

# Discovery Report

Piscataqua-Salmon Falls Watershed, HUC 01060003  
Carroll County, Rockingham County, and Strafford County  
New Hampshire  
Report Number 01

11/7/2016





## Project Area Community List

County Name	Community Name
Carroll	Town of Brookfield
Carroll	Town of Wakefield
Rockingham	Town of Brentwood
Rockingham	Town of Candia
Rockingham	Town of Chester
Rockingham	Town of Danville
Rockingham	Town of Deerfield
Rockingham	Town of Derry
Rockingham	Town of East Kingston
Rockingham	Town of Epping
Rockingham	Town of Fremont
Rockingham	Town of Hampstead
Rockingham	Town of Kensington
Rockingham	Town of Kingston
Rockingham	Town of Northwood
Rockingham	Town of Nottingham
Rockingham	Town of Raymond
Rockingham	Town of Sandown
Rockingham	Town of South Hampton
Strafford	Town of Barrington
Strafford	Town of Farmington
Strafford	Town of Lee
Strafford	Town of Middleton
Strafford	Town of Milton
Strafford	Town of New Durham
Strafford	City of Rochester
Strafford	City of Somersworth
Strafford	Town of Strafford

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## I. General Information

The Risk MAP Discovery process is intended to identify available resources that can be utilized in developing a FEMA watershed study. Through various stakeholder coordination activities at the state and local levels, the goal is to ascertain whether resources exist to improve current floodplain mapping as well as developing products that would aid in identifying community flood risk.

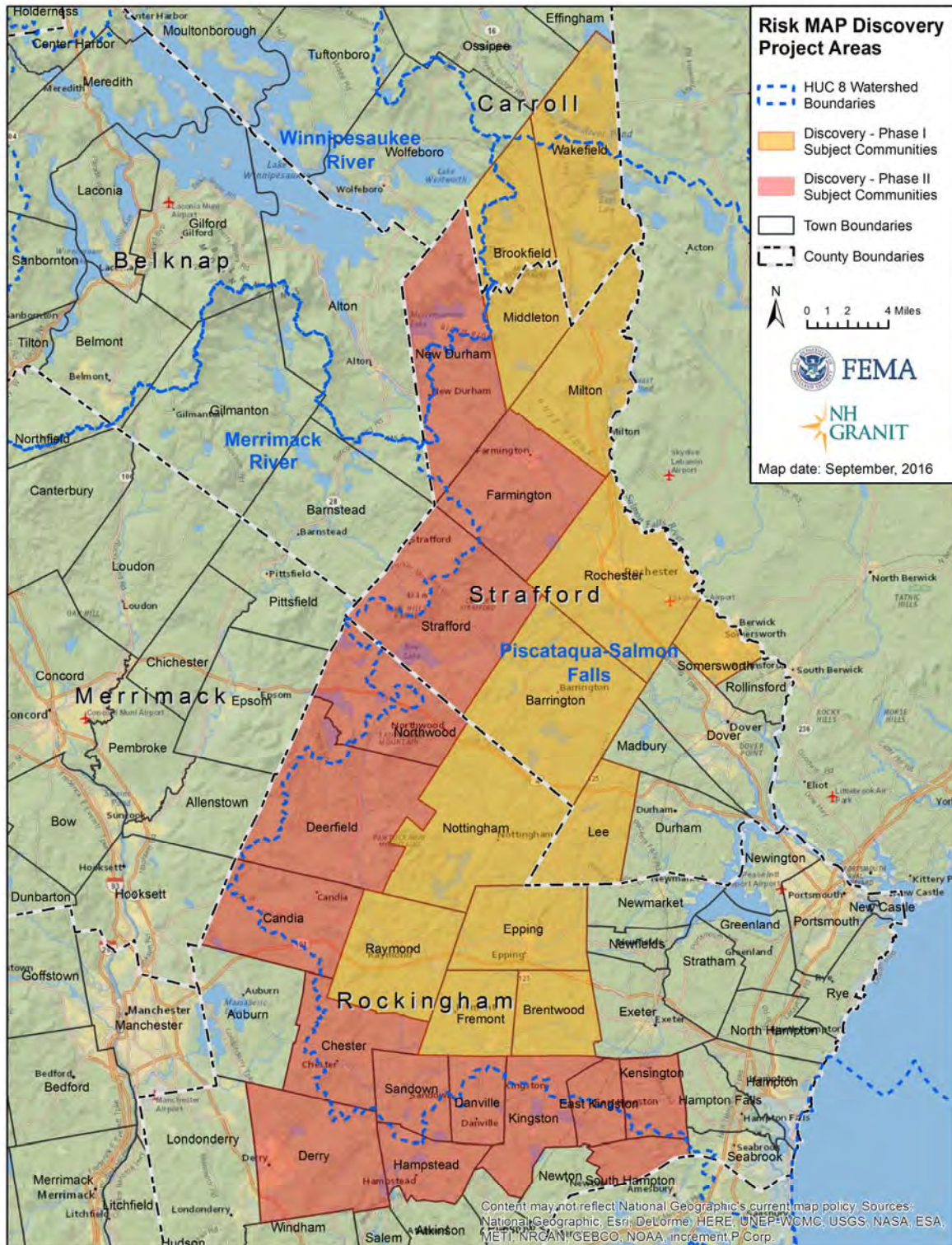
This Discovery project was divided into 2 phases that focused on selected communities within the Piscataqua-Salmon Falls Watershed (8-digit hydrologic unit code, or HUC, 01060003) in New Hampshire. Phase I focused on Brookfield and Wakefield in Carroll County, Brentwood, Epping, Fremont, Nottingham, and Raymond in Rockingham County, and Barrington, Lee, Middleton, Milton, Rochester, and Somersworth in Strafford County. Rivers in this study area include, but are not limited to, Branch River, Cocheco River, Exeter River, Isinglass River, Lamprey River, North River, and Salmon Falls River.

