3.0 Physical Characteristics of the Study Area

3.1 Regional Characteristics

3.1.1 Physiography

The former Pownal Tannery site is situated on the Hoosic River, an upper tributary of the Hudson River, between the Green and Taconic Mountain Sections of the New England Province (Fenneman 1938). The site, located on the narrow lowlands of the Vermont Valley physiographic zone, has twice been covered by glacial lakes and continental glaciers of the Pleistocene epoch. At the maximum depths of Lakes Bascom and Shaftsbury the valley was covered to more than 1,000 feet above mean sea level (Stewart and MacClintock 1969). The majority of the subsoil in the project area is derived from silts deposited by the Pleistocene lakes as well as Holocene alluvial deposits from the Hoosic River. The project area is approximately 20–25 miles east of the Hoosic River's juncture with the Hudson River, near Mechanicsville, New York. The Hoosic River is more than 50 miles long and drains over 700 square miles (Crock and Peterson 1995).

Cambrian slate and phyllite of the Taconic range underlie the site. In the vicinity of the site, a thrust fault, roughly aligned with the Hoosic River course, separates the underlying rocks of the Taconic Range from those of the Green Mountain range to the east. The bedrock to the east of this fault line, Ordovician in age, is comprised primarily of limestone as well as carbonaceous and pyritic slate and phyllite. These Ordovician rocks flank the western edge of the Precambrian rocks that comprise the Green Mountains. Compared to the rocks of the Green Mountains, those of the Taconic Highlands are comparatively less resistant to weathering. Both the Green Mountains and the Taconic Highlands rise abruptly in elevation to the east and west, respectively, from the Hoosic River valley. On a larger scale, the mass of rocks that make up the Taconic Highlands are a klippe, a large segment of a thrust slice that has been isolated by erosion, and these Cambrian and Ordovician rocks thereby overlie older (Precambrian) basement rocks.

The topography of the region reflects the structure and lithology of the underlying bedrock. The major landform features within the Hoosic Valley are low-gradient fluvial terraces associated with Pleistocene glaciation and modern floodplain sediment developed on an eroded valley fill of glacial lake sediment (Mac Fayden, 1956)

Figure 3.1-1 shows the historic extent of a glacial lake (Lake Bascom) which existed during the late Wisconsin/Pleistocene Glaciation after the Hoosic Ice Tongue retreated to the northwest and dammed the Hoosic River valley, creating the glacial lake. The bottom sediments of the lake are primarily clay, which are over 100 feet thick in some places. At the peak level, the surface of this glacial lake rose to an elevation hundreds of feet above the modern-day Hoosic River. During this time, large amounts of sediment poured into the lake from the melting glacier.

Figure 3.1-2 shows a map of the regional depth to bedrock. These data show the former depth of the glacial valley before it was filled with sediment.

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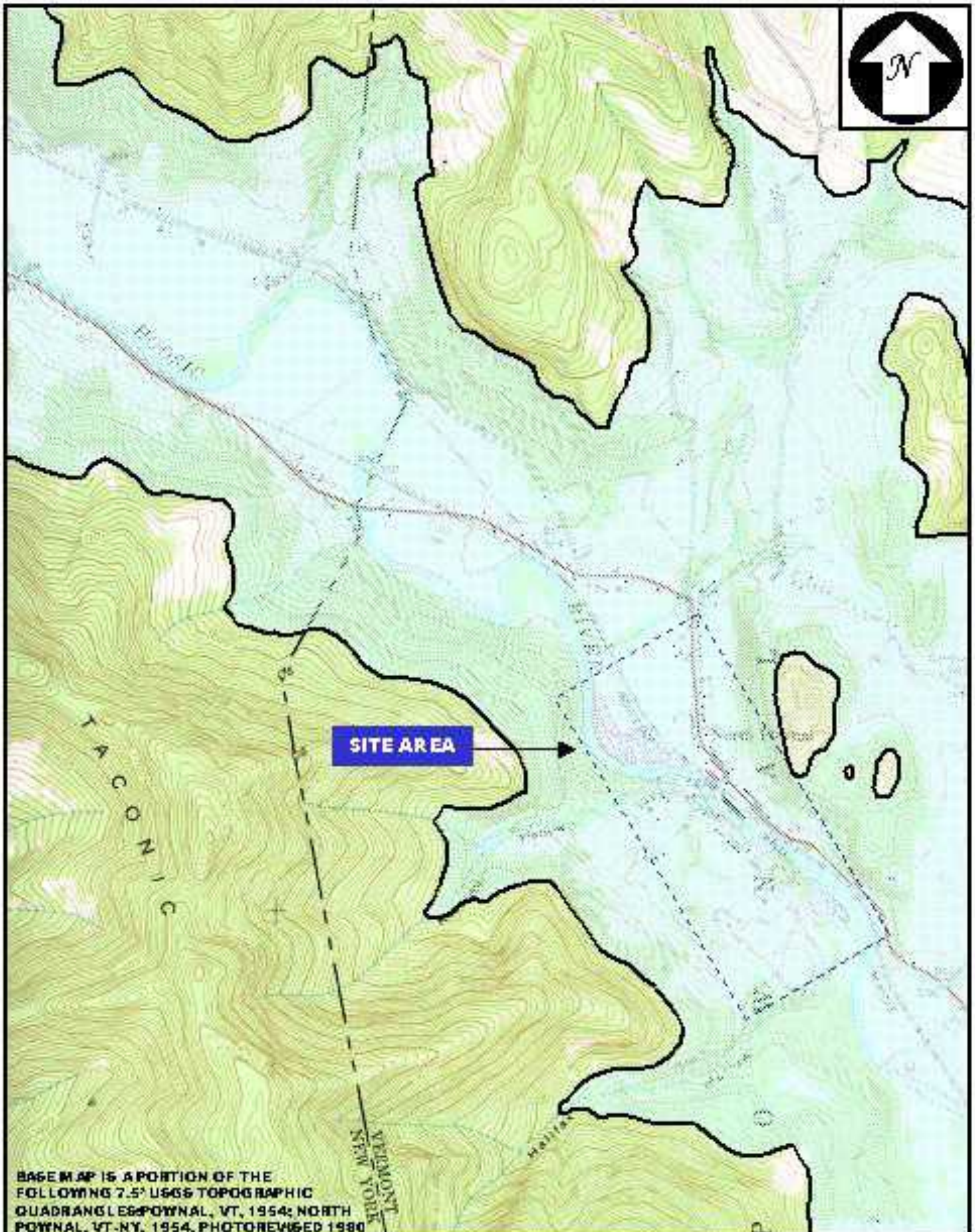

0 1000 2000 3000

approximate scale in feet

Figure 3.1-1

APPOXIMATE EXTENT OF GLACIAL LAKE (LAKE BASCOM) DURING RETREAT OF WISCONSONIAN ICE SHEET (HOOSIC Ice Tongue)

POWNAL TANNERY

POWNAL, VERMONT

Metcalf & Eddy

TRC

Lowell, MA [illegible]

QUADRANGLE LOCATION

VT

TRC PROJ. NO. [illegible]

EPA CONTRACT NO. [illegible]

RAC SUBCONTRACTOR NO. [illegible]

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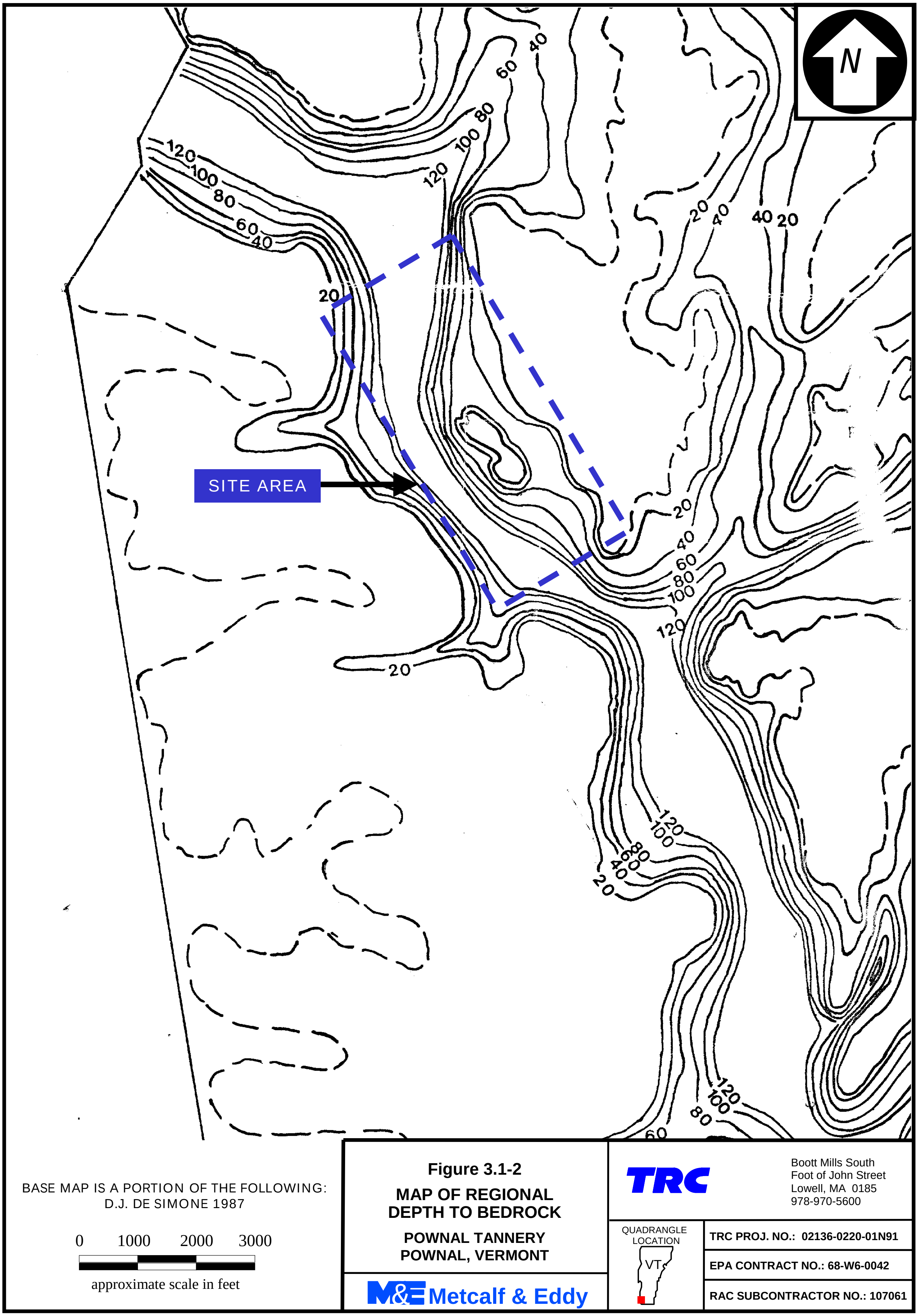

BASE MAP IS A PORTION OF THE FOLLOWING:
D.J. DE SIMONE 1987

Figure 3.1-2

MAP OF REGIONAL DEPTH TO BEDROCK

POWNAL TANNERY
POWNAL, VERMONT

Metcalf & Eddy

TRC

Boott Mills South
Foot of John Street
Lowell, MA 0185
978-970-5600

QUADRANGLE LOCATION
VT

TRC PROJ. NO.:	02136-0220-01N91
EPA CONTRACT NO.:	68-W6-0042
RAC SUBCONTRACTOR NO.:	107061

L00-219/DEPTH

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3.1.2 Hydrology

Figure 3.1-3 shows the Hoosic river drainage basin. The Hoosic River represents a Class B Water as defined by the Vermont Water Resources Board (1997). Class B waters have an objective of providing water quality that consistently exhibits good aesthetic value and provide high quality habitat for aquatic biota, fish and wildlife. Uses of Class B waters include public water supply (with filtration and disinfection); irrigation and other agricultural uses; swimming and recreation. The Hoosic River is also classified as a Cold Water Fish Habitat (i.e., suitable for coldwater fishes such as trout).

The width of the Hoosic River upstream of the North Pownal dam ranges from approximately 100 to 150 feet. Downstream of the dam, the river is narrower with an average width of approximately 75 to 100 feet. The topography surrounding the Hoosic River within the Pownal Tannery Study Area is characteristic of an alluvial floodplain. Broad flat areas adjacent to the river are located within the 100-year floodplain of the Hoosic River. However, occasional areas of exposed bedrock are also evident within reaches of the river. Terraces and severe scouring (e.g., bank undercutting) were evident along the reach of the Hoosic River downriver from the dam. The presence of wrack lines and sediment deposits within areas adjacent to the river provide additional evidence of periodic flooding. Distinct cut banks are present along the outer side of river bends while sediment accretion deposits were noted along the convex inner side of the Hoosic River.

Based on river sediment samples analyzed for grain size (Appendix X), sediments downstream of the dam consist of medium and fine sand (with some finer silt/clay present as well as coarse sand) while sediments upriver of the dam generally contain more silt/clay and fine sand. The total organic carbon content within the river sediments range from less than 0.5 percent to nearly 4 percent (average of 1.25 percent). The average pH of surface water in the Hoosic River is approximately 8.0.

3.1.3 Surficial Geology

Figure 3.1-4 shows a portion of the Vermont Surficial Geologic Map of Vermont. This map shows that the site is primarily underlain by Holocene river floodplain and tributary alluvium, comprised of sand and gravel. This alluvium surrounds the approximate current course of the Hoosic River. To the northeast of these deposits is a wide area of Holocene fluvial terrace deposits, also consisting of sand with gravel. Bedrock outcrops surround the area of the former Tannery buildings, and elongated areas of fill are mapped along the railway line to the east of the Hoosic River, to the north and south of the site. Upslope of the Taconic Highlands to the west and southwest of the site are broad areas of fan-delta deposits of sand and gravel, associated with the Wisconsin glacial lake (Lake Bascom) as well as kame sand and gravel deposits. As summarized on the surficial geologic map, outside of the more recent river floodplain and alluvial deposits, the majority of the surrounding surficial deposits were derived in glacial or glacial-lake conditions.

