FROM THE GROUND UP…

OBSERVED CLIMATE IMPACTS ON ECOLOGY AND WILDLIFE *(AND THINGS WE CAN DO ABOUT IT)*

Rick Van de Poll, Ph.D.

Ecosystem Management Consultants

Sandwich, NH

THE PREMISE -

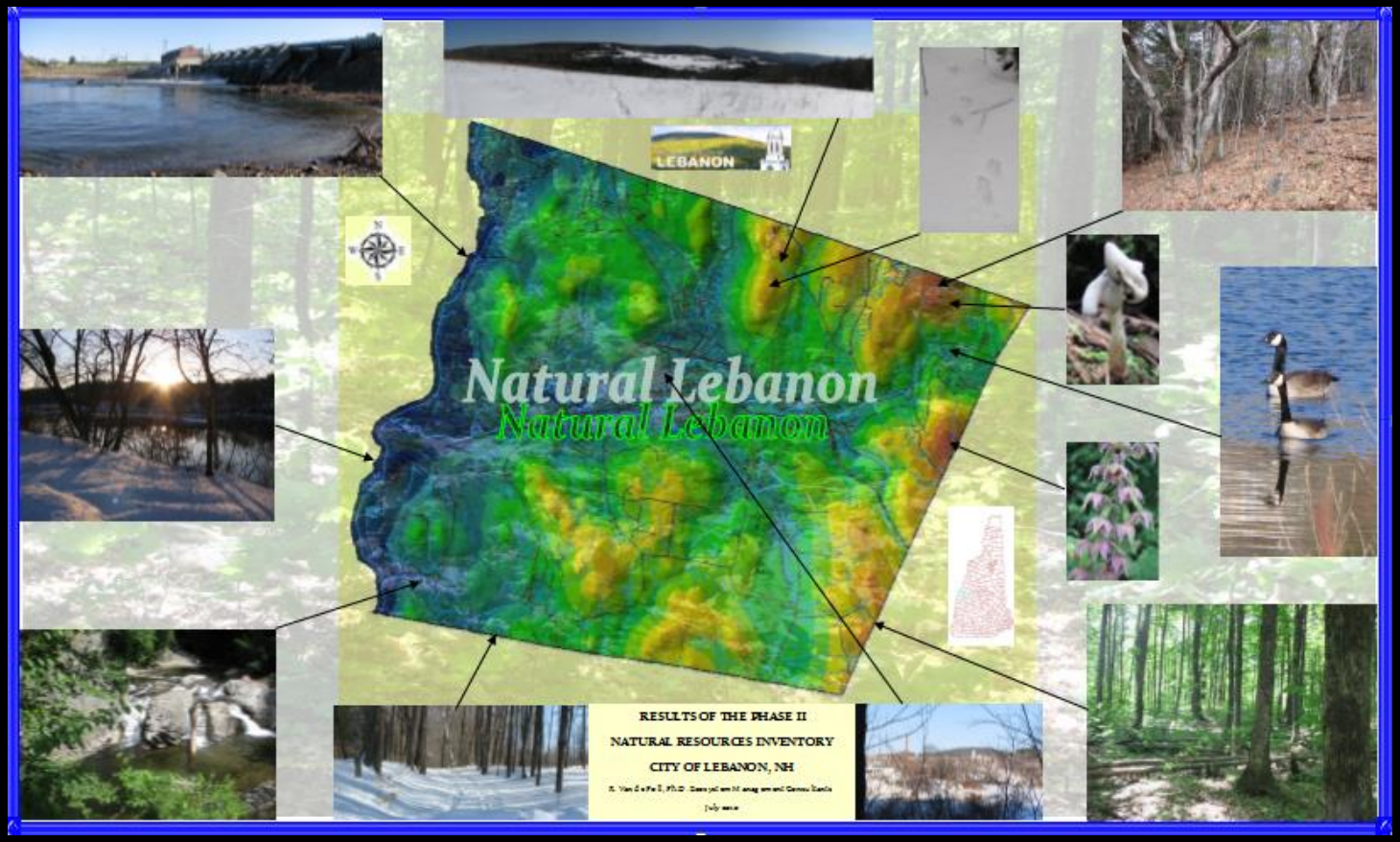
"Climate change shall affect virtually all of us, every species, every habitat, and every ecosystem, regardless of whether or not we are aware of or recognize the symptoms."

"The pace of global warming has and will outstrip the speed at which any of our keystone species can adapt through normal evolutionary means."

