Technical Memorandum  
Assessment of Sediment Sources in the Mountain View Lake Watershed

Introduction
Transport of sediment into Mountain View Lake is a result of natural conditions, such as geology, soils, vegetative cover, topography, and hydrology, overlain by human-induced conditions, such as land use and impervious cover. A complicating factor is the transport of sediment into Mountain View Lake from the Salmon River; sediment carried by rivers and streams draining large watersheds is primarily attributed to bank and channel erosion, rather than being washed in from local sources. As watershed size increases, the length of the stream channel network and its susceptibility to channel erosion increases. The braided channel and substantial meanders of Salmon Creek upstream of Mountain View Lake indicate that the river is actively eroding its banks and depositing sediment load.

This document constitutes an assessment of sediment source control techniques suitable for the Mountain View Lake watershed. This assessment includes:

1. Sources of sediment in the Mountain View Lake watershed
2. Sediment source control techniques

For this assessment, EcoLogic has compiled existing information on the natural and cultural factors affecting sediment export from the landscape. Publically available GIS files were evaluated to assess the landscape of the watershed. A watershed reconnaissance was also conducted to identify potential non-point sources of sediment such as construction sites, sand and gravel operations; and forestry practices. The watershed planning underway for the Salmon River was also an important source of information.

The available data sets were compiled into a simple modeling framework to calculate sediment loading. This approach relies on selecting appropriate export coefficients from areas with comparable soils, vegetation, land use, and meteorological conditions.

Watershed Characterization
Franklin County of New York State is in two major physiographic provinces. The northern one-third of the county, is mostly agricultural and is in the St Lawrence Valley plain. The southern two-thirds is in the Adirondack Mountains. The most dominant water feature in Franklin County is the Salmon River. The Salmon River originates in the Adirondack foothills of central Franklin County and follows a 46 mile course northward, to the U.S. and Canadian border at Dundee. (Franklin County Soil and Water Conservation District, 2014 Draft)
Mountain View Lake

Mountain View Lake is an impoundment of the Salmon River, located in the northern Adirondacks, within the Town of Bellmont (Figure 1). The lake has a surface area of 95 ha, with 13 km of shoreline. The maximum depth is 2.7 m, and the total volume is 542,542 m$^3$. The lake flushes about 135 times per year. (Kelting & Laxson, Report No. PSCAWI 2014-35, 2014a). The high flushing rate reflects that the lake is essentially a river system slowed by the presence of the dam.

The Mountain View Lake dam is privately owned and operated in the Salmon River headwaters for recreational use; this dam represents the only significant water storage in the Salmon River watershed. (Elan Planning, Design & Landscape Architecture, PLLC., 2011)

Indian Lake is a natural lake located adjacent to Mountain View Lake (Figure 2). These two lakes are connected by a narrow, navigable channel. Indian Lake has a surface area of 133 ha with 5 km of shoreline. The maximum depth is 4.9 m, and the total volume is 3,769,281 m$^3$. Indian Lake flushes about 1.2 times per year. (Kelting & Laxson, 2014b). The volume of Indian Lake is greater than that of Mountain View Lake, due to its greater depth and larger surface area.

A third lake within the Mountain View Lake watershed is Ragged Lake, which is privately owned. There is little data available for Ragged Lake (Table 1). Ingram Pond (Figure 2) is not within the Mountain View Lake watershed, as it discharges via tributary to the Salmon River downstream of the Mountain View Lake dam. Lily Pad Pond and Mud Pond are upgradient of Ragged Lake. Plumadore Pond has an outlet to the Salmon River upgradient of Mountain View Lake. Wolf Pond, at the southernmost end of the watershed, lies adjacent to a bog along Wolf Pond Road; little information about this pond is available.

