

**New Hampshire Broadband Mapping and Planning Program
University of New Hampshire
September 2011 Data Submission**

I. Data Description

In accordance with the effective NTIA guidance for Round 4 data submissions, the New Hampshire Broadband Mapping and Planning Program (NHBMP) submitted the data set described below and associated documents to NTIA in September of 2011.

NH_SBDD_2011_09_30.gdb – file geodatabase containing feature classes for:

Feature Class	Number of Records
BB_ConnectionPoint_LastMile	0
BB_ConnectionPoint_MiddleMile	109
BB_Service_Address	17
BB_Service_CAInstitutions	3,778
BB_Service_CensusBlock	95,452
BB_Service_Overview	0
BB_Service_RoadSegment	33,770
BB_Service_Wireless	37
State_Boundary	1

In total, almost 133,200 individual data records on broadband availability were submitted by New Hampshire. Collectively, these records describe availability as reported by 39 broadband providers in the state, representing an increase of 8 participating providers from the Spring 2011 submission. In addition, the NHBMP submitted data on 3,778 community anchor institutions, an increase of 402 records from the prior submission.

II. Provider Participation

The NHBMP has identified 63 broadband providers in the state. As noted above, 39 of these providers actively participated in the program for the Fall 2011 cycle. The participating providers include:

Provider Name	Technology
1. Argent Communications*	Cable, Fixed Wireless
2. AT&T Mobility LLC	Mobile Wireless
3. Charter Ring Communications	Cable
4. Comcast Cable Communications, LLC.	Cable
5. Covad Communications Company	DSL, Middle Mile
6. Cyberpine Cooperative, Inc.*	Fixed Wireless
7. Dunbarton Telephone Company, Inc.*	DSL
8. Earthlink Business (aka One Communications)	DSL, Middle Mile
9. FairPoint Communications, Inc.	DSL

10. Freedom Ring Communications, LLC. (dba BayRing Communications)*	Middle Mile
11. G4	DSL, Middle Mile
12. Granite State Communications (aka Granite State Telephone)*	DSL, Fiber
13. Great Auk Wireless**	Fixed Wireless
14. GWI (aka Biddeford Internet Corporation)	DSL
15. HughesNet	Satellite
16. IAMNOW.net	Fixed Wireless
17. Lakes Region Wireless	Fixed Wireless
18. Level 3 Communications	Fiber, Middle Mile
19. Lighttower Fiber Networks*	Middle Mile
20. MetroCast*	Cable
21. OTT Communications	DSL, Middle Mile
22. Oxford Networks*	Middle Mile
23. Sidera Networks, LLC	Middle Mile
24. SkiSat*	Cable
25. Sovernet Communications*	DSL
26. Spectra Access	Middle Mile
27. Sprint	Mobile Wireless
28. StarBand Communications, Inc.	Satellite
29. Tamworth Wireless Cooperative*	Fixed Wireless
30. TDS Telecom	DSL, Fiber, Middle Mile
31. Time Warner Cable	Cable
32. T-Mobile	Mobile Wireless
33. Topsham Communications*	Fiber
34. U.S. Cellular	Mobile Wireless
35. Verizon Wireless	Mobile Wireless
36. Wave Comm, LLC	Fixed Wireless
37. WildBlue	Satellite
38. Wireless LINC of NH and VT (f/k/a NCIC)	Fixed Wireless
39. WiValley	Fixed Wireless

* Provider did not submit revised data for this round. Data collected for the March, 2011 submission was reported as still being effective. All previously submitted data was reprocessed using Census 2010 geography.

** Provider's data submission was incomplete or contained errors. Consequently, data included in NHBMP submission represents only part of their coverage footprint.

The following 14 providers were identified during prior data submission rounds, but have remained unresponsive to multiple requests to participate in the NHBMP.

Provider Name	
1. Boston Telephone	2. Broadview Networks
3. CityVoice	4. DSCI
5. ITLLC (f/k/a Russet Communications)	6. NCIA
7. NHvt	8. Qwest Communications

9. RadiusNorth	10. segTel, Inc.
11. SkyWireWifi (f/k/a Akers Pond)	12. telJet
13. The Granite Connection	14. Turnpike Technologies

Finally, the 7 providers listed below were identified during the current submission round from analysis of the FCC Form 477 data (filings through February, 2011). The NHBMP has contacted these providers, but to this date the providers have either been unresponsive or data has not been received.

