Exhibits A-D

To the Petition for Review of a decision by the Illinois Environmental Protection Agency, July 2, 2009
(Hillsboro Energy, L.L.C., Deer Run Mine)

Exhibit A:
Joint Request for a Public Hearing by Prairie Rivers Network and the Illinois Chapter of the Sierra Club, July 14, 2008

SIERRA CLUB
FOUNDED 1892

ILLINOIS CHAPTER
70 East Lake Street • Suite 1500 • Chicago, IL 60601

tel: 312.251.1680
fax:312.251.1780
web: illinois.sierraclub.org

Sent via regular mail and email to larry.crislip@illinois.gov

July 14, 2008

Larry D. Crislip
Illinois Environmental Protection Agency
Bureau of Water, Division of Water Pollution Control
Permit Section
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

Re: NPDES Permit No. IL0078727, Notice No. 4885c, Hillsboro Energy, L.L.C., Deer Run Mine, REQUEST FOR HEARING

Dear Mr. Crislip:

Prairie Rivers Network and the Illinois Chapter of Sierra Club request that a public hearing be held on the draft NPDES permit planned to be issued to Hillsboro Energy for discharges of alkaline mine drainages from the proposed new Deer Run Mine to be located east of the town of Hillsboro in Montgomery County, Illinois. The proposal includes 803.5 acres of surface development and a 4,786 acre shadow area for an underground coal mine. Members of our groups live and recreate in Montgomery County and depend on clean waters in streams and wetlands in the Shoal Creek watershed for activities including swimming, fishing, boating, birdwatching and other wildlife viewing. The proposed mine also encompasses land within the watershed of Hillsboro Lake, a source of drinking water for residents of the City of Hillsboro; the villages of Taylor Springs, Schram City and Coffeen; the Graham Correctional Institution and the Montgomery County Rural Water District.

Objections

As detailed below, we object to the issuance of this permit for the following reasons which are described in futher detail in the following paragraphs:

- No information about potential impacts on public water supplies is included in the NPDES permit factsheet although it appears that Outfall 005 from the coarse refuse disposal area drains to Hillsboro Lake and the mine shadow area clearly encompasses area that drains to Hillsboro Lake.[1]
- Issuance of the proposed NPDES permit will allow the development of surface facilities for underground long wall mining, complete coal extraction and land subsidence whose impacts have not been fully anticipated or addressed.
- Because the composition of the discharge has not been studied adequately, the discharges allowed by the permit may cause or contribute to a violation of state water quality standards in violation of 40 CFR §§122.4, 122.44(d) and 35 Ill. Adm. Code 302.105(c)(2)(B)(i),(ii), 304.105, 309.141(d) and 309.142.
- Illinois Antidegradation Rule, 35 Ill. Adm. Code 302.105 (c)(B)(iii) has also not been satisfactory addressed in that alternatives for minimizing increases in pollutant loadings (sulfate, chloride, iron, manganese, etc) have not been fully explored.

The proposed NPDES permit inadequately captures the impacts of the proposed mining activity. The surface facilities at this underground mine contains the incline slope to reach the coal seam, two vertical shafts, coal preparation plant, reclaim tunnels, rail loading loop, rail loadout, parking lots, access roads, drainage control structures, office buildings, change rooms, assembly rooms, warehousing facilities, administration building, storage facilities, elevator facilities, ventilation facilities, refuse disposal areas, overland conveyors, screens, crusher, power distribution facilities, power lines, water lines, parking lots, topsoil and subsoil stockpile areas. Seven sedimentation ponds are proposed as surface drainage controls. The draft permit states that all outfalls will drain to the Shoal Creek Watershed Structure No. 5, owned by the City of Hillsboro.The proposed permit fails to addess impacts to water quality likely to occur due to land subsidence caused by proposed longwall mining activities.

Potential Impacts on Drinking Water Resources

A major concern is Outfall 005, which drains the proposed coarse refuse disposal area (RDA). The permit notice states that this outfall drains to an unnamed tributary to Shoal Creek Watershed Structure No. 5. The map contained in the NPDES permit public notice is wholly inadequate for the public to be able to assess the impacts of the proposed mine on surface waters. It illustrates only the outfall locations without showing any detail of the many proposed surface coal mining facilities listed in the Construction Authorization No. 0006-08 found in the draft permit, including the location of the planned sedimentation ponds and the path of flow from them. However, on Map 6 Surface Facilities[2] provided by Hillsboro Energy in their permit application to the Illinois Dept. of Natural Resources Office of Mine and Minerals, it appears that this outfall drains to a tributary to Lake Hillsboro, a source of drinking water for residents of the City of Hillsboro; the villages of Taylor Springs, Schram City and Coffeen; the Graham Correctional Institution and the Montgomery County Rural Water District. Potential impacts of the proposed mine on the quality of water which serves as a drinking water source for residents is a critical issue that is not addressed in the public notice and should be discussed at a public hearing. In addition, the impacts of land subsidence in the Lake Hillsboro watershed on the quality and quantity of the water supply to the lake need to be addressed before the mine is granted any permits. See Map 8 Post-Subsidence, IDNR OMM Permit Application No. 399[3]

Impacts of Proposed Mine Inadequately Addressed

The proposed issuance of this NPDES permit is premature in that many deficiencies are present in Hillsboro Energy's application for a mining permit (Permit No. 399). On May 30, 2008 the Illinois Dept. of Natural Resources Office of Mine and Minerals (IDNR OMM) requested that the applicant address 61 areas of concern.[4] Without the modifications requested by IDNR OMM, the application does not comply with the requirements of the Illinois Surface Coal Mining Land Conservation and Reclamation Act. The deficiencies in the application include issues pertinent to the discharge of pollutants to Illinois waters from the proposed mine site. These include:

14. Questions about soil stockpile
15. Location of drain tiles in both the permit and shadow areas
17. Questions about industrial land on the site
18. Questions about the area of refuse disposal
20. Questions about the proposed refuse disposal area (RDA), including liners, sediment ponds and ditches, quality control/quality assurance measures such that permeability of 1×10^{-7} cm/sec is achieved throughout the liner.
21. Request to characterize surface and groundwater regimes in permit, shadow and adjacent areas, including the utilization of water for mine processes and impacts on the hydrological balance

22. Request to quantify seasonal variations in surface and groundwater regimes in the permit, shadow and adjacent areas, including descriptions of the streams present.
23. Characterization of groundwater, seeps, streams, ponds within the permit, shadow and adjacent areas.
24. Concerns regarding impacts of the mine on Lake Hillsboro, a drinking water source, from Outfall 005.
25. Questions about the water quality sampling protocols used by the applicant
26. Impacts on water-bearing strata
27. More information on potential acid/toxic forming materials and potentially alkaline producing materials requested
28. Questions about extent of groundwater use by residents in the area
29. Details of proposed NPDES sampling protocol requested
30. Questions about hydrologic impacts
31. More details on potential sources of contamination of surface and ground waters requested
32. Previous mining activities impacts on surface and ground water
33. How the applicant proposes to deal with the occurrence of acidic conditions
34. Contradictory statements about the quality of groundwater
35. Questions about groundwater quality data provided
36. Potential for stream flow alterations due to mining activities need to be addressed
37. Concerns about drainage from soil storage areas
38. Inadequate information provided for areas identified as future refuse storage areas
40. Concerns about roads and rail lines that do not drain to a sediment pond
42. Concerns about proposed coal slurry impoundment
44. Need to coordinate on IEPA and IDNR OMM concerns
45. Concerns about drainage flow directions
46. Description of measures to prevent coal and coal waste from entering streams requested
53. Impacts to the Upland Management Area (previously Cranfill Unit) of the Coffeen Lake Fish and Wildlife Area have been ignored.
55. Questions about planned monitoring of domestic and residential water supplies
56. Concerns about request for an exemption from conducting a survey of water supplies

In addition to the modifications requested by IDNR OMM above on the subject of hydrological impacts, we repeat the following concerns which the Sierra Club has previously raised to IDNR OMM about inadequacies in the permit application regarding impacts of the proposed mine on the hydrology of the area.[5]

> The permit application does not contain a complete and accurate hydrologic characterization of existing conditions in the proposed permit, shadow and potentially impacted adjacent areas (hereinafter, areas of concern). The permit application does not identify all of the important components of the ground- and surface water hydrology, natural and anthropogenic, in the areas of concern. When the permit application does identify such components, it does not individually characterize those components sufficiently to establish the existing seasonal variations in the quantity and quality of their water. Generally, the application does not quantify the existing directions and rates of water movement within, or existing exchanges among, components of the hydrology. In instances where such exchanges are described, the interpretation offered is inconsistent with the limited site data. The application does not quantify the existing seasonal variation in those rates and exchanges, or characterize the results of those exchanges. Hence, the permit application does not describe the existing hydrologic balance of the areas of concern.

The permit application does not contain complete and defendable predictions of the hydrologic conditions during- and post-mining in the areas of concern. The permit application does not identify all of the important future elements of the ground- and surface water hydrology, natural and anthropogenic, in the areas of concern. When the permit application does identify such components, it does not individually characterize those components sufficiently to predict reasonably the future seasonal variations in the quantity and quality of their water. The application does not quantify predictions of the future directions and rates of water movement within, or future exchanges among, components of the hydrology. The application does not quantify predictions of the future seasonal variation in those rates and exchanges, or characterize the results of those predicted exchanges. Hence, the permit application does not describe the future hydrologic balance of the areas of concern.

The permit application contains a summary of the probable hydrologic consequences that is inaccurate, incomplete, and erroneous. This is partially due to the inadequacies in the characterizations, as described above. It is also due, however, to poor understanding of geological, hydrogeological, and geochemical principles that will influence the hydrologic consequences of the proposed operations.

The permit application contains inadequate characterization of soil, rock, and water in the areas of concern to establish a reasonable list of constituents to be monitored for baseline and compliance monitoring under SMCRA. The constituents to be monitored appear to have been selected based upon the minimum lists provided in the application form and a presumption that the natural materials to be disturbed and the processing chemicals will contain no toxins, no toxic forming materials, and no sources of acidity other than pyritic sulfur. This list of constituents for monitoring needs to be established by demonstration relative to site-specific materials and processes that are part of a complete characterization, not by presumption.

The permit application contains inadequate ground- and surface water monitoring plans. Monitoring locations are inappropriately positioned and/or insufficient in number for both plans. The parameters being monitored are potentially inadequate, as discussed above. The plans do not include a description of how the monitoring data will be used or interpreted to demonstrate that damage to the hydrologic balance within the permit area is being minimized and material damage outside the permit area is being prevented. The plans do not establish limits, thresholds, or trends for each parameter, exceedence of which would trigger enforcement by the agency, citizens, or courts and remedial action. There is no description of remedial actions that would be triggered by such enforcement.

The permit application does not contain adequate descriptions of the materials, construction methods, and verification processes for building the "impervious" base for the coal storage area. The permit application does not contain a definition of what "impervious" means. The permit application does not appear to describe a comparable "impervious" base for the refuse storage area, an area that should be underlain by liners that will protect underlying groundwater resources.

The permit application does not contain adequate descriptions of the materials, construction methods, and verification processes for building the soil cover for the coarse refuse storage area.

The permit does not provide an assessment of the rates of water and oxygen infiltration through the soil cover, the rate of leachate generation, the composition of that leachate, the period of time that the leachate will continue to form, and the means by which that leachate will be monitored and managed for the period of its production.

The permit application does not provide any estimate or projection of the composition of the initial water quality in the coal to be mined, the rates of water production from the mine as mining progresses, the impacts of dewatering the mine (including pumping related to the mine entrance through the shallow sediments), or the changes in water quality as the mine and collapsed areas are subject to mine leakage and oxidation of roof and floor rocks. The permit application does not provide any estimate or any data relative to the head in the mine after pumping ceases and a post-mining equilibrium is reached. It does not provide any discussion or any data related to the final post-mining water composition. It does not provide any discussion or any data related to what that head and composition means with respect to other elements of the hydrologic balance and water resources in the areas of concern.

The permit application is inconsistent in its representation of length of the long-wall panels. Several of the maps represent the center panels as stopping before undermining occurs of the [prison?] and cemetery located at the western end of the shadow area. However, Map 4, which has a more current date, shows the panels as now extending under those features.

The permit application provides interpretations of groundwater flow patterns, hydraulic conductivities and groundwater quality in the unconsolidated section that are unsupported by data within the application, contradicted by data within the application, or inconsistent with acceptable methods of interpretation.

Proposed Permit Does Not Minimize Increases in Pollutant Discharges

The proposed permit allows for significant increases in discharges of mine-related pollutants compared to existing conditions. Attachment III.2.C.2 Baseline Surface Water Sample Site Data[6] shows that the current water quality in Shoal Creek Watershed Structure No. 5 is significantly better than the discharges to it authorized by the proposed permit.

	Existing Water Quality at Discharge Location D-1 (dam at Shoal Creek Watershed Structure No. 5) January – June 2007 monthly samples (min – max in mg/L)	Proposed Daily Maximum Concentration Limits (mg/L) Outfalls 001-005 (min-max permitted)
Iron, Total	0.402-3.04	6.0
Sulfate, Total	8-26	753-2100
Chloride	6-18	500-1000
Manganese, Total	0.1 – 0.688	1-3.8

Special Condition No. 11(b)(iii) only requires annual monitoring downstream of the proposed mine outfalls. We request that such monitoring be performed quarterly. We also request that such monitoring be performed on a quarterly basis in the tributary which feeds Lake Hillsboro. Map 6 Surface Facilities shows that the proposed coarse refuse disposal area and its sedimentation pond are located within 200 feet of the tributary. In addition to our concerns about the location of Outfall 005, we are concerned about

contaminants leaching out of the unlined pond through groundwater flows into the creek, which supplies drinking water for many residents of Montgomery County.

The Antidegradation Assessment asserts that 'sedimentation ponds...are the only option available to mines for controlling stormwater runoff'. A public hearing is needed to discuss other options we have become of aware of through our research on this issue as outlined below.

The proposed mining facility has failed to satisfy antidegradation regulations.
The state antidegradation regulations at 35 IAC 302.105(c) (2) require that all reasonable measures be taken to avoid or minimize increased pollutant loading. The applicant has not considered alternatives to the use of sedimentation ponds for treating runoff from raw and clean coal storage areas as well as other areas on the mine site, including a coal refuse storage area. Alternatives to sedimentation exist that could facilitate the avoidance or minimization of increased discharges of sulfates, chlorides, manganese, iron, mercury and suspended solids. In practice, sedimentation ponds only address dissolved pollutants like sulfates and chlorides by holding them until they can be discharged during a rain event when they can take advantage of the dilution. A short survey of experts and consultants in the field of mine wastewater treatment found the following opportunities to prevent unnecessary new pollution as our Tier 2 antidegradation policy requires. We request these alternatives be evaluated to "assure...all technically feasible and economically reasonable pollutant loading [be] incorporated into the proposed activity."

1) Filtration is a well-established method for removing suspended solids by passing wastewater through a filter bed composed of granular material. Filtration may also take the form of ultrafiltration or nanofiltration, in which a membrane or other semi-permeable device (such as a ceramic filter) is used as the filter medium. Filtration is commonly used in treating mine wastewater for the reduction of sediment, metals, sulfate, and cyanide, thallium and other contaminants. Nanofiltration mechanisms, designed to remove sulfate, are being applied at the Tyron copper mine in New Mexico[7] and have been developed cooperatively by Dow Chemical Company and Marathon Oil Company.[8]
2) Bioremediation is process in which microorganisms are used to treat pollutants. Bioremediation is extensively used in the treatment of acidity, sulfate, nutrients and cyanide.
3) Reverse Osmosis uses a driving force or pressure across a membrane to cause water to flow from the stronger solution to the weaker, effecting a separation of water from soluble contaminants. It is highly effective for removing soluble metals, including low to medium molecular weight ionic species, including nitrate, potassium, magnesium, chloride and sulfate. Recent advances in operation and membrane maintenance have made RO effective on cyanide and metals, including arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium, silver and zinc. RO has been used in the mining industry for the treatment of discharges containing cyanide and metals resulting from heap leach operations and tailings ponds, with removal efficiencies of greater than 95%.
4) Coagulation-Precipitation is a process by which coagulation removes ultra fine colloidal particles and metal ions by causing the particles to come into contact with each other and bind together, forming a precipitate of a size large enough for removal by filtration. In industrial applications, coagulation-precipitation is routinely used for the treatment of total suspended solids, and in specific cases can remove sulfate, nitrogen compounds, and metals, including arsenic, chromium and mercury. It is used to treat mining wastewater for sulfate (heavy density sludge) metal precipitates including arsenic, zinc and copper and also to treat wastewater containing cyanide.

5) Ion exchange removes unwanted ions from water by transferring them to a solid material, called an ion exchanger, which accepts them while giving back an equivalent number of desirable ions contained in the ion exchanger. In the simplest terms, water softening is a form of ion exchange in which sodium, from salt, is exchanged with the calcium responsible for water "hardness." Ion exchange has been used to treat mine wastewater for metals and nitrate removal. An example of this method being utilized for sulfate removal is at the Sierrita copper mine in Arizona.[9]
6) The Cost Effective Sulfate Removal (CESR) process was developed to address the shortcomings of other technologies used for sulfate removal. The CESR process is an extension of wastewater treatment with lime in that it can meet more stringent requirements for sulfate removal. Addition of the CESR reagent to lime-treated water precipitates sulfate as a nearly insoluble calcium-alumina-sulfate compound known as ettringite. Ettringite formation can also provide a polishing effect, allowing precipitation of difficult-to-remove metals such as chromium, arsenic, selenium and cadmium, often below their respective analytical detection limits. Boron, fluoride and up to 30 percent of the chloride and nitrate in water have also been removed. Metals and other constituents which the ettringite removes are typically not leachable, allowing disposal as a nonhazardous waste. Unlike treatment methods such as sodium aluminate addition, all of the chemicals added during the CESR process can be precipitated. Water treated by the CESR process typically meets or exceeds recommended drinking water standards for sulfate, metals and other parameters. The process produces a net reduction in total dissolved solids (TDS). Additional information is available at: http://www.wateronline.com/article.mvc/A-New-Process-For-Sulfate-Removal-From-Indust-0001?VNETCOOKIE=NO
7) The Supervac of (Supervac) Canada Inc.) is a system of high density solids transfer pumps that can recover collected solids from settling ponds and transfer them through a sealed pipeline up to 3,000 feet away for permitting disposal. This can be an effective, low-cost operation to lower the TSS in high solids content drainage water in typical mining operations.

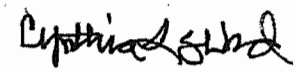
Questions

1. Has the Agency performed any review of the planned subsidence for Deer Run Mine within the 4,786 mine shadow area and its potential to change the discharge of pollutants in the waterways draining the mine shadow area?
2. Specifically, has the Agency considered the impacts of land subsidence on the water quality of McDavid Branch, which feeds Coffeen Lake State Fish & Wildlife Area?
3. Specifically, has the Agency considered the impacts of land subsidence on the water quality in the tributary which flows into Lake Hillsboro?
4. Can the Agency please provide a map that shows the route of flow of discharge from Outfall 005 to an unnamed tributary to Shoal Creek Watershed Structure No. 5 as is described in the public notice/factsheet for the proposed NPDES permit. The map provided in the public notice does not show any paths of flow from the outfalls within the map permit area. Map 6 Surface Facilities (from Hillsboro Energy application for permit no. 399, obtained from the IDNR OMM website) shows Outfall 005 at the NE corner of the coarse refuse disposal area, adjacent to the tributary which flows to Hillsboro Lake.
5. The Antidegradation Assessment states that runoff to Outfall 005 from the coal refuse storage area will receive treatment. Can the Agency please describe the nature of that treatment?

6. The Antidegradation Assessment states that 'management practices for minimizing sulfate formation and chloride leaching are available and will be encouraged'. What are this practices and why aren't they being required of the applicant in order to minimize pollutant loading?
7. How has the discharger and the agency determined exactly what metals and other pollutants will be contained in the discharge?
8. Why is no monitoring of manganese and mercury (subject to **Special Condition 13)** required for Outfalls 006 and 007?
9. Will discharges from mine dewatering be allowed under the proposed NPDES permit?

A public hearing is needed for residents of Montgomery County to make sure that their water quality, for drinking and recreational uses, is being protected and to allow information to be presented and discussed regarding the issues and questions discussed above. Thank you for this opportunity to raise our concerns with the Agency.

Sincerely,



Cynthia L. Skrukrud, Ph.D.
Clean Water Advocate

Phone: 815-675-2594
Email: cindy.skrukrud@sierraclub.org

Cc: Hillsboro Energy (comment letter with attachments 5, 7, 8 and 9)

Attachments

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[1] Public Notice No. P-2664, U.S. Army Corps of Engineers
[2] Map 6 Surface Facilities
[3] Map8 Post Subsidence
[4] Deer Run Mine Modification letter from IDNR OMM to Hillsboro Energy, May 30, 2008
[5] Sierra Club comments to IDNR OMM on Deer Run Mine Permit No. 399, March 31, 2008
[6] Attachment III.2.C.2 Baseline Surface Water Sample Site Data, p. 141 of IDNR OMM Permit Application No. 399
[7] Water Treatment as a Mitigation Method for Pit Lakes, Southwest Hydrology, Sept./Oct. 2002
[8] Sulfate Removal from Injected Water in Oilfield Operations (found at http://www.dow.com/liquidseps/prod/sp_oil.htm
[9] Sulphate removal demonstration plant using BioteQ's proprietary Sulf-IX ion-exchange technology (www.bioteq.ca)

Exhibit B:
Post-Hearing Comments of Prairie Rivers Network and Illinois Chapter of the Sierra Club, October 17, 2008

SIERRA CLUB
FOUNDED 1892

ILLINOIS CHAPTER
70 East Lake Street • Suite 1500 • Chicago, IL 60601

tel: 312.251.1680
fax:312.251.1780
web: illinois.sierraclub.org

Sent via email to kurt.neibergall@illinois.gov

October 17, 2008

Hearing Officer Kurt Neibergall #5
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

Re: Hillsboro Energy LLC, Deer Run Mine, Hillsboro, Montgomery County, IL
NPDES Draft Permit No. IL0078727

Dear Mr. Neibergall:

Prairie Rivers Network and the Illinois Chapter of Sierra Club are submitting these additional concerns and recommendations on the draft NPDES permit proposed to be issued to Hillsboro Energy for discharges of alkaline mine drainages from the planned new Deer Run Mine to be located east of the town of Hillsboro in Montgomery County, Illinois. These comments are follow-up to the issues and questions we raised in our initial comment letter of July 14, 2008 on the draft NPDES permit in which we requested that a public hearing be held and the points and questions raised by Sierra Club staff and volunteers at the public hearing held on September 17, 2008.

The proposal includes 803.5 acres of surface development and a 4,786 acre shadow area for an underground coal mine. Members of our groups live and recreate in Montgomery County and depend on clean waters in streams and wetlands in the Shoal Creek watershed for activities including swimming, fishing, boating, birdwatching and other wildlife viewing. The proposed mine also encompasses land within the watershed of Hillsboro Lake, a source of drinking water for residents of the City of Hillsboro; the villages of Taylor Springs, Schram City and Coffeen; the Graham Correctional Institution and the Montgomery County Rural Water District. Downstream, Shoal Creek supplies drinking water for residents including water users in Breese and the St. Rose Water District.

Objections

- Issuance of the proposed NPDES permit will allow the development of surface facilities for underground long wall mining, complete coal extraction and land subsidence whose impacts have not been fully anticipated or addressed.
- Because the composition of the discharge has not been studied adequately, the discharges allowed by the permit may cause or contribute to a violation of state water quality standards in violation of 40 CFR §§122.4, 122.44(d) and 35 Ill. Adm. Code 302.105(c)(2)(B)(i),(ii), 304.105, 309.141(d) and 309.142.
- Illinois Antidegradation Rule, 35 Ill. Adm. Code 302.105 (c)(B)(iii) has also not been satisfactory addressed in that alternatives for minimizing increases in pollutant loadings (sulfate, chloride, iron, manganese, etc) have not been fully explored.