The subject communities in Phase II are Candia, Chester, Danville, Deerfield, Derry, East Kingston, Hampstead, Kensington, Kingston, Northwood, Sandown and South Hampton in Rockingham County and Farmington, New Durham and Strafford in Strafford County. Rivers in the Phase II study area include, but are not limited, to Berrys River, Cocheco River, Ela River, Exeter River, Hartford Brook, Lamprey River, Mad River, Merrymeeting River, North Branch River, and Powwow River.

The total study area for the 28 communities in both phases is 783.6 square miles. According to the 2010 Census, the population within the study area is 190,636.

An overview map of the study areas described above can be seen in Figure 1.

Figure 1: Discovery Area Map



## II. Watershed Stakeholder Coordination

An important part of the Discovery process is reaching out to community officials so that they can be made aware of the Discovery meetings and so that their local community-specific insights can be incorporated through the process of having them complete a data questionnaire. (See Section IV of this report for further details on the meetings and the materials sent prior to those meetings.) The first step in this process was to reach out to New Hampshire's National Flood Insurance Program (NFIP) Coordinator to compile and verify a project contact listing, including local contacts for the project's subject communities within the Piscataqua-Salmon Falls Watershed as well as other state and federal stakeholders. Verification was conducted via web-based research followed by community phone calls. The community contact lists developed for both phases of this Discovery project are included, as Excel spreadsheets, as Appendix 1 and Appendix 2 of this report.

The community officials identified included the chief executive officer (in most cases, the planning or board of selectmen chair), the community floodplain administrator, and other local officials as appropriate. Each contact was sent a mailing which included a letter describing the Discovery process, an invitation to attend a Discovery meeting (see Section IV 'Discovery Meeting' for further details), a Discovery data questionnaire, and a Community Information Map specific to their community. The letters sent to each subject community are included in PDF format as Appendices 3 and 4 of this report, the data questionnaire is included in PDF format as Appendix 5, and the Community Information Maps are included in PDF format as Appendix 6.



### III. Data Analysis

The data collected during this Discovery project are summarized in the sections below. The data are presented in two sections: the first representing data that can be utilized in future Flood Risk products (regulatory and/or non-regulatory) and the second representing data that likely would not contribute to Flood Risk products directly, but aid in the development of said products (prioritizing areas of study and/or providing further insight/background to the study area).

