MEMORANDUM

FROM THE

LAKE CHAMPLAIN BASIN PROGRAM

To: **Erik Beck** - IJC Contract Officer's Representative **29 September 2009**
U. S. Environmental Protection Agency
New England Region

From: **Bill Howland**, Manager
Lake Champlain Basin Program
54 West Shore Road
Grand Isle, Vermont 05458

cc: **Robert Reynolds,** IJC
Beth Card, NEIWPCC

Re: IJC - New England Interstate Water Pollution Control Commission/Lake Champlain Basin Program Contract, *Missisquoi Bay Basin Project: Identification of Critical Source Areas of Phosphorus Pollution,* **Deliverable: Report on Data Acquisition and Publication**

Please accept this memorandum and attachments as the deliverable for Task 1 Subtask 2 (9.3.1.2.1) – *Report on Data Acquisition and Publication* – under the IJC-NEIWPCC contract number 1042-800734.

Appended Files

1. Report on Data Acquisition and Publication
2. Draft Missisquoi Bay Basin Project Database Summary
3. Summary of the *Workshop on Data Availability and Data Needs*

Missisquoi Bay Basin Project:
Identifying Critical Source Areas of Pollution

Report on Data Acquisition and Publication

Data Acquisition

The Lake Champlain Basin Program (LCBP) is tasked by the IJC-NEIWPCC grant to assemble relevant datasets in order to develop a transboundary understanding of pollutant loads from the Missisquoi Bay Basin (MBB) and to facilitate the development of a pollutant loading model for the Bay. Both GIS and other useful data are currently being compiled in the LCBP office for future use in this project and for use by other stakeholders.

The LCBP began by this task by identifying general data types and categories that would be necessary for most approaches to modeling critical source areas (CSAs). Categories include agriculture, natural and political boundaries, conservation, elevation, hydrology and wetlands, satellite imagery, infrastructure, land use/land cover, modeling results, monitoring, orthophotography, and soils. Geospatial data pertaining to these categories were then downloaded from public sources such as the Vermont Center for Geographic Information, Natural Resources Conservation Service (NRCS), Geobase, and GeoGratis (please refer to the appended spreadsheet for a comprehensive list of data holdings and sources).

In addition to acquiring published data, the LCBP contacted local agencies and offices to find additional data relevant to the MBB. The NRCS provided datasets developed for the Missisquoi Areawide Plan, including farmstead locations, field crops, and gaps in riparian buffers (all digitized from 2003 orthophotos). The NRCS also shared the Stream Geomorphic Assessment data and restorable wetlands classification data created by the Vermont Agency of Natural Resources (VTANR). Other soil-specific data such as fields amenable to no-till agriculture and soil erosion potential were provided as well.

The University of Vermont Spatial Analysis Laboratory (SAL) provided improved 1992 and 2001 land use/land cover data derived from the National Land Cover Database as part of a project funded by the LCBP. The SAL also shared data from the Grasslands study for Franklin County, which includes basic agricultural field cover types, pasture and suburban fields, and probable crop rotations based on soil types. Recently, the SAL has supplied tiles of elevation data derived from LiDAR acquired in the Rock River area (western portion of the U.S. MBB).

The LCBP also contacted watershed monitoring groups and agencies – including the VTANR, Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP), United States Geological Survey (USGS), the University of Vermont (UVM), and the Missisquoi River Basin Association (MRBA) – to determine their sampling locations and parameters sampled. Actual

monitoring data will be obtained as necessary to support model calibration and validation. Similarly, meteorological data will be obtained from the National Weather Service, Environment Canada Weather Office, or a third-party data distributor.

Currently, the most detailed hydrography datasets available are the Vermont Hydrography Dataset (1:20,000) and the Canadian National Hydrographic Network (1:50,000). This difference in spatial scale makes transboundary integration of stream networks difficult. In 2010, 1:20,000 provincial data for Quebec will be incorporated into the Canadian dataset, at which point the USGS plans to integrate it with the National Hydrography Dataset. Although this data is not currently available, it may become useful later in the modeling effort and will certainly be a valuable addition to the MBB database.

The LCBP has recently acquired county mosaics of 1-meter, 4-band orthophotos within the MBB generated by the 2008 National Aerial Imagery Program. In addition to this photography, the LCBP will obtain 1-foot orthophotography recently captured by the Department of Homeland Security for most of the MBB as well as additional LiDAR products for the Rock River Area, including 2-foot contours. A ½-foot digital elevation model derived from LiDAR within the Ewing Brook subbasin of the Pike River and an electronic atlas of recent project findings has been provided by l'Institut de recherche et de développement en agroenvironnement (IRDA). Predicted phosphorus load data generated by the 1992 USGS New England Sparrow Model has also been incorporated into the database. The LCBP will try to obtain data outputs from other models currently being applied within the Basin, from groups such as UVM.

One of the challenges when compiling all of this data is obtaining adequate metadata. When possible, supporting documents are included with data, as are notes detailing how data were obtained. As this project progresses, metadata will continue to be assembled, so that it is easier to apply quality assurance measures.

Data Workshop

After compiling and researching the aforementioned datasets, the LCBP convened a workshop on data availability and data needs on April 28, 2009 (please refer to appended workshop summary). About 25 participants from various organizations, federal, and state agencies discussed the acquired datasets, other potentially available datasets, gaps in existing data, and transboundary data assimilation.

Agricultural data comprised a large part of the discussion, especially data formats and availability. Although the Vermont Agency of Agriculture, Food, and Markets (VAAFM) and the NRCS have farm-specific data on land management and practices, they must aggregate this data before sharing it in order to preserve farm privacy. Unfortunately, very little of these data exist digitally and therefore will require time and expense to organize and aggregate for public use. The appended workshop

summary includes a detailed list of this data. The LCBP will attempt to acquire these datasets, when available and appropriate for this project.

Other datasets discussed in detail were soils, soil phosphorus, use value parcel identification, town parcels, storm-water infrastructure, and land use/land cover. Such datasets exist, could be generated from raw data, or are in production. Notable gaps were crop rotation schedules and locations of tile drainage, which could be approximated by photographic analysis. Other gaps may remain difficult to identify until a clearly defined management objective and a modeling approach are determined.