Concerns

Biologically Significant Stream resources downstream need to be protected
On October 15, 2008 the Illinois Dept. of Natural Resources (IDNR) released biological stream ratings that combine, update, and enhance the two previous approaches for rating Illinois streams. The report *Integrating Multiple Taxa in a Biological Stream Rating System* can be found at: http://www.dnr.state.il.us/orc/BioStrmRatings/. The report identifies Biologically Significant Stream segments for which the Dept. of Natural Resources believes 'biological communities present much be protected at the stream reach, as well as upstream of the reach' (Report at p. 23). The attached map of Biologically Significant Streams shows that stream reaches in the Shoal Creek watershed account for a significant percentage of such rare, high quality stream resources in the state.[1] On the map, IDNR states "Stream segments identified as biologically significant are unique resources in the state and the biological communities present must by protected at the stream reach, **as well as upstream of the reach.**" (emphasis added) Runoff from the proposed Deer Run mine will be tributary to these important stream resources. Deterioration of the existing high quality aquatic community present in the Shoal Creek watershed must be prevented. (See 35 Ill. Adm. Code 302.105 (a))

Drinking water resources must be protected
Both surface and groundwater drinking water supplies need to be protected from pollution emanating from the proposed coal mining activity. These issuess were raised at the public hearing including concerns for downstream surface water resources by:

- Greg Rehkemper, Director, St. Rose Water District in Northern Clinton County who stated "one of our wells is drawn from an aquifer right out of Shoal Creek and at a galloning trade of about a million and a half to two million gallons a month, and we also buy water from Breese, Illinois which they use water right out of Shoal Creek, and we also buy about four million gallons from them on a monthly basis." (Transcript at p. 40-41)
- Ryan Payne who stated "Has anybody taken into account, you know, as that wind blows across that gob pile and those sediment areas and seems to blow back into the Big Four Creek area... Are we going to do anything into that Big Four area? That goes directly to our lakes and water supply.... We've decided from this area is where our slag pile is going to be at, our sediment areas.As that wind blows, it's going to blow in toward this creek. This creek feeds directly into our old lake, into one of our water supplies." (Transcript at p. 165-166)

In our Recommendations section below, we discuss additional treatment measures, ground and surface monitoring requirements, groundwater protection measures and dust minimization measures needed to address this concern. In addition, the impacts of land subsidence in the Lake Hillsboro watershed on the quality and quantity of the water supply to the lake need to be addressed before the mine is granted any permits.

Impact of seismic events on liners under coal slurry area and sedimentation basins
Seismologists have provided us with an estimated probability of 40% to 60% for the occurrence of a 6.5R earthquake happening in the New Madrid Fault (fault system extends 150 miles southward from Cairo, Illinois through New Madrid and Caruthersville, Missouri, down through Blytheville, Arkansas to Marked Tree, Arkansas) within the next 15 years. Their probability projections for the 6.5R earthquake is 93 % to 98 % within the next 50 years. Estimates for 6.5R earthquakes based on the actual seismic event occurrence is one to occur every 55 to 85 years. Looking at the last event in that range (6.2R) in 1895 and adding 85 years to that date, 6.5R activity should have presented itself during 1980. In fact, when

members of the Future Gen alliance chose Mattoon and Tuscola as finalists for the proposed clean coal power plant over sites in Southern Illinois, they cited the relative lack of seismic activity in central Illinois.

It is unclear how, if at all, the Agency has taken into consideration that environmental damage and threat to water quality that will result from the projected seismic activity. What controls and specifications have been considered in the 1) location of the coal slurry area and the sedimentation basins, and 2) the design of the liners for the coal slurry impoundment and sedimentation basins? Considering that Class I[2] and II resources are located beneath the Deer Run mine permit are, we are concerned that should such a catastrophe take place, the potable drinking water supply for thousands of residents would be forever contaminated and unavailable for use. Please provide an explanation as to what anticipated consequences have been considered and prevented or mitigated by the proposed permit requirements.

Previous water pollution by Hillsboro Energy parent company and subsidiaries
In light of prior violations of Williamson Energy, LLC, a subsidiary to Foresight Energy (also owners of Hillsboro Energy LLC), IL EPA should impose much more stringent permit terms and conditions on Hillsboro Energy, LLC.

The Illinois Environmental Protection Act authorizes the IL EPA to consider a permit applicant's past acts of non-compliance in making permit determinations. The Act states:

> "In making its determinations on permit applications under this section the Agency may consider prior adjudications of noncompliance with this Act by the applicant that involved a release of a contaminant into the environment. In granting permits, the Agency may impose reasonable conditions specifically related to the applicant's past compliance history with this Act as necessary to correct, detect, or prevent non-compliance."
> 415 ILCS 5/39(a).

A list of violations of subsidiaries of Foresight Energy between July 1, 2003 and June 1, 2006 is located in the Sugar Camp Mine application #382 to IDNR, on page 65. The list includes 31 violations in West Virginia and 4 violations in Illinois. All four of the Illinois Violations are water related violations of the Pond Creek permit # 275. The nature of the first Notice of Violation, number 28-1-05[3] was "Disturbed area drainage was leaving the permit area without passing through a siltation structure". The nature of the second Notice of Violation, number 37-5-05[4] was "Sedimentation Pond 001 is discharging prior to the department receiving a PE Certified as-built inspection report". The nature of the third Notice of Violation, number 37-6-05[5] was "Failure to submit quarterly groundwater monitoring reports for third quarter 2005." And finally, the nature of the forth Notice of Violation, number 37-1-06[6] was "Conducting mining activities on surface land not currently permitted".

IEPA should require more stringent requirements in the Deer Run permit in order to prevent such violations from occurring again. Proposals for additional monitoring and special conditions to be imposed in the NPDES permit are included in our Recommendations section below.

Recommendations

Proposed Permit Must Minimize Increases in Pollutant Discharges
Illinois Antidegradation Rule, 35 Ill. Adm. Code 302.105 (c)(2)(B)(iii) has not been satisfactory addressed in the draft NPDES permit in that alternatives for minimizing increases in pollutant loadings (sulfate, chloride, iron, manganese, etc) have not been fully explored. The state antidegradation regulations require that all reasonable measures be taken to avoid or minimize increased pollutant loading. The applicant has not considered alternatives to the use of sedimentation ponds for treating runoff from raw and clean coal storage areas as well as other areas on the mine site, including a coal refuse storage area. Alternatives to sedimentation exist that could facilitate the avoidance or minimization of increased discharges of sulfates, chlorides, manganese, iron, mercury, selenium, cadmium, other metals and suspended solids.

The attached memo from Carpenter Environmental Associates (CEA)[7] provides information on treatment opportunities for preventing unnecessary new pollution as our Tier 2 antidegradation policy requires. We request these alternatives be evaluated to "assure...all technically feasible and economically reasonable pollutant loading [be] incorporated into the proposed activity." 35 Ill. Adm. Code 302.105 (c)(2)(B)(iii). (Papers (without online access) referenced in the CEA memo are attached at [8], [9], [10], [11], [12], [13] and [14].)

Separate treatment basins from stormwater basins
The draft permit describes seven outfalls, all of which are from sedimentation ponds. As described in the antidegradation assessment, "The sedimentation ponds will treat runoff from raw and clean coal storage areas as well as other areas on the mine site. One outfall, 005, will consist of treated runoff from a coal refuse storage area." Later in the assessment, "Sedimentation ponds will be constructed using best management practices and are the only option available to mines for controlling stormwater runoff...Other alternatives do not exist for treatment or control of runoff from mine areas." We are unclear as to which purpose the basins will be designed: treatment or for controlling stormwater. We understand from the engineering perspective that a basin cannot be designed to serve in both capacities. Please see the following excerpt from Unit 9 of the Soil Erosion and Sedimentation Control Training Manual, available from the Michigan Department of Environmental Quality, Water Bureau at http://www.deq.state.mi.us/documents/deq-land-sesc-trainingmanual.pdf

THE DIFFERENCE BETWEEN STORM WATER BASINS AND SEDIMENTATION BASINS

It is important to draw a distinction between storm water basins and sedimentation basins. Storm water basins are permanent structures designed to replace the natural water storage of a site and provide some water quality improvement after the site is completed. Historically, the primary purpose of storm water basins was to reduce on-site and downstream flooding by controlling the rate of storm water discharge. Secondary benefits include water quality improvement such as sediment removal, aesthetics, and recreational opportunities. Many of these secondary benefits are now being incorporated into the design of storm water basins. However, it is important to remember that most storm water basins are not designed to remove sediment and they generally do not work well for that purpose.

Sedimentation basins are used during construction and are specifically designed to control off-site migration of sediment. The primary purpose of basins is to trap sediment and other coarse material. Secondary benefits can include controlling runoff and preserving the capacity of downstream reservoirs, ditches, diversions, waterways, and streams. Once construction is completed, sedimentation basins are often filled to match the final site grade or converted to function as storm water basins.

> It is imperative that the type of basin to be constructed is identified in the project-planning phase, i.e. sedimentation or storm water. There are distinct design criteria to achieve these different functions. If the intention is for a storm water basin to serve as a temporary sedimentation basin during construction, then the design criteria to maximize sediment settling must be incorporated in the initial design. Some storm water basins control higher design flows and allow smaller design flows to pass through. To be used as sedimentation basins, they would need to control the smaller flows as well. This unit describes sedimentation basin review criteria; other manuals should be consulted for the review and design of storm water basins.

We request the basins at the Deer Run site to be constructed according to the distinct design criteria required to achieve the desired function, either treatment to improve water quality through settling or control of stormwater runoff. In addition, all stormwater runoff from this industrial site should be controlled. We are concerned that Special Condition No. 10 indicates that the release of some stormwater from the site will not be controlled.

Increase frequency of sampling and number of pollutants to be monitored in surface waters

Given the quality of the biology present in the streams of the Shoal Creek watershed and concerns for the quality of surface waters that serve as drinking water supplies, we request that the surface water monitoring requirements in the NDPES permit be expanded. Specifically, we recommend that Special Condition No. 11(b)(iii) be revised to require quarterly monitoring of Central Park Creek (described as 'the unnamed tributary to Middle Fork Shoal Creek receiving the overflow from Shoal Creek Watershed Structure No. 5) and of the tributary on the mine site which feeds Lake Hillsboro (called Big Four Creek by Ryan Payne). Constituents that should be monitored include those listed on permit p. 16 at 12(b) with the exception of water elevation. We include Big Four Creek because it is tributary to Lake Hillsboro, backup water supply for the City of Hillsboro, and because of the concerns about fugitive dust from the surface coal mining activities contaminating the stream and potential for contaminated groundwater under the surface facilities of the mine migrating to the stream.

Because of the quality biological resources found in the Shoal Creek watershed, we also request that permit require the water in Shoal Creek Watershed Structure No. 5 undergo yearly Whole Effluent Toxicity (WET) testing.

Best Management Practices to prevent coal spillage and control dust should be required of Deer Run Mine

From an article in *Power Engineering International, May 1999*[15], we see that there are several ways in which fugitive dust can be controlled. Considering that fugitive dust control is under the jurisdiction of the Illinois EPA (as well as the Illinois Department of Natural Resources), we request that these opportunities to control and reduce fugitive dust at the Deer Run mining site be evaluated and considered for implementation in order to reduce the amount of pollutants running off and settling into waters of the state.

We are aware of several coal mining facilities in the United States that employ measures and mechanisms for controlling fugitive dust including the use of coal storage silos at Cordero Rojo Coal Mine, WY (Coal storage facilities consists of 65,400 T-capacity in six silos), Gibson County Coal in Princeton, IN (5,000 Ton Raw Coal Silo and 10,000 Ton Clean Coal Silo) and at the Cline Mining Corporation-owned New

Elk Coal Company in Colorado. The North Antelope Rochelle Mine, WY uses both plastic-enclosed conveyors and coal storage silos.

Best Management Practices discussed at the public hearing need to be incorporated into the NPDES permit

A number of best management practices (BMP) and ground and surface water protection measures which were discussed at the public hearing are not reflected in the conditions of the draft NPDES permit. We request that the following items be incorporated into the permit:

- We learned at the hearing that five of the seven proposed sedimentation ponds are to be lined, but Special Condition No. 7 does not contain any information on the required lining. According to Larry Crislip, "Sediment ponds that are receiving runoff from refuse area and coal stockpiles, they are also receiving compacted clay liners." (Transcript at p. 84) and "As I recall, the application indicates that any ponds receiving refuse or coal runoff will be lined, so basically, if you looked at our permit and take a look at the outfalls that get mercury monitoring, those likely are the ones that will be lined." (Transcript at p. 194).

  We request that Special Condition No. 7 be revised to describe the clay liners planned for sedimentation basins 001, 002, 003, 004 and 005 as well as the specifications for construction and testing of the compacted clay liners.

  In addition, we ask that the Agency re-evaluate the potential need for liners in the two other planned basins (or any additional basins installed as result of our recommendation above that separate basins for treatment and stormwater runoff management be incorporated into the site design) based on concerned raised by Joyce Blumenshine at the public hearing "that some surface runoff would be going into some of those unlined ponds that could contain either coal contaminants or other contaminants like oil, gasoline, other things from the mine site" (Transcript at p. 110)

- The Antidegradation Assessment states ""Management practices for minimizing sulfate formation and chloride leaching are available and will be encouraged." When this statement was discussed at the public hearing, Larry Crislip stated "We, of course, do encourage those, but they are incorporated into the basic operation of the facility the way they handle their refuse, their grading replacement, compaction of the material, grading such that no ponding water occurs on the refuse, it runs off as rapidly as possible, various handling procedures like that. They are not specifically maybe itemized, but it's just a best management practice that is implemented by the applicant through the drainage control process. As a follow-up, you indicate why they are not required, and we are currently giving some consideration to permit conditions regarding that issue." (Transcript at p. 123) We request that the described BMPs to be utilized at the mine site be incorporated in the NPDES permit as special conditions.

- As was discussed at the public hearing, we request that the constituents to be monitored quarterly per IDNR/OMM requirements in monitoring wells Nos. MW26S, MW27S, MW28, MW30, MW31, MW32, MW33, MW34 be listed in the permit (Draft Permit p. 16 @ 12(c)(ii)).

- As was discussed at the public hearing, we request that the parameters required to be sampled from the sedimentation ponds in Special Condition No. 7 be spelled out.

Thank you for this opportunity to share our additional concerns and recommendations with the Agency.

Sincerely,

Cynthia L. Skrukrud, Ph.D.
Clean Water Advocate

Phone: 815-675-2594
Email: cindy.skrukrud@sierraclub.org

Attachments

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[1] Biologically Significant Streams map
[2] IDNR on Class I Groundwater Deer Run Mine
[3] Williamson violations 28-5-01
[4] Williamson violations 37-5-05
[5] Williamson violations 37-6-05
[6] Williamson violations 37-1-06
[7] CEA No. 08047 Treatment Technologies for Coal Mine Runoff
[8] Acid Mine Drainage - Innovative Treatment Technologies
[9] DOE & NETL - The PassiveTreatment of Coal Mine Drainage
[10] Applications of Passive Treatment to Trace Metals Recovery
[11] Rapid Manganese Removal from Mine Waters Using an Aerated Packed-Bed Bioreactor
[12] Treatment Technology Summary for Critical Pollutants of Concern in Power Plant Wastewaters
[13] VSEP Filtration of Acid Mine Drainage
[14] VSEP Treatment of RO Reject from Brackish Well Water
[15] Fugitive dust control

Exhibit C:
Final NPDES Permit No. IL0078727

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 - (217) 782-2829
JAMES R. THOMPSON CENTER, 100 WEST RANDOLPH, SUITE 11-300, CHICAGO, IL 60601 - (312) 814-6026

DOUGLAS P. SCOTT, DIRECTOR

618/993-7200

May 29, 2009

Hillsboro Energy, L.L.C.
925 S. Main Street
Hillsboro, IL 62049

Re: Hillsboro Energy, L.L.C.
Deer Run Mine
NPDES Permit No. IL0078727
Final Permit (Modified After Public Notice)

Gentlemen:

Attached is the final NPDES Permit for your discharge. The Permit as issued covers discharge limitations, monitoring, and reporting requirements. Your failure to meet any portion of the Permit could result in civil and/or criminal penalties. The Illinois Environmental Protection Agency is ready and willing to assist you in interpreting any of the conditions of the Permit as they relate specifically to your discharge.

The Permit as issued was modified after public notice to incorporate the following:

1. Outfall effluent pages, Pages 2 through 9, reflect modifications to indicate the correct special conditions relative to mercury and receiving stream monitoring requirements as necessary due to redrafting and renumbering of such special conditions.

2. The effluent page for Outfall 007, Page 8, was modified to reduce sulfate and chloride effluent limits to the applicable water quality standard and eliminate allowed mixing for discharges from this outfall.

3. Construction Authorization No. 0006-08 was modified as follows:

   a. Page 14 reflects modifications to indicate that construction and utilization of Slurry Impoundment No. 1 is subject to Condition No. 12 (see 2c below).

   b. Page 14 reflects modifications to clarify that compacted clay liners will be constructed in Sedimentation Basins 001, 002, 003, 004 and 005.

   c. Page 14 reflects redrafted groundwater monitoring discussion which includes requirement for two (2) additional groundwater monitoring wells.

   d. Page 14 reflects correction to groundwater monitoring condition reference due to renumbering.

   e. Page 16, Condition No. 11(c), reflects modification to reference the Agency log number of the project identifying the Best Management Practices (BMP's) to be implemented.

   f. Page 16, Condition No. 12, has been added to restrict vertical expansion of Slurry Impoundment No. 1 beyond elevations currently approved without prior Agency approval.

Hillsboro Energy, L.L.C.
Deer Run Mine
NPDES Permit No. IL0078727
Final Permit (Modified After Public Notice)

g. Page 16, Condition No. 13, is re-numbered previous Condition No. 12, required due to inclusion of new Condition No. 12 as discussed in Item No. 2(f) above.

h. Page 16, Condition No. 13, reflects modification to include the list of parameters required for routine quarterly monitoring for wells not associated with coal refuse disposal operations.

i. Page 17, Condition No. 13(f), reflects modification to add second paragraph providing Permittee option of requesting utilization of alternate statistical analysis method if justified.

4. Original Special Condition No. 11 was redrafted and separated into special Condition Nos. 11 and 12, Pages 21 and 22, to clarify applicability of allowed mixing and receiving stream monitoring requirements.

5. Page 22, Special Condition No. 13, is re-numbered previous Special Condition No. 12, required due to redrafting of Special Condition No. 11 discussed in Item No. 3 above.

6. Page 22, Special Condition No. 14, is re-numbered previous Special Condition No. 13, required due to redrafting of Special Condition No. 11 discussed above. Special Condition No. 14 was also modified to clarify testing method to be utilized for mercury monitoring.

The Permit as issued is effective as of the date indicated on the first page of the Permit. You have the right to appeal any conditions of the Permit to the Illinois Pollution Control Board within a 35 day period following the issuance date.

Should you have questions concerning the Permit, please contact Larry D. Crislip, P.E., at 618/993-7200.

Respectfully,

ENVIRONMENTAL PROTECTION AGENCY

Ronald E. Morse, Manager
Mine Pollution Control Program
Bureau of Water

REM:LDC:jkb/4831c/04-02-09

Enclosure: Final Permit

cc: IDNR/Office of Mines and Minerals/Land Reclamation/with Enclosure
IDNR/Division of Water Resources/with Enclosure
Larry Crislip, Marion Region/Mine Pollution Control Program/with Enclosure
BOW/DWPC/CAS
BOW/DWPC/Records

NPDES Permit No. IL0078727

Illinois Environmental Protection Agency

Division of Water Pollution Control

1021 North Grand Avenue, East

P.O. Box 19276

Springfield, Illinois 62794-9276

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

New NPDES Permit

Expiration Date: April 30, 2014

Issue Date: May 29, 2009
Effective Date: May 29, 2009

Name and Address of Permittee:

Hillsboro Energy, L.L.C.
925 South Main Street
Hillsboro, IL 62049

Facility Name and Address:

Hillsboro Energy, L.L.C.
Deer Run Mine
1 mile southeast of Hillsboro, Illinois
(Montgomery County)

Discharge Number and Name:		Receiving waters
001, 003, 006	Alkaline Mine Drainage	Shoal Creek Watershed Structure No. 5
002, 004, 005, 007	Alkaline Mine Drainage	Unnamed tributary to Shoal Creek Watershed Structure No. 5

In compliance with the provisions of the Illinois Environmental Protection Act, Subtitle C and/or Subtitle D Rules and Regulations of the Illinois Pollution Control Board, and the Clean Water Act, the above-named permittee is hereby authorized to discharge at the above location to the above-named receiving stream in accordance with the standard conditions and attachments herein.

Permittee is not authorized to discharge after the above expiration date. In order to receive authorization to discharge beyond the expiration date, the permittee shall submit the proper application as required by the Illinois Environmental Protection Agency (IEPA) not later than 180 days prior to the expiration date.

Ronald E. Morse, Manager
Mine Pollution Control Program
Bureau of Water

REM:LDC:jkb/4885c/04-02-09

NPDES Coal Mine Permit

NPDES Permit No. IL0078727

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVERAGE	LOAD LIMITS lbs/day DAILY MAXIMUM	CONCENTRATION LIMITS mg/l 30 DAY AVERAGE	CONCENTRATION LIMITS mg/l DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
From the effective date of this Permit until the expiration date, the effluent of the following discharge shall be monitored and limited at all times as follows:						
Outfall*:	001 (Alkaline Mine Drainage)					
Flow (MGD)					Measure When Monitoring	
Total Suspended Solids			35.0	70.0	***	Grab
Iron (total)			3.0	6.0	***	Grab
pH**	The pH shall not be less than 6.0 nor greater than 9.0				1/month	Grab
Alkalinity/ Acidity	Total acidity shall not exceed total alkalinity				1/month	Grab
Sulfates				771	***	Grab
Chlorides				500	***	Grab
Manganese				1.0	3/month	Grab
Mercury				Monitor only (See Special Condition No. 14)		

*** There shall be a minimum of nine (9) samples collected during the quarter when the pond is discharging. Of these 9 samples, a minimum of one sample each month shall be taken during base flow conditions. A "no flow" situation is not considered to be a sample of the discharge. A grab sample of each discharge caused by the following precipitation event(s) shall be taken for the following parameters during at least 3 separate events each quarter. For quarters in which there are less than 3 such precipitation events resulting in discharges, a grab sample of the discharge shall be required whenever such precipitation event(s) occur(s). The remaining three (3) samples may be taken from either base flow or during precipitation event.

Discharges from the above referenced outfalls that are subject to the requirements of 35 Ill. Adm. Code 406.110 must meet the water quality standards for sulfates and chlorides in the receiving stream.

In accordance with 35 Ill. Adm. Code 406.110(a), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period less than or equal to the 10-year, 24-hour precipitation event (or snowmelt or equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b). The 10-year, 24-hour precipitation event for this area is considered to be 4.65 inches.

Pollutant or Pollutant Property	Effluent Limitations
Settleable Solids	0.5 ml/l daily maximum
pH**	6.0 - 9.0 at all times

In accordance with 35 Ill. Adm. Code 406.110(d), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period greater than the 10-year, 24-hour precipitation event (or snowmelt of equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b).

Pollutant or Pollutant Property	Effluent Limitations
pH**	6.0 - 9.0 at all times

* The Permittee is subject to the limitations, and monitoring and reporting requirements of Special Condition Nos. 7 and 12 for the discharge from Outfall 001 and Shoal Creek Watershed Structure No. 5 receiving such discharges.