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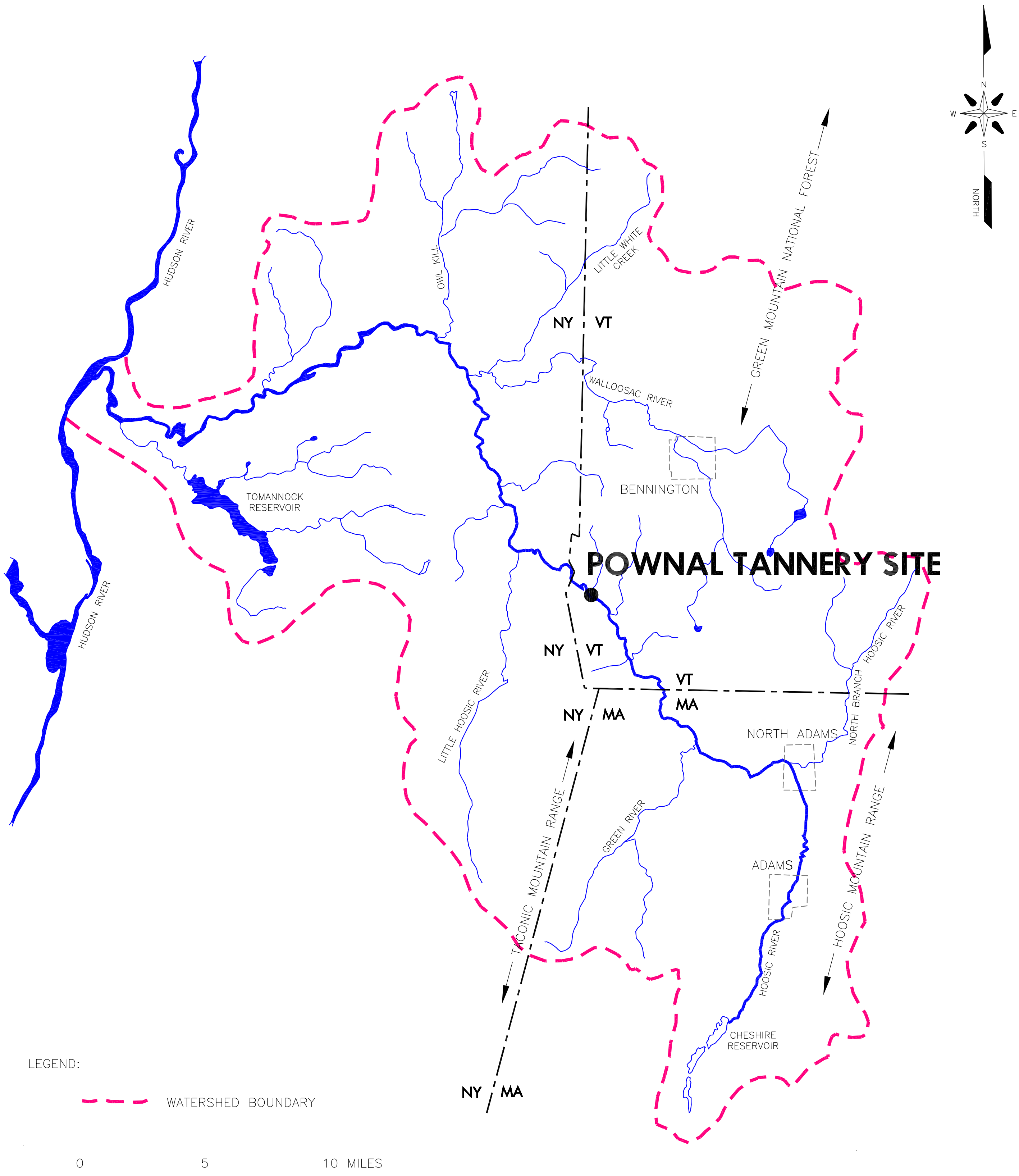

02136\POWNAL\TRIBUTARY2.DWG

TRC

Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

TRC PROJ. NO.: 02136-0350-01N99

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACTOR NO.: 107061

FIGURE 3.1-3
HOOSIC RIVER WATERSHED
AND MAJOR TRIBUTARIES

POWNAL TANNERY
POWNAL, VERMONT

M&E Metcalf & Eddy

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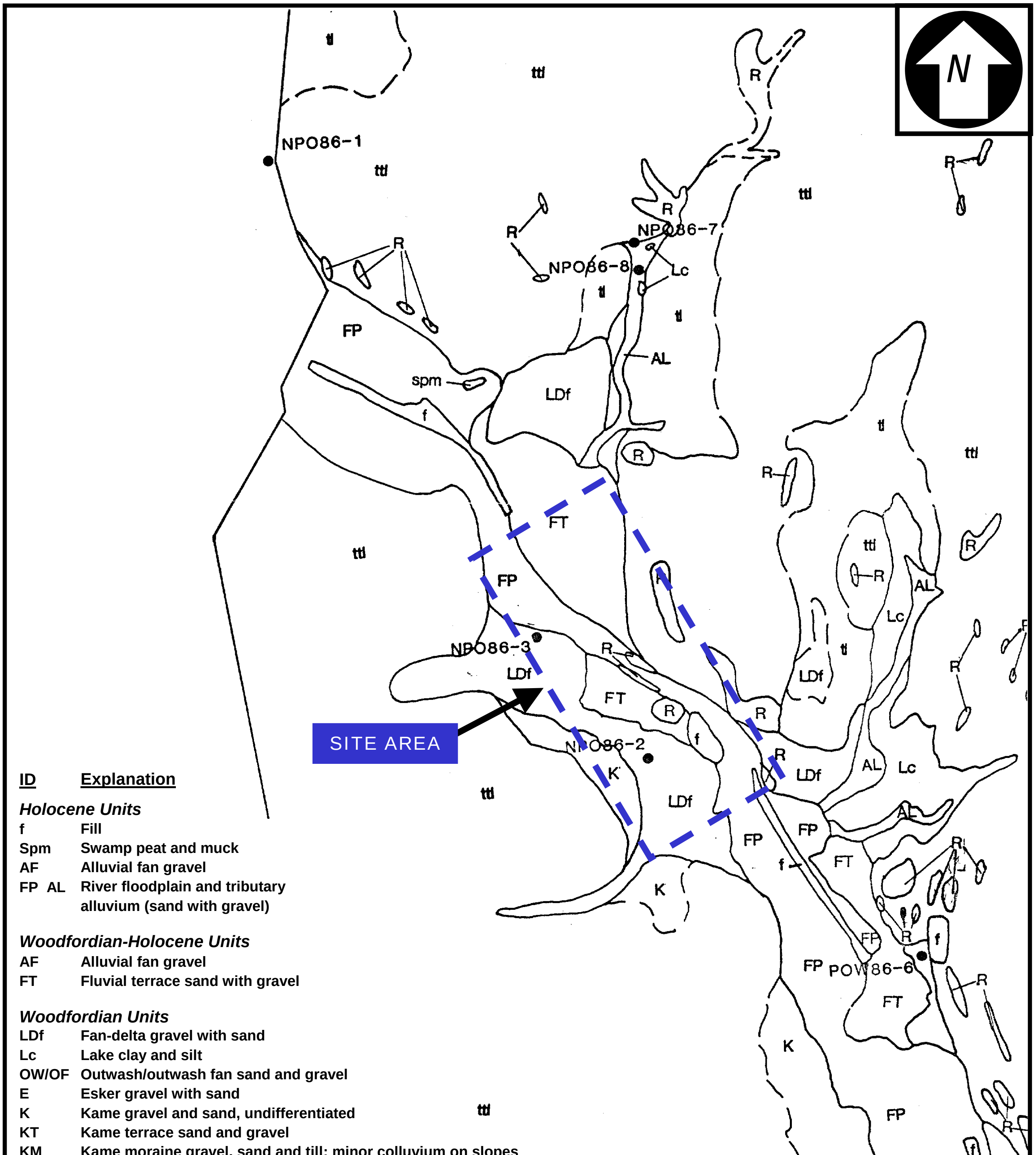

ID **Explanation**

Holocene Units

ID	Explanation
f	Fill
Spm	Swamp peat and muck
AF	Alluvial fan gravel
FP AL	River floodplain and tributary alluvium (sand with gravel)

Woodfordian-Holocene Units

ID	Explanation
AF	Alluvial fan gravel
FT	Fluvial terrace sand with gravel

Woodfordian Units

ID	Explanation
LDf	Fan-delta gravel with sand
Lc	Lake clay and silt
OW/OF	Outwash/outwash fan sand and gravel
E	Esker gravel with sand
K	Kame gravel and sand, undifferentiated
KT	Kame terrace sand and gravel
KM	Kame moraine gravel, sand and till; minor colluvium on slopes
KF	Kamefield gravel, sand and ablation till with minor colluvium
ta	Ablation till, thick (3m or 10') (colluviated on slopes)
tta	Ablation till, thin (3m or 10') with rock outcrop
tl	Lodgement or basal till, thick (3m or 10') (colluviated on slopes)
ttl	Lodgement or basal till, thin (3m or 10') with outcrop
M	Moraine till: boundary with silty-sandy matrix

BASE MAP IS A PORTION OF THE FOLLOWING:
D.J. DE SIMONE 1987

0 1000 2000 3000

approximate scale in feet

L00-219/SUFICIAL

Figure 3.1-4

SURFICIAL GEOLOGY MAP

POWNAL TANNERY
POWNAL, VERMONT

Metcalf & Eddy

TRC

Boott Mills South
Foot of John Street
Lowell, MA 0185
978-970-5600

QUADRANGLE LOCATION

VT

TRC PROJ. NO.: 02136-0220-01N91

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACTOR NO.: 107061

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3.1.4 Bedrock Geology

Figure 3.1-5 shows a portion of the Bedrock Geologic Map of Vermont. This map shows that the site is primarily underlain by bedrock associated with the Taconic Range, specifically the Cambrian St. Catherine formation. This formation consists of purple, gray-green, and variegated slate and phyllite containing minor interbeds of white to green quartzite, locally albitic. Purple and green chloritoid-bearing slate and phyllite is within dashed line in northern Taconic range, but not separated farther south. The tectonic information provided on the Bedrock Geologic Map of Vermont illustrates the Cambrian St. Catherine formation as eugeosynclinal rocks, separated from Ordovician Miogeosynclinal rocks to the east by a thrust fault.

This thrust fault, roughly aligned with the Hoosic River, separates the St. Catherine formation to the west from two adjacent Ordovician formations overthrusting from the east. These Ordovician rocks include the Hortonville formation and the Glens Falls/Orwell limestone formations. The Hortonville formation consists of black, carbonaceous and pyritic slate and phyllite, locally sandy; brown weathered lime-rich beds are common near the base. The Glens Falls/Orwell limestones (undifferentiated) are combined where deformation has made the thin-bedded Glens Falls indistinguishable from the thick-bedded Orwell.

3.1.5 Climate

The climate of Bennington County is characterized by short, warm summers and long, cold winters, with an average growing season of 130 days.

3.2 Site Characteristics

3.2.1 Geology

Based on observations during the installation of monitoring wells and the advancement of borings at the site, TRC identified several stratigraphic units. General descriptions of each unit are provided below. Other area-specific units that were encountered are described in later section of the report grouped together with discussions of the site characteristics of the areas where they were observed.

Fill: An upper layer of miscellaneous fill is present on the surface across much of the site.

Sand and Gravel: A sand and gravel layer was observed beneath the entire site, at depths up to approximately 24 feet. This stratigraphic unit generally consists of medium dense to very dense, light to dark brown, fine to coarse sand and gravel.