#### i. Data that can be used for Flood Risk Products

Data acquired for use in developing Flood Risk products and/or for potential use in any future regulatory mapping projects are outlined below:

**Topographic Data** – High accuracy (2 meter resolution) LiDAR data collected for 9 of the 13 Phase I subject communities (currently unavailable for Brookfield, Middleton, Milton, and Wakefield) and for 12 of the 15 Phase II subject communities (currently unavailable for Farmington, Strafford, and New Durham). (State of NH: LiDAR for the North East, Photo Science Inc, 2011). For the 7 communities not currently covered by LiDAR, the best available topographic data available was the USGS 10m Digital Elevation Model (DEM). High resolution topographic data for the gap communities is expected to be available by the end of 2016.

**Aerial Photography** - 2015 High Resolution (1 foot) Orthoimages for New Hampshire, U.S. Geological Survey, 2015.

**Effective FIS/FIRM data, FIRM Panel Index, and Political Boundaries** – Extracted from FEMA effective Digital Flood Insurance Rate Map Databases for Carroll County (2013), Rockingham County (2005), and Strafford County (2015\*).

*\*Please note that the 2015 Strafford County effective DFIRM database represents a partial coastal community update only. The effective date for data outside the updated area is 2005.*

**Surface Water Features and Watershed Boundaries** – National Hydrography Dataset, U.S. Geological Survey, 2016.

**Roads and Bridges** - NHDOT GIS database, NHDOT Bureau of Planning & Community Assistance, 2016.

**Dams** - Dam Inventory, NH Department of Environmental Services, 2015.

#### **First Order Approximation Data (FOA)**

FOA is a process utilized to determine the validity of the current effective Zone A floodplain mapping. As cited previously, a 2-meter resolution Digital Elevation Model (DEM) derived from the LiDAR data set was used as the topographic source for the majority of this study area while the 10-meter resolution DEM was used in areas for



which LiDAR was unavailable. The Zone A boundaries generated by the FOA analysis (where the LiDAR derived DEMs were used as the topographic source) should also be able to be leveraged for future regulatory floodplain mapping of this area.

As there were two topographic data sources for this study area, the first step in the analysis was to create a seamless Triangular Irregular Network (TIN). This new composite surface was used to support the subsequent FOA tasks.

The first of these tasks was to perform both a hydrologic and hydraulic analysis to support the mapping of the 1% annual chance flood hazard areas (Zone A boundaries). These analyses included the calculation of flood discharges based on regression equations and stream gage data (where available), basin delineation, determination of drainage areas, and the initial cross section layout. These cross sections were then subject to a thorough QA/QC process to ensure the accuracy of the resulting flood hazard area delineations.

The next task was to produce the 1% special flood hazard area boundaries. Initial boundaries were generated automatically by WISE software using the results of the hydrologic and hydraulic analyses as input variables. The resulting boundaries were then further analyzed using the DEM and aerial photography in a GIS environment to ensure topological accuracy, continuity, and that the results were logical and realistic in their representation of the 1% annual chance boundary.

The final task in the FOA process was to perform a validation of the current Zone A boundaries in FEMA's effective Digital Flood Insurance Rate Maps (DFIRMs). A modified version of FEMA's Floodplain Boundary Standard (FBS) certification process was used to compare the accuracy of the effective Zone A boundaries to the FOA boundaries. For the Phase I portion of this project, it was determined that all 73 stream reaches evaluated, comprising 240.3 miles of the CNMS Inventory of effective Zone A studies, failed this comparison check. For the Phase II portion of this project, it was determined that all 61 stream reaches evaluated, comprising 199.5 miles of the CNMS Inventory of effective Zone A studies, failed this comparison check. As a result, the CNMS Inventory of Zone A studies in both project areas has been updated to be categorized as "Unverified / To Be Studied".

