PAMAGIC Pennsylvania Mapping and Geographic Information Consortium

Report of Budget Workshop
In support of Water Data Initiative

December 17, 2014

Summary

Regulatory development in the area of water resources has produced dramatic improvements in quality and in public awareness of the water resource. The same process has divided how we view and manage that resource; programs proliferated and we have a highly complex and dispersed regulatory structure. It is also arguable that structure is built to manage problems we have solved rather than the problems we can envision for the future.

One clear consequence of the program proliferation is that we do not yet have a single frame of reference to which data about sites and events may be associated, but rather many data collection efforts for program-specific data referenced separately and spatially incompatible. This results in inefficiencies and duplication of effort, data unsuitable for holistic analysis, and a system incapable of utilizing the new technologies which might advance our understanding and management of water in the Commonwealth.

PaMAGIC suggests that the process of creating a singular water base map would serve as the essential first step to improve management and regulation of the water resource by clarifying just who is collecting which data. The mandate to establish and maintain such a unified database is already indicated specifically in Section 3117 of Act 220 of 2002 – the State Water Planning Act.

The workshop summarized herein advances the discussion and technical background for creation of a singular water base map.

Report Contents

I. Purpose – To generate initial estimates of costs and broad outlines of methodologies required to produce an integrated water base map by 2019. The workshop supported PaMAGIC's Integrated Water Data Initiative objectives:

- Designed as default and **authoritative water data basemap** allowing for collaboration across organization lines.
- Spatially compatible with **current mapping** such as PAMAP imagery and LiDAR.
- Includes man-made **stormwater infrastructure.**
- Provides **reference basis** for regulatory and analytical studies, modeling and data.
- Serves as the basis for **data catalog** applications and regulatory simplification.

II. Workshop Design – The group spent the first two hours reviewing the same set of base information and results from past and current projects upon which to base their later discussions. Projects discussed included two projects from other states to create local resolution National Hydrography Data (NHD), regional data development projects from PA, and general cost information from past and present methods. Appendix A contains thumbnail information from the projects discussed.

Once briefed, attendees broke into teams of 4-5 individuals and worked independently to:

- Develop a preliminary report of recommended methodology and estimated cost breakdown for development of a single, authoritative surface water basemap for PA**.**
- Create a brief analysis on key factors, priority data sets, and relative costs for integration of state agency data to the authoritative base map.

  Fixed assumptions:
  - Complete by 2019
  - Watershed boundary dataset integration is needed
  - Set as a priority through the Geospatial Advisory Board
  - Collaboration by multiple agencies and organizations is expected
  - Cost is a factor but not a limitation
  - Costs are truly rough estimates (AKA guesswork)
  - The resulting data will be the standard for state and local governments, and integrated into existing and future applications and systems
  - We do not understand all of the applications of the data

  Discussable assumptions:
  - Use of the NHD Data Model? If not, what alternative?
  - Use existing PA Map LiDAR and imagery?
  - Horizontal accuracy requirements?
  - Should we be collecting other data at the same time? (i.e. land use, new LiDAR, etc.)

III. Breakout Summaries – *listed here in the order presented; group membership listed in Appendix B.*

<u>Group 4</u>

- **Create a test site – small, intensive testing**
  - Will help determine costs in smaller area
  - Lancaster chosen
    - Old LiDAR and new LiDAR – 2008 and 2015
    - Has varied geology and urban vs rural (20-50 tiles) – also something with public appeal (political importance and geographic variance, Bay Program)
    - Political champion potential and related support (take project on the road)
    - Progressive GIS community, academia, consulting

        - High quality County hydrography layer
        - Consider Little Conestoga Watershed; other recent USGS studies there
    - Methodologies/Uses
        - **True need perhaps just a spatially accurate base others can build upon**
        - Try ANF methodology and tweak as needed then replicate across rest of tiles – use IUP experience with methods of flow path extraction
        - Use NHD behind it – helps with political backing (federal reporting)
        - Parlay into appropriate uses that the results will fulfill
    - Cost not estimated

Group 2

- Focused on data requirements rather than methodology
    - Broken down into 1:24000 vs photogrammetric 1:2400 vs LiDAR-derived
    - Different user groups may need different data no matter which method
    - **Need a maintenance program/protocol no matter what method or accuracy.**
    - Multiple data layers with varying resolutions and costs by watershed might be acceptable, so one pilot may not be sufficient statewide.
- Key Factors
    - Of all the various factors (funding, regulatory, IT and systems, integrated management opportunities, municipal variability, more) Politics is #1 and Public Opinion #2 in whether we can be successful
    - Policy is directly related to funding and development/maintenance, and time has fragmented regulation and management, thus funding. Even single agencies are fragmented within themselves.
- Priority Data?
    - **"What app are you going to build with all the data?"**
    - A networked water resource map could tie together and be enhanced by many existing and important data sets – gauge network, intakes/outfalls, geology/soils, Chapter 93, stormwater networks (MS4), roads/bridges/infrastructure, wetllands/buffers
    - Funding Sources are as varied as the priority data listed above, and we are certainly wasting opportunities for joint action on management of the water resource
    - We are wasting money at least through uncoordinated mapping.

