FEASIBILITY STUDY

DRAFT FINAL

FINESVILLE DAM REMOVAL MUSCONETCONG RIVER

HOLLAND TOWNSHIP, HUNTERDON COUNTY
POHATCONG TOWNSHIP, WARREN COUNTY
NEW JERSEY

PREPARED FOR:

MUSCONETCONG WATERSHED ASSOCIATION
P.O. BOX 113
ASBURY, NEW JERSEY 08802

PREPARED BY:

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FUNDED BY:

American Rivers
Thriving By Nature

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NOAA
U.S. DEPARTMENT OF COMMERCE

MARCH 2009
PRINCETON HYDRO, LLC PROJECT NO. 0662.003

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TABLE OF CONTENTS

1.0 Introduction 1
2.0 Project Goals 1
3.0 History of Finesville Dam and Village 2
4.0 Finesville Dam Construction and Condition 3
5.0 Dam Ownership 4
6.0 Impounded Sediment and Hydraulic Backwater 4
7.0 Surrounding Geology 7
8.0 Reach Geomorphology 7
9.0 Conceptual Approach to Partial or Full Dam Removal 8
9.1 Complete Removal 8
9.2 Partial Removal 9
9.3 Fish Habitat Enhancement 9
10.0 Preliminary Hydrologic and Hydraulic Analysis 10
10.1 Storm Flows 10
10.2 Geometry Data 11
10.3 Roughness Coefficient 'n' 11
10.4 Contraction and Expansion Coefficients 11
10.5 HEC-RAS Model 11
10.6 Results 11
11.0 Anticipated Regulatory Permitting and Approvals 13
11.1 NJDEP Dam Safety Construction Permit 13
11.2 NJDEP Land Use Regulation Program (Bureau of Freshwater Wetlands) 13
11.3 NJDEP Division of Fish and Wildlife 14
11.4 State and Federal Historic Preservation Acts Review 15
11.5 Soil Conservation District 15
11.6 Highlands Approvals 15
11.7 Local Approvals 16
12.0 Cost Estimates for Construction 16
12.1 Complete Removal 16
12.2 Partial Removal 17
12.3 Fish Habitat Enhancement Alternative (0ptional, but not necessary) 17
12.4 Engineering Design, Permitting and Construction Administration 17
13.0 Funding Sources 18
13.1 Natural Resource Conservation Service's Wildlife Habitat Incentive Program 18
13.2 US Fish and Wildlife Service's Partners for Wildlife Program 18
13.3 American Rivers-NOAA – Community-Based Restoration Grant Program 18
14.0 Schedule 18
15.0 Conclusions and Recommendations 19
16.0 Next Steps 20

Appendices:

Appendix A – USGS Site Location Map
Appendix B – DEP Letter Regarding Dam Ownership
Appendix C – Sediment Sampling Location Map
Appendix D – Summary of Laboratory Analytical Results
Appendix E – Bedrock Geology Map
Appendix F – Surficial Geology Map
Appendix G – Conceptual Stream Enhancement Plan
Appendix H – HEC-RAS Model Results

Attachment: Bathymetric Map with Profile and Cross-Sections
Fish Habitat Enhancement Concept Plan

1.0 Introduction

Princeton Hydro, LLC (Princeton Hydro) was contracted by the Musconetcong Watershed Association (MWA) to complete a feasibility analysis for the partial or total removal of the Finesville Dam on the Musconetcong River, a major tributary of the Delaware River. The study was funded by the American Rivers-NOAA Community-Based Restoration Program. The Finesville Dam is the first of eleven major dams that block fish passage on the Musconetcong River (see Appendix A). Its removal would reconnect three additional miles of tributary to the Delaware River and raise the incentive for addressing upstream obstructions. The Hughsville Dam is the next obstruction to fish passage, three miles upstream. As a run of the river structure, the Finesville Dam has no ability to attenuate flows. The dam is 5.5 feet high and the linear impoundment extends roughly 2,300 feet upstream.

This feasibility study is the result of the effort by the Musconetcong Watershed Association, American Rivers, the National Oceanic and Atmospheric Administration and a number of other project supporters, including:

- USDA, Natural Resource Conservation Service (NRCS);
- US Fish and Wildlife Service (USFWS);
- NJDEP, Bureau of Dam Safety and Flood Control;
- Trout Unlimited;
- North Jersey Resource & Development Council;
- Mr. James Grodon, dam owner.

The NRCS is currently providing leadership and management of the historic elements of Federal environmental review process under the National Environmental Policy Act (NEPA). Although this report has been prepared separate from NRCS in their NEPA review process, it will provide beneficial elements for the argument in favor of complete or partial removal. Restoration of diadromous fish passage, while a primary element of the function of NOAA, under their Open Rivers Initiative is also required to address the restoration of the riparian corridor functions, which includes natural flooding processes, sediment transport, and self-sustaining fringe and floodplain wetlands. No other alternative to fish passage, such as fish ladders, rock ramps or nature-like fishways, addresses all of the target riparian functions, and therefore, was not considered within this Feasibility Study.

2.0 Project Goals

The nonprofit MWA initiated this study after consulting the current dam owner and confirming their interest in investigating removal options. The owner is interested in removing the structure to reduce the potential public safety hazard, and to remove the corresponding regulatory requirements as promulgated by the NJ Dam Safety Regulations. In fact, in August 2003, a recreational kayaker perished after getting trapped in the powerful undercurrents at the toe of the dam. Furthermore, while the dam is not in immediate danger of failure, the dam contains a number of structural deficiencies that require repair. Additionally, NJDEP has classified it as a Significant Hazard Structure (Class II) – the failure of which may cause significant damage to property. Therefore, to reduce their liability for loss of life from the dam's presence and liability for property damage in the event of its failure, the dam owner is exclusively interested in removal.

Likewise, following its stated mission to protect and enhance the Musconetcong River, the MWA is striving to restore the river to a free-flowing state, maximize fish passage and provide ecological uplift within the Musconetcong River. With these goals in mind, the MWA has formed a natural partnership with American Rivers (AR) and the National Oceanic and

Atmospheric Administration (NOAA), a nonprofit-government collaboration that focuses funding on removal efforts. Other alternatives, which may be viable, such as a fishway or fish ladder, would not be eligible for additional financial support under the AR-NOAA program.

This Study focuses on the two options, partial or complete removal of Finesville Dam, which meets the goals of all project partners.

3.0 History of Finesville Dam and Village

The Finesville Dam was originally built for an iron forge around 1751 (Wacker, p. 152). While Finesville, the historic village, lies to the north of the river in Warren County, the dam was associated with the southern side of the river in Hunterdon County (Schmidt, p. 218). The dam may also have supplied power to a saw mill as well, as the operations were often coupled (Wacker, p. 86). A gristmill was built at this location on the north side of the river in 1791 (Wacker, p.119).

Finesville village was originally within Greenwich Township until the incorporation of Pohatcong in 1881. Holland Township, on the southern banks, was created permanently from Alexandria Township in 1879. Schmidt (1946, p. 216) identifies a forge that existed at Finesville on the Hunterdon County side of the river during colonial times. According to Wacker (1968, p.152), "…Finesville…owes its location to the establishment of Chelsea Forge on the site ca. 1751". Wacker (1968, p. 86) also reports: "Abram Evans of Philadelphia offered the Chelsea Forge, at what later became Finesville, on the Musconetcong, for sale in 1763". A gristmill was built on the north bank of the stream at Finesville in 1791 (Wacker, 1968, p. 119). Holland Township, Schmidt (p. 212) reported there were sawmills in every township in Hunterdon County with over 60 sawmills countywide. By 1853, Finesville was a small manufacturing village that contained about 20 dwellings (Barber and Howe, p. 489).

In the early 1900s, it is believed the dam spillway was reconstructed to the concrete design existing today. Despite the more recent work, the associated masonry abutments embody a distinctive and irreplaceable historic value and warrant being preserved in the design of the removal.

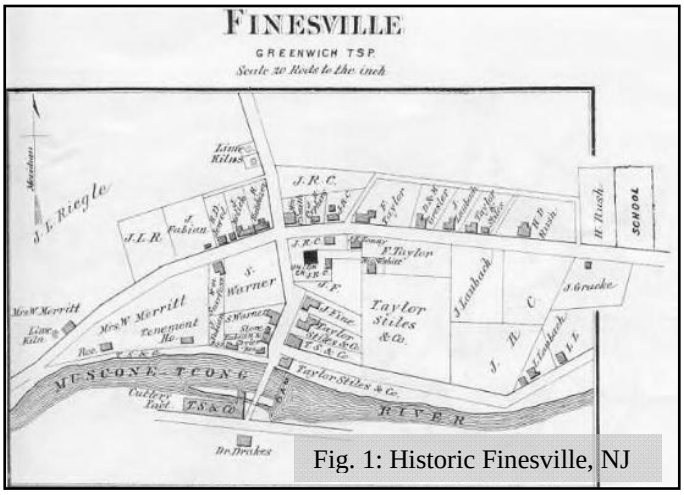


Fig. 1: Historic Finesville, NJ

In addition, it is understood that the sound of water over the dam enhances the historic and aesthetic value. Such sounds should also be considered in mitigating the removal of the dam, and can be recreated in the channel design.

References

Barber, John H., and Henry Howe. 1853. Historical Collections of the State of New Jersey. Benjamin Olds: Newark, NJ.

Holland Township. <http://www.hollandtownship.org/>. Accessed 9/08/2008.

Pohatcong Township. <http://www.pohatcong.com/municipal/index.html>. Accessed 9/08/2008.

Schmidt, Hubert G. 1946. Rural Hunterdon: An Agricultural History. Rutgers University Press: New Brunswick.

Wacker, Peter O. 1968. The Musconetcong Valley of New Jersey. Rutgers University Press: New Brunswick.

4.0 Finesville Dam Construction and Condition

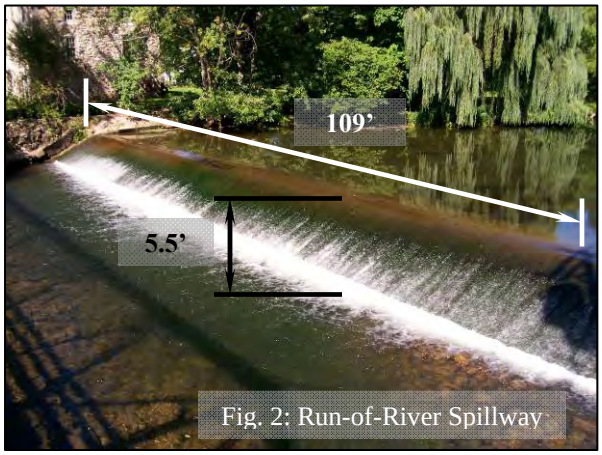


Fig. 2: Run-of-River Spillway

The Finesville Dam is 5.5 feet in height and 109 feet in length and has an inclined ramp spillway. The majority of the dam appears to be comprised of cast-in-place concrete, although based on the observation of the remnant foundation of the Riegelsville Dam downstream and the existing Hughesville Dam several miles upstream, NJDEP Dam Safety Bureau believes it may be a concrete capped timber crib. Due to the spillway's concrete composition, the current dam was likely constructed in the early 20th century. There was no visual evidence of the dam's foundation construction, or the original superstructure of previous spillways. The embankments are large stone masonry that also forms the base of the Mt. Joy Road Bridge that is approximately 20 feet downstream. The NJDEP identifies the dam as a Significant Hazard Structure (Class II). The linear impoundment is approximately 4.4 acres in aerial extent. Immediately downstream of the dam is a steel truss bridge that is part of Mount Joy Road. The bridge spans Warren and Hunterdon County, and therefore, has dual jurisdiction, however, as we understand there is an agreement for Hunterdon County to maintain this specific bridge. On the river left side of the dam, the remnant of the mill raceway is blocked off on the upstream side and filled in below Mount Joy Road. The remaining raceway is housed within the mill building (circa 1900s).

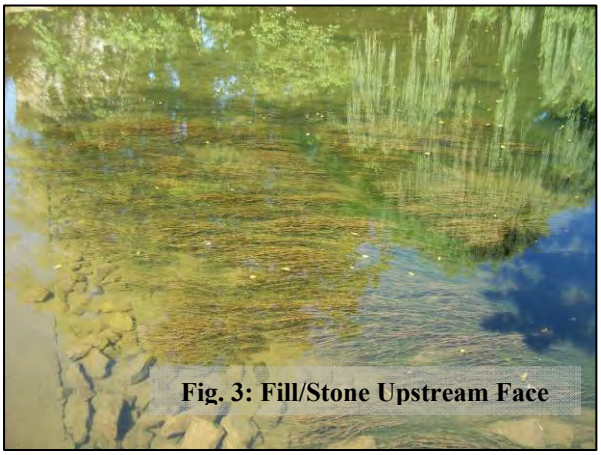


Fig. 3: Fill/Stone Upstream Face

Princeton Hydro engineers completed an informal visual inspection of the dam for compliance and to ascertain its current condition. Representatives of the NJDEP Bureau of Dam Safety and Flood Control were contacted to determine the dam's original construction and condition, however, no historical construction information was available. The downstream face of the spillway appears to be in good condition. The upstream faced is buried and covered with large diameter rip rap (18 inch mean diameter). There is significant subsidence behind the southern abutment wall from an apparent loss of soil at the toe of the wall below the water surface. The dam does not appear to have a concrete apron allowing a scour hole to form along the entire toe of the spillway to a distance of 10 feet. An extensive hydraulic roller forms during high flows that has displaced the bed material with a mean 6 inch diameter and deposited it just downstream of the scour hole. As a result of this scour across the width of the spillway, scour is also occurring at the foundations of the Mount Joy Road Bridge. It is our professional opinion if the dam is not repaired with a scour apron, there is a long-term danger of instability via sliding or rotational failure of the spillway. Additional areas of Dam Safety non-compliance with regard to the structure include the lack of a low-level outlet and lack of overtopping protection on lands adjacent to the spillway during regulatory events. As a Class II structure, this dam is also required to have an Operations and Maintenance Manual and an Emergency Action Plan.