** No discharge is allowed from any above referenced permitted outfall during "low flow" or "no flow" conditions in the receiving stream unless such discharge meets the water quality standards of 35 Ill. Adm. Code 302.204 for pH.

NPDES Coal Mine Permit

NPDES Permit No. IL0078727

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVERAGE	LOAD LIMITS lbs/day DAILY MAXIMUM	CONCENTRATION LIMITS mg/l 30 DAY AVERAGE	CONCENTRATION LIMITS mg/l DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
From the effective date of this Permit until the expiration date, the effluent of the following discharge shall be monitored and limited at all times as follows:						
Outfall*:	002 (Alkaline Mine Drainage)					
Flow (MGD)					Measure When Monitoring	
Total Suspended Solids			35.0	70.0	***	Grab
Iron (total)			3.0	6.0	***	Grab
pH**	The pH shall not be less than 6.0 nor greater than 9.0				1/month	Grab
Alkalinity/ Acidity	Total acidity shall not exceed total alkalinity				1/month	Grab
Sulfates				2100	***	Grab
Chlorides				1000	***	Grab
Manganese				3.8	3/month	Grab
Mercury				Monitor only (See Special Condition No. 14)		

*** There shall be a minimum of nine (9) samples collected during the quarter when the pond is discharging. Of these 9 samples, a minimum of one sample each month shall be taken during base flow conditions. A "no flow" situation is not considered to be a sample of the discharge. A grab sample of each discharge caused by the following precipitation event(s) shall be taken for the following parameters during at least 3 separate events each quarter. For quarters in which there are less than 3 such precipitation events resulting in discharges, a grab sample of the discharge shall be required whenever such precipitation event(s) occur(s). The remaining three (3) samples may be taken from either base flow or during precipitation event.

Discharges from the above referenced outfalls that are subject to the requirements of 35 Ill. Adm. Code 406.110 must meet the water quality standards for sulfates and chlorides in the receiving stream.

In accordance with 35 Ill. Adm. Code 406.110(a), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period less than or equal to the 10-year, 24-hour precipitation event (or snowmelt or equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b). The 10-year, 24-hour precipitation event for this area is considered to be 4.65 inches.

Pollutant or Pollutant Property	Effluent Limitations
Settleable Solids	0.5 ml/l daily maximum
pH**	6.0 - 9.0 at all times

In accordance with 35 Ill. Adm. Code 406.110(d), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period greater than the 10-year, 24-hour precipitation event (or snowmelt of equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b).

Pollutant or Pollutant Property	Effluent Limitations
pH**	6.0 - 9.0 at all times

* The Permittee is subject to the limitations, and monitoring and reporting requirements of Special Condition Nos. 7 and 11 for the discharge from Outfall 002 and unnamed tributary to Shoal Creek Watershed Structure No. 5 receiving such discharges.

** No discharge is allowed from any above referenced permitted outfall during "low flow" or "no flow" conditions in the receiving stream unless such discharge meets the water quality standards of 35 Ill. Adm. Code 302.204 for pH.

NPDES Coal Mine Permit

NPDES Permit No. IL0078727

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVERAGE	LOAD LIMITS lbs/day DAILY MAXIMUM	CONCENTRATION LIMITS mg/l 30 DAY AVERAGE	CONCENTRATION LIMITS mg/l DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
From the effective date of this Permit until the expiration date, the effluent of the following discharge shall be monitored and limited at all times as follows:						
Outfall*:	003 (Alkaline Mine Drainage)					
Flow (MGD)					Measure When Monitoring	
Total Suspended Solids			35.0	70.0	***	Grab
Iron (total)			3.0	6.0	***	Grab
pH**	The pH shall not be less than 6.0 nor greater than 9.0				1/month	Grab
Alkalinity/ Acidity	Total acidity shall not exceed total alkalinity				1/month	Grab
Sulfates				771	***	Grab
Chlorides				500	***	Grab
Manganese				1.0	3/month	Grab
Mercury				Monitor only (See Special Condition No. 14)		

*** There shall be a minimum of nine (9) samples collected during the quarter when the pond is discharging. Of these 9 samples, a minimum of one sample each month shall be taken during base flow conditions. A "no flow" situation is not considered to be a sample of the discharge. A grab sample of each discharge caused by the following precipitation event(s) shall be taken for the following parameters during at least 3 separate events each quarter. For quarters in which there are less than 3 such precipitation events resulting in discharges, a grab sample of the discharge shall be required whenever such precipitation event(s) occur(s). The remaining three (3) samples may be taken from either base flow or during precipitation event.

Discharges from the above referenced outfalls that are subject to the requirements of 35 Ill. Adm. Code 406.110 must meet the water quality standards for sulfates and chlorides in the receiving stream.

In accordance with 35 Ill. Adm. Code 406.110(a), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period less than or equal to the 10-year, 24-hour precipitation event (or snowmelt or equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b). The 10-year, 24-hour precipitation event for this area is considered to be 4.65 inches.

Pollutant or Pollutant Property	Effluent Limitations
Settleable Solids	0.5 ml/l daily maximum
pH**	6.0 - 9.0 at all times

In accordance with 35 Ill. Adm. Code 406.110(d), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period greater than the 10-year, 24-hour precipitation event (or snowmelt of equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b).

Pollutant or Pollutant Property	Effluent Limitations
pH**	6.0 - 9.0 at all times

* The Permittee is subject to the limitations, and monitoring and reporting requirements of Special Condition Nos. 7 and 12 for the discharge from Outfall 003 and Shoal Creek Watershed Structure No. 5 receiving such discharges.

** No discharge is allowed from any above referenced permitted outfall during "low flow" or "no flow" conditions in the receiving stream unless such discharge meets the water quality standards of 35 Ill. Adm. Code 302.204 for pH.

NPDES Coal Mine Permit

NPDES Permit No. IL0078727

Effluent Limitations and Monitoring

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From the effective date of this Permit until the expiration date, the effluent of the following discharge shall be monitored and limited at all times as follows:						
Outfall*:	004 (Alkaline Mine Drainage)					
Flow (MGD)					Measure When Monitoring	
Total Suspended Solids			35.0	70.0	***	Grab
Iron (total)			3.0	6.0	***	Grab
pH**	The pH shall not be less than 6.0 nor greater than 9.0				1/month	Grab
Alkalinity/ Acidity	Total acidity shall not exceed total alkalinity				1/month	Grab
Sulfates				753	***	Grab
Chlorides				542	***	Grab
Manganese				1.1	3/month	Grab
Mercury				Monitor only (See Special Condition No. 14)		

*** There shall be a minimum of nine (9) samples collected during the quarter when the pond is discharging. Of these 9 samples, a minimum of one sample each month shall be taken during base flow conditions. A "no flow" situation is not considered to be a sample of the discharge. A grab sample of each discharge caused by the following precipitation event(s) shall be taken for the following parameters during at least 3 separate events each quarter. For quarters in which there are less than 3 such precipitation events resulting in discharges, a grab sample of the discharge shall be required whenever such precipitation event(s) occur(s). The remaining three (3) samples may be taken from either base flow or during precipitation event.

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Settleable Solids	0.5 ml/l daily maximum
pH**	6.0 - 9.0 at all times

In accordance with 35 Ill. Adm. Code 406.110(d), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period greater than the 10-year, 24-hour precipitation event (or snowmelt of equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b).

Pollutant or Pollutant Property	Effluent Limitations
pH**	6.0 - 9.0 at all times

* The Permittee is subject to the limitations, and monitoring and reporting requirements of Special Condition Nos. 7 and 11 for the discharge from Outfall 004 and unnamed tributary to Shoal Creek Watershed Structure No. 5 receiving such discharges.

** No discharge is allowed from any above referenced permitted outfall during "low flow" or "no flow" conditions in the receiving stream unless such discharge meets the water quality standards of 35 Ill. Adm. Code 302.204 for pH.

NPDES Coal Mine Permit

NPDES Permit No. IL0078727

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVERAGE	LOAD LIMITS lbs/day DAILY MAXIMUM	CONCENTRATION LIMITS mg/l 30 DAY AVERAGE	CONCENTRATION LIMITS mg/l DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
From the effective date of this Permit until the expiration date, the effluent of the following discharge shall be monitored and limited at all times as follows:						
Outfall*:	005 (Alkaline Mine Drainage)					
Flow (MGD)					Measure When Monitoring	
Total Suspended Solids			35.0	70.0	***	Grab
Iron (total)			3.0	6.0	***	Grab
pH**	The pH shall not be less than 6.0 nor greater than 9.0				1/month	Grab
Alkalinity/ Acidity	Total acidity shall not exceed total alkalinity				1/month	Grab
Sulfates				1018	***	Grab
Chlorides				734	***	Grab
Manganese				1.3	3/month	Grab
Mercury				Monitor only (See Special Condition No. 14)		

*** There shall be a minimum of nine (9) samples collected during the quarter when the pond is discharging. Of these 9 samples, a minimum of one sample each month shall be taken during base flow conditions. A "no flow" situation is not considered to be a sample of the discharge. A grab sample of each discharge caused by the following precipitation event(s) shall be taken for the following parameters during at least 3 separate events each quarter. For quarters in which there are less than 3 such precipitation events resulting in discharges, a grab sample of the discharge shall be required whenever such precipitation event(s) occur(s). The remaining three (3) samples may be taken from either base flow or during precipitation event.

Discharges from the above referenced outfalls that are subject to the requirements of 35 Ill. Adm. Code 406.110 must meet the water quality standards for sulfates and chlorides in the receiving stream.

In accordance with 35 Ill. Adm. Code 406.110(a), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period less than or equal to the 10-year, 24-hour precipitation event (or snowmelt or equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b). The 10-year, 24-hour precipitation event for this area is considered to be 4.65 inches.

Pollutant or Pollutant Property	Effluent Limitations
Settleable Solids	0.5 ml/l daily maximum
pH**	6.0 - 9.0 at all times

In accordance with 35 Ill. Adm. Code 406.110(d), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period greater than the 10-year, 24-hour precipitation event (or snowmelt of equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b).

Pollutant or Pollutant Property	Effluent Limitations
pH**	6.0 - 9.0 at all times

* The Permittee is subject to the limitations, and monitoring and reporting requirements of Special Condition Nos. 7 and 11 for the discharge from Outfall 005 and unnamed tributary to Shoal Creek Watershed Structure No. 5 receiving such discharges.

** No discharge is allowed from any above referenced permitted outfall during "low flow" or "no flow" conditions in the receiving stream unless such discharge meets the water quality standards of 35 Ill. Adm. Code 302.204 for pH.

NPDES Coal Mine Permit

NPDES Permit No. IL0078727

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVERAGE	LOAD LIMITS lbs/day DAILY MAXIMUM	CONCENTRATION LIMITS mg/l 30 DAY AVERAGE	CONCENTRATION LIMITS mg/l DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
From the effective date of this Permit until the expiration date, the effluent of the following discharge shall be monitored and limited at all times as follows:						
Outfall*:	006 (Alkaline Mine Drainage)					
Flow (MGD)					Measure When Monitoring	
Total Suspended Solids			35.0	70.0	***	Grab
Iron (total)			3.0	6.0	***	Grab
pH**	The pH shall not be less than 6.0 nor greater than 9.0				1/month	Grab
Alkalinity/ Acidity	Total acidity shall not exceed total alkalinity				1/month	Grab
Sulfates				771	***	Grab
Chlorides				500	***	Grab

*** There shall be a minimum of nine (9) samples collected during the quarter when the pond is discharging. Of these 9 samples, a minimum of one sample each month shall be taken during base flow conditions. A "no flow" situation is not considered to be a sample of the discharge. A grab sample of each discharge caused by the following precipitation event(s) shall be taken for the following parameters during at least 3 separate events each quarter. For quarters in which there are less than 3 such precipitation events resulting in discharges, a grab sample of the discharge shall be required whenever such precipitation event(s) occur(s). The remaining three (3) samples may be taken from either base flow or during precipitation event.

Discharges from the above referenced outfalls that are subject to the requirements of 35 Ill. Adm. Code 406.110 must meet the water quality standards for sulfates and chlorides in the receiving stream.

In accordance with 35 Ill. Adm. Code 406.110(a), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period less than or equal to the 10-year, 24-hour precipitation event (or snowmelt or equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b). The 10-year, 24-hour precipitation event for this area is considered to be 4.65 inches.

Pollutant or Pollutant Property	Effluent Limitations
Settleable Solids	0.5 ml/l daily maximum
pH**	6.0 - 9.0 at all times

In accordance with 35 Ill. Adm. Code 406.110(d), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period greater than the 10-year, 24-hour precipitation event (or snowmelt of equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b).

Pollutant or Pollutant Property	Effluent Limitations
pH**	6.0 - 9.0 at all times

* The Permittee is subject to the limitations, and monitoring and reporting requirements of Special Condition Nos. 7 and 12 for the discharge from Outfall 006 and Shoal Creek Watershed Structure No. 5 receiving such discharges.

** No discharge is allowed from any above referenced permitted outfall during "low flow" or "no flow" conditions in the receiving stream unless such discharge meets the water quality standards of 35 Ill. Adm. Code 302.204 for pH.

NPDES Coal Mine Permit

NPDES Permit No. IL0078727

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVERAGE	LOAD LIMITS lbs/day DAILY MAXIMUM	CONCENTRATION LIMITS mg/l 30 DAY AVERAGE	CONCENTRATION LIMITS mg/l DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
From the effective date of this Permit until the expiration date, the effluent of the following discharge shall be monitored and limited at all times as follows:						
Outfall*:	007 (Alkaline Mine Drainage)					
Flow (MGD)					Measure When Monitoring	
Total Suspended Solids			35.0	70.0	***	Grab
Iron (total)			3.0	6.0	***	Grab
pH**	The pH shall not be less than 6.0 nor greater than 9.0				1/month	Grab
Alkalinity/ Acidity	Total acidity shall not exceed total alkalinity				1/month	Grab
Sulfates				967	***	Grab
Chlorides				500	***	Grab

*** There shall be a minimum of nine (9) samples collected during the quarter when the pond is discharging. Of these 9 samples, a minimum of one sample each month shall be taken during base flow conditions. A "no flow" situation is not considered to be a sample of the discharge. A grab sample of each discharge caused by the following precipitation event(s) shall be taken for the following parameters during at least 3 separate events each quarter. For quarters in which there are less than 3 such precipitation events resulting in discharges, a grab sample of the discharge shall be required whenever such precipitation event(s) occur(s). The remaining three (3) samples may be taken from either base flow or during precipitation event.

Discharges from the above referenced outfalls that are subject to the requirements of 35 Ill. Adm. Code 406.110 must meet the water quality standards for sulfates and chlorides in the receiving stream.

In accordance with 35 Ill. Adm. Code 406.110(a), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period less than or equal to the 10-year, 24-hour precipitation event (or snowmelt or equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b). The 10-year, 24-hour precipitation event for this area is considered to be 4.65 inches.

Pollutant or Pollutant Property	Effluent Limitations
Settleable Solids	0.5 ml/l daily maximum
pH**	6.0 - 9.0 at all times

In accordance with 35 Ill. Adm. Code 406.110(d), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period greater than the 10-year, 24-hour precipitation event (or snowmelt of equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b).

Pollutant or Pollutant Property	Effluent Limitations
pH**	6.0 - 9.0 at all times

* The Permittee is subject to the limitations, and monitoring and reporting requirements of Special Condition Nos. 7 and 12 for the discharge from Outfall 007 and unnamed tributary to Shoal Creek Watershed Structure No. 5 receiving such discharges.

** No discharge is allowed from any above referenced permitted outfall during "low flow" or "no flow" conditions in the receiving stream unless such discharge meets the water quality standards of 35 Ill. Adm. Code 302.204 for pH.

NPDES Coal Mine Permit

NPDES Permit No. IL0078727

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVERAGE	LOAD LIMITS lbs/day DAILY MAXIMUM	CONCENTRATION LIMITS mg/l 30 DAY AVERAGE	CONCENTRATION LIMITS mg/l DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
Upon completion of Special Condition 8 and approval from the Agency, the effluent of the following discharges shall be monitored and limited at all times as follows:						
Outfalls*:	001, 003, 006 (Reclamation Area Drainage)					
Flow (MGD)					Measure When Monitoring	
Settleable Solids				0.5 ml/l	1/month	Grab
pH**	The pH shall not be less than 6.0 nor greater than 9.0				1/month	Grab
Sulfates				771	1/month	Grab
Chlorides				500	1/month	Grab

In addition to the above base flow sampling requirements, a grab sample of each discharge caused by the following precipitation event(s) shall be taken (for the following parameters) during at least 3 separate events each quarter. For quarters in which there are less than 3 such precipitation events resulting in discharges, a grab sample of the discharge shall be required whenever such precipitation event(s) occur(s).

Discharges from the above referenced outfalls that are subject to the requirements of 35 Ill. Adm. Code 406.110 must meet the water quality standards for sulfates and chlorides in the receiving stream.

In accordance with 35 Ill. Adm. Code 406.110(d), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period greater than the 10-year, 24-hour precipitation event (or snowmelt of equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b). The 10-year, 24-hour precipitation event for this area is considered to be 4.65 inches.

Pollutant or Pollutant Property	Effluent Limitations
pH**	6.0 - 9.0 at all times

* The Permittee is subject to the limitations, and monitoring and reporting requirements of Special Condition No. 12 for the discharge from Outfalls 001, 003, 006 and Shoal Creek Watershed Structure No. 5 receiving such discharges.

** No discharge is allowed from any above referenced permitted outfall during "low flow" or "no flow" conditions in the receiving stream unless such discharge meets the water quality standards of 35 Ill. Adm. Code 302.204 for pH.

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NPDES Permit No. IL0078727

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVERAGE	LOAD LIMITS lbs/day DAILY MAXIMUM	CONCENTRATION LIMITS mg/l 30 DAY AVERAGE	CONCENTRATION LIMITS mg/l DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
Upon completion of Special Condition 8 and approval from the Agency, the effluent of the following discharges shall be monitored and limited at all times as follows:						
Outfalls*:	002, 007 (Reclamation Area Drainage)					
Flow (MGD)					Measure When Monitoring	
Settleable Solids				0.5 ml/l	1/month	Grab
pH**	The pH shall not be less than 6.0 nor greater than 9.0				1/month	Grab
Sulfates				967	1/month	Grab
Chlorides				500	1/month	Grab

In addition to the above base flow sampling requirements, a grab sample of each discharge caused by the following precipitation event(s) shall be taken (for the following parameters) during at least 3 separate events each quarter. For quarters in which there are less than 3 such precipitation events resulting in discharges, a grab sample of the discharge shall be required whenever such precipitation event(s) occur(s).

Discharges from the above referenced outfalls that are subject to the requirements of 35 Ill. Adm. Code 406.110 must meet the water quality standards for sulfates and chlorides in the receiving stream.

In accordance with 35 Ill. Adm. Code 406.110(d), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period greater than the 10-year, 24-hour precipitation event (or snowmelt of equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b). The 10-year, 24-hour precipitation event for this area is considered to be 4.65 inches.

Pollutant or Pollutant Property	Effluent Limitations
pH**	6.0 - 9.0 at all times

* The Permittee is subject to the limitations, and monitoring and reporting requirements of Special Condition No. 11 for the discharge from Outfall 002 and Special Condition No. 12 for the discharge from Outfall 007 and unnamed tributary to Shoal Creek Watershed Structure No. 5 receiving such discharges.

** No discharge is allowed from any above referenced permitted outfall during "low flow" or "no flow" conditions in the receiving stream unless such discharge meets the water quality standards of 35 Ill. Adm. Code 302.204 for pH.

NPDES Coal Mine Permit

NPDES Permit No. IL0078727

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVERAGE	LOAD LIMITS lbs/day DAILY MAXIMUM	CONCENTRATION LIMITS mg/l 30 DAY AVERAGE	CONCENTRATION LIMITS mg/l DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
Upon completion of Special Condition 8 and approval from the Agency, the effluent of the following discharges shall be monitored and limited at all times as follows:						
Outfall*:	004 (Reclamation Area Drainage)					
Flow (MGD)					Measure When Monitoring	
Settleable Solids				0.5 ml/l	1/month	Grab
pH**	The pH shall not be less than 6.0 nor greater than 9.0				1/month	Grab
Sulfates				693	1/month	Grab
Chlorides				500	1/month	Grab

In addition to the above base flow sampling requirements, a grab sample of each discharge caused by the following precipitation event(s) shall be taken (for the following parameters) during at least 3 separate events each quarter. For quarters in which there are less than 3 such precipitation events resulting in discharges, a grab sample of the discharge shall be required whenever such precipitation event(s) occur(s).

Discharges from the above referenced outfalls that are subject to the requirements of 35 Ill. Adm. Code 406.110 must meet the water quality standards for sulfates and chlorides in the receiving stream.

In accordance with 35 Ill. Adm. Code 406.110(d), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period greater than the 10-year, 24-hour precipitation event (or snowmelt of equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b). The 10-year, 24-hour precipitation event for this area is considered to be 4.65 inches.

Pollutant or Pollutant Property	Effluent Limitations
pH**	6.0 - 9.0 at all times

* The Permittee is subject to the limitations, and monitoring and reporting requirements of Special Condition No. 11 for the discharge from Outfall 004 and unnamed tributary to Shoal Creek Watershed Structure No. 5 receiving such discharges.

** No discharge is allowed from any above referenced permitted outfall during "low flow" or "no flow" conditions in the receiving stream unless such discharge meets the water quality standards of 35 Ill. Adm. Code 302.204 for pH.

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Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVERAGE	LOAD LIMITS lbs/day DAILY MAXIMUM	CONCENTRATION LIMITS mg/l 30 DAY AVERAGE	CONCENTRATION LIMITS mg/l DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
Upon completion of Special Condition 8 and approval from the Agency, the effluent of the following discharges shall be monitored and limited at all times as follows:						
Outfall*:	005 (Reclamation Area Drainage)					
Flow (MGD)					Measure When Monitoring	
Settleable Solids				0.5 ml/l	1/month	Grab
pH**	The pH shall not be less than 6.0 nor greater than 9.0				1/month	Grab
Sulfates				693	1/month	Grab
Chlorides				500	1/month	Grab

In addition to the above base flow sampling requirements, a grab sample of each discharge caused by the following precipitation event(s) shall be taken (for the following parameters) during at least 3 separate events each quarter. For quarters in which there are less than 3 such precipitation events resulting in discharges, a grab sample of the discharge shall be required whenever such precipitation event(s) occur(s).

Discharges from the above referenced outfalls that are subject to the requirements of 35 Ill. Adm. Code 406.110 must meet the water quality standards for sulfates and chlorides in the receiving stream.

In accordance with 35 Ill. Adm. Code 406.110(d), any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period greater than the 10-year, 24-hour precipitation event (or snowmelt of equivalent volume) shall comply with the following limitations instead of those in 35 Ill. Adm. Code 406.106(b). The 10-year, 24-hour precipitation event for this area is considered to be 4.65 inches.

Pollutant or Poliutant Property	Effluent Limitations
pH**	6.0 - 9.0 at all times

* The Permittee is subject to the limitations, and monitoring and reporting requirements of Special Condition No. 11 for the discharge from Outfall 005 and unnamed tributary to Shoal Creek Watershed Structure No. 5 receiving such discharges.

** No discharge is allowed from any above referenced permitted outfall during "low flow" or "no flow" conditions in the receiving stream unless such discharge meets the water quality standards of 35 Ill. Adm. Code 302.204 for pH.