Group 1

- Group approach started with stakeholder and funding source analysis
- **Trunk and branch approach – data trunk serves all, branch applications update data trunk**
    - Electronic data submission requirements support this
    - Does this eliminate regular overall updates; refer to Group 2 maintenance comment
- Current problem – inflexibility of NHD model; can NHD be modified within the same model?
    - Look at Virginia model (1:10000 improvement of existing NHD)- short-term fix?
    - **Acknowledge that real solution comes from looking 20-40 years ahead**
    - Modify NHD system by using model but getting more accurate data into it
        - Needs to be relatable and understandable (similar to Group 1)
        - Stakeholders needs to be able to use it and convey into funding support
        - Needs to be usable at the local level for a wide variety of needs
    - Acknowledge that some of this has to come from bottom up as a business model
        - Build customer demand locally/first investment is public information!
        - Demand for NHD model simplification and citizen engagement?
        - Privatization and monetization of applications?

Group 3

- Go big or go home! Group focused on what it will cost and how to budget for it.
- **Imagery (many bi-products and supporters) - $5 million statewide**
- LiDAR – needs to be updated only where landscape has changed - $4 million
    - Comes out ahead if use is for hydrology
- Integrating state agency data
    - $400,000 - $500,000 if we can agree upon the source
        - Might really be undeterminable
        - First agencies tougher, some more costly
- Rely as much as possible on PA Map specs and keep that consistency
    - i.e. 4-5 foot horizontal accuracy, 1.3 meter post-spacing etc.
    - Stakeholders still similar – PEMA, DEP, DOT, DCNR etc.
    - Coordination Council – get it to state budget like PA Map was
    - Costs quoted above pretty solid if sticking with PA Map specs
    - Do like PA Map in 3 year cycle – $1.3 million annually
- Annual maintenance – QA/QC costs need to be budgeted for
    - $150,000 - $200,000 per year
- Needs to be on renewal cycle; 3 years for imagery; ?? for LiDAR
- Diverse end users with a political component
    - **Need a focused message for political and therefore monetary support**
- Who is the holder of the data?
    - Infrastructure vs stewardship

IV. Discussion and Recommendations – *Although groups had all been tasked the same, the reports above show how different their discussions were. This discussion presents their cumulative results in light of the workshop goals:*

- *Develop a preliminary report of recommended methodology and estimated cost breakdown for development of a single, authoritative surface water basemap for PA.*
- *Brief analysis on key factors, priority data sets, and relative costs for integration of state agency data to the authoritative base map.*

Timeframe ok at 2019; i.e. – if given priority and seed money in the 2015-16 budget, improved data can be generated and existing data integrated in that time.

No price estimate is possible until we further understand and establish the scope of the project. In the initial briefing we placed outer bounds, somewhat facetiously, on full statewide data integration at between $50M and $1B in addition to what we spend today. A framework data set that includes the natural headwaters flowpaths could be developed for much less than $10M, but the man-made stormwater flowpaths, agency data integration, and process change are utterly undefined.

General discussion supported the **need for a $5 million initial budget**, and mentioned a technical budget of $1 million and $4 million to lobby and educate the public. Although perhaps exaggerated, this reflects the idea that public involvement and support are necessary for such an undertaking. The importance of the water network relative to the transportation network, which now requires $2.5B/year supplemental investment, makes engaging the public possible.

In a topic related to public involvement, **the group did not recommend any permanent funding stream** but had some limited discussion on possible sources for the larger project and data maintenance, including: bond issue, bottled water tax, and stream-naming rights.

The **pilot project in Lancaster County** should be defined as soon as possible. It can clarify questions raised or unanswered in the many existing "demonstration projects" to satisfy the scoping needs and to shorten the project cycle as compared to starting fresh; Appendix A lists those considered in this workshop. Concentrated pilots and analysis of existing regional projects is perhaps the only way to justify the ongoing waste from uncoordinated data development. It will be important to:

- Maximize the use of "ancillary data/existing data" illustrated in Appendix A in the new process.
- Testing flow path creation in Lancaster County with both new and existing LiDAR could validate the use of the existing LiDAR data statewide, thus shortening the project and reducing expenses.
- Include an initial study (perhaps a competition?) on simple network models other than NHD or even area-based models that might support data integration and maintenance as a base map for use in NHD and more operational models.

The variety of existing support data (from regional projects) makes it logical to **establish a *minimum* data production standard to ensure regulatory fairness** rather than a single standard production method. This concept is also supported given the variability of geology, terrain, and population density across the Commonwealth. A robust maintenance plan will accommodate ongoing updates and technological advance, both of which would alter maps from some initial production standard anyway, also making a uniform production method less important.

