10 Comparative Subwatershed Analysis

A Comparative Subwatershed Analysis was performed for the North Branch Park River subwatersheds to identify the subwatersheds with the greatest vulnerability and restoration potential. Subwatershed "metrics" were used to conduct this analysis. Metrics are numeric values that characterize the relative vulnerability and restoration potential of a subwatershed. The results of this analysis will be used to prioritize field assessment efforts in future phases of this study and to guide plan recommendations.

The analysis involves a screening-level evaluation of selected subwatershed metrics that are derived by analyzing available GIS layers and other subwatershed data sources. The basic approach used to conduct the Comparative Subwatershed Analysis consisted of:

1. Delineation of subwatershed boundaries and review of available data.
2. Selection and calculation of metrics that best describe subwatershed vulnerability and restoration potential. (The metrics used to rank subwatershed vulnerability were selected separately from the metrics used to rank subwatershed restoration potential.)
3. Developing weighting and scoring rules to assign values to each metric.
4. Computing aggregate scores and developing subwatershed rankings.

Subwatersheds with higher aggregate "vulnerability" scores are more sensitive to future development and should be the focus of watershed conservation efforts to maintain existing high-quality resources and conditions. Subwatersheds with higher aggregate "restoration potential" scores are more likely to have been impacted and have greater potential for restoration to improve upon existing conditions. This approach enables watershed planners to allocate limited resources on subwatersheds where restoration and conservation efforts have the greatest chances of success. The Comparative Subwatershed Analysis was performed for the following North Branch Park River subwatersheds:

- Beamans Brook East
- Beamans Brook West
- Blue Hills Reservoir
- Cold Spring Reservoir
- Filley Brook
- North Branch Park River
- Tumbledown Brook
- Tumbledown Brook South
- Tunxis Reservoir
- Wash Brook North
- Wash Brook South
- Wash Brook West
- West Hartford Reservoir
- Wintonbury Reservoir

The following sections present the metrics used, the rationale for their selection, how numerical values for the various metrics were calculated, and the results of the analysis. Available GIS and other data were used to assign a value for each metric.

10.1 Priority Subwatersheds for Conservation

Eight metrics were used to evaluate each subwatershed for vulnerability to future development, with a numerical value assigned for each metric based on the analyses presented in previous sections of this Baseline Watershed Assessment. *Table 10-1* presents the metrics used for determining the relative vulnerability of each subwatershed. Many of the metrics evaluate the potential changes in watershed in land use, land cover, impervious cover, and pollutant loading between existing and future conditions, as presented in previous sections of this report. Note that the pollutant loading metric does not account for combined sewer overflow loading in the watershed, and is comparing the loading from non-point sources (land use) only. Each metric was assigned a value of between 1 and 10, with 1 indicating the lowest vulnerability and 10 indicating the highest vulnerability to future development. The scores for each of the metrics were then added to arrive at an overall score for each subwatershed. The total number of points possible for each subwatershed is 80.

Table 10-1. Summary of Subwatershed Vulnerability Metrics

Subwatershed Metric	How Metric is Measured	Indicates Higher Vulnerability Potential When	Metric Points
1. Impervious Cover Change	% increase in impervious cover in subwatershed	**Predicted increase in IC is high**, suggesting greater development potential and stream impacts	Add 1 pt for each 2% increase in impervious cover, up to 10 pts
2. Impervious Cover Threshold	Comparison of current and future IC relative to ICM threshold	**Predicted increase in IC crosses "impacted" (10%) threshold**, development could result in significant stream impacts	Add 5 pts for each exceedance into higher category (0-10%; 10-25%; 25-60%, >60%)
3. Stream Order	% of subwatershed streams that are 1st or 2nd order	**Subwatershed contains lower order streams**, suggesting greater vulnerability of headwater streams to future development	Add 1 pt for each 10% of streams in subwatershed that are 1st or 2nd order
4. Pollutant Loading	Average % increase of N, P, TSS, and bacterian pollutant loading in subwatershed	**Predicted increase in pollutant loads is high,** suggesting greater water quality impacts from future development	Award 1 pt for each 10% increase in the average pollutant loading
5. Commercial & Industrial Land Use Change	% increase of commercial & industrial land in subwatershed	**Predicted increase in commercial & industrial land use is high**, suggesting greater potential for water quality impacts from pollutant hot spot	0% = 0 pts; 1 to 10% = 3 pts; 11 to 50% = 5 pts; 51 to 100% = 7 pts, > 100 % = 10 pt