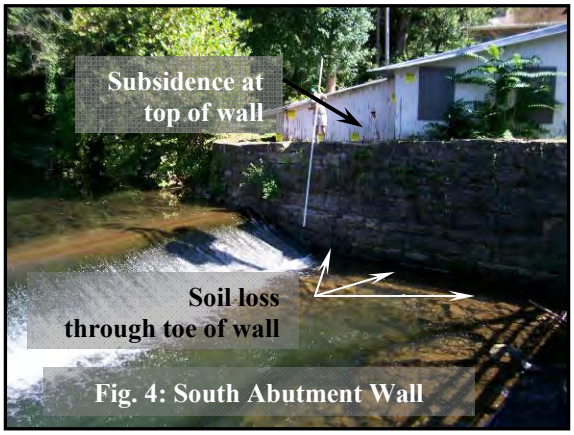


Fig. 4: South Abutment Wall

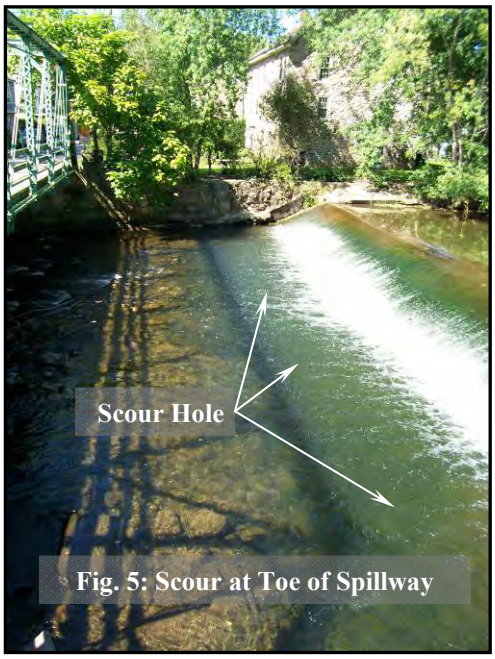


Fig. 5: Scour at Toe of Spillway

5.0 Dam Ownership

Mr. James Grodon, Jr. of 179 Mt. Joy Road, Phillipsburg, NJ 08865 is the sole owner of the Finesville Dam. According to the NJDEP Bureau of Dam Safety and Flood Control, the dam is located within Lot 12 of Block 4 in Holland Township and within Lot 2 of Block 117 in Pohatcong Township (Appendix B). According to tax records Mr. James Grodon is the listed owner of both properties.

6.0 Impounded Sediment and Hydraulic Backwater

Of primary concern for the removal of a run of the river dam is the sediment stored within the impoundment. Depending on the geology, watershed hydrology, historic land use, and river hydraulics sediment can provide minimal or significant impacts to the cost of construction, as well as ecological impacts downstream following the removal. According to aerial photograph interpretation, FEMA profile review, and site reconnaissance, it is estimated that the baseflow elevation of the Finesville Dam extends to a distance of 2,330 feet upstream. To assess the thickness and spatial distribution of sediment, Princeton Hydro surveyed the impoundment. To conduct the survey, staff employed a Knudsen 320B echosounder, which uses a dual frequency transducer to detect the depth to top of sediments and the depth to bottom of sediments. A calibrated rod was used to probe the bottom where the water was too shallow. Each depth measurement was located with a GPS and the points were later tied-in to NAVD 88. Refer to Appendix C for the impoundment bathymetry. With this bathymetric data, the volume of sediment in the impoundment was estimated to be 1,100 cubic yards, excluding the material that was placed adjacent to the dam for supplemental structural support. This quantity of sediment is equivalent to a mean sediment thickness of several inches over a 4.4-acre impoundment area. This surprisingly low volume of sediment may be due to the configuration of

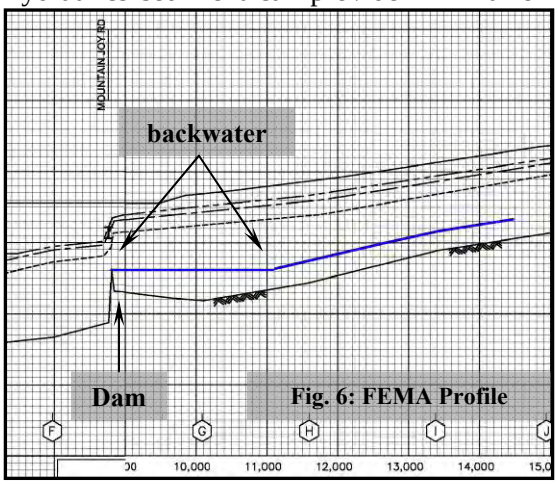


Fig. 6: FEMA Profile

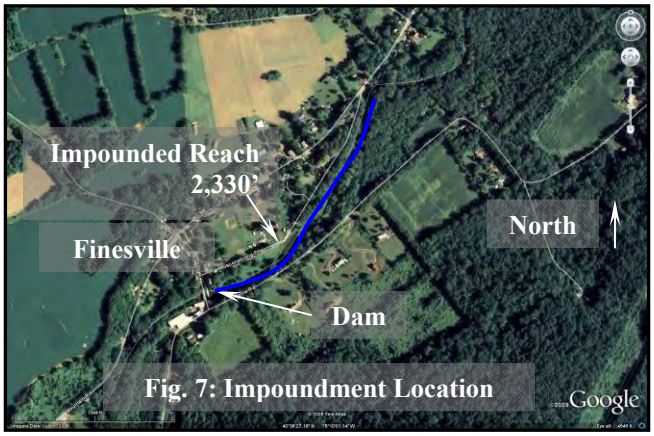


Fig. 7: Impoundment Location

the impoundment and the number of significant dams upstream. First, and foremost, the 2,300-foot impoundment is narrow; with a width of eighty (80) feet. Since the impoundment is only slightly wider than river reaches downstream of the dam and upstream of the impoundment, velocity through the impoundment is not significantly reduced during high flow events, further allowing for occasional resuspension and transport of previously deposited fine sediment. The presence of four dams upstream also has an effect on the sediment load available to the Finesville Dam impoundment. Upstream of Finesville is the 19-foot Hughesville Dam (NJDEP), the 37-foot Warren Glen Dam (NJDEP) and the Bloomsbury and Asbury Dams. All of these dams combined create an effective trap, reducing the sediment load to downstream reaches including the Finesville Dam. The stream bottom in the river reaches downstream of the Finesville Dam and upstream of the impoundment appears to be armored with cobbles and boulders, suggesting long-term sediment deprivation due to the dams upstream with the resulting loss of fines and smaller grained coarse aggregates from the substrate.

Two sediment samples collected from the Finesville Dam impoundment were analyzed for grain size and organic content in Princeton Hydro's geotechnical laboratory, and assessed for human health impact and screened for ecological risk evaluation by Integrated Analytical Laboratories, LLC. Grain size analysis of samples indicates a skew toward sand. By the Unified Soil Classification System, both sediment samples classify as SAND with silty clay. Coarse grained materials such as sands are not expected to contain contaminants; however, the samples were analyzed at Princeton Hydro's analytical laboratory subcontractor, Integrated Analytical Laboratories, Inc (IAL).

The samples were collected on 8/26/2008 from two locations within the impoundment (see Appendix C: Sediment Sampling Locations Map) and analyzed for the constituents of concern listed on the NJDEP Site Remediation Standards (SRS) which include volatile organic compounds (VOC), base neutral/acid extractable (BNA or semi-volatile organic compounds, SVOC), polychlorinated biphenyls (PCB), pesticides, metals/inorganics, and total cyanide. Additionally, although not on the current SRS list Hexavalent and Trivalent chromium were assessed and compared to the prior NJDEP Soil Clean-up Criteria. The sediment analysis results were also compared to the NJDEP Ecological Screening Values for Freshwater Sediment to screen for ecological risk evaluation. A complete list of pollutant parameters and results are attached in Appendix D. *No pollutants were detected above the Soil Remediation Standards or Ecological Screening Values. Since no detected concentrations were above "background" levels, no further investigation is necessary.*

These sample analysis results were discussed with partner agencies. Due the presence of historic paper mills on the Musconetcong River, it was suggested to consider dioxin/furan as additional parameters for analysis due to the presence of paper mills on the river. However, neither dioxin nor furan are required for testing and are not part of the NJDEP SRS List, nor are there any soil remediation standards established for these parameters. Additionally, due to the coarse grained nature of the sediments and the low levels of contaminants reported above, the presence of dioxin/furan are unlikely; therefore, additional analysis is not recommended at this time.

TABLE 1:
SUMMARY OF LABORATORY ANALYTICAL RESULTS - DETECTED COMPOUNDS

Client ID:	S-1			S-2			Ecological Screening Values (ESV) Freshwater Sediment (mg/kg) Persaud et al 1993		Residential Direct Contact Soil Remediation Standard (June 2, 2008, unless noted)
Sample Depth:									
Lab ID:	09899-001			09899-002					
Date Sampled:	08/26/2008			08/26/2008					
Matrix:	Sediment			Sediment			LEL	SEL	
PHYSICAL (%)	Conc	Q	MDL	Conc	Q	MDL			
Total Organics	**5.50**			**4.16**					
Gravel	**1.2**			**2.0**					
Sand	**90.8**			**87.4**					
Fines	**8.0**			**10.6**					
Volatiles (ppm)									
(Including MTBE & TBA)									
TOTAL VOC:	**ND**			**ND**					
TOTAL TIC (tentatively identified compounds):	**ND**			**ND**					
TOTAL VOC & TIC:	**ND**			**ND**					
Semivolatiles - BNA (ppm)									
Phthalates									
Diethyl phthalate	**0.107**		0.045	**0.082**		0.043	NA	NA	49,000
Polynulcear Aromatic Hydrocarbons (PAH)									
Phenanthrene	**0.164**		0.045	**0.067**		0.043	0.56	950	NA
Anthracene	**0.042**	J	0.045	**ND**		0.043	0.22	370	17,000
Fluoranthene	**0.288**		0.045	**0.104**		0.043	0.75	1020	2,300
Benzo[a]anthracene	**0.130**		0.045	**0.046**		0.043	0.32	1480	0.6
Chrysene	**0.131**		0.045	**0.053**		0.043	0.34	460	62
Benzo[b]fluoranthene	**0.118**		0.045	**0.040**	J	0.043	NA	NA	0.6
Benzo[k]fluoranthene	**0.087**		0.045	**0.032**	J	0.043	0.24	1340	6
Benzo[a]pyrene	**0.115**		0.045	**0.040**	J	0.043	0.37	1440	0.2
Indeno[1,2,3-cd]pyrene	**0.067**		0.045	**0.025**	J	0.043	0.2	320	0.6
Dibenz[a,h]anthracene	**0.027**	J	0.045	**ND**		0.043	0.06	130	0.2
Benzo[g,h,i]perylene	**0.068**		0.045	**0.026**	J	0.043	0.17	320	380,000
TOTAL BNA:	**1.56**	J		**0.601**	J				
TOTAL TIC:	**0.200**			**ND**					
TOTAL BNA & TIC:	**1.76**	J		**0.601**	J				
Metals/Inorganics (ppm)									
Aluminum	**4770**		13.8	**4580**		12.9	2.55%	NA	78,000
Arsenic	**3.18**		1.38	**2.71**		1.29	6	33	19
Barium	**26.4**		13.8	**23.8**		12.9	NA	NA	16,000
Chromium, Trivalent	**8.38**		2.75	**11.6**		2.58	NA	NA	120,000 (a)
Cobalt	**4.46**		2.75	**3.57**		2.58	50	NA	1,600
Copper	**12.9**		2.75	**7.74**		2.58	16	110	3,100
Lead	**10.4**		0.688	**8.98**		0.645	31	250	400
Manganese	**336**		1.38	**223**		1.29	630	1100	11,000
Mercury	**0.026**		0.017	**0.026**		0.016	0.2	2	23
Nickel	**6.43**		1.38	**4.95**		1.29	16	75	1,600
Vanadium	**12.4**		2.75	**11.3**		2.58	NA	NA	78
Zinc	**38.5**		2.75	**38.5**		2.58	120	820	23,000

NOTES:

All concentrations reported in milligrams per kilogram (mg/kg), equivalent to parts per million.
ND = Analyzed for but Not Detected at the Method Detection Limit (MDL).
J = The concentration was detected at a value below the MDL.
All qualifiers on individual Volatiles & Semivolatiles are carried down through summation.
NA = Ecological Screening Value not available.
ESV represent NJDEP's preferred set for screening ecological risk assessment of sediment in freshwaters.
LEL = Low Effect Level (chronic exposure screening); SEL + Severe Effect Level (acute exposure screening).
Persaud et al. 1993 = Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Water Resources Branch, Ontario Ministry of the Environment. Toronto.
(a) based on NJDEP Soil Clean-up Criteria of May 1999 as no guidance has been provided yet with the June 2, 2008 standards.