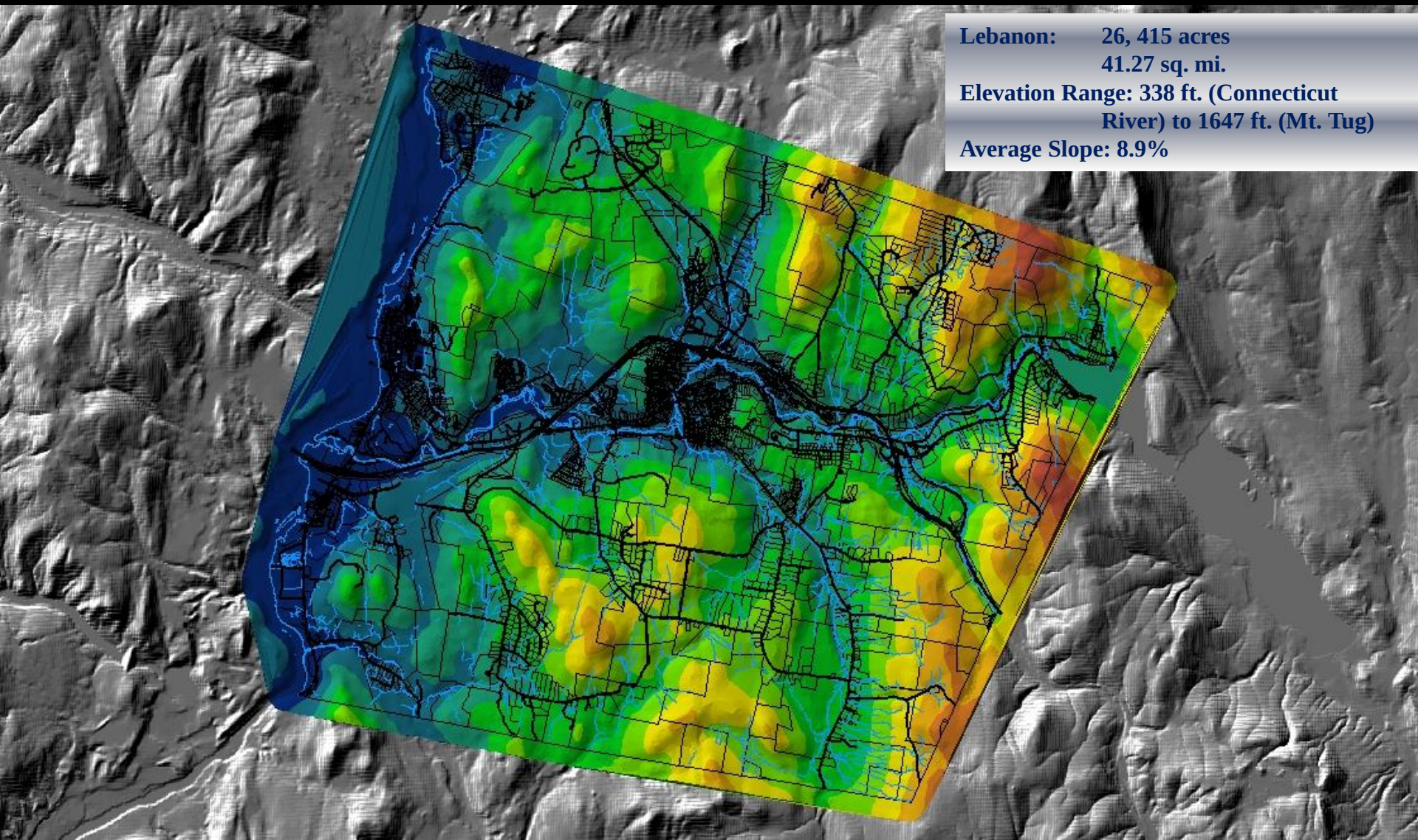
R. Van de Poll, AUNE, September 1991

JULY 2, 2013
SLAYTON HILL RD
AT RIVERMERE

LEBANON NATURAL RESOURCES INVENTORY 2008 – 2009

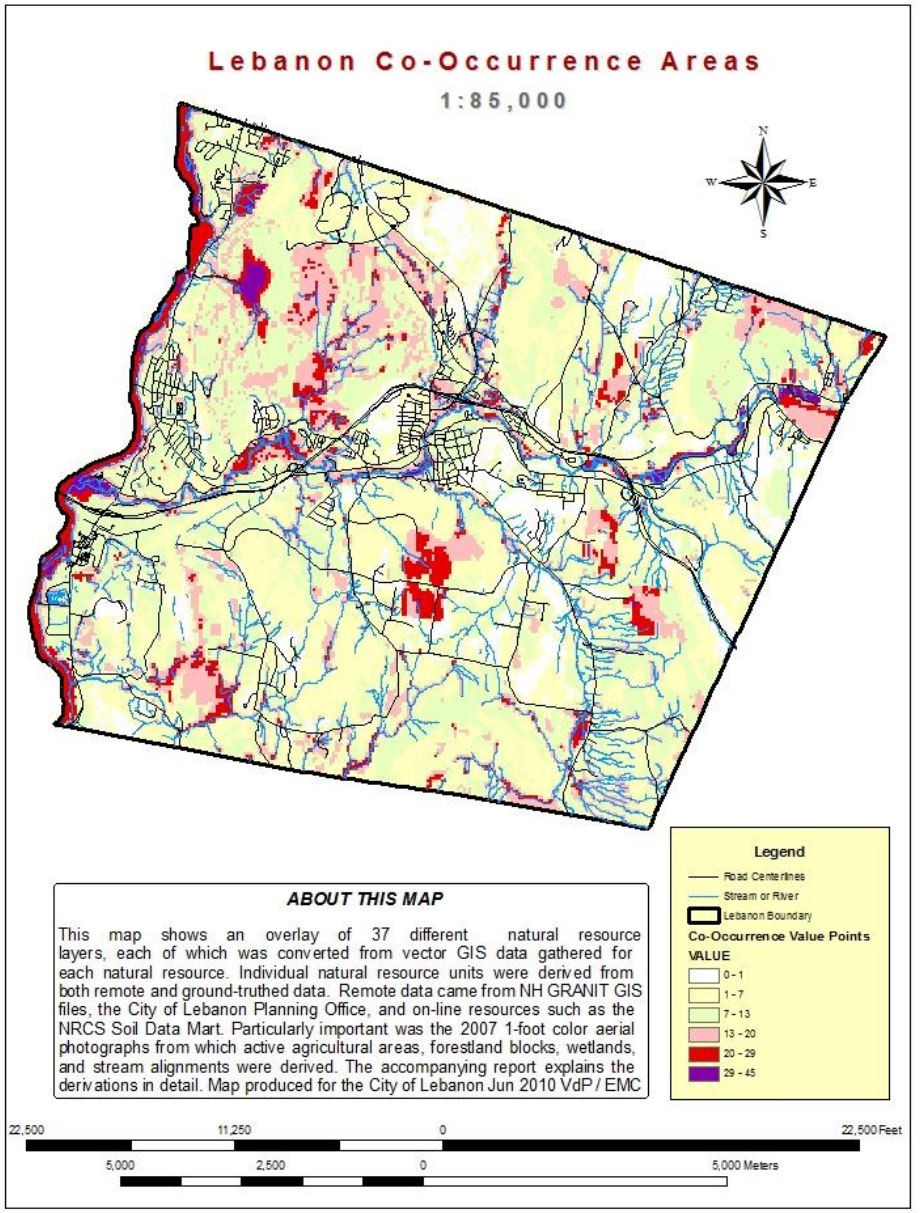


PHASE II NRI - 1) UPDATE GIS BASE MAPS



Lebanon: 26, 415 acres
41.27 sq. mi.
Elevation Range: 338 ft. (Connecticut River) to 1647 ft. (Mt. Tug)
Average Slope: 8.9%

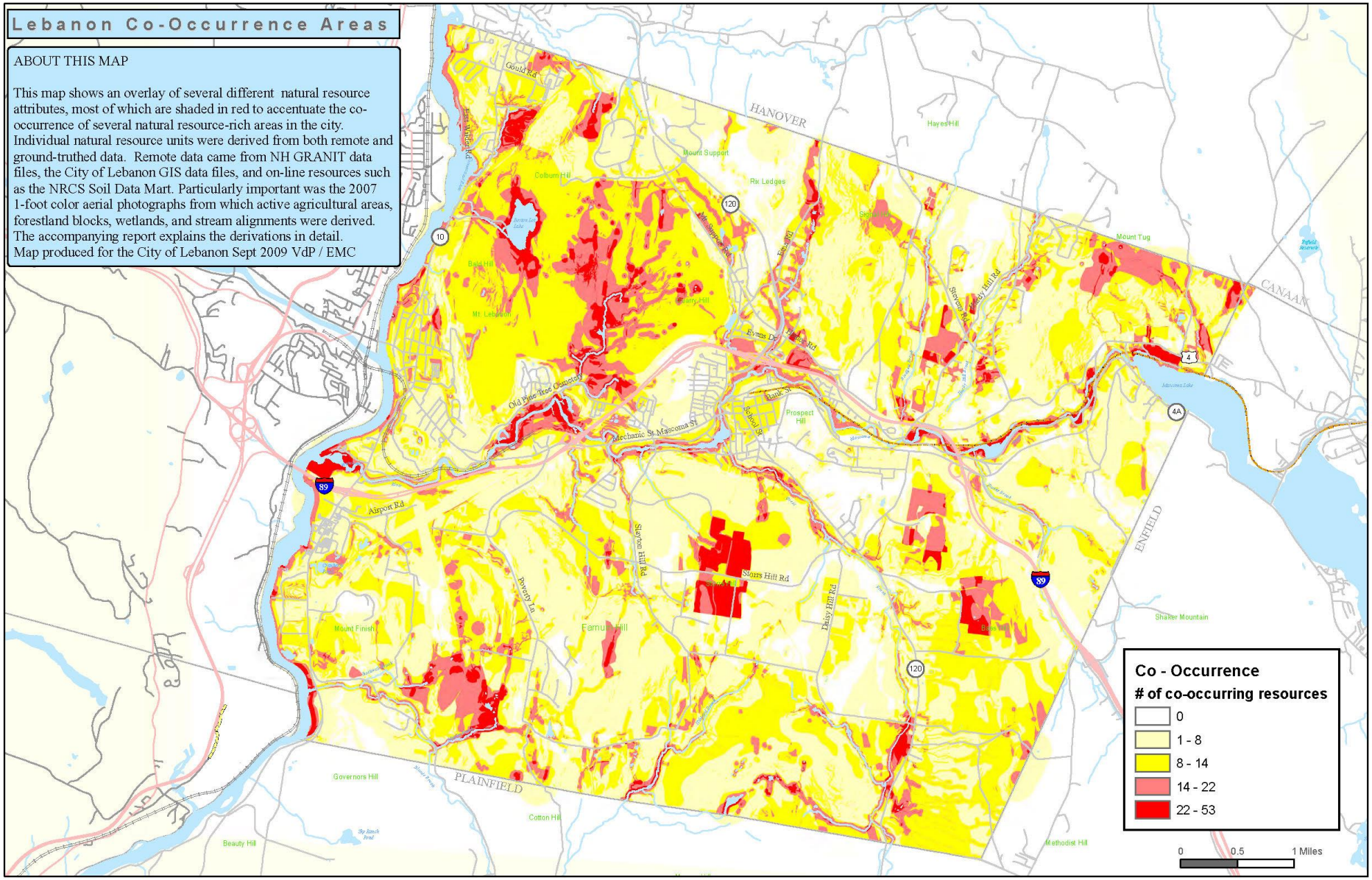
- Good Agricultural Land
- Good Forest Land
- Steep & Erosive Soils
- Surface Water Resources
- Principal Wetlands
- Aquifers, Sand & Gravel
- Unfragmented Lands
- Significant Ecological Areas
- Important Wildlife Habitat Areas
- Co-Occurrence Areas Summary



