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

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Goals

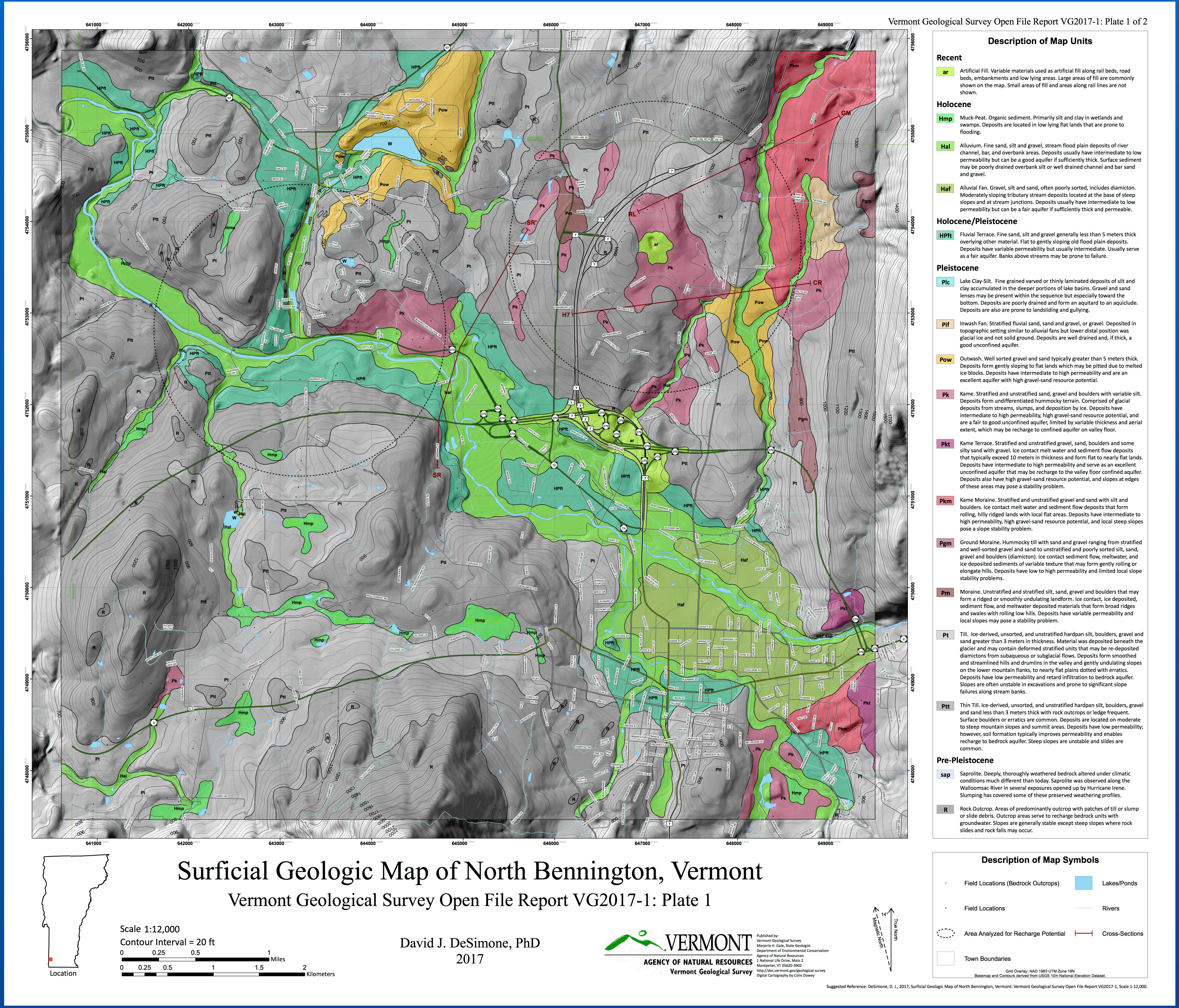
> Complete 1:12,000 surficial geologic mapping of designated area largely within Bennington quad but edging into Hoosick Falls, Pownal and North Pownal quads.