7.0 Surrounding Geology

At the Finesville Dam, the Musconetcong Valley lowlands and northern slope are underlain by bedrock formations dominated by dolomite – a major type of sedimentary carbonate rock (see Figure 7 and Appendix E). The area of the dam and impoundment is underlain by Allentown dolomite (OCa) and Leithesville dolomite (Cl). Like limestone, dolomite can be dissolved or precipitated by groundwater depending on physical conditions and can provide large groundwater stores. The southern upland areas are formed by erosion resistant sandstone, quartzite (metamorphosed sandstone) and granite.

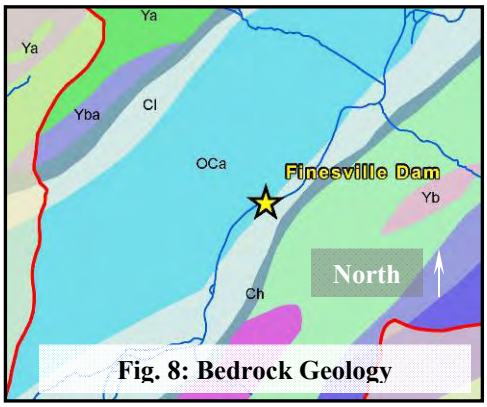


Fig. 8: Bedrock Geology

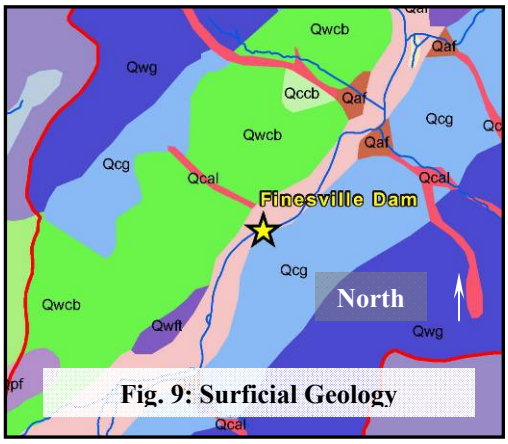


Fig. 9: Surficial Geology

Surficial geology datalayers from NJ DEP show the river within a ribbon of fluvially deposited sand, gravel and silt (see Figure 8 and Appendix F). Following the pattern of bedrock, the valley slope to the north is covered by weathered carbonate rock while the southern hillside is dominated by gneiss colluvium. Tributary valleys in the vicinity of the dam contain colluvium and alluvium and suggest the steep valley walls may have been an historic source of colluvial cobbles and boulders.

8.0 Reach Geomorphology

Fig. 10: Example Rosgen B4c Type Channel

The downstream reach of the Musconetcong River, in the vicinity of the Finesville Dam, is a low gradient, gravel- and cobble-bottom stream with low sinuosity. The channel resembles a Rosgen B4c stream type or Montgomery-Buffington plane bed channel with extended riffles and sporadic local scour pools. An 8,000 foot reach that spans the dam site has a slope of approximately 0.002 ft/ft and a sinuosity of 1.12. The channel in this reach is approximately 80 feet wide. Valley width varies from narrowly confining in the Musconetcong Gorge (confinement ratio of 2) to broad and non-confining in the vicinity of the dam (confinement ratio of 6 – 10). The river is currently confined by Musconetcong Street and Bellis Road, which run parallel upstream from the dam. Construction of Riegelsville Warren Glen Road may have resulted in floodplain encroachment in the vicinity of the dam. The long-term presence of multiple dams (three in the 10 miles downstream from the Musconetcong Gorge) has likely reduced the sediment load of the entire fluvial system. However, the gravel/cobble with boulder substrate in this reach suggests the channel is relatively stable and resistant to reach-wide degradation that could be initiated by dam removal. Localized streambank erosion is not

anticipated to be a major concern since the channel is likely to narrow in the existing impoundment and much of the existing streambanks are lined with trees and woody vegetation.

References

Montgomery, D.R. and J. M. Buffington. 1997. Channel-reach morphology in mountain drainage basins. GSA Bulletin, 109(5), 956-611.

Rosgen, D. and L. Silvey. 1998. Field Guide for Stream Classification. Wildand Hydrology.

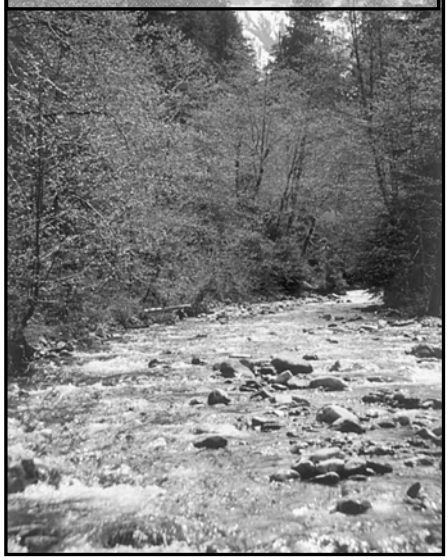


Fig. 11: Plane bed channel (Montgomery & Buffington 1997)

9.0 Conceptual Approach to Partial or Full Dam Removal

Two options exist for addressing the liability, safety and ecological concerns posed by the dam. *Full Dam Removal* entails excavating the entire width of the dam and allowing the channel to return to a free-flowing condition. In contrast, *Partial Dam Removal* entails cutting out and removing a portion of the dam on a side or in the middle of the channel so that no water is impounded. In this case, the river would be directed through the dam breach. Due to the potential historic value of the dam and the desire to leave evidence of the structure on site, there may be a benefit to retain portions of the historic masonry embankments whether providing for a partial or complete removal of the dam. Furthermore, the embankment retaining walls may currently provide necessary structural support to adjacent private buildings and the Mt. Joy Road Bridge.

9.1 Complete Removal

To completely remove the dam, an excavator would be utilized to break up the entire concrete dam and spillway into slabs that are hauled off site for disposal. Any separated river stone that is part of the existing dam shall be left on site to be used to stabilize and naturalize the channel. Removal of the dam will provide fish passage and allow the river to begin recreating a channel through the former impoundment. As the stream channel narrows, velocity increases and sediment transport begins again, fluvial features including a thalweg, localized pools, riffles, runs as well as depositional areas will develop. These physical features create the foundation for habitat with a mosaic of water depths, velocities and substrate types. Since these features will take form naturally with the restoration of flow and sediment transport, manipulation of the streambed or creation of these features is not imperative. In addition, due to the low slope of the bed in the impoundment, engineered grade control structures designed to insure aquatic organism passage are not necessary.

Fig. 12: Looking Downstream Before Removal (Existing)

Fig. 13: Concept; Looking Downstream After Full Removal

If necessary, banks on the outside bends or adjacent to roads (i.e. Musconetcong Road, Bellis Road) or structures could be stabilized with accepted bioengineering practices that employ rock, vegetation and geotextiles. Sediment bars on the impoundment margins could be replanted with native trees, shrubs, and seed mix to stabilize newly exposed sediment and to inhibit the establishment of nonnative invasive species. These areas would provide important riparian habitat as well as storage of flood volumes and dissipation of overbank velocities. Over the long term, the Musconetcong River would have the ability to form new meanders and migrate across the corridor that is currently contained within the impoundment. At the toe of the masonry embankments on both sides of the current dam, Princeton Hydro proposes installing boulders to enhance long-term stability and protect the banks, masonry and bridge supports from excessive velocities and debris during high flows.

9.2 Partial Removal

Partial removal of the dam would require specialized concrete cutting tools, such as a diamond wire saw, to cut the spillway and remove a portion of the dam. The use of such a saw would create a "cleaner" and neat edge of spillway to remain. Leaving portions of the dam in place may reduce the amount of sediment that needs to be stabilized or removed and may serve to better protect the existing masonry walls on both sides of the channel and under the Mt. Joy Road Bridge. It is anticipated that up to 20 feet could remain on the north bank, while 10 feet could remain on the southern bank. It is noted, however, that the spillway, unlike the abutment masonry walls, is comprised of cast-in-place concrete and was constructed after 1900 to replace or repair an earlier structure.

Fig. 14: Example of Partial Removal. Note remaining spillway.

9.3 Fish Habitat Enhancement

While not critical to the success of providing passage for diadromous and resident fish species, it may be advantageous to create habitat within the subject river reach for the purpose of enhancing the angler's experience. The creation of pools and riffles within the impoundment is an idea that has been put forth by the NJ Division of Fish and Wildlife and Trout Unlimited, and has also been successfully constructed several miles upstream, in Asbury, NJ at the Warren County Rod and Gun Club property. For conceptual purposes and not necessarily endorsed by NOAA, American Rivers and the Musconetcong Watershed Association, a concept has been prepared that could be used in the future to create fish habitat enhancement. The goal of this enhancement would be to create more diverse pool riffle habitat preferable to native and stocked trout species.

This concept has been prepared by Joseph Urbani and Associates, Inc. of Bozeman, Montana. The proposed habitat plan has been included as an Attachment.

10.0 Preliminary Hydrologic and Hydraulic Analysis

In accordance with NJAC 7:20, Dam Safety Standards, a partial or complete removal must neither negatively affect the downstream reaches of a stream, nor increase the water surface elevations of the 10-, 50- and 100-year flood events. To determine the potential effect on the stream and the associated floodplain, the US Army Corps of Engineers (USACE) Hydrologic Engineering Centers' River Analysis System (HEC- RAS), Version 4.0, model was employed.

In order to perform the HEC-RAS analysis, various existing data were compiled to represent the condition of the stream. This section of the Musconetcong River was previously studied by NJDEP for a State adopted floodplain delineation, dated March 30, 1978, using HEC-2 software. The HEC-2 data was obtained from the NJDEP, Bureau of Floodplain Management, and imported to HEC-RAS for the existing condition. The hydrologic data, geometric data, roughness coefficients, and other parameters were adopted from the HEC-2 study with modifications, as necessary. This HEC-2 State Study was utilized for this preliminary analysis as this study represents the only data readily available for this reach and because it is of more than sufficient detail. As the primary goal of this analysis is to inform the feasibility of partial or complete removal, the study should be considered preliminary, and as such, would need to be updated with more detailed input to inform any future proposed design and permitting.

The modeled reach extends from the downstream confluence with the Delaware River to approximately 2,500 feet upstream of the Finesville Dam, extending beyond the influence of the impoundment.

10.1 Storm Flows

The 10-year, 50-year, and 100-year peak flow rates in Musconetcong River at the Finesville Dam are adopted from the NJDEP HEC-2 study. Additionally, the 100-yr + 25% (Flood Hazard Area Design Flood), and the 500-yr storms were also analyzed. Normal depth was used for downstream boundary conditions. The flow rates at the Finesville Dam utilized for this study are listed in Table 1.

Table 2. Flow Rate and Frequency

Frequency	***Flow Rate (CFS)***
10-year	3,880
50-year	6,560
100-year	8,010
100-year + 25%	10,013
500-year	12,230

10.2 Geometry Data

The geometry data utilized for the existing conditions (before removal) scenario was adopted from the NJDEP HEC-2 data. The geometric data are attached in Appendix H, which include cross sections and profiles of the channel.

For the proposed conditions (after removal) scenario the geometry of the Musconetcong River was revised just downstream of the concrete masonry dam to approximately 1,200 feet upstream. The remainder of the geometry of the stream is not changed. Specifically, the geometry of both cross-section (side slope, bottom width, depth) and profile (slope) were adjusted to mimic existing conditions beyond the influence of the dam.

It should be noted that for this feasibility study, the proposed conditions reflect the full removal (bank to bank) of the dam. This was considered a conservative approach with regard to changes in WSEL and velocities. During any future proposed design, this model would be updated to include more accurate input as it becomes available during the design process. Attached in Appendix H are comparisons between existing and proposed conditions geometry.

10.3 Roughness Coefficient 'n'

All roughness coefficients (Manning's 'n' values) were adopted from the NJDEP HEC-2 study and were not changed under the existing conditions model. The 'n' values before dam removal are shown in the Geometry Data attached in Appendix H. Channel coefficients were set to 0.035 for both existing and proposed conditions, as both existing and proposed conditions are estimated to be relatively straight, with gravel/cobble substrate and no deep pools. Again, during proposed design, these assumptions should be verified, and modified as necessary to reflect actual design conditions. Overbank 'n' values were set to 0.9 within this reach to reflect the wooded floodplain conditions, for both existing and proposed scenarios.

10.4 Contraction and Expansion Coefficients

Contraction or expansion of flow due to changes in cross sectional area results in energy loss. Contraction coefficients in the study varied from 0.1 to 0.3, with the highest values occurring at the dam. Expansion coefficients varied from 0.3 to 0.5, with the higher values occurring at the dam and the Mt. Joy Road Bridge downstream of the dam.

10.5 HEC-RAS Model

Using the HEC-RAS model, a one-dimensional, steady peak flow, combined subcritical and supercritical (mixed flow) analysis was performed. For all events normal depth using a slope of 0.0019 ft/ft was used for the upstream boundary conditions. For the downstream boundary conditions known WSEL for the Delaware River backwater influence was used. The energy, standard step modeling procedure was utilized to determine the water surface profile.

10.6 Results

The HEC-RAS program was utilized to analyze existing conditions and the post removal scenario. The water surface profiles post dam removal using HEC-RAS were compared with the existing conditions results for the same flow rate. *The results, attached in Appendix H, illustrate that the water surface profiles pre-dam removal and the water surface profiles post dam removal*

satisfy the requirements of NJAC 7:20. of no negative impact on downstream reach and no increase in water surface elevations of the 10-, 50-, or 100-year flood events.