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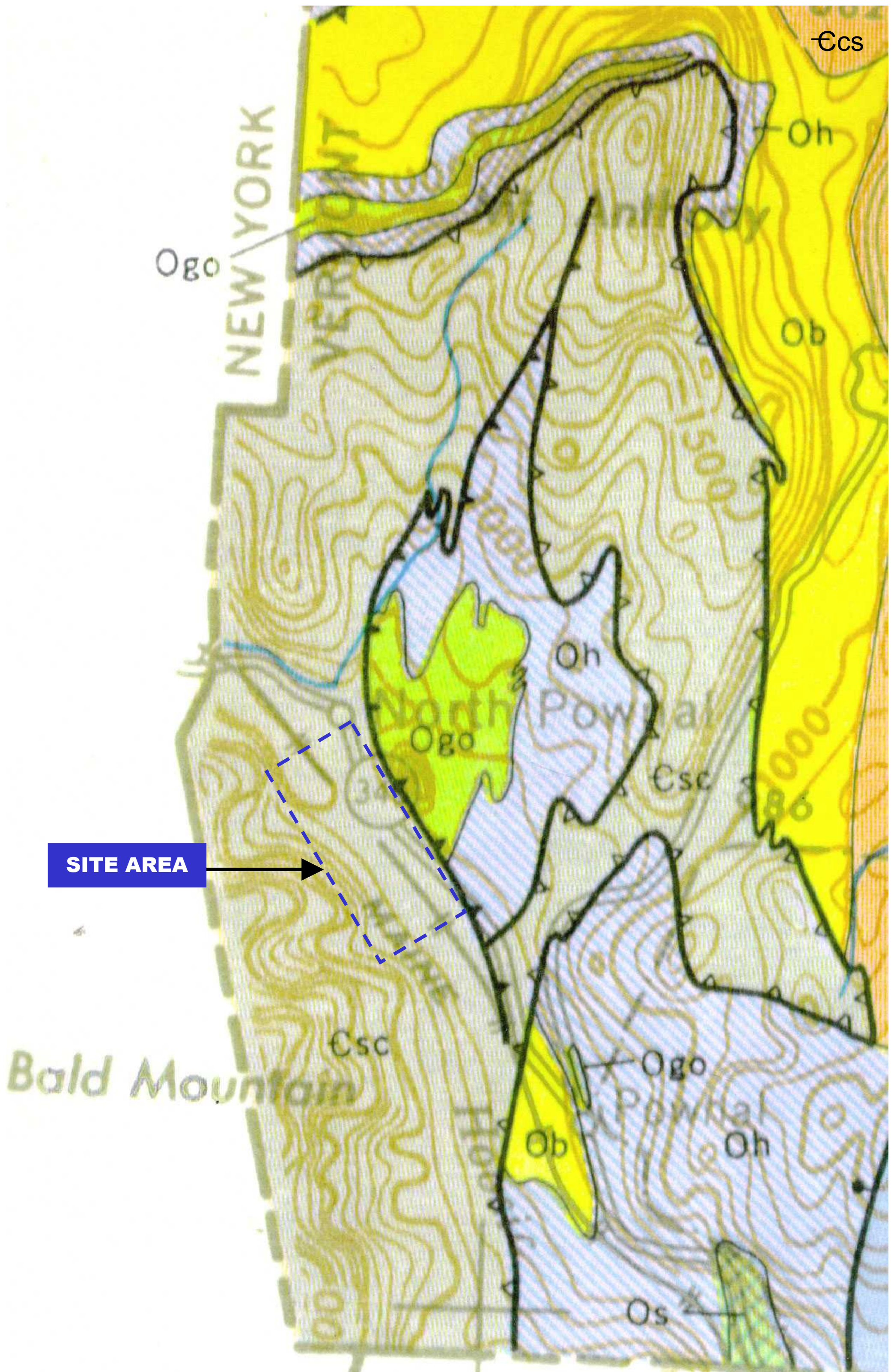

LEGEND

Hortonville formation

Oh — *Black, carbonaceous and pyritic slate and phyllite, locally sandy; brown weathered limy beds are common near base. Occurs east of Highgate Springs, Champlain, and Orwell thrusts.*

Glens Falls and Orwell limestones, undifferentiated

Ogo — *Combined where deformation has made the thin bedded Glens Falls indistinguishable from the thick bedded Orwell; from West Rutland south may contain rocks as low as the Middlebury.*

Bascom formation, and undifferentiated Luke Hill, Naylor Ledge and Hastings Creek limestones

Ob, Obb — *Interbedded dolomite, limestone or marble, calcareous sandstone, quartzite, and limestone breccia; irregular dolomitic layers, thin sandy laminae, and slaty or phyllitic partings charaterize limestone and marble of lower, middle, and upper parts of the Bascom, respectively; south of West Rutland it includes some of Chipman formation. The combined Luke Hill, Naylor Ledge, and Hastings Creek, east of Philipsburg thrust, are strati-graphically equivalent to the Bascom.*

Obb, *Brownell Mountain phyllite member: calcareous phyllite in upper part of the Bascom formation of east limb of Hinesburg synclinorium.*

Shelburne, Whitehall, and Strites Pond formations

Os — *The Shelburne is chiefly a white marble or gray limestone characterized by raised reticulate lines of gray dolomite on the weathered surface; includes Sutherland Falls marble, intermediate dolomite and Columbian marble of the marble quarries. Interbedded massive dolomite increases westward and predominates in the Whitehall formation, west of Champlain and Orwell thrusts. The Strites Pond, which is identical to the Shelburne, is east of Philipsburg thrust.*

Clarendon Springs, Ticonderoga, and Rock River dolomites; Gorge formation

Ꞓcs — *Fairly uniform, massive, smooth weathered gray dolomite characterized by numerous geodes and knots of white quartz; quartz sandstone and irregular masses of chert are near the top. Called the Ticonderoga west of Orwell and Champlain thrusts and the Rock River east of Philipsburg thrust. The Gorge is a partly conglomeratic facies on west limb of the St. Albans synclinorium.*

Cheshire quartzite

Ꞓc — *Very massive, white to faintly pink or buff vitreous quartzite near the top in west-central and southwestern Vermont; predominantly a less massive appearing mottled gray, somewhat phyllitic quartzite; dolomitic sandstone and conglomerate near the base of the formation in west-central Vermont apparently grades southward into the Dalton formation.*

St. Catherine formation

Ꞓsc, Ꞓscz, Ꞓscb — *Purple, gray-green, and variegated slate and phyllite containing minor interbeds of white to green quartzite; locally albitic. Purple and green chloritoid-bearing slate and phyllite is within dashed line in northern Taconic Range, but not separated farther south.*

Ꞓscb, *Bomoseen graywacke member: green to olive-colored arkose and graywacke that weathers pale red to white; contains visible flakes of mica and rock fragments.*

Ꞓscz, *Zion Hill quartzite member: white weathered green, vitreous chloritic quartzite and graywacke spotted with limonite.*

BASE MAP IS A PORTION OF THE FOLLOWING: CENTENNIAL GEOLOGIC MAP OF VERMONT, COMPILED AND EDITED UNDER THE DIRECTION OF CHARLES G. DOLL, STATE GEOLOGIST; BY CHARLES G. DOLL, VERMONT GEOLOGICAL SURVEY-WALLACE M. CADY, U.S. GEOLOGICAL SURVEY, JAMES B. THOMPSON JR., AND MARLAND P. BILLINGS, HARVARD UNIVERSITY, 1961

Figure 3.1-5

BEDROCK GEOLOGY MAP

POWNAL TANNERY
POWNAL, VERMONT

M&E Metcalf & Eddy

TRC

Boott Mills South
Foot of John Street
Lowell, MA 0185
978-970-5600

QUADRANGLE LOCATION — VT

TRC PROJ. NO.: 02136-0220-01N91
EPA CONTRACT NO.: 68-W6-0042
RAC SUBCONTRACTOR NO.: 107061

L00-219/BED-GEO

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Fine Silty Sand: Layers of Fine Silty Sand were observed underlying the Sand and Gravel in some, but not all of the borings advanced at the site (MW-101U, MW-102U, MW-103R, MW-104U, MW-106U, MW-107R, MW-109U, and MW-111U). This material generally consisted of medium dense, light brown, fine silty sand. At three of the boring locations where this material was observed (MW-106U, MW-109U, and MW-111U), the lower portion of this overburden layer also included fine to medium gravel. The thickness of this material varied at each location, from approximately 8 to 32 feet.

Silt and Clay: At three locations at the site (MW-102U, MW-106U, and MW-112U), Silt and Clay was observed underlying the alluvial Sand and Gravel or the Fine Silty Sand. While appearing as a distinct unit, this material may represent a gradual transition from the overlying Fine Silty Sand and the underlying Gray Clay. The thickness of this material ranges up to 20 feet, and is generally comprised of medium dense, light brown to gray silt and clay.

Gray Clay: Figure 3.3-9 presents an isopach map of the gray clay layer in the lagoon area. This layer is present beneath the entire site except where bedrock is exposed at the surface, and in areas where the bedrock is very shallow (<10 feet). Two areas where the Gray Clay may be thin or absent include limited areas in the former building area and the west side of the Hoosic River across from Lagoon 4. The Gray Clay unit is thickest near the landfill, reaching thicknesses of over 120 feet.

This layer is relatively homogeneous and generally consists of medium-stiff, light gray, highly cohesive clay, with an occasional presence of very thin (<1/8-inch) lenses of fine silty sand. The upper surface of this layer varied in depths below grade from 17 to 79 feet, and extended to depths ranging from 57 to 151 feet.

Basal Silty Sand: As observed at three of the boring locations (MW-102U, MW-103R, and MW-107U/MW-107R), in some areas of the site, the Gray Clay is underlain by a layer of more granular material. This material consists of medium to very dense, dark gray, fine sand with some silt and clay. The thickness of this unit at the three locations where it was observed ranged from 6 to 28 feet.

Bedrock: The bedrock encountered at the site is a fissile, gray green to silver and/or purple phyllite with interbeds of white to green quartzite. The upper 20 to 40 feet of the bedrock is highly weathered and rock cores could not be retrieved from this interval.

3.2.2 Hydrogeology

Ground water flow in the area is predominantly influenced by the Hoosic River. Generally, overburden ground water appears to flow toward and discharge to the Hoosic River.

TRC identified six hydrostratigraphic layers at the site.

Upper Fill and Soil Layers: Most of the site is overlain by an unconfined aquifer comprised of heterogeneous fill and soil.

Sludge: In the lagoon area, there are thin (<10 feet) lenses of a fine grained sludge which may act as a discontinuous, semi-confining or leaky confining layer.

Gravel: Near the river, especially in the lagoon area, there is a layer of gravel, approximately 10-15 feet thick, lying below the sludge and fill. This aquifer may be partially confined when it lies beneath the sludge.

Gray Clay: The thick clay layer separating the upper unconfined layers from the bedrock below, is a major confining layer.

Lower Sand: A thin (<15 feet), discontinuous sand layer is present beneath the Gray Clay at the landfill and at the lagoons. This layer acts as a confined aquifer and is probably well connected with the underlying bedrock aquifer since the bedrock is highly fractured and there is no hydraulic barrier between the two units.

Bedrock: The highly fractured bedrock is a confined aquifer throughout most of the site, except in areas where the bedrock is very shallow and the clay is not present (i.e. near the former building area).

3.2.3 Ecology

Plant Community: The project area falls within the Hemlock-White Pine Northern Hardwoods Region of the Eastern North American Deciduous Forest that stretches from Minnesota to the Atlantic Coast. The region is covered in a mixed community of deciduous and coniferous forest the hillsides in contrast to the more open lowlands. Floral species include hemlock, white pine, sugar maple, beech and yellow birch (Braun 1967).

Animal Community: Table 3.2-1 lists wildlife species that are likely to occur or were observed within the Hoosic River or adjacent riparian forest. Faunal species include eastern cotton-tailed rabbit, white tailed deer, moose, black bear, eastern gray squirrels, woodchuck, and various songbirds. Anadromous fish species, such as salmon and herring are not found in the Hoosic River due to impassable falls at the mouth of the river (Hasenstab and McArdle 1988).

Riverine wetlands such as the Hoosic River and the immediately adjacent palustrine wetlands may support a variety of aquatic, semi-aquatic, and terrestrial species. These species would include invertebrates, fish, amphibians, reptiles, birds and mammals. A variety of amphibian and reptilian species may potentially use the aquatic habitats associated with the Hoosic River. Several of the identified amphibian species inhabit aquatic habitats throughout the year. Examples of these species include the northern spring salamander, red-spotted newt and bullfrog. Additional amphibians may potentially use the aquatic and riparian habitats of the Hoosic River seasonally as a breeding or foraging habitat. At other times of the year, these species may forage within uplands or wetlands located adjacent to the river. Amphibians are generally insectivores consuming insects and other invertebrates although larger species such as the bullfrog may also feed on small vertebrates.

Table 3.2-1: Study Area Wildlife								
Common Name	**Scientific Name**	**Hoosic River**	**River Riparianz Forest**	**Lagoon Shallow Marsh**	**Lagoon Scrub-Shrub**	**Landfill Pond**	**Landfill Seep Forest**	**Landfill Meadow**
Amphibians								
Blue-spotted Salamander	*Ambystoma laterale*		X	X			X	X
Jefferson Salamander	*Ambystoma jeffersonianum*		X	X				
Spotted Salamander*	*Ambystoma maculatum*		X	X			X	
Eastern American Toad*	*Bufo a. americanus*		X	X	X	X	X	X
Gray Treefrog*	*Hyla versicolor*		X	X		X	X	X
Northern Spring Peeper*	*Pseudacris c. crucifer*		X	X		X	X	X
N. Dusky Salamander	*Desmognathus f. fuscus*	X					X	
N. Spring Salamander	*Gyrinophilus p. porphyriticus*	X						
N. Two-lined Salamander	*Eurycea b. bislineata*	X					X	
Redback Salamander	*Plethodon c. cinereus*		X				X	
Bullfrog*	*Rana catesbeiana*	X		X		X		
Green Frog*	*Rana clamitans melanota*	X	X	X		X	X	X
Pickerel Frog*	*Rana palustris*	X		X		X	X	X
Wood Frog*	*Rana sylvatica*		X	X			X	
Red-spotted Newt*	*Notophthalmus viridescens*	X	X	X		X	X	X
Birds								
Cooper's Hawk	*Accipiter cooperii*				X		X	
Northern Harrier	*Circus cyaneus*							X
Red-tailed Hawk*	*Buteo jamaicensis*				X			
Sharp-shinned Hawk	*Accipiter striatus*				X		X	
Belted Kingfisher*	*Ceryle alcyon*	X				X		
American Black Duck	*Anas rubripes*	X		X		X		X
Canada Goose*	*Branta canadensis*	X		X		X		X
Common Merganser*	*Mergus merganser*	X						
Hooded Merganser	*Lophodytes cucullatus*	X				X		
Mallard*	*Anas platyrhynchos*	X		X		X		X
Wood Duck	*Aix sponsa*	X	X	X		X		
Chimney Swift*	*Chaetura pelagica*	X		X	X	X		X
Black-crowned Night Heron	*Nycticorax nycticorax*	X		X		X		
Great Blue Heron*	*Ardea herodias*	X		X		X		X
Green-backed Heron*	*Butorides striatus*	X	X	X		X		X
Cedar Waxwing	*Bombycilla cedrorum*		X		X			
Common Nighthawk	*Chordeiles minor*			X				X
Brown Creeper	*Certhia americana*		X				X	
Killdeer	*Charadrius vociferus*							X
Mourning Dove	*Zenaida macroura*				X			
American Crow*	*Corvus brachyrhynchos*		X		X			

