Surficial Geology Map & Recharge Potential of the North Bennington Through Old Landfill Region

David J DeSimone, PhD
DeSimone Geoscience Investigations
Petersburg, NY 12138

hawkeye272david@yahoo.com

Vermont Geological Survey open file report VG2017-1
Vermont Agency of Natural Resources Contract #32310

submitted 26 December 2016
Goals

> Complete 1:12,000 surficial geologic mapping of designated area largely within Bennington quad but edging into Hoosick Falls, Pownal and North Pownal quads.

> Interpret the Late Pleistocene through Holocene landscape evolution.

> Analyze ChemFab borings and work with Jon Kim, Emmet Norris & Peter Ryan to construct a fence diagram of that contaminated site.

> Use well logs to construct cross sections in the Old Landfill area & through any other places of interest.

> Generate aquifer recharge potential maps of the ChemFab & Old Landfill areas to aid in understanding downward movement of PFOA through overburden.
Basic Map Elements

Flood plain = apple green
Alluvial fans = olive green
Fluvial terraces = mint green
Lake clay-silt = blue
Outwash = yellow
Ice contact sediments = shades of red-brown-pink
Till = grays
Bedrock = darkest gray

*See the map on poster*
Landscape Elements & Pleistocene History

> Pre-glacial landscape with probable trellis-rectangular drainage network

> Walloomsac Valley cuts across lithologies/structures = antecedent

> Deep pre-glacial Furnace Brook valley at foot of Green Mountains with thick overburden

> Prominent ice contact sediments in Furnace Brook valley

> Hale Mountain ridge constrained retreating ice northwest of Old Landfill

> Shaftsbury ice margin records lowering of Lake Bascom & retreat from it left local lakes (Small & DeSimone, 1993; Libbey & Pierson, 1994)
Paran Creek Detail

- Scoured valley walls, till with outcrop
- Remnant 700ft outwash
- Valley floor terraces & flood plain alluvium
- No residual lake clay-silt

Landscape Evolution

- Ice margin to north in Shaftsbury
- Lake Bascom drops from 900ft to lower levels including 700ft with outwash
- Drainage of Lake Bascom causes valley floor erosion
- Minor glacial lakes to the north drain and scour channel. (Lake Flat Top of Libbey & Pierson, 1994; Lake Emmons of Small & DeSimone, 1993)

Stratigraphy ? ...
Thin alluvium over bedrock in Paran Creek...Unit 3.

**F** Artificial Fill- 4-10ft thick; Variable composition with coal, ash, brick, concrete & angular rock fragments

**Unit 3** Flood plain alluvium; 9-15ft thick but tapers westward to 0-5ft thick in Paran Creek; Fining upwards sequence with well preserved A & B horizons in core 7; basal poorly sorted cobble to pebble gravel & silt fines upward through medium & fine sand to fine sand & silt.

**Unit 2** Walloomsac middle alluvium; 5.5ft thick; cobble to pebble gravel fining upwards to coarse & medium sand; well sorted & bedding preserved; confined to Walloomsac bedrock channel.

**Unit 1** Walloomsac basal alluvium; basal cobble to pebble gravel with silt & small wood fragment; fines upward through medium sand to fine sand & silt; disseminated organic matter throughout.

**Bedrock** Whitish-weathering, gray crystalline dolomitic limestone of the Shelburne Formation
Walloomac Valley section also reveals 2 sandy terrace sequences that may correlate to Units 1 & 2 in the ChemFab fence diagram.
Aquifer Recharge Potential does not inhibit downward flow of contaminants to bedrock aquifer.

Areas of highest recharge potential are located in the Paran Creek alluvium. This area is characterized by predominantly fluvial sediment that may have lenses and interbeds of low permeability till that are typically not laterally extensive. Outwash is a highly permeable fluvial deposit of gravel and sand with little or no impermeable sediment. Adjacent kame deposits may have permeable and impermeable interbedded sediments.

Areas of intermediate recharge potential are characterized by kame terraces and alluvium. The kame areas are typically laterally extensive with cobbles and boulders of sand and gravel. The outermost edges of kame terraces are typically laterally extensive with cobbles and boulders of sand and gravel. These areas may have permeable deposits.

Areas of thin till overlying bedrock. The upper meter or so of the till is typically weathered to a more permeable texture than the underlying till. Weathered till should allow water infiltration to bedrock more easily than unweathered till. The presence of soil formation occurring above the upper meter or so of the till indicates that weathering of the till has occurred. The permeability of the soil is also related to weathering.
Old Landfill Detail

> Ice margin on NW side of ridge
> Stagnant ice to lee of ridge
> Typical landfill from half a century ago
Two Cross Sections

> North & south of Old Landfill
> Thick sand & gravel
> Easy infiltration of PFOA into the subsurface
> Probable valuable overburden aquifer
Conclusions

> Role of the surficial/Quaternary geologist in these investigations - geomorphology matters

* Interpret landscape evolution
* Interpret overburden stratigraphy
* 3-D distribution of sediments and their textures must fit the interpretation of landscape development
* Generate aquifer recharge maps for infiltration to either/both overburden and bedrock aquifers
* Identify possible pathways of waste migration
* Wind deposition of airborne contaminants & pattern of contaminated wells may be better understood if permeability of overburden is evaluated

> Synergy of having both surficial and bedrock expertise involved is invaluable

* We help each other…bounce ideas…even off the wall ones
* Modelers of bedrock aquifer flow must consider recharge through overburden