> 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

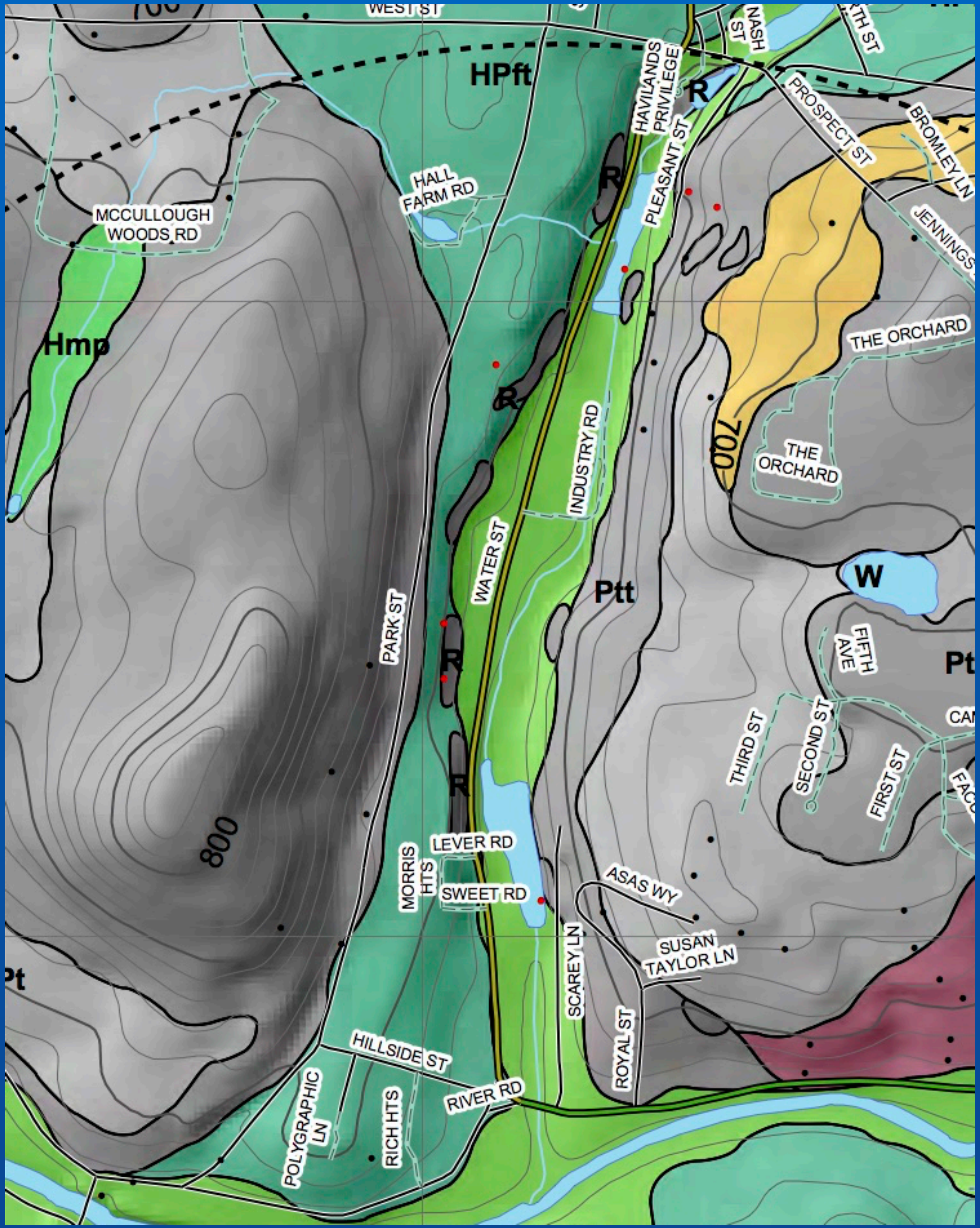
> Walloomsac Valley cuts across lithologies/structures = antecedent

> 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)



