STREAMS, LAKES, RIVERS & TIDAL WATERS

Grading Growth Management & Land Use Plan Example

This example illustrates a process for grading a growth management or land use plan for how well streams, lakes, rivers, tidal waters and other aquatic resources will be preserved and enhanced with anticipated growth. The goal is to present this information in a way that makes it easy for the residents of the planning area to understand how this aspect of their quality of life may change in the future.

The starting point must be a clear depiction of current aquatic resource quality and how it was affected by past growth. Next, the plan shows the effect of anticipated growth using criteria that directly relate to the beneficial uses area residents value. Finally, the plan sets forth actions for preserving high quality aquatic resources and restoring those already degraded.

This information is presented below in response to five questions posed on the CEDS Grading Growth Management & Land Use Plans webpage with regard to streams, lakes, rivers and tidal waters. First though, a bit of background.

BACKGROUND

To preserve and enhance quality of life, a plan should address all of the waters significant enough to have a name within the planning area (e.g. Smith River, Ferry Branch, Vista Lake, etc.). These waters tend to be the most highly valued by planning area residents. Also, to preserve the quality of these larger waters all smaller tributaries must be safeguarded as well. The plan should present the quality of each expressed as:

> **Excellent** waters are fit for all human uses and can support highly-sensitive fish and other aquatic creatures.
>
> **Good** waters can support a high number of game fish but not necessarily highly-sensitive organisms. These waters are also suitable for swimming, wading and even aquatic playgrounds for children.
>
> **Fair** waters support few game fish or sensitive organisms and are not suitable for swimming or as aquatic playgrounds for children.
>
> **Poor** quality waters support only the most pollution-tolerant organisms and one should avoid body contact.

Quality can be based upon fish or other biological sampling. Watershed land use can be related to quality as follows:

Watersheds dominated by forest are usually of **Excellent** quality.

A mix of forest and farms with extensive use of soil-water conservation practices on cropfields produces **Good** quality waters.

A mix of farms, forest and suburban development usually yields **Fair** quality waters.

Intense suburban-urban development results in **Poor** aquatic resource quality.

The percent of a watershed covered by buildings, streets, parking lots and other impervious surfaces also relates to aquatic resource quality as:

Excellent less than 5% of a watershed is covered by impervious surfaces, which equals less than one house for every four acres of watershed area;

Good less than 10% impervious area or less than one house for every ***two acres***;

Fair less than 15% impervious area or less than one house ***per acre***; and

Poor greater than 15% impervious area or greater than one house per acre.

In addition to current quality the plan should show how the health of named streams, rivers, lakes, reservoirs and tidal waters will change with anticipated growth. The change can be determined by estimating how watershed impervious area will increase with future growth. Further development-caused aquatic resource damage can be prevented if the runoff from all new impervious surfaces drains to highly-effective Best Management Practices (BMPs). Waters degraded by past development can be restored if existing impervious areas are redeveloped so runoff from these surfaces drains to highly-effective BMPs.

The plan should describe the steps taken to ensure that all future development will fully utilize highly-effective BMPs or explain why not. The plan must also set forth actions that will be taken to restore Fair or Poor quality waters to a Good condition. About 165 feet of Poor quality waters may be restored to Good condition for each acre of existing impervious area retrofitted so stormwater runoff from that acre is treated with highly-effective BMPs. Restoring waters to an Excellent condition may not be attainable. Indeed, restoration to a Good condition is rare.

In most cases, actions to enhance quality must begin with retrofitting existing impervious surfaces with highly-effective BMPs. Upgrading wastewater treatment plants and fixing sewers prone to overflows may be necessary too. A recent review of numerous projects showed that in-stream restoration alone cannot counter the effects of watershed development. Only after these steps are taken should in-stream restoration or planting trees be considered. It's not that these two measures are unimportant. They are simply insufficient to fully restore degraded waters without retrofits.

For further information visit: Protecting Wetlands, Streams, Lakes, Tidal Waters & Wells from the Impacts of Land Development.

Following are keywords to use in searching a plan for the information needed to understand how well a plan will preserve and enhance aquatic resources: impervious area, BMP, stormwater management, restoration, excellent, good, fair, poor, stream, lake, river, estuary, tidal, marine and wetland.

Questions for Grading a Plan Regarding How Well Streams, Lakes Rivers & Tidal Waters Will Be Preserved & Enhanced

As with most other Quality of Life factors, five questions were suggested on the CEDS Grading Growth Management & Land Use Plans webpage for assessing how well a plan will preserve and enhance streams, lakes, rivers and tidal waters. Following is an example of how a hypothetical plan addresses those questions.

1. **Does the plan set forth criteria for assessing the impact of past and anticipated growth?**

   The criteria suggested on the CEDS Grading Growth Management & Land Use Plans webpage for streams, lakes, rivers and tidal waters was: Current and future quality based on the percent impervious area for the watershed of each named water body or waterway.