The group also discussed transboundary data issues and identified data types that would benefit from cross-border integration. For hydrology, stream order classifications at a similar scale as well as a common framework for comparing impaired water designations would be helpful. Common soil groupings with unified drainage, slope, and erosion classes should be developed. Monitoring efforts would benefit from improved online access to Quebec flow gage data as well as standardized laboratory methods for determining bioavailable phosphorus, sediment, and bacteria. Land use/land cover classifications should be identical and based on the same remotely-sensed data. Agricultural data would benefit from standardized aggregation methods, similar phosphorus estimates per animal unit, and better management practice definitions. It is hoped that the ongoing discussion of transboundary data coordination will result in better integration of such datasets and more effective future collaboration between researchers.

Data Publication

The Lake Champlain Basin Program will publish relevant datasets for the Missisquoi Bay Basin Project, as required by Task 1, Subtask 2 of the IJC-NEIWPCC contract. All datasets will be subject to the *Missisquoi Bay Basin Project: Secondary Data Evaluation 2009 QAPP*, as outlined by Task 1, Subtask 2 of the IJC-NEIWPCC contract. Datasets in compliance with these standards will be considered acceptable for use in the task of identifying CSAs and publishable by the LCBP.

The LCBP will publish a list of datasets deemed acceptable for use in this project on its website, after the start of the modeling analysis. Each data entry on the list will be hyperlinked to metadata, so that users can determine the utility of the data for their needs. This data list will be updated as new data is developed or becomes available, so that it is not a static source. Users interested in acquiring data will be instructed to contact the LCBP in order to receive desired data. Large datasets will be distributed by CD or DVD through the mail; small datasets may be emailed to the user. In the case of datasets too large for discs (e.g. LiDAR products, orthophotography), the LCBP will direct users to the original data providers or request a hard drive from the user for transferring files. If requests become frequent, the LCBP will consider hosting data online so that it can be downloaded from the website. Alternatively, the data could be shared through a local clearinghouse such as the Vermont Center for Geographic Information. The website will also provide links and/or contact information for primary data sources of spatial or monitoring data.

Geospatial datasets will be provided in standard GIS formats, for example: shapefiles for vector data, ESRI grid or ERDAS Imagine formats for raster data, and MrSID compressed files or TIFFs for images. Tabular data will be provided as spreadsheets and contain relevant geographic information (e.g. town or county names, subwatershed name or code) for ease in joining to spatial data. All geospatial data will be projected in Universal Transverse Mercator, Zone 18N using the North American Datum. When possible, compatible Vermont and Quebec datasets will be merged and provided as one dataset. This unification is subject to constraints of scale, accuracy, precision, classification, and licensing.

Next Steps

The LCBP will continue to work with partners to gather datasets, as they become available, for the Missisquoi Bay Basin Project with appropriate metadata. The LCBP will also continue to identify transboundary datasets to be unified and help facilitate this process, when possible. The *Secondary Data Evaluation 2009 QAPP* will be used to determine acceptable datasets for this project, which will be made available by the LCBP after the start of the modeling analysis.

Missisquoi Bay Basin Project:
Identifying Critical Source Areas of Pollution

DRAFT Database Summary

Instructions for Use

The "Data Hierarchy" worksheet is set up to mirror the hierarchical database maintained by the LCBP. Column A lists folders organized by functional group. Columns B-E list either subfolders or enclosed datasets (bolded names represent folders). The first set of subfolders (Column B) usually pertains to the geographic extent of the dataset (e.g. Lake Champlain Basin, VT, QC, etc.). Column F contains a short description of each dataset (or group of datasets); G details the source agency; H gives the latest date through which the data is relevant (year-month-day); I gives the date published; and J records the status of the metadata. The "Acronyms" worksheet explains any acronyms used in data descriptions. Questions about viewing this file can be directed to Nicole Grohoski at ngrohoski@lcbp.org or 802.372.3213 x 20.

Data listed in this workbook will be subject to quality assurance standards before becoming available for distribution by the Lake Champlain Basin Program. If you are interested in obtaining the data listed, please contact the source directly.

Data to be Acquired

Other known data yet to be acquired are listed below. Reasons for absence in database include upcoming release dates, cost and licensing, and undetermined frequency and aggregation of data needed for analysis. Other data to be acquired, but not listed below, are detailed in the Summary of the *Workshop on Data Availability and Data Needs*.

- LiDAR for the western basin in Vermont
    - Unreleased products include a seamless DEM and contours
- International boundary imagery (Dept. of Homeland Security)
    - Currently in quality control
- Canadian National Hydrographic Network will incorporate 1:20,000 provincial data for Quebec
    - current data is derived from 1:50,000 photography
    - to be completed in 2010, integration by the USGS with the US NHD may occur after this release
- Canadian data available for purchase from geoboutique.mrnf.gouv.qc.ca
    - Includes: orthophotos (21, 30, 56, or 100 cm – not sure what is available for this region)
    - satellite imagery (1:100,000)
    - digital elevation models (1:20,000)
- 1:20,000 Canadian soil data is available for purchase from IRDA.
- The Canadian Insured Crop Database is available for purchase and may include agricultural parcel locations and current crops (http://www.fadq.qc.ca/index.php?id=2173&L=1)
- Measured data will not be obtained until specifications for their use are determined.
    - Monitoring data (monitoring locations are detailed in the GIS datasets)

- Meteorological data (National Weather Service or Environment Canada Weather Office)
- Stream flow data (USGS or MDDEP)

Data Gaps

Other data that might be useful for the CSA analysis but that do not currently exist are listed below. Additional data gaps may be recognized once the analysis approach and scale are determined.