Table 3.2-1: Study Area Wildlife								
Common Name	**Scientific Name**	**Hoosic River**	**River Riparianz Forest**	**Lagoon Shallow Marsh**	**Lagoon Scrub-Shrub**	**Landfill Pond**	**Landfill Seep Forest**	**Landfill Meadow**
Blue Jay*	*Cyanocitta cristata*		X		X		X	
Black-billed Cuckoo	*Coccyzus erythropthalmus*				X			
Yellow-billed Cuckoo	*Coccyzus americanus*				X			
American Kestrel	*Falco sparverius*				X			X
American Goldfinch*	*Carduelis tristis*		X		X		X	X
American Tree Sparrow	*Spizella arborea*		X		X			X
Dark-eyed Junco	*Junco hyemalis*				X		X	
Field Sparrow*	*Spizella pusilla*				X			
Indigo Bunting	*Passerina cyanea*		X		X		X	
Northern Cardinal	*Cardinalis cardinalis*		X		X		X	X
Rose-breasted Grosbeak	*Pheucticus ludovicianus*		X		X			
Savannah Sparrow	*Passerculus sandwichensis*			X				X
Song Sparrow*	*Melospiza melodia*		X		X		X	X
Swamp Sparrow	*Melospiza georgiana*		X	X		X		X
Vesper Sparrow	*Pooecetes gramineus*				X			
Bank Swallow*	*Riparia riparia*	X		X	X	X		X
Barn Swallow	*Hirundo rustica*	X		X	X	X		X
Cliff Swallow	*Hirundo pyrrhonota*	X		X	X	X		X
N. Rough-winged Swallow	*Stelgidopteryx serripennis*	X		X	X	X		X
Tree Swallow*	*Tachycineata bicolor*	X	X	X	X	X		X
Baltimore Oriole*	*Icterus galbula*		X		X		X	
Brown-headed Cowbird	*Molothrus ater*		X		X		X	X
Common Grackle*	*Quiscalus quiscula*	X	X	X		X		X
Red-winged Blackbird*	*Agelaius phoeniceus*	X		X		X		X
Herring Gull	*Larus argentatus*	X						
Brown Thrasher	*Toxostoma rufum*		X		X		X	
Gray Catbird*	*Dumetella carolinensis*		X		X		X	X
Black-capped Chickadee*	*Parus atricapillus*		X		X		X	
Tufted Titmouse	*Parus bicolor*		X				X	
American Redstart	*Setophaga ruticilla*		X				X	
Black-and-White Warbler	*Mniotilta varia*		X				X	
Canada Warbler	*Wilsonia canadensis*		X				X	
Chestnut-sided Warbler	*Dendroica pensylvanica*				X		X	
Common Yellowthroat*	*Geothlypis trichas*		X	X	X	X	X	X
Golden-winged Warbler	*Vermivora chrysoptera*				X			
Nashville Warbler	*Vermivora ruficapilla*				X			
Northern Waterthrush	*Seiurus noveboracensis*	X						
Yellow Warbler*	*Dendroica petechia*				X		X	
Double-crested Cormorant*	*Phalacrocorax auritus*	X						
Downy Woodpecker	*Picoides pubescens*		X				X	

Table 3.2-1: Study Area Wildlife								
Common Name	**Scientific Name**	**Hoosic River**	**River Riparianz Forest**	**Lagoon Shallow Marsh**	**Lagoon Scrub-Shrub**	**Landfill Pond**	**Landfill Seep Forest**	**Landfill Meadow**
Hairy Woodpecker*	*Picoides villosus*		X					
Northern Flicker	*Colaptes auratus*		X		X			
Pileated Woodpecker	*Dryocopus pileatus*		X					
House Sparrow	*Passer domesticus*				X			
American Woodcock	*Scolopax minor*				X		X	X
Common Snipe	*Gallinago gallinago*							X
Spotted Sandpiper*	*Actitis macularia*	X				X		
White-breasted Nuthatch	*Sitta carolinensis*		X				X	
Eastern Screech-Owl	*Otus asio*		X		X		X	X
Great Horned Owl	*Bubo virginianus*		X		X		X	X
European Starling*	*Sturnus vulgaris*		X		X			X
Blue-gray Gnatcatcher	*Polioptila caerulea*				X		X	
Ruffed Grouse	*Bonasa umbellus*				X		X	
Ruby-throated Hummingbird*	*Archilochus colubris*				X		X	
House Wren	*Troglodytes aedon*		X		X		X	
Marsh Wren	*Cistothorus palustris*			X				
American Robin*	*Turdus migratorius*		X		X		X	X
Eastern Bluebird	*Sialia sialis*				X			
Hermit Thrush	*Catharus guttatus*		X				X	
Wood Thrush	*Hylocichla mustelina*		X				X	
Alder Flycatcher	*Empidonax alnorum*		X		X			X
Eastern Kingbird*	*Tyrannus tyrannus*		X		X	X		
Eastern Phoebe*	*Sayornis phoebe*	X	X		X			X
Least Flycatcher	*Empidonax minimus*		X				X	
Olive-sided Flycatcher	*Contopus borealis*					X		
Willow Flycatcher	*Empidonax traillii*				X			
Red-eyed Vireo	*Virea olivaceus*		X					
Warbling Vireo	*Vireo gilvus*		X					
Mammals								
Coyote	*Canis latrans*		X	X	X		X	X
Gray Fox	*Urocyon cinereoargenteus*		X	X	X		X	X
Red Fox	*Vulpes vulpes*		X	X	X		X	X
Beaver*	*Castor canadensis*	X	X	X		X		
White-tailed Deer*	*Odocoileus virginianus*		X	X	X		X	X
Deer Mouse	*Peromyscus maniculatus*		X		X		X	
Meadow Vole*	*Microtus pennsylvanicus*				X			X
Muskrat*	*Ondatra zibethicus*	X		X		X		X
S. Red-backed Vole	*Clethrionomys gapperi*		X		X		X	
Southern Bog Lemming	*Synaptomys cooperi*			X				X
White-footed Mouse	*Peromyscus leucopus*		X		X		X	X

Table 3.2-1: Study Area Wildlife								
Common Name	**Scientific Name**	**Hoosic River**	**River Riparianz Forest**	**Lagoon Shallow Marsh**	**Lagoon Scrub-Shrub**	**Landfill Pond**	**Landfill Seep Forest**	**Landfill Meadow**
Woodland Vole	*Microtus pinetorum*		X		X		X	
Virginia Opossum	*Didelphis virginiana*		X	X	X		X	X
Eastern Cottontail*	*Sylvilagus floridanus*		X		X		X	X
New England Cottontail	*Sylvilagus transitionalis*		X		X		X	X
Snowshoe Hare	*Lepus americanus*				X			
House Mouse	*Mus musculus*				X			
Norway Rat	*Rattus norvegicus*				X			
Ermine	*Mustela erminea*		X		X		X	
Long-tailed Weasel	*Mustela frenata*		X	X	X		X	X
Mink	*Mustela vison*	X	X	X		X	X	X
River Otter	*Lutra canadensis*	X	X			X		
Striped Skunk*	*Mephitis mephitis*		X	X	X		X	X
Raccoon*	*Procyon lotor*	X	X	X	X		X	X
Eastern Chipmunk	*Tamias striatus*				X			
Red Squirrel	*Tamiasciurus hudsonicus*		X				X	
Woodchuck*	*Marmota monax*				X			
Masked Shrew	*Sorex cinereus*		X	X	X		X	X
N. Short-tailed Shrew	*Blarina brevicauda*		X		X		X	X
Pygmy Shrew	*Sorex hoyi*		X					
Smoky Shrew	*Sorex fumeus*		X				X	
Water Shrew	*Sorex palustris*	X		X		X		X
Hairy-tailed Mole*	*Parascalops breweri*		X		X		X	
Star-nosed Mole	*Condylura cristata*	X		X		X		X
Big Brown Bat	*Eptesicus fuscus*	X		X	X	X		X
Eastern Pipistrelle	*Pipistrellus subflavus*	X		X	X	X		X
Hoary Bat	*Lasiurus cinereus*	X		X	X	X		X
Little Brown Bat	*Myotis lucifugus*	X		X	X	X		X
N. Long-eared Bat	*Myotis septentrionalis*	X		X	X	X		X
Red Bat	*Lasiurus borealis*	X		X	X	X		X
Silver-haired Bat	*Lasionycteris noctivagans*	X		X	X	X		X
Meadow Jumping Mouse	*Zapus hudsonius*			X	X			X
Woodland Jumping Mouse	*Napaeozapus insignis*		X		X		X	
Reptiles								
Snapping Turtle*	*Chelydra serpentina*	X		X	X	X		
E. Smooth Green Snake	*Opheodrys v. vernalis*		X		X		X	X
Eastern Garter Snake*	*Thamnophia s. sirtalis*	X	X	X	X		X	X
Eastern Milk Snake	*Lampropeltis t. triangulum*						X	
Eastern Ribbon Snake	*Thamnophis s. sauritus*	X		X		X		X
Northern Black Racer	*Coluber c. constrictor*		X		X			X
Northern Brown Snake	*Storeria d. dekayi*				X		X	X

Table 3.2-1: Study Area Wildlife								
Common Name	**Scientific Name**	**Hoosic River**	**River Riparianz Forest**	**Lagoon Shallow Marsh**	**Lagoon Scrub-Shrub**	**Landfill Pond**	**Landfill Seep Forest**	**Landfill Meadow**
Northern Redbelly Snake	*Storeria o. occipitomaculata*						X	X
Northern Water Snake	*Nerodia s. sipedon*	X	X			X	X	X
Midland Painted Turtle*	*Chrysemys p. marginata*	X		X		X		
Wood Turtle	*Clemmys insculpta*	X	X	X	X	X	X	X
Musk Turtle	*Sternotherus odoratus*	X		X	X	X		

NOTES:

* Species (or sign) observed on the site during site reconnaissance or sampling by TRC.

1 Includes resident, breeding, and wintering amphibian, avian, mammalian, and reptilian species within the vicinity of the Hoosic River, lagoons, and landfill pond and wetlands. Migratory species are also likely to use these habitats, however, these species would have less potential for prolonged exposure to site contaminants than species inhabiting the site for extended periods.

Several species of snakes and turtles are also expected to inhabit the Hoosic River and adjacent riparian area. Snake species which may be present are generally carnivorous and include two species in particular that are often associated with aquatic/wetland habitats: the northern water snake and eastern ribbon snake. Turtle species potentially present are generally omnivorous species that forage on the water bottom. Egg deposition for several of these species, including the common snapping turtle and painted turtle is usually in fairly close proximity to an aquatic habitat such as a river bank.

A diverse assemblage of avian species representing a variety of feeding guilds may use the habitats provided by the Hoosic River and adjacent riparian forest. Aquatic bird species that may forage within the Hoosic River include a variety of waterfowl such as the Canada goose, mallard, and common merganser. Additional aquatic bird species such as various wading birds (e.g., herons) and kingfishers may also forage on small fish, amphibians and macroinvertebrates within the Hoosic River.

Several species of swallows are likely to hawk insects above the Hoosic River as emerging insects are particularly abundant above an aquatic environment. A wide diversity of songbirds are also expected to inhabit the riparian vegetation present along the banks of the river. These species would include shrub nesters such as the common yellowthroat and tree nesters such as the eastern kingbird, insectivores that may consume terrestrial insects and recently emerged aquatic insects.

Several mammal species representing different foraging guilds are expected to use the aquatic and riparian habitat provided by the Hoosic River. Herbivorous rodents including aquatic species such as the muskrat and beaver may inhabit the river while a variety of bat species are likely to forage for insects above the Hoosic River. Aquatic habitats are generally very productive sites for invertebrates including a variety of aquatic insects. Emerging insects would provide an important food resource for bats in the vicinity of the site. Species such as the little brown bat and big brown bat are often associated with structures/buildings located near aquatic habitats. Additional bat species such as the red bat and silver-haired bat may forage above the Hoosic River adjacent to forested areas that provide roosting sites.

Mammalian predators such as the raccoon and various mustelids are expected to forage within or along the banks of the Hoosic River. The raccoon is an omnivorous feeder that consumes a wide variety of items including macroinvertebrates and amphibians that would be present along a river shoreline. The river otter and mink are two carnivorous members of the weasel family that consume a high proportion of fish in their diets.

Wetlands: Seven wetland areas were identified on the Pownal Tannery site.

- Lagoon 1 Wetland (Palustrine Emergent)
- Lagoon 2 Wetland (Palustrine Emergent/ Palustrine Scrub-Shrub)
- Lagoon 4 Wetland (Palustrine Emergent/Palustrine Scrub Shrub)
- Lagoon 5 Wetland (Palustrine Emergent/Open Water)
- Former Landfill Wetland
- Hoosic River Fringe Wetlands (Palustrine Forested/Scrub-Shrub/Emergent)
- Hoosic River Floodplain Wetlands (Palustrine Emergent/Forested/Open Water)

In accordance with the Vermont Wetland Rules as adopted under *Title 10 V.S.A. Chapter 37, section 905 (7-9)*, all wetlands in the state of Vermont are designated as either Class One, Class Two, or Class Three wetlands. Those wetlands designated as Class One or Class Two have been deemed to be so significant that they merit protection.

A description of each Class and its relationship to the Pownal Tannery wetlands is presented below.

Class One: Class One wetlands are those wetlands that, "…in and of themselves, based on an evaluation of the functions in Section 5, are exceptional or irreplaceable in their contribution to Vermont's natural heritage and are therefore so significant that they merit the highest level of protection under these rules." No wetlands have yet been designated as Class One wetlands within the State of Vermont, and therefore none of the Pownal Tannery wetlands are considered Class One wetlands.