Provider Name	
1. Airespring, Inc.	2. BergNet
3. Global Crossing North America, Inc.	4. New Edge Network, Inc.
5. NextWave Wireless, Inc.	6. PaeTec Communications
7. Telovations, Inc.	

The NHBMP is continuing its efforts to identify active service providers in the state beyond those listed above. Preliminary review of speed tests submitted through the project web site has identified additional providers that may be offering broadband service but are not yet represented in our current listings. Additional analysis will be conducted to identify which of the recorded entities represents new providers, and not providers doing-business-as a currently identified provider, providers operating private networks, out-of-state cellular service providers, and/or providers that are a remnant of mergers.

III. Data Collection and Integration

A. Primary Data Collection

Data Acquisition

Primary data was collected directly from the service providers. The NHBMP first developed a set of guidance documents based on NTIA specifications, and distributed those to the individual providers. Once the guidance was disseminated, NHBMP staff followed up with providers via phone/email to encourage participation and address questions, as required. Typically, multiple communications were required to ensure a complete data submission was received.

Data Pre-Processing

To support the data mapping and integration efforts, the following base data sets were acquired and/or retrieved from the NH GRANIT state GIS clearinghouse archives:

- State and town boundaries (based on 1:24,000 USGS DLG files);
- 2001 Land Cover data set (derived from Landsat TM imagery);
- 2010 TIGER Census Blocks;
- 2010 Census MAF/TIGER Road Segments; and
- 2009 USGS National Elevation Data set (NED).

All required NTIA fields were added to the census block and road segment data sets. In addition, the road segments were processed against the census blocks to populate two fields used internally – the left block ID and the right block ID associated with each road segment.

Data Processing and Integration

The broadband availability data was processed and integrated using a suite of GIS tools and procedures, depending upon the format and content of the data submitted by the individual providers. Generally, the processing involved executing one or more of the following steps:

- Scanning and georeferencing paper maps and using the results as a visual reference to select out corresponding features from the project base data sets.
- Geocoding addresses using both an internal locator based on the TIGER road segments, and where required, the ESRI TA_BatchAddress_US subscription service; where NDAs were in place, geocoded points were then used to identify the host census block (if ≤ 2 sq. mi.), or the TIGER road segment in closest proximity but within 500' (if the host census block was > 2 sq. mi.). Related note(s):
 - In some cases, the selection of the TIGER road segment in closest proximity to the geocoded point yielded a pattern of disconnected road segments with broadband service.
- Using ArcGIS Network Analyst to select road segments within a cumulative distance of 18,000 lineal feet from central office locations. The selected segments were subsequently used to identify adjacent census blocks ≤ 2 sq. mi. or used as features to quantify coverage along census blocks > 2 sq. mi.
- Processing KMZ image files, using the bounding rectangle to establish interior georeferencing, and then converting the georeferenced image to polygons.
- Utilizing Cellular Expert ArcGIS extension to generate a signal prediction surface for wireless providers submitting antenna locations (and associated data). Related note(s):
 - Working with UNC-Raleigh and a NH-based fixed-wireless provider, the data processing models previously utilized were refined to take into consideration visibility parameters (in addition to vegetation and topography).
 - A -86 DB threshold was used to define service areas of fixed-wireless providers.
 - In processing the fixed-wireless polygon data, exterior polygons, e.g. those outside of the main coverage footprint, that were $< .125$ sq. mi. were eliminated. Interior non-coverage polygons were not eliminated.
- Processing satellite coverage footprints to incorporate the Utah shadow analysis (as posted on PBWorks).

Data Processing Issues

The NHBMP encountered a number of issues in processing the broadband data for the state. These include:

- Most providers submitted data only on areas that are currently served, and not on areas that could be served following the NTIA guidance. This contributed to the pattern of occasional disconnected rural road segments with broadband service.