- Field crop rotation schedules
- Agricultural ditch and tile drainage network
- Municipal sewage and water networks
- Wastewater treatment facility outfall locations

DATA HIERARCHY	SUBFOLDER/FILE NAME	SUBFOLDER/FILE NAME	SUBFOLDER/FILE NAME	FILE NAME	FILE DESCRIPTION	data source	relevancy of data	date published	metadata
C:\Data									
\LCBP									
agricultural									
	basin								
		NoTill_Procedures			written procedure to map suitable areas for no-till crop management	NRCS	NA	NA	NA
		crop&hay_allMisq.shp			corn, hay, and other ag fields in MBB digitized from 2003 orthophotography	NRCS	2003	200801	prelim
		MQ_farmsteads.shp			point locations of farmsteads in US MBB digitized from 2003 orthophotography	NRCS	2003	200801	prelim
		NoTillGood_MQ			fields in MBB that are amenable to no-till agriculture	NRCS	based on SSUF	200801	prelim
		StABay_farmsteads.shp			point locations of farmsteads in St Albans Bay Basin digitized from 2003 orthophotography	NRCS	2003	200801	prelim
boundaries									
	basin								
		LCB_boundary.shp			Lake Champlain Basin extent	LCBP			none
		LCB_counties.shp			US counties clipped to LCB extent	LCBP			none
		LCB_towns.shp			US LCB town names	LCBP			none
		LCB_census_towns.shp			US and Canadian LCB towns	LCBP			none
		LCB_sub_basin.shp			Extent of 7 subbasins in LCB	LCBP			none
		QC_LCB_towns.shp			Quebec towns in the LCB (1996 pop)	LCBP			none
	Canada								
		Census_divisions.shp			Statistics Canada county equivalents (Quebec has municipalité régionale de comté)	StatisticsCanada	2006	2006	prelim
		Provinces_line.shp			Canadian province lines	Geobase	200301	200301	x
		Provines_poly.shp			Canadian province polygons (generic Nunavut)	Geobase	200301	200301	x
		Provinces_poly_dtl.shp			Canadian province and oceanic boundaries (detailed N. islands)	GeoGratis	200807	200807	x
	VT								
		VT_admin_bounds.shp			VT state administrative boundaries (Exec Order #7-95)	VCGI	20071231	20080212	x
		VT_counties.shp			VT county boundaries	VCGI	20071231	20080212	x
		VT_LEPCs.shp			VT Local Emergency Planning Committee Boundaries	VCGI	20071231	20080212	x
		VT_line.shp			VT state outline	VCGI	20071231	20080212	x
		VT_poly.shp			VT state polygon	VCGI	20071231	20080212	x
		VT_RPCS.shp			VT Regional Planning Commissions	VCGI	20071231	20080212	x
		VT_town.shp			VT town boundaries	VCGI	20071231	20080212	x
		VT_villages.shp			VT village boundaries	VCGI	20071231	20080212	x
conservation									
	basin								
		Riparian_Gap_Procedures			written procedures used to create riparian gap files	NRCS	NA	NA	NA
		LCB_QC_pad.shp			CBI/WWF provincially owned protected areas in QC LCB	CBI	1970-2001	200111	x
		LCB_US_pad.shp			CBI/WWF federal/state/local owned protected areas in US LCB	CBI	1970-2002	200111	x
		restorable_wetlands.shp			Prioritization of restorable wetlands in LCB	VT ANR	200808	200702	x
		RiparianGaps_MQ.shp			Gaps in 25' riparian buffers for SGA stream reaches, US MBB	NRCS	2003		prelim
		RiparianGaps_StABay.shp			Gaps in 25' riparian buffers for SGA stream reaches, St. Albans Bay Basin	NRCS	2003	20080902	prelim
	VT								
		RestorWetl_VT.shp			areas classified as restorable wetlands in VT	VT ANR	200808	200702	x

		VT_conslands.shp			VT Conserved Lands Database (w/o proprietary parcels)	SAL	200412	200412	x
		VT_conslands_public_line.shp			line subset of VT CLD (municipal, state, federal, public easements)	SAL	200412	200412	x
		VT_conslands_public_poly.shp			poly subset of VT CLD (municipal, state, federal, public easements)	SAL	200412	200412	x
elev									
	basin								
		QC_LiDAR							
			dem_ewing		0.5-m elevation grid for Ewing Brook subbasin of Pike River	IRDA			
			dem_pike		30-m elevation grid for the Pike River Basin	IRDA			
			LIDAR_LIGNE_DE_VOL.shp		Lines of flight for Ruisseaus Morpions/Wallbridge LiDAR	IRDA			none
			LIMITE.shp		Extent of Ruisseaus Morpions/Wallbridge LiDAR	IRDA			none
		Rock_River_LiDAR			folder containing tiled .tifs of 1.4m DEMs derived from Rock River LiDAR project	SAL		200908	none
			LAS2000_AllPoints_TileLayout.shp		gridded tile layout for Rock River LiDAR data products	SAL		200909	none
			LAS2000_Ground_TileLayout.shp		gridded tile layout for Rock River LiDAR data products	SAL		200910	none
		NEDdem26m			LCB USGS 26.6m 1:24,000 National Elevation Dataset (height in m)	USGS		200208	needs work
	VT								
		contours_100ft.shp			100-foot contour intervals interpolated from USGS 7.5' NED data	VCGI		20021009	x
		contours_50ft.shp			50-foot contour intervals interpolated from USGS 7.5' NED data	VCGI		20021009	x
		vt_dem			VT USGS 26.6m 1:24,000 National Elevation Dataset (height in ft)	VCGI		200210	x
		vt_hillshade			VT hillshade derived from 26.6m NED DEM	VCGI		200210	x
		vthydrodem			VT 10m DEM compliant with VHD (height in cm)	VCGI	2000	200610	x
hydro									
	basin_cartography								
		LCB_huc14.shp			LCB hydrologic unit code 14 designations	LCBP			none
		major_river.shp			LCB major rivers	LCBP			none
		nhd_basinlakes.shp			LCB lakes/ponds from NHD	LCBP			prelim
		nhd_basinrivers.shp			LCB rivers/streams from NHD	LCBP			none
	Canada								
		ondrcarto_l.shp			Ontario drainage system, 1:1,000,000 lines	GeoGratis	200807	200807	x
		ondrcarto_p.shp			Ontario drainage system, 1:1,000,000 polys	GeoGratis	200807	200807	x
		qcdrcarto_l.shp			Quebec drainage system, 1:1,000,000 lines	GeoGratis	200807	200807	x
		qcdrcarto_p.shp			Quebec drainage system, 1:1,000,000 polys	GeoGratis	200807	200807	x
	QC								
		nhn_02og000	many shapefiles (lakes, reservoirs, watercourses (rivers and streams),		1:50,000 National Hydro Network files covering most of MBB	Geobase	199512	200712	x
		nhn_02oh001	many shapefiles (lakes, reservoirs, watercourses (rivers and streams),		1:50,000 National Hydro Network files covering area north of MBB	Geobase	1996	200712	x
	US								
		US_lakes.shp			1:2,000,000 US National Atlas water features (polygons)	Natl Atlas	2002	200512	x
		US_rivers.shp			1:2,000,000 US National Atlas water features (lines)	Natl Atlas	2002	200512	x
	VT								
		basin							
			SGA_MQ.shp		US MBB SGA line data, merged	NRCS/ANR			none
			VT_labeled_rivers.shp		major rivers/streams in VT LCB	LCBP			none
			VT_labeled_water.shp		major lakes in VT LCB	LCBP			none
		state							
			SGA_Data		SGA base data organized into folders by subwatershed (stream reaches, meander centerlines, valley walls)	ANR			none