## ii. Other Data and Information

This section describes other data sets that are not appropriate to be utilized in the development of regulatory and/or non-regulatory products, but rather, could be useful in directing the scope, focus, and outreach components of a Flood Risk project.

### **Hazard Mitigation Plans**

The current hazard mitigation plan status for all communities in this Discovery project area is summarized in Table 1 below.

**Table 1: Hazard Mitigation Plan Status**

County	Community	Status (October, 2016)	Expiration Date
Carroll	Brookfield	Approved	9/9/2019
	Wakefield	Expired	4/27/2016
Rockingham	Brentwood	Approved	8/16/2020
	Candia	Approved	5/15/2017
	Chester	Submitted for Approval	6/12/2016
	Danville	Approved	8/24/2020
	Deerfield	Approved	3/31/2018
	Derry	Approved	12/21/2020
	East Kingston	Approved	10/29/2019
	Epping	Approved	12/19/2018
	Fremont	Approved	5/4/2021
	Hampstead	Approved	5/7/2018
	Kensington	Approved	5/11/2019
	Kingston	Approved	8/18/2018
	Northwood	Approved	7/21/2019
	Nottingham	Approved	11/28/2017
	Raymond	Approved	12/3/2019
Sandown	Approved	11/16/2020	
South Hampton	Submitted for Approval	7/12/2016	
Strafford	Barrington	Approved	9/27/2021
	Farmington	Approved	5/7/2018
	Lee	Approved	9/8/2018
	Middleton	Approved	11/28/2017
	Milton	Approved	11/28/2017
	New Durham	Approved	9/27/2021
	Rochester	Approved	3/28/2018
	Somersworth	Approved	6/16/2021
	Strafford	Approved	5/21/2017

### **Community Rating System (CRS)**

The CRS is a voluntary program provided by the National Flood Insurance Program (NFIP) in which communities can engage in floodplain management activities that exceed the minimum requirements in order to earn discounted flood insurance premium rates. Currently, no communities in this project’s focus area are participating. However,

the CRS was discussed at the Discovery meetings and communities were encouraged to participate.

### National Flood Insurance Program (NFIP) Policies and Claims

An examination of the current number of flood insurance policies and past claims is not only a good indicator of the level of flood risk for a community, but should also serve as an incentive for communities to consider joining the Community Rating System program, as discussed above. Table 2 below summarizes NFIP policies and claims data within the project communities, and suggests that the towns of Derry and Raymond would benefit greatly from participating in the CRS program given the large number of policies in place.

**Table 2: NFIP Policies and Claims Data Summary**

County	Community	Insurance Overview *				
		Total No. of Policies	Total Premiums	Total Insurance in Force	Number of Closed Paid Losses	\$ of Closed Paid Losses
Carroll	Brookfield	0	\$0	\$0	0	\$0
	Wakefield	33	\$35,302	\$5,390,000	2	\$14,292
Rockingham	Brentwood	11	\$8,164	\$2,604,200	10	\$83,729
	Candia	7	\$11,087	\$1,458,600	0	\$0
	Chester	11	\$14,917	\$2,186,000	2	\$11,331
	Danville	9	\$7,012	\$2,072,900	0	\$0
	Deerfield	28	\$34,464	\$5,870,900	11	\$97,679
	Derry	102	\$67,195	\$22,844,700	27	\$192,970
	East Kingston	5	\$5,068	\$1,040,700	1	\$1,086
	Epping	31	\$39,006	\$5,512,400	31	\$621,280
	Fremont	38	\$35,209	\$7,557,200	38	\$851,402
	Hampstead	31	\$30,175	\$6,346,400	8	\$80,472
	Kensington	0	\$0	\$0	0	\$0
	Kingston	37	\$39,295	\$7,858,900	7	\$100,318
	Northwood	21	\$22,073	\$4,358,700	1	\$10,870
	Nottingham	15	\$17,444	\$3,827,500	13	\$129,526
	Raymond	139	\$114,466	\$28,156,100	71	\$1,289,575
Sandown	5	\$1,853	\$839,300	1	\$6,759	
South Hampton	2	\$1,656	\$183,900	3	\$18,627	
Strafford	Barrington	15	\$8,973	\$3,238,700	5	\$138,705
	Farmington	12	\$10,735	\$1,798,800	7	\$57,285
	Lee	13	\$13,317	\$3,135,200	12	\$291,311
	Middleton	13	\$15,522	\$2,683,000	1	\$1,204