Table 10-1. Summary of Subwatershed Vulnerability Metrics

Subwatershed Metric	How Metric is Measured	Indicates Higher Vulnerability Potential When	Metric Points
6. Developable Forest Cover	% of subwatershed with developable forest cover	**Area of developable forest cover is high**, suggesting greater potential for future reductions in forested land	Add 1 pt for each 5% of developable forest cover
7. Stream Corridor Forest Cover and Public Ownership	% of stream corridor that is developable forest	**Stream corridor forest cover is high and public ownership within stream corridor is low**, suggesting greater potential for future reductions in vegetated riparian areas	Award 1 point for each 1% of stream corridor that is developable forest
8. Road Crossings	number of road crossings / square mile	**Number of road crossings is high**, suggesting greater potential for direct stormwater discharges from roadways	Add 3 pts for each stream crossing /sq mi

The results of the vulnerability analysis are summarized in *Table 10-2*. The overall subwatershed vulnerability scores range from 22 to 68 points out of a possible 80 points. The highlighting identifies subwatersheds with high (orange), moderate (yellow), and low (green) relative vulnerability in the North Branch Park River watershed.

Table 10-2. Results of Subwatershed Vulnerability Analysis

Subwatershed	Impervious Cover Change	Impervious Cover Threshold	Stream Order	Pollutant Loading	Commercial & Industrial Land Use Change	Developable Forest Cover	Stream Corridor Forest Cover and Public Ownership	Road Crossings	Total	Rank
Wash Brook North	9	5	10	5	10	7	7	9	**62**	**1**
Beaman Brook East	10	10	10	8	0	7	4	6	**55**	**2**
Wintonbury Reservoir	5	0	10	6	10	7	7	5	**50**	**3**
Blue Hills Reservoir	6	5	10	2	5	4	6	4	**42**	**4**
Filley Brook	1	5	10	1	5	5	5	6	**38**	**5**
Tumbledown Brook	7	5	5	1	0	4	3	10	**35**	**6**
Beaman Brook West	1	0	10	1	5	3	4	10	**34**	**7**
Cold Spring Reservoir	2	5	6	2	0	5	6	8	**34**	**8**
Wash Brook West	3	5	10	5	0	3	6	2	**34**	**9**

Table 10-2. Results of Subwatershed Vulnerability Analysis

Subwatershed	Impervious Cover Change	Impervious Cover Threshold	Stream Order	Pollutant Loading	Commercial & Industrial Land Use Change	Developable Forest Cover	Stream Corridor Forest Cover and Public Ownership	Road Crossings	Total	Rank
Tunxis Reservoir	1	5	6	2	3	3	7	4	**31**	**10**
Wash Brook South	3	0	3	2	3	5	4	10	**30**	**11**
West Hartford Reservoir	0	0	10	4	0	2	8	2	**26**	**12**
Tumbledown Brook South	1	0	6	3	0	2	4	9	**25**	**13**
North Branch Park River	2	0	2	1	5	4	4	6	**24**	**14**

As shown in *Table 10-2*, the following subwatersheds are considered most vulnerable to future development impacts and should be given higher priority for conservation efforts to maintain existing resource conditions:

- *Wash Brook North* – The Wash Brook North subwatershed is ranked as the most vulnerable subwatershed to future development. The subwatershed contains headwater streams (1st and 2nd order streams), which are important components of ecosystem health because they are a critical food source for the river, influence downstream conditions, and support biodiversity. The subwatershed is predicted to experience a significant increase in impervious cover from existing to future watershed conditions, with a large potential increase in commercial and industrial land uses. The percentage of developable forest cover in the subwatershed is moderate to high. There is also a high density of stream crossings in this watershed, which suggests a potential for increased stormwater runoff from roads as the subwatershed becomes more developed.

- *Beamans Brook East* – The Beamans Brook East subwatershed is the smallest subwatershed in land area, at only 163 acres. However, this subwatershed is predicted to experience significant land use changes under a buildout scenario. The majority of the subwatershed is within a "planned residential" zoning area and much of the existing land is forested. Impervious cover is predicted to increase by almost 50% under a future buildout scenario.