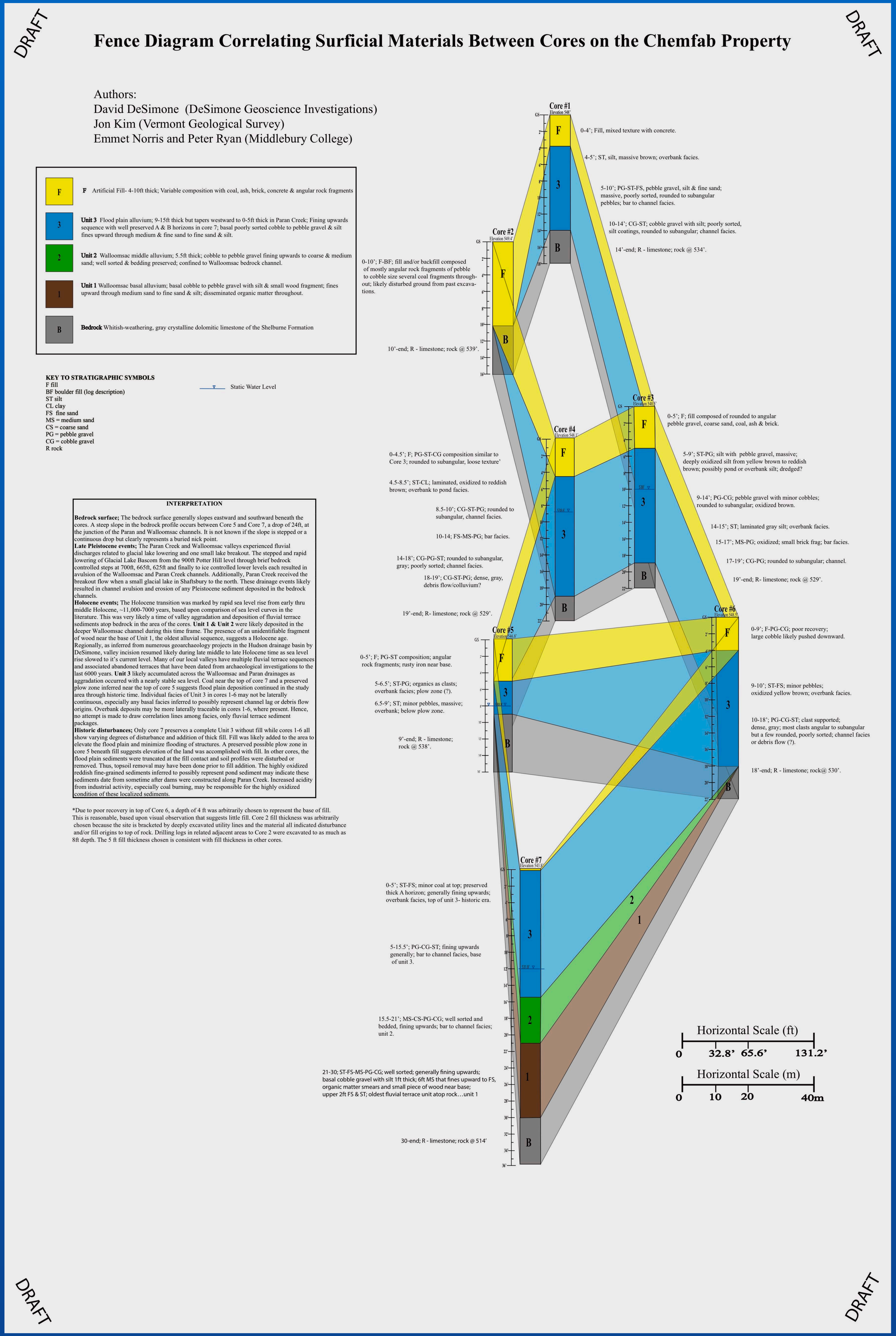
Paran Creek Detail

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

Landscape Evolution

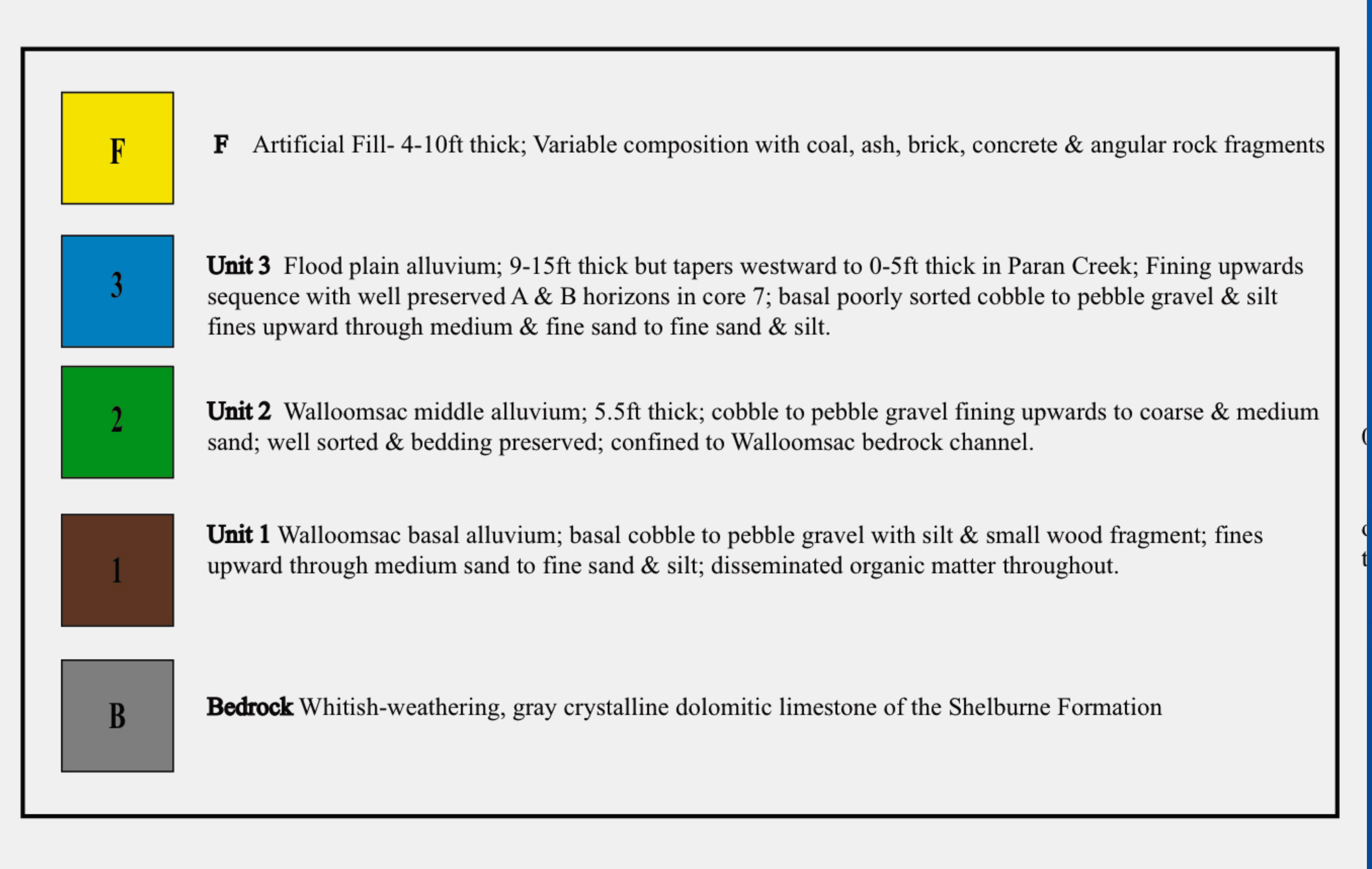
> Ice margin to north in Shaftsbury
> Lake Bascom drops from 900ft to lower levels including 700ft with outwash
> Drainage of Lake Bascom causes valley floor erosion
> Minor glacial lakes to the north drain and scour channel. (Lake Flat Top of Libbey & Pierson, 1994; Lake Emmons of Small & DeSimone,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