NPDES Coal Mine Permit

NPDES Permit No. IL0078727

Effluent Limitations and Monitoring

PARAMETER	LOAD LIMITS lbs/day 30 DAY AVERAGE	LOAD LIMITS lbs/day DAILY MAXIMUM	CONCENTRATION LIMITS mg/l 30 DAY AVERAGE	CONCENTRATION LIMITS mg/l DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
Upon completion of Special Condition 9 and approval from the Agency, the effluent of the following discharges shall be monitored and limited at all times as follows:						
	Outfalls:	001, 002, 003, 004, 005, 006, 007 (Stormwater Discharge)				
Settleable Solids				0.5 ml/l	1/Year	Grab
pH*	The pH shall not be less than 6.0 nor greater than 9.0				1/Year	Grab

Storm water discharge monitoring is subject to the following reporting requirements:

Analysis of samples must be submitted with second quarter Discharge Monitoring Reports.

If discharges can be shown to be similar, a plan may be submitted by November 1 of each year preceding sampling to propose grouping of similar discharges and/or updated previously submitted groupings. If updating of a previously submitted plan is not necessary, a written notification to the Agency, indicating such is required. Upon approval from the Agency, one representative sample for each group may be submitted.

Annual storm water monitoring is required for all discharges until Final SMCRA Bond is released and approval to cease such monitoring is obtained from the Agency.

* No discharge is allowed from any above referenced permitted outfall during "low flow" or "no flow" conditions in the receiving stream unless such discharge meets the water quality standards of 35 Ill. Adm. Code 302.204 for pH.

NPDES Permit No. IL0078727

Construction Authorization No. 0006-08

C.A. Date: May 20, 2008

Authorization is herby granted to the above designee to construct and operate the mine and mine refuse area described as follows:

An underground mine containing a total of 803.5 acres, as described and depicted in IEPA Log No. 0006-08 (OMM Permit No. 399) located in Sections 7, 8, 17 and 18, Township 8 North, Range 3 West, Montgomery County, and Section 12 and 13, Township 8 North, Range 4 West, 3rd P.M., Montgomery County, Illinois.

The surface facilities at this underground mine contains the incline slope to reach the coal seam, two vertical shafts, coal preparation plant, reclaim tunnels, rail loading loop, rail loadout, parking lots, access roads, drainage control structures, office buildings, change rooms, assembly rooms, warehousing facilities, administration building, storage facilities, elevator facilities, ventilation facilities, refuse disposal areas, overland conveyors, screens, crusher, power distribution facilities, power lines, water lines, parking lots, topsoil and subsoil stockpile areas.

Surface drainage control is provided by seven (7) sedimentation ponds with discharges designated as Outfalls 001, 002, 003, 004, 005, 006 and 007, all classified as alkaline mine drainage.

Location and receiving stream of the Outfalls at this facility is as follows:

Outfall Number	Latitude			Longitude			Receiving Waters
	DEG	MIN	SEC	DEG	MIN	SEC	
001	39°	08'	51"	89°	28'	26"	Shoal Creek Watershed Structure No. 5 to unnamed tributary to Middle Fork Shoal Creek
002	39°	08'	45"	89°	28'	07"	Unnamed tributary to Shoal Creek Watershed Structure No. 5 tributary to Middle Fork Shoal Creek
003	39°	08'	43"	89°	28'	23"	Shoal Creek Watershed Structure No. 5 to unnamed tributary to Middle Fork Shoal Creek
004	39°	08'	25"	89°	28'	18"	Unnamed tributary to Shoal Creek Watershed Structure No. 5 tributary to Middle Fork Shoal Creek
005	39°	08'	16"	89°	27'	21"	Unnamed tributary to Shoal Creek Watershed Structure No. 5 tributary to Middle Fork Shoal Creek
006	39°	08'	32"	89°	28'	25"	Shoal Creek Watershed Structure No. 5 to unnamed tributary to Middle Fork Shoal Creek
007	39°	08'	46"	89°	28'	08"	Unnamed tributary to Shoal Creek Watershed Structure No. 5 tributary to Middle Fork Shoal Creek

Coarse and fine coal refuse disposal is approved in the eastern portion of the permit area as depicted in IEPA Log No. 0006-08-D. Foundation preparation for this disposal area shall consist of construction of a compacted four (4) foot clay liner. Construction, development and utilization of Slurry Impoundment No. 1 is subject to Condition 12. Such clay liner shall be constructed in six (6) to eight (8) inch soil lifts with compacted effort on each lift sufficient to achieve a permeability of $1X10^{-7}$ cm/sec or less. Specifications for construction and testing of the compacted clay liner is contained in IEPA Log No. 0006-08-C.

In addition to the refuse disposal areas, compacted clay liners as described above will also be constructed in Sedimentation Basins 001, 002, 003, 004 and 005, which receive pumpage and/or runoff from coal stockpiles or coal refuse disposal activities.

Areas designated for "future" refuse disposal in IEPA Log No. 0006-08-D are not currently approved. Coal refuse may not be disposed in these designated areas until such time that plans and specifications addressing foundation preparation and groundwater monitoring are submitted to and approved by this Agency.

Groundwater monitoring for this facility will consist of the following:

a. Twelve (12) existing and/or proposed monitoring wells identified as Well Nos. MW22, MW23, MW24S, MW25S, MW26S, MW27S, MW28, MW30, MW31, MW32, MW33 and MW34 as depicted in IEPA Log No. 0006-08.

b. Two (2) additional monitoring wells with one well to be located downgradient of both Sedimentation Basin 001 and 003. Such additional wells shall be located between the basins and permit boundary in the vicinity of the outfall and/or discharge channel with the screened interval located in the first water-bearing zone encountered in excess of 10 feet below ground surface. Within 30 days following installation of these wells, a location map, well identification and well boring logs shall be submitted to the Agency.

Monitoring Well Nos. MW22, MW23, MW24S and MW25S will monitor effects of the initial refuse disposal area. Groundwater monitoring requirements are outlined in Condition No. 13.

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C.A. Date: May 20, 2008

The abandonment plan shall be executed and completed in accordance with 35 Ill. Adm. Code 405.109.

All water remaining upon abandonment must meet the requirements of 35 Ill. Adm. Code 406.202. For the constituents not covered by Parts 302 or 303, all water remaining upon abandonment must meet the requirements of 35 Ill. Adm. Code 406.106.

This Authorization is issued subject to the following Condition(s). If such Condition(s) require(s) additional or revised facilities, satisfactory engineering plan documents must be submitted to this Agency for review and approval to secure issuance of a Supplemental Authorization to Construct.

1. If any statement or representation is found to be incorrect, this permit may be revoked and the permittee thereupon waives all rights thereunder.

2. The issuance of this permit (a) shall not be considered as in any manner affecting the title of the premises upon which the mine or mine refuse area is to be located; (b) does not release the permittee from any liability for damage to person or property caused by or resulting from the installation, maintenance or operation of the proposed facilities; (c) does not take into consideration the structural stability of any units or parts of the project; and (d) does not release the permittee from compliance with other applicable statutes of the State of Illinois, or with applicable local laws, regulations or ordinances.

3. Final plans, specifications, application and supporting documents as submitted by the person indicated on Page 1 as approved shall constitute part of this permit and are identified by Log Nos. 0006-08 and 0006-08-C in the records of the Illinois Environmental Protection Agency.

4. There shall be no deviations from the approved plans and specifications unless revised plans, specifications and application shall first have been submitted to the Illinois Environmental Protection Agency and a supplemental permit issued.

5. The permit holder shall notify the Environmental Protection Agency (217/782-3637) immediately of an emergency at the mine or mine refuse area which causes or threatens to cause a sudden discharge of contaminants into the waters of Illinois and shall immediately undertake necessary corrective measures as required by 35 Ill. Adm. Code 405.111. (217/782-3637 for calls between the hours of 5:00 p.m. to 8:30 a.m. and on weekends.)

6. The termination of an NPDES discharge monitoring point or cessation of monitoring of an NPDES discharge is not authorized by this Agency until the permittee submits adequate justification to show what alternate treatment is provided or that untreated drainage will meet applicable effluent and water quality standards.

7. Initial construction activities in areas to be disturbed shall be for collection and treatment facilities only. Prior to the start of other activities, surface drainage controls shall be constructed and operated to avoid violations of the Act or Subtitle D. At such time as runoff water is collected in the sedimentation pond, a sample shall be collected and analyzed, with the results sent to this Agency. Should additional treatment be necessary to meet the standards of 35 Ill. Adm. Code 406.106, a Supplemental Permit must be obtained. Discharge from this pond is not allowed unless applicable effluent standards of Subtitle D are met at the basin discharge(s).

8. This Agency must be informed in writing and an application submitted if drainage, which was previously classified as alkaline (pH greater than 6.0), becomes acid (pH less than 6.0) or ferruginous (base flow with an iron concentration greater than 10 mg/l). The type of drainage reporting to the basin should be reclassified in a manner consistent with the applicable rule of 35 Ill. Adm. Code 406 as amended in R84-29 at 11 Ill. Reg. 12899. The application should discuss the treatment method and demonstrate how the discharge will meet the applicable standards.

9. A permittee has the obligation to add a settling aid if necessary to meet the suspended solids or settleable solids effluent standards. The selection of a settling aid and the application practice shall be in accordance with a. or b. below.

   a. Alum ($Al_2(SO_4)_3$), hydrated lime ($Ca(OH)_2$), soda ash (Na_2CO_3), alkaline pit pumpage, acetylene production by-product (tested for impurities), and ground limestone are acceptable settling aids and are hereby permitted for alkaline mine drainage sedimentation ponds.

   b. Any other settling aids such as commercial flocculents and coagulants are permitted only on prior approval from the Agency. To obtain approval a permittee must demonstrate in writing to the Agency that such use will not cause a violation of the toxic substances standard of 35 Ill. Adm. Code 302.210 or of the appropriate effluent and water quality standards of 35 Ill. Adm. Code parts 302, 304, and 406.

NPDES Permit No. IL0078727

Construction Authorization No. 0006-08

C.A. Date: May 20, 2008

10. A general plan for the nature and disposition of all liquids used to drill boreholes shall be filed with this Agency prior to any such operation. This plan should be filed at such time that the operator becomes aware of the need to drill unless the plan of operation was contained in a previously approved application. After settling, recirculation water which meets the requirements of 35 Ill. Adm. Code 406.106 and 406.202, may be discharged. The use of additives in the recirculation water which require treatment other than settling to comply with the Act will require a revised permit.

11. Any of the following shall be a violation of the provisions required under 35 Ill. Adm. Code 406.202:

    a. It is demonstrated that an adverse effect on the environment in and around the receiving stream has occurred or is likely to occur.

    b. It is demonstrated that the discharge has adversely affected or is likely to adversely affect any public water supply.

    c. The Agency determines the permittee is not utilizing Best Management Practices (BMP's) identified in IEPA Log No. 0006-08-F which are applicable in order to minimize the discharge of total dissolved solids, chloride, sulfate, iron and manganese.

12. Slurry Impoundment No. 1 shall be constructed as proposed in IEPA Log No. 0006-08-D. The surface pool elevation of the slurry impoundment shall not exceed approximately 626.5 ft. msl as proposed. Any deviation and/or modification of the proposed design of Slurry Impoundment No. 1 shall consider potential impacts to the compacted clay liner and shall be approved by the Agency prior to such deviation and/or modification being implemented.

13. Groundwater monitoring requirements for the OMM Permit No. 399 area as approved under IEPA Log No. 0006-08 are as follows:

    a. Groundwater monitoring shall consist of existing and/or proposed Well Nos. MW22, MW23, MW24S, MW25S, MW26S, MW27S, MW28, MW30, MW31, MW32, MW33 and MW34, and two (2) additional wells located downgradient of both Sedimentation Basin 001 and 003.

    b. Ambient background monitoring shall be performed for all wells identified in 13(a) above. Such ambient monitoring shall consist of six (6) samples collected during the first year (approximately bi-monthly) following well installation but no later than during the first year of facility operation to determine ambient background concentrations. Background monitoring shall include the following list of constituents:

Aluminum	Fluoride	Sulfate
Antimony	Iron (dissolved)	Thallium
Arsenic	Iron (total)	Total Dissolved Solids
Barium	Lead	Vanadium
Beryllium	Manganese (dissolved)	Zinc
Boron	Manganese (total)	pH
Cadmium	Mercury	Acidity
Chloride	Molybdenum	Alkalinity
Chromium	Nickel	Hardness
Cobalt	Phenols	Water Elevation
Copper	Selenium	
Cyanide	Silver	

    c. Following the ambient monitoring as required under 13(b) above, routine monitoring shall continue on a quarterly basis as follows:

        i. Monitoring Well Nos. MW22, MW23, MW24S and MW25S, associated with refuse disposal shall continue to be monitored quarterly for the contaminants identified in 13(b) above.

ii. Monitoring Well Nos. MW26S, MW27S, MW28, MW30, MW31, MW32, MW33, MW34 and the two (2) additional wells downgradient of Basins 001 and 003 shall be monitored quarterly as required by IDNR/OMM for the following list of constituents:

Iron (dissolved)	Hardness
Iron (total)	Acidity
Manganese (dissolved)	Alkalinity
Manganese (total)	pH
Sulfate	Water Elevation
Total Dissolved Solids	

d. Groundwater monitoring reports shall be submitted in accordance with the following schedule.

January, February, March	May 1
April, May, June	August 1
July, August, September	November 1
October, November, December	February 1

e. Two copies of all groundwater monitoring reports shall be submitted to the following address:

Illinois Environmental Protection Agency
Mine Pollution Control Program, Permits
2309 West Main Street, Suite 116
Marion, IL 62959

Should electronic filing of groundwater monitoring data be elected, electronic notification shall be provided to the Agency upon submittal of groundwater data to IDNR/OMM.

f. A statistically valid representation of background water quality required under Condition 13(b) above shall be submitted utilizing the following method. This method shall be used to determine the upper 95 percent confidence limit for each parameter listed above.

Should the Permittee that an alternate statistical method would be more appropriate based on the data being evaluated, the Permittee may request utilization of such alternate methodology. Upon approval from the Agency, the alternate methodology may be utilized to determine a statically valid representation of background water quality.

This method should be used to predict the confidence limit when single groundwater samples are taken from each monitoring (test) well.

i. Determine the arithmetic mean ($\overline{X}_b$) of each indicator parameter for the background sampling period. If more than one background (upgradient) well is used, an equal number of samples must be taken from each well.

$$\overline{X}_b = \frac{X_1 + X_2 + \ldots X_n}{n}$$

Where:

$\overline{X}_b$ = Average background value for a given chemical parameter

X_n – Background values for each upgradient sample

n = Number of background samples taken

ii. Calculate the background variance (S_b^2) and standard deviation (S_b) for each parameter using the values (X_n) from each background sample of the upgradient well(s) as follows:

$$S_b^2 = \frac{(X_1 - \overline{X}_b)^2 + (X_2 - \overline{X}_b)^2 + \ldots + (X_n - X_b)^2}{n-1}$$

$$S_b = \sqrt{S_b^2}$$

iii. Calculate the upper confidence limit using the following formula:

$$CL = X_b \pm t\sqrt{X_b + t1 + 1/n(S_b)}$$

Where:

CL = upper confidence limit prediction
(upper and lower limits should be calculated for pH)
t = one-tailed t value at the required significance level and at n-1 degrees of freedom from Table 1
(a two-tailed t value should be used for pH)

iv. If the values of any routine parameter for any monitoring well exceeds the upper confidence limit for that parameter, the permittee shall conclude that a statistically significant change has occurred at that well.

v. When some of the background (upgradient) values are less than the Method Detection Limit (MDL), a value of one-half (1/2) the MDL shall be substituted for each background value that is reported as less than the MDL. All other computations shall be calculated as given above.

If all the background (upgradient) values are less than the MDL for a given parameter, the Practical Quantitation Limit (PQL), as given in 35 Ill. Adm. Code Part 724 Appendix I shall be used to evaluate data from monitoring wells. If the analytical results from any monitoring well exceeds two (2) times the PQL for any single parameter, or if they exceed the PQLs for two or more parameters, the permittee shall conclude that a statistically significant change has occurred.

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Construction Authorization No. 0006-08

C.A. Date: May 20, 2008

Table 1
Standard T-Tables Level of Significance

Degrees of freedom	t-values (one-tail)		t-values (two-tail)*	
	99%	95%	99%	95%
4	3.747	2.132	4.604	2.776
5	3.365	2.015	4.032	2.571
6	3.143	1.943	3.707	2.447
7	2.998	1.895	3.499	2.365
8	2.896	1.860	3.355	2.306
9	2.821	1.833	3.250	2.262
10	2.764	1.812	3.169	2.228
11	2.718	1.796	3.106	2.201
12	2.681	1.782	3.055	2.179
13	2.650	1.771	3.012	2.160
14	2.624	1.761	2.977	2.145
15	2.602	1.753	2.947	2.131
16	2.583	1.746	2.921	2.120
17	2.567	1.740	2.898	2.110
18	2.552	1.734	2.878	2.101
19	2.539	1.729	2.861	2.093
20	2.528	1.725	2.845	2.086
21	2.518	1.721	2.831	2.080
22	2.508	1.717	2.819	2.074
23	2.500	1.714	2.807	2.069
24	2.492	1.711	2.797	2.064
25	2.485	1.708	2.787	2.060
30	2.457	1.697	2.750	2.042
40	2.423	1.684	2.704	2.021

Adopted from Table III of "Statistical Tables for Biological Agricultural and Medical Research" (1947. R.A. Fisher and F. Yates).

For pH only when required.

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Special Conditions

Special Condition No. 1: No effluent from any mine related facility area under this permit shall, alone or in combination with other sources, cause a violation of any applicable water quality standard as set out in the Illinois Pollution Control Board Rules and Regulations, Subtitle C: Water Pollution.

Special Condition No. 2: Samples taken in compliance with the effluent monitoring requirements shall be taken at a point representative of the discharge, but prior to entry into the receiving stream.

Special Condition No. 3: The permittee shall record monitoring results on Discharge Monitoring Report Forms using one such form for each discharge each month. The Discharge Monitoring Report forms shall be submitted to the Agency in accordance with the schedule outlined in Special Condition No. 4 below.

Discharge Monitoring Reports shall be mailed to the IEPA at the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand Ave., East
P.O. Box 19276
Springfield, Illinois 62794-9276

Attn: Compliance Assurance Section

Special Condition No. 4: The completed Discharge Monitoring Report form shall be retained by the permittee for a period of three months and shall be mailed and received by the IEPA in accordance with the following schedule, unless otherwise specified by the permitting authority.

Period	Received by IEPA
January, February, March	April 15
April, May, June	July 15
July, August, September	October 15
October, November, December	January 15

Special Condition No. 5: If an applicable effluent standard or limitation is promulgated under Sections 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) of the Clean Water Act and that effluent standard or limitation is more stringent than any effluent limitation in the permit or controls a pollutant not limited in the NPDES Permit, the Agency shall revise or modify the permit in accordance with the more stringent standard or prohibition and shall so notify the permittee.

Special Condition No. 6: The permittee shall notify the Agency in writing by certified mail within thirty days of abandonment, cessation, or suspension of active mining for thirty days or more unless caused by a labor dispute. During cessation or suspension of active mining, whether caused by a labor dispute or not, the permittee shall provide whatever interim impoundment, drainage diversion, and wastewater treatment is necessary to avoid violations of the Act or Subtitle D.

Special Condition No. 7: Plans must be submitted to and approved by this Agency prior to construction of a sedimentation pond. At such time as runoff water is collected in the sedimentation pond, a sample shall be collected and analyzed for the parameters designated as 1M-15M under Part 5-C of Form 2C and the effluent parameters designated herein with the results sent to this Agency. Should additional treatment be necessary to meet these standards, a Supplemental Permit must also be obtained. Discharge from a pond is not allowed unless applicable effluent and water quality standards are met.

Special Condition No. 8: The special reclamation area effluent standards of 35 Ill. Adm. Code 406.109 apply only on approval from the Agency. To obtain approval, a request form and supporting documentation shall be submitted 45 days prior to the month that the permittee wishes the discharge be classified as a reclamation area discharge. The Agency will notify the permittee upon approval of the change.

Special Condition No. 9: The special stormwater effluent standards apply only on approval from the Agency. To obtain approval, a request with supporting documentation shall be submitted 45 days prior to the month that the permittee proposes the discharge to be classified as a stormwater discharge. The documentation supporting the request shall include analysis results indicating the discharge will consistently comply with reclamation area discharge effluent standards. The Agency will notify the permittee upon approval of the change.

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Special Conditions

Special Condition No. 10: Annual stormwater monitoring is required for all discharges not reporting to a sediment basin until Final SMCRA Bond is released and approval to cease such monitoring is obtained from the Agency.

a. Each discharge must be monitored for pH and settleable solids annually.

b. Analysis of samples must be submitted with second quarter Discharge Monitoring Reports. A map with discharge locations must be included in this submittal.

c. If discharges can be shown to be similar, a plan may be submitted by November 1 of each year preceding sampling to propose grouping of similar discharges and/or update previously submitted groupings. If updating of a previously submitted plan is not necessary, a written notification to the Agency indicating such is required. Upon approval from the Agency, one representative sample for each group may be submitted.

Special Condition No. 11: Sediment Pond Operation and Maintenance (Outfalls 002, 004 and 005):

a. No discharge is allowed from Outfall Nos. 002, 004 and 005 during "low flow" or "no flow" conditions in the receiving stream, unless such discharge meets the water quality standards of 35 Ill. Adm. Code 302. For purposes of this Condition "low flow" shall be defined as any condition wherein the upstream flow available for mixing is less than the ratios times the flowrate being discharged from the respective outfalls. These ratios are as follows:

Outfall No.	Flow Ratio of Receiving Stream to Outfall Discharge
002	3.99
004	1.10
005	0.48

Pursuant to 35 Ill. Adm. Code 302.102, discharges from the referenced outfalls that otherwise would not meet the water quality standards of 35 Ill. Adm. Code 302 may be permitted if sufficient flow exists in the receiving stream to ensure that applicable water quality standards are met. That is, discharges not meeting the water quality standards of 35 Ill. Adm. Code 302 may only be discharged in combination with stormwater discharge from the basin, and only at such times that sufficient flows exists in the receiving stream to ensure that water quality standards in the receiving stream beyond the area of allowed mixing will not be exceeded. Following any such stormwater discharge, but prior to the flow in the receiving stream subsiding, the impounded water in the basin may be pumped or otherwise evacuated sufficiently below the discharge elevation to provide capacity for holding a sufficient volume of mine pumpage and/or surface runoff to preclude the possibility of discharge until such time that a subsequent precipitation event results in discharge from the basin. At times of stormwater discharge, in addition to the alternate effluent monitoring requirements, Outfall Nos. 002, 004 and 005 discharges shall be monitored and reported for Discharge Rate, Sulfate, Chloride and Hardness.

b. The following sampling and monitoring requirements are applicable to flow in the unnamed tributary to Shoal Creek Watershed Structure No. 5 which receives the discharges from Outfalls 002, 004 and 005.

i. All sampling and monitoring required under 11(b)(ii) and (iii) below shall be performed during a discharge and monitoring event from the associated outfall.

ii. The unnamed tributary to Shoal Creek Watershed Structure No. 5 shall be monitored and reported quarterly for Discharge Rate, Chloride, Sulfate and Hardness upstream of the associated outfall. At such time that sufficient information has been collected regarding stream flow characteristics and in-stream contaminant concentrations, the permittee may request a re-evaluation of the monitoring frequency required herein for possible reduction or elimination. For the purpose of re-evaluating the upstream monitoring frequency of the receiving streams, "sufficient information" is defined as a minimum of ten (10) quarterly sampling events.

In the event that upstream monitoring of the receiving waters is eliminated during the term of this permit based on an evaluation of the quarterly data, a minimum of three (3) additional samples analyzed for the parameters identified above must be submitted with the permit renewal application a minimum of 180 days prior to expiration of this permit.

iii. The unnamed tributary to Shoal Creek Watershed Structure No. 5 shall be monitored and reported annually for Discharge Rate, Chloride, Sulfate and Hardness downstream of each associated outfall. This downstream monitoring shall be performed a sufficient distance downstream of the associated outfall to ensure that complete mixing has occurred.