<table>
<thead>
<tr>
<th>Table 1. Summary of lake morphology</th>
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<tbody>
<tr>
<td>Mountain View Lake</td>
</tr>
<tr>
<td>Surface area (ha)</td>
</tr>
<tr>
<td>Shoreline length (km)</td>
</tr>
<tr>
<td>Maximum depth (m)</td>
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<tr>
<td>Total volume (m$^3$)</td>
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<tr>
<td>Flushing rate (times/year)</td>
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Sources:
Mountain View Lake (Kelting & Laxson, 2014a)
Indian Lake (Kelting & Laxson, 2014b)
Ragged Lake – approximate, digitized from orthoimagery by EcoLogic staff.
Figure 2. Watershed of the Salmon River headwaters with lakes and ponds, including Mountain View and Indian Lakes, on topographic base map. Based on data from the National Hydrography dataset.
History

During the 19th century, the early industries common in Franklin County were potash production, agriculture (hops and potatoes), mills, and iron ore mining. Large amounts of timber were created when clearing land for farms, roads and houses. The timber from these clearings were used in the making of potash, which involved burning the timber in great piles, leaching the ashes, and boiling the lye to dryness. Once roads were carved into the great forest lands, logging became a profitable industry. Extensive tracts of trees were cleared and the logs hauled to rivers and floated out of the wilderness. (Franklin County Soil and Water Conservation District, 2014 Draft).

As described in a historical account of the Town of Bellmont by Seaver (1918), Mountain View Lake was created when a dam was installed on the Salmon River around 1856. Into the 20th century, the Town of Bellmont remained largely undeveloped. Since the soils and terrain were generally unsuitable for profitable agriculture, timber was a significant resource. In the early 20th century the forests were destroyed for conversion into charcoal for industrial uses, and much of the timber cut within the town was shipped to mills elsewhere for manufacture. The summer resort business was also present in the area in the early 20th century: “Mountain View… was once one of the most prolific trout waters in the Adirondacks, and Indian Lake (Round Pond) was a famous hunting resort. Mountain View and Indian Lake are in close proximity, and together had perhaps a hundred cottages…. But Ragged Lake, Ingraham Pond and other waters in the town have only one or two summer camps each.” (Seaver, 1918).

Logging continued in Franklin County into the 1900’s, and in the early part of the 20th century approximately 60% of the county remained forested while the northern third of the County had been cleared for agricultural production; the Salmon River was used for floating materials to either mills or railheads (Franklin County Soil and Water Conservation District, 2001). “The Adirondack and St. Lawrence Railway enters Bellmont from Malone at Chasm Falls, near the northwest corner of the town, and, bearing southeasterly for about twelve miles, passes into Franklin near Plumadore Pond. The Chateaugay Railway enters at Standish, on the eastern border, and runs southwestwardly seven or eight miles to Wolf Pond, where the two lines are almost in contact. The former has stations in Bellmont at Owls Head and Mountain View, and the latter at Middle Kilns and Wolf Pond. The Chateaugay Railway was built through Bellmont in 1886, and the Adirondack and St. Lawrence in 1892.” (Seaver, 1918)
In addition to man-made incursions that removed tree cover in the watershed, natural events have also had an impact. In January of 1998, “a series of ice storms blanketed northern New England and New York with up to three inches of ice. Forestland covers 40 million acres of this region, and 17 million acres of those forests were damaged by the storm…” (NEFA, 1998). This storm will have impacts for years to come. Severely damaged trees likely will not survive, damaged trees will be susceptible to attack from insects or disease, increased sunlight to the forest floor will increase growth of understory vegetation, and debris from damaged trees will make cross-county travel more difficult. To mitigate for these negative consequences from the ice storm, there has been extensive salvage logging in the affected areas (New York State Department of Environmental Conservation, 2009). In Franklin County, sugar bushes were effectively clear-cut, and areas of pine plantations were reduced to pulp or chips as the residual timber was destroyed (Franklin County Soil and Water Conservation District, 2001).

Ownership of lands in the watershed has changed over the years. In addition to small, privately owned parcels for camps, homes, churches and businesses, extensive areas within the watershed have been held by a handful of property owners. In 2001, DOMTAR, Inc. was one of the largest owners of commercial managed woodland in Franklin County; other major landholders included Champion International, the Rockefeller family and the Ross (DuPont) family; each family held over 25,000 acres in Franklin County (Franklin County Soil and Water Conservation District, 2001).

In 2004, Domtar Industries Inc. sold approximately 84,400 of its 104,400 acre Adirondack holdings in Clinton and Franklin Counties - referred to as the “Sable Highlands” Property by New York State - to Chateaugay Woodlands LLC. The remaining 20,000 acres was sold to The Nature Conservancy, and were subsequently transferred to the State as additions to Forest Preserve and State Forest lands, administered by the NYS Department of Environmental Conservation. In April 2009, a conservation easement sale to the State of approximately 84,000 acres of the land acquired by Chateaugay Woodlands LLC was established, which would provide for:

- A significant portion of the property to remain as working forest
- Designated Private Recreation Lease Areas
- Designated Public Recreation Use Areas.

