/Unspecified – 91,824 miles
- Hydromodification -- 79,400 miles
- Habitat Alterations – 51,298 miles
- Natural – 41,724 miles.

The leading criteria for impairment included: Sediment/siltation (100,446 miles), pathogens (82,133 miles), habitat alterations (80,974 miles), metals (52,809 miles), and nutrients (52,228 miles). [Id. p. 9]

The stream miles impacted that were attributed to coal mining were not identified in the 2002 EPA report but this information is available in the 305(b) data base which is associated with the report and which is available over the internet for each of 24 coal mining states. The results are presented below in table IV-5.

Table IV-5 -- Stream miles impaired due to mining

	Stream Miles Impaired		
	Underground Mining	Abandoned Mines	Surface Mining
Alabama	17	275	114
Alaska	n/a	33	354
Arizona	n/a	n/a	180
Arkansas	n/a	n/a	n/a
Colorado	n/a	n/a	n/a
Illinois	n/a	25	515
Indiana	n/a	24	159
Kansas	n/a	83	n/a
Kentucky	n/a	0	0
Louisiana	n/a	n/a	17
Maryland	n/a	n/a	n/a
Mississippi	n/a	n/a	n/a
Missouri	n/a	n/a	250
Montana	102	710	8
New Mexico	n/a	16	96
North Dakota	n/a	n/a	0
Ohio	n/a	496	1354
Oklahoma	n/a	8	22
Pennsylvania	n/a	3118	39
Tennessee	n/a	391	27
Texas	n/a	n/a	n/a
Utah	n/a	31	0
Virginia	n/a	28	91
Washington	n/a	n/a	n/a
West Virginia	n/a	4142	46
Wyoming	n/a	n/a	7
PERCENTAGE OF EVALUATED STREAMS IMPAIRED	0.02 %	1.35 %	0.47 %

A caveat regarding the above table: EPA warns that it is not appropriate to use the information in this database to make statements about national trends in water quality. The methods states use to monitor and assess their waters and report their findings vary from state to state and even over time. Many states target their limited monitoring resources to waters they suspect are impaired; therefore, assess only a small percentage of their waters. These may not reflect conditions in state waters as a whole. States often monitor a different set of waters from cycle to cycle. Even weather conditions - such as prolonged drought - can have an impact on whether waters meet their standards from one year to the next.

In addition, EPA cautions that sources of impairment in the table above were not consistently categorized among the states. In some cases, specific sources involving mining may have not been linked as a source of impairment. On the other hand, stream impairment may be due to more than one source. Because of this, there may be some overlap among the stream mileage of two or more categories of impairment. Lastly, in most cases, it was difficult to differentiate between coal mining and other forms of mining.

In 2004, the U.S. Department of Agriculture – Forest Service published a report entitled: National Report on Sustainable Forests - 2003. [USDA 2004a] In the Forest Service report, 67 indicators were examined to characterize the status of the 749 million acres of our Nation’s forest as it relates to the environment, social, and economic concerns. Indicator 24 is the percent of water bodies in forest areas with a significant variation from the historic range of variability in pH, dissolved oxygen, level of chemicals (electrical conductivity), sedimentation, or temperature change. General high pH, low dissolved oxygen, high electrical conductivity, high sedimentation, and high temperature are indicators of problems affecting aquatic systems. For this indicator, the Forest Service agglomerated and analyzed data for three regions: the North (North Central and Northeast), South (South Central and Southeast), and West (Rocky Mountain, Pacific Coast, and Alaska). These geographic regions are shown in figure IV-2.

All three regions had a significant proportion (greater than 10 percent) of forested counties in the poor or bad condition. [USDA 2004a, p.38] See figure IV-4 below.

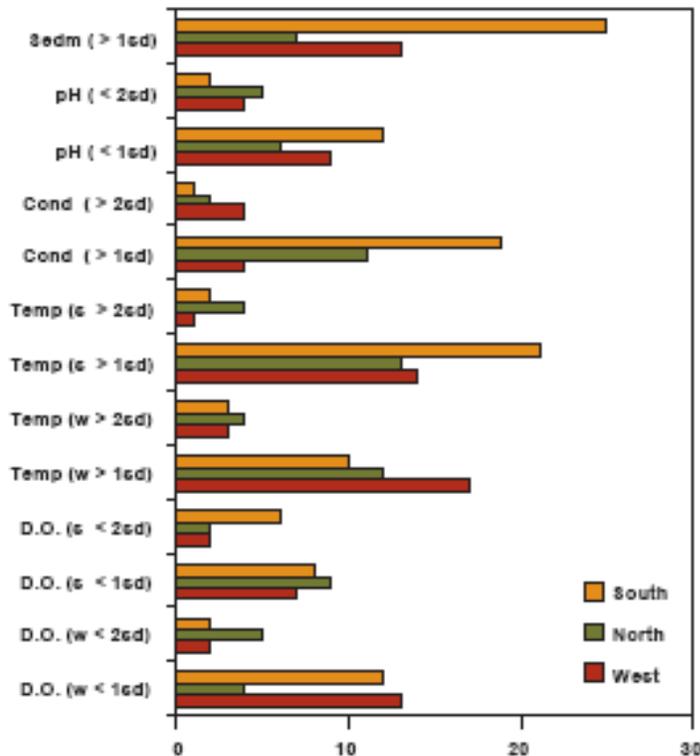


Figure IV-4 -- Percentage of counties with HUC-8 watersheds that were significantly different from other counties within each Resources Planning Act region. (Sedm = sediment; pH = water pH; Cond = electrical conductivity; Temp = temperature of water; DO = dissolved oxygen in water; s=summer; w=winter; sd=standard deviation of mean). [USDA 2004a, Figure 24-1]

The Northern region’s biggest issues are temperature in the winter and summer, and electrical conductivity. The Southern regions issues are dissolved oxygen in winter, temperature winter and summer, electrical conductivity, pH, and sedimentation. The Western region’s biggest issues are dissolved oxygen in winter, temperature in winters and summers, and sedimentation. [Id]

The cumulative effects of the proposed Federal action and associated actions are shown in table

IV-6.

Table IV-6 – Cumulative effects on water quality

ACTION	PAST	PRESENT	FUTURE
Alternative 1- change excess spoil/coal waste/SBZ rules	Not applicable	Not applicable	Slight positive-reduced excess fill footprint in all states, alternative analysis for fills and coal waste facilities
Alternative 2- change excess spoil/SBZ rules	Not applicable	Not applicable	Slight positive-reduced excess fill footprint in all states, alternative analysis for fills
Alternative 3- change excess spoil rules	Not applicable	Not applicable	Slight positive-reduced excess fill footprint in all states, alternative analysis for fills
Alternative 4- change SBZ rule	Not applicable	Not applicable	None
SMCRA Title V Requirements Unaffected	Significant positive- implementing requirements to reduced sedimentation and toxic mine drainage	Significant positive- implementing requirements to reduced sedimentation and toxic mine drainage	Significant positive- implementing requirements to reduced sedimentation and toxic mine drainage
AML Program	Moderate positive- AML reclamation and grants to watershed projects	Moderate positive-AML reclamation and grants to watershed projects	Significant positive-increased spending on AML water related projects
TMDL Program	Slight positive-delay of implementing TMDL program	Moderate positive- establishing load limits on impaired streams	Significant positive-increasing the number of TMDL prepared and implemented
NPDES Program	Significant positive-control of water quality from point discharges	Significant positive-control of water quality from point discharges	Significant positive-control of water quality from point discharges
CWA 404 Program	Minor positive-due to relying on the SMCRA permit review	Significant positive- independent reviews and compensatory mitigation to ensure environmental effects are no more than minimal	Significant positive- independent reviews and compensatory mitigation to ensure environmental effects are no more than minimal
EWP Program	Minor short term increases in turbidity; long term reduction in nonpoint source runoff	Modest but significant improvement in water quality due to riparian easements and application of "green" measures	Modest but significant improvement in water quality due to riparian easements and application of "green" measures
Coal Mining Trends	Significant negative-lack of mature technology to prevent sedimentation and toxic mine drainage	Moderate negative-technology matures to control sediment and toxic mine drainage but acceleration of mining increases both independent and cumulative effects	Moderate negative-technology further matures to control sediment and toxic mine drainage but further acceleration of mining increases both independent and cumulative effects
Forest Trends	Moderate adverse-short term turbidity	Moderate adverse-short term turbidity	Moderate adverse-short term turbidity
Agriculture Trends	Significant adverse-nutrient and sediment contributions with immature technology to control	Moderate adverse-decrease acreage and maturity of technology to control nutrient and sediment contributions	Moderate adverse-decrease acreage and maturity of technology to control nutrient and sediment contributions

Surface Water Flow

As discussed in sections III.I.2.d) and IV.B.1.c), mining can have a significant effect on surface hydrology. Removal of vegetation, new drainage patterns, storage of water on benches or in ponds, drainage of water into underground mines and alternate ground cover change the runoff characteristics. These changes in runoff may cause scouring and erosion of unprotected stream channels and can contribute to flooding. The SMCRA program requires a surface coal mining permit applicant to consider these changes and design the mine to minimize these impacts. The regulatory authority is required to analyze the cumulative hydrologic impacts of the proposed mining operation, others in existence, and all anticipated operations. Changes in landscape also occur with other non-mining land activities such as – but not limited to -- agriculture, forestry, industrialization, and residential development.