Lebanon Co-Occurrence Areas

ABOUT THIS MAP

This map shows an overlay of several different natural resource attributes, most of which are shaded in red to accentuate the co-occurrence of several natural resource-rich areas in the city. Individual natural resource units were derived from both remote and ground-truthed data. Remote data came from NH GRANIT data files, the City of Lebanon GIS data files, and on-line resources such as the NRCS Soil Data Mart. Particularly important was the 2007 1-foot color aerial photographs from which active agricultural areas, forestland blocks, wetlands, and stream alignments were derived. The accompanying report explains the derivations in detail.
Map produced for the City of Lebanon Sept 2009 VdP / EMC



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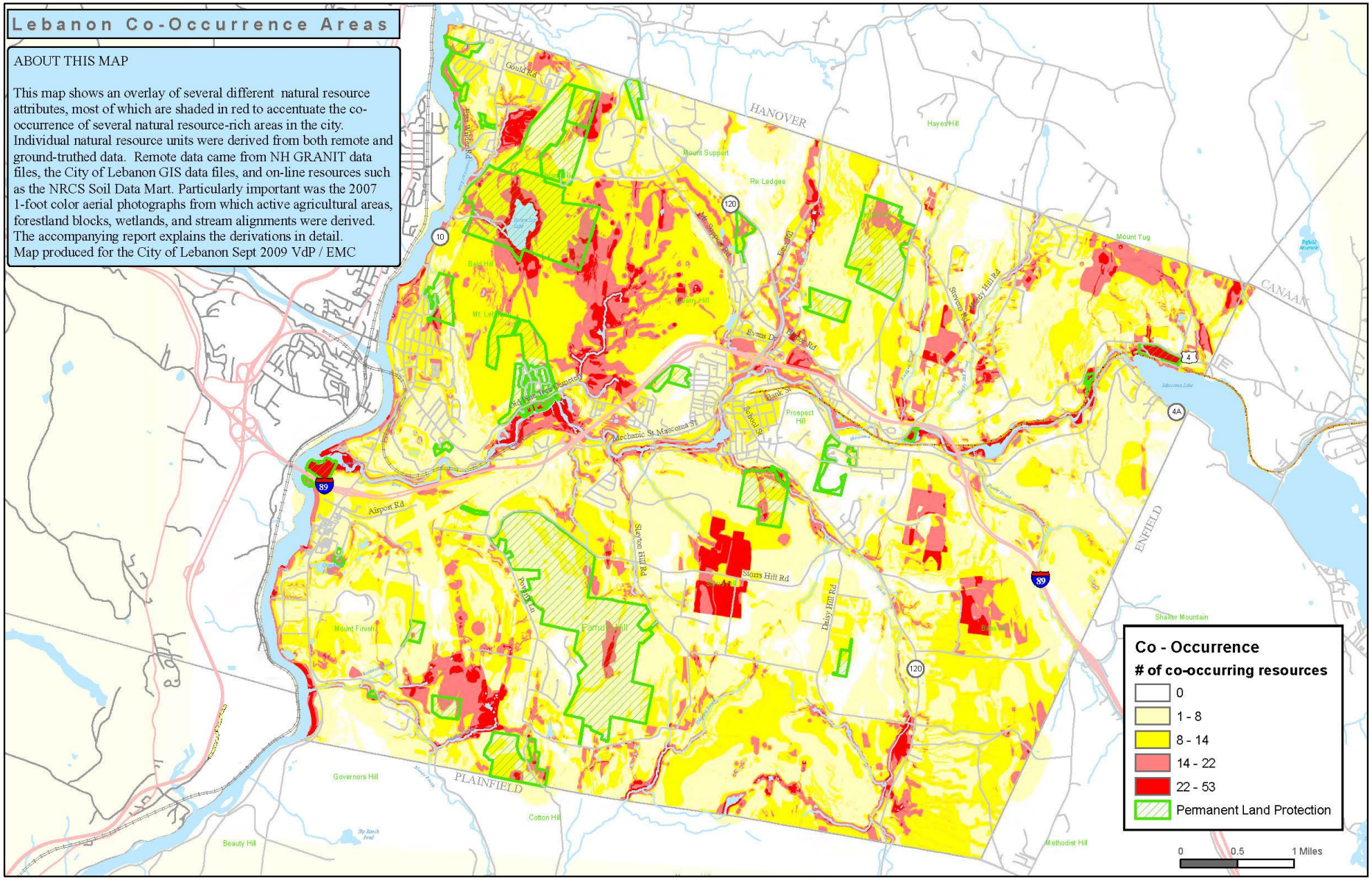