Class Two: Class Two wetlands are those wetlands that "…other than Class One wetlands, which based on an evaluation of the functions in Section 5, are found to be so significant, either taken alone or in conjunction with other wetlands, that they merit protection under these rules". Furthermore, Class Two wetlands include those wetlands depicted on the National Wetlands Inventory Maps for the State of Vermont and all wetlands that are contiguous to these wetlands. It should be noted that the State has some latitude with regards to the classification level of certain NWI wetlands (i.e., some Class Two wetlands might be reclassified as Class Three wetlands).

Each Class Two wetland is presumed, until determined otherwise, to serve all of the wetland functions as specified in the Vermont Wetland Rules (Sec. 5). The wetland functions in Section 5 include the following.

1. Water Storage for Flood Water and Storm Runoff
2. Surface and Ground Water Protection
3. Fisheries Habitat
4. Wildlife and Migratory Bird Habitat
5. Hydrophytic Vegetation Habitat
6. Threatened and Endangered Species Habitat
7. Education and Research in Natural Sciences
8. Recreational Value and Economic Benefits
9. Open Space and Aesthetics
10. Erosion Control through Binding and Stabilizing the Soil

Class Three: Class Three wetlands are those wetlands that are not designated as Class One or Class Two and include the following National Wetland Inventory (NWI) categories.

- Riverine Lower Perennial Open Water (R2OW)
- Riverine Lower Perennial Beach/Bar ((R2BB)
- Riverine Upper Perennial Open Water (R3OW)
- Riverine Upper Perennial Beach/Bar (R3BB)
- Lacustrine Limnetic Open Water (L1OW)
- Lacustrine Littoral Open Water (L2OW)
- Lacustrine Littoral Beach/Bar (L2BB)

3.3 Former Tannery Building Area

3.3.1 Geology

Figure 3.3-1 shows the bedrock elevation in the Former Tannery Building Area. Bedrock in the southern portion of this area is very shallow, and is exposed on the western Hoosic River bank. From the dam, the bedrock surface slopes steeply to the north, dropping over 100 feet from the dam to the bridge located 800 feet away.

Figure 3.3-1 also shows the location of Cross Section A-A' depicting the subsurface geology in the Former Tannery Building Area. This section shows the bedrock surface steeply dipping to the north in the direction of the Lagoon Area, overlain by a thick Gray Clay layer.

This area is underlain by Fill and the Gray Clay layer that rests directly on bedrock. Boring MW-110U encountered bedrock at a depth of 8 feet, overlain by a two foot thick clay layer and 6 feet of fill. The USACE also reportedly excavated a large amount of clay during the NTCRA from the building area, indicating that the clay layer is present even where the bedrock is very shallow.

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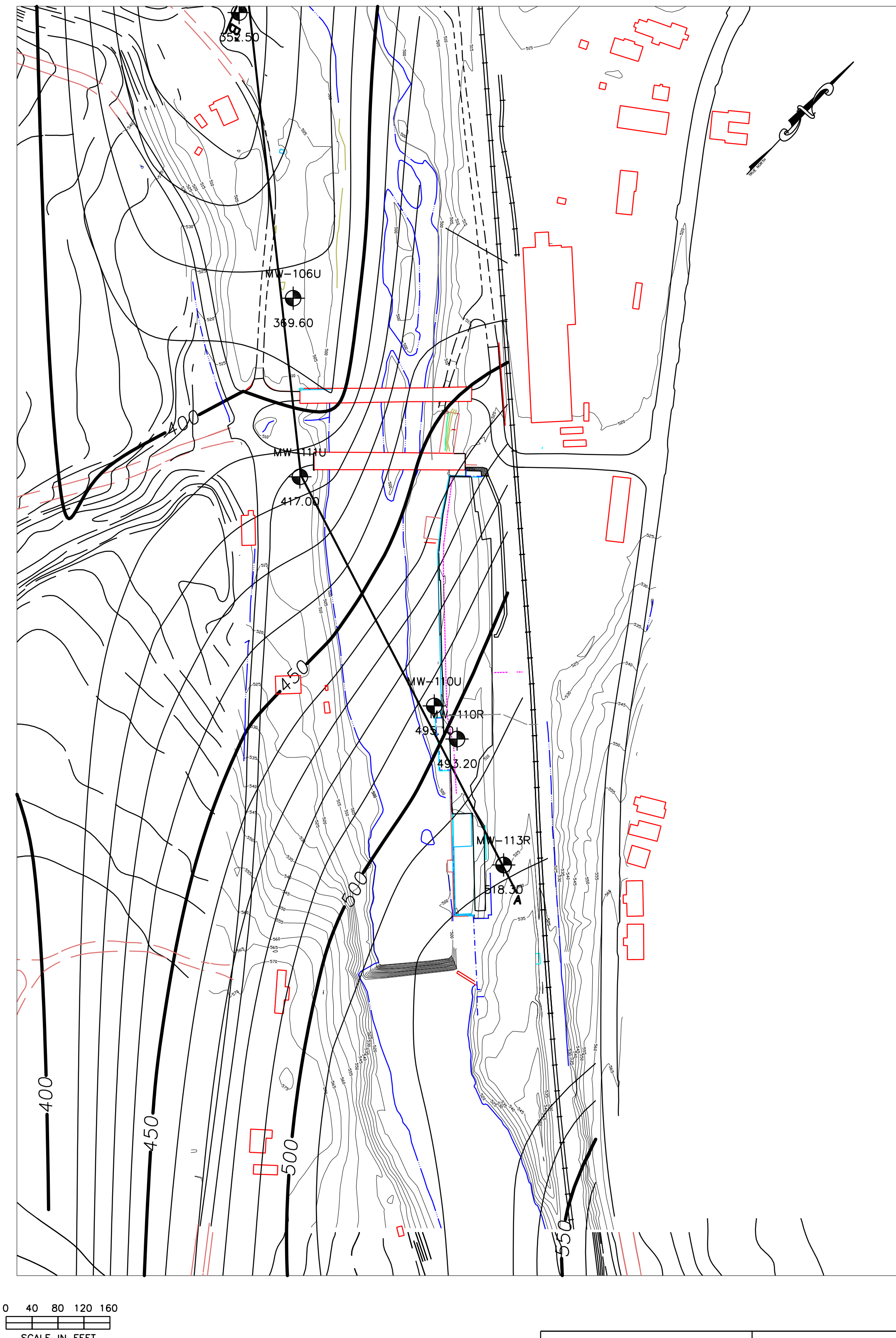

LEGEND

2" MONITORING WELL WITH BEDROCK ELEVATION

TRC

Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

TRC PROJ. NO.: 02136-0220-01N93

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACTOR NO.: 107061

FIGURE 3.3-1
BEDROCK ELEVATION MAP
FORMER
TANNERY BUILDING AREA
POWNAL TANNERY
POWNAL, VERMONT

M&E Metcalf & Eddy

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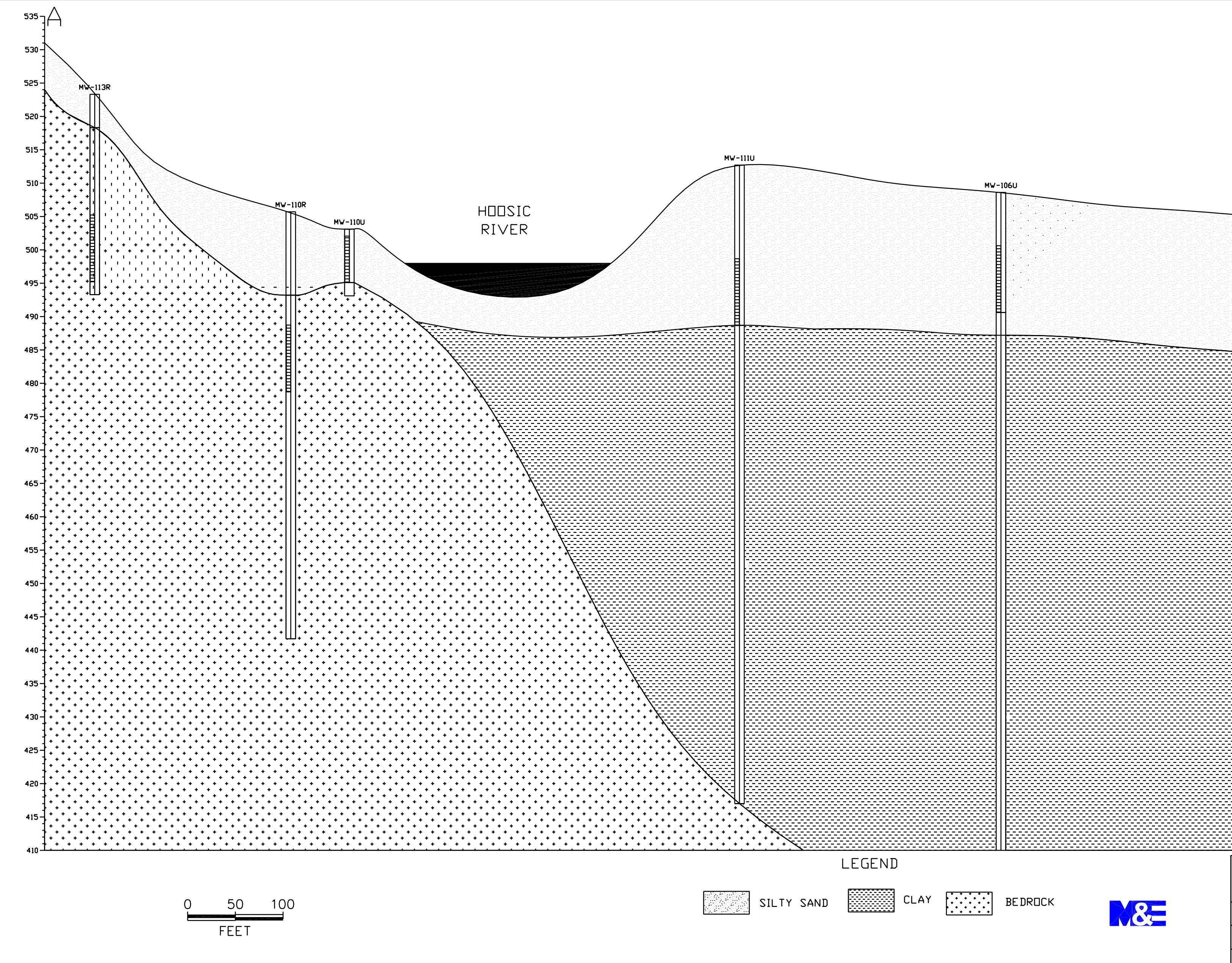

TRC
Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

TRC PROJ. NO.: 02136-0220-01N93

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACTOR NO.: 107061

FIGURE 3.3-2
CROSS SECTION
A-A'

POWNAL TANNERY
POWNAL, VERMONT

Metcalf & Eddy

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The Gray Clay layer was not observed at boring MW-110R, which encountered bedrock slightly deeper (13 feet). The overlying fill at this location was also noticeably stained black. This staining is presumably related to a petroleum release from a tank in the building that was removed by the USACE as part of the NTCRA.

The upper 50 feet of bedrock at this area is highly fractured, but due to the fracturing, it was not possible to obtain a rock core sample from this location.

3.3.2 Hydrogeology

Table 3.3-1 presents a summary of the hydraulic conductivities computed from the rising head slug tests conducted in each well. The geometric mean hydraulic conductivity for the two overburden wells is 3.3×10^{-4} cm/s and the bedrock wells have a geometric mean hydraulic conductivity of 3.6×10^{-4} cm/s.

Table 3.3-1: Hydraulic Conductivities, Former Tannery Building Area					
Overburden Wells					
Well	***Formation***	***Hydraulic Conductivity***			
MW-110U	Upper sand and gravel	4.1E-04	ft/min	2.1E-04	cm/s
MW-111U	Upper sand and gravel	1.0E-03	ft/min	5.3E-04	cm/s
Geometric Mean =		6.4E-04	ft/min	3.3E-04	cm/s
Bedrock Wells					
Well	***Formation***	***Hydraulic Conductivity***			
MW-110R	Bedrock	2.4E-04	ft/min	1.3E-04	cm/s
MW-113R	Bedrock	2.0E-05	ft/min	1.0E-05	cm/s
Geometric Mean =		7.1E-05	ft/min	3.6E-05	cm/s

Appendix D presents hydrographs for all of the ground water monitoring wells, piezometers, and staff gauges.

The vertical hydraulic gradient computed at location MW-110 could not be determined since the PVC well pipe was extended (as part of the NTCRA) after measurement of the water levels, but before the reference elevation was surveyed.

3.3.3 Ecology

Figure 3.3-3 shows the extent of wetlands on the site.

Two wetland areas were identified at the Former Tannery Building Area.