- Reliance on the TIGER road segments likely yielded overstated broadband coverage in rural areas. A single rural customer address, when geocoded, could result in a long street segment being selected as part of a provider's coverage area.
- Most providers did not submit typical speed data. As the volume of our speed test data set grows, we will explore using this information to estimate typical speeds.
- Fixed wireless providers frequently did not deliver the full set of antenna parameters required for the signal propagation software, and required multiple requests for data followed by requests for clarification of those data submitted. In some cases, data was missing on exact antenna patterns (which in some instances was also unavailable from the antenna manufacturer), and/or on detailed power information specific to an antenna (e.g. power information provided on the host tower only). In these situations, default values were used to run the software. As reported in the previous section, our refinement of the data processing models has yielded improved results despite missing detailed power information.
- Elevation data submitted by middle mile providers was typically reported relative to sea level, not relative to grade.
- Providers who are knowledgeable and experienced with the original 2009 NTIA NOFA and corresponding clarification documentation provided information appropriate to that data schema / model, and modifications to these in June 2011 resulted in additional follow-up required to achieve a complete data submission.
- Migration to the 2010 census data provided some processing challenges. Crosswalking strictly via attributes tables between the 2000 and 2010 vintage data sets was difficult, as we encountered cases where sections of 2000 census blocks were appended/split into 2010 blocks. As a result, the NHBMP opted to use spatial overlays rather than a crosswalking approach to convert provider data reported based on 2000 geometry to the 2010 standard. All data submitted to NTIA in the Fall 2011 data round was processed against 2010 geometry (census blocks and road segments), regardless of whether the provider submitted data previously or delivered updated information for this submission.
- As a result of reprocessing the data against 2010 geometry, coverage footprints occasionally changed even when providers did not report new data. Some blocks that were formerly greater than 2 square miles were split into smaller census blocks, resulting in coverage that was previously reported in the road segment feature class now being reported in the census block feature class. The opposite situation also occurred, in that some formerly smaller census blocks expanded to cover an area larger than 2 square miles, resulting in the data being reported at the census block level rather than the road segment level.
- For providers who submitted address records, the first process was to geocode those addresses to the 2010 TIGER road segments. For any ungeocoded addresses, the program next utilized ESRI's online geocoding services. Any remaining, ungeocoded records were geocoded manually using Bing. In some instances, records continued to remain uncoded after this three-phase approach. We have identified a number of issues with some of the resulting geocoded data:
 - In reviewing addresses geocoded against ESRI services, we discovered a small number of records that did not appear to be correctly positioned. The incorrect positioning was confirmed by viewing the geocoded points relative to both TIGER road data and by referencing Bing. In some instances, the geocoded

points were positioned a significant distance away from any mapped road segment. A proximity analysis with a 500' distance constraint was used to identify the closest road in these instances.

- Finally, some geocoded results were mapped in a town other than the town identified by the provider in their address records. In most instances the geocoded result was to a neighboring town and was within .1 miles of the recorded town. The NHBMP retained the geocoded locations and notified the provider of these discrepancies.
- For speeds reported by providers in ranges, e.g. 4G LTE, the speed tier reported was selected to include the upper end of the range.
- Some fixed wireless providers continue to report minimum download speeds < 768 kbps, e.g. outside of the NTIA domain, but maximum download speeds within NTIA speed tier domain values. In these instances, the NHBMP reported the data based on the maximum speed reported.

B. Community Anchor Institutions

Data was submitted for 3,778 Community Anchor Institutions (CAIs) in the state covering the full range of categories established by NTIA, as follows:

Category	Number of CAIs	Percent of Total
1. School – K through 12	770	20.4%
2. Library	774	20.5%
3. Medical/health care	808	21.4%
4. Public safety	566	15.0%
5. University, college, other post-secondary	65	1.7%
6. Other community support – government	745	19.7%
7. Other community support – non governmental	50	1.3%
TOTAL	3,778	100.0%

In this data collection and maintenance round, the collection was largely accomplished by the nine regional planning commissions in New Hampshire, with the Upper Valley Lake Sunapee Regional Planning Commission (UVLSRPC) & NHBMP staff at the University responsible for developing guidance, for overseeing collection, and for compiling the resulting regional data sets into a standardized statewide layer. The primary steps in the process included:

- Develop a master list of CAIs by category that were not inventoried in previous rounds through review of updated statewide lists (schools, libraries, health care facilities), existing GIS data sets (largely from local hazard mitigation plans), and local knowledge;
- Develop a list of previously identified CAIs with incomplete broadband information;
- Contact those entities to collect their broadband details using an email outreach methodology, as well as phone surveys;
- Map the location of each unmapped CAI, using existing GIS data sets, reference to aerial imagery, property boundaries, web research, and field data collection where necessary;

- Verify data (see verification section below).