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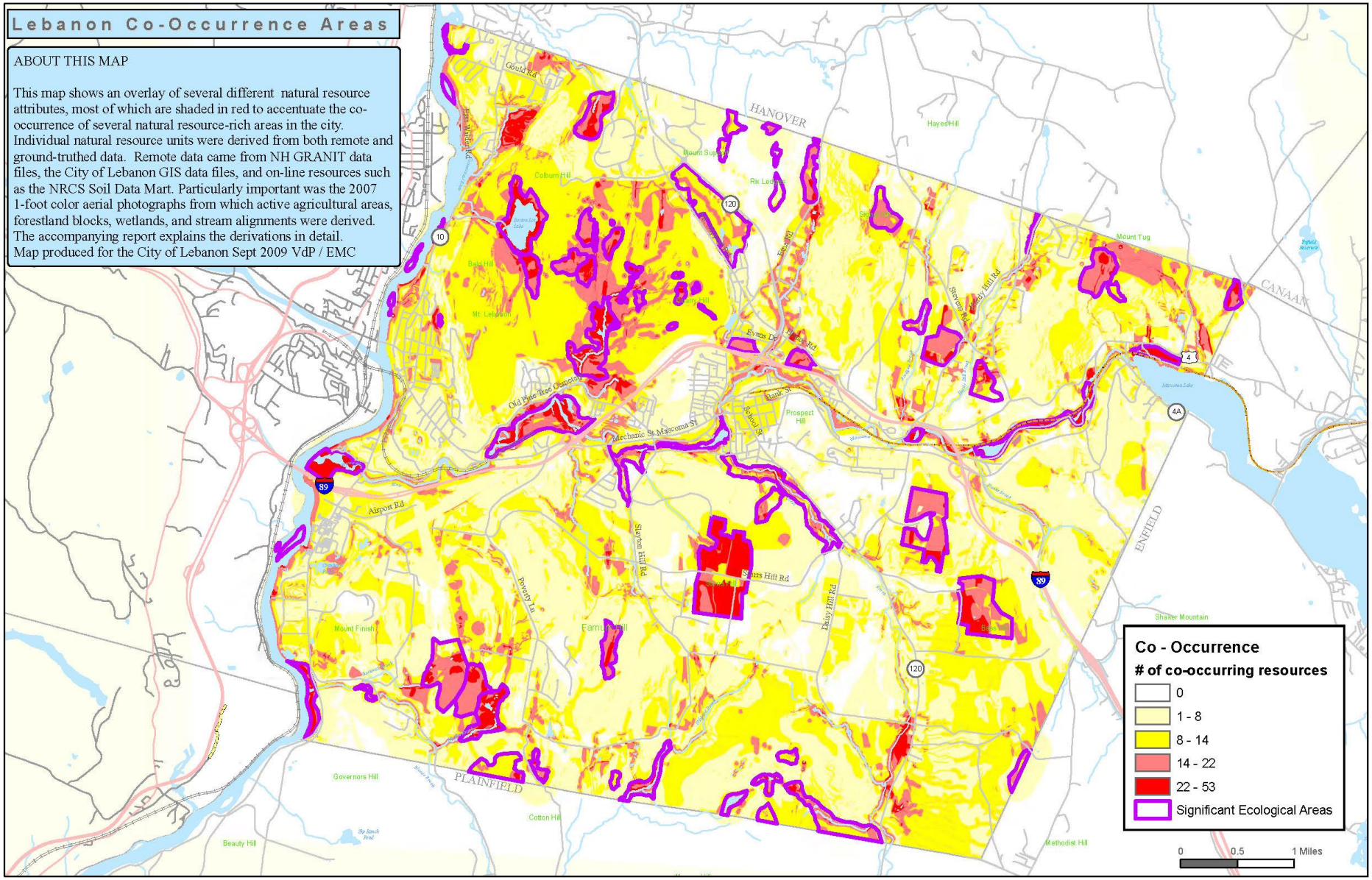
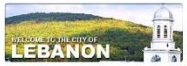


Lebanon Wildlife Habitat



CITY OF LEBANON

N
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1:24,000

Legend

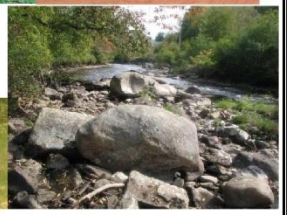
- Vernal Pools
- Wildlife Crossings
- Lebanon City Boundary
- Stream/River
- Road Centerlines
- 50-foot Contours
- Grasslands > 10 acres
- Upland Scrub
- Unfragmented Lands - Core
- Deer Yards
- Ponds & Detention Basins
- Lakes
- Rivers & Streams
- Active Agricultural Areas
- Emergent Marsh
- Scrub-Shrub Swamp
- Swamp - Forested Dead
- Swamp - Forested Living

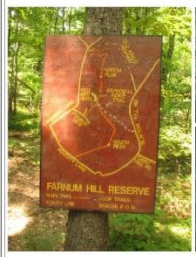
Upland Forest Cover Types

- Appalachian Oak-Pine
- Floodplain Forest
- Hemlock-Hardwood-Pine
- Lowland Spruce-fir
- Northern-Hardwood-Conifer

Starr Hill Natural Area, in spite of lying outside of the unfragmented forest lands of the City, offers an excellent example of wildlife habitats that are common in Lebanon, including the most common upland forest type - the Hemlock-Hardwood-Pine Forest. This public property also contains one of the finest vernal pools in the City, a steep talus slope, hemlock forest, oak forest, and at the bottom near I-89, a beaver marsh and scrub-shrub wetland. The unusual black form of the redback salamander, as depicted below, was also a common resident of the mixed, mesic forest.

The Mascoma River offers an exceptional series of wildlife habitats among the 11 City-owned lands known as the "string of pearls," including Baker's Crossing below. Brook, rainbow, and brown trout ply the waters; beaver, mink, and muskrat swim along the shoreline; and the uncommon hackberry and slippery elm grow in the floodplain forest. In spite of running through the middle of the City, this invaluable water supply river remains relatively pristine.





Farnum Hill Reserve is one of the premiere tracts of unfragmented land in the southern part of Lebanon, and contains high quality upland furbearer habitat, such as dry oak-pine ridgeline forest, vernal pools (at left), and an aggrading forest with ample amounts of fungi such as the bears-head tooth, with exposures on all sides. It offers a mix of habitats for deer, moose, fisher, ermine, coyote, fox, and raccoon. It also supports a wide variety of neo-tropical migrant warblers. A single tracking day in March yielded over 500 red squirrel intercepts, or roughly one every 11 meters. A sizeable deer yard was also observed on the southern flanks of Farnum Hill. In one visit in September, 116 species of mushrooms were observed.

The Landmark Lands west of Mt Support Road, east of Route 10 and north of Pine Tree Cemetery Road, along with Boston Lot and Indian Ridge, represents the largest tract of unbroken land in Lebanon. The diversity of forested and wetland habitats are exceptional in both abundance and quality. Over half of the active vernal pools found in the City were found in this area, along with over two dozen other isolated pools and swamps with excellent habitat. Whereas the Quarry Hill site has a young forest, parts of the Landmark Lands have been untouched for over a century.
Evidence of bear (below right), bobcat (below left), and wintering deer (below middle) was common throughout the area. Prominent and unusual rock formations, wetlands, and innumerable streams and drainageways prevented widespread farming in the 18th and19th centuries. Hurricanes and fire have also impeded timber harvesting activities, and have resulted in one of the oldest forests in Lebanon. These features also make this area perfectly suited for the City's best wildlife reserve. At over 3,000 acres, it is more than 1000 acres larger than any other unfragmented landscape in Lebanon.