Stratigraphy ? …

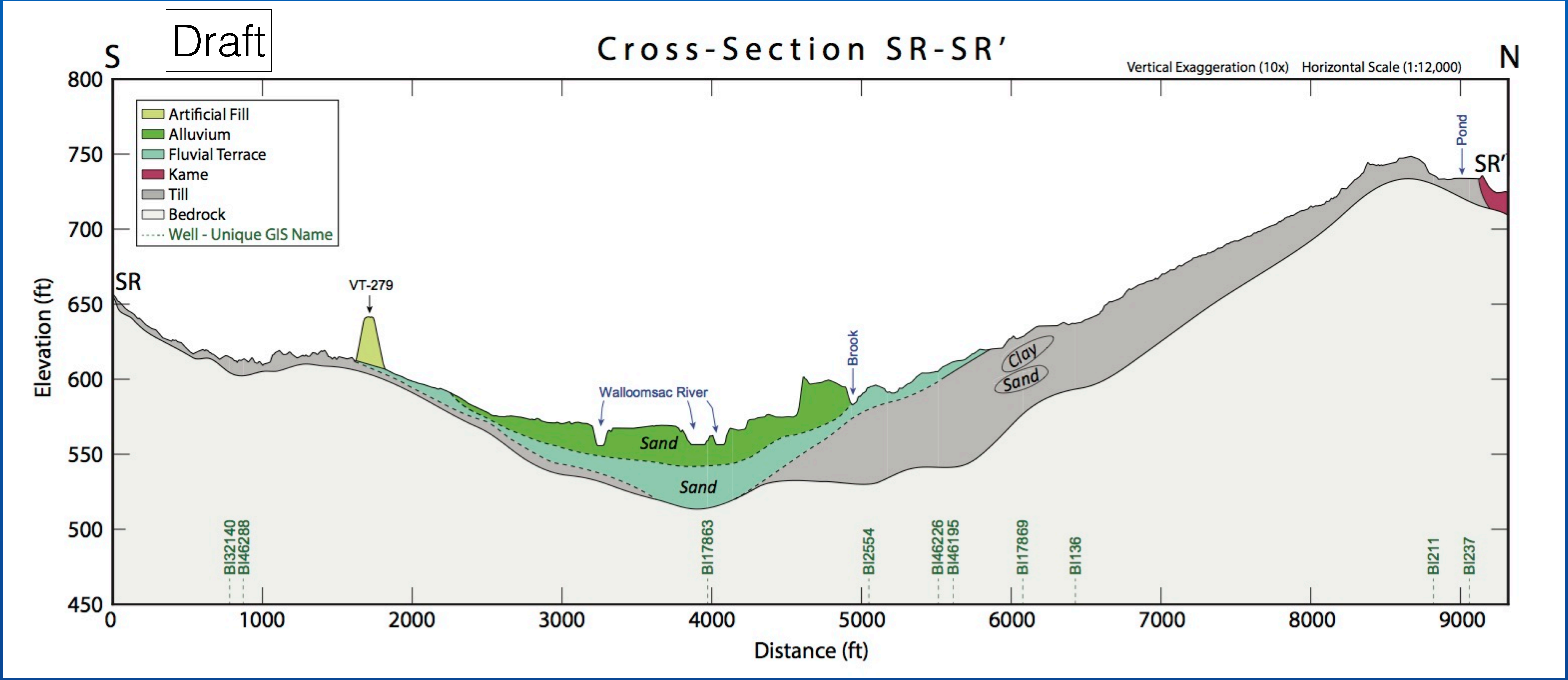


ChemFab Fence Diagram

> Thin alluvium over bedrock in Paran Creek…Unit 3.