			WaterHydro_VHD		VHD package of edited NHD files (includes polygon rivers and waterbodies, streams, HUC bounds, code tables)	VCGI	200001	200808	x
			VT_basins_HUC12_line.shp		VT hydrological unit boundaries (12 digit) -line	VCGI	200305	200305	x
			VT_basins_HUC12_poly.shp		VT hydrological unit boundaries (12 digit) -poly	VCGI	200305	200305	x
			VT_basins_HUC8_line.shp		VT hydrological unit boundaries (8 digit) -line	VCGI	200305	200305	x
			VT_basins_HUC8_poly.shp		VT hydrological unit boundaries (8 digit) -poly	VCGI	200305	200305	x
	wetlands								
		VT							
			nwicodes.dbf		NWI codes with enumerated classes and systems				none
			VT_NWI_line.shp		VT NWI quads with codes (line)	VCGI	1983	200403	x
			VT_NWI_poly.shp		VT NWI quads with codes (poly)	VCGI	1983	200403	x
			VT_sig_wetlands.shp		VT Significant Wetland Inventory (generalized type)	VCGI	1975-1978	199610	x
imagery									
	Landsat1991				IDRISI .rst files				none
	Landsat1999								
		p014r029_b123457.img			July 1999 Landsat image of LCB, 30 m, bands 1-5, 7				prelim
		p014r029_b8			July 1999 Landsat image of LCB, 15 m, band 8 (b/w)				prelim
infrastructure									
	VT								
		muni_sewers							
			xsewer.shp		polygon extents for municipal sewage in NWRPC area: x= alburgh, enosburg, fairfax, richford, st albans, or swanton	NWRPC			none
		muni_water							
			xwater.shp		polygon extents for municipal water in NWRPC area: x= alburgh, enosburg, fairfax, richford, st albans, or swanton	NWRPC			none
		VT_dams.shp			Vermont Dam Inventory dam point locations (type and use status)	VCGI	200902	20090226	x
	NY_VT_PCS_locations.shp				NY/VT locations of EPA permitted water discharges extracted from IMS, discharge data can be added (for other EPA data, connect to geodata.epa.gov)	EPA	20090513	20090513	x
lake_champlain									
	bathymetry				LC water depth model interpolated from NOAA chart depth points				needs work
	champlain_contours.shp				bathymetric contours with 10 foot intervals				none
	champlain_depths.shp				NOAA chart depths and points from LCBP data bundle	VCGI		200306	x
	champlain_poly.shp				LC polygon with islands shown	LCBP			none
	champlain_shoreline.shp				LC line outline	LCBP			none
lulc									
	basin								
		LULC_LCB_1992			improved 2001 LULC data for LCB created by UVM SAL (7 classes)	SAL	1992	200703	x
		LULC_LCB_2001			improved 1992 LULC data for LCB created by UVM SAL (7 classes)	SAL	2001	200703	x
		LULC_MQ_corridor.shp			US Missisquoi, North Branch, and Trout River LULC for 800' buffer corridors (14 classes)	SAL	200309	200603	x
	unknown								
		93landcover_scene.mxd							
		basinlu_74			LULC for LCB from Landsat imagery		1974?		none
		basinlu_93			LULC for LCB from Landsat imagery	VCGI	1993?	199801	x
		basinlu_rcl			Reclass of 1993 LULC from 17 to 14 classes		1993?		none
	VT								
		Grasslands.mdb							
			Grasslands		study area: Addison, Chittenden, Franklin, and Grand Isle				
				Crop_DomSoil	Agricultural cover types and dominant soil types (for above)	SAL	2003	200506	x