ABOUT THIS MAP

Wildlife habitat was initially determined from the 2005 Wildlife Action Plan (WAP) map data, courtesy of NH Fish & Game Department and Complex Systems Research Center, UNH, Durham, NH. Additional types were identified from remote data sources and fieldwork. The most useful GIS data layer was the 2007 1-foot color aerial photographs supplied by the City of Lebanon Planning Department. Roadside and off-road fieldwork was conducted over the course of 14 months between July 2008 and October 2009. Winter snow tracking, vernal pool surveys, rare plant & animal surveys, and wetland assesments provided much of the field-verified data. As a result, several changes were made to the initial wildlife-habitat map: water bodies were broken out into three parts - lakes, rivers & streams, and small ponds & detention basins; grasslands were converted to "active agricultural areas," which included all visibly active open lands > .5 acre such as cropland, orchard, hay field, pasture land, and brush-hogged meadow; a transitional type was recognized - "upland scrub," which included all old fields, field edges, hedgerows, maintained riverlands, managed glades, and waste ground such as old gravel pits & quarries; emergent marshes were separated from scrub-shrub swamps within the WAP "marsh" category; and both forested-living and forested-dead swamps were separated from upland forest types. The remaining five upland forest types were reconfigured on the basis of field data and aerial photo interpretation.
Deer yards were initially derived from NH Fish & Game data, and then modified on the basis of field surveys and local knowledge.
Wildlife crossings were mostly derived from the snow track transects and roadside survey work in winter, where multiple species trails were evident. A total of 66 crossing locales were identified. Vernal pools were mostly identified from fieldwork, with assistance from Jeff Littleton of Moosewood Ecological and John Joline of Hanover. A total of 74 vernal pools were positively identified from the presence of obligate amphibian species. Fifty-nine other pools were listed as "probable" on the basis of surface topography and soil characteristics; 16 additional pools were listed as "possible" on the basis of seasonal inundation and infrequent use by obligate vernal pool species such as wood frog or spotted salamander. Note that most field data were derived from the use of hand-held GPS units and should not be used for survey purposes.

*Map prepared and produced by R. Van de Poll / ECOSYSTEM MANAGEMENT CONSULTANTS *** January 2010*

WILDLIFE CORRIDOR ANALYSIS 2013 - 2016

- Goals:
  - Build upon the 2008-2009 Natural Resources Inventory (NRI)
  - Phase I (2013-14) – look at three critical wildlife crossing areas
  - Phase II (2015-16) - expand upon Phase I study to include 14 additional wildlife crossing areas
  - Assess each crossing area for usage, value, and connectivity
  - Provide recommendations for improving the viability of each crossing area

LEBANON WILDLIFE CORRIDORS – PHASE II

Species Found Crossing the Roadways

- White-tailed Deer
- Eastern Coyote
- Red Fox
- Raccoon
- Black Bear
- Bobcat
- Fisher
- Porcupine
- Mink

LEBANON WILDLIFE CORRIDORS – PHASE II

Other Species of Concern

- Moose
- Gray Fox
- Snowshoe Hare
- River Otter
- Beaver
- Opossum
- Long-tailed Weasel
- Ermine

WILDLIFE CROSSING CONCERNS

- Direct Mortality
- Behavior Modification
- Kinship Loss
- Metapopulation Restructuring
- Localized Extirpation
- Extinction

IMAGINE THE COMPLEXITY…

Gee these ash buds are tasty!

Mmm… Petunias, I wonder…

Why do they make these holes so small?

Mmm… no screen, bet I can push that window right open…

IF I WAS A BEAR…[SHORT LIST]

- What if the ash trees all died from EAB & buds were no longer present in the spring?
- What if beech blight reduces the amount, frequency, and nutritional value of beech nuts in my usual stand?
- What if winters are so warm I don't really feel like going to sleep and so use up all my stored fat by January?
- What if I wake up hungry to a nice balmy February but the sedges I'm used to finding aren't up yet?
- What if a drought/pollinator loss/insect blight wipes out all my berries and apples in the fall?

GENERAL APPROACHES

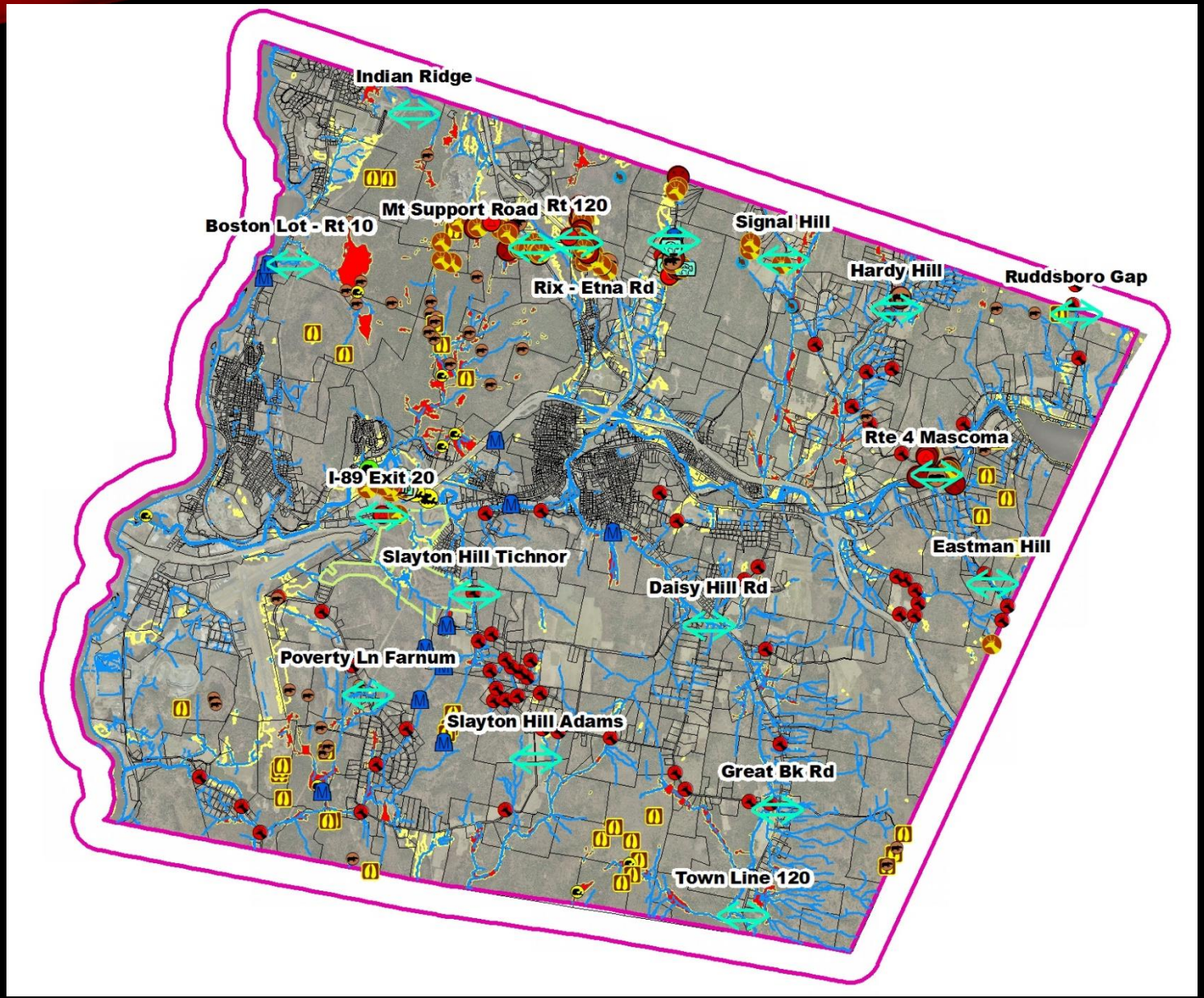
Climate Change Symptoms

1) Excessive flooding, loss of riparian habitat
2) Prolonged drought, higher risk of fire
3) Warmer winters, increased parasites & pathogens
4) Increased strength & frequency of severe storm events