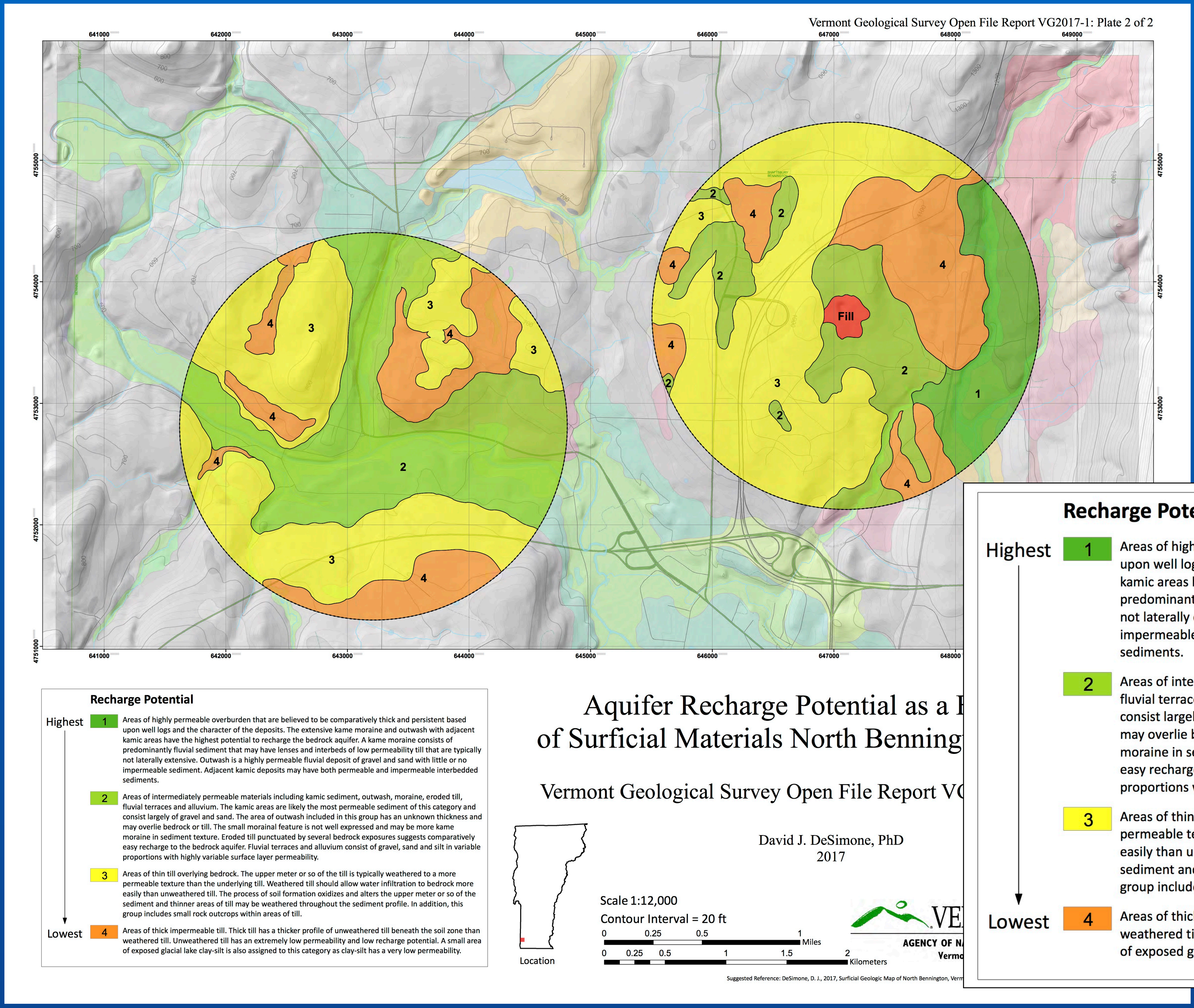


Walloomsac Valley section also reveals 2 sandy terrace sequences that may correlate to Units 1 & 2 in the ChemFab fence diagram.