Special Condition No. 12: Sediment Pond Operation and Maintenance (Outfalls 001, 003, 006 and 007):

a. For discharges resulting from precipitation events, in addition to the alternate effluent monitoring requirements, discharges from Outfalls, 001, 003, 006 and 007 shall be monitored and reported for Discharge Rate, Sulfate, Chloride and Hardness.

b. The following sampling and monitoring requirements are applicable to flow in the unnamed tributary to Middle Fork Shoal Creek (known locally as Central Park Creek) receiving the overflow from Shoal Creek Watershed Structure No. 5 which receives discharges from Outfalls 001, 003, and 006 and the unnamed tributary to Shoal Creek Watershed Structure No. 5 which receives the discharge from Outfall 007:

i. All sampling and monitoring required under 12(b)(ii) and (iii) below shall be performed during a discharge and monitoring event from the associated outfalls.

ii. The unnamed tributary to Shoal Creek Watershed Structure No. 5 shall be monitored and reported quarterly for Discharge Rate, Chloride, Sulfate and Hardness upstream of Outfall 007. At such time that sufficient information has been collected regarding stream flow characteristics and in-stream contaminant concentrations, the permittee may request a re-evaluation of the monitoring frequency required herein for possible reduction or elimination. For the purpose of re-evaluating the upstream monitoring frequency of the receiving streams, "sufficient information" is defined as a minimum of ten (10) quarterly sampling events.

In the event that upstream monitoring of the receiving waters is eliminated during the term of this permit based on an evaluation of the quarterly data, a minimum of three (3) additional samples analyzed for the parameters identified above must be submitted with the permit renewal application a minimum of 180 days prior to expiration of this permit.

iii. The unnamed tributary to Middle Fork Shoal Creek (known locally as Central Park Creek) downstream of Shoal Creek Watershed Structure No. 5 and the unnamed tributary to Shoal Creek Watershed Structure No. 5 downstream of Outfall 007 shall be monitored and reported annually for Discharge Rate, Chloride, Sulfate and Hardness. This downstream monitoring shall be performed a sufficient distance downstream of the Shoal Creek Watershed Structure No. 5 overflow and Outfall 007 to ensure that complete mixing has occurred.

Special Condition No. 13: Data collected in accordance with Special Conditions Nos. 11 and 12 above will be utilized to evaluate the appropriateness of the effluent limits established in this Permit. Should the Agency's evaluation of this data indicate revised effluent limits are warranted; this permit may be reopened and modified to incorporate more appropriate effluent limitations. This data will also be used for determination of effluent limitations at the time of permit renewal.

Special Condition No. 14: Mercury shall be monitored quarterly until a minimum of ten (10) samples have been collected. Samples shall be collected and tested in accordance with USEPA 1631E using the option at Section 11.1.1.2 requiring the heating of samples at 50°C for 6 hours in a BrCl solution in closed vessels. This test method has a Method Detection Limit (MDL) of 0.001 µg/l. The results of such testing must be submitted with the quarterly Discharge Monitoring Reports (DMR's). The Permittee may submit a written request to the Agency to discontinue quarterly Mercury monitoring if the sampling results show no reasonable potential to exceed the Mercury water quality standard.

Attachment H

Standard Conditions

Definitions

Act means the Illinois Environmental Protection Act, 415 ILCS 5 as Amended.

Agency means the Illinois Environmental Protection Agency.

Board means the Illinois Pollution Control Board.

Clean Water Act (formerly referred to as the Federal Water Pollution Control Act) means Pub. L 92-500, as amended. 33 U.S.C. 1251 et seq.

NPDES (National Pollutant Discharge Elimination System) means 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 405 of the Clean Water Act.

USEPA means the United States Environmental Protection Agency.

Daily Discharge means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurements, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

Maximum Daily Discharge Limitation (daily maximum) means the highest allowable daily discharge.

Average Monthly Discharge Limitation (30 day average) means the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

Average Weekly Discharge Limitation (7 day average) means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Aliquot means a sample of specified volume used to make up a total composite sample.

Grab Sample means an individual sample of at least 100 milliliters collected at a randomly-selected time over a period not exceeding 15 minutes.

24 Hour Composite Sample means a combination of at least 8 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over a 24-hour period.

8 Hour Composite Sample means a combination of at least 3 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over an 8-hour period.

Flow Proportional Composite Sample means a combination of sample aliquots of at least 100 milliliters collected at periodic intervals such that either the time interval between each aliquot or the volume of each aliquot is proportional to either the stream flow at the time of sampling or the total stream flow since the collection of the previous aliquot.

(1) **Duty to comply.** The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action, permit termination, revocation and reissuance, modification, or for denial of a permit renewal application. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

(2) **Duty to reapply.** If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. If the permittee submits a proper application as required by the Agency no later than 180 days prior to the expiration date, this permit shall continue in full force and effect until the final Agency decision on the application has been made.

(3) **Need to halt or reduce activity not a defense.** It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

(4) **Duty to mitigate.** The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

(5) **Proper operation and maintenance.** The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up, or auxiliary facilities, or similar systems only when necessary to achieve compliance with the conditions of the permit.

(6) **Permit actions.** This permit may be modified, revoked and reissued, or terminated for cause by the Agency pursuant to 40 CFR 122.62. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

(7) **Property rights.** This permit does not convey any property rights of any sort, or any exclusive privilege.

(8) **Duty to provide information.** The permittee shall furnish to the Agency within a reasonable time, any information which the Agency may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The permittee shall also furnish to the Agency, upon request, copies of records required to be kept by this permit.

(9) **Inspection and entry.** The permittee shall allow an authorized representative of the Agency, upon the presentation of credentials and other documents as may be required by law, to:

(a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

(b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

(c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

(d) Sample or monitor at reasonable times, for the purpose of assuring permit compliance, or as otherwise authorized by the Act, any substances or parameters at any location.

(10) **Monitoring and records.**

(a) Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

(b) The permittee shall retain records of all monitoring information, including all calibration and maintenance records, and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of this permit, measurement, report or application. This period may be extended by request of the Agency at any time.

(c) Records of monitoring information shall include:

(1) The date, exact place, and time of sampling or measurements;

(2) The individual(s) who performed the sampling or measurements;

(3) The date(s) analyses were performed;

(4) The individual(s) who performed the analyses;

(5) The analytical techniques or methods used; and

(6) The results of such analyses.

(d) Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit. Where no test procedure under 40 CFR Part 136 has been approved, the permittee must submit to the Agency a test method for approval. The permittee shall calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals to ensure accuracy of measurements.

(11) **Signatory requirement.** All applications, reports or information submitted to the Agency shall be signed and certified.

(a) **Application.** All permit applications shall be signed as follows:

(1) **For a corporation:** by a principal executive officer of at least the level of vice president or a person or position having overall responsibility for environmental matters for the corporation;

(2) **For a partnership or sole proprietorship:** by a general partner or the proprietor, respectively; or

(3) **For a municipality, State, Federal, or other public agency:** by either a principal executive officer or ranking elected official.

(b) **Reports.** All reports required by permits, or other information requested by the Agency shall be signed by a person described in paragraph (a) or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in paragraph (a); and

(2) The authorization specifies either an individual or a position responsible for the overall operation of the facility, from which the discharge originates, such as a plant manager, superintendent or person of equivalent responsibility; and

(3) The written authorization is submitted to the Agency.

(c) **Changes of Authorization.** If an authorization under (b) is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of (b) must be submitted to the Agency prior to or together with any reports, information, or applications to be signed by an authorized representative.

(12) **Reporting requirements.**

(a) **Planned changes.** The permittee shall give notice to the Agency as soon as possible of any planned physical alterations or additions to the permitted facility.

(b) **Anticipated noncompliance.** The permittee shall give advance notice to the Agency of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

(c) **Compliance schedules.** Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

(d) **Monitoring reports.** Monitoring results shall be reported at the intervals specified elsewhere in this permit.

(1) Monitoring results must be reported on a Discharge Monitoring Report (DMR).

(2) If the permittee monitors any pollutant more frequently than required by the permit, using test procedures approved under 40 CFR 136 or as specified in the permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

(3) Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified by the Agency in the permit.

(e) **Twenty-four hour reporting.** The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and time; and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The following shall be included as information which must be reported within 24 hours:

(1) Any unanticipated bypass which exceeds any effluent limitation in the permit;

(2) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Agency in the permit to be reported within 24 hours.

The Agency may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

(f) **Other noncompliance.** The permittee shall report all instances of noncompliance not reported under paragraphs (12)(c), (d), or (e), at the time monitoring reports are submitted. The reports shall contain the information listed in paragraph (12)(e).

(g) **Other information.** Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to the Agency, it shall promptly submit such facts or information.

(13) **Transfer of permits.** A permit may be automatically transferred to a new permittee if:

(a) The current permittee notifies the Agency at least 30 days in advance of the proposed transfer date;

(b) The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage and liability between the current and new permittees; and

(c) The Agency does not notify the existing permittee and the proposed new permittee of its intent to modify or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement.

(14) All manufacturing, commercial, mining, and silvicultural dischargers must notify the Agency as soon as they know or have reason to believe:

(a) That any activity has occurred or will occur which would result in the discharge of any toxic pollutant identified under Section 307 of the Clean Water Act which is not limited in the permit, if that discharge will exceed the highest of the following notification levels:

(1) One hundred micrograms per liter (100 ug/l);

(2) Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4,6 dinitrophenol; and one milligram per liter (1 mg/l) for antimony.

(3) Five (5) times the maximum concentration value reported for that pollutant in the NPDES permit application; or

(4) The level established by the Agency in this permit.

(b) That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the NPDES permit application.

(15) All Publicly Owned Treatment Works (POTWs) must provide adequate notice to the Agency of the following:

(a) Any new introduction of pollutants into that POTW from an indirect discharge which would be subject to Sections 301 or 306 of the Clean Water Act if it were directly discharging those pollutants; and

(b) Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

(c) For purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

(16) If the permit is issued to a publicly owned or publicly regulated treatment works, the permittee shall require any industrial user of such treatment works to comply with federal requirements concerning:

(a) User charges pursuant to Section 204(b) of the Clean Water Act, and applicable regulations appearing in 40 CFR 35;

(b) Toxic pollutant effluent standards and pretreatment standards pursuant to Section 307 of the Clean Water Act; and

(c) Inspection, monitoring and entry pursuant to Section 308 of the Clean Water Act.

(17) If an applicable standard or limitation is promulgated under Section 301(b)(2)(C) and (D), 304(b)(2), or 307(a)(2) and that effluent standard or limitation is more stringent than any effluent limitation in the permit, or controls a pollutant not limited in the permit, the permit shall be promptly modified or revoked, and reissued to conform to that effluent standard or limitation.

(18) Any authorization to construct issued to the permittee pursuant to 35 Ill. Adm. Code 309.154 is hereby incorporated by reference as a condition of this permit.

(19) The permittee shall not make any false statement, representation or certification in any application, record, report, plan or other document submitted to the Agency or the USEPA, or required to be maintained under this permit.

(20) The Clean Water Act provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Clean Water Act is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions implementing Sections 301, 302, 306, 307, or 308 of the Clean Water Act is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than one year, or both.

(21) The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

(22) The Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit shall, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

(23) Collected screening, slurries, sludges, and other solids shall be disposed of in such a manner as to prevent entry of those wastes (or runoff from the wastes) into waters of the State. The proper authorization for such disposal shall be obtained from the Agency and is incorporated as part hereof by reference.

(24) In case of conflict between these standard conditions and any other condition(s) included in this permit, the other condition(s) shall govern.

(25) The permittee shall comply with, in addition to the requirements of the permit, all applicable provisions of 35 Ill. Adm. Code, Subtitle C, Subtitle D, Subtitle E, and all applicable orders of the Board.

(26) The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit is held invalid, the remaining provisions of this permit shall continue in full force and effect.

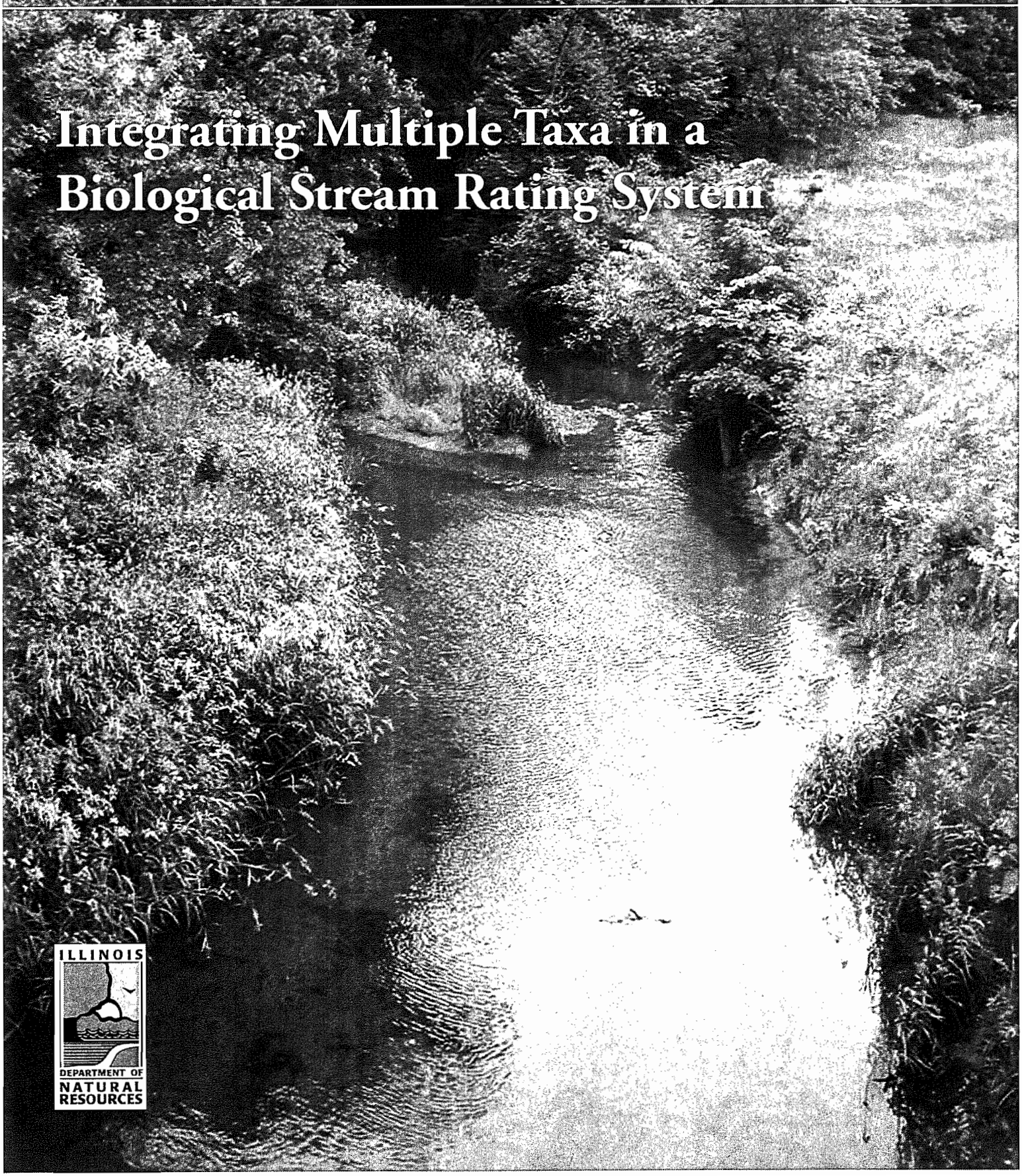
(Rev. 3-13-98)

Exhibit D:
IDNR, Integrating Multiple Taxa in a Biological Stream Rating System (2008)

State of Illinois
Rod R. Blagojevich, Governor

Illinois Department of Natural Resources
Office of Resource Conservation

Integrating Multiple Taxa in a Biological Stream Rating System



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page 6 - Kevin Cummings - Threatened mussels at Salt Fork
page 7 - Kevin Cummings - Mussel sampling on the North Fork Vermilion River
page 11 - Chris Taylor - *Orconectes propinquus*
page 15 - Kevin Cummings - Asian clams at Lone Tree Creek
page 21 - Kevin Cummings - Pink Heelsplitter from the Sangamon River

Acknowledgments

This work would not have been possible without the previous efforts of the Biological Stream Characterization Work Group that instituted a statewide stream rating system in the late 1980s and the Illinois Natural History Survey that developed the initial Biologically Significant Streams listing. We would like to thank all the members of our Biologically Significant Streams work group for their efforts at enhancing this project. Special thanks to Kevin Cummings, Ed DeWalt, Mark Joseph, Christine Mayer, Chris Phillips, Bob Schanzle, Bob Szafoni, Chris Taylor, John Wilker, and the IDNR stream specialists for providing access to data from streams throughout Illinois. This report is based largely on work done by Leslie Bol and Leon Hinz of the Illinois Natural History Survey, and Ann Marie Holtrop of the IDNR. Their work was funded by IDNR through the Illinois State Wildlife Grant Program (T-20-P-001). ●

Preface

Updated stream ratings are provided in this report under authority of state law (see 515 ILCS 5-5 and 520 ILCS 5/2.1). This state law provides the Illinois Department of Natural Resources (IDNR) with ownership of the wildlife and aquatic resources residing within the borders of the State of Illinois. The IDNR is designated as the agency of state government charged with the regulation, protection, and preservation of those natural resources. Tools such as the stream ratings provided in this report are used by IDNR as the basis for field program implementation for resource protection. For over twenty years, resource mangers in Illinois have used stream biological ratings as a vehicle for the interpretation, assessment, and communication of aquatic resource values. The first stream ratings, published in 1989, were based on a five-tiered classification system predicted largely on the type and condition of the fishery resource. In July 2005, the State of Illinois submitted a Comprehensive Wildlife Conservation Plan to the U. S. Fish and Wildlife Service as part of a Congressional mandate to be eligible for future federal funding. The plan was accepted, renamed the Illinois Wildlife Action Plan, and became the strategic document guiding protection and conservation efforts throughout the state. As the name implies, the Illinois Wildlife Action Plan outlines a plan of action to address the particular needs of wildlife that are declining and presents a targeted approach to habitat enhancement and conservation. The Wildlife Action Plan broadly addresses all types of wildlife including fish, mussels, amphibians, and reptiles. To help establish baseline conditions against which change promoted by the Illinois Wildlife Action Plan could be measured and understood, the following report describes in detail a stream rating process based on multiple aquatic taxonomic groups. Users desiring access to the most current ratings and additional location information are encouraged to search http://www.dnr.state.il.us/orc/BioStrmRatings/. The ratings will provide the Illinois Department of Natural Resources with a mechanism for identifying high-quality examples of all stream communities and will guide management and restoration activities throughout the state.●

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Introduction

Comprehensive statewide biological, chemical, and physical information associated with streams in Illinois has been routinely collected since 1980 through a partnership between the Illinois Department of Natural Resources (IDNR) and the Illinois Environmental Protection Agency (IEPA; Bertrand et al. 1996). This partnership was established in order to assess fish and macroinvertebrate communities, water quality, and habitat throughout major basins of Illinois. In 1984, a Biological Stream Characterization (BSC) Work Group was convened to create a mechanism for interpreting data collected as part of the interagency Basin Survey Program, and "to provide managers an overall prospective of the state's stream resources" (Hite and Bertrand 1989). The BSC Work Group developed stream ratings using letter grades "A" through "E", thereby establishing a means of communicating the quality of biological resources in streams to diverse stakeholders.

At the time the BSC Work Group began, the fish-based Index of Biotic Integrity (IBI) was recently developed, and it became the predominant stream integrity indicator used for rating streams (Hite and Bertrand 1989). In recognition of the need to also protect other stream-dependent organisms in the state, the Illinois Natural History Survey (INHS) developed a list of Biologically Significant Streams (BSS) that incorporated data on mussel communities and rare species (endangered, threatened, watch list) of crustaceans, fish, mussels, and aquatic plants in addition to stream segments rated as "A" by the initial BSC (Page et al. 1992). The goal of the BSS project was to protect 100% of the stream-dependent biodiversity, thus a stream with characteristics that met any one of the established criteria could achieve status as a BSS (Page et al. 1992).

Despite the lack of regular updates, the BSC and BSS processes generated products that are still used extensively by diverse stakeholders including state and federal agencies, local watershed groups, consultants, environmental interest groups, and municipalities.

In 2006, the IDNR initiated an effort to combine and update the previous stream rating efforts into a single rating. The purpose behind the project was not only to update outdated information (i.e., the existing ratings were based on data at least 15 years old) but to create a rating system that would help resource mangers determine efficacy in implementing the aquatic goals of the Illinois Wildlife Action Plan (State of Illinois 2005). To be most useful in evaluating and guiding implementation of the Wildlife Action Plan, IDNR sought a single rating for stream segments that represented multiple signals of stream condition. This intent was similar to the "overall prospective" identified by Hite and Bertrand (1989). Although the main purpose behind stream ratings has changed since the creation of BSC and BSS, several other objectives for the development and use of ratings remain. These include:

- Facilitate planning and prudent allocation of State resources in IDNR monitoring activities;
- Inventory and identify the nature, extent, and distribution of Illinois stream resources;
- Establish a common vehicle for the interpretation, assessment, and communication of aquatic resource values;
- Identify stream segments exhibiting a high potential for resource management or restoration activities;

- Focus greater emphasis on the importance of uncommon aquatic biotic resources and an awareness of where these resources exist.

Since BSC and BSS were developed, the quantity and quality of aquatic data and assessment tools has increased. For example, multi-metric indices have been developed for benthic macroinvertebrates (Tetra Tech, Inc. 2007) and mussels (Szafoni 2002), and revised for fish (Smogor 2000). Further, the Basin Survey Program, which assesses fish and macroinvertebrate communities, has continued. These available indices and data presented new opportunities to create a rating that reflects how different taxonomic groups can respond dissimilarly to shared stream conditions because of differences in life-history, mobility, and sensitivities to stressors (Paller 2001). Specifically in this project we used fish, macroinvertebrate, and mussel information because these taxa reflect steam conditions at different spatial and temporal scales (Diamond and Serveiss 2001, Freund and Petty 2007, Kilgour and Barton 1999, Lammert and Allan 1999). For instance, due to their limited mobility, typically shorter life spans, and association with stream substrate, macroinvertebrates may be indicators of local and more recent stream conditions (Freund and Petty 2007), whereas fish may be better indicators of regional conditions because they have greater movement capabilities and longer life cycles. Mussels, due to their limited dispersal as adults, may also indicate local conditions, but due to longer life spans may reflect historic stressors related to specific areas (Diamond and Serveiss 2001). By incorporating various taxonomic groups and averaging standardized taxonomic scores, we generated an overall rating for stream segments that is representative of multiple signals of stream conditions. This report describes an approach that results in assigning up to three designations for a stream segment, which are a diversity rating, integrity rating, and identification as a biologically significant stream. ●

General Approach for Diversity and Integrity Ratings

Several purposes of the previous BSC and BSS processes overlapped between the two initiatives. Both had objectives to identify the extent of Illinois stream resources, to identify stream segments of exceptional quality, and to focus protection efforts toward uncommon resources or biologically significant streams (Bertrand et al. 1996, Page et al. 1992). However, the two initiatives differed in their overall intent to rate a stream's biological diversity (Page et al. 1992) or biological integrity (Bertrand et al. 1996; Hite and Bertrand 1989). For the purposes of implementing Illinois' Wildlife Action Plan, IDNR sought a rating system that would include both diversity and integrity measures. Although the approach to obtain the diversity and integrity ratings is similar, we have not directly combined the two ratings for an overall rating. Diversity and integrity ratings were kept separate because it is possible to have highly intact communities that are not biologically very diverse. For instance, species richness expectations for small or cold-water streams are expected to be low compared with larger or warmer streams. Therefore, it is possible to have a small stream that would rate high for integrity but low for diversity. Additionally, keeping the two ratings separate enables stakeholders with different purposes to consider the rating that is most applicable to their needs. The letter ratings of A-E were maintained for both the diversity and integrity ratings as these designations were used in the previous BSC revision.