- *Wintonbury Reservoir* – The northern portion of the Wintonbury Reservoir subwatershed is currently undeveloped and is located in an area zoned for industrial use along Blue Hills Avenue (Route 187). Potential future development in this area is predicted to

increase the amount of impervious cover and industrial land use in the subwatershed, while decreasing forest cover. The subwatershed contains a 1st order stream that flows through an area of potential industrial development, which may be impacted by these potential future changes in land cover and land use.

- *Blue Hills Reservoir* – The Blue Hills Reservoir subwatershed is adjacent to the Wintonbury Reservoir subwatershed. Similar to the Wintonbury Reservoir subwatershed, potential future development is anticipated along the industrial-zoned areas of the Route 187 corridor, resulting in the conversion of forest and open space to additional industrial land use. Therefore, the hydrology and water quality of the headwater streams in this subwatershed are vulnerable to future industrial development.

- *Filley Brook* –Filley Brook is a headwater (1st order) stream that joins Tumbledown Brook near the confluence with the North Branch Park River. Although there is a limited amount of developable land within the Filley Brook subwatershed, the remaining developable land is generally located along the Filley Brook stream corridor.

10.2 Priority Subwatersheds for Restoration

Ten metrics were used to evaluate each subwatershed for restoration potential, with a numerical value assigned for each metric based on the analyses presented in previous sections of this Baseline Watershed Assessment. *Table 10-3* presents the metrics used for determining the relative restoration potential of each subwatershed. Each metric was assigned a value of between 1 and 10, with 1 indicating the lowest restoration potential and 10 indicating the highest restoration potential. The scores for each of the metrics were then added to arrive at an overall score for each subwatershed. The total number of points possible for each subwatershed is 100.

Table 10-3. Summary of Subwatershed Restoration Potential Metrics

Subwatershed Metric	How Metric is Measured	Indicates Higher Restoration Potential When	Metric Points
1. Existing Impervious Cover	% impervious cover in subwatershed	**Current impervious cover is low**, suggesting range of possible sites for storage retrofits and stream repairs	< 10% = 10pts; 10 to 25% = 7 pts; 26 to 40 = 5 pts; 41 to 60% = 3 pts; > 60% = 1 pts
2. Forest Cover	% forest cover in subwatershed	**Forest cover is low**, suggesting greater potential for upland and riparian reforestation	< 20% = 10 pts; 21 to 30% = 7 pts; 31 to 40% = 5 pts; 41 to 60% = 3 pts, > 60 % = 1 pt
3. Subwatershed Development Potential	% of subwatershed that is developable	**The amount of potential future development is low,** suggesting stable conditions and greater potential for stream repairs and storage retrofits	Award 1 pt for each 10% percent below 100%

Table 10-3. Summary of Subwatershed Restoration Potential Metrics

Subwatershed Metric	How Metric is Measured	Indicates Higher Restoration Potential When	Metric Points
4. Publicly-owned land	% of subwatershed that is publicly owned	**Public land ownership is high**, providing range of potential sites for restoration practices	Award 1 pt for ea 2% in public ownership (up to 10 pts)
5. Single-family Residential Land	% of subwatershed residential land use	**Detached residential land is high**, suggesting greater potential for neighborhood source controls, on-site retrofits and upland forestry	Award 1 pt for each 5% single-family land use
6. Commercial Land	% of subwatershed commercial land use	**Commercial land use is high**, suggesting greater potential for source controls, discharge prevention, and on-site retrofits	Award 1 pt for each 2% of subwatershed classified as commercial land use
7. Stream Corridor Forest Cover and Public Ownership	% of stream corridor that is publicly-owned and not forested	**Stream corridor forest cover is low and public ownership within stream corridor is high,** suggesting greater potential for riparian reforestation, stream restoration, and storage retrofits	Award 2 pt for each 10% of stream corridor area
8. Stream Density	stream miles / square mile	**Stream density is high**, suggesting greater potential for stream corridor practices	Award 3 pts for each mile of stream/sq mi
9. Regulated Site Density	regulated sites / sq mi. (CTDEP General Permits)	**Regulated site density is high,** suggesting greater potential to implement source controls, discharge prevention and on-site retrofits	0 to 1 = 1 pt; 1 to 2 = 3 pts; 2 to 5 = 5 pts; 5 to 10 = 7 pts; > 10 = 10 pts
10. Road Crossings	crossings / stream mile	**Number of road crossings is high**, suggesting greater potential for stream and potential fish passage restoration	Award 3 pts for each road crossing /sq mi

The results of the subwatershed restoration potential analysis are summarized in *Table 10-4*. The restoration potential scores range from 31 to 63 points out of a possible 100 points. The highlighting identifies subwatersheds with high (orange), moderate (yellow), and low (green) relative restoration potential in the North Branch Park River watershed.