New York State developed an Interim Recreation Management Plan for the Sable Highlands Conservation Easement Lands, which is intended to serve until a Recreation Management Plan is developed by the State to facilitate and manage the public recreational uses of the property, in compliance with the terms and conditions of the conservation easement. (New York State Department of Environmental Conservation, 2009)

Watershed Characteristics

The Mountain View Lake watershed (Figure 3) extends over 11,448 ha, 4% of which is surface water. Ninety percent of watershed is dominated by forest cover, subdivided into 74% deciduous, 11% evergreen, and 5% mixed forests. There are 12.8 km of local roads (county, town, and local) – many of them unpaved - and no State roads or US highways (Kelting & Laxson, 2014a).
The Indian Lake watershed, which is a sub-watershed of the Mountain View Lake watershed, is 651 ha in size (Error! Reference source not found.4). The land cover is 21% surface water. The watershed is dominated by forest cover (77%), divided among deciduous (63%), evergreen (7%), and mixed forests (7%). There are 1.5 km of local roads (county, town, and local) – many of which are unpaved - and no state roads or US highways. (Kelting & Laxson, 2014b). Error! Reference source not found.5 presents the National Land Cover Dataset (NLCD 2006) for the Salmon River headwaters watershed. Note that this watershed includes Ingraham Lake and other tributaries, which do not discharge directly to Mountain View Lake.
Figure 3. Watershed boundary of Mountain View Lake.
Source: (Kelting & Laxson, 2014a)

Figure 4. Watershed boundary of Indian Lake
Source: (Kelting & Laxson, 2014b)
Figure 5. National Land Cover Dataset (NLCD) 2006 for the Salmon River headwaters watershed (HUC 12). The Mountain View Lake watershed is a sub-watershed to this.
Mountain View Lake has two major tributaries entering the Lake from the south: Ragged Lake Outlet and Salmon River (Error! Reference source not found.5).

Over time, the Salmon River has carved a steep sided valley corridor into the landscape. Slopes on the sides of the valley commonly exceed 15 or 25 percent. Upgradient of Mountain View Lake, the Salmon River is a low gradient (8.25 feet/mile), cold and narrow stream. Alders line the banks and the entire river flows on private lands. There are no barriers to fish migration. Major tributaries that enter the Salmon River in this reach are the Plumadore Pond Outlet and Cold Brook. The headwater Notch or Elbow Ponds (SC-P66 and P67) are shallow, interconnected, spring-fed ponds. Each is approximately five acres in area with a maximum depth of five feet. (Franklin County Soil and Water Conservation District, 2014 Draft). The elevation at the most southern end of the headwaters is approximately 1500 ft amsl.

Ragged Lake is a private lake at elevation of approximately 1740 amsl, 249 ft above the level of Mountain View Lake, based on the USGS topographic map. The Ragged Lake Outlet is a discharge stream from Ragged Lake that flows into Mountain View Lake approximately 2,000 ft northeast of the mouth of the Salmon River. The Ragged Lake Outlet runs a course of approximately 3 miles (excluding meanders) from Ragged Lake through a valley between three mountains (Sugarloaf Mtn. to the west and Ragged Lake Mtn. and W Mtn. to the east and south) to the confluence with Mountain View Lake. With the change in elevation of about 249 ft, the gradient for Ragged Lake Outlet is estimated at approximately 83 ft/mile, for a slope averaging almost 2%.

Within the watershed for Mountain View Lake is the Sugarloaf Public Use Area of the Sable Highlands. The Sable Highlands is a conservation easement in the Adirondack Forest Preserve (Error! Reference source not found.6; Section 0). Covering 5,460 acres, the Sugarloaf PUA (Error! Reference source not found.7) contains outstanding natural features and good road access, making this parcel excellent for public recreation. The parcel is accessible from the northeast via the Goat Path Road (Linear Recreation Corridor 1 as it passes through private lease areas), from the southeast via Linear Recreation Corridor 11, and from the northwest via the Sugarloaf Road. Currently, motorized vehicle use is prohibited on the Linear Recreation Corridors. No recreational facilities have been developed on this parcel at this time. (Sources: New York State Department of Environmental Conservation, 2009; http://www.dec.ny.gov/lands/71173.html).