				Suburban_Pasture	Suburban and pasture fields in above study area	SAL	200309	200603	x
			CropRotation_SoilType		likely crop rotations based on soils for study area	SAL	200604	200604	x
			CropRotationCodes_Domain		crop rotation codes	SAL	NA	NA	NA
			LULC_Domain		Land use/land cover codes	SAL	NA	NA	NA
		CCAP_vt_01_06.img			CCAP Land Cover change analysis (based on 2001-era and 2000-era classifications)	NOAA	1999-2006	20071120	x
		CCAP_vt_06.img			CCAP Land Cover classification for VT (22 classes)	NOAA	2005-2006	20071121	x
		CCAP_vt_96_01.img			CCAP Land Cover change analysis (based on 1995-era and 2000-era classifications)	NOAA	1994-2003	20060508	x
		IMPERV2001.img			Percent imperviousness based on 2001 National Land Cover Database (30 m res)	VCGI	200310	200309	x
	nlcd_legend.gif				National Land Cover Dataset Classification System legend	NA	NA	NA	NA
modeling									
	Missisquoi_River_92_TP_SPARROW					USGS			
		Metadata			metadata files for shapefiles within this folder	USGS	early 1990s	2004	x
		catchments			Catchment areas of reaches with primary P source noted	USGS	early 1990s	2005	in folder
		reaches			NHD reaches at 1:100k with predicted P load (kg/yr	USGS	early 1990s	2006	in folder
		sources&loads.mxd			Shows NHD reaches with line width increasing with total phosphorus load (kg/yr)	USGS	early 1990s	2007	in folder
		states_ne			outline of New England states for reference in .mxd	USGS	early 1990s	2008	in folder
monitoring									
	basin								
		LC_USGS_ECsites.shp			USGS emerging contaminant monitoring sites in VT	USGS	2006-8	200811	prelim
		LC_USGS_HgSites.shp			USGS mercury monitoring sites in VT	USGS	2008	200811	prelim
		LC_VTUSGS_gages.shp			USGS continuous flow gages in VT	USGS	2008	200811	prelim
		LongTermLakeSites.shp			LCBP Long term monitoring sites on Lake Champlain	LCBP	2008	200802	prelim
		LongTermTribSites.shp			LCBP Long term monitoring sites on LCB tributaries	LCBP	2008	200802	prelim
		WWTF_P_Loads_VT-NY-QC.xls			Annually averaged WWTF phosphorus loads, 1991-2008	ANR	1991-2008	2009	prelim
	Missisquoi								
		Sampling_results							
			MRBA_Monitoring_05-07.xls		Raw and summary data for MRBA sites (05-07)	MRBA	2005-7	200901	prelim
		CC_RockRiverSites.shp			Rock River grab-sample sites (DEC 08)	VT ANR	2008	200811	prelim
		MQ_FlowGageSites.shp			Continuous flow gage locations in MBB (USGS, MDDEP)	DEC/MDDEP	2007	200805	prelim
		MQ_PhosSamplingSites.shp			Phophorus sampling sites in MBB (DEC, MDDEP 2002-5)	DEC/MDDEP	2002-5	200805	prelim
		MRBA_05-07.shp			MRBA grab-sample sites in MBB (05-07)	MRBA	2005-7	200901	prelim
		MRBA_08_sites.shp			MRBA grab-sample sites in MBB (08)	MRBA	2008	200812	prelim
		UVM_Hungerford_Sites			Hungerford Brook gaged stream sampling sites (UVM May-Nov 06)	UVM	2006	200709	prelim
	precipitation								
		precip01_02albers.img			LCB 2001-2 mean annual precipitation in inches	SAL	2001-2	200705	x
		precip_91_albers.img			LCB 1991 mean annual precipitation in inches	SAL	1991	1999	x
		precip_mean_albers.img			LCB long-term mean annual precipitation in inches, 57 stations, 1951-1996	SAL	1951-96	1999	x
		region_precip_stations			stations used to create the precipitation images				prelim
		stations_precip_1995.shp			stations with 1995 min, max, and mean precipitation values				none
		updated_precip			cooperative and automatic weather stations in and near the MBB	NWS/MDDEP/EC	200902	200901	prelim
	VT								
		2008_303dPartA_line.shp			VT CWA 303d Part A impaired surface streams	VCGI	200810	200811	x
		2008_303dPartA_poly.shp			VT CWA 303d Part A impaired surface lakes	VCGI	200810	200811	x
		2008_priority_waterBtoG_line.shp			VT Priority Surface streams outside of CWA	VCGI	20081001	20090109	x
		2008_priority_waterBtoG_poly.shp			VT Priority Surface lakes outside of CWA	VCGI	20081001	20090109	x

		stormwater_outfalls.shp			Stormwater outfalls associated with 2004 VT Impaired waters list	VCGI	20050405	20050405	x
orthos									
	2008_NAIP_UTM								
		Essex			contains .jp2 orthomosaic for Essex County: 1 m, color IR, 2008 NAIP	USGS	2008	20080921	x
		Franklin			contains .jp2 orthomosaic for Franklin County: 1 m, color IR, 2008 NAIP	USGS	2008	20080921	x
		Grand_Isle			contains .jp2 orthomosaic for Grand Isle County: 1 m, color IR, 2008 NAIP	USGS	2008	20080921	x
		Orleans			contains .jp2 orthomosaic for Orleans County: 1 m, color IR, 2008 NAIP	USGS	2008	20080921	x
	Hungerford_1ft_prerelease	HBSAWS_n_30_2008_1.sid			Hungerford Brook watershed orthophoto mosaic, 2008 NAIP 1' color	USDA	20080821	2008927	x
	NAIP_VTSP				VT color 1m orthos (Mr. sid)	VCGI	various		in folder
	Rock_1ft_prerelease	RRWS_n_30_2008_1.sid			Rock River watershed orthophoto mosaic, 2008 NAIP 1' color	USDA	20080821	2008927	x
	VMP				Vermont Mapping Program bw 0.5m orthos (Mr. sid)	VMP	various		VMP program
	vtortho_vt011.sid				portion of VT LCB bw ortho mosaic (Mr. sid)	LCBP			none
soils									
	VT_SSURGO								
		20_useful_soilattr			DBFs of 20 most common soil attributes compiled for and by VT	VCGI	based on SSUF	200305	x
		soil_vt005			SSURGO spatial and tabular datasets - Caledonia County	NRCS		20081219	x
		soil_vt007			SSURGO spatial and tabular datasets - Chittenden County	NRCS		20080317	x
		soil_vt011			SSURGO spatial and tabular datasets - Franklin County	NRCS		20080317	x
		soil_vt013			SSURGO spatial and tabular datasets - Grand Isle County	NRCS		20080317	x
		soil_vt015			SSURGO spatial and tabular datasets - Lamoille County	NRCS		20080317	x
		soil_vt019			SSURGO spatial and tabular datasets - Orleans County	NRCS		20081219	x
		blank_soildb_VT_2002.mdb			for the import of county SSURGO data	NRCS			
		soil_vt011_streambankerosion.shp			streambank erosion rankings by soil type, Franklin County, VT	NRCS			prelim
		soil_vt015_streambankerosion.shp			streambank erosion rankings by soil type, Lamoille County, VT	NRCS			prelim
		soil_vt019_streambankerosion.shp			streambank erosion rankings by soil type, Orleans County, VT	NRCS			prelim
		Streambank Erosion Hazard Rule Tree.doc			decision flow to determine erosion susceptibility				
topos									
	Canada								
		indexes							
			NTS_index_1mil.shp		Canadian NTS Index 1:1 million scale	GeoGratis	200804	200804	x
			NTS_index_250k.shp		Canadian NTS Index 1:250,000 scale	GeoGratis	200804	200804	x
			NTS_index_50k.shp		Canadian NTS Index 1:50,000 scale	GeoGratis	200804	200804	x
		topos_250k			1 topo tile at 1:250,000 covering QC LCB	GeoGratis	1988	200509	x
		topos_50k			6 topo tiles at 1:50,000 covering QC LCB	GeoGratis	1985-96 (varic	2004-7 (vario	x
	VT								
		VT_100k							
			_VT_100k_topos.lyr		layer file referencing all VT 100k topos	USGS/VCGI	NA	NA	NA
			DRG_standards.txt		Standards for Digital Raster Graphics	USGS/VCGI			
			TOPOxx.TIF		13 VT topo tiles at 1:100 000 scale	USGS/VCGI	various	200009	x
			Topo_index_100k.shp		Index of 1:100 000 topo maps	USGS/VCGI	200009	200009	x
		VT_24k							
			_VT_24k_topos.lyr		layer file referencing all VT 24k topos	USGS/VCGI	NA	NA	NA
			metadata		metadata files for all 1:24,000 topos in folder	USGS/VCGI	various	199811	some missing