Some suggested solutions

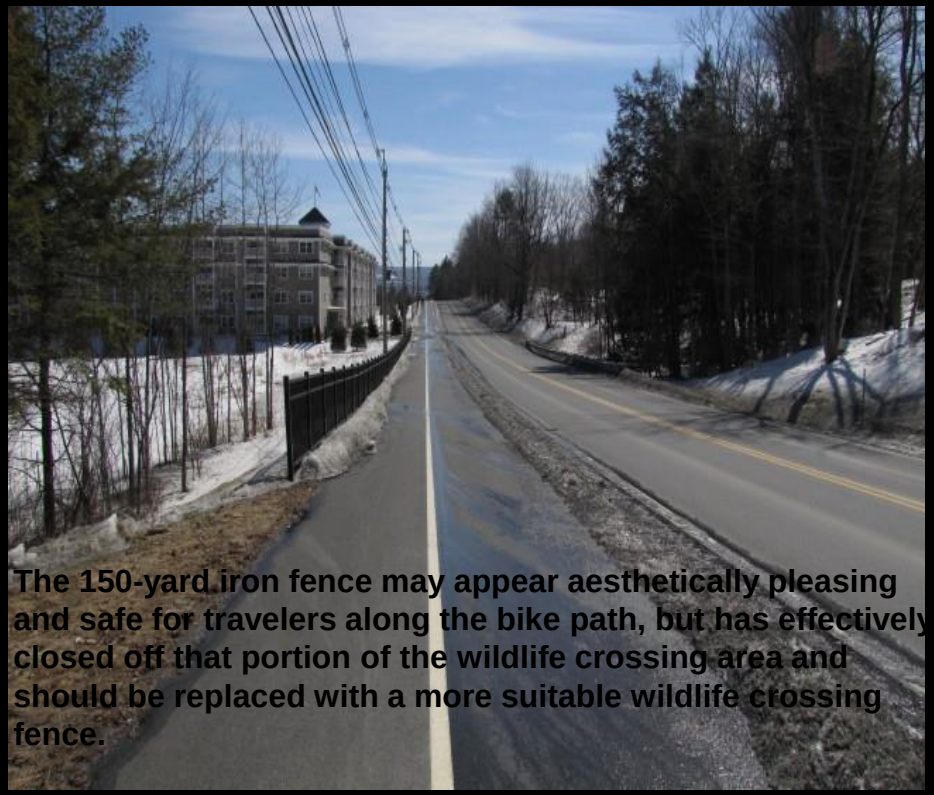
1) Increase culvert size, protect floodplains, establish riparian buffers
2) Increase infiltration in impervious areas; protect wetlands & surface waters; reduce water use; reduce fuel loads
3) Reduce hunting/fishing pressure; reduce parasite/pathogen spread; protect 'cool' sites
4) Alter forest management practices; seek to limit spread of invasive species

SPECIFIC APPROACHES FOR SELECTED WILDLIFE CROSSING AREAS



FINAL REPORT ON THE PHASE I ASSESSMENT– MT SUPPORT ROAD

1. **Protect and preserve a 100-foot wide vegetated strip just south of LeHaye Drive**
2. **Remove the rip-rap from the roadside banks and stabilize these areas with jute-netting and hydroseed, especially in the area across from the Pat Lumber Jack lot across from the southeast corner of the hay field**
3. **Remove the northerly portion of the iron fence along the sidewalk in front of Timberwood**

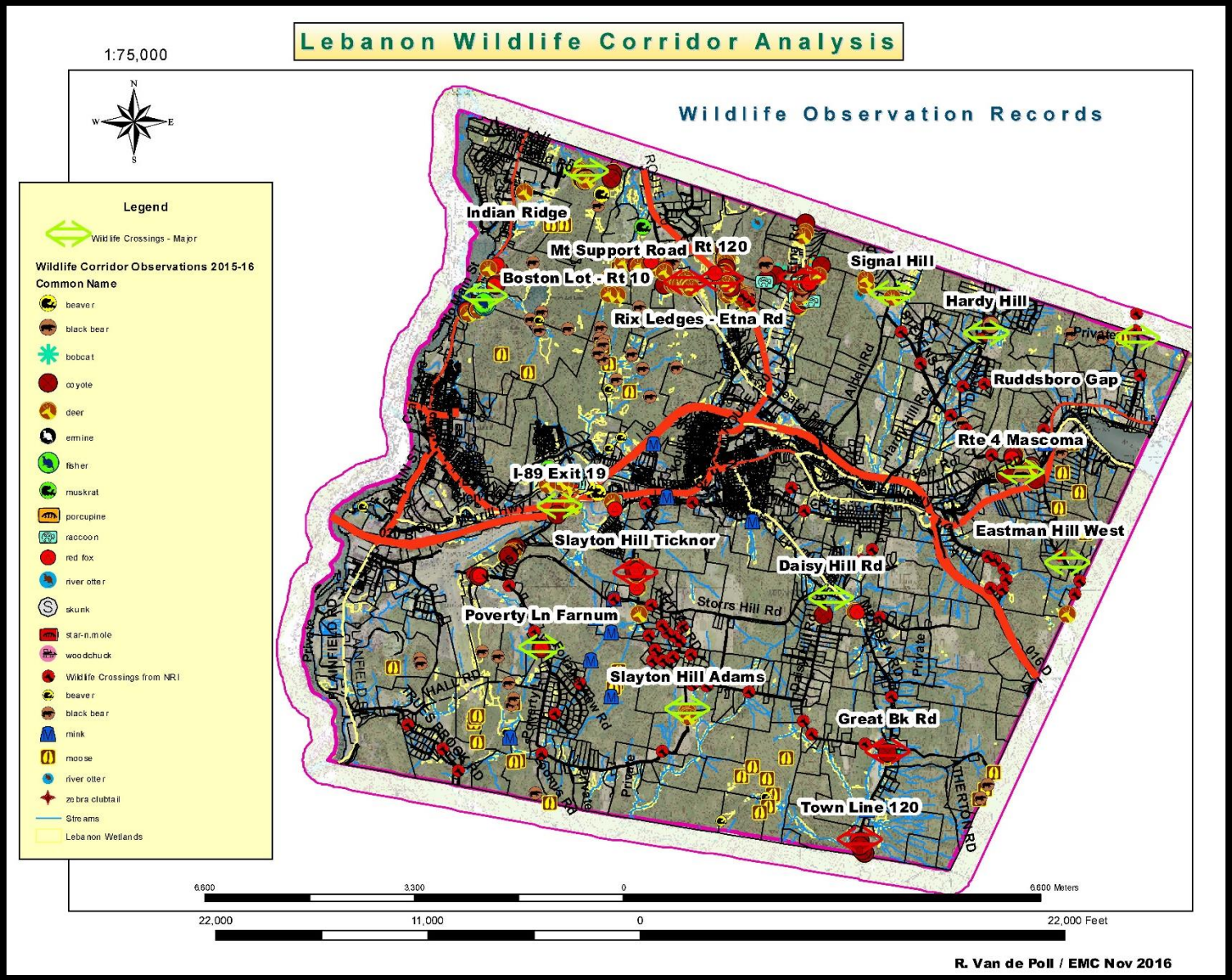


The 150-yard iron fence may appear aesthetically pleasing and safe for travelers along the bike path, but has effectively closed off that portion of the wildlife crossing area and should be replaced with a more suitable wildlife crossing fence.