Within the Sable Highlands there are steep rugged areas, large sloping hills, numerous small streams, and several river valleys. Ragged Lake Mountain, just east of the Ragged Lake Outlet, is one of the important elevations in the Sable Highlands, at 2,750 feet. (New York State Department of Environmental Conservation, 2009)
Figure 6. Adirondack Forest Preserve, with approximate location of watershed boundary (black line) of Mountain View Lake. Source: Adirondack Forest Preserve Map and Guide, NYSDEC December 2009.
Figure 3. Sable Highlands Public Use Areas in the vicinity of the Mountain View Lake watershed.
The U.S. Department of Agriculture Soil Conservation Service Soil Survey Report for Franklin County was reviewed to identify the soil types in the Mountain View Lake watershed. The county-wide Soil Association Map showed there are several types within the watershed; however, a detailed soils map for this area of Franklin County was not provided in the report.

The bedrock in this area is granite and gneiss. The granite and gneiss are examples of igneous rocks, which are rocks that have solidified after being molten. (New York State Department of Environmental Conservation, 2009)

The soil associations within the Mountain View Lake watershed that were identified from the Franklin County Soil Report are:

**HB (Hermon-Becket)** – located generally along the slopes of the valleys. Soil from glacial outwash, mainly crystalline rock, dominantly well-drained and stony to very stony.

**AC (Adams-Colton)** – located generally in the Salmon River Valley, around Mountain View and Indian Lakes, and upgradient (north) of Ragged Lake. Soil from glacial outwash, dominantly well-drained.

**RM (Rough Mountainous Land)** – generally located along the higher peaks in the watershed. Soils from glacial till and crystalline rock, dominantly well-drained, stony to very stony with much rock outcrop.

**SR (Skerry-Ridgebury)** – In an area east of Ragged Lake, along the watershed boundary, and outside of the watershed downstream of the Mountain View Lake dam. Soils from glacial till, sandstone and crystalline rock, moderately well to poorly drained, stony to very stony.

These soil types are, overall, dominantly well-drained, meaning that water will percolate through relatively quickly to groundwater, rather than allow water to pond on the surface or runoff.

“There are basically two broad soil types found in the [Sable Highlands] Property; glacial tills and glacial outwash. Glacial tills consist of material that was directly deposited by a glacier. These soils are a mixture of clay, silt, sand, and stone. Their occurrence in the Property is widespread. They dominate the lower and middle slopes. The deeper and richer soils occur around the base of the mountains, especially on terraces... Hardwoods today dominate these richer soils with mixed conifer/hardwood stands found at the lower slopes with partially water-washed soils. Glacial outwash soil is made of material which was deposited by water flowing from a glacier. These are stratified soils deposited as eskers and moraines in areas subject to periods of flash-flooding during the glacial retreat and from which the nutrient-bearing silts and clays have been washed away. Because the soils are so stony, the fast-growing and deep-rooted pines out-compete the other more demanding tree species.”

(New York State Department of Environmental Conservation, 2009)
Figure 4. Soils Association Map, with approximate watershed boundary (black line).
United States Department of Agriculture Soil Conservation Service in cooperation with Cornell University Agricultural Experiment Station.
Site Reconnaissance

On July 14, staff from EcoLogic visited the Mountain View Lake watershed. Observations were made of the watershed from the ground, and navigation around the watershed was accomplished using USGS 7.5 minute topographic maps as well as a highway map of Franklin County (Figure 9) and a road atlas of the Adirondacks and North Country (Figure 10).

Observations were made during an ATV ride on private property adjacent to a logging area on Sugarloaf Mountain (Photographs 1 to 8). The logging area visited had been cut approximately 5 years ago (2009) and the vegetative cover was an expanse of raspberry and other shrubs, interspersed with rows of taller trees. The private property had been harvested for timber a number of years prior (estimated 1950’s by the owner’s recollection), as evidenced by the number of old logging roads criss-crossing the property. Based on the observations of these areas, as well as the long history of logging activities in the region, it is presumed that the interior woodlands of much of the Mountain View Lake watershed is similar in structure and presence of access roads for logging activities.

