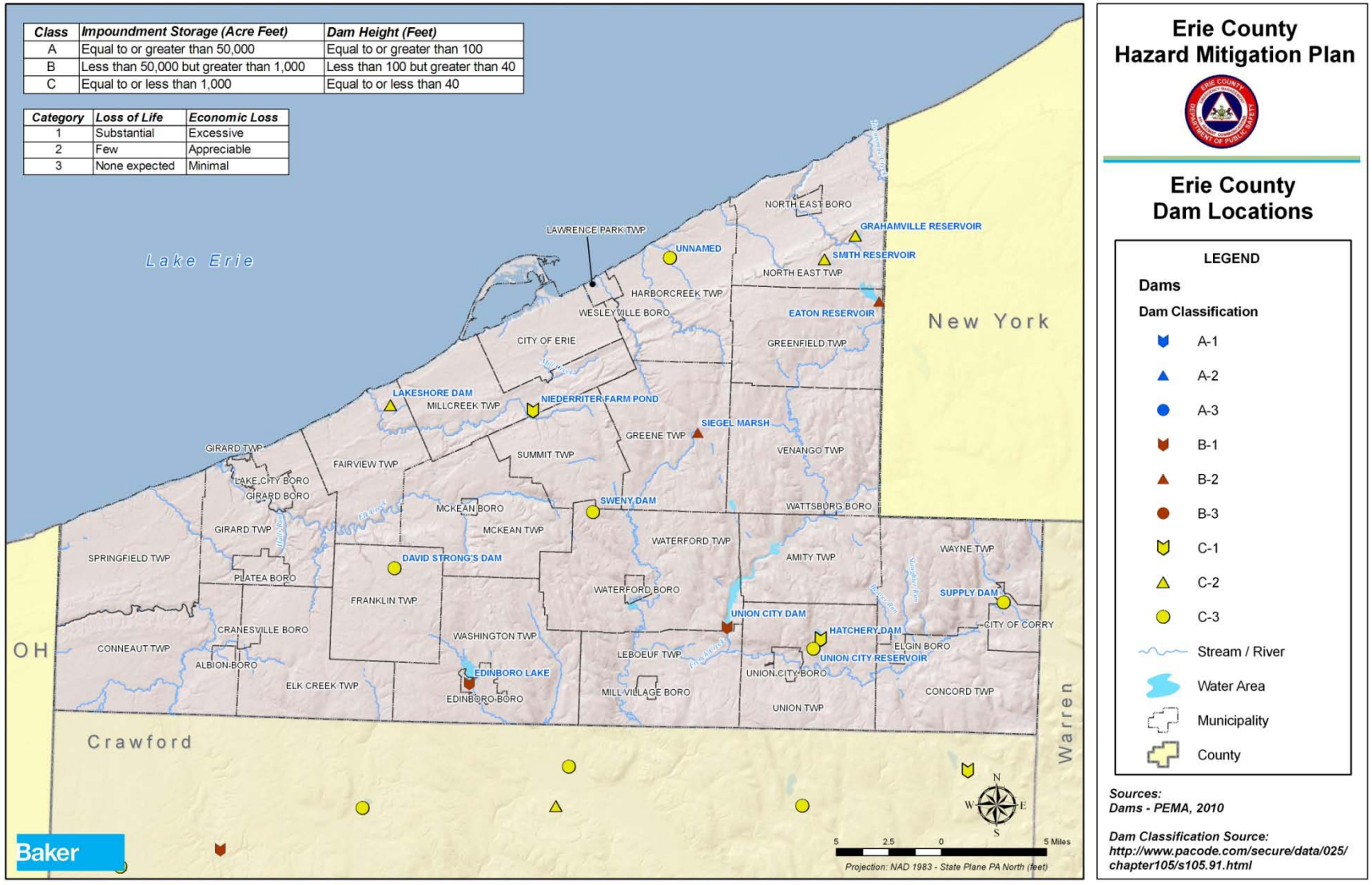
Appendix G – Dam Failure Hazard Profile (Section 4.3.9)

4.3.9 Dam Failure

4.3.9.1 Location and Extent

Dam failures most often occur during or after a massive rainfall, flooding, or spring thaws, sometimes with little to no warning. Depending on the size of the water body where the dam is constructed, water contributions may come from distant upstream locations. According to the Pennsylvania Emergency Management Agency, there are approximately fourteen dams in Erie County. There are no high-hazard dams requiring Emergency Action Plans (EAPs) in the County, and the ECEM reports that none of the County's dams are hazardous (ECEM, 2010). The locations of Erie County's dams are shown in Figure 4.3.9-1.

Figure 4.3.9-1: Erie County dams.