While no substitute for a site specific analysis, the U.S. Forest Service in their national report on sustainable forests, examined the effects nationally of forest management and other factors on flow, including quantity and timing of flow. The U.S. Forest Service analysis is one of most comprehensive studies completed for this issue: 20 million flow measurements from 1870 to 2000 were analyzed for 506 of 1960 hydrologic unit code watersheds (HUC-8) in the conterminous 48 States. Maximum flow ratios (95th percentile of annual flow values) and minimum flow ratios (5th percentile of annual flow values) of pre-1940 flow rates were compared with flow rates in subsequent decades. Ratios greater than 1.5 indicated significant change in maximum and minimum flow rates. The study found that 10 percent of the watersheds had decreased minimum flow rates and 25 percent had increased minimum flow rates. Similarly, 5 percent of the watersheds had lower maximum flow rates, and 25 percent had higher maximum flow rates. Additional analysis of watersheds by decades (1940s, 1950s, etc.) indicated no apparent temporal change in lower or higher maximum flow rates, but did show an increasingly change in minimum flow rates for the 1970s, 1980s, and 1990s with about 20 percent of the watersheds showing increased minimum flow in 1940 to 1969, to about 35 percent of the watersheds with increased minimum flows in 1970 to 2000. Spatially, most of the increased minimum and maximum flow rates were found in the Eastern United States. Most of decreased minimum and maximum flow rates were more common in the Central and Western United States. [USDA 2004a, p. 34]

The cumulative effects of this proposed Federal action along with associated activities are shown in table IV-7.

Table IV-7 – Cumulative effects on water flow

ACTION	PAST	PRESENT	FUTURE
Alternative 1- change excess spoil/coal waste/SBZ rules	Not applicable	Not applicable	Slight positive/adverse-fill minimization may result in decrease/increased runoff
Alternative 2- change excess spoil/SBZ rules	Not applicable	Not applicable	Slight positive/adverse-fill minimization may result in decrease/increased runoff
Alternative 3- change excess spoil rules	Not applicable	Not applicable	Slight positive/adverse-fill minimization may result in decrease/increased runoff
Alternative 4- change SBZ rule	Not applicable	Not applicable	None

ACTION	PAST	PRESENT	FUTURE
SMCRA Title V Requirements Unaffected	Significant positive- implementing PHC and CHIA requirements address flow	Significant positive- implementing PHC and CHIA requirements address flow	Significant positive- implementing PHC and CHIA requirements address flow
AML Program	Moderate positive- AML reclamation and grants to watershed projects	Moderate positive-AML reclamation and grants to watershed projects	Significant positive-increased spending on AML water related projects
TMDL Program	Negligible	Negligible	Negligible
NPDES Program	Negligible	Negligible	Negligible
CWA 404 Program	Minor positive-due to relying on the SMCRA permit review	Significant positive-independent cumulative review to ensure no increase risk of flooding	Significant positive-independent cumulative review to ensure no increase risk of flooding
EWP Program	Moderate positive local benefits as traditional flood control measures used; moderate adverse downstream of EWP measures	Significant positive due to increased use of riparian easements and application of "green" measures that restore natural function to attenuate flow	Significant positive due to increased use of riparian easements and application of "green" measures that restore natural function to attenuate flow
Coal Mining Trends	Minor adverse-change in land cover increase potential for increased runoff; somewhat offset by mine plan design to prevent abnormal runoff	Minor adverse-change in land cover increase potential for increased runoff; somewhat offset by mine plan design to prevent abnormal runoff	Minor adverse-change in land cover increase potential for increased runoff; somewhat offset by mine plan design to prevent abnormal runoff
Forest Trends	Moderate adverse short term-due removal of trees w/o consideration of cumulative effects	Minor adverse short term-due removal of trees but lessened with consideration of cumulative effects	Minor adverse short term-due removal of trees but lessened with consideration of cumulative effects
Agriculture Trends	Significant adverse-removal of natural vegetation coupled with widespread farmland acreage	Moderate adverse-decrease acreage and increased voluntary decision to keep natural riparian zone intact	Moderate adverse-decrease acreage and increased voluntary decision to keep natural riparian zone intact

Cumulative Effects on Headwater Streams

As discussed in detail in section III.1.2, headwater stream perform many ecological functions: including attenuating floods, maintaining water supplies, and improving water quality. These streams also provide a rich diversity of habitats that provide shelter, food, protection from predators, spawning sites and nursery areas, and travel corridors between terrestrial and aquatic habitats for many animal species at different stages in their life history. There are approximately 59,000 stream miles within central Appalachian coal fields [EPA 2003, p. IV.B-1], and 17 million miles of stream nationwide [see Chapter III, I, 2].

Coal mining activities have had a significant impact on headwater streams over the years both from direct and indirect effects.

Based on permits issued between October 1, 2001 and June 30, 2005, about 535 miles of stream will be directly affected by surface coal mining activities conducted pursuant to those permits. This length of stream and the data that follows has been derived from information provided by the respective regulatory authorities in each of the coal producing states and Indian lands.

Approximately two thirds of this length will be permanent based on information derived from permits issued in West Virginia. Of this length, 68.6 percent of the total (or 367 miles) are attributed to mining in Appalachian Basin coal fields [see Section III.1.2], primarily from excess spoil fills and coal waste disposal anticipated to be constructed in eastern Kentucky, southern West Virginia, and southwestern Virginia. For this same period, approximately 100 miles of temporary stream impacts are associated with surface mining in Texas. Considerably less direct effects are anticipated in other States.

The estimated length of streams directly impacted from mining in central Appalachian coal fields from 1992 to 2002 based on permit information was 1,208 miles (2.05 % of streams in central Appalachian coal fields). It is estimated that if this rate would continue for ten years, 4.1 % of the streams in Appalachia would be directly impacted. [EPA 2003, p.IV.B-1] The miles of stream directly impacted by excess spoil fills for permits issued between 1985 and 2001 is 724 miles, which is approximately 1.2 percent of the streams in central Appalachia. If valley fills continue to be constructed at this rate, an additional 724 miles of headwater stream would be buried in 17 years or by 2018. [Id., p. IV.B-2]

Other non-coal related activities also have affected headwater streams. Quantification of these effects is not available and it would be cost-prohibitive to collect this information on a National basis. Table IV-8 summarizes the impacts of other action on a qualitative basis.

Table IV-8 – Cumulative effects on headwater streams

ACTION	PAST	PRESENT	FUTURE
Alternative 1- change excess spoil/coal waste/SBZ rules	Not applicable	Not applicable	Slight positive-fill minimization results in reduction of stream length impacted; reduced environmental impacts due to alternatives analysis
Alternative 2- change excess spoil/SBZ rules	Not applicable	Not applicable	Slight positive-fill minimization results in reduction of stream length impacted; reduced environmental impacts due to alternatives analysis
Alternative 3- change excess spoil rules	Not applicable	Not applicable	Slight positive-fill minimization results in reduction of stream length impacted; reduced environmental impacts due to alternatives analysis
Alternative 4- change SBZ rule	Not applicable	Not applicable	None
SMCRA Title V Requirements Unaffected	Significant positive- implementing PHC and CHIA and requirements to avoid and restore stream functions	Significant positive- implementing PHC and CHIA and requirements to avoid and restore stream functions	Significant positive- implementing PHC and CHIA and requirements to avoid and restore stream functions
AML Program	Moderate positive- AML reclamation and grants to watershed projects	Moderate positive-AML reclamation and grants to watershed projects	Significant positive-increased spending on AML water related projects
TMDL Program	Slight positive-delay of implementing TMDL program	Moderate positive- establishing load limits on impaired streams	Significant positive-increasing the number of TMDL prepared and implemented
NPDES Program	Significant positive-control of water quality from point discharges	Significant positive-control of water quality from point discharges	Significant positive-control of water quality from point discharges

ACTION	PAST	PRESENT	FUTURE
CWA 404 Program	Minor positive-due to relying on the SMCRA permit review	Significant positive-independent review to assess projects using CWA 404(b)(1) standards and requirements for compensatory mitigation to ensure no more than a minimal effect from incursions	Significant positive-independent review to assess projects using CWA 404(b)(1) standards and requirements for compensatory mitigation to ensure no more than a minimal effect from incursions
EWP Program	Moderate positive/adverse traditional measures used to remove debris and harden channel	Significant positive-increased use of riparian easements and application of "green" measures that restore natural stream functions	Significant positive-increased use of riparian easements and application of "green" measures that restore natural stream functions
Coal Mining Trends	Significant – buried streams with spoil and coal processing waste, mining through streams, locating sediment ponds.	Significant – buried streams with spoil and coal processing waste, mining through streams, locating sediment ponds.	Significant – buried streams with spoil and coal processing waste, mining through streams, locating sediment ponds.
Forest Trends	Moderate adverse-short term increased sedimentation	Moderate adverse-short term increased sedimentation	Moderate adverse-short term increased sedimentation
Agriculture Trends	Significant adverse-nutrient and sediment contributions with immature technology to control	Moderate adverse-decrease acreage and maturity of technology to control nutrient and sediment contributions	Moderate adverse-decrease acreage and maturity of technology to control nutrient and sediment contributions

Cumulative Effects on Aquatic Fauna

As discussed in Section IV.B.2, mining can have a significant effect on aquatic fauna by directly effecting headwater streams or indirectly degrading the downstream waters by increasing sediment, dissolved solids, or thermal effects. Table IV-9 examines the effect of the proposed Federal action and other related actions.