More observations in the watershed were made by car along the roadways. The length of Wolf Pond Road was traversed as far south as Wolf Pond (Photographs 9 to 30). Starting at the intersection of Bryant Siding Road and heading south, Wolf Pond road was strictly a dirt road. Along this route, logging activities were occurring, as well as road ditch maintenance by the Town of Bellmont. Several of the culverts under the road were in need of repair, and the presence of new culverts along the roadside at some of these areas indicated that such repairs were scheduled. Erosion of the roadway was also observed, particularly at these culvert crossings. The major tributaries shown on the USGS topo maps were identified along the road, as well as a number of minor tributaries not marked on the maps. Wetland areas were evident between Wolf Pond Road and the Salmon River upstream of Mountain View Lake; many of these tributaries crossing under Wolf Pond Road were discharging into relatively flat wetland areas before reaching the Salmon River. The Salmon River itself, at it’s upper reaches where it crosses under Wolf Pond Road, consisted of a densely vegetated, shrubby shoreline, with little evidence of shoreline erosion.

In April 2014, a high flow event on Ragged Lake Outlet washed out a portion of Bryant Siding Road where the river crosses under the road through two approximately 10ft-diameter culverts (Photographs 31 to 36). By July 15, 2014, the road was temporarily repaired and re-opened. Future repair/rebuilding is planned (Les Howard, personal communication).

In addition to the Ragged Lake Outlet (Photographs 37 and 38), two other tributaries enter Mountain View Lake at the south end – Charlie Pond and Salmon River:

“The Wolf Pond Road is a narrow, dirt municipal road which is heavily utilized by logging trucks.”  
(New York State Department of Environmental Conservation, 2009)  
HTTP://WWW.DEC.NY.GOV/LANDS/71173.HTML
Charlie Pond (Photographs 39 and 40) is connected to Mountain View Lake by a narrow channel that passes under Bryant Siding Road west of Ragged Lake Outlet. The shoreline of Charlie Pond is well-vegetated, and the pond would act as a sink for suspended sediments in runoff from the surrounding landscape. The channel from Charlie Pond passes under Bryant Siding Road and enters a cattail marsh before discharging into Mountain View Lake; it is likely, under most typical conditions, that any sediment that is suspended and transported from Charlie Pond would be trapped in the marsh before entering the lake.

The Salmon River (Photographs 41 to 43) is broad and quiet in this reach. There was some exposed sediment under the vegetation along the shore of Mountain View Lake at this confluence, north of the bridge of Bryant Siding Road, but it is not clear whether this is a depositional area, or an area that may be eroded during high flows.

Examples of other erosion areas observed around Mountain View and Indian Lakes are shown in Photographs 44 to 56. A rainfall event occurred during site reconnaissance, and runoff was observed – these observations are shown in Photographs 57 to 60.

Based on review of aerial photography images, patterns were observed throughout the watershed indicative of the long history of timber harvesting. An example of these patterns of logging roads in the Mountain View Lake watershed is shown in Figure 11 (source: Google Earth), in an image from 2008:

These patterns are evident even after the harvest is completed (Figure 11). To the right is an image of the same area taken in 2011, three years later. These images show that the dirt logging roads are still present, and the areas cleared are still visible in the vegetation. The flow of surface runoff in these areas is likely to be expedited along these pathways – and leading to the dirt roads - until mature forest grows back.
Figure 9. Photocopy of reference map used for watershed site reconnaissance – the pencil line denotes the approximate watershed boundary. Source: Highway Map of Franklin County, New York State. Franklin County Highway Department, 2007.
Figure 10. Photocopy of the road map of immediate vicinity of Mountain View Lake, used during watershed site reconnaissance. Note there are two North Shore Roads near the lake – one is to the east of Indian Lake, the other is at the north end of Indian Lake. Source: JIMAPCO Adirondack-North Country Road Atlas, ©2013.
Figure 9. Aerial images showing logging patterns and dirt roads in the landscape of Mountain View Lake. Above: image dated 2008; below: image dated 2011.
Estimate of Sediment Loading

A widely-used model, the Simple Model (Schueler, 1987), was used to estimate the export of sediment from the landscape that might ultimately reach Mountain View Lake. This model estimates stormwater pollutant loads as the product of mean pollutant concentration and runoff depths over specified time periods (usually annual or seasonal). To best calibrate this model to a particular watershed, it is important to use data from areas with comparable soils, vegetation, land use, and meteorological conditions. Based on the annual sediment export from similar watersheds, such as Lake George, one would predict an average event mean concentration of total suspended solids (TSS) to break down by land use (Table 2):

Table 2. Average TSS Concentrations by land cover area.