FINAL REPORT ON THE PHASE I ASSESSMENT – ROUTE 120

1. **Provide adequate signage along Route 120 requesting that drivers remain alert and moderate their speed**
2. **Allow selected areas near the above five crossing sites to revegetate up to near the edge of the roadway shoulder**
3. **At the second crossing locale, replace the existing 42-inch culvert with a six-foot wide, four-foot high box culvert to allow for better under-highway passage of medium to small mammals**

LEBANON WILDLIFE CORRIDORS – PHASE II



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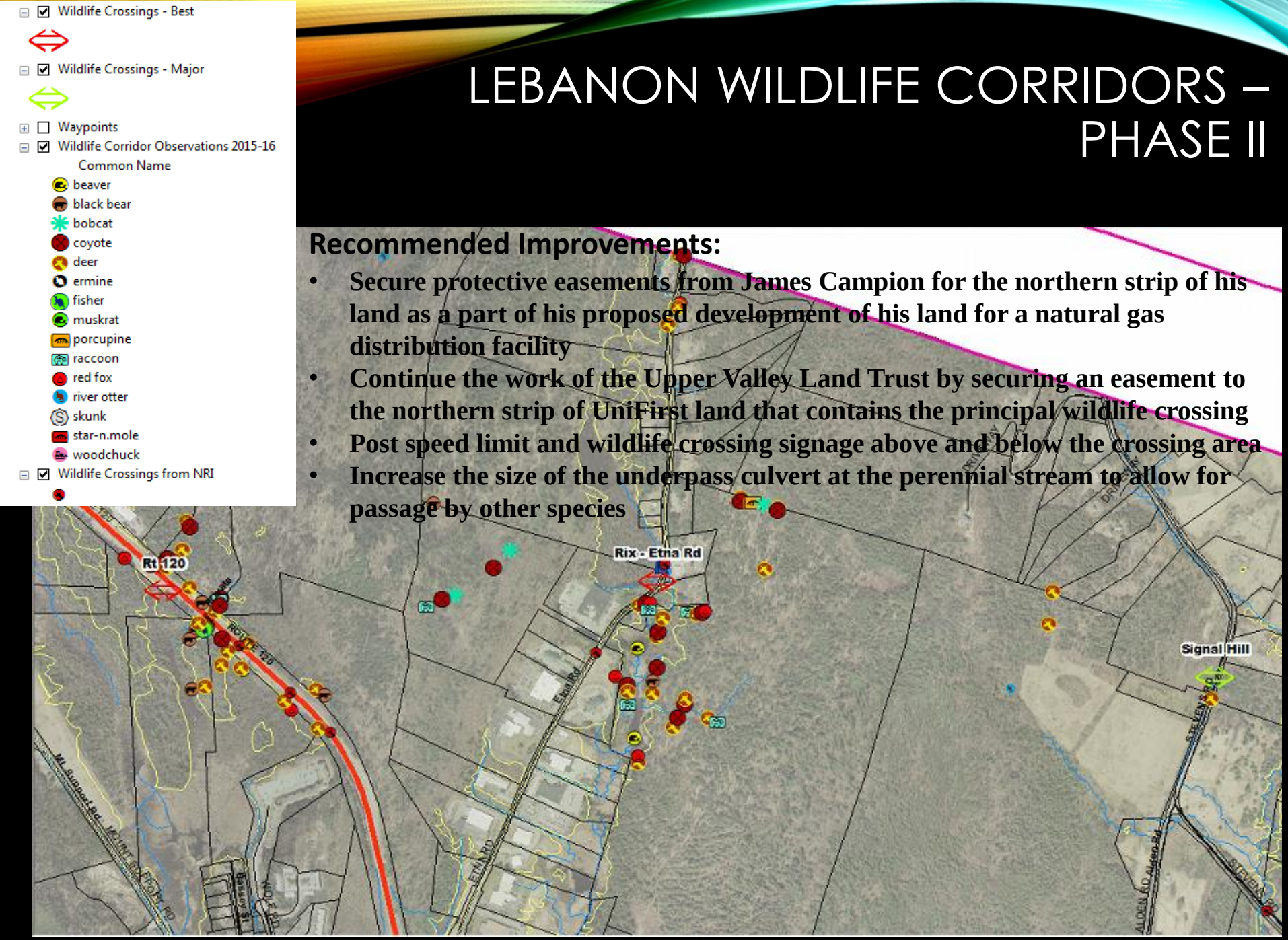
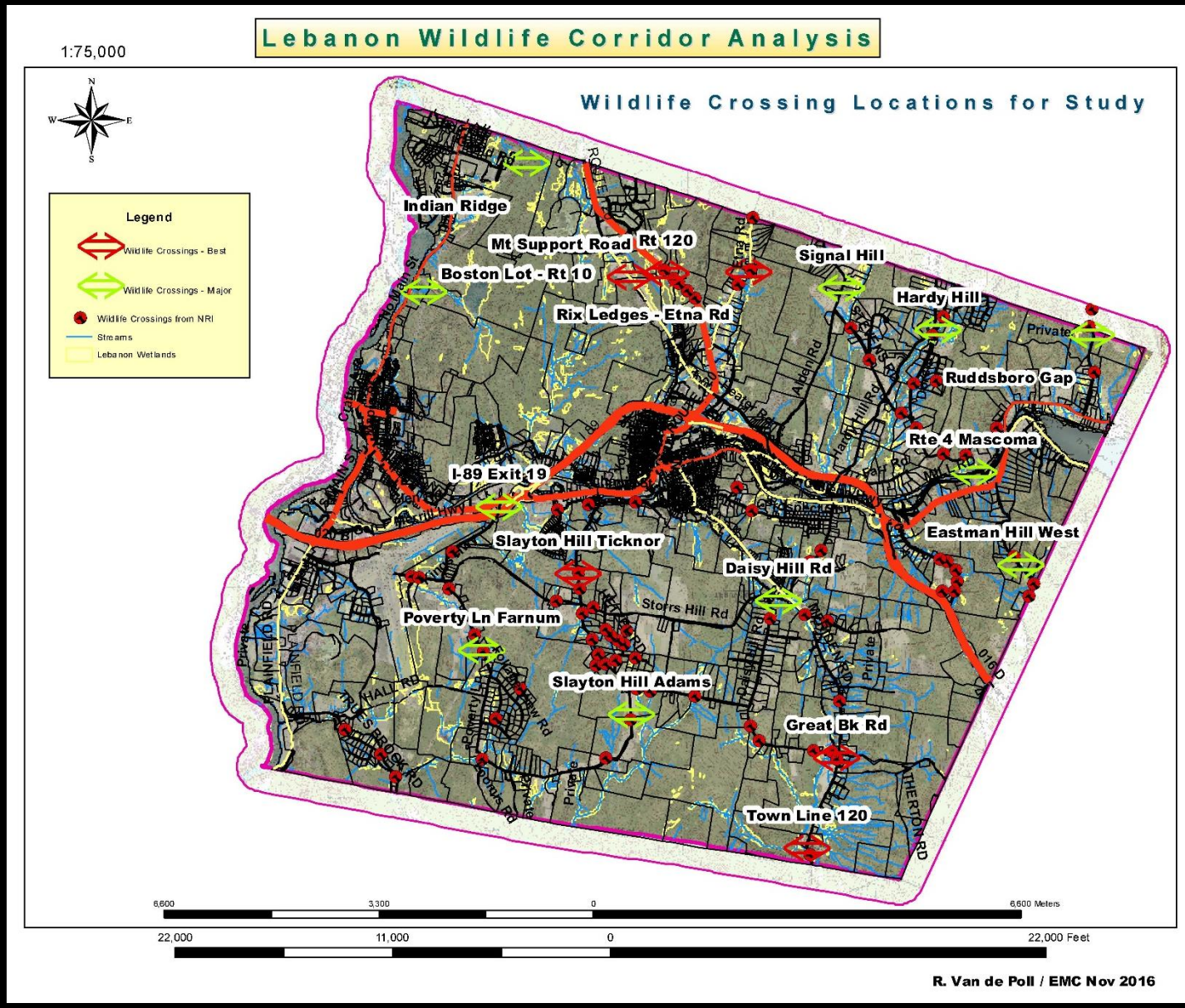