Table 2 summarizes results for existing and proposed conditions for selected cross-sections below, at and above the dam. Top width refers to the width of the water in the channel. Froude # is a unitless metric of turbulence, whereby values below 1.0 indicate slow and deep flow (subcritical), values above 1.0 indicate shallow and fast flow (supercritical) and values near 1.0 indicate transitional flows (critical). Downstream of the dam (River Station 87.64), no changes occur in water depth, average velocity, top width, or Froude #. However, at the top of the spillway (River Station 88.1), water depth increases, velocity decreases and Froude # drops due to the removal of the dam and the resulting transformation from supercritical to subcritical flow. Twenty (20) feet upstream of the dam, within the impoundment and above the impoundment (River Stations 88.3, 100.78 and 115.95, respectively), water depths change minimally, velocity increases slightly where moving water will be restored, top of width narrows markedly and Froude # increases slightly with velocity.

Table 3. Hydraulic Properties Summary

River Station & Location*	*Profile*	*Water Depth (ft)*		*Average Velocity (ft/s)*		*Top Width (ft)*		*Froude #*	
		Existing	*Proposed*	*Existing*	*Proposed*	*Existing*	*Proposed*	*Existing*	*Proposed*
115.95 Upstream of Impoundment	10-yr	9.65	9.07	6.22	6.83	447.34	328.31	0.38	0.44
	50-yr	11.74	11.3	6.82	7.42	521.4	509.44	0.38	0.42
	100-yr	12.63	12.31	7.12	7.53	544.5	536.85	0.38	0.4
100.78 Impoundment	10-yr	10.84	9.11	4.55	6.31	437.29	338.1	0.26	0.4
	50-yr	12.82	11.76	5.49	6.52	452.17	444.18	0.29	0.36
	100-yr	13.65	12.94	5.95	6.58	458.4	453.07	0.3	0.34
88.3 Upstream of Dam	10-yr	8.46	10.18	4.67	4.75	313.71	132.9	0.3	0.3
	50-yr	10.12	12.76	6.08	5.8	508.63	338.86	0.36	0.32
	100-yr	10.81	14.04	6.63	6.08	560.15	494.65	0.37	0.32
88.1 Top of Spillway	10-yr	3.54	10.41	10.21	4.05	159.4	124.98	0.97	0.24
	50-yr	6.01	13	9.17	5.16	357.7	322.75	0.66	0.27
	100-yr	6.55	14.27	9.97	5.5	410.05	463.18	0.69	0.27
87.64 Downstream of Dam	10-yr	10.44	10.44	4.12	4.12	100.45	100.45	0.24	0.24
	50-yr	12.96	12.96	5.43	5.43	448.21	448.21	0.28	0.28
	100-yr	14.26	14.26	5.69	5.69	562.55	562.55	0.28	0.28

* In hundreds of feet upstream from confluence with Delaware River

Following these results, it is our professional opinion that the partial or complete removal of Finesville Dam would neither negatively affect the downstream reaches, nor increase the water surface elevations of the 10-, 50- and 100-year flood events.

11.0 Anticipated Regulatory Permitting and Approvals

The approvals for the removal of dams in general can be a complicated process. In addition to complying with the NJ Safe Dam Act, a dam's location within a riparian corridor and their age will require approval from several other State and possibly Federal agencies. The following paragraphs will discuss the various anticipated approvals that will be necessary and their affect on the timing and physical impacts of the dam removal project:

11.1 NJDEP Dam Safety Construction Permit

In New Jersey, stream obstructions or structures that have the ability to raise the water levels over the existing stream or land surface greater than five (5) feet are regulated under the New Jersey Safe Dam Act. The Dam Safety Regulations (N.J.A.C 7:20) provide guidance on the means and methods for obtaining approvals and the physical requirements for dam construction, which includes partial and complete removal. Under the current version of the regulation, to obtain an approval to remove a dam an applicant must demonstrate that the modification will reduce the regulatory height of the dam, mitigate an increase in downstream flooding, and prepare a sediment stabilization and control plan to minimize to the maximum extent practicable, the discharge of impounded sediment downstream. As we understand, the NJ Dam Safety Section is in the process of finalizing guidance to stabilize the exposed bed of reservoirs, lakes and ponds.

As part of the process of a dam removal, public notice must be provided in a local newspaper, and to all property owners that abut the impoundment but do not own the dam. The public will have 30 days to petition the NJDEP and oppose the project. Within 30 days of an additional public notice of a hearing, the NJDEP Commissioner will hear a case for maintaining the dam. Usually, the Commissioner's decision is based on the protection of public safety and the willingness of the opposition to provide monetary assistance for the restoration of the dam. If the opposition will not provide monetary assistance, the decision will be made to approve the removal.

To issue a construction permit to remove the dam, the owner or applicant must submit engineering plans and specifications. The permit is always conditioned on receiving all other required approvals.

11.2 NJDEP Land Use Regulation Program (Bureau of Freshwater Wetlands)

As this removal would involve work within a stream and its associated fringe wetlands, an application for approval under the Freshwater Wetlands Protection Act Rules, NJAC 7:7A must be submitted to the NJDEP's Land Use Regulation Program (LURP). The Rules have general permits that allow similar activities throughout the State be conducted as long as specific conditions are met. For repair, partial removal or complete removal of a dam, NJAC 7:7A provides a permit identified as a Freshwater Wetlands Statewide General Permit No. 18, Dam Repairs (GP-18). The conditions of this permit allow for the permanent disturbance of no more than one (1) acre of Freshwater Wetlands. The review of an application includes a determination of whether or not there are negative impacts to State or Federal threatened or endangered species, and impacts to structures or features of historic significance.

As will be discussed below, it is expected that due to the age of the structure and that Federal funding may be used to finance the project, there will be a review by the State Historic Preservation Office (SHPO) and possibly by the National Park Service, the agency responsible

for implementing the National Historic Preservation Act, Section 106. The issuance of the GP-18 will be predicated on satisfying SHPO and the conditions of Section 106.

An alternative to a GP-18, if the project is funded in any part by a Federal grant for the purpose of habitat restoration, would be a General Permit No. 16, Wetland Enhancement (GP-16). The benefit of the GP-16 is that there is no limit on wetlands impacts, as it is assumed that such impacts would be positive; i.e. restoration or enhancement.

An application for a GP-18 or GP-16, as in all Freshwater Wetlands permits will require public notice to all property owners within 200 feet of the project area or property area (depending on whether project is small compared to the property boundary) and notification to the municipality and county where the project resides. A copy of the permit application must be submitted to the municipality's clerk to allow review by the public.

11.3 NJDEP Division of Fish and Wildlife

The Division of Fish and Wildlife will have a dual role in a review of a dam removal application. First and foremost, they would provide comment during the Dam Safety Permit and Freshwater Wetlands application process. Secondly, any water lowering of an impoundment must apply for a Division of Fish and Wildlife Water Lowering Permit, a Scientific Collectors Permit and a Stocking Permit. The Water Lowering Permit will address the requirements to protect game fish during dewatering. The Scientific Collectors Permit may be required to catch the fish within an impoundment, however, it is expected that all fish within the impoundment are riverine species what will not require relocation. The Stocking Permit will be required if the game fish within the impoundments are to be relocated to another impoundment.

During the LURP general permit review, the Division of Fish and Wildlife will review the impacts to the fishery within the reservoirs, as well as to the downstream water resources (i.e. trout production and maintenance waters). In addition, the Division will comment and make recommendations on the restoration of the resulting exposed lake beds and stabilized stream.

Due to migratory limitations for diadromous fish species, and trout stocking, the project will necessitate timing so as not to impact such species. For example, the following timing restrictions are anticipated to apply in this reach of the Musconetcong River:

- Trout-stocked waters; Trout maintenance waters; and an area within one mile upstream of a trout-stocked or a trout maintenance water

  March 15 through June 15

- Delaware River from Trenton to New York State line:

  April 1 through June 30; and September 1 through November 30

While general gamefish may not be an issue, an additional timing restriction may be imposed as follows:

- Water bodies that support general game fish

  May 1 to June 3

Other restrictions could apply area restrictions for water bodies that support pickerel and walleye, however, the Musconetcong River in this reach is not known, nor is a viable habitat for these fish species.

11.4 State and Federal Historic Preservation Acts Review

Any structure that is determined to be greater than 50 years in age may be subject to review under both the NJ Register of Historic Places Act and the National Historic Preservation Act Section 106. The USDA NRCS has taken the lead on complying with this requirement by initiating the application process with the SHPO and communicating regarding archaeological and architectural surveys.

Although a partial removal would most likely not be opposed by SHPO or the National Park Service, mitigation would be required. Mitigation would be in the form of preserving artifacts of the site, such as leaving key elements in place.

11.5 Soil Conservation District

Under the purview of the Soil Erosion and Sediment Control Act of 1975 (NJSA 4:24-39 et. seq NJAC 2:90-1.1 et seq), a project that disturbs greater than 5,000 square feet of land area must apply to the County Soil Conservation District for a Soil Erosion and Sediment Control (E&S) Plan approval. Since the impoundment is approximately 2,300 feet long and nearly 100 feet wide, the area of land to be disturbed is likely over 5,000 square feet. As Finesville Dam spans both Hunterdon and Warren Counties, one county will likely take jurisdiction over the entire project and preclude the need to seek permits from both counties. It is also noted that any project that proposes to disturb greater than one (1) acre of land will also be required to submit an application for a Request for Authorization (RFA) under the NJ Pollution Discharge Elimination System (NJPDES) for approval to discharge construction related runoff. As part of the approval process a Stormwater Pollution Prevention Plan (SPPP) must be prepared that describes the controls for mitigating sediment laden runoff from a construction site.

The E&S Plans must be prepared in accordance with the County Soil Conservation Districts specifications. An E&S Plan and Notes are usually prepared and provided as the last sheets in a set of engineering plans. Aside from the SPPP the RFA is simply required to provide the NJDEP with data of construction projects to satisfy the Federal Clean Water Act's inventory requirements for construction related stormwater runoff. The SPPP plan will describe the methods of mitigating sediment laden stormwater runoff, emergency measures in the event of a discharge of sediment slugs and overall maintenance procedures similar to those required and listed in the E&S Plan and Notes sheets.

11.6 Highlands Approvals

At the Finesville Dam, the Musconetcong River marks the boundary between the Highlands Planning Area and the Highlands Protection Area. Therefore, this project may be subject to this regulation and may require application to the Highlands Council for review and approval. Special waivers to perform construction work within the 300-foot stream protection buffer may be required. Prior to the initiation of this project, it is recommended that a pre-application meeting with the Highlands Council be arranged to determine their position on this project.

11.7 Local Approvals

While the Finesville Dam impoundment does not contain a large sediment volume, it is worth noting that both Holland and Pohatcong Townships require soil disturbance approvals that may apply if sediments are to be removed from the dam site. In Holland Township, "Soil Removal Permits" for less than 500 cubic yards of soil, rock, sand or gravel can be issued by the Zoning Enforcement Officer in consultation with the Township Engineer. Permits for removal of more than 500 cubic yards of soil are referred to the Township Committee. No permit is required if the soil, rock, sand or gravel is redistributed and kept on the same premises. In Pohatcong, all applications for "Soil Disturbance Permits" are reviewed by the Planning Board of the Township of Pohatcong.

12.0 Cost Estimates for Construction

12.1 Complete Removal

Activity	*Unit*	*Cost/Unit*	*Number*	*Cost*
Mobilization/Demobilization	LS	$ 13,000.00	1	$13,000.00
Concrete Demolition & Removal	CY	$ 150.00	300	$45,000.00
Transport of Concrete to Recycling Facility	Tons	$ 10.00	600	$6,000.00
Disposal of Concrete	Tons	$ 15.00	600	$9,000.00
Management of Trapped Sediments (Excavation/Placement of Unconsolidated Sediments)	CY	$ 20.00	1000	$20,000.00
Bank Stabilization	LF	$ 150.00	200	$30,000.00
Soil Erosion and Sediment Control	LS	$ 5,000.00	1	$5,000.00
Miscellaneous Items	LS	$ 11,500.00	1	$11,500.00
			TOTAL $139	**,500.00**

12.2 Partial Removal

Activity	*Unit*	*Cost/Unit*	*Number*	*Cost*
Mobilization	LS	$ 18,000.00	1	$ 18,000.00
Concrete Cutting	Day	$ 18,000.00	2	$ 36,000.00
Concrete Demolition & Removal	CY	$ 150.00	200	$ 30,000.00
Transport of Concrete to Recycling Facility	Tons	$ 10.00	400	$ 4,000.00
Disposal of Concrete	Tons	$ 15.00	400	$ 6,000.00
Management of Trapped Sediments (Excavation/Placement of Unconsolidated Sediments)	CY	$ 20.00	500	$ 10,000.00
Bank Stabilization	LF	$ 150.00	200	$ 75,000.00
Miscellaneous Items	LS	$ 16,100.00	1	$ 16,100.00
			TOTAL	**$ 195,100.00**

12.3 Fish Habitat Enhancement Alternative (0ptional, but not necessary)

Activity	*Unit*	*Cost/Unit*	*Number*	*Cost*
Stream Channel Creation (Excavation/Placement of Materials Onsite)	CY	$ 20.00	4200	$ 84,000.00
Gravel/ Boulders	Ton	$ 50.00	1000	$ 50,000.00
Transport	Ton	$ 10.00	1000	$ 10,000.00
			TOTAL	**$ 144,000.00**

12.4 Engineering Design, Permitting and Construction Administration

To complete the engineering designs and permit applications, it is estimated that the following soft costs would be incurred for the complete and partial removal options.

- Engineering and Permitting $ 40,000.00
- Permit Application Fees $ 1,500.00
- Construction Administration $ 25,000.00
- As-built Surveys $ 5,500.00

These costs do not reflect the effort required to complete stream enhancement designs or permitting necessary upstream of the dam removal area.