<table>
<thead>
<tr>
<th>In streams draining...</th>
<th>Average Event TSS Concentration</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Range</td>
</tr>
<tr>
<td>Forested areas</td>
<td>12 to 34 mg/l</td>
</tr>
<tr>
<td>Residential areas</td>
<td>7 to 176 mg/l</td>
</tr>
<tr>
<td>Urban areas</td>
<td>10 to 300 mg/l</td>
</tr>
</tbody>
</table>

Data were selected from studies of materials loading in Lake George and Hubbard Brook (New Hampshire) watersheds to provide reasonable estimates for the Mountain View Lake watershed. A reasonable long-term average erosion rate for undisturbed forests in this region is 30 to 40 kg/ha/yr. (Bormann et. al. 1974, Patric et al. 1984). Depending on the forestry practices employed, timber harvesting can increase sediment export by a factor of ten or more. Using this information it is possible to estimate the amount of sediment transported into Mountain View Lake from the watershed on an annual basis.

\[
L = \left[\frac{(P)(P_j)(R_v)}{12}\right] (C)(A)(2.72)
\]

Where:
- \(P\) = rainfall depth (inches) over the desired time interval (38.86 inches/year)\(^1\)
- \(C\) = flow weighted mean concentration of TSS in the runoff (23 mg/l)
- \(P_j\) = factor that corrects \(P\) for rain events that produce no runoff (0.9 for seasonal calculation, assumes 90% of rainfall events produce runoff)
- \(R_v\) = runoff coefficient, which expresses the fraction of the rainfall which is converted into runoff (forested lands range from 0.05 to 0.25\(^2\); for this analysis, the midpoint of the range (0.15) was selected)
- \(A\) = area (acres) of the watershed or development site (27,157 acres, excluding surface waters)
- 12 and 2.72 are conversion factors to obtain pounds/year.

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\(^1\) NOAA Climate Center, 1981-2010 Normals, Malone NY. http://www.ncdc.noaa.gov/cdo-web/
Using the values selected above to represent unmeasured conditions in the Mountain View Lake watershed, the transport of sediment from the watershed to Mountain View Lake is estimated to be approximately 387 tons/year, or 30.7 kg/ha/year. This value is consistent with the long-term average erosion rate for undisturbed forests of 30 to 40 kg/ha/yr. (Bormann et. al. 1974, Patric et al. 1984).

In the preceding analysis, the value 0.15 was used to represent the fraction of the rainfall which is converted into runoff, which is the midpoint value for the range cited for undisturbed forest land cover. It is well established the impact of timber harvest on streamflow, in the short term, results in increased annual water yield - for example, August streamflow in a study watershed increased by an average 45% for the 3 years following clear-cut harvest of 14% of the 1,084 ha watershed (Surfleet & Skaugset, 2013).

With the understanding that timber harvest is common in the watershed, the Simple Method is used to evaluate this scenario using the higher runoff coefficient of 0.25 from the literature to represent more disturbed forest conditions, estimating that a quarter of the rainfall in these areas becomes runoff (for reference, an impervious surface such as a paved parking lot would have a runoff coefficient of 100%). Using this value, the estimated erosion rate with the periodic clearing from timber harvest would be approximately 51 kg/ha/year.

Looking at the major sub-watersheds of Mountain View Lake – Indian Lake, Salmon River, Ragged Lake Outlet, and the lake nearshore areas – an estimate of the sub-watershed areas was approximated using a Digital Elevation Model (DEM) and heads-up digitizing. These estimated areas were used to generate estimates for sediment loading from these sub-watersheds (Table 3).

Table 3. Estimated sediment loading for sub-watersheds of Mountain View Lake, using the Simple Method.