- Hoosic River Fringe Wetlands (Palustrine Forested/Scrub-Shrub/Emergent) *Class Three Wetland*
- Hoosic River Floodplain Wetlands (Palustrine Emergent/Forested/Open Water) *Class Two Wetland*

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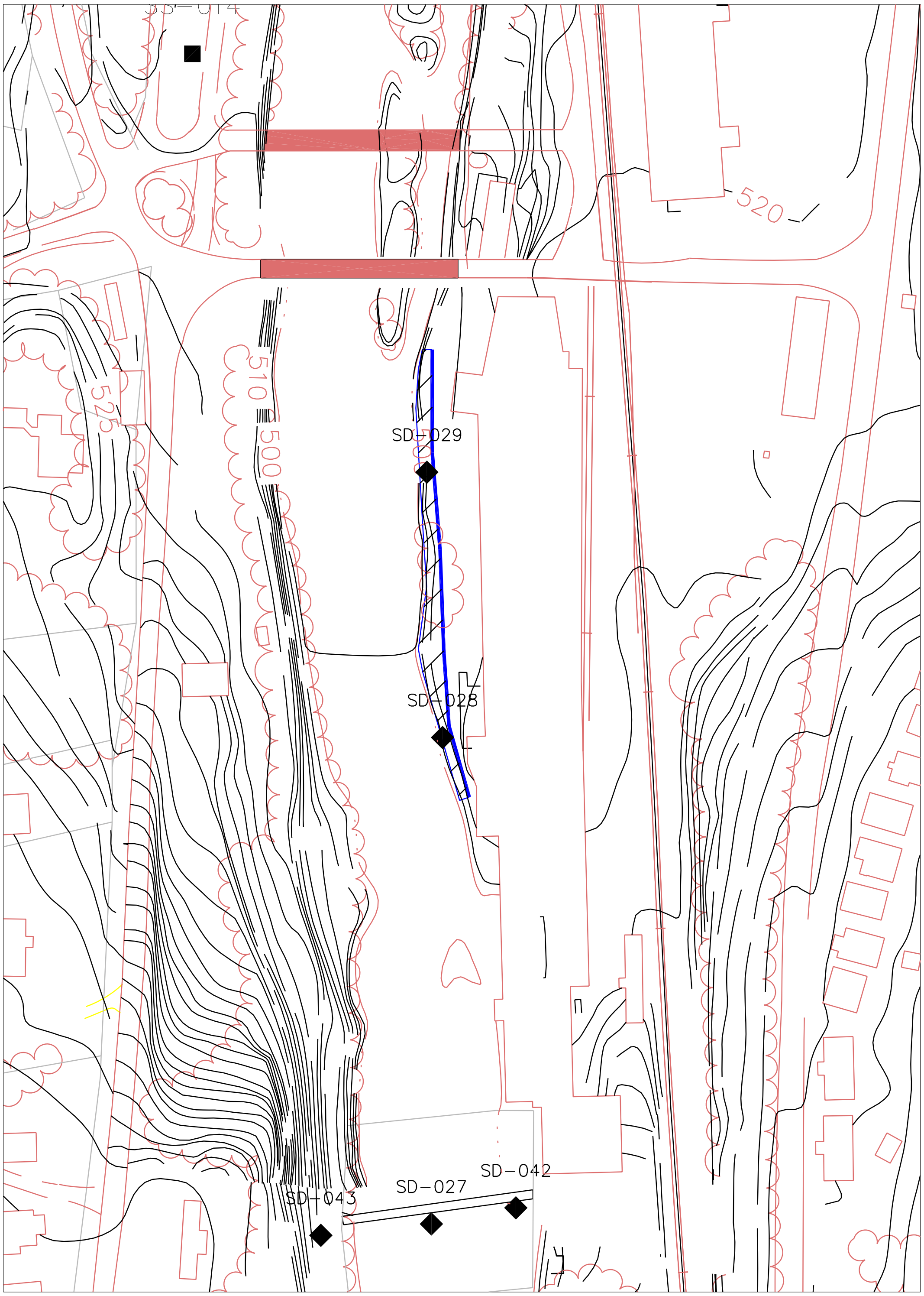

0 40 80 120 160

SCALE IN FEET

LEGEND

SEDIMENT SAMPLE LOCATION

SURFACE WATER SAMPLE LOCATION

SURFACE SOIL SAMPLE LOCATION

WETLAND DELINEATION

TRC

Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

TRC PROJ. NO.: 02136-0220-01N93

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACTOR NO.: 107061

FIGURE 3.3-3
WETLAND EXTENT
FORMER TANNERY
BUILDING AREA
POWNAL TANNERY
POWNAL, VERMONT

M&E Metcalf & Eddy

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Riparian (River) habitat is present along the banks of the Hoosic River and within several small islands located downriver of the dam and slightly upriver from the lagoons. The vegetation along the riverbanks in the vicinity of the lagoons is generally diverse and consists predominately of cottonwood (*Populus deltoides*) and box-elder (*Acer negundo*) in the tree layer with some individuals of silver maple (*Acer saccharinum*) and sycamore (*Platanus occidentalis*) also present. The dominant shrub is silky dogwood (*Cornus amomum*) with tatarian honeysuckle (*Lonicera tatarica*) also present. Herbaceous understory vegetation is comprised predominately of garlic mustard (*Alliaria officinallis*), goldenrod (*Solidago* spp.) and reed canary-grass (*Phalaris arundinacea*). The small islands consist of scrub-shrub vegetation that is comprised predominately of silky dogwood. Vegetation on the opposite bank of the Hoosic River from the lagoons is markedly different. A conifer forest comprised of eastern white pine (*Pinus strobus*) and eastern hemlock (*Tsuga canadensis*) is present on the steep eroding bank.

3.4 Lagoon Area

3.4.1 Geology

TRC identified several additional stratigraphic units underlying the Lagoon Area. General descriptions of these units are provided below.

Surficial Clay (Lagoon Cap): A layer of clay was observed capping the lagoon fill material in Lagoons 1 and 3, at thicknesses of 1 to 4 feet. This material generally consisted of moist, brown to gray clay with some silt, organics, and trace to little amounts of gravel. Lagoons 2 and 4 appeared to have been excavated of cover material and fill, and Lagoon 5 (where the majority of the lagoon was filled with standing water) does not appear to have a clay cap.

Surficial Soil (Lagoon Cover Material): A layer of soil was observed covering various areas of Lagoons 1, 2, 3, and 4. This material generally consisted of brown to gray, very fine to medium sand with small amounts of silt. In Lagoon 3, this material also included some gravel.

Lagoon Sludge: Figure 3.4-1 shows an isopach map of the lagoon sludge observed at the site. TRC documented the presence of Lagoon sludge in Lagoons 1, 3, and 5, as well as in a limited area of Lagoon 4. The thickness of this material varied from location to location, with the thickest deposits being 4 to 9 feet in Lagoon 1, and up to 11 feet in Lagoon 3. Deposits of sludge in Lagoon 5 were less than 4 feet in thickness. The majority of sludge appeared to have been removed from Lagoon 2. Except for the southern end of Lagoon 4 (adjacent to Lagoon 3), there was no sludge in Lagoon 4.

The sludge present in Lagoon 1 generally consisted of moist organic silt including layers of gray clay and varying quantities of hair and hide fragments. The sludge in Lagoon 1 contains layers of various colors (black, blue, white, red, and gray). The upper surface of this deposit was often coated with thin (<1 inch) layers of dry white powder, which may be lime that was added to the sludge to minimize odors.

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The sludge present in Lagoon 3 was generally black to gray in color, not as consistent in thickness as that observed in Lagoon 1, and appeared to include an increased percentage of sand relative to Lagoon 1. This sludge generally consisted of fine organic silt and sand with trace amounts of hair and hide fragments.

The limited amount of sludge observed in the southern portion of Lagoon 4 generally consisted of black organic silt with trace amounts of hair. The thin white layers (presumably lime) were also observed in this area.

The layers of sludge present in Lagoon 5 generally consisted of moist, black to gray organic silt with little quantities of clay and trace amounts of hair.

Gravel Layer: Beneath all of the lagoons, TRC observed a basal layer of gravel under the Fill. This material generally consisted of brown to black, poorly sorted gravel, with little amounts of sand and silt, and appeared to be alluvial in origin (based on rounded gravel pieces). This layer of gravel was black, underlying Lagoons 1, 3, 5 and part of 4, and was brown in the majority of the remaining lagoon areas (the majority of Lagoons 2 and 4). Based on several borings through this layer, the gravel is underlain by either gray to brown, very fine sand and silt, or homogeneous, light gray, cohesive clay.

Figure 3.4-2 shows the locations of five cross sections (Figures 3.4-3, 3.4-4, 3.4-5, 3.4-6 and 3.4-7) that present the subsurface distribution of these layers.

Figure 3.4-3 shows cross section B-B' extending across Lagoons 1 and 2. The cross section shows up to 8 feet of sludge in Lagoon 1, underlain by gravel, and partially covered with soil fill material, and only a thin (1 foot) layer of clay at SBL1-08. The cross section also shows that Lagoon 2 does not contain any sludge, presumably due to the reported excavation of sludge from this lagoon. The underlying Gray Clay unit is over 50 feet thick on this section.

Figure 3.4-4 shows cross section C-C' extending from Lagoon 1 across Lagoon 3. The sludge in Lagoon 1 has more cover on this line of section, but still is up to 8 feet thick. The cover on the sludge in this area is clay. The sludge in Lagoon 3 varies more dramatically in this line of section, from 1 to 11 feet. The covering on the sludge in Lagoon 3 is shown to be partially clay (at the perimeter) and partially soil fill. The Gray Clay unit is at least 70 feet thick.

Figure 3.4-5 shows cross section D-D' that crosses Lagoons 4, 3, and 2. Note that the material in Lagoon 4 is not the sludge unit, but is comprised of 4 to 12 feet of fill. Sludge only appears on this line of section in Lagoon 3, where it is overlain by clay. This line of section confirms the reported excavation of Lagoon 2, depicting only a depression cut into fill, on the underlying gravel layer. Note the steep rise in bedrock elevation to the west, eventually reaching the surface on the western side of the Hoosic River. There are not enough sample locations to determine the exact thickness of the clay layer and where the clay layer ends, but the existence of the clay layer is confirmed at several borings along the eastern side of the river (including SBL4-10 shown on the figure).

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Figure 3.4-6 shows cross section E-E' that extends across the long axis of Lagoon 4. This section also shows the lack of sludge in Lagoon 4 and the presence of over 10 feet of fill material. The Gray Clay unit is shown to thin in the middle of the section to less than 10 feet due to the shallow bedrock in the area.

Figure 3.4-7 shows cross section F-F' crossing Lagoons 1 and 5. Up to 4 feet of uncovered sludge are present in Lagoon 5. Based on field observations, Lagoon 5 appears to contain water throughout the entire year. The sludge in Lagoon 1 is shown to extend in thickness up to 9 feet and is overlain by 1 to 4 feet of clay. The Gray Clay unit is over 50 feet thick.

Figure 3.4-8 shows the bedrock elevations in the Lagoon Area.

3.4.2 Hydrogeology

TRC identified six hydrostratigraphic layers at the Lagoon Area.

Upper Fill and Soil Layers: Most of the site is overlain by an unconfined aquifer comprised of heterogeneous fill and soil.

Sludge: In the lagoon area, there are thin (<10 feet) lenses of a fine grain sludge that may act as a discontinuous, semi-confining or leaky confining layer.

Gravel: Near the river, especially in the lagoon area, there is a layer of gravel, approximately 10-15 feet thick, lying below the sludge and fill. This aquifer may be partially confined when it lies beneath the sludge.

Gray Clay: The thick clay layer separating the upper unconfined layers from the bedrock below, is a major confining layer.

Lower Sand: A thin (<15 feet), discontinuous sand layer is present beneath the Gray Clay at the landfill and at the lagoons. This layer acts as a confined aquifer and is probably well connected with the underlying bedrock aquifer since the bedrock is highly fractured and there is no hydraulic barrier between the two units.

Bedrock: The highly fractured bedrock is a confined aquifer throughout most of the site, except in areas where the bedrock is very shallow and the clay is not present (i.e. near the former building area).

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Table 3.4-1 presents a summary of the hydraulic conductivities computed from the rising head slug tests conducted in each well. The hydraulic conductivity in the overburden wells ranges from 1.5 x 10^{-3} cm/s to 1.8 x 10^{-2} cm/s. The geometric mean hydraulic conductivity for the overburden wells in the Lagoon Area is 5.3 x 10^{-3} cm/s.

The hydraulic conductivity measured in bedrock ground water monitoring well MW-107R is 4.3 x 10^{-5} cm/s.

Table 3.4-1: Hydraulic Conductivities, Lagoon Area					
Overburden Wells					
Well	***Formation***	***Hydraulic Conductivity***			
MW-104U	Upper sand	3.5E-02	ft/min	1.8E-02	cm/s
MW-107U	Upper sand and gravel	1.1E-02	ft/min	5.4E-03	cm/s
MW-109U	Upper silty sand and gravel	2.9E-03	ft/min	1.5E-03	cm/s
Geometric Mean =		1.0E-02	ft/min	5.3E-03	cm/s
Bedrock Wells					
Well	***Formation***	***Hydraulic Conductivity***			
MW-107R	Bedrock	8.3E-05	ft/min	4.3E-05	cm/s

Appendix D presents hydrographs for all of the ground water monitoring wells, piezometers, and staff gauges.

The vertical hydraulic gradient computed at location MW-107 is 0.13 upward.

Ground water flow in the Lagoon Area is radially away from Lagoon 2, directed toward the Hoosic River.

3.4.3 Ecology

Figure 3.4-13 shows the six wetland areas that were identified at the Lagoon Area.

- Lagoon 1 Wetland (Palustrine Emergent), *Class Two*
- Lagoon 2 Wetland (Palustrine Emergent/ Palustrine Scrub-Shrub), *Class Two*
- Lagoon 4 Wetland (Palustrine Emergent/Palustrine Scrub Shrub), *Class Two*
- Lagoon 5 Wetland (Palustrine Emergent/Open Water), *Class Two*
- Hoosic River Fringe Wetlands (Palustrine Forested/Scrub-Shrub/Emergent), *Class Three*
- Hoosic River Floodplain Wetlands (Palustrine Emergent/Forested/Open Water), *Class Two*

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TRC observed the following wetland functions at the Lagoon Area Wetlands.

- Water Storage for Flood Water and Storm Runoff
- Wildlife and Migratory Bird Habitat

TRC observed the following functions at the Hoosic River Floodplain wetland.

- Water Storage for Flood Water and Storm Runoff;
- Fisheries Habitat
- Wildlife and Migratory Bird Habitat

Habitats identified within the lagoon area include three wetland communities: palustrine unconsolidated bottom (shallow marsh), palustrine emergent persistent (wet meadow), and palustrine scrub-shrub. An upland community comprised of scrub-shrub vegetation interspersed with stands of deciduous saplings and herbaceous vegetation is also present within this area. The locations of these habitat cover types are depicted in Figure 3.4-13. The entire lagoon area is located within the 100-year floodplain of the Hoosic River (FEMA, 1980). Brief descriptions of each cover type present within the lagoon area are provided below.