4.3.9.2 Range of Magnitude

Dam failures can pose a serious threat to communities located downstream from major dams. The impact of a dam failure is dependent on the volume of water impounded by the dam and the amount of population or assets located downstream. Catastrophic failures are characterized by the sudden, rapid, and uncontrolled release of impounded water or any other fluid or semi-fluid from a dammed impoundment or water body. The DEP defines a *high hazard dam* as "any dam so located as to endanger populated areas downstream by its failure" [Def. added May 16, 1985, P.L.32, No. 15]. High hazard dams receive two inspections each year – once by a professional engineer on behalf of the owner and once by a DEP inspector (DEP, 2008).

Dam failures may or may not leave enough time for evacuation of people and property, depending on their abruptness. Seepages in earth dams usually develop gradually, and, if the embankment damage is detected early, downhill residents have at least a few hours or days to evacuate. Failures of concrete or masonry dams tend to occur suddenly, sending a wall of water and debris down the valley at more than 100 mph. Survival would be a matter of having the good fortune not to be in the flood path at the time of the break. Dam failures due to the overtopping of a dam normally give sufficient lead time for evacuation.

The worst dam failure in Pennsylvania was the Johnstown Flood of 1889. The worst case scenario of a dam failure in Erie County was in 1907. The Edinboro Lake Dam failed in February 1907 and caused an unknown amount of damage.

4.3.9.3 Past Occurrence

There have been two significant dam failures in Pennsylvania. The worst dam failure to occur in the U.S. took place in Johnstown, PA in 1889 which claimed 2,209 lives. Another dam failure took place in Austin, PA (Potter County) in 1911 which claimed 78 lives. There was one dam failure in Erie County in 1907 which caused an unknown amount of damage. According to PEMA, minor dam failures occur annually, but the impact of these events is minimal and these events may never be reported.

There have been two minor incidents involving dams reported to the Pennsylvania Emergency Incident Reporting System between 2002 and 2009. PEIRS is a voluntary reporting database, so this may not be a comprehensive list of incidents in Erie County during this time period. These incidents are shown in Table 4.3.9-1.

Table 4.3.9-1: Dam incidents in Erie County (PEIRS, 2011).

DATE	MUNICIPALITY	DETAILS OF INCIDENT
9/9/2004	Edinboro Borough	A dam near Edinboro Borough crested and was in danger of failure. Residents evacuated downstream.
5/26/2005	Edinboro Borough	A private dam was found to have erosion. The owner was asked to lower the water levels in the dam.

4.3.9.4 Future Occurrence

Provided that adequate engineering and continued maintenance measures are in place, future occurrence of dam failures can be considered unlikely as defined by the Risk Factor

Methodology probability criteria (see Table 4.4-1). The Pennsylvania Department of Environmental Protection inventories and regulates all dams that meet or exceed the following criteria (PADEP, 2008):

- Impound water from a drainage area of greater than 100 acres;
- Have a maximum water depth greater than 15 feet;
- Have a maximum storage capacity of 50 acre-feet or greater.

The construction, operation, maintenance, modification and abandonment of dams is reviewed and monitored by the Department's Division of Dam Safety. Dams are evaluated based on categories such as slope stability, undermining seepage and spillway adequacy. The presence of structural integrity and inspection programs significantly reduces the potential for major dam failure events to occur.

4.3.9.5 Vulnerability Assessment

Property and populations located downstream from any dam are vulnerable to dam failure. The Pennsylvania Code (*§ 105.91 Classification of dams and reservoirs*) classifies both dams by size and the amount of loss of life and economic loss expected in a failure event. Table 4.3.9-2 displays the dam classification; although the size of a dam may result in varying impacts, the hazard potential classification of Category 1 dams are most important, since they have the potential to cause substantial loss of life and excessive economic loss.

Table 4.3.9-2: Dam Classification (The Pennsylvania Code).

Dam Size Classification		
CLASS	**IMPOUNDMENT STORAGE (acre feet)**	**DAM HEIGHT (feet)**
A	Equal to or greater than 50,000	Equal to or greater than 100
B	Less than 50,000 but greater than 1000	Less than 100 but greater than 40
C	Equal to or less than 1000	Equal to or less than 40
Dam Damage Classification		
CATEGORY	**LOSS OF LIFE**	**ECONOMIC LOSS**
1	Substantial	Excessive
2	Few	Appreciable
3	None Expected	Minimal

There are four Category 1 dams in Erie County, two are Class B and two are Class C. Communities downstream of Category 1 dams should pay particular attention to inspection and maintenance activities that keep their communities safe. With these activities and oversight from the DEP, vulnerability decreases significantly. The remaining ten dams in the County are category 2 and 3 dams. While the loss dam damage classification loss of life and economic loss for these categories of dams are less than that of a category 1 dam, they nevertheless pose a threat to downstream jurisdictions and should also be maintained to keep communities safe.