Table IV-9 – Cumulative effects on aquatic fauna

ACTION	PAST	PRESENT	FUTURE
Alternative 1-change excess spoil/coal waste/SBZ rules	Not applicable	Not applicable	Slight positive-reduced excess fill footprint in all states, alternative analysis for fills and coal waste facilities
Alternative 2-change excess spoil/SBZ rules	Not applicable	Not applicable	Slight positive-reduced excess fill footprint in all states, alternative analysis for fills
Alternative 3-change excess spoil rules	Not applicable	Not applicable	Slight positive-reduced excess fill footprint in all states, alternative analysis for fills
Alternative 4-change SBZ rule	Not applicable	Not applicable	None

SMCRA Title V Requirements Unaffected	Significant positive-implementing requirements to reduced sedimentation and toxic mine drainage	Significant positive-implementing requirements to reduced sedimentation and toxic mine drainage	Significant positive-implementing requirements to reduced sedimentation and toxic mine drainage
AML Program	Moderate positive- AML reclamation and grants to watershed projects	Moderate positive-AML reclamation and grants to watershed projects	Significant positive-increased spending on AML water related projects
TMDL Program	Slight positive-delay of implementing TMDL program	Moderate positive-establishing load limits on impaired streams	Significant positive-increasing the number of TMDL prepared and implemented
NPDES Program	Significant positive-control of water quality from point discharges	Significant positive-control of water quality from point discharges	Significant positive-control of water quality from point discharges
CWA 404 Program	Minor positive-due to relying on the SMCRA permit review	Significant positive-independent reviews and compensatory mitigation to ensure environmental effects are no more than minimal	Significant positive-independent reviews and compensatory mitigation to ensure environmental effects are no more than minimal
EWP Program	Minor short term increases in turbidity; long term reduction in nonpoint source runoff	Modest but significant improvement in water quality due to riparian easements and application of "green" measures	Modest but significant improvement in water quality due to riparian easements and application of "green" measures
Coal Mining Trends	Significant negative-lack of mature technology to prevent sedimentation and toxic mine drainage	Moderate negative-technology matures to control sediment and toxic mine drainage but acceleration of mining increases both independent and cumulative effects	Moderate negative-technology further matures to control sediment and toxic mine drainage but further acceleration of mining increases both independent and cumulative effects
Forest Trends	Moderate adverse-short term sediment	Moderate adverse-short term sediment	Moderate adverse-short term sediment
Agriculture Trends	Significant adverse-nutrient and sediment contributions with immature technology to control	Moderate adverse-decrease acreage and maturity of technology to control nutrient and sediment contributions	Moderate adverse-decrease acreage and maturity of technology to control nutrient and sediment contributions

Cumulative impacts on terrestrial fauna

As discussed previously in section IV.B.3, riparian buffer zones are important terrestrial habitats. These zones have the potential to provide a rich habitat for a wide variety of birds, mammals, reptiles and amphibians. Changes in terrestrial biotic communities occur when mined areas are reclaimed. Even if forest is replaced with forest, there is a period of time in which riparian dependent species would be absent for a reclaimed area. If grasslands are established, it is likely that riparian-dependent species will not return. Terrestrial species that are dependent on the riparian zone are most vulnerable to permanent mining facilities such as excess spoil fills.

Surface mining outside of the riparian zone and other human activities have impacts on terrestrial fauna. The U.S. Forest Service in their national report on sustainable forests conducted a comprehensive review of the number of native species associated with forest habitats and estimated the change in the number of forest bird species from 1975 to 1999. Data on the distribution of 689 tree and 1,486 terrestrial animal species associated with forest habitats (including 227 mammals, 417 birds, 176 amphibians, 191 reptiles, and 475 butterflies) were analyzed. [USDA 2004a, p. 20]

Species richness (number of species) is highest in the Southeast and in the arid ecoregions of the Southwest (figure IV-5). Since the mid-1970s, trends in forest bird richness have been mixed.

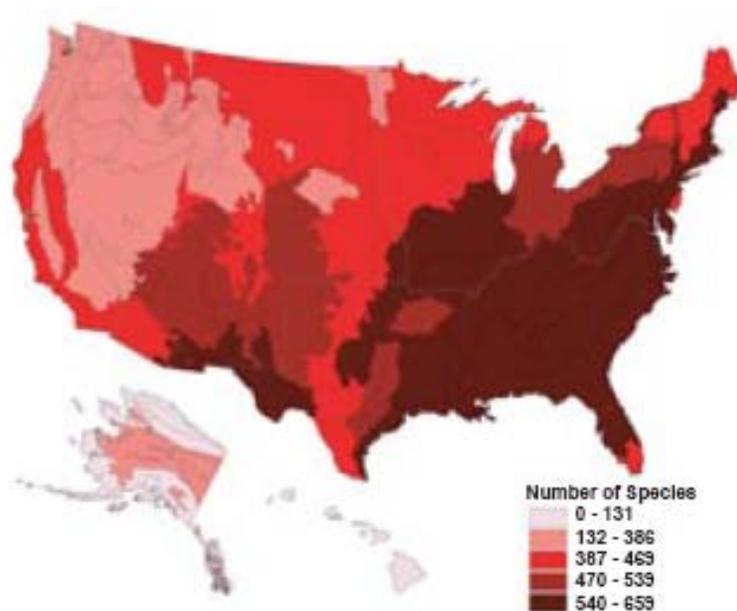


Figure IV-5 -- The number of tree and terrestrial animal species associated with forest habitats (Based on data provided by NatureServe and World Wildlife Fund.) [Id]

Ecoregions where forest bird richness has increased the greatest are found in the West and include the Great Basin, northern Rocky Mountains, northern mixed grasslands, and southwestern deserts (figure IV-6). Declining forest bird richness has primarily occurred in the East, with notable areas of decline in the Mississippi lowland forests, southeastern coastal plain, northern New England, southern and eastern Great Lakes forests, and central tall grass prairie.

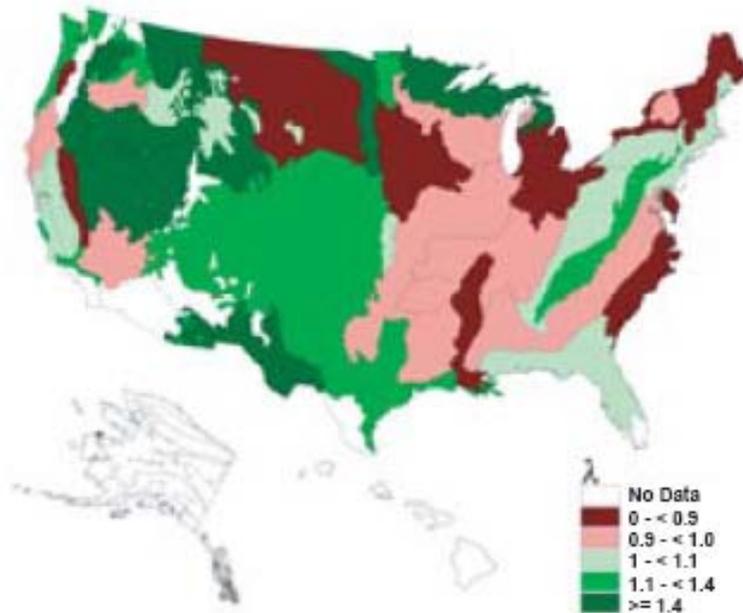


Figure IV-6 -- The estimated change in the number of forest associated bird species from 1975 to 1999. Change is measured as λ (1999 richness/1975 richness). Values of $\lambda > 1.0$ indicate increasing richness (green shades); values of $\lambda < 1.0$ indicate declining richness (red shades). (Data provided by NatureServe and the U.S. Geological Survey Biological Resources Division.) [Id]

Cumulatively mining and other human activities will continue to affect terrestrial species. Birds are particularly susceptible to land use changes. From the information presented, the richness of bird species is declining in some areas but is increasing in others. The reason why these changes are occurring is not known and the data is not readily available.

As we have discussed previously in this section, we anticipate that the four alternatives examined in detail in this EIS will have a negligible effect on mining production nationally or regionally. We do anticipate the proposed requirement to minimize the generation of excess spoil and adverse effects of excess spoil fills and coal processing waste facilities will have a slight beneficial effect on terrestrial species. Since there are many human activities that may impact terrestrial species, the cumulative effects of this slightly positive impact will be diluted and will be negligible.

The cumulative effects of the proposed Federal action and related actions on terrestrial fauna are shown in table IV-10.