Given the change in focus and use for this project from previous stream ratings, we considered several aspects of the previous rating processes and modified the process accordingly. Because multiple data sources are used to generate a rating, there was a need to standardize data from different sources in an effort to give equal weight to all communities of organisms found in streams if adequate and comparable sampling had occurred. Second, we sought a data driven and reproducible process that did not include narrative information (see Hite and Bertrand 1989 and Bertrand et al. 1996 for an explanation of how narrative information was used previously). Third, we envisioned a product that could be easily updated as new information became available.

The general approach for obtaining a diversity or integrity rating is a six step process:

1. Select data for inclusion in the rating.
2. Convert raw data to a class score.
3. Standardize classes into a proportional score (P score).
4. Average the proportional scores within a given taxonomic group to obtain a single taxonomic score (T score).
5. Average proportional and/or taxonomic score for multiple sites on a valley segment.
6. Determine the final diversity and/or integrity rating for a valley segment.

We considered all the information that contributed to both integrity and diversity ratings in order to identify Biologically Significant Streams (BSS). Similar to the initial BSS effort, we incorporated multiple datasets and identified streams based on available taxonomic groups rather than relying on the fish data as the primary stream integrity indicator. However, unlike the additive approach of the original BSS that identified all reaches with appropriately high

threatened and endangered species presence regardless of what other available information may have indicated, the current process uses a holistic approach that combines data sources to determine if the biologically significant stream designation is appropriate.

Fish, mussel, macroinvertebrate, crayfish, and threatened and endangered species data collected by various state agencies were used for stream ratings. All datasets were overlaid on the 1:100,000 – scale, National Hydrography Dataset (NHD; USGS 2000) that was refined for a previous project (Holtrop and Dolan 2003). Point locations of data that were greater than 60m from the nearest digitized stream line were visually inspected using an overlay of aerial images to determine if the point was associated with a large river or a small stream that was not digitized. Points that were associated with large rivers and undigitized streams were separated into a different file and omitted from further analysis. Points that did not fall into either of these categories were further investigated to determine if there was an error with the spatial coordinates. Errors were remedied where possible, and points that could not be corrected and still fell greater than 60m from the nearest stream were omitted.

Point data or sampling sites for the final ratings were summarized according to valley segment. Valley segments are aggregations of linearly adjacent, physically similar stream reaches (Seelbach et al. 1997). Physical characteristics used to define valley segments were related to stream size (drainage area), surficial geology (bedrock, coarse substrates), discharge (flow yield), and gradient. Valley segments were independently derived prior to this project using a spatially-constrained clustering method based on the cluster affinity search technique (Brenden et al. 2008). Valley segment numbers were assigned to datasets through a spatial join in ArcMap 9.2. Datasets were then associated with each other for calculation of the final rating according to valley segment number in a query performed in Microsoft Office Access 2003. ●

Diversity Ratings

Background

Diversity simply defined is the number of different kinds of things (Angermeier and Karr 1994) or the variety of life and its processes (Hughes and Noss 1992). Although diversity can be represented mathematically using summary indices or a simple species number, we chose to consider it more broadly as the variety of taxa within several important aquatic groups (e.g., mussels, fish, macroinvertebrates, and crayfish). In December 2006, project stakeholders met and discussed the appropriateness of available datasets for inclusion in the diversity analysis. We considered data collected within the past decade (1997-2006) that were collected as part of IDNR, IEPA, or INHS monitoring programs. We limited data to these institutions to ensure that collection methods were standardized, repeatable, and will be continued in the future so that data will be available for revisions of these ratings.

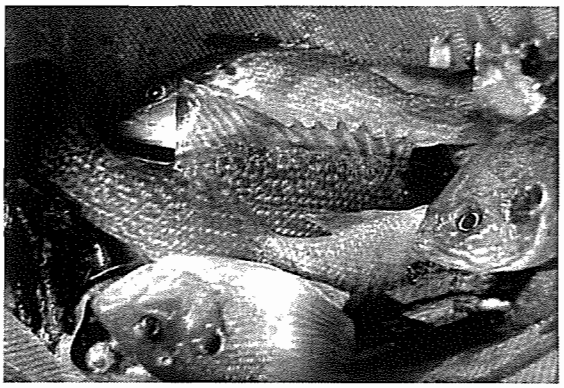
Approach

The general approach for obtaining a diversity rating is a six step process.

Step 1. *Select data for inclusion into the rating.*

We considered only data that were collected within the past decade. However, if a single site had more than one sample from the past decade, we used the sample with the highest richness for inclusion in the final rating calculation. We used this approach rather than taking the most recent sample or an average of the samples because the highest richness represents a conservative estimate of the biological potential for the site and this approach accounts for variation that may occur with sampling. Additionally, we did not average the data from multiple samples since the average could represent a condition that had not been found at the site. The following data were used in the final diversity ratings.

Fish – Fish data from community samples taken as part of cooperative basin surveys and other department monitoring were provided by the IDNR. These data were reviewed by regional IDNR stream biologists for verification that the samples were representative of community samples with adequate sampling efficiency. The species

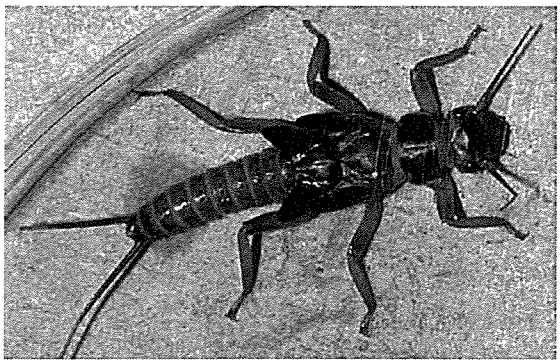


richness metric was retrieved from the Index of Biotic Integrity (IBI; Smogor 2000) summaries and was used as a component of the diversity rating. A total of 731 sites were used in the diversity score analysis (Table 1). There were fewer sites with fish species richness than fish IBI scores since the individual metrics scores used to calculate the fish IBI were not always available.

Table 1. The number of sites from each dataset used to calculate diversity ratings.

Potential Data Source	Number of Sites
Fish Species Richness	731
Macroinvertebrate Taxa Richness	452
CTAP EPT Species Richness	179
S1S2 EPT Species Richness	104
Mussel Species Richness	596
Crayfish Species Richness	18
Threatened and Endangered Species Richness	413
Total	2493

Aquatic Macroinvertebrates – Data for aquatic macroinvertebrates were compiled from three different entities.



Macroinvertebrate Taxa Richness

First, benthic macroinvertebrate data were compiled from the IEPA in Springfield. These data were collected following protocols established for use in the Stream Condition Index (Tetra Tech, Inc. 2007), but referred to as the Macroinvertebrate Index of Biotic Integrity (MIBI) in this report. The taxa richness metric was retrieved from the MIBI, and a total of 452 sites were used for the final diversity score analysis (Table 1).

Critical Trends Assessment Program (CTAP)

Second, Ephemeroptera (mayflies), Plecoptera (stoneflies), and Tricoptera (caddis flies; EPT) data that were collected since 1997 as part of CTAP (http://ctap.inhs.uiuc.edu/index.asp) were obtained. Although the MIBI contains an EPT richness metric, the CTAP data were used because these data were collected in the spring of the year prior to the emergence of many of these species and also typically on smaller streams than those included in the IEPA sampling. A total of 179 sites were used for the final diversity score analysis (Table 1).

S1S2 EPT

Third, we included information on sensitive Ephemeroptera, Plecoptera, and Tricoptera data provided by Dr. Ed DeWalt (INHS). These data were included because currently no EPT species are listed as endangered or threatened by the Illinois Endangered Species Protection Act (http://dnr.state.il.us/espb/datelist.htm), although some species within these orders have been identified as critically imperiled (S1) or imperiled (S2) at the state level by an INHS entomologist (DeWalt et al. 2005, Favret and DeWalt 2002). S1S2 refers to conservation status ranks used by NatureServe (http://www.natureserve.org/). A total of 104 sites were used for the final diversity score analysis (Table 1).

Mussels – Mussel data were obtained from the INHS mollusk collections database (http://www.inhs.uiuc.edu/cbd/collections/molluskmolluskintro.html) and IDNR. Records associated with freshwater snails, fingernail clams, zebra mussels, and Asian clams were not included, as well as any records not associated with stream habitat. In order to query data that were representative of community samples, we restricted our data to a list of collectors' names obtained from Kevin Cummings, the INHS malacologist and mussel database manager. A total of 596 sites were used for the final diversity score analysis (Table 1).

Crayfish – Native crayfish data were obtained from the INHS crustacean

collection database (http://www.inhs.uiuc.edu/cbd/collections/crustacean/crustaceanintro.html). Despite the lack of systematically collected crayfish data across the state, we included crayfish in a limited capacity in the final diversity ratings because they are abundant in Illinois streams and we anticipate that additional collections will be available for future updates of stream ratings. A total of 18 sites were used for the final diversity score analysis (Table 1).

Threatened and Endangered Species – Data on threatened and endangered (T&E) fish, mussel, crayfish, amphibian, and plant species (see Appendix A for species lists) were extracted from the Biotics Database maintained by the IDNR Office of Resource Conservation, Division of Natural Heritage. A total of 413 sites with T&E species were used for the final diversity score analysis (Table 1).

Step 2. *Convert raw data to a class score.*

One of the objectives for this project was to give equal weight to all communities of organisms found in streams if adequate and comparable sampling had occurred. To do this, we developed classes for each dataset used in the analysis in an attempt to interpret raw data from different sources and classify it similarly. Classes were independently developed for each dataset using each sample collection as an independent record rather than pooling samples from a single site. For example, if one site had multiple samples collected between 1997-2006, then each sample was treated as an independent record for the purpose of creating the class scores. Therefore, richness expectations were based on the number of species you would expect to find in a single sampling event. Once the classes were established, only the sample that had the highest richness from each site was used to calculate the final diversity rating.

Fish Species Richness — The fish species richness metric was retrieved from the Index of Biotic Integrity (IBI; Smogor 2000) summaries and was used as a component of the diversity rating. We used the classes developed for IBI because they accounted for variation in fish species

richness expectations across different sized streams, slope, and region. We maintained these classes with a single modification. In the IBI, fish richness metric scores range from 0-6. Because the "0" does not represent a true absence of fish, we added "1" to each class thereby resulting in class scores from 1-7.

Macroinvertebrate Taxa Richness — The MIBI did not have classes associated with individual metrics; however the availability of least-disturbed samples provided the opportunity to define classes for macroinvertebrate taxa richness by using the same approach that was used to define classes for individual metrics within the fish IBI (Smogor 2000). The top class for taxa richness was set at the 75th percentile of reference sites. Using this approach, taxa richness values for MIBI ranged from 0 to 35+ and were placed into seven classes (Table 2). Data were not further stratified by stream size or location because previous analysis determined that neither affected taxa richness expectations (Tetra Tech, Inc. 2007).

Table 2. Number of taxa corresponding to each class in the Macro-invertebrate Index of Biotic Integrity (Tetra Tech, Inc. 2007).

Class Score	Taxa Richness
7	35+
6	31 - 34
5	25 - 30
4	19 - 24
3	13 - 18
2	7 - 12
1	0 - 6

CTAP EPT Species Richness — In order to maintain similarity across data sources, we used the 90th percentile as the boundary for the highest class for datasets that were not developed with a reference site approach (i.e., mussels, CTAP EPT macroinvertebrates, S1S2 macroinvertebrates, crayfish, and threatened and endangered species). Our rationale was that by raising the standard for the top class for these datasets to at least the 90th percentile, the highest class would be similarly restrictive as the datasets that did have reference site data available. Using the 90th percentile as the cut for the top class, three classes were created (Table 3).

Table 3. Number of species corresponding to the three classes developed for the Critical Trend Assessment Program's Ephemeroptera, Plecoptera, and Tricoptera data. The species from the three orders are considered together.

Class	Percentile	Number of Species
1	<50th	1 - 8
2	50th - 89th	9 - 18
3	90th+	19+

Mussel Species Richness — A mussel species richness of ten species or greater was previously used to identify BSS (Page et al. 1992) and was also used as the threshold for defining the highest classification for the species richness factor in the Illinois Mussel Classification Index (Szafoni 2002; MCI). However, we investigated the relationship among mussel species richness across different sized streams defined by steam link (Shreve 1967) within different drainages and subsequently adopted new class scores based on our analysis. Three classes were developed for mussel species richness expectations for each of the major drainages based on the percentiles within three stream size groupings of the tributary streams and the mainstem (Table 4). Class one consisted of samples that were below average richness within the drainage (0-49th percentile), class two were above average samples (50-89th), and class three were exceptionally high scoring samples (90th percentile and above (Table 4)).

Bonus Points –The final diversity rating also integrates information about taxa that

Table 4. Class scores for mussel species richness values based on expectations according to drainage and stream size. Stream size is defined by link number, which is the number of first order streams based on the 1:100,000 National Hydrography Dataset (NHD) upstream of a given stream reach. Link codes refer to groupings of link numbers.

Stream Size	Drainage	Class 1 (<50th percentile)	Class 2 (50th - 90th percentille)	Class 3 (90th percentile +)
Small (Link code 1)	Illinois	<3	3 - 7	8+
	Mississippli	<2	2 - 5	6+
	Ohio	1	2	3+
	Wabash	<3	3 - 8	9+
Medium (Link code 2 - 3)	Illinois	<5	5 - 11	12+
	Mississippli	<5	5 - 10	11+
	Ohio	<2	2 - 3	4+
	Wabash	<5	2 - 10	11+
Large (Link code 4 - 6)	Illinois	<5	5 - 11	12+
	Mississippli	<7	5 - 11	12+
	Ohio	<2	2 - 5	6+
	Wabash	<6	6 - 13	14+
Mainstem (Link code 7)	Illinois	<9	9 - 10	11+
	Mississippli	<15	15 - 20	21+
	Ohio	<6	6 - 13	14+
	Wabash	<3	3 - 9	10+

were deemed important due to their rarity. The S1S2 EPT, Crayfish, and T&E datasets had a limited range of data and subsequently were used differently in the final ratings than other fish, macroinvertebrate, and mussel data described previously. The rationale for this is described in steps 4 and 6 below. Class scores for these three datasets were based on percentiles, but were adjusted in weight based on how these data were added to the diversity rating.

Step 3. *Standardize classes into a proportional score (P score).*

All class scores range from "1" to a greater number with the greatest number always representing the highest class. In this step, we divided the assigned class score by the total number of classes available to obtain a proportional score (P score), which has a maximum of 1. For example, a site that had 26 macroinvertebrate taxa falls in class 5, which equates to a P score of 5/7 (0.714). Proportional scores were used to standardize differing numbers of classes among variables.

Step 4. *Average the proportional scores for the three different macroinvertebrate datasets in order to obtain a single taxonomic score (T score).*

When multiple datasets (i.e., taxa richness from MIBI, EPT richness from CTAP, and S1S2 EPT species) were available for macroinvertebrates, the average of the proportional scores was used to determine the taxonomic score (i.e., macroinvertebrate taxonomic score). Creating a taxonomic score allowed us to include information derived from separate assessments into a combined signal for macroinvertebrates. However, we averaged all available macroinvertebrate information into a

taxonomic score rather than keeping the datasets separate and averaging them all into a final score in order to give equal weight to fish, macroinvertebrates, and mussels in the final diversity rating.

S1S2 EPT data were added to the macroinvertebrate taxonomic score as bonus point data rather than averaged into the taxa score in order to ensure that the presence of these sensitive taxa always improved a stream rating. The maximum number of bonus points was awarded to samples with three or more species as this corresponds to the 90th percentile for the number of species found per sample. Samples with 1-2 species were awarded half the maximum. The diversity score prior to adding bonus points is based on the average of the macroinvertebrate taxonomic score, the fish proportional score and the mussel proportional score. Since the macroinvertebrate taxonomic score is potentially 1/3 of the overall diversity score, and S1S2 EPT potentially contribute 1/3 to the macroinvertebrate taxonomic score, the S1S2 EPT data potentially contribute 1/9th (0.11) of the pre-bonus points diversity score. We therefore, assigned 0.11 for samples with 3+ and 0.055 for 1-2 species.

Some valley segments had S1S2 EPT data available but lacked other macroinvertebrate data. In these cases we added the bonus points after the fish and mussel taxonomic scores had been averaged (Step 5). However, since the data were added at a different point in the process, the bonus points were divided by three since they would contribute to a third of the diversity score prior to the T&E and Crayfish bonus points being added. Therefore, for valley segments without other macroinvertebrate data, 0.037 was added when there were 3+ species and 0.018 for samples with 1-2 species.

Step 5. *Average proportional and/or taxonomic score for multiple sites on a valley segment.*

When multiple sites were associated with a particular valley segment within a dataset, the average of these proportional or taxonomic (for macroinvertebrates) scores was used to calculate the final diversity score. An average from the different sites was used rather than considering the highest proportional score from the valley segment since conditions within the stream segment may vary between sites and an average for the whole valley segment was a better representation than the signal from a single site.

Step 6. *Determine the final diversity rating for a valley segment.*

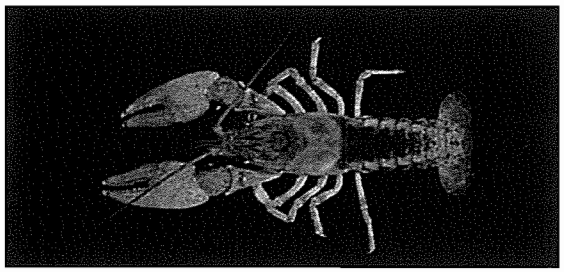
The final diversity score is based on five potential data sources: average of the fish proportional scores available for the valley segment, average of the mussel proportional scores available for the valley segment, the average macroinvertebrate taxonomic scores, as well as crayfish and T&E species richness.

Threatened and Endangered Species (T&E)

Aquatic T&E data were added to the diversity score after the fish proportional scores, mussel proportional scores, and macroinvertebrate taxonomic scores have been averaged. Because T&E species were one of five potential values contributing to a final diversity rating, the 95th percentile of T&E values (i.e., 2+ species) was awarded 0.2 (1/5) bonus points. Sites having one T&E species were awarded 0.1 bonus points. The maximum points T&E species could add to a final diversity score was 0.2, even if more than one sample for a given valley segment had 2+ T&E species.

Crayfish

Similarly to T&E species, crayfish are added as bonus points after available fish, macroinvertebrate, and mussel information had been averaged. However, bonus points for crayfish were only awarded to samples that had three or more species. Three or more species represented the 95th percentile of available data and resulted in 0.1 bonus points.



The final diversity score for a valley segment was calculated as:

Diversity Score = average (average fish species richness P scores + average mussel species P scores + average macroinvertebrate T Scores) + threatened and endangered species bonus points + crayfish bonus points, where P score = proportional score and T score = taxonomic score.

The cut-offs for the final diversity letter ratings were determined by visually inspecting the distribution of the diversity scores (Figure 1). We also attempted to have a similar percentage of valley segments within each letter category as the previous BSC projects. A total of 1127 valley segments were assigned a diversity rating of A-E (Figure 2). This represents 3% of the total 38046 valley segments that exist for the state of Illinois. Of the valley segments that were rated, the percentage with the assignment of the ratings A-E is 13, 22, 38, 25 and 1 respectively. While this procedure has been developed for assigning ratings using multiple datasets, approximately one half of the total valley segments that were rated had data available from only one dataset (Table 5).

Table 5. Number of datasets contributing to final diversity ratings.

Datasets	Total Valley Segments
1	565
2	370
3	134
4	44
5	11
6	3
Total	1127

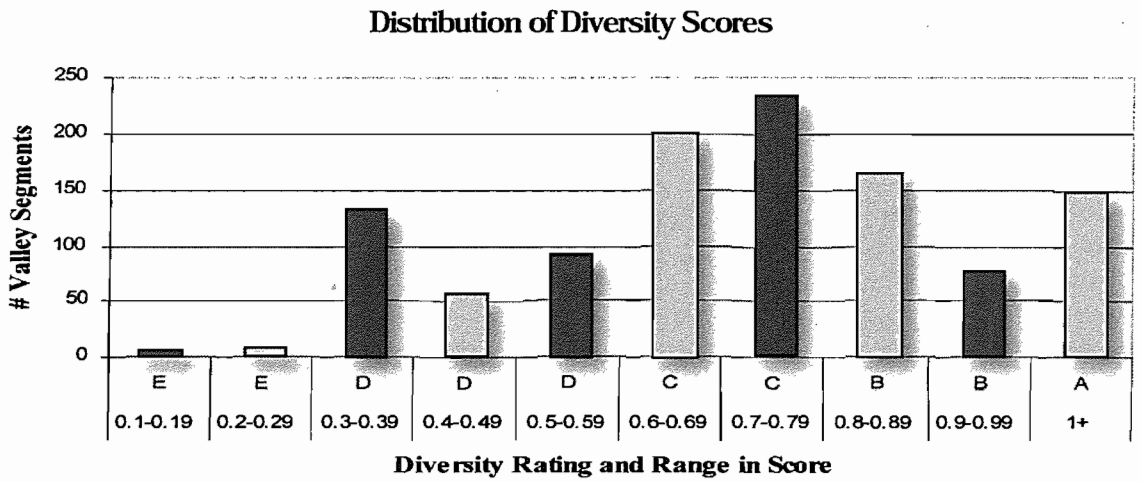


Figure 1. Distribution of diversity scores and corresponding letter rating. The percentage of valley segments with diversity ratings of A-E is 13, 22, 38, 25, and 1 respectively.

Examples of Diversity Ratings

To further illustrate the diversity process, we present several examples (Table 6). In the first example, only one dataset is associated with the valley segment. The fish species richness is 15, which corresponds to a class score of 5. To obtain the proportional score, 5 is divided by the total number of classes, which is 7. Since there are no other datasets to average with the fish species richness, the final diversity score is the same as the fish proportional score. A final diversity score of 0.714 equates to a letter rating of C.

In the second example, data are available from three taxonomic groups. The fish species richness is 22, which equates to a class score of 6 and a proportional score of 0.857. The mussel species richness is 6, which equates to a class score of 2 and a proportional score of 0.667. The macroinvertebrate taxa richness is 42, which equates to a class score of 7 and a proportional score of 1. The diversity score is determined by averaging these three proportional scores. The final score of 0.841 corresponds to a letter rating of C.

The third example has two sets of macroinvertebrate data as well as fish and mussel data. The fish species richness is 10, equating to a class score of 3 and a proportional score of 0.429. The mussel species richness is 1, equating to a class

Table 6. Examples of calculating diversity scores.