Milton	60	\$74,233	\$11,796,900	15	\$257,304
New Durham	18	\$25,127	\$2,900,100	2	\$22,690
Rochester	56	\$60,668	\$13,560,500	14	\$80,309
Somersworth	13	\$10,925	\$4,160,000	3	\$243,618
Strafford	17	\$17,270	\$3,955,800	1	\$775

\* Data retrieved on 10/24/2016 from <https://portal.fema.gov/famsVuWeb/home>

### **Regulatory Mapping (Effective FIS/FIRM Data)**

The development of regulatory mapping products (Flood Insurance Studies and Flood Insurance Rate Maps) has undergone a shift in focus from a county-based approach, as with FEMA’s previous Map Modernization Program, to a watershed-based concept under the current Risk MAP (Mapping, Planning and Assessment) program. Under Risk MAP, the Piscataqua-Salmon Falls Watershed was identified as a high priority area for regulatory mapping updates. This resulted in an initial project focused on the 17 immediate “coastal communities”, which produced partial database updates for Strafford County (Effective September, 2015) and Rockingham County (Preliminary April, 2014). The subject area for this Discovery project (see Figure 1 on page 2 of this report) was defined with the intent of completing the regulatory mapping updates for all NH communities within the Piscataqua-Salmon Falls Watershed.

The effective FIS and DFIRM data in the Rockingham and Strafford County portions of this project were developed under the aforementioned Map Modernization Program and both have an effective date of May, 2005. The FIS and DFIRM data for Carroll County were developed under the Risk MAP program, and have an effective date of March, 2013.

### **Data Questionnaire Results**

Data Questionnaires were issued to each community in the project area to solicit knowledge regarding sources of known flooding issues and to help develop future flood mapping priorities. Community responses to the Data Questionnaires and input from other local resources (e.g. NH Office of Energy and Planning and NH Department of Transportation) are summarized in Table 3. This input, in conjunction with the analysis of the Coordinated Needs Management Strategy (CNMS) and Letters of Map Change (LOMC) analysis, is utilized in the recommendations for future regulatory floodplain mapping.

**Table 3: Known Flooding/Mapping issues identified in Community Data Questionnaire**

Communities	Data Questionnaire Results - Desired Study Areas
Town of Barrington	Reported inaccuracies in floodplain mapping in areas along Bellamy River, Berry River, Caldwell Brook, Green Hill Brook, Hall Brook, Hartford Brook into Isinglass River, Isinglass River, Little Long Pond, Long Pond Outlet, Mallego Brook, Nippo Brook, Oyster River, Spruce Brook, Swains Lake, Wentworth Brook, and 2 unnamed brooks
Town of Deerfield	Mapping inaccuracies and clustered LOMAs reported for Pleasant Lake, and the intersection of NH State Routes 43 and 107 was listed as an area of flood risk concern
*Town of Epping	Lamprey River (due to Bunker Pond Dam removal)
Town of Fremont	Clustered LOMAs reported for Exeter River and tributary to Red Brook/Spruce Swamp
Town of Milton	Salmon Falls River listed as desired study area
Town of Nottingham	Clustered LOMAs reported for Nottingham Lake
City of Rochester	Cocheco River listed as desired study area
City of Somersworth	Incorrect elevations reported for area along Salmon Falls River
Town of South Hampton	Areas of flood risk concern reported as bridges at Jewell Street and Chase Road are overtopped during significant flood events. Previous claim reported for Hilldale Avenue/Hume Brook during 1996 flood event.

*\* Bunker Pond Dam removal data provided by NH OEP and NHDOT*

**Coordinated Needs Management Strategy (CNMS)**

FEMA’s CNMS database is a spatial database which measures the viability of currently effective studies and is used to store and prioritize flood mapping needs. For the purposes of this report, only those reaches that were within both the subject communities and within the subject watershed were used in the analyses conducted to produce the data provided in the tables below.