<table>
<thead>
<tr>
<th>Sub-watershed</th>
<th>Acres</th>
<th>Rv (4)</th>
<th>Loading (kg/ha/yr)</th>
<th>Notes (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Lake</td>
<td>1,271 (1)</td>
<td>0.25</td>
<td>2.39</td>
<td>Excludes surface water of lake</td>
</tr>
<tr>
<td>Salmon River</td>
<td>14,246 (2)</td>
<td>0.15</td>
<td>16.1</td>
<td>Includes surface waters</td>
</tr>
<tr>
<td>Ragged Lake Outlet</td>
<td>9,909 (2)</td>
<td>0.15</td>
<td>11.2</td>
<td>Excludes surface water of lake</td>
</tr>
<tr>
<td>Near-shore areas</td>
<td>2,019 (3)</td>
<td>0.25</td>
<td>3.80</td>
<td>Excludes surface water of lake</td>
</tr>
</tbody>
</table>

Sum of estimated loading from sub-watersheds: 33.8

Sources and Notes:
1) (Kelting & Laxson, 2014b)
2) Derived from DEM; values approximated.
3) Difference between land area of Mountain View Lake watershed (excluding surface area of the lake) and the areas of the other sub-watersheds. Values approximated.
4) Rv value for Salmon River and Ragged Lake Outlet represents midpoint for forested values (0.15); Rv value for Indian Lake and Near-shore areas was selected higher (0.25) due to closer proximity to the lake as well as greater road density and presence of camps.
5) Estimated sediment loading calculated using these values: $P = 38.86\text{ inches}; P_j = 0.9; C = 23\text{ mg/l}$
This analysis highlights that, using this method, the larger sub-watersheds contribute more sediment to the lake than do the smaller sub-watersheds.

The Simple Method is limited for use in this watershed since it only allows for estimates of the amount of sediment that may be transported, based on current landscape conditions, as a result of precipitation events in an average year. This Method is not designed to account for stream bank and bed erosion. As described in this report, the harvest of timber has been on-going in this watershed for over a century. Measures to control stormwater runoff erosion may not have been as well implemented in the past as they are today. Since it is documented that timber harvesting increases the water yield for a given watershed (Surfleet & Skaugset, 2013) – including the potential to increase groundwater discharge via springs – it is likely that increased flows may occur in tributary streams separate from precipitation events. Given the potential for increased water yield in this watershed due to historic – and current – timber harvesting activities, it is likely that sediments which accumulated historically in the floodplains of the Salmon River and Ragged Lake Outlet are continuing to be re-suspended and transported to Mountain View Lake. Since the Simple Method does not account for loading based on re-suspension of sediment from stream bank and bed erosion, the results of this analysis are likely to underestimate the mass of sediment transported downstream.

**Sediment Management**

Based on observations made in the watershed, as well as information obtained through available data sets and calculations to estimate sediment loading values, the following conclusions are drawn:

1. The Mountain View Lake watershed is densely vegetated, with very little in the way of development or impervious surfaces. The most significant potential sources of sediment in this watershed are:
   a. Short- and long-term impacts from timber harvest
   b. Dirt roads
   c. Sand piles, and
   d. Sandy areas used heavily by ATV operators.

2. Timber harvesting is known to increase the water yield of a parcel (Surfleet & Skaugset, 2013) due to removal of vegetation, which indicates that streams running through harvested areas will have higher flows throughout the year than if the areas were not harvested. These increased flows are likely to result in higher stream velocity and more streambed scour, with overall increased loading of sediment to the lake. Water yield increases are not limited to surface water; since the region has dominantly well-drained soils, rainfall will infiltrate easily to groundwater and ground water discharge to tributaries and springs may also increase.

3. “Erosion and sedimentation from ground extensively disturbed by road building and tractor yarding remain elevated decades after harvest.” (Keppeler & Lewis, 2007). This finding suggests
that sediment loading from these impacted areas is likely to remain elevated for some time to come after harvest is completed. Additionally, natural events such as the Ice Storm of 1998 can impact the forest structure, and have an impact on the rate of erosion in affected areas.

4. Wetlands are abundant along the Salmon River upstream of Mountain View Lake, and most tributaries from the western portion of the watershed discharge to wetlands before reaching the river. These areas should promote settling of runoff-borne sediment by both reducing the velocity of the flow, and by providing vegetative structures that can retain sediment.

5. The Ragged Lake Outlet has a steeper gradient than does the Salmon River. Based on USGS topographic map review, it appears that the Outlet has a typical gradient of about 2%, within an approximately 4,000 ft reach having a gradient of about 0.5% and pronounced sinuosity. The Outlet runs in a valley between two steep mountains that have been actively harvested for timber in the past; as such, this waterway has a high potential to capture and transport sediment in runoff to Mountain View Lake. The runoff event of April 2014, which washed out the culvert at Bryant Siding Road, demonstrates the potential for Ragged Lake Outlet to have a volume of flow significant enough to scour upstream areas and transport scoured bed materials downstream to the lake.