Table IV-10 – Cumulative effects on terrestrial fauna

ACTION	PAST	PRESENT	FUTURE
Alternative 1- change excess spoil/coal waste/SBZ rules	Not applicable	Not applicable	Slight positive-reduced excess fill footprint in all states, alternative analysis for fills and coal waste facilities
Alternative 2- change excess spoil/SBZ rules	Not applicable	Not applicable	Slight positive-reduced excess fill footprint in all states, alternative analysis for fills
Alternative 3- change excess spoil rules	Not applicable	Not applicable	Slight positive-reduced excess fill footprint in all states, alternative analysis for fills
Alternative 4- change SBZ rule	Not applicable	Not applicable	None
SMCRA Title V Requirements Unaffected	Significant positive- implementing requirements to reduced sedimentation and toxic mine drainage	Significant positive- implementing requirements to reduced sedimentation and toxic mine drainage	Significant positive- implementing requirements to reduced sedimentation and toxic mine drainage
AML Program	Short term – adverse minor construction. Long term moderate positive- reclamation of adverse conditions	Short term – adverse minor construction. Long term moderate positive- reclamation of adverse conditions	Short term – adverse moderate increased construction. Long term significant positive- increased reclamation of adverse conditions
TMDL Program	Negligible	Negligible	Negligible
NPDES Program	Negligible	Negligible	Negligible
CWA 404 Program	Negligible	Negligible	Negligible
EWP Program	Negligible	Modest due to riparian zone easements	Modest due to riparian zone easements
Coal Mining Trends	Extreme negative short term-construction activities and changes in vegetative cover and water resources. Long term moderate – natural vegetation must compete with grasses	Extreme negative short term- construction activities and changes in vegetative cover and water resources. Long term minor – application of technology to promote trees and natural succession	Extreme negative short term- construction activities and changes in vegetative cover and water resources. Long term minor – application of technology to promote trees and natural succession
Forest Trends	Significant adverse-short term removal of trees. Long term moderate adverse forest recovery	Significant adverse-short term removal of trees. Long term moderate adverse forest recovery	Significant adverse-short term removal of trees. Long term moderate adverse forest recovery
Agriculture Trends	Significant adverse-Long term change in natural vegetation and habitat	Moderate adverse-decrease acreage and increased use of riparian zone easements allow corridor for terrestrial species	Moderate adverse-decrease acreage and increased use of riparian zone easements allow corridor for terrestrial species

Cumulative Effects on Threatened and Endangered Species

Threatened and endangered species are protected under the Endangered Species Act of 1973. As discussed earlier in section IV.B.4, coal mining has the potential to adversely affect threatened and endangered species and their habitat. However, the State and Federal SMCRA programs contain numerous statutory and regulatory requirements to ensure that these impacts don't occur. The U.S. Fish and Wildlife Service stated in the 1996 Biological Opinion and Conference Report that SMCRA and its implementing regulations set forth the programmatic standards and procedures designed to minimize mining-related impacts on fish and wildlife in general and threatened and endangered species in particular. [USFWS 1996, p.7]

Other programs and Federal activities are also designed to protect threatened and endangered species and their habitat. The U.S. Forest Service in their national report on sustainable forests examined the status of species at risk of not maintaining viable breeding populations as part of Indicator 7. They found that trend in species extinction since the turn of the 20th century varies by taxonomic group. Very few species of crustaceans, amphibians, or mammals, and no reptiles, have become extinct in the last 100 years (figure IV-7). Although birds are prominent on the list of extinct species, their numbers have remained fairly constant since the early 1900s. In contrast, the number of insects, mollusks, fish, and vascular plants considered extinct has increased over time. When considering only trees and terrestrial animals associated with forests, 15 percent are currently at risk of extinction. Proportionately, most of those at-risk, forest-associated species are amphibians, butterflies, and grasshoppers. The at-risk species associated with forest habitats are concentrated geographically in Hawaii, in the southeast, and on the west coast.

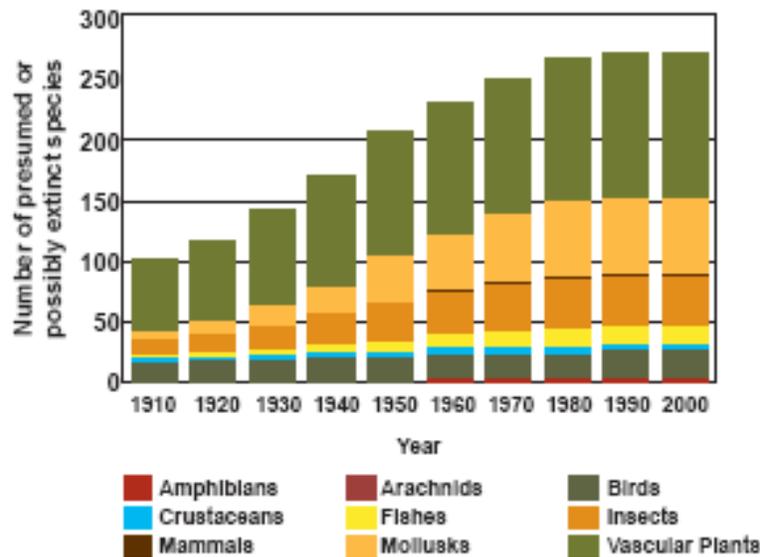


Figure IV-7 - Cumulative number of species that are considered to have become extinct since 1900 by taxonomic group. [Id]

10. Irreversible and Irretrievable Commitment of Resources

A resource is irreversibly committed when an action alters the resource so that it cannot be restored or returned to its original or pre-disturbance condition. A resource is irretrievably committed when it is removed or consumed. For example, in the surface mining of coal, the

removal of coal would be an irreversible and irretrievable commitment of resources. While the coal would be irreversibly committed from the geologic formations, it is also irretrievably committed when burned for electrical generation.

Another example of irreversible loss involves native soil loss or erosion. Soil losses from handling, erosion losses from topsoil stockpiles, and other unavoidable erosion losses of native soils would be irreversible. SMCRA requires that soil erosion and sedimentation be minimized and otherwise controlled to mitigate these effects to the maximum extent technologically feasible. Also, studies of reclaimed sites have shown that non-native mine soils, with time, become more like stable developed native soils.

The direct burial of stream segments by excess spoil or coal preparation waste is a long-term irretrievable commitment of resources for the buried stream segment. However, the CWA and SMCRA provisions are designed to assure that adverse impacts to aquatic resources are minimized and that significant degradation of the downstream watershed does not occur. Consequently, the effects of surface coal mining on aquatic resources are irreversible for a buried stream segment, but may produce varying levels of impact to the overall hydrologic regime depending on the watershed considered.

Impacts on terrestrial resources, such as forests and wildlife may be either permanent or temporary depending on the time frame considered. For instance, a mine site without reforestation as the post-mining land use may still result in a reversion to forestry through natural succession—despite the problems of excess compaction, lack of native seed sources across the reclaimed area, and other conditions hostile to reforestation. With sufficient time, although it may take hundreds of years, natural processes for mine soil improvement and succession can overcome conditions limiting reforestation, and the resource loss is not irreversible. Conversely, intensively managed reclaimed mine sites may never regain trees due to long-term use as industrial, residential, agricultural, or other non-forest uses. Reclamation techniques may exist to equal or exceed natural forest regeneration and productivity. In the cases where these techniques are applied, the loss of forest resource may be no less reversible than such losses are from timbering; and in some cases productivity gains may surpass forestation on native soils. Reclamation of mine sites to forest conditions (commercial or otherwise) may not reestablish wildlife habitat to pre-mining conditions. While no program can dictate post-mining land uses, many programs encourage and promote the tangible benefits for return of mined land to forest conditions so as to minimize and mitigate adverse effects.

While loss of individuals of certain species within the mined areas may be irreversible, individuals of other species may be mobile enough to relocate to adjacent interior forest tracts. The adjacent forest tracts, which include their own resident populations, may or may not be able to support the additional populations due to competition for habitat. Again, the reclamation methods employed and post-mining land uses selected will determine whether or not the loss of wildlife resources is irreversible. Researchers have debated the benefits and detriments of forest edge habitat versus forest interior habitat, centered on the concept of biodiversity. Studies have shown that a post mining change in habitat can provide transitional habitat for declining grassland species uncommon to forested ecosystems. Accordingly, a shift in wildlife resource species may be temporary in nature, as with the vegetative cover, and provide arguments both for and against irreversible change—depending on the viewpoint of the observer.

Environmental controls on surface coal mining and reclamation may render some coal resources irretrievable. Avoiding and minimizing valley fill stream impacts could make portions of coal seams recoverable only by inefficient methods or not feasible to recover at all. However, these effects may be temporary for some coal resource blocks if different mining methods become feasible or the coal market makes it economical to mine the reserves in compliance with environmental controls. That is, rising energy prices or new technology might allow reclamation techniques that currently cannot be performed within profit margins. The loss of these reserves would not have an immediate, irreversible effect on energy production, because sufficient coal

reserves exist elsewhere to meet current energy demands. However, long-term effects on energy production could occur, since rendering some surface mining coal reserves unminable could ultimately hasten reserve depletion when other coal sources dwindle.