13.0 Funding Sources

There are a number of sources of funding that have been pursued to assist in offsetting the costs for removing the Finesville Dam.

13.1 Natural Resource Conservation Service's Wildlife Habitat Incentive Program

The Natural Resource Conservation Service (NRCS) through the Wildlife Habitat Incentive Program (WHIP) has provided $247,950 to the Musconetcong Watershed Association for this project. About $225,000 of those funds are allocated for construction while the remainder is for several specified practices including fish passage, stream channel stabilization, tree and shrub planting, shoreline protection and invasive plant removal. This program reimburses up to 75% of the construction costs of an environmental restoration project. All allocated funds are paid to the grant recipient once the construction is complete.

13.2 US Fish and Wildlife Service's Partners for Wildlife Program

Through the Partners for Wildlife Program, the US Fish and Wildlife Service has provided a grant for $45,000 to the Musconetcong Watershed Association. This program will reimburse the grant recipient immediately following completion of construction. The USFWS, through this same program, can also provide in-kind services through invasive species management or the donation of construction materials such as trees, shrubs and herbaceous plants.

13.3 American Rivers-NOAA – Community-Based Restoration Grant Program

Through this program, $30,000 was provided to the Musconetcong Watershed Association to fund this feasibility study. An additional $29,000 has been requested to fund engineering, permitting, H&H modeling and other services.

14.0 Schedule

The most time consuming aspect of the project will be related to permit reviews. Specifically, permit application reviews by NJDEP Dam Safety and the State Historic Preservation Office are anticipated to require approximately six (6) months. If designs and permitting were authorized to start on March 30, 2009, then it is expected that all permits and approvals could be received by November 30, 2009. Construction of the removal could be completed by January 2010.

Activity	*Expected Time*
Preliminary Design	3 months
Final Design	3 months
Permitting	6 months
Construction	1 months

15.0 Conclusions and Recommendations

Princeton Hydro was contracted to assess the feasibility of a dam removal or a partial removal that would adequately restore the riparian functions of the Musconetcong River within the reach of the Finesville Dam and its associated impoundment, extending from the Mt. Joy Road Bridge in Finesville, NJ 2,300 feet upstream (northeast) to the intersection of Musconetcong Street and Riegelsville-Warren Glen Road on the northern bank of the river. Based on the desktop study, field work, and data analysis, we offer the following conclusions regarding the removal or partial removal of the Finesville Dam:

- The village of Finesville is an important part of the historic character of NJ, and specifically is an excellent example of a river town that originated from the mill operations, recorded as far back as circa 1741. The original owners, the Fein family, started the mill operations – first as a grist mill, then later the mill operations were also used for processing lumber. The existing dam, while maintaining the impoundment similar to its historic origin, is not the original structure, and is in fact constructed of cast-in-place concrete, a construction technique not widely used until the early 1900s. A removal or partial removal of the dam must consider mitigating the historic impacts. Such mitigation may be accomplished through preservation of the abutment walls, placing rock structures within the river to maintain the hydraulic sound that the dam creates, and providing signage documenting the importance of the "pre-existing dam" and its association to the milling operations.

- As became tragically apparent, the Finesville dam creates a hydraulic jump immediately downstream of the spillway. This has proven lethal as was the case in August 2003 when a kayaker drowned in the hydraulic at the downstream end of the spillway. Removal of the dam will eliminate future accidents.

- The dam, while considered low-hazard by NJDEP Dam Safety, is significantly out of compliance, due to several structural (missing downstream apron, no low-level outlet, continuous soil loss at the abutments) and administrative deficiencies (no dam breach analysis, Emergency Action Plan if found necessary, recent inspections). The owner of the dam is only interested in deregulating the dam, which will require its lowering to less than five (5) feet in height, or removal.

- Based on our preliminary modeling of the pre- and post-removal comparisons of the Finesville Dam, it was determined that, in accordance with NJDEP Dam Safety regulations, that the 10-, 50-, and 100-year flood recurrence, 24-hour duration events will not increase flooding downstream, and in fact, will reduce the backwater flooding within the dam's impoundment.

- As a major tributary to the Delaware River, the Musconetcong River, based on studies conducted by the US Fish and Wildlife Service has the potential for diadromous fish migration, including blueback herring (*Alosa aestivalis)*, alewife (*Alosa pseudoharengus)*, and American Eel (*Anguilla rostrata)*. In fact, a survey completed by the US Fish and Wildlife Services of the subject section of the Musconetcong River found the habitat to have average suitability for the smaller river herring species. While there is also the potential for American shad (*Alosa sapidissima*) and hickory shad (*Alosa mediocris*), due to the shallow nature of the river (plane bed system), and relatively low

flows compared to the Delaware River, may not have significant potential for spawning of these larger herring species.

- The removal of this dam is critical in the reestablishment of migratory fish passage on the Musctonetcong River, and creating the potential for funding of upstream dam removals through the National Oceanic and Atmospheric Administration (NOAA), the agency charged with the restoration, protection and maintenance of the United State's commercial fisheries. Diadromous fish such as American eel and river herring are considered important commercial and recreational fish species.

- The complete, or at least near complete, removal of the Finesville Dam will be vital in restoring the ecological functions and values of a true riparian system. Other fish passage techniques such as fish ladders, nature-like fishways, and rock ramps will not reestablish the natural function of the impounded section, and may in fact be detrimental to bottom feeding riverine species that would require a coarser substrate than that if fines trapped behind dams.

- Based on the survey completed by Princeton Hydro, the impoundment of the Finesville Dam contains very limited accumulated sediment; 1,000+/- cubic yards of sediment. It is our professional opinion that the simple removal of the dam structure and its associated fills (soil and rock on the upstream face), will not discharge a significant quantity of sediment downstream that would negatively impact the resource of the Musconetcong River. While there will be temporary migration of sediment and stream bed materials downstream, this impact will be temporary and full recovery of the corridor downstream of the removal would be expected within several months of removal, while the impoundment would recover from its near 300 years of impacts within 2-3 years of removal via the colonization of vegetation. It is noted that such vegetative colonization should be monitored and managed to preclude the establishment of non-native and aggressive invasive plants.

- While not necessary to reestablish a migratory pathway for diadromous fish, there may be opportunities for fish habitat enhancement within the subject impoundment following removal. Joseph Urbani & Associates, Inc. has prepared a conceptual trout fishery improvement plan for the subject reach. While this plan is not part of the scope of this Feasibility Study, it may be used by the project partners as a guide to post-dam removal habitat improvement. It our recommendation that following removal, the newly exposed impoundment be allowed to adjust to the new water surface elevations and flow regime, and an assessment of improvements be established after a one (1) to two (2) year monitoring period.

- Although significant stream restoration in the impoundment would not be a primary recommendation, it may be beneficial following the removal to introduce large woody debris to the system, by felling trees or placing engineering and adequately anchored tree materials to the system.

16.0 Next Steps

This Feasibility Study has compiled the initial data and provided conclusions and recommendations for the restoration of the Musconetcong River within the footprint of the

existing dam and its associated impoundment. The following sequence of effort is recommended to achieve the goals of the project partners in the removal of the Finesville Dam.

- Initiate a pre-application meeting with the NJDEP to assess additional concerns by the agencies involved in the removal of the dam. The following areas of NJDEP must be invited to a pre-application meeting:

    - Bureau of Dam Safety and Flood Control
    - Land Use Regulation Program, Bureau of Freshwater Wetlands
    - NJDEP Division of Fish and Wildlife
    - NJDEP State Historic Preservation Office
    - Highlands Council

    In addition to these areas within NJDEP, it is also recommended that the following project partners or other interested NGO and governmental agencies be included in the pre-application meeting:

    - National Park Service, Lower Delaware and Musconetcong River Wild and Scenic River
    - Delaware River Basin Commission
    - USDA, Natural Resource and Conservation Service
    - USDA, North Jersey Resource and Development Council
    - American Rivers
    - Trout Unlimited

- As we understand the NRCS is completing a National Environmental Policy Act (NEPA) review of the project and has completed an initial meeting, and will complete a second public meeting in the near future. In addition to the above governmental and NGO entities, it is also recommended that the following entities be engaged to obtain input for the approach to a removal.

    - The Delaware River Keeper Network
    - The Delaware River Greenway Partnership
    - Hunterdon County and Warren County Engineering Departments
    - Township of Pohatcong, Warren County
    - Township of Holland, Hunterdon County

- It is recommended that an additional survey be completed around the upland portions of the impoundment to be used for engineering plans and specifications. The plans would be prepared at 2' contour intervals in an appropriate datum (NGVD 1929 or NAVD 1988).

- Collect concrete cores of the dam to determine if the structure is a concrete capped timber crib spillway or a monolithic concrete structure.

- Set up baseline monitoring data and monumenting to allow the project partners and regulatory agencies to develop long term data on river response to dam removal. It is recommended that the monitoring protocols of the "Stream Barrier Removal Monitoring Guide", prepared by the Gulf of Maine Council on the Marine Environment, dated

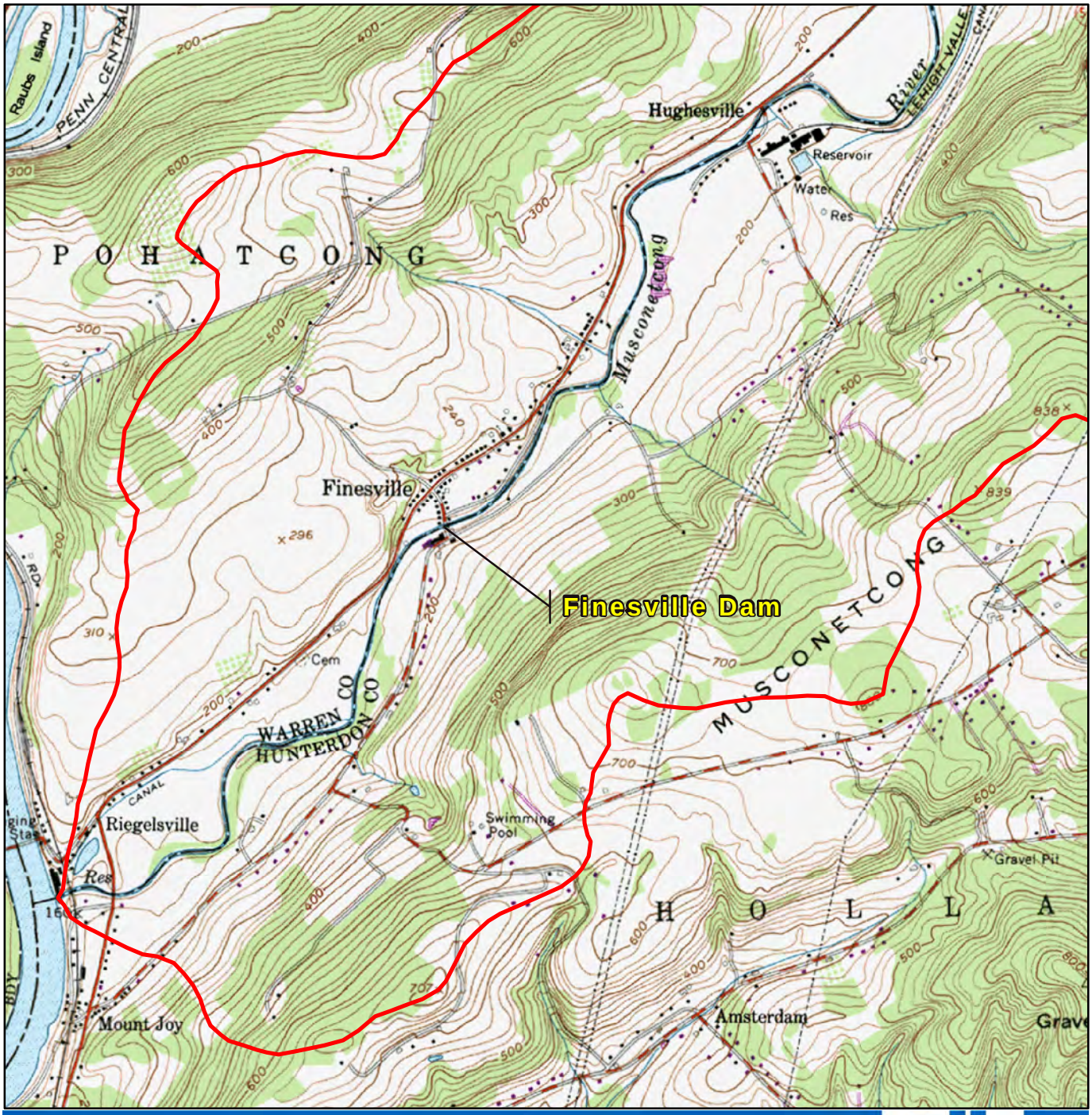
December 2007 be used to establish monitoring goals and objectives. This document can be found at http://www.gulfofmaine.org/streambarrierremoval/.

- Following input from NJDEP, other local, State and Federal agencies and NGOs, the design can be completed and submitted with associated permit applications for approval.

APPENDICES

APPENDIX A

USGS SITE LOCATION MAP



Princeton Hydro

USGS SITE LOCATION MAP

FINESVILLE DAM REMOVAL
HOLLAND TOWNSHIP, HUNTERDON COUNTY
POHATCONG TOWNSHIP, WARREN COUNTY
NEW JERSEY

LEGEND

Watershed Boundary - HUC14

0 1,000 2,000 Feet

1 inch = 2,000 feet

PRINCETON HYDRO, LLC.
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551

SOURCES:

1. Project site is not an official PLS survey. Inaccuracies may exist.
2. USGS 7.5 Minute Series Topographic Map for Riegelsville, NJ, as exported from Terrain Navigator Pro.
3. Watershed boundary (HUC14) as obtained from NJDEP GIS website.