The shallow marsh community is located primarily within Lagoon 5 although several small areas of standing water are also present within Lagoons 2 and 4. This cover type generally consists of an area of open water (approximately one to two feet in depth) surrounded by a band of emergent wetland vegetation comprised primarily of reed canary-grass (Lagoons 4 and 5) or co-dominated by purple loosestrife (*Lythrum salicaria*) and reed canary-grass (Lagoon 2). Other vegetation noted within these areas includes broad-leaved cat-tail (*Typha latifolia*), bebb willow (*Salix bebbiana*) and common reed (*Phragmites australis*).

The emergent wet meadow community is present within Lagoon 1 and is comprised primarily of common reed with broad-leaved cat-tail and reed canary-grass also present. Standing water is present for a shorter duration within this cover type than within the shallow marsh communities present within the lagoons.

A scrub-shrub wetland area occupies much of Lagoon 4. Small box-elder, bebb willow, and cottonwood trees are present with a dense shrub stratum comprised primarily of multiflora rose (*Rosa multiflora*), tatarian honeysuckle, and staghorn sumac (*Rhus typhina*). Herbaceous vegetation is dominated by common reed, reed canary-grass and Canada goldenrod (*Solidago canadensis*). Other less common herbaceous species noted within this wetland include blue vervain (*Verbena hastata*), garlic mustard and wild madder (*Gallium mollugo*). Although plant species typical of upland areas are common within this cover type, the majority of the vegetation was comprised of hydrophytic species. Hydric soils associated with wetlands due to prolonged saturation were noted within this habitat, however, standing water is typically not present.

Uplands within the lagoon area and on the roadways located between the lagoons are generally representative of an early successional plant community ("old field" habitat). This cover type is found within portions of Lagoons 1, 2, 3 and 4. Vegetation consists of cottonwood, box-elder and aspen (*Populus tremuloides*) saplings, multiflora rose, tatarian honeysuckle and staghorn sumac in the shrub stratum and a herbaceous layer comprised of Canada goldenrod, garlic mustard, wild madder, common tansy (*Taracetum vulgare*), ragweed (*Ambrosia artemisiifolia*), Queen Anne's lace (*Dauca carota*), and gill-over-the-ground (*Glechoma hederacea*).

3.5 Landfill Area

3.5.1 Geology

Figure 3.5-1 shows the bedrock elevation in the Landfill Area as determined from the three borings advanced to bedrock, and interpolated from surface bedrock exposures located on the eastern bank of the Hoosic River. The bedrock surface slopes steeply down to the west, dropping over 100 feet from the surface exposures to the depth under the landfill.

Figure 3.5-1 also shows the location of a cross section, G-G' depicting the subsurface geology at the site.

Figure 3.5-2 shows cross section G-G' across the Landfill. This section shows the surface elevation of the landfill after capping as part of the NTCRA. The figure shows the thick Gray Clay unit on bedrock, which rises sharply to the east (right side of figure). The extent of the waste mass in the Landfill is estimated, since no borings were advanced through the fill material.

3.5.2 Hydrogeology

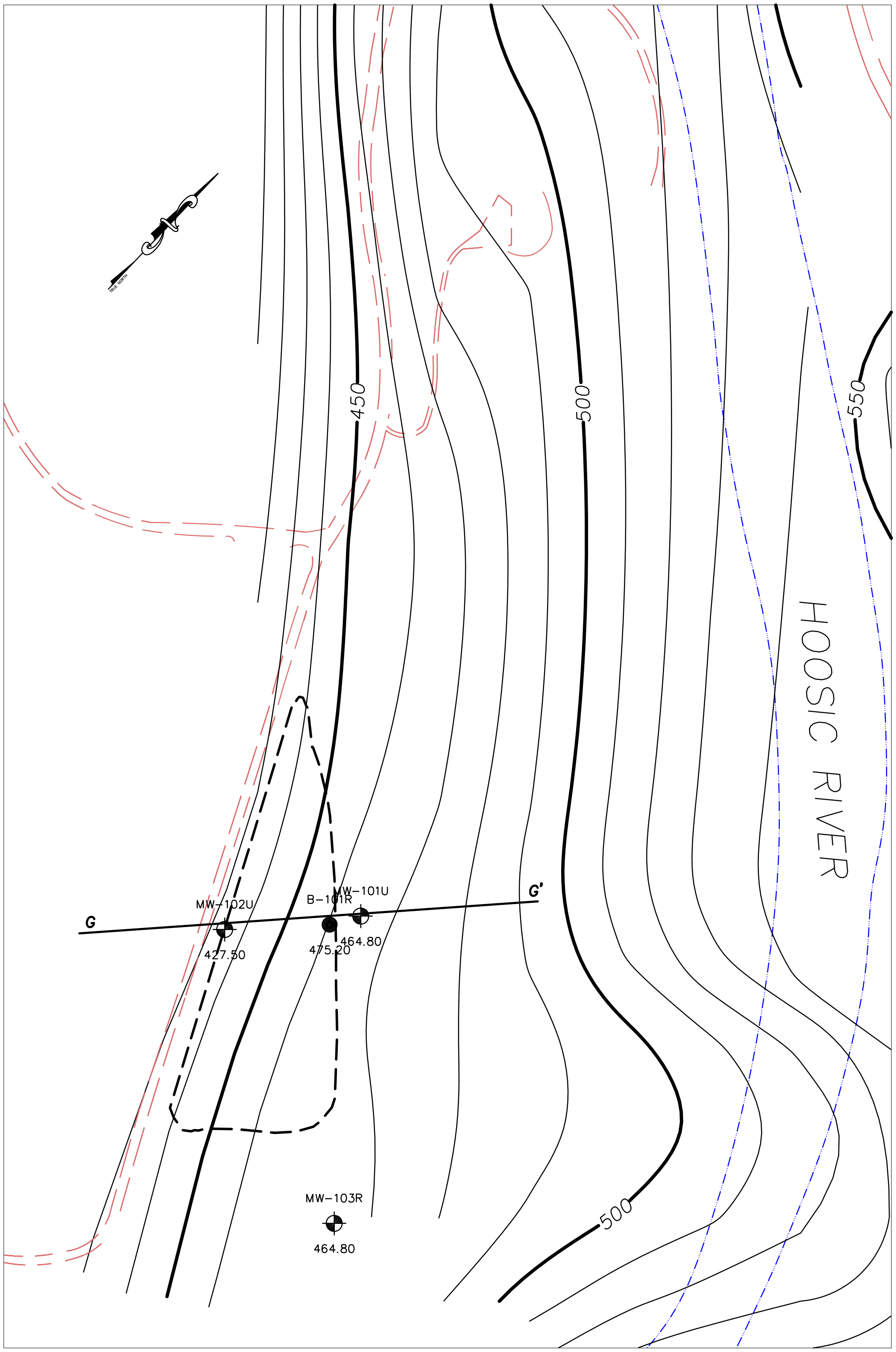
Table 3.5-1 presents a summary of the hydraulic conductivities computed from the rising head slug tests conducted in each well. The geometric mean hydraulic conductivity for the overburden wells in the Landfill Area is 3.6 x 10^{-4} cm/s.

The geometric mean hydraulic conductivity of the bedrock is 2.6 x 10^{-3} cm/s.

Table 3.5-1: Hydraulic Conductivities, Landfill Area

Overburden Wells					
Well	***Formation***	***Hydraulic Conductivity***			
MW-101U	Upper silty sand	1.5E-04	ft/min	7.7E-05	cm/s
MW-102U	Upper sand	8.8E-04	ft/min	4.5E-04	cm/s
MW-103U	Upper sand	2.5E-03	ft/min	1.3E-03	cm/s
Geometric Mean =		6.9E-04	ft/min	3.6E-04	cm/s
Bedrock Wells					
Well	***Formation***	***Hydraulic Conductivity***			
MW-103R	Bedrock	5.1E-03	ft/min	2.6E-03	cm/s
Geometric Mean =		5.1E-03	ft/min	2.6E-03	cm/s

Appendix D presents hydrographs for all of the ground water monitoring wells, piezometers, and staff gauges.



LEGEND

2" MONITORING WELL WITH BEDROCK ELEVATION

LANDFILL OUTLINE

500 BEDROCK ELEVATION CONTOUR INTERVAL (FEET)

TRC
Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

TRC PROJ. NO.: 02136-0220-01N93

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACTOR NO.: 107061

FIGURE 3.5-1
BEDROCK ELEVATION MAP
LANDFILL AREA
POWNAL TANNERY
POWNAL, VERMONT

M&E Metcalf & Eddy

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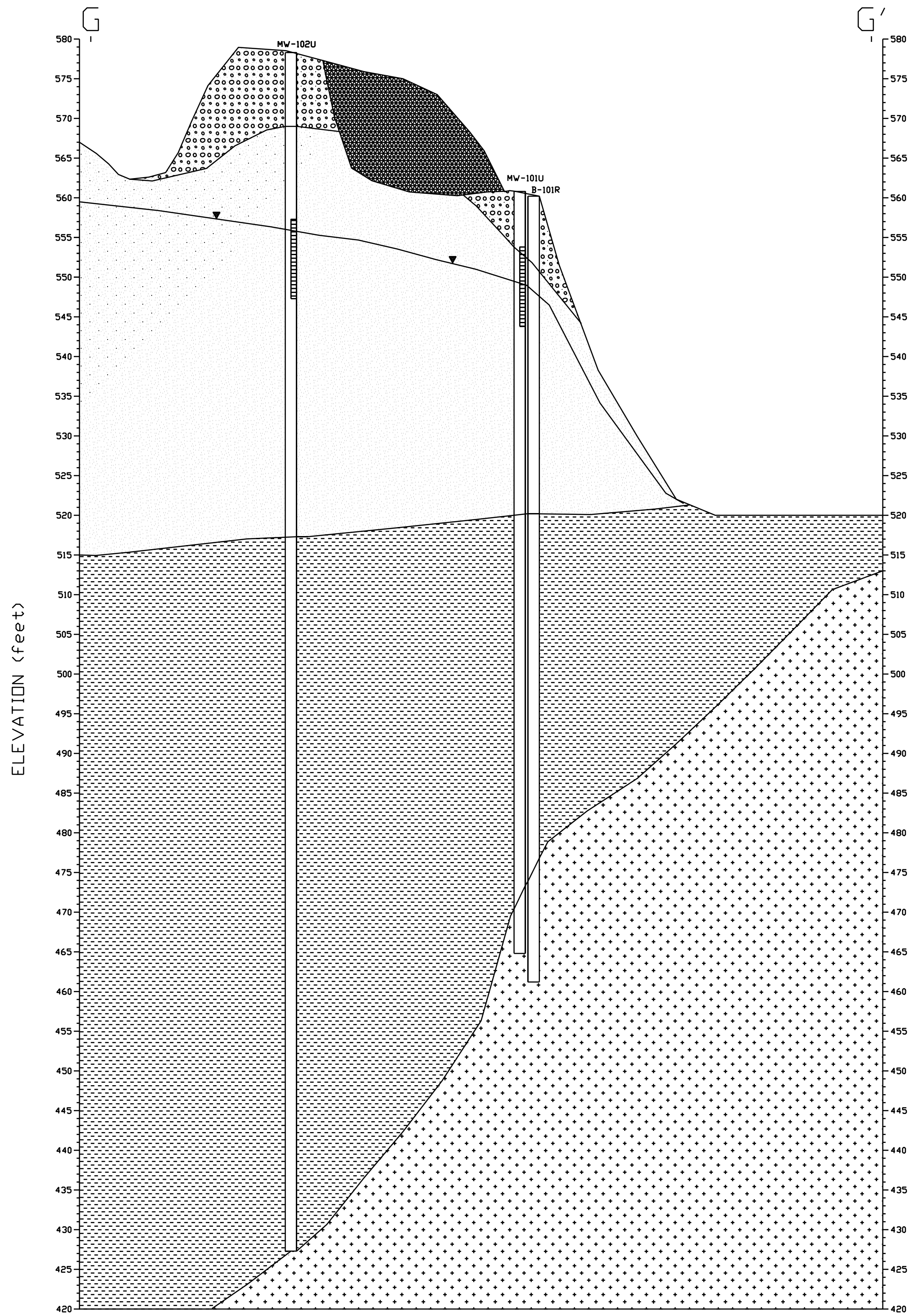

0 50 100
FEET

LEGEND

LANDFILL WASTE
CLAY
SANDY, SILTY, GRAVEL
BEDROCK
SILTY SAND
WATER TABLE (7/7/2000)

TRC
Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

TRC PROJ. NO.: 02136-0220-01N93
EPA CONTRACT NO.: 68-W6-0042
RAC SUBCONTRACTOR NO.: 107061

FIGURE 3.5-2
CROSS SECTION
G-G'
LANDFILL
POWNAL TANNERY
POWNAL, VERMONT

M&E Metcalf & Eddy

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The vertical hydraulic gradient computed at location MW-103 is 0.29 upward.

3.5.3 Ecology

Figure 3.5-3 shows the extent of wetlands in the Landfill Area. Three wetland areas were identified at the Landfill Area.

- Former Landfill Wetland, *Class Three*
- Hoosic River Fringe Wetlands (Palustrine Forested/Scrub-Shrub/Emergent), *Class Three*
- Hoosic River Floodplain Wetlands (Palustrine Emergent/Forested/Open Water), *Class Two*

Note that the Former Landfill Wetland Area was destroyed during construction of the landfill cap. However, an assessment of this wetland area was performed by Metcalf & Eddy (1997), and TRC utilized the information in that report to locate and classify this former wetland area.