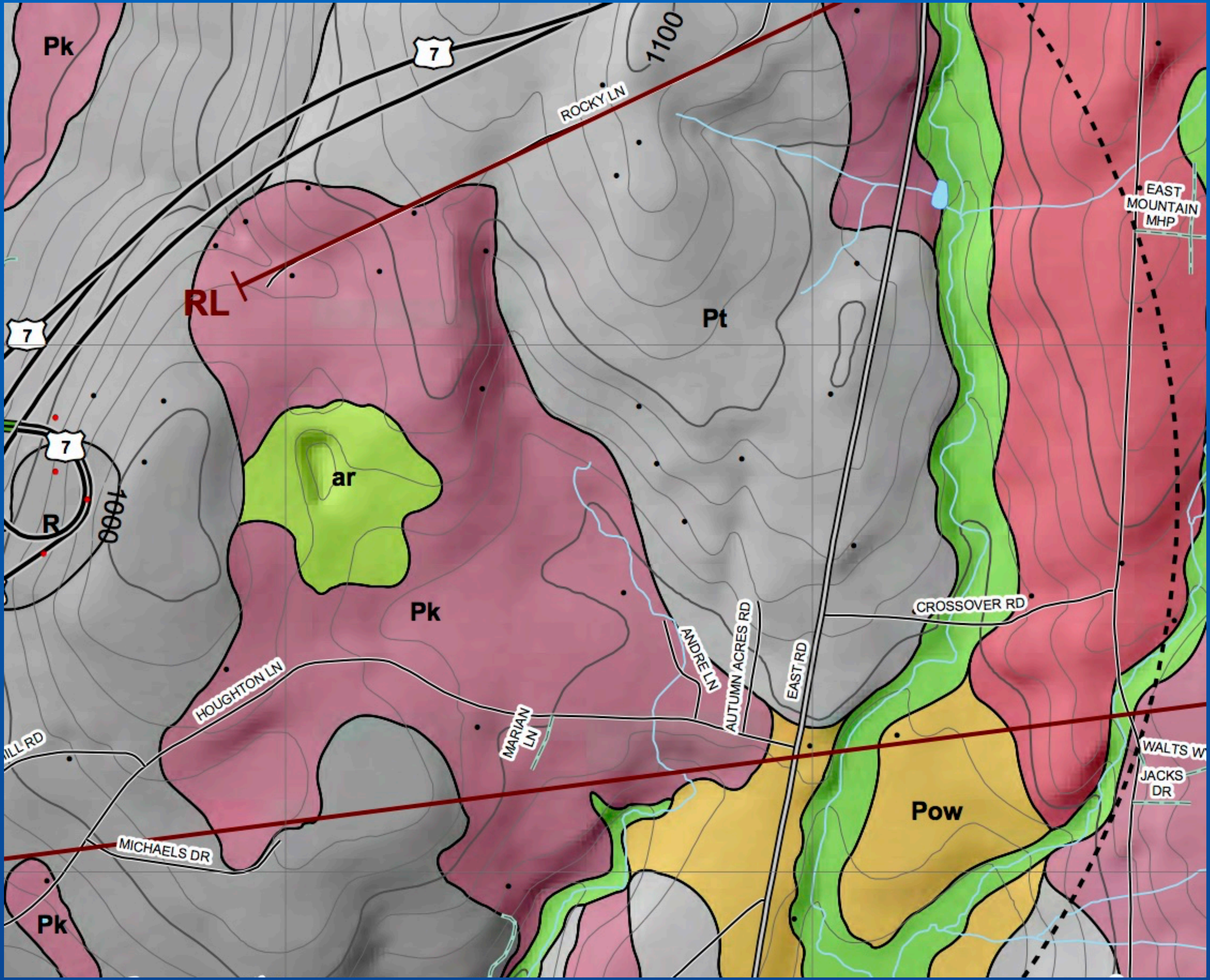
Aquifer Recharge Potential

> Paran Creek alluvium does not inhibit downward flow of contaminants to bedrock aquifer.