Regarding **the use of some simplified data model that might support later conflation to NHD** and other models, it is worth noting the current USGS Study titled, *"Assessment of Business Requirements and Benefits of Enhanced Geospatial Water Data".* Despite the fact that they are about two years out of ideal synchronization, the Water Data Initiative and the USGS Study can inform and support each other explicitly if that is part of the project design.

The entire group was firm in the notion that **no statewide project should be undertaken (pilots and project scoping excepted) without maintenance and update defined**. Crowdsource (volunteer-generated information) should be a component of the maintenance plan.

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Appendix A – Project Experience Thumbnails

NJ Local Resolution NHD Development 2002-2012

- NJ Land Area about 7,500 sq. miles
- Great collaboration with NHD Program/USGS Partner
- Photogrammetric compilation, including water bodies
- Total contractor costs (2002):
  - $1.6 M Land use, streams, water bodies
  - $300K NHD Conflation
  - $140K NHD Matching/Refinement
- 10 years later have stable dataset, other agencies finally recognizing need
- Interested in adding LiDAR flowpaths upstream of perennial
- "NHD only way to go for agencies with federal reporting needs"

PAMAP Perspective 2003-2010

- $25 Million present version
  - *-unique pre-Marcellus basemap!*
- Est. $15 Million to latest specs
- Still a three-year renewal cycle recommended

Mercer County Demo 2007-2008

- $47K without NHD Conflation, included photo interpretation comparison
- Demonstrated complexity and variety of processing decisions
- Demonstrated urban dilemma

ANF Flow Accumulation Study 2009-2010

- $40K without significant field checks
- No regional source of culvert data
- Painful to manage two data sets (stewardship issue)

NYC Watershed 2009-2011

- Data Model considerations – NHD, NHD Plus have limitations for many applications
- Stormwater conditioning of point cloud goes first
- Horizontal accuracy of stream location - 3m saves 80% vs 1m
- Vertical connectivity/detail a bonus from LiDAR delineation

IUP DATA Modeling and Management Trials

- Sheer quantities of data matter
- Modeling method matters for consistency and file size, file management
- Don't reinvent the wheel, but always do your own homework

PA Agency-related Data Development

PEMA/E911 Funded Data Development 2005-present

Limited attributes

Vertical enforcement

Many and varied projects over the decades

DOT Bridge/Culvert Mapping 2010-2014
- Culverts useful for conditioning LiDAR flowpaths
- Regional MPO projects had differences in process, product, capabilities
- Some automation possible in identifying culvert locations
- Interested in upstream flow paths

Bureau of Forestry Stream Realignment 2013-present
- 2M acres of state forests
- Property and compartment boundaries
- Screen digitized

Fish and Boat Commission Unassessed Streams 2010-present
- Field studies on native trout occurrence
- Potential field validation of stream type
- Student and volunteer partners

DEP NWI Update
- Not planned/expected (ever)
- Promotes potential for permit data inclusion
- LiDAR flowpaths useful product

DEP Oil and Gas Permit Operations
- Dramatic potential benefits with digital data acceptance
- Wetlands and streams from alternatives analysis

Indiana Statewide Local Resolution NHD 2012-2015
- Statewide development, 3-year project
- 36,000 sq mi; data development from existing LiDAR
- Some protocols derived from earlier NC experience
- Statewide product is local-resolution NHD; single contract
- 6-acre catchment (from LiDAR) “pour-point” as upper point of NHD streams
- 15-person state committee to guide project
- Low-cost labor source (prison)
- Did not study data integration costs
- Pilot phase(s) recommended
- NHD model will not support many local uses

Appendix B– Workshop Participants

Moderators

Mike Bialousz	DCNR GIS, Harrisburg
Eric Jespersen	PaMAGIC, Drums

Group 1

Robert Wilson	Institute for Mine Mapping, Archival Procedure and Safety, Indiana
Bob Pliszka	JMT Technology Group, Philadelphia
Jay Lynch	Meiser and Earl, State College
Eric Moore	West Branch Regional Authority, Muncy

Group 2

Scott Hoffman	USGS Water Science Center, New Cumberland
Mike McGeehin	Dewberry, Philadelphia
Harry Wise	DEP Oil and Gas, Harrisburg
Dave Gilbert	GeoDecisions, State College

Group 3

Chris Holmes	T3 Global Strategies, Pittsburgh
Seth Pelepko	DEP Oil and Gas, Harrisburg
Tom Kulakowski	Fish and Boat Commission, Pleasant Gap
Tom Denslinger	Self-employed, Harrisburg
Andy Pickford	BAE Systems, Mount Holly NJ

Group 4

Gregory Mirth	Institute for Mine Mapping, Archival Procedure and Safety, Indiana
Marcie Dunn	NRCS, Harrisburg
Stew Beattie	DEP Oil and Gas, Harrisburg
Scott Williams	Lycoming County GIS, Williamsport