TRC observed the following functions at the Hoosic River Floodplain wetland.

- Water Storage for Flood Water and Storm Runoff
- Fisheries Habitat
- Wildlife and Migratory Bird Habitat
- Recreational Value and Economic Benefits
- Open Space and Aesthetics

Habitats of concern present in the vicinity of the landfill include stream (Halifax Hollow), palustrine unconsolidated bottom (pond), palustrine emergent wetland (wet meadow), and palustrine forested wetland (seepage areas). The pond and wet meadow communities are present within the 100-year floodplain of the Hoosic River. Brief descriptions of these communities are described below.

Halifax Hollow is a small perennial stream located south and adjacent to the landfill. This stream is a tributary to the Hoosic River slightly upriver from where the landfill is situated along the Hoosic River. The watershed to Halifax Hollow consists of forested slopes associated with the Taconic Mountains to the west of the landfill. The stream channel is approximately six to eight feet wide and very well defined adjacent to and upgradient of the landfill with one to two foot vertical banks present. Downgradient of the landfill, the stream contains many braids though a broad forested wetland with little topographical relief. Only some of the braids contain flowing water. It appears that the formation of the braids is in response to severe precipitation events where surface water flows overtop the stream banks creating new channels through the forested wetland. The substrate within both the braided and the well-defined channel portions of the stream consists predominately of cobbles, gravel and sand. Surface water depths noted by TRC during Spring 2000 ranged from approximately two to six inches. No seepage areas originating from the landfill and discharging to Halifax Hollow were observed during the Remedial Investigation.

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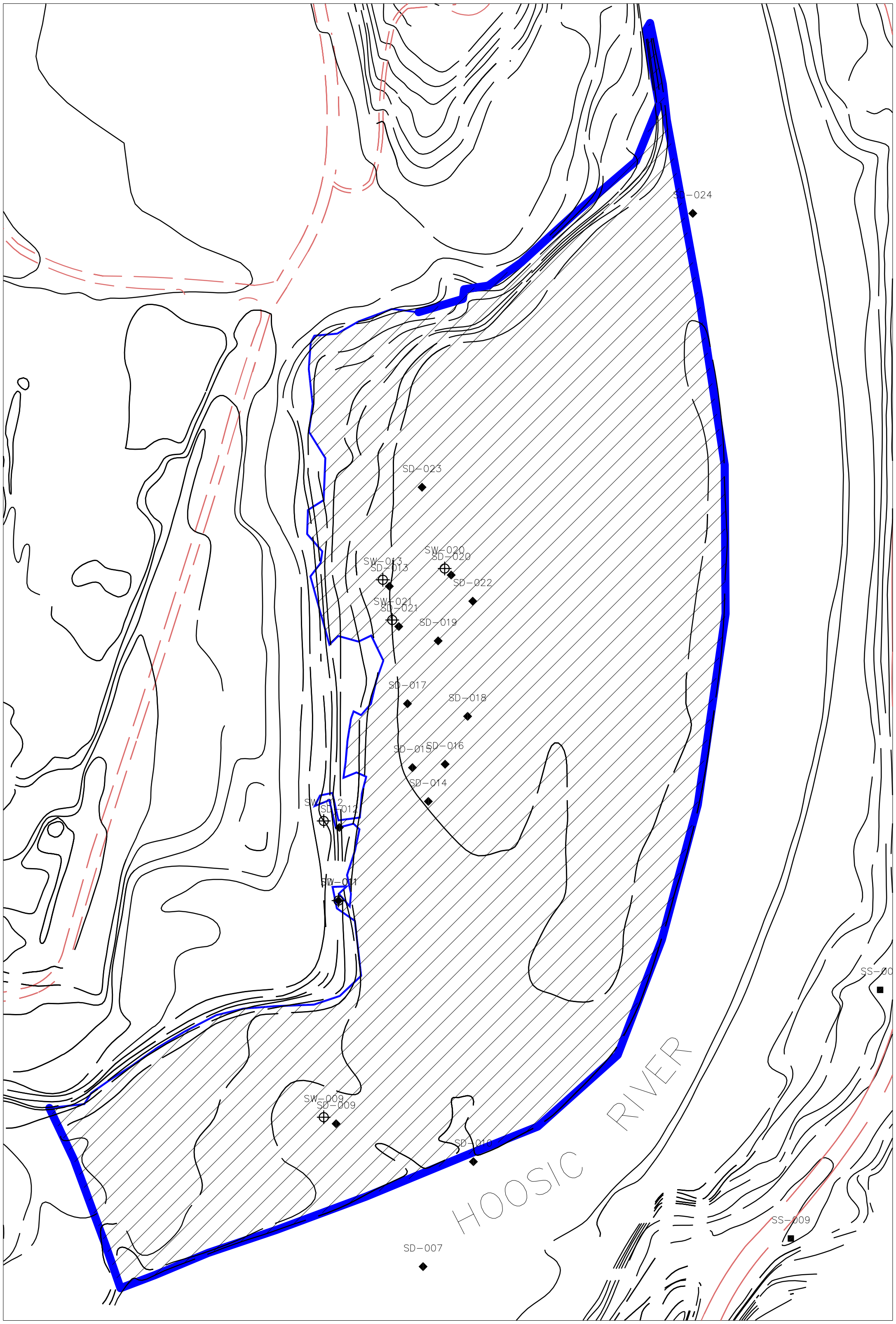

0 40 80 120 160

SCALE IN FEET

LEGEND

SEDIMENT SAMPLE LOCATION

SURFACE WATER SAMPLE LOCATION

SURFACE SOIL SAMPLE LOCATION

WETLAND DELINEATION

TRC

Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

TRC PROJ. NO.: 02136-0220-01N93

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACTOR NO.: 107061

FIGURE 3.5-3
WETLAND EXTENT
LANDFILL AREA

POWNAL TANNERY
POWNAL, VERMONT

M&E Metcalf & Eddy

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The palustrine unconsolidated bottom (pond) wetland community is present to the northeast and near the base of the landfill slope. This pond may represent an oxbow pond in that a former meander bend of the Hoosic River became separated from the main channel and partially filled in with sediment forming a pond. The pond is connected to the Hoosic River via a narrow outlet at the northeast end of the pond. Vegetation within the pond is sparse and consists of wool-grass (*Scirpus cyperinus*), broad-leaved cat-tail, and sedges (*Carex* spp.) growing primarily along the periphery of the pond. Significant areas of exposed and unvegetated mudflat are also present within portions of the pond. Sources of water to the pond include several seeps located along the steep slope downgradient of the landfill as well as from direct precipitation and flooding events from the nearby Hoosic River. Surface water depths within the pond are shallow (generally less than three feet in depth) with a soft substrate comprised primarily of fine material (silt, clay and organic matter). The average total organic carbon content of the sediment is nearly five percent. In Spring 2000, iron-stained leachate was noted by TRC to be present within the southern portion of the pond. It is not known whether this leachate is from the landfill or some other source.

The wet meadow community is located immediately adjacent to and south of the pond. This floodplain wetland is dominated by reed canary-grass with sedges, sensitive fern (*Onoclea sensibilis*), and wool-grass also present. The substrate of the wet meadow generally consists of fine silt, clay and organic matter. Hummocks of vegetation are interspersed with narrow rivulets where surface water flows are occasionally present. The surface water flows discharge into the adjacent pond. In Spring 2000, TRC observed iron flocs and sheens within several of these rivulets. In addition, a small dead sunfish was also noted by TRC within one of the rivulets.

The forested wetland is present along the northeast slope located below the landfill and is associated with several seepage areas that originate along the slope. The seeps are weakly defined with small channels. Surface water depths were approximately three inches with a slight perceptible flow. The seepage areas discharge both to the downgradient pond and wet meadow. Vegetation within the adjacent forested wetlands consists predominately of red maple (*Acer rubrum*) with some yellow birch (*Betula alleghanensis*) and cottonwood also present in the tree layer. Numerous tree throws were noted within this habitat indicating shallow rooting by the overstory trees. Speckled alder (*Alnus rugosa*) is the predominate species present in the shrub stratum with scattered tatarian honeysuckle, multiflora rose, and silky dogwood also present. The ground layer of vegetation contains primarily sedges, sensitive fern, and sphagnum moss (*Sphagnum* sp.) with water hemlock (*Cicuta maculata*), garlic mustard and goldenrod also present. The substrate within the seepage areas consisted primarily of fine silt, clay and organic matter.

The pond, wet meadow and forested seepage areas are each expected to provide suitable habitat for a variety of aquatic, semi-aquatic and terrestrial wildlife. The pond is expected to provide suitable habitat for aquatic species including various amphibians and reptiles such as the green frog, bullfrog, painted turtle and common snapping turtle. Most of these species forage, breed and hibernate within the pond itself, however, turtles generally deposit eggs in nearby upland areas. These species would be expected to forage primarily on the various macroinvertebrates present within the pond. Some of these species may also utilize the adjacent wet meadow habitat. Snakes such as the northern water snake and eastern ribbon snake are likely to forage both within the pond and wet meadow habitats. The forested seeps are likely to provide suitable habitat for species that prefer small and shallow areas of flowing water such as the northern two-lined and northern dusky salamanders and pickerel frogs. Several snakes including the northern redbelly snake and eastern garter snake may also forage along the margins of the seeps.

Birds noted or likely to use the pond itself as a foraging area include primarily aquatic species such as waterfowl, wading birds and shorebirds. These species may be attracted by the presence of vegetation and macroinvertebrates inhabiting the soft substrate of the pond. Shorebirds such as the spotted sandpiper prefer exposed mudflats or areas of shallow water that often contain abundant macroinvertebrates. The small fish likely to inhabit the pond may also provide food for wading birds such as green-backed herons and piscivorous species such as the belted kingfisher. Aerial screeners such as various swallows and bats are likely to forage on emerging insects above the pond. Other mammals such as the herbivorous muskrat and piscivorous mink and river otter may also occasionally forage within the pond on fish, amphibians and larger macroinvertebrates such as crayfish that inhabit the pond.

The wet meadow is expected to provide suitable habitat for a variety of avian species that may forage on invertebrates and/or seeds such as various sparrows, finches, brown-headed cowbird, and American woodcock. Similar to the pond, a variety of swallows and bats are likely to forage on insects above the wet meadow. Small mammals including herbivores (e.g., meadow vole), omnivores (e.g., white-footed mice and meadow jumping mice), and insectivores (e.g., short-tailed and masked shrews) are likely to inhabit the wet meadow throughout the year except during flooding events. Larger herbivorous mammals such as white-tailed deer and muskrat and omnivorous species such as the Virginia opossum and raccoon are also likely to forage on the vegetation or the invertebrates and amphibians present within the wet meadow. Predators such as red fox and several raptor species such as the northern harrier are also likely to prey on small mammals inhabiting the meadow.

The forested seepage area contains greater vertical structural habitat diversity than the wet meadow cover type. This increase in habitat structure is likely to provide additional foraging and/or nesting habitat for birds and mammals. For example, shrub nesters such as northern cardinal, chestnut-sided warbler, and gray catbird are likely to nest and forage within this cover type. The early-growth tree layer is also expected to provide additional foraging/nesting habitat for species such as downy woodpecker, black-capped chickadee, thrushes and flycatchers. Ground nesters and/or feeders such as the American woodcock are also expected to be present within this habitat. A variety of small mammal species including herbivores, omnivores, and insectivores are anticipated to inhabit the forested seep area as are larger predators such as mustelids, coyote, and gray fox.

3.6 Warehouse Area

3.6.1 Geology

The only subsurface exploration in this area was limited to a shallow borings advanced under the warehouse building and the adjacent parking area. Based on these borings, the area is underlain by a surficial layer of brown sand and gravel that may be over ten feet thick. In some locations under the warehouse building (SBW-7, SBW-8, SBW-9, SBW-10, SBW-11, SBW-12) there is a layer of coal between one and eight feet thick.

3.6.2 Hydrogeology

No ground water monitoring wells were installed in the Warehouse Area to measure the ground water flow direction, but given the proximity to the Hoosic River, it is likely that ground water flow is directed to the west.

3.7 Woods Road Waste Disposal Area

3.7.1 Geology

There are four stratigraphic layers present in this area: the Fill, Silty Sand, Gray Clay and Bedrock. The Fill layer in this area was particularly well characterized due to the numerous test pits that were excavated and since the USACE removed approximately 2,500 cubic yards. The fill in this area consisted of soil, ash, leather scraps, demolition debris, piping and wire, as well as some black petroleum stained layers.

3.7.2 Hydrogeology

Table 3.7-1 presents a summary of the hydraulic conductivities computed from the rising head slug tests conducted in each well. The hydraulic conductivity in the overburden wells ranges from 1.3 x 10^{-3} cm/s to 2.0 x 10^{-2} cm/s. The geometric mean hydraulic conductivity for all of the overburden wells is 5.1 x 10^{-3} cm/s.

Table 3.7-1: Hydraulic Conductivities, Woods Road Waste Disposal Area

Overburden Wells					
Well	***Formation***	***Hydraulic Conductivity***			
MW-106U	Upper sand and gravel	3.9E-02	ft/min	2.0E-02	cm/s
MW-112U	Upper sand and gravel	2.5E-03	ft/min	1.3E-03	cm/s
Geometric Mean =		9.9E-03	ft/min	5.1E-03	cm/s

Appendix D presents hydrographs for all of the ground water monitoring wells, piezometers, and staff gauges.

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0 10 20 30 40 50

SCALE IN FEET

LEGEND

TP-01 TEST PIT

5 WASTE THICKNESS CONTOUR (FEET)

TRC

Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

TRC PROJ. NO.: 02136-0220-01N93

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACTOR NO.: 107061

FIGURE 3.7-1

WASTE THICKNESS MAP

WASTE DISPOSAL AREA

POWNAL TANNERY
POWNAL, VERMONT

M&E Metcalf & Eddy

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