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VII. Distribution List

Federal Agencies

Council on Environmental Quality
Federal Emergency Management Agency
Tennessee Valley Authority
U.S. Department of Agriculture: U.S. Forest Service
U.S. Department of Commerce
U.S. Department of Defense
U.S. Army Corps of Engineers:
 HQ, Washington, DC
 Huntington District
 Louisville District
 Nashville District
 Norfolk District Pittsburgh District

U.S. Department of Energy
U.S. Department of Homeland Security
U.S. Department of the Interior:
 Bureau of Land Management
 National Park Service
 U.S. Fish and Wildlife Service
 U.S. Geological Survey
U.S. Department of Justice
U.S. Department of Labor
U.S. Department of Transportation
Federal Highway Administration
U.S. Environmental Protection Agency
 Office of Federal Activities, Washington, DC
 Office of Water, Washington, DC
 Region III, Philadelphia, PA
 Region IV, Atlanta, GA

Other Agencies

Advisory Council on Historic Preservation
Interstate Commerce Commission

State Agencies

Alabama Department of Conservation & Natural Resources
Alabama Division of State Parks
Alabama Surface Mining Commission
Alaska Division of Mining and Water Management
Alaska Division of Parks & Outdoor Recreation
Arkansas Department of Natural Resources
Arkansas Department of Environmental Control
Arkansas Department of Finance and Administration
California Office of Planning and Research
California State Mining and Geology Board
Colorado State Parks
Colorado Division of Minerals & Geology
Georgia Department of Natural Resources
Georgia State Clearinghouse
Idaho Bureau of Minerals
Illinois Department of Commerce and Economic
Illinois Office of Mines & Minerals
Indiana Department of Natural Resources
Indiana Division of State Parks & Reservoirs
Iowa Department of Management
Iowa Mines & Minerals Bureau
Kansas Department of Health and Environment
Kentucky Department of Parks
Kentucky Department of Surface Mining Reclamation & Enforcement
Kentucky The Governor's Office for Local Development
Kentucky Natural Resources & Environment Protection Cabinet
Louisiana Department of Natural Resources
Maryland Department of the Environment
Maryland State Clearinghouse for Intergovernmental Assistance
Maryland Department of Natural Resources
Mississippi Department of Environmental Quality
Mississippi Department of Finance and Administration

Missouri Federal Assistance Clearinghouse
Montana Department of Environmental Quality
Montana Department of State Lands
Montana Division of Parks
New Mexico Mining & Minerals Division
North Dakota Department of Commerce
North Dakota Public Service Commission, Reclamation Division
Ohio Division of Mines & Reclamation
Ohio Division of Parks & Recreation
Ohio Environmental Protection Agency
Oklahoma Conservation Commission
Oklahoma Department of Mines
Oklahoma Division of State Parks
Oregon Mined Land Reclamation
Pennsylvania Bureau of Mining & Reclamation
Pennsylvania Bureau of State Parks
Pennsylvania Department of Conservation & Natural Resources
Pennsylvania Department of Environmental Protection
Tennessee, Office of the Governor
Tennessee Department of Environment & Conservation
Tennessee Valley Authority
Texas Division of Parks
Texas Governor's Office of Budget and Planning
Texas Railroad Commission
Utah Bureau of Land Management
Utah Department of Environmental Quality
Utah Division of Oil, Gas & Mining
Utah State Clearinghouse
Utah State Parks Recreation
Virginia State Parks & Recreation
Virginia Department of Conservation & Recreation
Virginia Department of Mines, Minerals & Energy
Washington State Park & Recreation Commission
West Virginia Department of Environmental Protection
West Virginia Development Office
West Virginia Division of Natural Resources
West Virginia State Parks & Forests Recreation
Wyoming Department of Natural Resources
Wyoming Department of Environmental Quality

Indian Tribes

Crow Tribe of Indians
Hopi Tribal Council
Northern Cheyenne
The Navajo Nation

Libraries

Kentucky

Middlesborough-Bell County Public Library, Middlesboro, KY
Boyd County Public Library, Ashland, KY
Breathitt County Public Library, Jackson, KY
Clark County Public Library, Winchester, KY
Clay County Public Library, Manchester, KY
Elliott County Public Library, Sandy Hook, KY

Floyd County Public Library, Prestonsburg, KY
GreenUp County Public Library, GreenUp, KY
Harlan County Public Library, Harlan, KY
Jackson County Public Library, McKee, KY Johnson County Public Library, Paintsville, KY
Knott County Public Library, Hindman, KY
Knox County Public Library, Barbourville, KY
Laurel County Public Library, London, KY
Lawrence County Public Library, Louisa, KY
Lee County Public Library, Beattyville, KY
Leslie County Public Library, Hyden, KY
Martin County Public Library, Inez, KY
McCreary County Public Library, Whitley City, KY
Menifee County Public Library, Frenchburg, KY
John F. Kennedy Memorial Public Library, West Liberty, KY
Owsley County Public Library, Booneville, KY
Perry County Public Library, Hazard, KY
Pike County Public Library District, Pikeville, KY
Powell County Public Library, Stanton, KY
Pulaski County Public Library, Somerset, KY
Rock Castle County Public Library, Mount Vernon, KY
Wayne County Public Library, Monticello, KY
Whitley County Public Library, Williamsburg, KY
Wolfe County Public Library, Campton, KY

Tennessee

Briceville Public Library, Briceville, TN
Clinton Public Library, Clinton, TN
Clinch-Powell Regional Library Center, Clinton, TN
Lake City Public Library, Lake City, TN
Betty Anne Jolly Norris Community Library, Norris, TN
Oak Ridge Public Library, Oak Ridge, TN
Altamont Public Library, Altamont, TN
Beersheba Springs Public Library, Beersheba Springs, TN
Coalmont Public Library, Coalmont, TN
Monteagle (May Justus Memorial Library), Monteagle, TN
Palmer Public Library, Palmer, TN
Tracy City Public Library, Tracy City, TN
Sequatchie County Public Library, Dunlap, TN
Jasper Public Library, Jasper, TN
Beene-Pearson Public Library, South Pittsburg, TN
Orena Humphreys Public Library, Whitwell, TN
Bledsoe County Public Library, Pikeville, TN
Barbara Reynolds Carr Memorial Library, Tazewell, TN
Caryville Public Library, Caryville, TN
Jacksboro Public Library, Jacksboro, TN
Jellico Public Library, Jellico, TN
LaFollette Public Library, LaFollette, TN
Huntsville Public Library, Huntsville, TN
Oneida Public Library, Oneida, TN
Winfield Public Library, Winfield, TN
Coalfield Public Library, Coalfield, TN
Deer Lodge Public Library, Deer Lodge, TN
Oakdale Public Library, Oakdale, TN
Petros Public Library, Petros, TN

Sunbright Public Library, Sunbright, TN
Wartburg Public Library, Wartburg, TN
Art Circle Public Library, Crossville, TN
Fentress County Public Library, Jamestown, TN

Virginia

Buchanan County Public Library, Grundy, VA
Wise County Public Library, Wise, VA
Russell County Public Library, Lebanon, VA
Tazewell County Public Library, Tazewell, VA
Scott County Public Library, Gate City, VA
Lee County Public Library, Pennington Gap, VA

West Virginia

Ansted Public Library, Ansted, WV
Boone - Madison Public Library, Madison, WV
Bradshaw Public Library, Davy, WV
Clay Co. Public Library, Clay, WV
Fort Gay Public Library, Fort Gay, WV
Gilbert Public Library, Gilbert, WV
Glasgow Public Library, Glasgow, WV
Graigsville Public Library, Graigsville, WV
Fayetteville Public Library, Fayetteville, WV
Fayette County Public Libraries, Oak Hill WV
Hamlin - Lincoln Co., Hamlin WV
Kanawha Co. Public, Charleston, WV
Kermit Public Library, Kermit, WV
Logan Area Public Library, Logan, WV
Mingo County Public Library, Delbarton, WV
McDowell County Public Library, Welch, WV
Oceana Public Library, Oceana, WV
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Organizations and Coal Industry

Alpha Natural Resources
Appalachian Center for the Economy and the Environment
Appalachian Citizens Law Center, Inc.
Audubon Society
Buckeye Forest Council
Charleston Gazette
Citizens Coal Council
Coal River Watch
Coalition for Health Concern
Colorado Mining Association
Dakota Resource Council
Earthjustice
Friends of the Cacapon River
Harvit & Schwartz, L.C.
Hoosier Environmental Council
Interstate Mining Compact Commission
Katuah Earth First!
Kentuckians for the Commonwealth
Kentucky Coal Association
Kentucky Conservation Committee
Kentucky Resource Council
Kentucky Riverkeeper
Kentucky Waterways Alliance
League of Women Voters of Tennessee
Main Island Watershed
Mountain Removal Road Show
Mountain State Justice, Inc.
Mountain Justice Summer
National Mining Association
National Parks Conservation Association – Southeast Region
National Trust for Historic Preservation
National Wildlife Federation
Ohio Mining & Reclamation Association
Ohio Valley Environmental Coalition
Powder River Basin Resource Council
Prairie Rivers Network
Save Our Cumberland Mountains
Sierra Club
 Headquarter, San Francisco, California
 Harvey Bloom Group
 Tennessee Chapter
 Upper Cumberland Group
 West Virginia Chapter
Tennessee Citizens for Wilderness Planning
Tennessee Clean Water Network
Tennessee Coal Association
The Alabama Environmental Council
The Kentucky Center
The Nature Conservancy
The Ohio Valley Coal Company
The Virginia Coal Association, Inc.
The West Virginia Highlands Conservancy
Trial Lawyers for Public Justice
Tri-State Citizen Mining Network & Mountain

United Mine Workers of America
United Mountain Defense
Virginia Mining Association
Virginia Organizing Project
Western Interstate Energy Board
West Virginia Citizen Action Group
West Virginia Coal Association
West Virginia Environmental Council
West Virginia Rivers Coalition
Western Slope Environmental Resource Council
Wild West Virginia

VIII. Glossary

Affected Environment: In the context of NEPA, the environment of the area(s) to be affected or created by the alternatives under consideration. (40 CFR 1502.15)

Alternative: A combination of management prescriptions applied in specific amounts and locations to achieve a desired management emphasis as expressed in goals and objectives. One of several policies, plans, or projects proposed for decision-making. An alternative need not substitute for another in all respects.