NEW JERSEY COUNTY MAP

File: P:\0662\Projects\0662003\GIS\mxd\USGS_SiteLocation.mxd Jan 12, 2009. Copyright Princeton Hydro, LLC.

APPENDIX B

DEP LETTER REGARDING DAM OWNERSHIP

File

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Natural and Historic Resources
Office of Engineering & Construction

JON S. CORZINE
Governor

LISA P. JACKSON
Commissioner

FEB 27 2007

Mr. James Grodon, Jr.
179 Mt. Joy Road
Phillipsburg, NJ 08865

Re: Finesville Dam, NJ Dam File No. 24-2
Holland Township, Hunterdon County and Pohatcong Township, Warren County

Dear Mr. Grodon:

This is in reference to our letter dated February 5, 2007 and your subsequent letter to this office dated February 7, 2007 (copies enclosed) regarding the above referenced dam located across the Musconetcong River within both Holland Township, Hunterdon County and Pohatcong Township, Warren County.

The dam in question is located across the Musconetcong River and just upstream of Mt. Joy Road within Lot 12 of Block 4 in Holland Township and within Lot 2 of Block 117 in Pohatcong Township. Tax records do confirm Mr. James Grodon as owner of both lots in questions and therefore, sole owner of this dam.

Since this is a run of the river structure with a low head differential, it should be considered a low hazard structure. Low hazard structures require an inspection every four years and do not require an Emergency Action Plan (EAP).

Should you have any questions regarding this matter or need a copy of the inspection guidelines, please contact this office at 609-984-0859.

Sincerely,

John H. Moyle

John H. Moyle, P.E., Manager
Bureau of Dam Safety and Flood Control

DBL 2/22/07

Enclosures

c: Holland Township Engineer and Clerk (w/enclosures)
Hunterdon County Engineer (w/enclosures)
Pohatcong Township Engineer and Clerk (w/enclosures)
Warren County Engineer (w/enclosures)

N:\SHARED\NHRG\Damsafe\DATABASE\07letter\24002dbl7a.doc

E-Mail Address: DamSafety@dep.state.nj.us
Internet Address: www.state.nj.us/dep/damsafety
Mailing Address: 501 East State Street, P.O. Box 419, Trenton, NJ 08625
New Jersey Is An Equal Opportunity Employer • Printed on Recycled Paper and Recyclable

ENGINEERING & CONSTRUC Fax:609-984-1908 Dec 27 2007 15:30 P.02

Beth Styler Barry
Executive Director
Musconetcong Watershed Association
P.O. Box 113
Asbury, New Jersey 08802

December 15, 2007

Dear Ms. Styler Barry,

I have learned that the Musconetcong Watershed Association along with other partners has applied for funding to investigate removal of the dam on the Musconetcong River at Mount Joy Road in Finesville. I understand the importance of dam removal and I am writing to you to express my support for investigating the possibility of removing this dam.

I realize that the investigation of the dam removal is in the very early stages and that there is no promise that the dam removal will occur. Please keep me apprised of the project as it develops.

Sincerely,

Mr. James Grodon

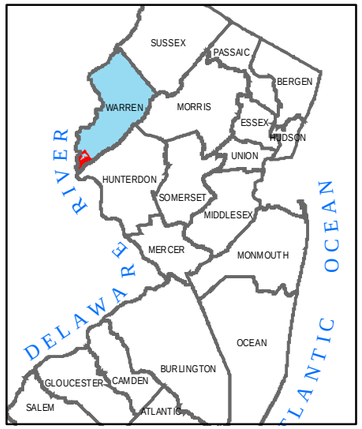
APPENDIX C

SEDIMENT SAMPLING LOCATIONS MAP

P:\0662\projects\0662003\GIS\MXD\Sed_Sampling.mxd

Princeton Hydro

NEW JERSEY COUNTY MAP



PRINCETON HYDRO, LLC
1200 LIBERTY PLACE
SICKLERVILLE, NJ, 08081
Ph: 856.629.8889
Fax: 856.629.8866
OFFICES IN RINGOES, NJ & EXTON, PA

N

0 100 200 Feet

1 inch equals 200 feet

SOURCES:
1. 2002 Aerial Photograph obtained from the New Jersey Image Warehouse website.

SEDIMENT SAMPLING LOCATIONS

FINESVILLE DAM

BLOOMSBURY TOWNSHIP
WARREN COUNTY, NJ

Legend

- Sediment Sample Locations
- Survey Boundary

APPENDIX D

SUMMARY OF LABORATORY ANALYTICAL RESULTS

November 14, 2008

Scientists, Engineers & Environmental Planners Designing Innovative Solutions for Water, Wetland and Soil Resource Management

MEMORANDUM

To: Ms. Beth Styler Barry
Musconetcong Watershed Association

From: Geoffrey M. Goll, P.E.

enclosures: Sample Location Map, Analytical Summary and Geotechnical Results

Re: Finesville Dam Investigation
Sediment Analysis
Township of Pohatcong, Warren County
Township of Holland, Hunterdon County
New Jersey
Princeton Hydro Project No. 0662.003

The following is an update on the feasibility study being progressed on the Finesville Dam fish passage feasibility analysis. The discussion to follow describes the methods of sediment survey, collection and analysis. As we are still waiting for the data from our Professional Land Surveyor regarding benchmarks, we have not yet completed the volume estimate, however, we expect that work to be completed within the next two (2) weeks.

Princeton Hydro, LLC (Princeton Hydro) has been contracted by the Musconetcong Watershed Association (MWA) to complete an assessment and feasibility study to breach the Finesville Dam, located just upstream of the intersection of the Musconetcong River and Mt. Joy Road. The center of Musconetcong River at this location is the boundary between the Township of Pohatcong in Warren County (to the north), and the Township of Holland in Hunterdon County (to the south). The dam is constructed of run of the river concrete gravity dam, eight (8) feet in height and 105 feet in length. As we understand a dam at this location was constructed in the 1740s and was replaced sometime in the early 20th century by the existing structure. Currently the dam is severely undermined on the east abutment and the downstream apron has been severely damaged. The dam impounds 2,300 feet of the river to where the Musconetcong meanders within 20 feet of the intersection of Musconetcong Street and Riegelsville Warren Glen Road northeast of the dam.

Princeton Hydro conducted a survey of the impoundment on August 26, 2008. To conduct the survey, staff utilized a Knudsen 320B echosounder. The echosounder uses a dual frequency transducer to collect top of sediment and bottom of sediment depths. The horizontal location of each sounding is identified using GPS, allowing replication of the data for future use. Where the water was too shallow (less than 1 foot), a calibrated rod was used to probe the bottom. All hand probes used the GPS for horizontal locations. A benchmark was placed on the southern abutment of the dam for later location by a Professional Land Surveyor to create all data and survey information relative to NAVD 88 or NGVD 29.

Two (2) sediment samples were collected during the field survey to assess the physical and chemical characteristics of the impounded sediment. The sediment samples were collected using hand cores and were progressed to refusal. Due to the dense and gravelly nature of the impounded sediment, refusal was encountered within several feet of the sediment surface, and therefore, full probes could not be obtained.

The sediment was collected and segregated into two (2) collection containers. Each type of container was dependent on the nature of the analysis to be performed. The samples to be forwarded to Princeton Hydro's geotechnical laboratory were placed in one (1) gallon zip lock bags. The samples to be forwarded to Princeton Hydro's subcontracting laboratory, Integrated Analytical Laboratories, Inc. (IAL) were placed in decontaminated air tight jars and transported in a cooler at a temperature of 4°C.

FIELD SURVEY

The first task to be completed for the feasibility study included field survey of the impoundment and an assessment

This memorandum provides a summary and interpretations regarding ecological risk screening assessment based on review of laboratory analytical data that pertain to two (2) sediment samples collected upstream of the Finesville Dam located on the Musconetcong River.

The collected samples were analyzed for a broad suite of pollutant parameters including volatile organic compounds (VOC), base neutral/acid extractable (BNA or semi-volatile organic compounds; SVOC), polychlorinated biphenyls (PCB), pesticides, metals/inorganics, total cyanide, hexavalent chromium, grain size distribution, moisture content, and organic matter content.

The following table summarizes the laboratory analytical results by parameter and for detected analytes includes comparison to the set of NJDEP Site Remediation Standards (SRS), and Ecological Screening Values (ESV) preferred for use by New Jersey Department of Environmental Protection (NJDEP) for screening-level ecological risk assessment purposes. It is emphasized that ESV are not cleanup standards or remediation criteria; rather the purpose of ESV is to facilitate decision making regarding whether to pursue advanced-tier ecological risk assessment activities.

SUMMARY OF LABORATORY ANALYTICAL RESULTS - DETECTED COMPOUNDS

Client ID:	S-1			S-2			Ecological Screening Values (ESV) Freshwater Sediment (mg/kg) Persaud et al 1993		Residential Direct Contact Soil Remediation Standard (June 2, 2008, unless noted)
Sample Depth:									
Lab ID:	09899-001			09899-002					
Date Sampled:	08/26/2008			08/26/2008					
Matrix:	Sediment			Sediment			LEL	SEL	
PHYSICAL (%)	Conc	Q	MDL	Conc	Q	MDL			
Total Organics	**5.50**			**4.16**					
Gravel	**1.2**			**2.0**					
Sand	**90.8**			**87.4**					
Fines	**8.0**			**10.6**					
Volatiles (ppm)									
(Including MTBE & TBA)									
TOTAL VOC:	**ND**			**ND**					
TOTAL TIC (tentatively identified compounds):	**ND**			**ND**					
TOTAL VOC & TIC:	**ND**			**ND**					
Semivolatiles - BNA (ppm)									
Phthalates									
Diethyl phthalate	**0.107**		0.045	**0.082**		0.043	NA	NA	49,000
Polynulcear Aromatic Hydrocarbons (PAH)									
Phenanthrene	**0.164**		0.045	**0.067**		0.043	0.56	950	NA
Anthracene	**0.042**	J	0.045	**ND**		0.043	0.22	370	17,000
Fluoranthene	**0.288**		0.045	**0.104**		0.043	0.75	1020	2,300
Benzo[a]anthracene	**0.130**		0.045	**0.046**		0.043	0.32	1480	0.6
Chrysene	**0.131**		0.045	**0.053**		0.043	0.34	460	62
Benzo[b]fluoranthene	**0.118**		0.045	**0.040**	J	0.043	NA	NA	0.6
Benzo[k]fluoranthene	**0.087**		0.045	**0.032**	J	0.043	0.24	1340	6
Benzo[a]pyrene	**0.115**		0.045	**0.040**	J	0.043	0.37	1440	0.2
Indeno[1,2,3-cd]pyrene	**0.067**		0.045	**0.025**	J	0.043	0.2	320	0.6
Dibenz[a,h]anthracene	**0.027**	J	0.045	**ND**		0.043	0.06	130	0.2
Benzo[g,h,i]perylene	**0.068**		0.045	**0.026**	J	0.043	0.17	320	380,000
TOTAL BNA:	**1.56**	J		**0.601**	J				
TOTAL TIC:	**0.200**			**ND**					
TOTAL BNA & TIC:	**1.76**	J		**0.601**	J				
Metals/Inorganics (ppm)									
Aluminum	**4770**		13.8	**4580**		12.9	2.55%	NA	78,000
Arsenic	**3.18**		1.38	**2.71**		1.29	6	33	19
Barium	**26.4**		13.8	**23.8**		12.9	NA	NA	16,000
Chromium, Trivalent	**8.38**		2.75	**11.6**		2.58	NA	NA	120,000 (a)
Cobalt	**4.46**		2.75	**3.57**		2.58	50	NA	1,600
Copper	**12.9**		2.75	**7.74**		2.58	16	110	3,100
Lead	**10.4**		0.688	**8.98**		0.645	31	250	400
Manganese	**336**		1.38	**223**		1.29	630	1100	11,000
Mercury	**0.026**		0.017	**0.026**		0.016	0.2	2	23
Nickel	**6.43**		1.38	**4.95**		1.29	16	75	1,600
Vanadium	**12.4**		2.75	**11.3**		2.58	NA	NA	78
Zinc	**38.5**		2.75	**38.5**		2.58	120	820	23,000

NOTES:

All concentrations reported in miligrams per kilogram (mg/kg), equivalent to parts per million.

ND = Analyzed for but Not Detected at the Method Detection Limit (MDL).

J = The concentration was detected at a value below the MDL.

All qualifiers on individual Volatiles & Semivolatiles are carried down through summation.

NA = Ecological Screening Value not available.

ESV represent NJDEP's preferred set for screening ecological risk assessment of sediment in freshwaters.

LEL = Low Effect Level (chronic exposure screening); SEL + Severe Effect Level (acute exposure screening).

Persaud et al. 1993 = Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Water Resources Branch, Ontario Ministry of the Environment. Toronto.

(a) based on NJDEP Soil Clean-up Criteria of May 1999 as no guidance has been provided yet with the June 2, 2008 standards.

INTERPRETATIONS

The organic content data are consistent with benthic aquatic settings and indicate depositional framework in general. Grain size distribution indicates a skew toward sand (by Unified Soil Classification System, both sediment samples classify as SAND with silty clay) that is consistent with descriptions of the Finesville Dam "impoundment pool" as a modest gradient reach with constant through flow. The majority of sediment-associated contaminants partition to organic matter and fine mineral particulates. While skewed toward sand, these two samples appeared to exhibit sufficient fine mineral as well as organic matter content to reveal contaminants, if present.