Table 10-4. Results of Subwatershed Restoration Potential Analysis

Subwatershed	Existing Impervious Cover	Forest Cover	Subwatershed Development Potential	Publicly-owned land	Single-family Residential Land	Commercial Land	Stream Corridor Forest Cover and Public Ownership	Stream Density	Regulated Site Density	Road Crossings	Total	Rank
Beamans Brook West	7	10	8	8	5	2	3	5	5	10	**63**	**1**
Tumbledown Brook	7	7	7	2	5	6	6	8	5	10	**63**	**1**
Filley Brook	7	10	8	2	9	6	1	6	7	6	**62**	**3**
North Branch Park River	5	10	8	7	5	3	6	4	7	6	**61**	**4**
Wash Brook South	7	7	7	2	7	5	1	8	7	10	**61**	**4**
Tumbledown Brook South	7	7	8	2	6	0	7	7	3	9	**56**	**6**
Wash Brook North	7	5	5	2	2	8	2	9	7	9	**56**	**6**
Blue Hills Reservoir	7	5	6	3	0	10	5	4	10	4	**54**	**8**
Cold Spring Reservoir	10	3	7	0	9	0	5	7	1	8	**50**	**9**
Wash Brook West	10	3	7	0	9	0	9	7	3	2	**50**	**9**
Tunxis Reservoir	10	3	7	1	5	3	3	4	5	4	**45**	**11**
Wintonbury Reservoir	7	5	6	0	3	4	5	3	7	5	**45**	**11**
Beamans Brook East	10	7	5	0	3	0	2	6	1	6	**40**	**13**
West Hartford Reservoir	10	1	8	1	1	0	2	5	1	2	**31**	**14**

As shown in *Table 10-4*, the following subwatersheds are considered to have the greatest restoration potential:

- *Beamans Brook West* – The Beamans Brook West subwatershed has a high percentage of developed land, impervious cover, and few remaining forested areas, suggesting a stable subwatershed with the potential for a variety of retrofits. Additionally, this subwatershed has a high percentage of publicly-owned land, thereby providing greater retrofit opportunities.

- *Tumbledown Brook* – The Tumbledown Brook subwatershed ranked moderate to high in many of the evaluation categories. The subwatershed has a high density of streams and road crossings, providing numerous opportunities for stream restoration, stormwater retrofits, and stream cleanups.

- *Filley Brook* – Filley Brook ranks among the subwatersheds with the greatest restoration potential in the North Branch Park River watershed. Forest cover in the subwatershed

is low, suggesting the potential for upland and riparian reforestation practices. Single-family residential neighborhoods comprise a large percentage of the land use in the subwatershed, providing opportunities for neighborhood source controls and on-site residential retrofits. The subwatershed has a moderate to high density of streams, permitted commercial and industrial facilities, and road crossings which may provide a variety of potential restoration opportunities.

- *North Branch Park River* – The North Branch Park River subwatershed is highly developed with a mix of residential, commercial, institutional, and recreational uses. Despite the dense development in this subwatershed, there are publicly-owned undeveloped areas that are potentially suitable for restoration projects. The watershed has high visibility since the runoff drains directly to the North Branch Park River and it encompasses the urban areas of Hartford and West Harford.

- *Wash Brook South* – The Wash Brook South subwatershed has a high restoration potential since much of its land area is developed, with a high percentage of impervious cover and relatively little buildable land. The subwatershed also has a high stream density and numerous road crossings, which could yield potential opportunities for stormwater retrofits and stream restoration. Potential reforestation opportunities also exist along the stream corridor and in upland areas.

10.3 Subwatersheds Recommended for Field Assessments

The Comparative Subwatershed Analysis results were used to identify "priority subwatersheds" that are targeted for subsequent field assessments. The objective of the field assessments is to further evaluate subwatershed conditions and identify potential candidate restoration sites and opportunities. Based on the Comparative Subwatershed Analysis results, the priority subwatersheds include those subwatersheds that are ranked "high" in terms of potential vulnerability to future development or restoration potential. *Figure 10-1* depicts the resulting priority subwatersheds.