			TOPOxxxx.TIF		234 VT topo tiles at 1:24,000 scale	USGS/VCGI	various	199811	some missing
			Topo_index_24k.shp		Index of 1:24,000 topo maps	USGS/VCGI	200009	200009	x
trans									
	QC								
		NRN_QC_rds.shp			National Roads Network QC roads (paved/unpaved surfaces noted)	Geobase	200211	200706	x
	VT								
		bridge_culvert	shapefiles and PGDB		VT bridge and culvert database of transportation structures (Vtrans)	VCGI	20080616	20080616	x
		VT_e911_rds.shp			E911 road centerlines from 1:5000 photos and GPS	VCGI	200601	200601	x
		vt_pavemt_type98.shp			1998 pavement types for select VT roads	VCGI	19980101	20000101	x
		VT_roadbases_2000.shp			2000 roadway base materials for select VT highways	VCGI	2000	20030311	x
		Vtrans_majrds1.shp			VTrans road centerlines -major and minor roads (less reliable naming than e911)	VCGI	200810	200810	x
		Vtrans_majrds2.shp			VTrans road centerlines -major and minor roads (less reliable naming than e911)	VCGI	200810	200810	x
		Vtrans_rds.shp			VTrans road centerlines -all roads including surface info (less reliable naming than e911)	VCGI	200810	200810	x
C:\Projects									
\MBBP_Phos									
data									
	Basin_bounds	Misq_basin.shp			MBB polygon	LCBP		2008	none
		Misq_basin_line.shp			MBB outline	LCBP		2008	none
		Misq_HUC12.shp			MBB HUC12 polygons	LCBP		2008	none
		Misq_HUC12_lines.shp			MBB HUC12 outlines	LCBP		2008	none
		Misq_mask.shp			rectangle of area surrounding, but not including, MBB	LCBP		2008	none
	Basin_water	Misq_QC_lakes.shp			Canadian MBB waterbodies from NHN	LCBP		2008	none
		Misq_QC_streams.shp			Canadian MBB streams/rivers from NHN (with some border corrections)	LCBP		2008	none
		Misq_VT_lakes.shp			US MBB waterbodies from VHD	LCBP		2008	none
		Misq_VT_streams.shp			US MBB streams/rivers from VHD (with some border corrections)	LCBP		2008	none
	Impaired_water	Misq_303d_streams_partA.shp			US MBB streams designated under Part A of CWA 303(d) 2008	VCGI		2008	none
		Misq_303d_streams_partsAC.shp			US MBB streams designated under CWA 303(d) (part A) 2008 or Vermont List of Priority List of Surface Waters (part C) 2008	LCBP		2008	none
		Misq_303d_lakes_partA.shp			US MBB waterbodies designated under Part A of CWA 303(d) 2008	VCGI		2008	none
		Misq_QC_impaired.shp			QC impaired waters 2005-7	MDDEP		2008	none
	Reference_features	Misq_towns.shp			MBB major towns for cartographic use	LCBP		2008	none

ACRONYM	MEANING
CBI	Conservation Biology Institute
CCAP	Coastal Change Analysis Program
CLD	Conserved Lands Database
CWA	Clean Water Act
DEC	Department of Environmental Coservation (Vermont)
ECWO	Environment Canada Weather Office
GNIS	Geographic Names Information System
HUC	USGS Hydrologic Unit Code
IRDA	l'Institut de recherche et de développement en agroenvironnement
LCB	Lake Champlain Basin
LULC	Land use/land cover
MBB	Missisquoi Bay Basin
MDDEP	Ministère du Développement durable, de l'Environnement et des Parcs
MRBA	Missisquoi River Basin Association
NHD	National Hydrography Dataset
NHN	National Hydro Network (Canada)
NTS	National Topographical System (Canada)
NWI	National Wetlands Inventory (US)
SAL	Spatial Analysis Lab
SGA	Stream Geomorphic Assessment
USGS	United States Geological Survey
UVM	University of Vermont
VHD	Vermont Hydrography Dataset
VMP	Vermont Mapping Program
WWF	World Wildlife Fund

Missisquoi Bay Basin Project:
Identifying Critical Source Areas of Pollution

Workshop on Data Availability and Data Needs
Tuesday, April 28, 2009
10:00 AM – 2:00 PM
Gordon Center House, Grand Isle, VT

Workshop Summary

I. Welcome and Introductions

II. Overview of the Missisquoi Bay Basin Project

Bill Howland, manager of the Lake Champlain Basin Program (LCBP), provided an overview of the Missisquoi Bay Basin Project to date. This workshop is the fourth in the series to guide the identification of critical sources areas of pollution. Previous workshop topics included defining a critical source area (CSA), reviewing possible approaches to CSA identification, and determining short term monitoring needs. The LCBP plans to establish new stream gage and water quality sampling sites as well as meteorological stations in conjunction with the United States Geological Survey (USGS).