For detected analytes that have a corresponding ESV or SRS, none of the detected concentrations were above the corresponding ESV or SRS. Several analytes were detected, but ESV and SRS were not available from NJDEP's preferred sources. Typically, this condition is not sufficient to elevate a screening level ecological risk assessment to an advanced tier of investigation. This interpretation is particularly appropriate herein because it can be emphasized that this data set lacks concentrations above the chronic exposure ESV for commonly encountered PAH and metals/inorganics that routinely are encountered in "background" samples at levels greater than chronic exposure ESV.

CONCLUSIONS

Based on review of the data and information provided, it is my opinion that special consideration with respect to potential ecological exposure to sediment-associated contaminants is not warranted regarding the Finesville Dam project.

INTEGRATED ANALYTICAL LABORATORIES, LLC.

SUMMARY REPORT
Client: Princeton Hydro, LLC
Project: FINESVILLE DAM
Lab Case No.: E08-09899

Client ID:	**S-1**			**S-2**		
Sample Depth:						
Lab ID:	**09899-001**			**09899-002**		
Date Sampled:	**08/26/2008**			**08/26/2008**		
Matrix:	**Sediment**			**Sediment**		
Volatiles (ppm)	Conc	Q	MDL	Conc	Q	MDL
(Including MTBE & TBA)						
Dichlorodifluoromethane	ND		0.0049	ND		0.00465
Chloromethane	ND		0.0049	ND		0.00465
Vinyl chloride	ND		0.0049	ND		0.00465
Bromomethane	ND		0.0049	ND		0.00465
Chloroethane	ND		0.0049	ND		0.00465
Trichlorofluoromethane	ND		0.0049	ND		0.00465
Acrolein	ND		0.0049	ND		0.00465
1,1-Dichloroethene	ND		0.0049	ND		0.00465
Acetone	ND		0.0098	ND		0.0093
Carbon disulfide	ND		0.0049	ND		0.00465
Methylene chloride	ND		0.0049	ND		0.00465
Acrylonitrile	ND		0.0049	ND		0.00465
tert-Butyl alcohol (TBA)	ND		0.0098	ND		0.0093
trans-1,2-Dichloroethene	ND		0.0049	ND		0.00465
Methyl tert-butyl ether (MTBE)	ND		0.0049	ND		0.00465
1,1-Dichloroethane	ND		0.0049	ND		0.00465
cis-1,2-Dichloroethene	ND		0.0049	ND		0.00465
2-Butanone (MEK)	ND		0.0098	ND		0.0093
Chloroform	ND		0.0049	ND		0.00465
1,1,1-Trichloroethane	ND		0.0049	ND		0.00465
Carbon tetrachloride	ND		0.0049	ND		0.00465
1,2-Dichloroethane (EDC)	ND		0.0049	ND		0.00465
Benzene	ND		0.0049	ND		0.00465
Trichloroethene	ND		0.0049	ND		0.00465
1,2-Dichloropropane	ND		0.0049	ND		0.00465
Bromodichloromethane	ND		0.0049	ND		0.00465
cis-1,3-Dichloropropene	ND		0.0049	ND		0.00465
Toluene	ND		0.0049	ND		0.00465
trans-1,3-Dichloropropene	ND		0.0049	ND		0.00465
1,1,2-Trichloroethane	ND		0.0049	ND		0.00465
Tetrachloroethene	ND		0.0049	ND		0.00465
Dibromochloromethane	ND		0.0049	ND		0.00465
1,2-Dibromoethane (EDB)	ND		0.0049	ND		0.00465
Chlorobenzene	ND		0.0049	ND		0.00465
Ethylbenzene	ND		0.0049	ND		0.00465
Total Xylenes	ND		0.0049	ND		0.00465
Styrene	ND		0.0049	ND		0.00465
Bromoform	ND		0.0049	ND		0.00465
1,1,2,2-Tetrachloroethane	ND		0.0049	ND		0.00465
1,3-Dichlorobenzene	ND		0.0049	ND		0.00465
1,4-Dichlorobenzene	ND		0.0049	ND		0.00465
1,2-Dichlorobenzene	ND		0.0049	ND		0.00465
1,2-Dibromo-3-chloropropane	ND		0.0049	ND		0.00465
1,2,4-Trichlorobenzene	ND		0.0049	ND		0.00465
Hexachlorobutadiene	ND		0.0049	ND		0.00465

INTEGRATED ANALYTICAL LABORATORIES, LLC.

SUMMARY REPORT
Client: Princeton Hydro, LLC
Project: FINESVILLE DAM
Lab Case No.: E08-09899

Client ID:	**S-1**		**S-2**	
Sample Depth:				
Lab ID:	**09899-001**		**09899-002**	
Date Sampled:	**08/26/2008**		**08/26/2008**	
Matrix:	**Sediment**		**Sediment**	
Naphthalene	ND	0.0049	ND	0.00465
Methyl acetate	ND	0.0049	ND	0.00465
TOTAL VO's:	ND		ND	
TOTAL TIC's:	ND		ND	
TOTAL VO's & TIC's:	ND		ND	
Semivolatiles - BNA (ppm)				
N-Nitrosodimethylamine	ND	0.045	ND	0.043
Benzaldehyde	ND	0.045	ND	0.043
Phenol	ND	0.045	ND	0.043
Bis(2-chloroethyl) ether	ND	0.045	ND	0.043
2-Chlorophenol	ND	0.045	ND	0.043
1,3-Dichlorobenzene	ND	0.045	ND	0.043
1,4-Dichlorobenzene	ND	0.045	ND	0.043
Benzyl alcohol	ND	0.045	ND	0.043
1,2-Dichlorobenzene	ND	0.045	ND	0.043
2-Methylphenol	ND	0.045	ND	0.043
Bis(2-chloroisopropyl) ether	ND	0.045	ND	0.043
4-Methylphenol	ND	0.045	ND	0.043
N-Nitrosodi-n-propylamine	ND	0.045	ND	0.043
Acetophenone	ND	0.045	ND	0.043
Hexachloroethane	ND	0.045	ND	0.043
Nitrobenzene	ND	0.045	ND	0.043
Isophorone	ND	0.045	ND	0.043
2,4+2,5-Dimethylphenol	ND	0.045	ND	0.043
2,4-Dichlorophenol	ND	0.045	ND	0.043
1,2,4-Trichlorobenzene	ND	0.045	ND	0.043
Naphthalene	ND	0.045	ND	0.043
4-Chloroaniline	ND	0.045	ND	0.043
Hexachlorobutadiene	ND	0.045	ND	0.043
Caprolactam	ND	0.045	ND	0.043
4-Chloro-3-methylphenol	ND	0.045	ND	0.043
2-Methylnaphthalene	ND	0.045	ND	0.043
Hexachlorocyclopentadiene	ND	0.045	ND	0.043
2,4,6-Trichlorophenol	ND	0.045	ND	0.043
2,4,5-Trichlorophenol	ND	0.045	ND	0.043
Biphenyl	ND	0.045	ND	0.043
2-Nitroaniline	ND	0.045	ND	0.043
2,6-Dinitrotoluene	ND	0.045	ND	0.043
Acenaphthylene	ND	0.045	ND	0.043
Acenaphthene	ND	0.045	ND	0.043
2,4-Dinitrophenol	ND	0.045	ND	0.043
2,4-Dinitrotoluene	ND	0.045	ND	0.043
Diethyl phthalate	0.107	0.045	0.082	0.043
Fluorene	ND	0.045	ND	0.043
4,6-Dinitro-2-methylphenol	ND	0.045	ND	0.043
N-Nitrosodiphenylamine	ND	0.045	ND	0.043
1,2-Diphenylhydrazine	ND	0.045	ND	0.043

INTEGRATED ANALYTICAL LABORATORIES, LLC.

SUMMARY REPORT
Client: Princeton Hydro, LLC
Project: FINESVILLE DAM
Lab Case No.: E08-09899

Client ID:	S-1			S-2		
Sample Depth:						
Lab ID:	09899-001			09899-002		
Date Sampled:	08/26/2008			08/26/2008		
Matrix:	Sediment			Sediment		
Hexachlorobenzene	ND		0.045	ND		0.043
Atrazine	ND		0.045	ND		0.043
Pentachlorophenol	ND		0.045	ND		0.043
Phenanthrene	0.164		0.045	0.067		0.043
Anthracene	0.042	J	0.045	ND		0.043
Carbazole	ND		0.045	ND		0.043
Di-n-butyl phthalate	ND		0.045	ND		0.043
Fluoranthene	0.288		0.045	0.104		0.043
Benzidine	ND		0.045	ND		0.043
Pyrene	0.215		0.045	0.086		0.043
Butyl benzyl phthalate	ND		0.045	ND		0.043
3,3'-Dichlorobenzidine	ND		0.045	ND		0.043
Benzo[a]anthracene	0.130		0.045	0.046		0.043
Chrysene	0.131		0.045	0.053		0.043
Bis(2-ethylhexyl) phthalate	ND		0.045	ND		0.043
Di-n-octyl phthalate	ND		0.045	ND		0.043
Benzo[b]fluoranthene	0.118		0.045	0.040	J	0.043
Benzo[k]fluoranthene	0.087		0.045	0.032	J	0.043
Benzo[a]pyrene	0.115		0.045	0.040	J	0.043
Indeno[1,2,3-cd]pyrene	0.067		0.045	0.025	J	0.043
Dibenz[a,h]anthracene	0.027	J	0.045	ND		0.043
Benzo[g,h,i]perylene	0.068		0.045	0.026	J	0.043
TOTAL BNA'S:	1.56	J		0.601	J	
TOTAL TIC's:	0.200			ND		
TOTAL BNA'S & TIC's:	1.76	J		0.601	J	
PCB's (ppm)						
Aroclor-1016	ND		0.000908	ND		0.00084
Aroclor-1221	ND		0.000908	ND		0.00084
Aroclor-1232	ND		0.000908	ND		0.00084
Aroclor-1242	ND		0.000908	ND		0.00084
Aroclor-1248	ND		0.000908	ND		0.00084
Aroclor-1254	ND		0.000908	ND		0.00084
Aroclor-1260	ND		0.000908	ND		0.00084
Pesticides (ppm)						
alpha-BHC	ND		0.00227	ND		0.0021
beta-BHC	ND		0.00227	ND		0.0021
gamma-BHC	ND		0.00227	ND		0.0021
Heptachlor	ND		0.00227	ND		0.0021
Aldrin	ND		0.00227	ND		0.0021
Heptachlor epoxide	ND		0.00227	ND		0.0021
Endosulfan I	ND		0.00227	ND		0.0021
4,4'-DDE	ND		0.00227	ND		0.0021
Dieldrin	ND		0.00227	ND		0.0021
Endrin	ND		0.00227	ND		0.0021
Endosulfan II	ND		0.00227	ND		0.0021
4,4'-DDD	ND		0.00227	ND		0.0021
Endosulfan sulfate	ND		0.00227	ND		0.0021

INTEGRATED ANALYTICAL LABORATORIES, LLC.

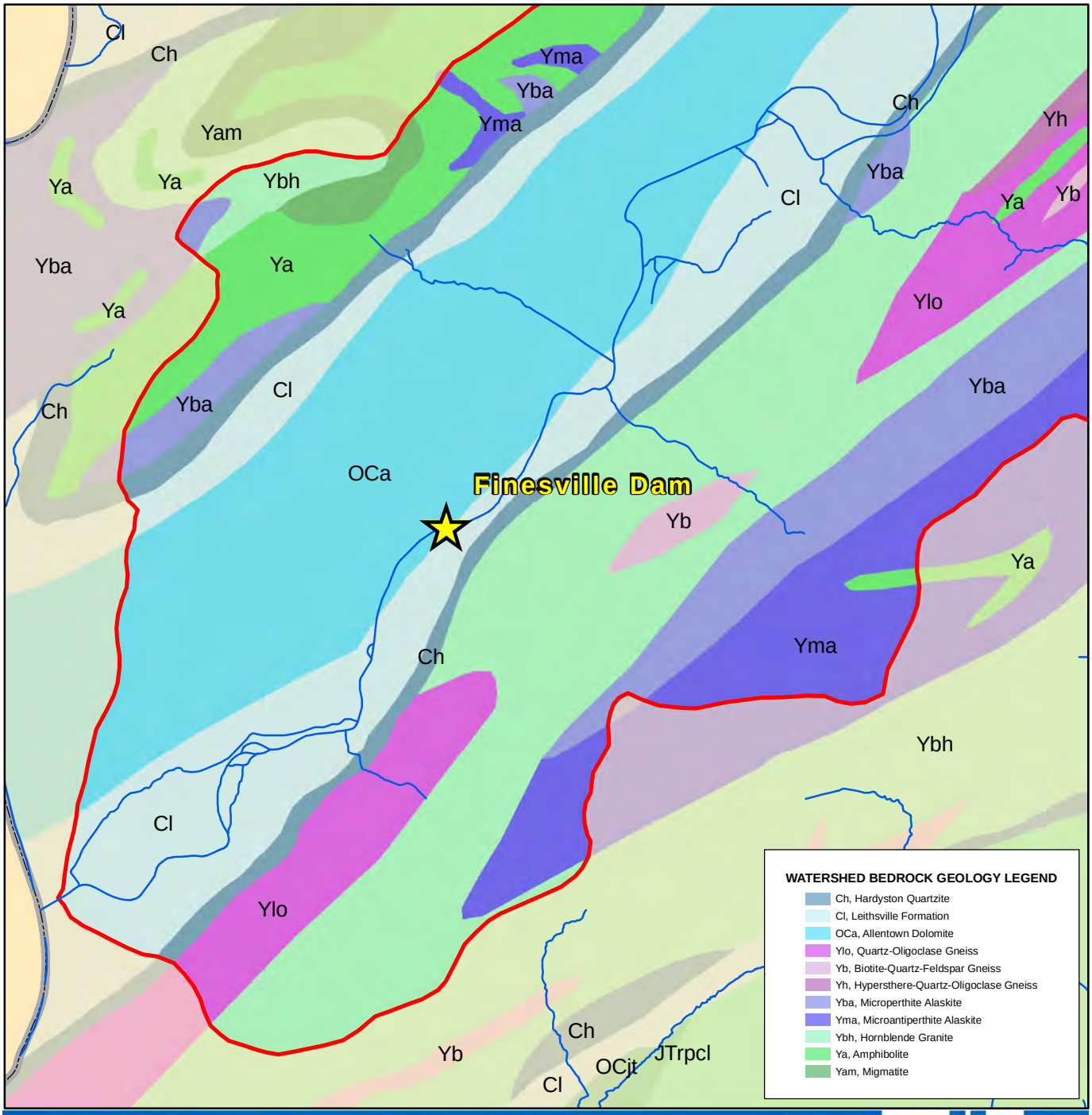
SUMMARY REPORT
Client: Princeton Hydro, LLC
Project: FINESVILLE DAM
Lab Case No.: E08-09899