	Example with single dataset	Example with three taxonomic groups	Example with two macroinvertebrate datasets	Example with S1S2 EPT bonus points	Example with two mussel sites and threatened and endangered species bonus points
Valley Segment	21679	39073	37913	3557	44269
Fish Species Richness	15	22	10		33
Fish species richness class score	5	6	3		7
Fish proportional score	0.714 (5/7)	0.857 (6/7)	0.429 (3/7)		1 (7/7)
Mussel species richness		6	1		1 and 13
Mussel species richness class score		2	1		1 and 3
Mussel proportional score		0.667 (2/3)	0.333 (1/3)		0.667 (average of 0.33 and 1)
Macroinvertebrate taxa richness		42	31		40
Macroinvertebrate taxa richness class score		7	6		7
Macroinvertebrate taxa richness proportional score		1 (7/7)	0.857 (6/7)		1 (7/7)
CTAP EPT species richness			17	20	
CTAP EPT species richness class score			2	3	
CTAP EPT species richness proportional score			0.667 (2/3)	1 (3/3)	
S1S2 EPT specie richness				1	
S1S2 EPT specie richness bonus points				0.055	
Macroinvertebrate taxonomic score		1	0.76	1.055	1
Pre-bonus points Diversity score	0.714	0.841	0.51	1.055	0.889
Crayfish species richness					
Crayfish species richness bonus points					
Threatened and Endangered species richness					2
Threatened and Endangered species richness bonus points					0.2
Final Diversity Score	0.714	0.841	0.51	1.055	1.089
Diversity Rating	C	B	D	A	A

score of 1 and a proportional score of 0.333. The macroinvertebrate taxa richness is 31 equating to a class score of 6 and a proportional score of 0.857. The CTAP EPT species richness is 17 equating to a class score of 2 and a proportional score of 0.667. Before the diversity score can be calculated, available macroinvertebrate data are combined into a taxonomic score. The macroinvertebrate taxonomic score is determined by averaging the macroinvertebrate taxa richness proportional score and the CTAP EPT proportional score. The final diversity score (0.51 with a diversity rating of D) is calculated by averaging the fish and mussel proportional scores and the macroinvertebrate taxonomic score.

The fourth example also has two datasets available for macroinvertebrates. However, one of the datasets is S1S2 EPT bonus data. The CTAP ETP species richness is 20, which represents a class score of 3 and a proportional score of 1. There is one S1S2 EPT species associated with the valley segment that is awarded 0.055 bonus points. The macroinvertebrate taxonomic score is therefore the CTAP EPT proportional score plus the S1S2 EPT bonus points. Since no other data are available, the final score is equal to the macroinvertebrate taxonomic score (1.055 with a diversity rating of A).

The final example illustrates the procedure for dealing with valley segments that may have more than one sampling site associated with them and for calculating a final diversity score using threatened and endangered species bonus points. The fish species richness is 33 equaling a class/metric score of 7 and a proportional score of 1. There are two mussel sites associated with the valley segment with species richness of 1 and 13. These correspond to class/metric scores of 1 and 3 respectively. To determine the final proportional score for the mussels, the average is taken of the two site proportional scores. The fish and mussel proportional scores are then averaged before bonus points are awarded. Two threatened and endangered species are associated with the valley segment equating to 0.2 bonus points. Once these are added to the pre-bonus point diversity score of 0.889, the final diversity score is 1.089, which equals an A rating. ●

Map of Diversity Ratings

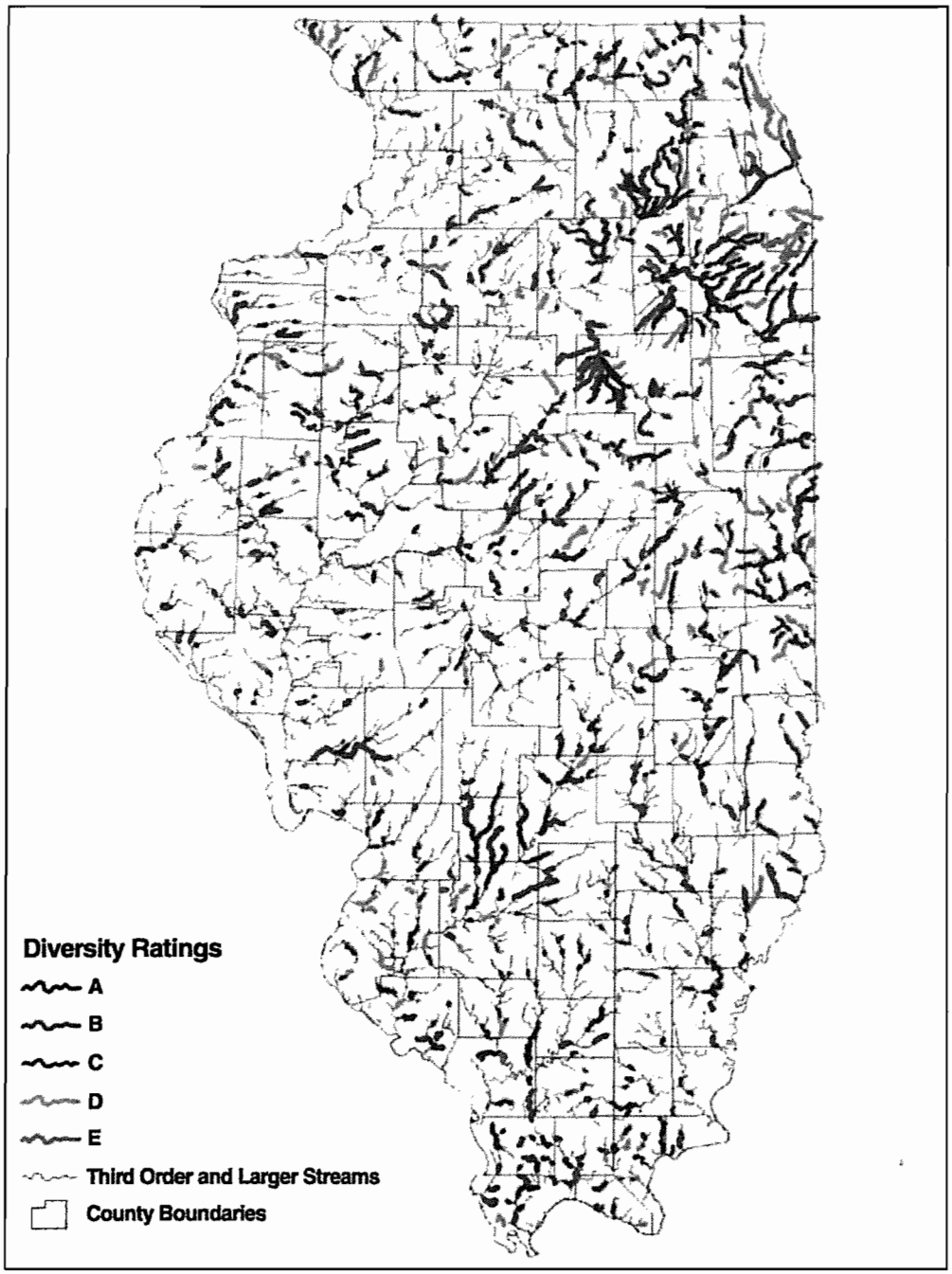


Figure 2. Geographic distribution of diversity ratings. Three percent of all valley segments for Illinois have a diversity rating. Access to the diversity data associated with individual streams is available at: http://www.dnr.state.il.us/orc/BioStrmRatings/.

Integrity Ratings

Background

Biological integrity refers to a system's wholeness (Angermeier and Karr 1994) and the ability of a system to support organisms and processes comparable to natural habitat of the region (Hughes and Noss 1992). Indices or assessment measures like the fish and macroinvertebrate Indexes of Biotic Integrity (Smogor 2000, Tetra Tech, Inc. 2007) measure how closely a test community resembles a natural, least-disturbed, or intact community (see Stoddard et al. 2006 for a discussion of these terms). Intactness for fish and macroinvertebrates was determined from the indices of biotic integrity in comparison to least disturbed or reference sites. Intactness for mussels was determined in comparison to historical species richness expectations for a site. In December 2006, project stakeholders met and discussed the appropriateness of available datasets for inclusion in the integrity analysis. We considered data collected within the past decade (1997-2006) that were collected as part of IDNR, IEPA, or INHS monitoring programs. We limited data to these institutions to ensure that collection methods were standardized, repeatable, and will be continued in the future so that data will be available for revisions of these ratings.

Approach

The general approach for obtaining an integrity rating is a six step process.

Step 1. *Select data for inclusion into the rating.*

We considered only data that were collected within the past decade. However, if a single site had more than one sample from the past decade, we used the sample with the highest value for inclusion in the final rating calculation. We used this approach rather than taking the most recent sample or an average of the samples because the highest value represents a conservative estimate of the biological potential for the site and this approach accounts for variation that may occur with sampling. Additionally, we did not average the data from multiple samples because the average could represent a condition that had not been found at the site. The following data were used in the final integrity ratings.

Fish – Fish data from community samples taken as part of the cooperative Basin Survey Program and other department monitoring were provided by the IDNR. These data were reviewed by regional IDNR stream biologists to verify that the samples were representative community samples with adequate sampling efficiency. Fish Index of Biotic Integrity (IBI) scores from the compiled samples were used to calculate integrity ratings. A total of 744 sites with calculated Fish Index of Biotic Integrity (IBI; Smogor 2000) scores were used in the final integrity score analysis (Table 7).

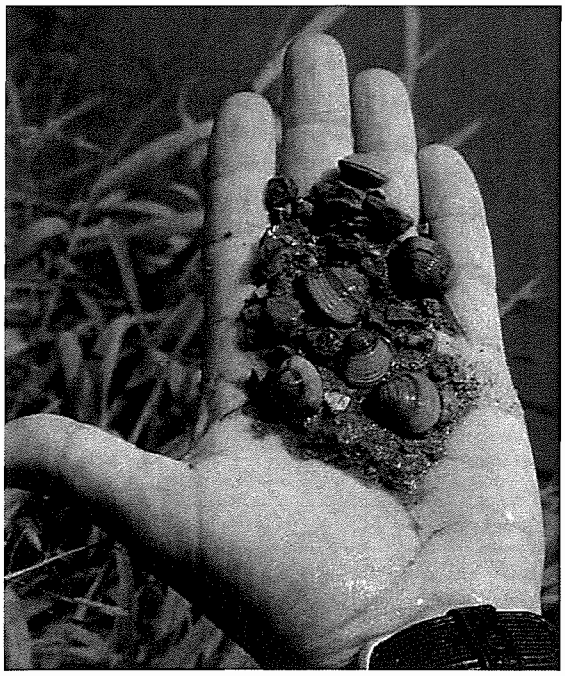
Table 7. The number of sites from each dataset used to calculate integrity scores.

Integrity Dataset	Number of Sites
Fish IBI	744
Macroinvertebrate IBI	452
Mussel Classification Index	134
Mussel Single Sample Intactness	329
Mussel Historical Intactness	366
Total	2025

Aquatic Macroinvertebrates – Benthic macroinvertebrate data were compiled

from the IEPA in Springfield. These data were collected following protocols established for use in their Stream Condition Index (Tetra Tech, Inc. 2007), referred to as the Macroinvertebrate Index of Biotic Integrity (MIBI) in this project. A total of 452 sites with total MIBI scores were used for the final integrity score analysis (Table 7).

Mussels – Mussel data were obtained from the INHS mollusk collections database (http://www.inhs.uiuc.edu/cbd/collections/mollusk/molluskintro.html) and IDNR. Records associated with freshwater snails, fingernail clams, zebra mussels, and Asian clams were not included, as well as any records not located in streams. In order to query data that were representative of community samples, we restricted our data to a list of collectors' names obtained from Kevin Cummings, the INHS malacologist and mussel database manager. Three variables were used to determine integrity ratings for mussels: mussel community index (MCI), single sample intactness, and historical intactness.



Freshwater Mussel Classification Index (MCI)

Data were obtained from Bob Szafoni (IDNR) for sites where the MCI has been calculated (Szafoni 2002). The MCI is comprised of four metrics: species richness, abundance, presence of intolerant species, and recruitment (Szafoni 2002). Each of these metrics is scored and the scores are then summed to determine an index score. Although the MCI is comprised of multiple metrics like the fish IBI and MIBI, it differs from these because the response of metrics included in MCI to human impacts in watersheds has not been considered as part of the MCI development. Because reference conditions were not used to evaluate metrics, the resulting MCI scores do not represent how far a sampled mussel community is from a natural or reference condition. Rather, they were selected to represent the characteristics of a healthy functioning community. Fundamentally this is different than the fish and macroinvertebrate IBIs, however we included the MCI in this project with the expectation that the index will be refined in the future and the availability of data will increase. A total of 134 sites were used for the final integrity score analysis (Table 7).

Intactness

One metric currently considered for inclusion into the MCI is community intactness, which is simply defined as the proportion of live species found at site to what is expected. Initial analysis suggested that the expected value increased with the number of samples available for a site. Therefore, we calculated both single sample and historical intactness values to account for different numbers of samples among sites.

Both intactness values were calculated for a site using the community sample from the past decade with the highest species richness of live mussel species divided by the total number of species including dead (dead and newly empty shells) and relict (old shells) specimens. For single sample intactness, the total number of species was from the single sample while for historical intactness it included all the species found at the site from all available samples. If both historical and single sample intactness were calculated for a site, then historical intactness was used in the final integrity ratings. A total of 366 historical intactness sites and 329 non-overlapping single sample intactness sites were used for the final integrity score analysis (695 total mussel sites, Table 7).

Step 2. *Convert raw data to a class score.*

One of the objectives for this project was to give equal weight to all communities of organisms found in streams if adequate and comparable sampling had occurred. To do this, we developed classes for each dataset used in the analysis in an attempt to interpret raw data from different sources and classify it similarly. Classes were independently developed for each dataset using each sample collection as an independent record rather than pooling samples from a single site. For example, if one site had multiple samples collected between 1997-2006, then each sample was treated as an independent record for the purpose of creating the class scores. Therefore, integrity and intactness expectations were based on the number of species you would expect to find in a single sampling event. Once the classes were established, only the sample that had the highest value from each site was used to calculate the final integrity rating.

Fish Index of Biotic Integrity — The fish Index of Biotic Integrity (IBI; Smogor 2000) scores were used as a component of the integrity rating. Because the IBI already had five integrity classes associated with the index (Smogor 2005), we maintained these classes with little modification. In the IBI, the integrity classes ranged from one (best) to five (worst). We reversed the numbering of the classes to give the sites with the highest IBI score a 5 instead of a 1.

Macroinvertebrate Index of Biotic Integrity (MIBI) — The MIBI (Tetra Tech, Inc. 2007) scores, based on seven metrics, were used as a component of the integrity rating. In the MIBI, final scores are placed into one of four classes, with one being the worst and four being the best. We maintained these four classes for this project.

Mussels

Mussel Classification Index (MCI)

Szafoni (2002) defined five classes for the MCI ranging from 0-4. We maintained classes 1 through 4 for the integrity ratings. Sites with a total score of 0 had no live mussels present and were not included in the final integrity rating calculations.

Intactness

We used the 90th percentile as the boundary for the highest class for datasets that were not developed with a reference site approach or did not have classes already developed for the index. Our rationale was that by raising the standard for the top class for intactness the 90th percentile, the highest class would be similarly restrictive as the datasets that did have reference site data available. We developed classes for historic and single sample intactness independently. For each,

intactness classes consisted of the 1-10th percentile for class 1 and the 11-50th, 51-89th and 90th+ percentile for classes 2, 3, and 4 respectively. Similar to mussel species richness expectations, classes were assigned according to drainage and stream size (Tables 8 and 9).

Step 3. *Standardize classes into a proportional score (P score).*

Proportional scores were used to standardize differing numbers of classes among variables. All metric/class scores range from "1" to a greater number with the greatest number always representing the highest class. In this step, we divided the assigned class score by the total number of classes available to obtain a proportional score (P score), which has a maximum of 1.

Step 4. *Average the proportional scores within a given taxonomic group to obtain a single taxonomic score (T score).*

Three datasets were potentially available for mussels: MCI score (Szafoni 2002), single sample intactness, and historical intactness. If both historical and single sample intactness were available for a site, then historical intactness was used in the final integrity ratings. When MCI and intactness scores were both available for mussels, then the average of the proportional scores was used to determine the taxonomic score (i.e., mussel taxonomic score). Creating a taxonomic score allowed us to

Table 8. Class scores for mussel single sample intactness percentages based on expectations according to drainage and stream size. Stream size is defined by link number, which is the number of first order streams based on the 1:100,000 National Hydrography Dataset (NHD) upstream of a given stream reach. Link codes refer to groupings of link numbers.

		Single Sample Intactness Percentage			
Stream Size	Drainage	Class 1	Class 2	Class 3	Class 4
Small (Link code 1)	Illinois	1 - 27	28 - 65	66 - 83	84+
	Mississippli	1 - 19	20 - 50	51 - 83	84+
	Ohio	1 - 20	21 - 42	43 - 54	55+
	Wabash	1 - 33	34 - 60	61 - 79	80+
Medium (Link code 2 - 3)	Illinois	1 - 26	27 - 71	72 - 90	91+
	Mississippli	1 - 35	36 - 71	72 - 88	89+
	Ohio	1 - 12	13 - 44	45 - 76	77+
	Wabash	1 - 20	21 - 50	51 - 82	83+
Large (Link code 4 - 6)	Illinois	1 - 21	22 - 50	51 - 83	84+
	Mississippli	1 - 32	33 - 64	65 - 77	78+
	Ohio	na	na	na	na
	Wabash	1 - 24	25 - 55	56 - 88	89+

Table 9. Class scores for mussel single sample intactness percentages based on expectations according to drainage and stream size. Stream size is defined by link number, which is the number of first order streams based on the 1:100,000 National Hydrography Dataset (NHD) upstream of a given stream reach. Link codes refer to groupings of link numbers.

		Historical Intactness Percentage			
Stream Size	Drainage	Class 1	Class 2	Class 3	Class 4
Small (Link code 1)	Illinois	1 - 22	23 - 50	51 - 79	80+
	Mississippli	na	na	na	na
	Ohio	1 - 15	16 - 27	28 - 59	60+
	Wabash	1 - 17	18 - 50	51 - 71	72+
Medium (Link code 2 - 3)	Illinois	1 - 20	21 - 62	63 - 79	80+
	Mississippli	1 - 20	21 - 57	58 - 79	80+
	Ohio	1 - 14	15 - 31	32 - 53	54+
	Wabash	1 - 14	15 - 41	42 - 71	72+
Large (Link code 4 - 6)	Illinois	1 - 11	12 - 44	45 - 69	70+
	Mississippli	1 - 16	17 - 45	46 - 63	64+
	Ohio	na	na	na	na
	Wabash	1 - 13	14 - 40	41 - 62	63+

include information derived from separate assessments into a combined signal for mussels. However, we averaged all available mussel information into a taxonomic score in order to give equal weight to fish, macroinvertebrates, and mussels in the final integrity rating.

Step 5. *Average proportional and/or taxonomic score for multiple sites on a valley segment.*

When multiple sites were associated with a particular valley segment for a dataset, the average of these proportional or taxonomic (for mussels) scores was used to calculate the final integrity score. An average from the different sites was used rather than considering the highest proportional score from the valley segment since conditions within the stream segment may vary and an average for the whole valley segment was a better representation than the signal from a single site.

Step 6. *Determine the final integrity rating for a valley segment.*

The final integrity score for a valley segment was calculated as:

Integrity Score = average (average fish IBI P scores + average MIBI P scores + average mussel T scores), where P score = proportional score and T score = taxonomic score

The cut-offs for the final integrity letter ratings were determined by visually inspecting the distribution of the integrity scores (Figure 3). We also attempted to have a similar percentage of rated valley segments within each letter category to the previous BSC projects. A total of 1019 valley segments were assigned an integrity rating of A-E (Figure 4). This represents 2.7% of the total valley segments. The percentage of valley segments with the assignment of ratings A - E is 9, 31, 45, 10 and 5 respectively. While this procedure has been developed for assigning ratings using multiple datasets, approximately one half of the total valley segments that were assigned an integrity score used data from only one dataset (Table 10).

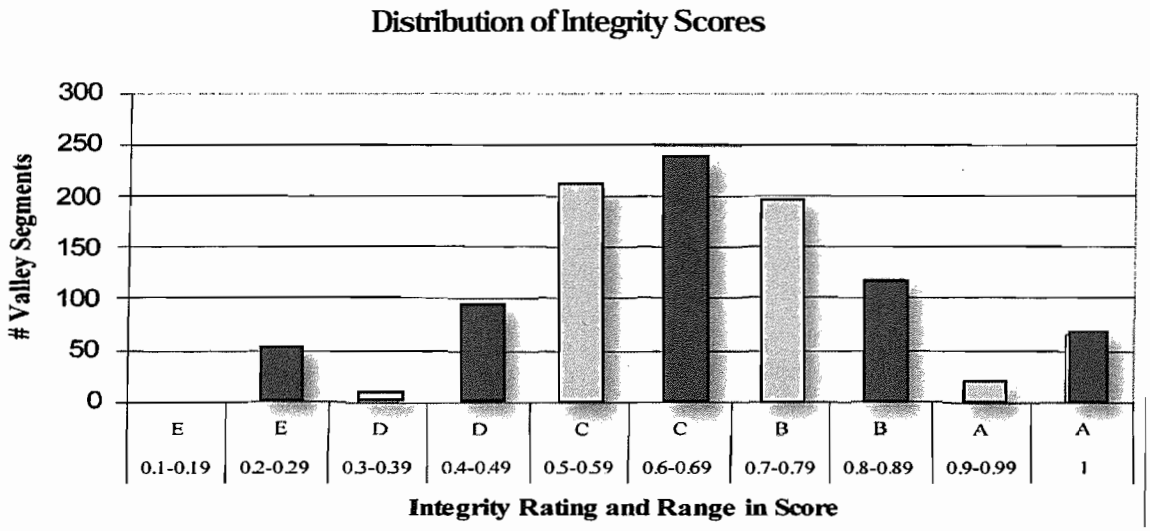


Figure 3. Distribution of integrity scores and corresponding letter ratings. The percentage of valley segments with integrity ratings of A-E is 9, 31, 45, 10, and 5 respectively.

Examples of Integrity Ratings

We provide several examples to further illustrate the integrity rating process (Table 11). In the first example only the single dataset of macroinvertebrate IBI is associated with the valley segment. The MIBI score is 39.99 which equals a class 2 out of 4; therefore the proportional score is 0.5. Since there are no other datasets available for this valley segment the final integrity rating is also 0.5 (Integrity Rating C).

Table 10. The number of datasets contributing to final integrity ratings.

Datasets	Total Valley Segments
1	515
2	306
3	104
4	80
5	12
Total	1019

In the second example both the MIBI and fish IBI are available. The fish IBI score is 47 corresponding to class 4 and a proportional score of 0.8. The MIBI score is 65.39 corresponding to class 3 and a proportional score of 0.75. The average of the fish IBI and MIBI proportional scores is calculated to determine the final integrity score of 0.775, which equates to an integrity rating of B.

In the third example, the fish IBI, MIBI, and two mussel datasets are available. The fish IBI score is 55, which is a class 4 score with a proportional score of 0.8. The MIBI score is 78.23 with a class score of 4 and a proportional score of 1. The mussel

Table 11. Examples of calculating integrity scores.