This workshop, facilitated by Mike Winslow of the Lake Champlain Committee and Bill Howland, aims to discuss data availability, gaps in existing data, and the coordination of transboundary datasets within the Missisquoi Bay Basin. Participants will be asked to share the types of data their agencies or groups have publicly available for the LCBP and other interested users to acquire. Data requirements for potential models as well as for other research needs will be discussed and later help inform a Request For Proposals for the modeling effort.

III. Data Availability

Nicole Grohoski, LCBP technical associate, presented a spreadsheet of the database of geospatial data currently acquired to support this project. Major sources of data were the Vermont Center for Geographic Information (VCGI), the Missisquoi Areawide Plan, and the Spatial Analysis Lab in addition to water quality monitoring groups who shared sampling locations and parameters. The LCBP will obtain recent orthophotography and LiDAR data soon and looks forward to learning about additional data to acquire. The discussion was structured around different data categories, as outlined below.

Agriculture

At the Vermont Agency of Agriculture, Food & Markets (VAAFM), most collected data is input into spreadsheets and tagged with a Hydrologic Unit Code (HUC), though the scale of this code is not consistent (can be 8-, 12-, or 14-digit). Data that could be aggregated by HUC (depending on time, resources, and current format) and shared include:

- Acreage with VAAFM-funded Nutrient Management Plans (NMPs) with crop type noted
- Acreage in the Conservation Reserve Enhancement Program and contract type
- Farm Agronomic Practice Program annual data (total acres in no-till, cover crop, strip till, etc.)

- Type and number of contracted Best Management Practices (BMPs)
- Medium and Large Farm Operation annual reports (manure transfer and production, animal numbers, number of farms)
- Soil test data (not currently linked to a HUC code and not updated beyond 2007)
- Medium and some Small Farm Operation surveys (farm problems, silage, manure) (available at the 8-digit HUC level)
- Acreage of aeration or injector usage
- Complaints and violations of Accepted Agricultural Practices (linked to 17 basins statewide, not HUC code)
- Number of farms with written and/or updated NMPs
- Annual totals of fertilizer sold by county
- Groundwater nitrate, pesticide, and herbicide concentrations from sampled wells

The Natural Resources Conservation Service (NRCS) can share the following data:

- Crop insurance data, though these can be unreliable
- Watershed planning information
- Type of the BMPs supported by the NRCS (currently not easy to access)
- Areas of concern located by photo-interpretation (gully erosion, livestock fence issues)
- 2008 field locations and crop type in the US Rock River watershed (photo-interpretation)

The University of Vermont Soil Test Lab has soil phosphorus data than can be aggregated by the county, zip code, or town that the farm is in. The sampling methods for these tests vary and results exist electronically as far back as 1992. The test data is accompanied by a field questionnaire, which includes optional reporting on field acreage and cropping. It would also be possible for the lab to consider phosphorus trends by soil type. Additionally, private consultants such as Bourdeau and Bushey have NMPs with data about soils, crops, animal numbers etc. This data is confidential but could be aggregated and shared; individual soil phosphorus tests would require release forms from farmers.

In Quebec, the Department of Agriculture aggregates farm census data such that each grouping has a four-farm minimum. Soil phosphorus data can be accessed by farm postal codes and NMPs are mandatory. Crop insurance plans require digitized farm boundaries which farmers often opt to share.

Boundaries

There is a statewide initiative being led by VCGI to create a parcel boundary dataset. This information could be useful in conjunction with land cover data. As of now, very few towns in the Basin have digital parcel boundaries, though the Natural Resources Conservation District intends to do this.

Conservation

Extents of forestry value-use parcels are being mapped for Franklin County. The rare, threatened, and endangered species dataset is used to guide management decisions and could be combined with model outputs to locate areas of special concern. Internally, the ANR has a more detailed and sensitive version of this dataset that may be accessible in a buffered format (sites of archaeological interest are similar).

Hydrography

In rural areas, locating tile drainage would help to understand the hydrologic network and modifications to it. Some drainage might be visible in photographs or extracted from a summer vegetation index, since its implementation is unregulated and undocumented. Its presence could also be predicted by considering land cover and soil drainage characteristics.

In urban areas, the ANR is compiling information this summer about stormwater infrastructure and practices as well as performing some sewer mapping. Impervious surface recognition will be automated in areas with LiDAR data by the SAL. Locations of stormwater permits and discharge concentrations should also be added to the database. The Environmental Protection Agency (EPA) has an online national database of water treatment plants.

Land Use/Land Cover
The National Oceanic and Atmospheric Administration (NOAA) Coastal Change Analysis Program developed a land cover dataset in 2006 and performed change detection analysis. The SAL will also complete land cover mapping for areas with LiDAR data.

Photography
High resolution aerial photos, taken at oblique angles, have also been collected by the Agency of Natural Resources (ANR) over the past three years. These cannot be georectified, but they can be used as a reference for identify CSAs. Historical photos dating back to the 1930s could be scanned and then compared digitally to current photos.

Soils
In Franklin County, soils were classified in the 1940s and 1950s and are not accurate. The NRCS has sampled along the Rock River corridor to better characterize soils and establish a native phosphorus level.

Other Data
Geological information is available through the Vermont Geological Survey. The USGS can provide phosphorus and nitrogen predictions from a 1995 SPARROW model. They also have an enhanced EPA point source database and related nutrient load estimates. National assessments of both streambed sediment quality and agricultural fertilizer and manure application are available. The USGS has estimates of water use by census tract, though this does not include agricultural use, as well as information on where sewer lines extend.