Client ID:	**S-1**		**S-2**	
Sample Depth:				
Lab ID:	**09899-001**		**09899-002**	
Date Sampled:	**08/26/2008**		**08/26/2008**	
Matrix:	**Sediment**		**Sediment**	
4,4'-DDT	ND	0.00227	ND	0.0021
Methoxychlor	ND	0.00227	ND	0.0021
alpha-Chlordane	ND	0.00227	ND	0.0021
gamma-Chlordane	ND	0.00227	ND	0.0021
Toxaphene	ND	0.00681	ND	0.00631
Metals (ppm)				
Aluminum	4770	13.8	4580	12.9
Antimony	ND	1.38	ND	1.29
Arsenic	3.18	1.38	2.71	1.29
Barium	26.4	13.8	23.8	12.9
Beryllium	ND	0.688	ND	0.645
Cadmium	ND	0.344	ND	0.323
Chromium	8.38	2.75	11.6	2.58
Cobalt	4.46	2.75	3.57	2.58
Copper	12.9	2.75	7.74	2.58
Lead	10.4	0.688	8.98	0.645
Manganese	336	1.38	223	1.29
Mercury	0.026	0.017	0.026	0.016
Nickel	6.43	1.38	4.95	1.29
Selenium	ND	2.75	ND	2.58
Silver	ND	0.688	ND	0.645
Thallium	ND	0.138	ND	0.129
Vanadium	12.4	2.75	11.3	2.58
Zinc	38.5	2.75	38.5	2.58
General Analytical				
Hexavalent Chromium	ND	2.74	ND	2.58
Cyanide, Total	ND	1.37	ND	1.29
Trivalent Chromium	8.38	2.75	11.6	2.58

ND = Analyzed for but Not Detected at the MDL
J = The concentration was detected at a value below the MDL
All qualifiers on individual Volatiles & Semivolatiles are carried down through summation.

APPENDIX E

BEDROCK GEOLOGY MAP



Princeton Hydro

BEDROCK GEOLOGY MAP

FINESVILLE DAM REMOVAL
HOLLAND TOWNSHIP, HUNTERDON COUNTY
POHATCONG TOWNSHIP, WARREN COUNTY
NEW JERSEY

LEGEND

- Streams
- Watershed Boundary - HUC14
- NJ State Boundary

0 1,000 2,000 Feet

1 inch = 2,000 feet

PRINCETON HYDRO, LLC.
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551

SOURCES:

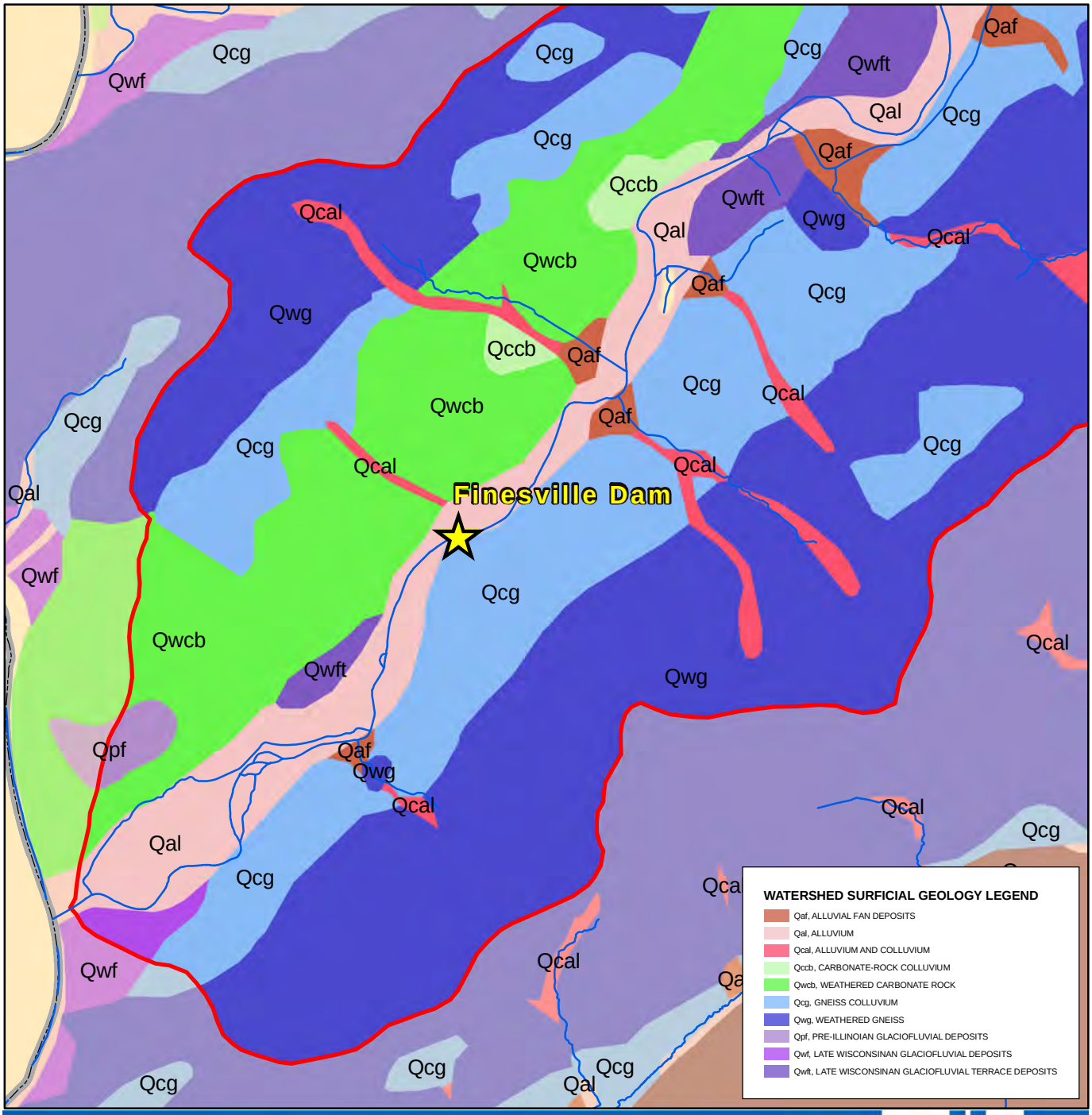
1. Project site is not an official PLS survey. Inaccuracies may exist.
2. Watershed boundary (HUC14) and streams as obtained from NJDEP GIS website.
3. State boundary as obtained from NJ Geographic Information Network.
4. Bedrock geology as obtained from NJDEP Geological Survey.

NEW JERSEY COUNTY MAP

File: P:\0662\Projects\0662003\GIS\mxd\BedrockGeology.mxd Jan 13, 2009, Copyright Princeton Hydro, LLC.

APPENDIX F

SURFICIAL GEOLOGY MAP



Princeton Hydro

SURFICIAL GEOLOGY MAP

FINESVILLE DAM REMOVAL
HOLLAND TOWNSHIP, HUNTERDON COUNTY
POHATCONG TOWNSHIP, WARREN COUNTY
NEW JERSEY

LEGEND

- Streams
- Watershed Boundary - HUC14
- NJ State Boundary

0 1,000 2,000 Feet

1 inch = 2,000 feet

PRINCETON HYDRO, LLC.
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551

SOURCES:

1. Project site is not an official PLS survey. Inaccuracies may exist.
2. Watershed boundary (HUC14) and streams as obtained from NJDEP GIS website.
3. State boundary as obtained from NJ Geographic Information Network.
4. Surficial geology as obtained from NJDEP Geological Survey.

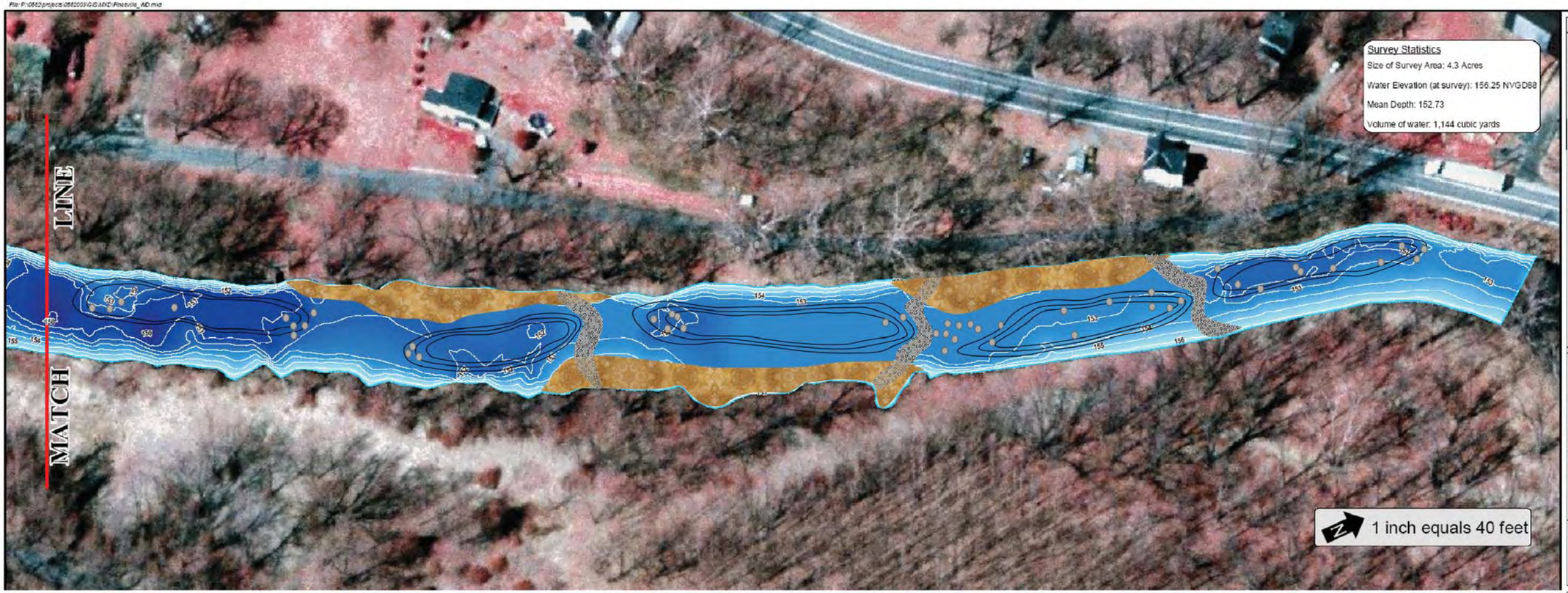
NEW JERSEY COUNTY MAP

File: P:\0662\Projects\0662003\GIS\mxd\SurficialGeology.mxd Jan 13, 2009, Copyright Princeton Hydro, LLC.

APPENDIX G

CONCEPTUAL STREAM ENHANCEMENT PLAN

File: P:\0662\projects\0662003\GIS\MXD\Finesville_WD.mxd



NEW JERSEY COUNTY MAP

SOURCES:

1. 2002 aerial photographs obtained from the New Jersey Image Warehouse website.
2. Bathymetric survey by Princeton Hydro, LLC., performed on April 23, 2009. Survey conducted with a Knudsen Echosounder in unison with a Trimble ProXH GPS unit.
3. Bathymetric data post-processing completed with Hypack Max software.
4. All 3-D modeling and contouring completed with ESRI's ArcGIS version 9.2
5. All elevations are registered in National Geodetic Vertical Datum (NGVD) 1998.

0 20 40 80 Feet

1 inch equals 40 feet

PREPARED FOR:

Musconetcong Watershed Association

Asbury, New Jersey

PRINCETON HYDRO, LLC

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WWW.PRINCETONHYDRO.COM
OFFICES IN RINGOES, NJ AND EXTON, PA

PROJECT NAME/LOCATION:

FINESVILLE DAM
FISH PASSAGE STUDY

FINESVILLE, NEW JERSEY

DRAWING NAME:

WATER DEPTH CONTOURS

Legend

Water Depth Contours

Limit of Survey

APPENDIX H

HEC-RAS MODEL RESULTS