	Example with single dataset	Example based on Fish and Macroinvertebrate IBIs	Example with t average of mussel datasets
Valley Segment	38663	29766	44269
Fish IBI score		47	55
Fish IBI class score		4	4
Fish IBI proportional score		0.8 (4/5)	0.8 (4/5)
Macroinvertebrate IBI score	39.99	68.39	78.23
Macroinvertebrate IBI class score	2	3	4
Macroinvertebrate IBI proportional score	0.5 (2/4)	0.75 (3/4)	1 (4/4)
Mussel Classification Index score			16
Mussel Classification Index class score			4
Mussel Classification Index proportional score			1 (4/4)
Mussel single sample intactness percentage			29
Mussel single sample intactness class score			2 (2/4)
Mussel single sample intactness proportional score			0.5
Mussel historical intactness percentage			
Mussel historical intactness class score			
Mussel historical intactness proportional score			
Mussel taxonomic score			0.75
Integrity score	0.5	0.775	0.85
Integrity rating	C	B	B

classification index score is 16 with a class score of 4 and a proportional score of 1. The single sample intactness percentage is 29, which is a class 2 score and a proportional score of 0.5. The two mussel proportional scores are averaged for a mussel taxonomic score of 0.75. The final integrity score is then the average of the fish IBI proportional score, the MIBI proportional score, and the mussel taxonomic score. The final score equals 0.85, which is equivalent to an integrity rating of B. ●

Map of Integrity Ratings

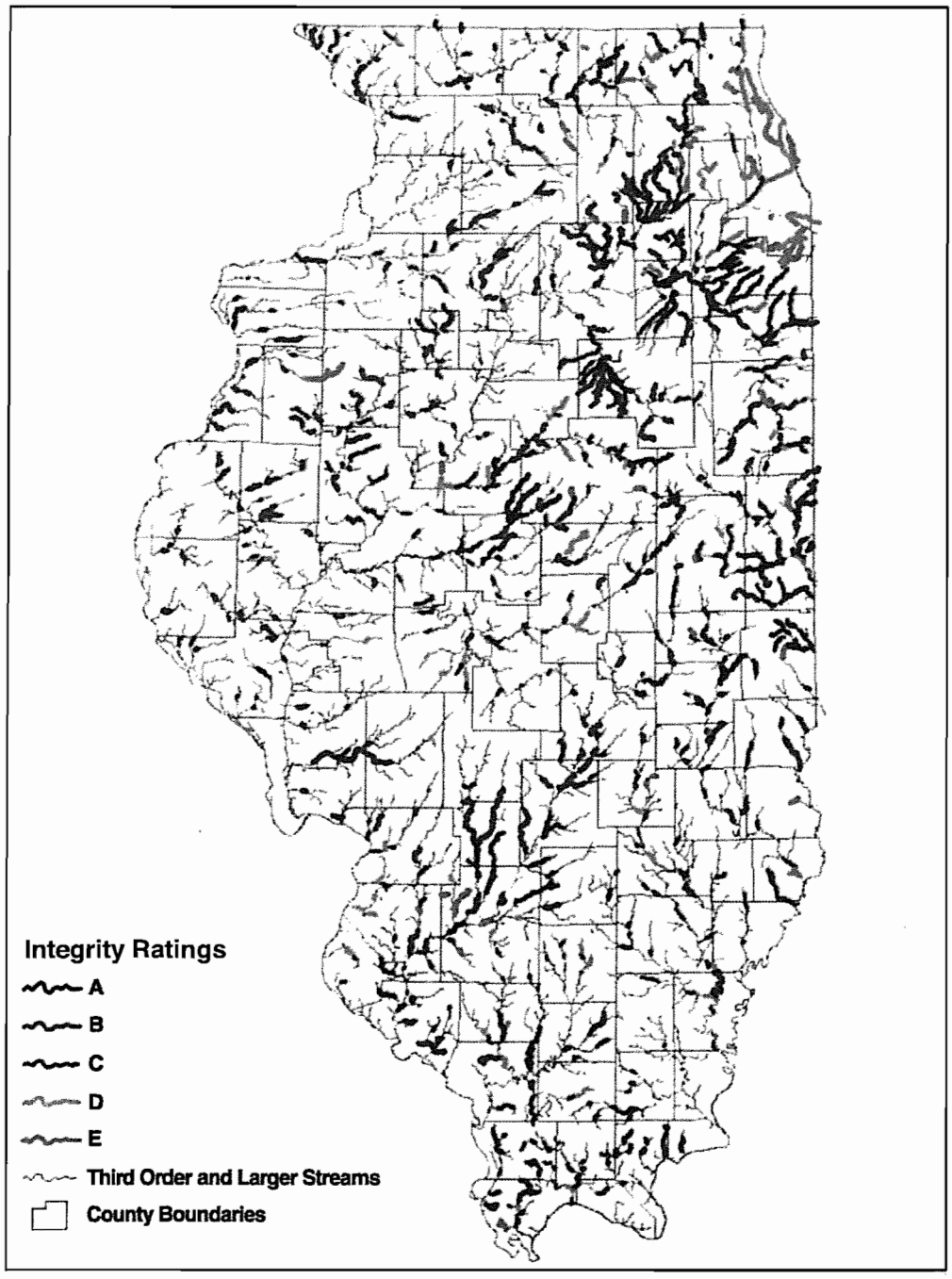


Figure 4. Geographic distribution of integrity ratings. Of the total 38,046 valley segments for the state, only 2.7% have an integrity rating. Access to the integrity data associated with individual streams is available at: http://www.dnr.state.il.us/orc/BioStrmRatings/.

Biologically Significant Streams

Biologically Significant Streams (BSS) are defined as streams that have a high rating or score based on data from at least two taxonomic groups. This can be achieved by obtaining an A rating either for diversity or for integrity that is based on data from two or more taxonomic groups. A second way to achieve this status is for a stream segment to have class scores in the highest class for at least two different taxonomic groups when considering the combined data from the diversity and integrity ratings. While these criteria may seem more rigorous than the previous BSS assessment, we believe this is merited. By requiring BSS segments to have either an A rating or high class scores from separate assessments, we assured that only the highest rated reaches are given biologically significant status. By considering two taxonomic groups, we have more confidence in the BSS designation because at least two signals are indicating high biological significance within the stream.

A total of 1366 valley segments had data associated with them. Our primary criteria requiring a valley segment to contain the highest class score from two different taxonomic groups accounted for 84% of all BSS identifications. However, most valley segments (56%) that were identified as biologically significant also received an A rating for Diversity and/or Integrity (Table 12).

Stream segments identified as biologically significant are unique resources in the state and we believe that the biological communities present must be protected at the stream reach, as well as upstream of the reach. It is well documented in the scientific literature that the physical and chemical properties of water at a stream site reflect upstream influences (Omernick et al. 1981, Smart et al. 1981, Hunsaker and Levine 1995). However, we are unaware of any criteria that can definitively identify the upstream extent of influence on biota within each stream reach identified as biologically significant. Therefore, we used some simple, practical constraints for extrapolating from site-specific information to upstream stream segments to arrive at the final segments identified as biologically significant. Stream reaches (i.e., arcs defined as confluence to confluence reaches) upstream of a valley segment that was identified as BSS were also

Table 12. The underlying qualifications for designation as a biologically significant stream (BSS). All BSS were evaluated based on information from at least two datasets from differing taxonomic groups. For streams rated A for diversity or integrity, at least two datasets from different taxonomic groups had to contribute to the final rating. For streams that had the highest class score, the two different taxonomic groups could be derived from a combination of both the diversity and integrity datasets.

Rationale	Count
2+ highest classes but no A ratings	54
Total with A rating	68
Total BSS valley segments	122
Breakdown 2+ highest class ratings	
Integrity A & 2+ highest classes	5
Diversity A & Integrity A & 2+ highest classes	11
Diversity A & 2+ highest classes	33
2+ highest classes but no A ratings	54
Total with 2+ highest classes	103
Breakdown A ratings	
Diversity A & Integrity A	1
Integrity A & 2+ highest classes	5
Diversity A	8
Integrity A	10
Diversity A & Integrity A & 2+ highest classes	11
Diversity A & 2+ highest classes	33
Total with A Rating	68

identified as biologically significant if ALL of the following criteria applied:

1) The nearest downstream valley segment has sufficient biological information to warrant BSS status.

2) The stream reach is part of the BSS and not a tributary connecting to it.

3) The stream reach is not smaller than third order in size. Stream order is a relative measure of stream size; larger orders represent larger streams. Using third order as a size limit is consistent with the extent of range for the majority of fish, mussel, and macroinvertebrate information used, which predominately was collected from third-order streams and larger. Importantly, not all stream segments smaller than third order were denied BSS status outright. As per the first criterion, regardless of stream size, if sufficient biological information was available from the valley segment and the information indicates high integrity or diversity, the segment was identified for BSS status.

4) The stream reach is free-flowing, i.e., not obviously part of a lake, reservoir, or large river. ●

Map of Biologically Significant Streams

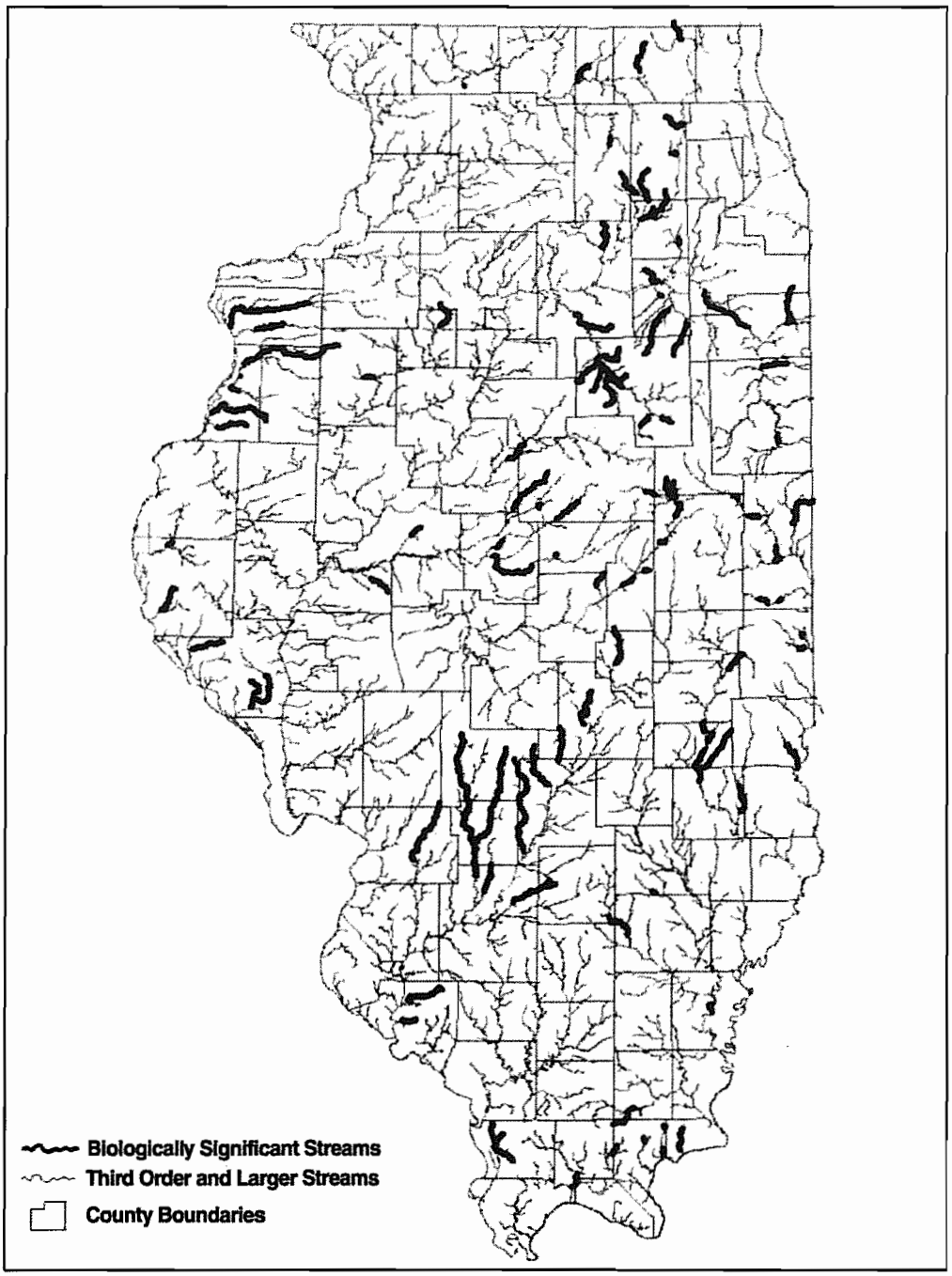


Figure 5. Geographic distribution of biologically significant streams. Access to the data associated with individual streams is available at: http://www.dnr.state.il.us/orc/BioStrmRatings/.

Conclusions

The ratings proposed in this document incorporate aspects of both previous BSC and BSS processes. Since the publication of BSC and BSS, new initiatives have been implemented to collect biological information relevant to streams such as the Critical Trends Assessment Program, Mussel Classification Index, and the Benthic Macroinvertebrate Stream Condition Index (MIBI in this report). The fish IBI has also been revised and the list of threatened and endangered species has changed since the original publication of BSS. With the additions and changes to these data sources, it was pertinent to reassess the strengths and weaknesses of the previous stream ratings in the context of supporting implementation of Illinois' Wildlife Action Plan. The Illinois Wildlife Action Plan identifies a broad array of species in greatest need of conservation, and therefore it was appropriate to consider multiple taxonomic groups in this project. In keeping with the Illinois Wildlife Action Plan's stream habitat goal that: "High–quality examples of all river and stream communities . . . are restored and managed within all natural divisions in which they occur", the current stream ratings and identification of biologically significant streams provide a new and updated tool to identify and target such areas. By combining multiple datasets from different taxonomic groups into a single rating, this project gives ratings that are a holistic representation of stream biological resources. Because we considered data in addition to fish, ratings were applied to an additional 483 valley segments that lacked fish data.

Data Issues

Other taxonomic groups were investigated but not used because of limited available data. For example, information on amphibians and reptiles in Illinois were obtained from the INHS amphibian and reptile collection. Of the listed amphibian and reptile species, the Dusky Salamander, is a species found in stream habitat (Phillips et al. 1999) and is considered an indicator species in small streams without fish (Southerland et al. 2004). While we included the Dusky Salamander in with the T&E species, we did not include other reptiles and amphibians because we lacked sufficient statewide information on the distribution of herpitiles inhabiting streams.

Plant information was also pursued because multiple species were included previously in the Biologically Significant Illinois Streams (Page et al. 1992) publication. However, of the plant species that are still protected under the Illinois Endangered Species Protection Act, only the heart-leaved plantain (Plantago cordata) is considered an associate of stream habitat (Herkert and Ebinger 2002). Many of the species included in the original BSS were aquatic plants associated with pond habitats and therefore were not included in our analysis. We consulted State experts, including INHS personnel previously involved with BSS (Page et al. 1992), to determine if other potential botanical datasets were available. However, no additional plant species were included in our ratings since there have not been systematic statewide surveys of plants associated with stream habitat.

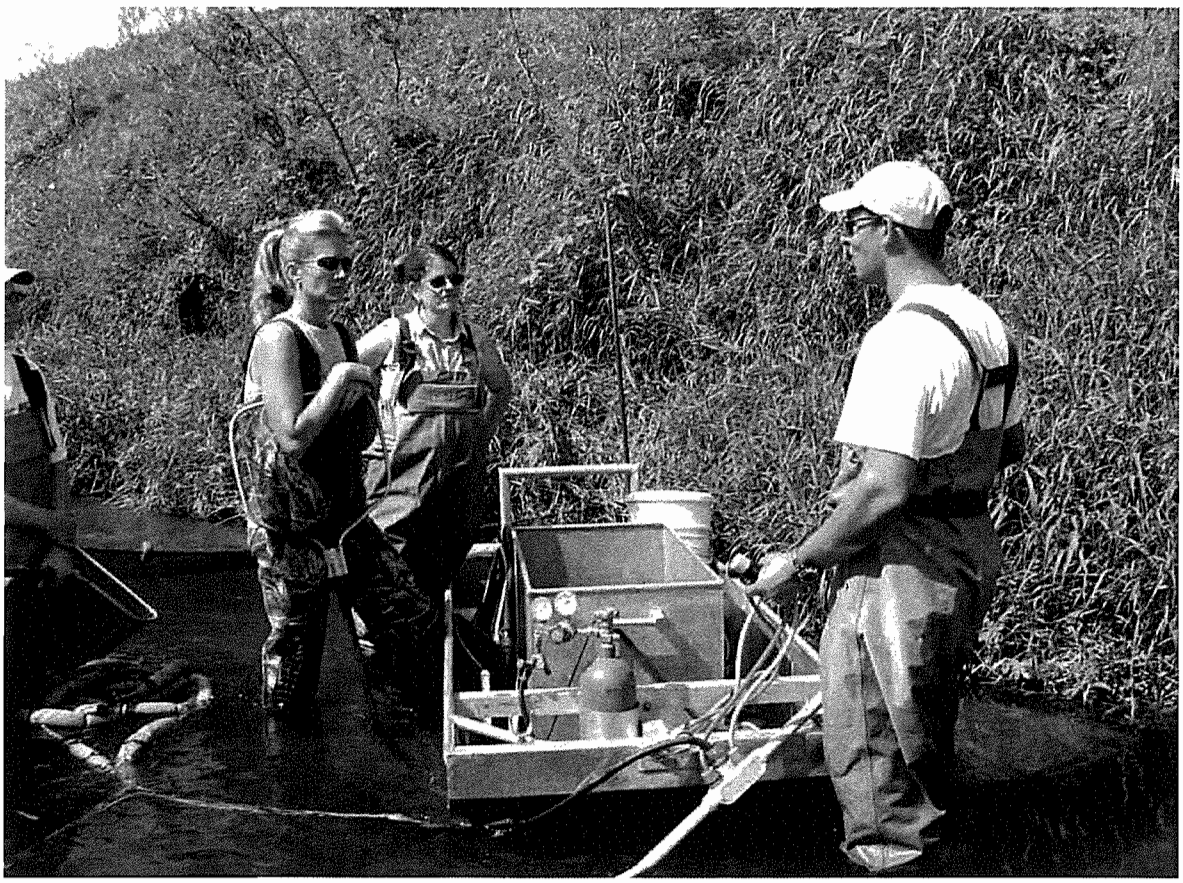
Updates and Revisions

One of the goals of the previous BSC initiatives was to update stream ratings on an annual basis and to publish the revised ratings every five years. However, the original BSC stream ratings were updated only once based on data that were collected through 1993. Similarly, the BSS project was based on data collected through 1991 and has not been updated since. Therefore, stream designations identified in these projects are based on data that is at least 14 years old. Given that these ratings are used by a diverse group of stakeholders, it was clear that an updated version was required.

Several reasons may explain why previous stream ratings have changed through this project including: a new process evaluating diversity and integrity data, addition of data previously unavailable, revision to the fish IBI and T&E species list, and changes in stream condition. Because previous stream ratings may have changed for these reasons, comparisons of new ratings to previous ratings (from Hite and Bertrand 1989, Page et al. 1992, Bertrand et al. 1996) are not appropriate. For example, a stream reach rated as C in this report that was previously B should not be interpreted automatically as a degradation in stream quality. In addition to a revised process for assigning letter grades, biologically significant streams must now have data from two different taxonomic groups. Therefore, some streams previously identified as BSS did not receive the BSS designation in this effort because they lacked sufficient data given the change in criteria.

The ratings included in this report can assist in identifying streams that are in need of restoration or improved conservation. Given that less than 5% of the valley segments in the state have data associated with them, this project also indicates data gaps and can help prioritize future survey efforts. Current fish and macroinvertebrate indexes are only applicable to wadeable streams, thus we limited ratings to wadeable conditions. Development of assessment tools for headwaters and larger rivers would allow broader application of ratings in the future. Systematic surveys of mussels and crayfishes would support index refinement and broader inclusion of these taxa. As statewide surveys increase, the inclusion of other taxa such as herpitiles or aquatic macrophytes may be possible in future updates of the stream ratings.

The final product of diversity and integrity ratings and biologically significant streams, available at http://www.dnr.state.il.us/orc/BioStrmRatings/, indicates the data sources that contribute to each final rating and includes the proportional scores for these data. This information will enable different stakeholders with varying goals to use the ratings and contributing data for their particular purposes. For example, if a stakeholder wanted to target their efforts at streams with high mussel species diversity they would be able to identify those streams according to the mussel species richness proportional score contributing to the final diversity score. Similarly, efforts focused at streams with a high fish IBI score could consider the fish IBI proportional score contributing to a final integrity score.



The major data collection programs (collaborative basin surveys, CTAP, Endangered Species Board updates) used in this project operate on a five year interval to assess streams statewide. Therefore, the IDNR intends to update ratings annually at http://www.dnr.state.il.us/orc/BioStrmRatings/ and publish new ratings, including designating biologically significant streams, after the completion of each round of basin surveys. A published revision of ratings should be available approximately every 5-6 years. With each published update, a new range of data from each of the sources will be selected to encompass the last ten years. For certain datasets such as the fish and macroinvertebrate IBIs, the values that correspond to the class scores will not have to be recalculated since they were already established. However, for other datasets such as the mussel species richness and intactness data, the number of species that correspond to the percentiles that were used to determine class scores will undoubtedly change with the collection of additional data. For these datasets, the values that represent the different class scores should be recalculated using the new data for each revision until these values can be more formally established. In addition, the cut-offs for the letter ratings are based on the distribution of the final scores. In the future these cut-offs could change as new data are analyzed. Therefore, the final scores that correspond to the letter ratings A-E should be reevaluated with any update.●

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Appendix A. List of threatened and endangered species included in stream ratings.

Amphibians

Endangered

Spotted Dusky Salamander	*(Desmognathus conanti)*

Crayfish

Endangered

Indiana Crayfish	*Orconectes indianensis*
Kentucky Crayfish	*Orconectes kentuckiensis*
Shrimp Crayfish	*Orconectes lancifer*
Bigclaw Crayfish	*Orconectes placidus*

Fish

Endangered

Lake Sturgeon	*Acipenser fulvescens*
Western Sand Darter	*Ammocrypta clarum*
Bluebreast Darter	*Etheostoma camurum*
Harlequin Darter	*Etheostoma histrio*
Cypress Minnow	*Hybognathus hayi*
Bigeye Chub	*Hybopsis amblops*
Pallid Shiner	*Hybopsis amnis*
Northern Brook Lamprey	*Ichthyomyzon fossor*
Sturgeon Chub	*Macrhybopsis gelida*
Greater Redhorse	*Moxostoma valenciennesi*
River Chub	*Nocomis micropogon*
Pugnose Shiner	*Notropis anogenus*
Bigeye Shiner	*Notropis boops*
Blacknose Shiner	*Notropis heterolepis*
Taillight Shiner	*Notropis maculatus*
Weed Shiner	*Notropis texanus*
Northern Madtom	*Noturus stigmosus*
Pallid Sturgeon	*Scaphirhynchus albus*

Threatened

Eastern Sand Darter	*Ammocrypta pellucidum*
Longnose Sucker	*Catostomus catostomus*
Cisco	*Coregonus artedi*
Gravel Chub	*Erimystax x-punctatus*

Iowa Darter	*Etheostoma exile*
Banded Killifish	*Fundulus diaphanus*
Starhead Topminnow	*Fundulus dispar*
Least Brook Lamprey	*Lampetra aepyptera*
Redspotted Sunfish	*Lepomis miniatus*
Bantam Sunfish	*Lepomis symmetricus*
River Redhorse	*Moxostoma carinatum*
Ironcolor Shiner	*Notropis chalybaeus*
Blackchin Shiner	*Notropis heterodon*

Mussels

Endangered

Spectaclecase	*Cumberlandia monodonta*
Fanshell	*Cyprogenia stegaria*
Snuffbox	*Epioblasma triquetra*
Pink Mucket	*Lampsilis abrupta*
Wavy-rayed Lampmussel	*Lampsilis fasciola*
Higgins Eye	*Lampsilis higginsii*
Orangefoot Pimpleback	*Plethobasus cooperianus*
Sheepnose	*Plethobasus cyphyus*
Clubshell	*Pleurobema clava*
Ohio Pigtoe	*Pleurobema cordatum*
Fat Pocketbook	*Potamilus capax*
Kidneyshell	*Ptychobranchus fasciolaris*
Rabbitsfoot	*Quadrula cylindrica*
Salamander Mussel	*Simpsonaias ambigua*
Purple Lilliput	*Toxolasma lividus*
Rainbow	*Villosa iris*

Threatened

Slippershell	*Alasmidonta viridis*
Purple Wartyback	*Cyclonaias tuberculata*
Butterfly	*Ellipsaria lineolata*
Elephant-ear	*Elliptio crassidens*
Spike	*Elliptio dilatata*
Ebonyshell	*Fusconaia ebena*
Black Sandshell	*Ligumia recta*
Little Spectaclecase	*Villosa lienosa*

Plants

Endangered

Heart-leaved Plantain	*Plantain cordata*

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