6. The ClimAid Synthesis Report on climate change in New York State predicts increased rainfall in the Adirondack region (Rosenzweig, et al., 2011), with precipitation increasing by 5% to 15% by the 2080s. Should this occur, there will be more runoff in the Mountain View Lake watershed over the next 50 years than occurs presently.

Given the watershed observations, the Town of Bellmont has several options to mitigate for sediment loading to Mountain View Lake.

**Focus on Road Erosion**

The Town can focus on controlling erosion from the dirt roads. The Town is already engaged in activities to improve the drainage along Wolf Pond Road, as well as replacing damaged stream culverts. But as shown in the stormwater runoff photographs taken in the watershed by EcoLogic (Photographs 57 through 60), sediment is clearly being transported by runoff into streams that discharge to the lake.

Measures that can be implemented to reduce erosion along roads and reduce the potential for sediment transport to the lake include:

- Vegetative filter strips along the roadside to reduce the velocity of surface runoff and provide an opportunity for particulate materials to settle.
- Gabion walls to stabilize critical segments of road banks, where these banks are collapsing into the roadside drainage ditches.
- Check dams in roadside ditches that will reduce the velocity and erosive potential of runoff.
- Where lake tributaries pass under dirt roads, detention basins can be built to capture the runoff exiting the culvert, which will allow particulate material to settle. Such basins would need to be cleaned out periodically, and being located adjacent to the road should allow for easy access.
Focus on Exposed Sand and Gravel
A large sand pile was observed along North Shore Road (Photograph 56) during the watershed reconnaissance. Other sand piles or small gravel pits are likely to exist within the watershed for property owners to use to maintain dirt roads on their properties. The Town of Bellmont can implement the following suggestions:

- Where the Town maintains large sand piles for use by the Town, invest in covering to keep the sand from being washed away. Tarps anchored by weights are one simple method; another would be constructing covered sheds or storage facilities.
- The Town can educate the community on the importance of keeping their soil piles or gravel pits covered to prevent erosion.
- A zoning ordinance can require a minimum set-back from water courses for sand or gravel piles on private property.

Watershed reconnaissance also identified expose sand and soil actively used by ATV operators for recreation (Photographs 52 through 54). These activities can loosen the soil and make erosion more likely to occur. A publication by the U.S. Forest Service (2008) documents the effects of ATVs on forested lands (Meadows, Foltz, & Geehan, 2008). In this report, the Forest Service found that following any level of disturbance, runoff and sediment generated on the ATV trails increased by 56 percent to 625 percent compared to the undisturbed forest floor. The levels of disturbance can be reduced by proper trail design and maintenance and by focusing efforts on trail sections that require extra attention. One method to control runoff is frequent diversions of trail runoff onto the forest floor, which will reduce the amount of sediment and runoff as it infiltrates into the forest floor (Meadows, Foltz, & Geehan, 2008).

Focus on In-Stream Bank Stabilization
During the watershed reconnaissance, there was very little stream bank erosion observed on the main channel of the Salmon River, either at the confluence with Mountain View Lake (Photographs 41 through 43) or upstream at Wolf Pond Road crossing (Photographs 20 through 23). However, these two sample locations may not be indicative of other areas along the river that were not observed during the reconnaissance. Ragged Lake Outlet exhibited evidence of shoreline erosion and sediment deposition downstream of the Bryant Siding Road crossing (Photographs 35 and 36), which may have been a result of the washout in April 2014.

The watershed reconnaissance conducted of the Salmon River and Ragged Lake Outlet was limited by low level of accessibility, as there are very few public roadways in the area. A Phase I Rapid Geomorphic Assessment, consisting of evaluation of data from topographic maps and aerial photographs, can be conducted to predict channel conditions, adjustment processes, and reach sensitivity based on watershed and river corridor land use, and channel and floodplain modifications (Vermont Agency of Natural Resources, 2003). Once areas of potential concern have been identified and prioritized, site-appropriate technical measures can be implemented to stabilize the stream channel, if necessary.
**Focus on Timber Harvest Impacts**

The Town of Bellmont and Franklin County SWCD can work with the harvesters to establish practical Best Management Practices that can reduce soil loss from forestry practices.
References


Franklin County Soil and Water Conservation District. (2001). *Franklin County Agricultural and Farmland Protection Plan - The Future of Agriculture in Franklin County*.