Table 4 provides a summary of stream miles for all reaches in the CNMS database within this Discovery study area by county, flood zone type, and by validation status. As shown, the majority of stream miles within this study area have a validation status of “Unknown”. The “Unknown” validation status is assigned to those reaches that have either yet to be evaluated, have been evaluated but validity remains unknown, or the evaluation has been deferred due to the area being defined as low priority.

**Table 4: Summary of CNMS Stream Miles**

County	Flood Zone	Unknown Stream Miles	Unverified Stream Miles	Valid Stream Miles	Total Stream Miles
Carroll	Zone A	14.3	0	0	14.3
	Zone AE	0	0	7.2	7.2
Rockingham	Zone A	234.7	0	0	234.7
	Zone AE	0	46.6	3.5	50.1
Strafford	Zone A	184.5	0	9.5	194
	Zone AE	0	49.7	28.4	78.1

Table 5 provides a listing of Zone AE reaches whose validation status is listed as “Unverified”, indicating that at least one critical element and/or at least four secondary elements have failed for that reach. The reaches are listed in order of most to least critical elements failing and then from most to least secondary elements failing. A full description of the codes listed in Table 5 (e.g. C1, C2, S1, S2) is included in Excel Spreadsheet format as Appendix 7 of this report.

**Table 5: CNMS Analysis of Unverified Zone AE reaches**

Number of Critical Elements Failing	Number of Secondary Elements Failing	Reach	Elements Failing (see Appendix 7)
2	3	Exeter River	C1, C2, S6, S9, S10
2	2	Salmon Falls River	C2, C4, S2, S9
1	5	Cocheco River	C2, S2, S4, S6, S9, S10
1	4	Lamprey River	C1, S2, S6, S9, S10
1	2	Dudley Brook	C1, S6, S9

**Letters of Map Change (LOMC)**

Another useful resource that helps to identify where current flood mapping inaccuracies may exist is the inventory of LOMCs. A high number of LOMCs for a particular flooding source is typically an indicator of mapping inaccuracies. To examine where these inaccuracies may exist, a Letter of Map Amendment (LOMA) point shapefile was acquired from FEMA (accessed 6/17/2016) and all points located within the Phase I and Phase II study areas for this project were deemed valid LOMCs. The results presented in Table 6 represent those flooding sources with 5 or more LOMCs on record. LOMCs with unknown/unnamed flooding sources or where “local flooding” was cited as the flooding source are not represented in this table. The flooding sources listed in Table 6 should be strongly considered for future floodplain remapping/redelineation.

**Table 6: Prioritization of Flooding Sources based on number of LOMCs**

<b>Flooding Source</b>	<b>Community Name(s)</b>	<b>Number of Valid LOMCs</b>
Exeter River	Brentwood, Chester, Fremont, Kensington, Raymond, Sandown	72
Lamprey River	Deerfield, Epping, Lee, Raymond	55
Nottingham Lake	Nottingham	31
Governors Lake	Raymond	27
Sunrise Lake	Middleton	27
Salmon Falls River	Milton, Rochester, Somersworth	22
Great East Lake	Wakefield	15
Little River	Brentwood, Kingston, Nottingham	11
North River	Epping, Lee, Nottingham	11
Bow Lake	Northwood, Strafford	10
Freesees Pond	Deerfield	9
Isinglass River	Barrington, Rochester	9
Pisacassic River	Fremont	9
Red Brook	Fremont	8
Tributary to Lamprey River	Candia, Deerfield, Epping, Fremont	8
Fordway Brook	Raymond	7
Copp Brook	Wakefield	6
Baxter Lake	Farmington	5
Chalk Pond	New Durham	5

## **Recommendations**

The ideal solution to rectifying regulatory mapping inaccuracies is completing a new detailed study (e.g. conducting a field survey along the entirety of any given flooding source). However, this approach is very expensive and would require resources that are currently unavailable. The next best option for improving flood mapping inaccuracies is performing a redelineation study, where previous detailed studies are updated with newer, more accurate topographic data. In examining the results yielded from all previously described processes and taking into account the feasibility of funding a project area of this size, Table 7 represents the recommended areas for updated regulatory mapping (development of new DFIRM products).