Recommended Improvements:

- **Secure protective easements from James Campion for the northern strip of his land as a part of his proposed development of his land for a natural gas distribution facility**
- **Continue the work of the Upper Valley Land Trust by securing an easement to the northern strip of UniFirst land that contains the principal wildlife crossing**
- **Post speed limit and wildlife crossing signage above and below the crossing area**
- **Increase the size of the underpass culvert at the perennial stream to allow for passage by other species**

LEBANON WILDLIFE CORRIDORS – PHASE II



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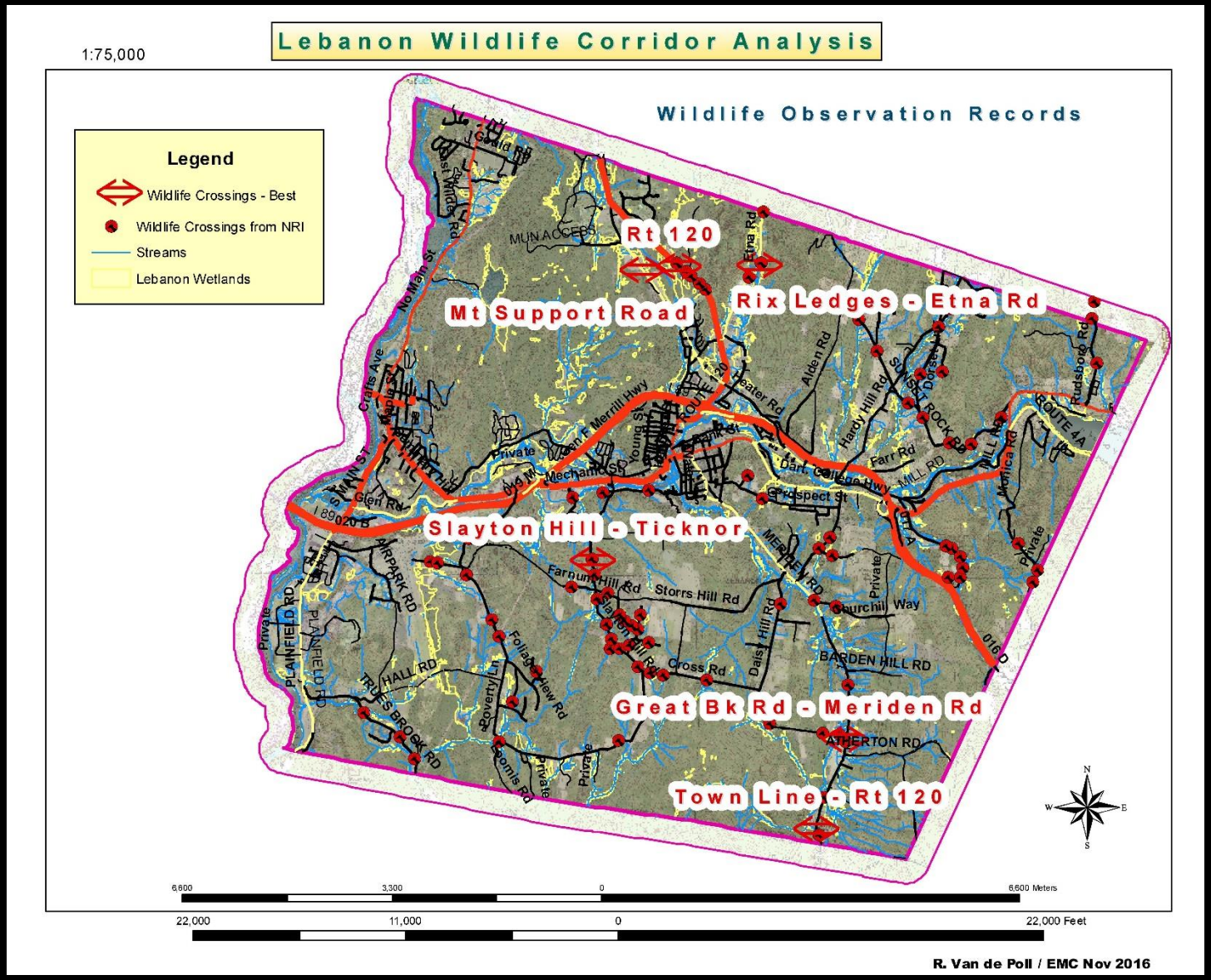

ACKNOWLEDGMENTS

- *City of Lebanon Planning Department*
  Lebanon Conservation Commission
  NH Fish & Game Department
  NH Natural Heritage Bureau
  NH Audubon Society
  Natural Resource Conservation Service
  NH Department of Environmental Services
  Dartmouth College
  UNH Cooperative Extension
- *Several Citizens of Lebanon who assisted but are too numerous to mention!*

EMC BACKGROUND

- 90 public presentations on natural resources since 2000
- 9 published works on natural resources and wetlands
- 79 gray papers on natural resource inventories
- Contract work with 85 towns in NH-VT-ME-NY
- Mapped, classified and evaluated 1150 wetlands in NH
- Field surveys of +/- 340,000 acres in 5 states
- Since 1986 established 176 long-term monitoring plots in New Hampshire
- In Lebanon, completed a comprehensive natural resource inventory and wildlife corridor analysis