Alternative, No-Action: An alternative that maintains established trends or management direction.

Annual Plants: Plants living for only one growing season and then seeding to form the next generation.

Anthracite Coal: A hard, black lustrous coal containing a high percentage of fixed carbon and a low percentage of volatile matter. Commonly referred to as hard coal, it is mined in the United States, mainly in eastern Pennsylvania, although in small quantities in other states.

Approximate Original Contour (AOC): The surface configuration achieved by backfilling and grading of the mined area so that the reclaimed area, including any terracing or access roads, closely resembles the general surface configuration of the land prior to mining and blends into and complements the drainage pattern of the surrounding terrain, with all highwalls and spoil piles eliminated. SMCRA section 701(2). All mined areas are to be returned to AOC, unless they receive a variance from the AOC requirement. SMCRA sections 515(b)(3) and (c).

Approximate Original Contour (AOC) Variance: A regulatory authority may grant a variance or waiver from the requirement to restore a site to AOC if certain specified conditions are satisfied.

Aquifer: (a) A layer of geologic material that contains water. (b) A zone, stratum, or group of strata that can store and transmit water in sufficient quantities for a specific use.

Augering: A method of mining coal at a cliff or highwall by drilling holes into an exposed coal seam from the highwall and transporting the coal along an auger bit to the surface.

Backfill: Refilling an excavation. Also, the material placed in an excavation in the process of backfilling.

Bank Cubic Yards: The volume of overburden material in the ground before it has been excavated and expanded by swell.

Bench: Specific to surface mining, this refers to the floor(s) of mining excavation areas where

backfilling will occur.

Benthic: Relating to or occurring at the bottom of a body of water.

Best Technology Currently Available: Equipment, devices, systems, methods, or techniques which will (a) prevent, to the extent possible, additional contributions of suspended solids to stream flow or runoff outside the permit area, but in no event result in contributions of suspended solids in excess of requirements set by applicable State or Federal laws; and (b) minimize, to the extent possible, disturbances and adverse impacts on fish, wildlife and related environmental values, and achieve enhancement of those resources where practicable. The term includes equipment, devices, systems, methods, or techniques which are currently available anywhere as determined by the Director, even if they are not in routine use. The term includes, but is not limited to, construction practices, siting requirements, vegetative selection and planting requirements, animal stocking requirements, scheduling of activities and design of sedimentation ponds in accordance with 30 CFR parts 816 and 817. Within the constraints of the permanent program, the regulatory authority shall have the discretion to determine the best technology currently available on a case-by-case basis, as authorized by the Act and this chapter. (30 CFR 701.5)

Biological Diversity: The relative abundance of wildlife species, plant species, communities, habitats, or habitat features per unit of area.

Bituminous Coal: (1) Coal that ranks between subbituminous coal and anthracite and that contains more than 14 percent volatile matter (on a dry, ash-free basis) and has a calorific value of more than 11,500 Btu/lb (moist, mineral-matter-free) or more than 10,500 Btu/lb if agglomerating (ASTM). It is dark brown to black in color and burns with a smoky flame. Bituminous coal is the most abundant rank of coal; much is Carboniferous in age.

Blanket Drain: Porous zone of large rock formed beneath a valley fill by rolling segregation during wing dumping.

Box Cut: A mining cut excavated into the slope of a hillside, resulting in highwalls on three sides of the cut, or through a mountaintop or ridge crest, resulting in highwalls on two sides of the cut. This type of cut is used to initially open a hillside or mountaintop or ridge crest to all initiation of spoil casting by equipment or explosives.

BTU: British Thermal Unit - a measure of the heat content; the heat required to raise the temperature of one pound of water by one degree (F).

Buffer Zone: An area between two different land uses that is intended to resist, absorb, or otherwise preclude developments or intrusions between the two use areas.

Bulking Factor: The net expansion of overburden material resulting from excavation and subsequent backfilling, usually referred to in the mining industry as the swell factor.

Center Ditch: Rock-lined ditch used to carry runoff from the surface of a valley fill down its face to its toe.

CHIA, cumulative hydrologic impact assessment: Before a SMCRA permit can be approved, an assessment of the cumulative hydrologic impacts of all anticipated mining on the hydrologic balance in the cumulative impact area is performed. Before a SMCRA permit can be approved, the CHIA must find that the proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area. CHIA preparation is an integrated process which embodies a specific application of hydrologic information management at each step of the process. The scope of a CHIA may initially include all components of the ground water and surface-water systems in the cumulative impact area. This initial scope can be systematically and

logically reduced to those concerns of quantity and quality considered significant to maintaining the hydrologic balance of the area. The process focuses on those aspects of the hydrologic balance that are likely to affect designated uses of water. A sample outline is available at the Office of Surface Mining website: <http://www.osmre.gov//chiaint.htm>

Coal seam: A layer, vein, or deposit of coal.

Coal Mine Waste: Coal processing waste and underground development waste. (30 CFR 701.5)

Coal Processing Waste: Earth materials which are separated and wasted from the product coal during cleaning, concentrating, or other processing or preparation of coal. (30 CFR 701.5)

Contour Mining: Surface mining that progresses in a narrow zone following the outcrop of a coal seam in mountainous terrain, and in which the overburden, removed to gain access to the mineral commodity, is immediately placed in the previously mined area, so that reclamation is carried out contemporaneously with extraction.

Core Drain: Central column of porous large rocks in a valley fill formed by rolling segregation and convergence of materials at the valley fill center during wing dumping.

Council on Environmental Quality (CEQ): An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews federal programs for their effort on the environment, conducts environmental studies, and advises the President on environmental matters.

Cross Ridge Mining: Surface mining associated with ridges in steep slope terrain in which the entire coal is extracted by parallel cuts that progress perpendicular to topographic contour and spoil is returned to the mined out area to simulate the approximate premining topography.

Cultural Landscape: A cultural landscape is a geographic area, including both cultural and natural resources and the wildlife and domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values. There are four general types of cultural landscapes, not mutually exclusive: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes.

Cultural Resources: For purposes of historic preservation, all of the physical manifestations of archeology and history. Cultural resources include archeological sites, structures and objects significant to American history and prehistory. They may include battlefields, ships, places where treaties were signed, places of significant events. They are important for their representation of cultures, lifestyles, people, architecture, engineering, arts and events, or for the information they contain, or for associations they have with past people or events. Cultural resources are considered fragile and non renewable resources, because once they are removed, lost, or destroyed, they are gone forever.

Cumulative Impact: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (40 CFR 1508.7)

Cut: An excavation, generally applied to surface mining; to make an incision in a block of coal; in underground mining, that part of the face of coal that has been undercut.

Dendritic: The dendritic drainage pattern is characterized by irregular branching in all directions with the tributaries joining the main stream at all angles. Resembling the vein patterns in a tree leaf.

Disturbed Area: An area where vegetation, topsoil, or overburden is removed or upon which topsoil, spoil, coal processing waste, underground development waste, or noncoal waste is placed by surface coal mining operations. Those areas are classified as disturbed until reclamation is complete and the performance bond or other assurance of performance is released.

Durable Rock: Naturally formed aggregates that will not slake in water or degrade to soil material. Federal law provides that durable-rock fills must consist of at least 80 percent durable rock. (30 CFR 816.73 and 817.73)

Effects: Effects include direct effects and indirect effects. Direct effects are caused by the action and occur at the same time and place. Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. Effect and impacts . . . are synonymous. Effects includes ecological such as the effects on natural resources and on the components, structures and functioning of affected ecosystems, aesthetic, historic, cultural, economic, social or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if in balance the agency believes that the effect will be beneficial. (40 CFR 1508.8)

Endangered Species: Federally listed endangered species include any species of animal or plant in danger of extinction throughout all or a significant portion of its range; state (group I): species whose prospect of survival or recruitment in the state are in jeopardy in the foreseeable future; state (group II): species whose prospect of survival or recruitment within the state may become jeopardized in the near future.

Environmental Assessment (EA): A concise public document prepared to provide sufficient evidence and analysis for determining whether to prepare an Environmental Impact Statement or a Finding of No Significant Impact. An EA includes a brief discussion of the need for a proposal, the alternatives considered, the environmental impacts of the proposed action and alternatives, and a list of agencies and individuals consulted.

Environmental Impact Statement (EIS): A document prepared to analyze the impacts on the environment of a proposed project or action and released to the public for comment and review. An EIS must meet the requirements of NEPA, CEQ, and the directives of the agency responsible for the proposed project or action.