**Table 7: Proposed Zone AE Reaches for Remapping**

<b>Flooding Source</b>	<b>Study Type</b>	<b>Study Length</b>	<b>Number of Structures</b>
Bow Lake	Redelineation	2.8	0
Branch River	Redelineation	4.6	2
Club Pond	Redelineation	0.7	0
Cocheco River	Detailed	2.8	0
Cocheco River	Redelineation	18.2	0
Dames Brook	Redelineation	0.1	1
Dudley Brook	Detailed	4.0	2
Ela River	Redelineation	5.2	5
Exeter River	Detailed	3.2	2
Exeter River	Redelineation	7.8	5
Kicking Horse Brook	Redelineation	0.9	8
Lamprey River	Detailed	23.4	15
Mad River	Redelineation	3.1	4
Miller Brook	Redelineation	0.7	2
Salmon Falls River	Redelineation	34.9	6

## IV. Discovery Meeting

Discovery meetings were held in order to actively engage with the 13 Phase I subject communities and 15 Phase II subject communities in the Piscataqua-Salmon Falls Watershed, initiate discussions regarding community flood risk, and to gather local input and data pertaining to known flooding issues. For the Phase I portion of this project, there were two Discovery meetings held in order to provide participants with a degree of flexibility with regard to location and time. The first was held on December 3, 2015 at 10:00 AM at the Lee Public Safety Center in Lee, NH. The second was also held on December 3, 2015, at 2:00 PM at the Rochester Community Center in Rochester, NH. For the Phase II portion of this project, there were an additional two meetings held. The first was held on May 6, 2016 at 9:30 AM at the Kingston Town Hall in Kingston, NH. The second was also held on May 6, 2016, at 2:00 PM at the New Durham Fire Department in New Durham, NH. The organizations involved in facilitating these meetings were the Federal Emergency Management Agency (FEMA), NH GRANIT at the University of New Hampshire, AECOM, and the New Hampshire Office of Energy and Planning (NH OEP). The meeting agenda and presentation have been included in PDF format as Appendices 8 and 9 of this report and the list of meeting participants has also been included in PDF format as Appendix 10.

To coordinate this effort, letters were mailed to all community contacts listed in Appendices 1 and 2 approximately one month prior to their respective Discovery meetings. In addition to the letters, a mailing containing a data questionnaire, Community Information Map, and CD containing digital versions of these documents was sent to each community's floodplain administrator. Further, several rounds of follow-up communications were extended via email and/or telephone to actively engage community officials in the Discovery process, and to gather as much information as possible within the timeframe established for this project.

The goal of the data questionnaire was to gather from local officials known flooding issues or mapping problems and data that would improve the current mapping within their community (e.g. better topography, more up-to-date base mapping, hazard mitigation efforts, etc.). The Community Information Map was an 11x17 format map customized to each of the 28 subject communities which displayed a base map, hydrologic features, community and watershed boundaries, the effective special flood hazard area mapping, and point locations for National Flood Insurance Program (NFIP) claims data. Communities were then encouraged to physically mark on the maps their areas of concern and submit for incorporation into this Discovery project's results and for consideration towards future flood risk and regulatory flood mapping projects.

## **Appendix and Tables**

Appendix 1 – Discovery Phase I Community Contact List

Appendix 2 – Discovery Phase II Community Contact List

Appendix 3 – Letters to Phase I Communities

Appendix 4 – Letters to Phase II Communities

Appendix 5 – Discovery Data Questionnaire

Appendix 6 – Community Information Maps

Appendix 7 – Coordinated Needs Management Strategy (CNMS) Documentation

Appendix 8 – Discovery Phase I Meeting Agenda and Presentation

Appendix 9 – Discovery Phase II Meeting Agenda and Presentation

Appendix 10 – Discovery Meeting Participants