IV. Data Gaps

Mike Winslow facilitated a discussion to identify other data that could be useful for the critical source area analysis. Determining the scale of the analysis would help to understand what assumptions can be made and what data would be helpful to collect. For instance, if we are trying to determine critical subbasins, then the current hydrography resolution is adequate; however, if we are looking for critical fields, LiDAR-derived hydrography would be necessary.

There is currently no data on field crop rotation schedules, which would be useful for understanding land use over time. Depending on the scale of modeling, this information may not be necessary or assumptions may be suitable. If rotations are done between fields, then there is little change in production at the farm level. However, recent data has shown that although the acreage of fields has remained the same, the production of corn and hay has changed, indicating crop rotation. NMPs

require a universal soil loss equation evaluation, which includes a planned field rotation in order to meet tolerable soil loss requirements.

Extending the hydrologic network to include tile drains and ditches and then comparing this network to historical photos would help determine changes in the system.

The Phosphorus Index establishes a relative understanding of field-level transport and source, but that info is owned by the farmer and not available for this effort. It probably does not make sense to aggregate this data because of the way that it is calculated, though aggregating based on land-use type might make sense. Grouping these field-based values can also obscure hydrographic boundaries. Quebec uses a quantitative index which might be helpful in validating phosphorus estimates.

V. Transboundary Data

Bill Howland led a discussion about datasets that would benefit from transboundary data unification and what this process might involve. Access limitations and differences in data type, accuracy, precision, and classification between Quebec and Vermont were considered. It is important that datasets be consistent for modeling, but this data should also be created for use in future, unrelated projects. Considerations were based around different data categories, as outlined below.

Agriculture

Land cover data in Quebec differentiates between crop types and is available in an aggregated basis. Using standard aggregation methods would help with transboundary comparisons. Animal unit data is detailed in Quebec but only available for dairy cows in the U.S.; each country estimates phosphorus outputs per animal unit differently and manure exportation is also an important consideration. NMP requirements and BMP expectations are also not equivalent across the border.

Hydrography

Currently, public hydrography data is at different scales on either side of the border. Quebec is in the process of adding 1:20,000 data to Canada's National Hydrographic Network, and the USGS plans to merge this data with the U.S. National Hydrographic Dataset. The Missisquoi Bay Basin will hopefully become a priority in this national endeavor. Alternatively, the IJC might consider joining U.S. data with the current 1:50,000 Quebec data sooner. If necessary, a contractor may need to edge match datasets for modeling. Having accurate subwatershed boundaries derived from the same elevation model (or ones of the same precision) will be important. Another goal is to standardize stream order classifications and understand how surface water impairment classes relate across the border (Quebec uses a scoring index, but Vermont determines if a stream reach meets defined standards for different types of pollutants).

Land Use/Land Cover

The 2001 SAL dataset covers the entire Lake Champlain Basin, but the 2006 NOAA dataset does not. It is possible to complete a new classification using a common image, so that there is consistency for modeling. Cropping differs from that of the U.S. so creating a common classification system is important.

Soils

Soil surveys differ significantly across the border; on the U.S. side, map units do not capture the true variability of soils in river corridors. Common slope, erodibility, and drainage classifications are needed. The Quebec survey was done in 1991 and has a different resolution than U.S. data. The NRCS may be able to sample soils across the border in order to make comparisons between soil series classifications.

Water Quality Monitoring
Quebec flow gage information is not currently available online; it would useful to have one webpage where monitoring data for the entire basin is available. There has been interest in this from the Quebec side – perhaps the IJC could help in this process. More information about phosphorus loads, by stream segment or subbasin, is also an ongoing goal. Currently, Quebec uses a different test for phosphorus concentration which can be related to Vermont tests, but might be advantageous to harmonize. Considering bioavailable phosphorus and sediment concentrations may also be important. There are also differences in bacteria monitoring and beach closure policies.

Other Data
Right now, the orthophotography cuts off along the border, but the new Department of Homeland Security imagery should correct this issue. Quebec has a comprehensive roads layer similar to the E911 data, though whether or not it contains information on road surfaces is unknown. E911-type point data referencing building locations would be helpful in generating a basin-wide density surface. This data could theoretically be used in conjunction with sewer line extents to determine where septic systems are located.

VI. Next Steps and Adjourn
Bill Howland thanked everyone for attending and providing input. This project database will continue to grow and become more comprehensive in the coming months, based on the information learned here. After datasets are reviewed in accordance with quality assurance protocols, the LCBP will make this data available to the public. The LCBP is considering how to distribute large datasets and how to inform people as new or updated data becomes available. It will notify attendees of the workshop series of data publication when the time comes, as well as provide workshop summaries and attendee lists online.

Workshop Attendees

Name	Organization
Caroline Alves	Natural Resource Conservation Service
Erik Beck	Environmental Protection Agency
Alexandra Dichter	Environmental Protection Agency
Laura DiPietro	Vermont Agency of Agriculture Food & Markets
Sally Flis	Bourdeau Brothers
Lula Ghebremichael	University of Vermont
Alexandra Haselton	VT EPSCoR Streams Project
Bill Hegman	Middlebury College
Buzz Hoerr	VT Citizens Advisory Committee, LCBP Education & Outreach
Richard Kiah	United States Geological Survey
Aubert Michaud	Institut de Recherche et Développement Agroenvironnement
Julie Moore	Vermont Agency of Natural Resources
Lin Neifert	United States Geological Survey
Jarlath O'Neil-Dunne	University of Vermont Spatial Analysis Lab
Kip Potter	Natural Resource Conservation Service
Keith Robinson	United States Geological Survey
Reed Sims	Natural Resource Conservation Service
Eric Smeltzer	Vermont Agency of Natural Resources
Joel Tilley	University of Vermont Soil Test Lab
Carl Waite	Vermont Monitoring Cooperative
Mike Winchell	Stone Environmental, Inc.
Mike Winslow	Lake Champlain Committee

Lake Champlain Basin Program Staff:
Nicole Grohoski, Bill Howland, Kris Joppe-Mercure, Meg Modley