Ephemeral Stream: A stream which flows only in direct response to precipitation in the immediate watershed or in response to the melting of a cover of snow and ice, and which has a channel bottom that is always above the local water table. (30 CFR 701.5)

Excess Spoil: (1) Spoil in excess of that necessary to backfill and grade affected areas to the approximate original contour. The term may include box-cut spoil where it has been demonstrated for the duration of the mining operation, that the box-cut spoil is not needed to restore the approximate original contour. (2) Overburden material that is disposed of in a location other than the mine pit. (30 CFR 701.5)

Exotic: Those species that occupy habitats in which they did not evolve and in which they often have no natural enemies to limit their reproduction and spread--frequently at the expense of native plants and animals and, sometimes, of entire ecosystems. The words exotic, invasive, and non-indigenous are often used synonymously.

Face: The working surface of a coal seam where it is being excavated, usually applied to

underground mining. Also the front of the downstream end of a valley fill.

Factor of Safety: Engineering term expressed in a ratio, used to evaluate slope stability in valley fills with regard to rotational sliding and failure; greater values for a factor of safety indicate greater slope stability.

Fills: Fill structures that are created by the placement of excess spoil in valleys, on hill sides, or on preexisting benches. Although most excess-spoil fills are commonly referred to as valley fills, most mountaintop-removal and steep-slope mining operations today involve the construction of durable-rock fills. (30 CFR Sections 816.71 and 817.71)

Fines: Very fine-grained coal materials or dust typically generated as residue from coal processing facilities.

Flume: see Core Drain.

Forb: Any herbaceous plant that is not a grass or grass-like in nature; leafy soft-stemmed plants.

Fragipan: A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Fugitive Dust: The particulate matter not emitted from a duct or stack that becomes airborne due to the forces of wind or surface coal mining and reclamation operations or both. During surface coal mining and reclamation operations it may include emissions from haul roads; wind erosion of exposed surfaces, storage piles, and spoil piles; reclamation operations; and other activities in which material is either removed, stored, transported, or redistributed.

Glaciated: Said of an area that is: (1) scoured and worn down by glacial action, or strewn with ice-laid drift; or (2) covered by and subjected to the action of a glacier.

Glaciation: Alteration of the Earth's solid surface through erosion and deposition by glacier ice.

Groin Ditch: Rock-lined ditch used to carry runoff from slopes surrounding a valley fill to the toe of the valley fill.

Ground water: Subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated.

Haul Road: (1) A road built to carry heavily loaded trucks at a good speed. The grade is limited on this type of road and usually kept to less than 17 percent of climb in direction of load movement. (2) Road from pit to loading dock, tippie, ramp, or preparation plant used for transporting mined material by truck.

Head-of-Hollow Fill: A fill structure consisting of any materials, other than a coal processing waste or organic material, placed in the uppermost reaches of a hollow where side slopes of the existing hollow measured at the steepest point are greater than 20 degrees, or the average slope of the profile of the hollow from the toe of the fill to the top of the fill is greater than 10 degrees. In fills with less than 250,000 yd³ of material, associated with steep slope mining, the top surface of the fill will be at the elevation of the coal seam. In all other head-of-hollow fills, the top surface of the fill will be at approximately the same elevation as the adjacent ridge line, and no significant area of natural drainage will occur above the fill, draining into the fill areas.

Headwater: The source (or sources) and upper part of a stream, including the upper drainage

basin.

Herbaceous: Term for soft-stemmed grass and forb plant species.

Historic Property or Historic Resource: Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places. The term "eligible for inclusion in the national Register of Historic Places" includes both properties formally determined as such by the Secretary of the Interior and all other properties that meet the National Register listing criteria.

Highwall: The unexcavated face of exposed overburden and coal or ore in an opencast mine, or the face or bank on the uphill side of a contour strip mine excavation.

Highwall Limits: The maximum economical mining depth for a coal seam as established by its stripping ratio and market value.

Highwall Mining: Removal of coal from beneath a standing highwall without excavation of the overburden, using augers or continuous highwall mining machines.

Hydrologic Balance: The relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit such as a drainage basin, aquifer, soil zone, lake, or reservoir. It encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in ground and surface-water storage. (30 CFR 701.5)

Hydrology: The science that relates to the water systems of the earth, or the principles of water flow, or the presence of surface or ground water.

Impounding Structure: A dam, embankment or other structure used to impound water, slurry, or other liquid or semi-liquid material. (30 CFR 701.5)

Impoundments: All water, sediment, slurry or other liquid or semi-liquid holding structures and depressions, either naturally formed or artificially built. (30 CFR 701.5)

Interburden: Rock strata between two coal seams to be mined. Both interburden and overburden are often referred to collectively as overburden.

Intermittent Stream: (a) A stream or reach of a stream that drains a watershed of at least one square mile, or (b) A stream or reach of a stream that is below the local water table for at least some part of the year, and obtains its flow from both surface runoff and ground-water discharge. (30 CFR 701.5)

Invasive: Those species that colonize natural or semi-natural ecosystems, are agents of change, and threats to native biodiversity. The words exotic, invasive, and non-indigenous are often used synonymously.

Lentic: Non-flowing aquatic systems such as ponds.

Loose Cubic Yards: The volume of overburden material after it has been excavated.

Lotic: Flowing aquatic systems such as streams.

Metallurgical: Bituminous coal used in a beehive coke oven.

Mine Mouth: The entrance to a mine, or the point of shipping of raw coal from a surface or deep mine operation.

Mineral Extraction Area: Portion of a mine permit where coal will actually be extracted.

Mitigation: Mitigation includes: (a) Avoiding the impact altogether by not taking a certain action or parts of an action. (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation. (c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environments. (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action. (e) Compensating for the impact by replacing or providing substitute resources or environments. (40 CFR 1508.20)

Mountaintop Mining/Valley Fill (MTM/VF) Mining: Surface coal mining occurring on mountaintops, ridges, and other steep slopes (by definition those of 20 degrees or more). Removal of overburden from coal on mountaintop mining sites may result in generation of excess mine spoil in quantities that may not allow regrading of a mine site to its approximate original topographic contours or that must otherwise be disposed of to allow for regrading of a mine site to its approximate original topographic contours or that must otherwise be disposed of to allow for efficient and economical coal extraction. One method of disposing of this excess spoil is to place it in the heads of hollows or valleys of streams, a practice often referred to as valley fill. For the purposes of this EIS, steep slope surface coal mining operations that produce excess spoil and dispose of it in heads of hollows or valleys of streams shall be referred to collectively as mountaintop mining/valley fill (MTM/VF) operations, in recognition that repetitive discussion of individual mining methods would be cumbersome.

Mountaintop-Removal Operation: According to SMCRA, a type of surface-mining operation that extracts an entire coal seam or seams running through the upper fraction of a mountain, ridge, or hill. Coal extraction must be accomplished by removing all of the overburden and creating a level plateau or a gently rolling contour that both has no highwalls remaining and is capable of supporting certain postmining land uses.

Multiple Seam Mining: Surface mining in areas where several seams are recovered from the same hillside.

National Pollutant Discharge Elimination System (NPDES): The national program for issuing, modifying, revoking, and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318, and 40 of the CWA. (40 CFR 122.2)

Nationwide Permits: a type of general permit giving authorization under 33 CFR Part 330 for specified activities nationwide. If certain conditions are met, the activities can take place without the need for an individual or regional permit. (33 CFR 325.5(c) (2))

NEPA, The National Environmental Policy Act of 1969: Declares the national policy to encourage a productive and enjoyable harmony between man and his environment. Section 102 of that Act directs that "to the fullest extent possible: (1) The policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act, and (2) all agencies of the federal government shall insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations". (42 U.S.C. 4321-4347; See 33 CFR Part 325, Appendix B)

Ordinary High Water Mark: That line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas. (33 CFR 328.3(e))

Outcrop: (a) The part of a rock formation that appears at the surface of the ground. (b) A term

used in connection with a vein or lode as an essential part of the definition of apex. It does not necessarily imply the visible presentation of the mineral on the surface of the earth, but includes those deposits that are so near to the surface as to be found easily by digging. (c) The part of a geologic formation or structure that appears at the surface of the earth; also, bedrock that is earth's surface; to crop out.

Outslope: The face of the spoil or embankment sloping downward from the highest elevation to the toe. (30 CFR 701.5)

Overburden: Material of any nature, consolidated or unconsolidated, that overlies a coal deposit, excluding topsoil. (30 CFR 701.5)

Perennial Plants: Plants that live for more than one growing season.

Perennial Stream: A stream or part of a stream that flows continuously during all of the calendar year as a result of ground-water discharge or surface runoff. The term does not include intermittent streams or ephemeral streams.

Permit: Authorization to conduct surface coal mining and reclamation operations issued by the State regulatory authority pursuant to a State program or by the Secretary pursuant to a Federal program. For purposes of the Federal lands program, permit means a permit issued by the State regulatory authority under a cooperative agreement or by OSM where there is no cooperative agreement.

Permit Area: The area of land, indicated on the approved map submitted by the operator with his or her application, required to be covered by the operator's performance bond which includes the area of land upon which the operator proposes to conduct surface coal mining and reclamation operations under the permit, including all disturbed areas; provided that areas adequately bonded under another valid permit may be excluded from the permit area.