IV. Validation

A. Primary Data Collection

The NHBMPP utilized multiple processes to verify the broadband provider data collected during the current round. First, the NHBMPP continued to use local knowledge to conduct an internal analysis of the reasonableness and consistency of our mapping results. Significant overstatements or understatements of service areas resulting from internal processing issues were readily identified and addressed.

Secondly, the Fall 2011 feedback loop with providers was more robust than prior rounds, largely due to increased effort on the part of program staff to solicit comment and the strong relationship now established between the providers and program staff. Unlike in the previous round where feedback/verification was primarily implemented in cases where the provider delivered non-geographic data, this round's efforts engaged all providers, including those who did not submit new data. The NHBMPP returned maps (.pdf files) to each provider for review and correction. Where providers delivered addresses or road segments, the product returned was a geographically referenced version of the data that was submitted. For wireless providers who delivered antenna locations and specifications, the program provided maps that displayed the modeled coverage area generated from the Cellular Expert signal propagation modeling software. Some providers requested the data verification information be provided in shapefile and/or Google Earth (.kmz) format. The process was successful in identifying several significant errors/omissions, e.g. in one instance, a provider identified that their data vendor incorrectly processed the coverage information and required them to resubmit their data for inclusion in the NHBMPP.

Thirdly, the NHBMPP utilized FCC Form 477 filings (through February, 2011) to support the verification of provider coverage areas. Analysis of tracts reported as being served by each provider against those developed from the provider's submission allowed for verification and validation of service areas. There were some instances where a provider's FCC report indicated a greater footprint than indicated by their data submission, and this information was relayed back to the provider during the data review period. In two cases to date, providers identified that their FCC Form 477 was incorrect and would require updating due to the NHBMPP mapping and verification efforts.

The NHBMPP also verified the "reasonableness" of data by comparing current coverage footprints to those reported during the prior round. This allowed us to identify areas where significantly greater (or reduced) service areas were mapped, and to communicate these findings to the provider for verification.

Other verification measures included:

- Speed test – The NHBMPP program has posted a customized speed test on the project web site (iwantbroadbandnh.org). To date, approximately 4,000 records have been submitted. We have processed those data to generate speed result summaries and the locations from which the tests were conducted. Through further

analysis of the speed tests focusing on reported providers, the program will compare the service identified to the provider's reported coverage area to ensure there are not areas unreported, and/or areas where speed test results represent a significant deviation from the reported speed tier.

- Broadband survey – The NHBMPP website also hosts an online broadband survey, encouraging users to report their broadband access (or lack thereof) at the address level. The address submitted is then geocoded, which delivers a means of verifying provider coverage data at specific locations. (The survey is also linked to the speed test, so that users completing the form are asked to take the speed test as well.) To date, 324 surveys have been completed.
- Satellite dish survey – The NHBMPP has completed a drive-by inventory of satellite dishes in selected rural areas of the state, under the premise that a cluster of buildings with satellite broadband dishes signifies an area with no other broadband options available. This information has been utilized as part of the internal data review cycle.

B. Community Anchor Institutions

The CAI data has been subjected to several rounds of verification during this and previous data submission cycles. An initial round of verification was completed in May, 2010 by re-interviewing a randomly selected subset of CAI contacts (20% of the entities within each of the 7 data categories). Subsequent verification rounds, including one conducted during July/August of 2011, were accomplished by generating a broadband profile sheet for each CAI, emailing that to each CAI contact for review, and modifying the CAI record based on any updates returned. Over 275 responses were received, and those updates were incorporated in the data set prior to the Fall 2011 submission.