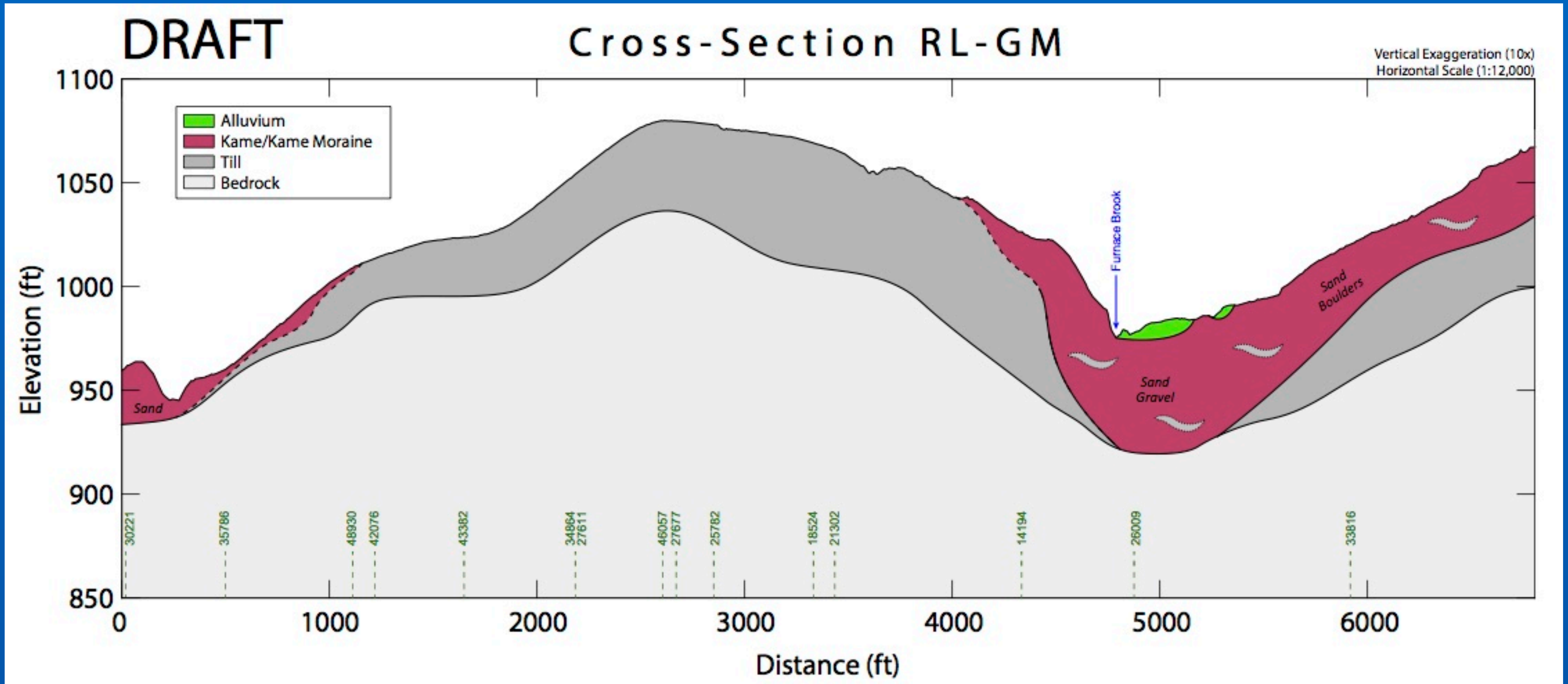
Recharge Potential

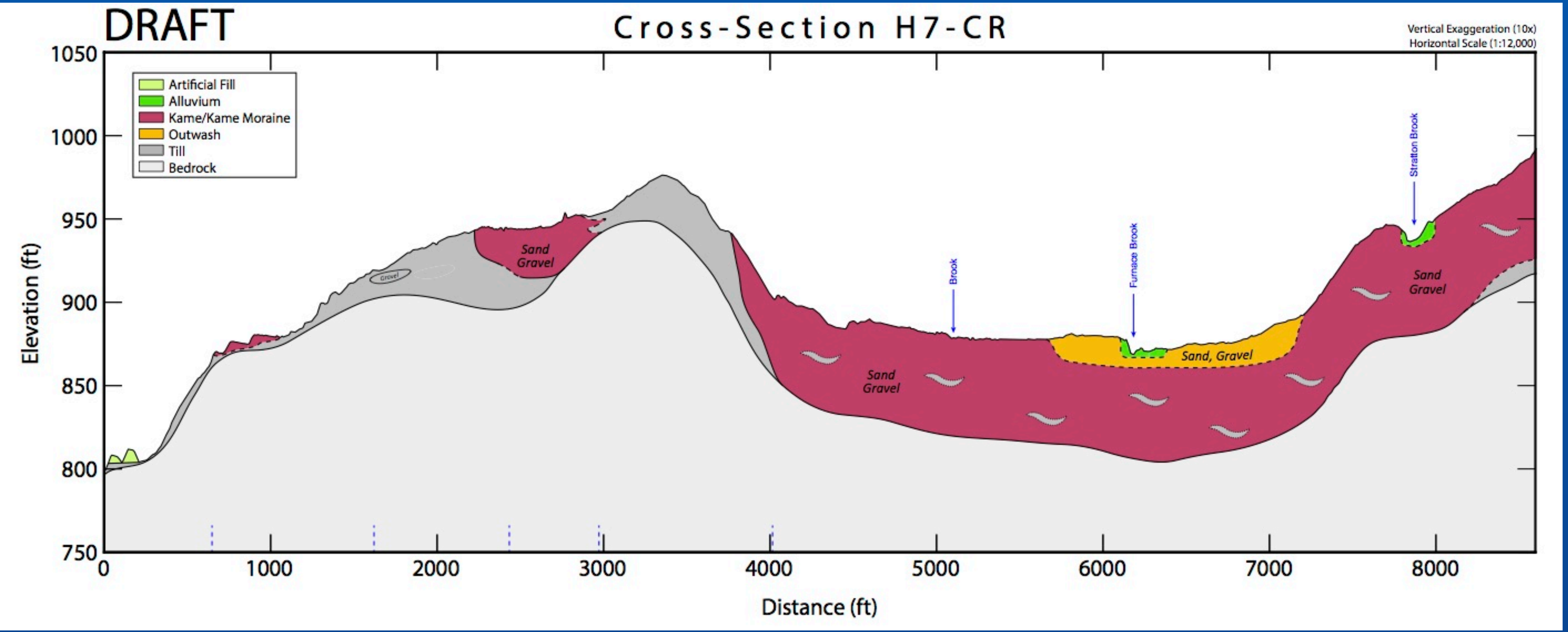
Highest	1	Areas of highly permeable overburden that are believed to be comparatively thick and persistent based upon well logs and the character of the deposits. The extensive kame moraine and outwash with adjacent kamic areas have the highest potential to recharge the bedrock aquifer. A kame moraine consists of 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 kamic deposits may have both permeable and impermeable interbedded sediments.
	2	Areas of intermediately permeable materials including kamic sediment, outwash, moraine, eroded till, fluvial terraces and alluvium. The kamic areas are likely the most permeable sediment of this category and consist largely of gravel and sand. The area of outwash included in this group has an unknown thickness and may overlie bedrock or till. The small morainal feature is not well expressed and may be more kame moraine in sediment texture. Eroded till punctuated by several bedrock exposures suggests comparatively easy recharge to the bedrock aquifer. Fluvial terraces and alluvium consist of gravel, sand and silt in variable proportions with highly variable surface layer permeability.
	3	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 process of soil formation oxidizes and alters the upper meter or so of the sediment and thinner areas of till may be weathered throughout the sediment profile. In addition, this group includes small rock outcrops within areas of till.
Lowest	4	Areas of thick impermeable till. Thick till has a thicker profile of unweathered till beneath the soil zone than weathered till. Unweathered till has an extremely low permeability and low recharge potential. A small area of exposed glacial lake clay-silt is also assigned to this category as clay-silt has a very low permeability.



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