Probable Hydrologic Consequences (PHC): A determination of PHC consists of the following steps, repeated as many times as necessary to mitigate adverse impacts: Data collection; Characterization of the premining hydrologic balance; Prediction of mining disturbances; Design of measures to mitigate mining disturbances; and Documentation of residual impacts on the hydrologic balance remaining after implementation of mitigative measures. Any remaining unmitigated impacts must be documented in the PHC determination. The PHC determination process is intended to reduce the predicted adverse impacts on the hydrologic balance to an acceptable level. A sample outline for the PHC determination is available for downloading at <http://www.osmre.gov/hyphc.htm>.

Pit: In surface mining, the void left after removal of overburden to expose the coal in a cut.

Preparation Plant: A facility where coal is subjected to chemical or physical processing or cleaning, concentrating, or other processing or preparation. A preparation plant's facilities include, but are not limited to, the following: loading facilities; storage and stockpile facilities; sheds, shops, and other buildings; water-treatment and water-storage facilities; settling basins and impoundments; and coal processing and other waste disposal areas.

Production Equipment: Heavy equipment used for primary spoil movement and coal excavation, usually draglines, shovels, hydraulic excavators, or large loaders, the latter three working with haul trucks; also large dozers in the case of cast blasting.

Recovery Rate: The net percentage of the total coal in a reserve that is recovered by mining and not left in the ground. Can be applied either to the total reserve or to working areas within a reserve.

Relief: Difference in elevation between the highest mountaintop, ridge, or hill and the lowest valley within a permit area.

Required Findings: Specific findings that a regulatory authority must make prior to granting a mountaintop-removal or steep-slope AOC variance [Subsections 515(c) and (e) of SMCRA].

Reserve: That portion of the demonstrated coal reserve base that is estimated to be recoverable at the time of determination. The reserve is derived by applying a recovery factor to that component of the identified coal resource designated as the demonstrated reserve base.

Revegetation: Plants or growth that replaces original ground cover following land disturbance.

Runoff: That portion of the rainfall that is not absorbed by the deep strata, is used by vegetation or lost by evaporation, or that may find its way into streams as surface flow.

Scope: The range of actions, alternatives, and impacts to be considered in an environmental impact statement. The scope of an individual statement may depend on its relationships to other statements (40 CFR 1502.20 and 1508.28). To determine the scope of environmental impact statements, agencies shall consider three types of action, three types of alternatives, and three types of impacts. They include:

(a) Actions, other than unconnected single actions, which may be: 1) Connected actions, which means that they are closely related and therefore should be discussed in the same impact statement. Actions are connected if they: (i) Automatically trigger other actions which may require environmental impact statements. (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously. (ii) Are interdependent parts of a larger action and depend on the larger action for their justification. 2) Cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement. 3) Similar actions, which when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography. An agency may wish to analyze these actions in the same impact statement. It should do so when the best way to assess adequately the combined impacts of similar actions or reasonable alternatives to such actions is to treat them in a single impact statement.

(b) Alternatives, which include: 1) "No Action" alternative. 2) Other reasonable courses of actions. 3) Mitigation measures (not in the proposed action).

(c) Impacts, which may be: 1) Direct; 2) Indirect; 3) Cumulative.

(40 CFR 1508.25)

Sediment: Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.

Sediment Channel/Ditch: see Perimeter Ditch.

Sedimentation: The process of depositing sediments carried by water.

Sedimentation Pond: A reservoir for the confinement and retention of silt, gravel, rock, or other debris from a sediment-producing area.

Severance Tax: A tax levied against coal as it is mined, based either on the value of the coal or at a flat rate per ton, used to compensate federal, state, and sometimes local governments for the value of the portion of the reserve that is extracted.

Shrinkage Factor: Percent decrease in loose material volume resulting from backfilling and subsequent compression by overlying material.

Significantly: "Significantly" as used in NEPA requires consideration of both context and intensity:

- Context. This means that the significance of an action must be analyzed in several contexts, such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.
- Intensity. This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the federal agency believes that on balance the effect will be beneficial.
2. The degree to which the proposed action affects public health or safety.
3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, and wild and scenic rivers, or ecologically critical areas.
4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.
5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for the listing in the National Register of Historic Places, or may cause loss or destruction of significant scientific, cultural, or historic resources.
9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
10. Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment.

(40 CFR 1508.27)

Slake Durability: The ability of rock or spoil materials to resist dissolution or breakdown in water; used for assessing the suitability of spoil material for use in valley fill construction.

Soil: The unconsolidated mineral or organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. (ii) The unconsolidated mineral or organic matter on the surface of the earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including water and temperature effects), and macro- and microorganisms, conditioned by relief, acting on parent material over a period of time. A product-soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics. Please refer to <http://soils.usda.gov/> for detailed information regarding a specific soil taxa or regime.

Soil Horizons: Contrasting layers of soil parallel or nearly parallel to the land surface. Soil horizons are differentiated on the basis of field characteristics and laboratory data. The four master soil horizons are:

- (1) A horizon. The uppermost mineral layer, often called the surface soil, is the part of the soil in which organic matter is most abundant, and leaching of soluble or suspended particles is typically the greatest;

- (2) E horizon. The layer is commonly near the surface below an A horizon and above a B horizon. An E horizon is most commonly differentiated from an overlying A horizon by lighter color and generally has measurably less organic matter than the A horizon. An E horizon is most commonly differentiated from an underlying B horizon in the same sequum by color or higher value or lower chroma, by coarser texture, or by a combination of these properties;
- (3) B horizon. The layer that typically is immediately beneath the E horizon and often called the subsoil. This middle layer commonly contains more clay, iron, or aluminum than the A, E, or C horizons; and
- (4) C horizon. The deepest layer of soil profile consists of loose material or weathered rock that is relatively unaffected by biologic activity.

Special Handling: General term for methods of blending, isolation, or encapsulation of toxic materials within the backfill to prevent adverse impacts to chemical water quality.

Spoil Bank: An accumulation of overburden. Also, underground mine refuse piled outside.

Steep Slope: Any slope of more than 20 degrees or such lesser slope as may be designated by the regulatory authority after consideration of soil, climate, and other characteristics of a region or state. (30 CFR 701.5)

Steep-Slope Mining: Type of surface-mining operation where the natural slope of the land within the proposed permit area exceeds an average of 20 degrees.

Storage Capacity: The amount of water that can be store in a specific volume of rock.

Stratum: Geologic term for a sedimentary rock bed, plural strata.

Stripping Ratio: The unit amount of spoil or overburden that must be removed to gain access to a unit amount of coal. It is generally expressed in cubic yards of overburden to raw tons of mineral material.

Sub-Bituminous Coal: Coal of rank intermediate between lignite and bituminous. In the specifications adopted jointly by the American Society for Testing and Materials (D388-38) and the American Standards Association (M20 .1-1938), subbituminous coals are those with calorific values in the range 8,300 to 13,000 Btu's calculated on a moist, mineral-mater-free basis, which are both weathering and non-agglomerating according to criteria in the classification.

Support Areas: Portions of a mine permit that are maintained to support the production and development areas, such as haul roads, building facilities, and erosion and sedimentation control facilities.

Swell: The tendency of soils and bedrock, on being removed from their natural, compacted beds, to increase or swell owing to the creation of voids or spaces between soil or rock particles. The volumetric increase, normally expressed as a percentage that occurs as the consequence of changing undisturbed overburden (bank) into loose (excavated) material.

Swell Factor: The percentage increase in the volume of rock material as it is broken to form spoil, resulting from the creation of voids between the broken rock fragments that were not present in the original unbroken rock. Also used in industry as the equivalent to the term "bulking factor," or the net percentage increase between the volume of rock material and its resultant spoil after compaction in backfill.

Syncline: A fold in rocks in which the strata dip inward from both sides towards the axis.

Terrace: A level or nearly level plain, generally narrow in comparison with its length, from which

the surface slopes upward on one side and downward on the other side. Terraces and their bounding slopes are formed in a variety of ways, some being aggradational and others degradational.

Topsoil: The A, O, and E soil horizon layers of the four master soil horizons.

Toxic Material: Specific to coal mining, this includes overburden strata or coal materials that have been identified as containing materials that may result in adverse impacts to chemical water quality if exposed to air and water.

Underground Mining: Also known as deep mining, a process by which coal is extracted by excavating within the horizon of a coal seam and without removing the overlying overburden for reasons other than primary seam access.

Valley Fill: A fill structure consisting of any material other than coal waste and organic material that is placed in a valley where side slopes of the existing valley measured at the deepest point are greater than 20 degrees, or the average slope of the profile of the valley from the toe of the fill to the top of the fill is greater than 10 degrees.

Waters of the United States: Those waters included in this term pursuant to 33 CFR Part 328. For purposes of this EIS, OSM assumes that this term includes: intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds. Final authority regarding determinations as to the status of waters as "waters of the United States" pursuant to the Clean Water Act remains with the U.S. Environmental Protection Agency.

Wetland: Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. (Section 404 of the Clean Water Act) For resource mapping purposes, the FWS (Cowardin et al. 1979) has also defined wetlands as follows: Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) At least periodically, the land supports predominantly hydrophytes; (2) The substrate is predominantly undrained hydric soils; and (3) The substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

Wing Dumping: End dumping of spoil from haul trucks on opposite sides of a valley fill area to create blanket and core drains beneath the fill.

Zero-order stream: Swales and hollows that lack distinct stream banks but serve as conduits of water, sediment, nutrients, and other materials during rainstorms and snowmelt.