The following priority subwatersheds are therefore recommended for detailed field assessments, including stream corridor assessments, stream corridor restoration and recapture investigation, upland subwatershed site reconnaissance (neighborhood source assessment, hotspot confirmation, and streets and storm drain assessment), and upland stormwater retrofit inventories:

- Filley Brook
- Wash Brook North and South
- Beamans Brook East and West
- Tumbledown Brook
- North Branch Park River
- Blue Hills Reservoir
- Wintonberry Reservoir

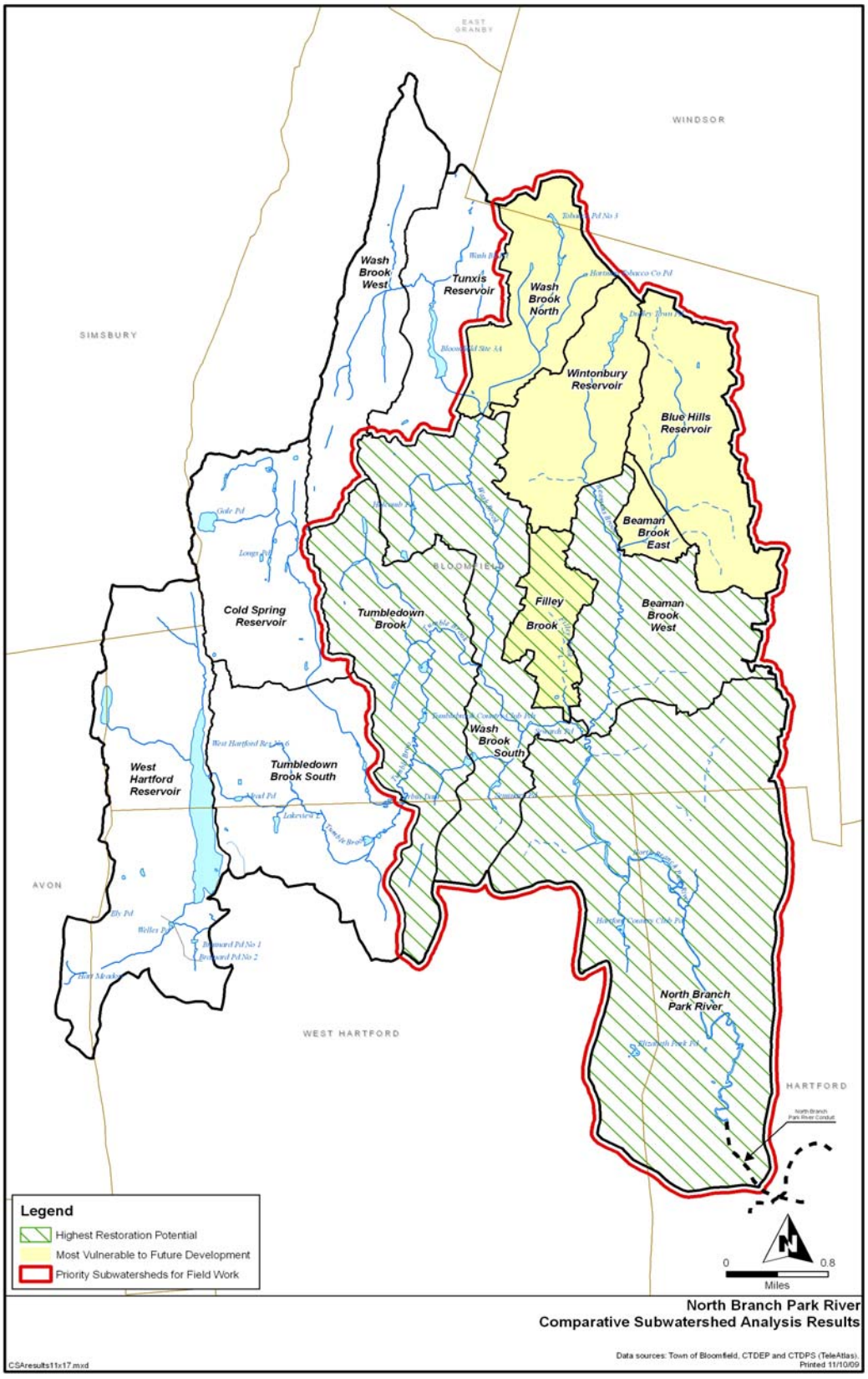

Figure 10-1. Priority Subwatersheds Based on Comparative Subwatershed Analysis