2. **Does the plan show current quality of all named waters within the planning area?**

   In this example a hypothetical planning area contains the four named water bodies. The quality of life significance of each water body follows:

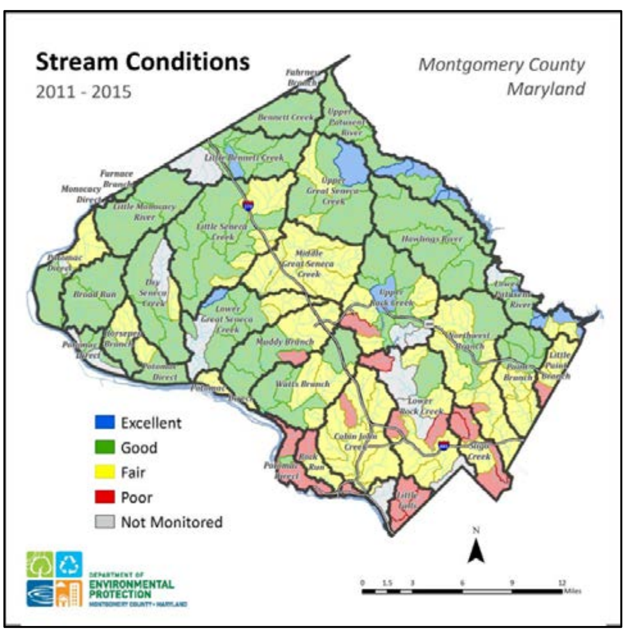
   - **East Branch** flows through a heavily used park. Local children can frequently be seen playing in the stream. Area residents are concerned that anticipated growth may make the stream unfit as an aquatic playground.

- **Smith Lake** is used by many area residents for boating, wading, fishing, picnicking, and hiking but algae blooms along with an increasingly murky appearance has discouraged swimming over the last couple of decades as the watershed has developed.
- **Trout Run** supports a healthy population of these very sensitive gamefish. The highly-regarded Brook Trout fishing attracts significant tourism. But, like Smith Lake, the trout are not doing as well as they did in the past. Fishery biologists have attributed the decline to the watershed having reached 2% impervious area, which is the upper limit for supporting a healthy Brook Trout population. Anticipated growth would double watershed imperviousness causing the Brook Trout to disappear. As the cleanest waterway in the planning area Trout Run also serves as a significant water supply source. Further poorly managed growth in the watershed could jeopardize drinking water quality and drive up treatment costs.

- **West River** also attracts many tourists. The planning area covers only a small part of the watershed. This means that future growth in just the planning area may have little impact to West River. Nevertheless, residents still wish to pursue actions that will preserve River quality.

The current quality and watershed impervious area of the four named waters is shown in the table to the right.

Waters	Quality	Impervious Area
East Branch	Good	8%
Smith Lake	Fair	15%
Trout Run	Excellent	2%
West River	Good	6%



Following are two examples of maps from actual planning documents showing aquatic resource health and watershed imperviousness.

The map to the left is from the Montgomery County, MD Water Resources Functional Master Plan. This map shows the health of most of the named streams in that county. The map on the next page is from an earlier planning document and provides percent impervious area of all named waters within a subwatershed.

Subwatersheds and Existing Impervious Cover

Figure 10

3. **Does the plan show the quality of all named waters with anticipated growth?**

Table 9 to the right, is from the [City of Gaithersburg, MD 2009 Master Plan Water Resources Element]().

Table 9: Gaithersburg Potential Land Use Changes

Watershed / Land Use Category	2008 City Limits			2008 City Limits and MEL		
	2008 Baseline (acres)	2030 Potential (acres)	Change (acres)	2008 Baseline (acres)	2030 Potential (acres)	Change (acres)
Lower Great Seneca						
Development	1090	1095	*5*	1485	1503	*18*
Mixed open land	39	38	*-1*	42	41	*-1*
Agriculture	0	0	*0*	13	0	*-13*
Forest	118	114	*-4*	167	164	*-4*
Water	7	7	*0*	28	28	*0*
Middle Great Seneca						
Development	1752	1819	*67*	2139	2282	*143*
Mixed open land	97	99	*2*	145	154	*9*
Agriculture	24	0	*-24*	40	0	*-40*
Forest	260	214	*-46*	389	275	*-114*
Water	28	30	*1*	30	32	*1*
Muddy Branch						
Development	2365	2680	*315*	3947	4386	*439*
Mixed open land	301	139	*-162*	323	160	*-163*
Agriculture	162	0	*-162*	286	0	*-286*
Forest	297	305	*8*	320	329	*8*
Water	58	59	*1*	77	78	*1*
Upper Rock Creek						
Development	0	0	*0*	176	179	*3*
Mixed open land	0	0	*0*	9	96	*87*
Agriculture	0	0	*0*	90	0	*-90*
Forest	0	0	*0*	52	52	*0*
Water	0	0	*0*	5	5	*0*
Watts Branch						
Development	0	0	*0*	214	214	*0*
Mixed open land	0	0	*0*	0	0	*0*
Agriculture	0	0	*0*	0	0	*0*
Forest	0	0	*0*	0	0	*0*
Water	0	0	*0*	3	3	*0*
Grand Total						
Development	**5207**	**5595**	***388***	**7961**	**8564**	***604***
Mixed open land	**437**	**276**	***-161***	**519**	**451**	***-67***
Agriculture	**187**	**0**	***-187***	**429**	**0**	***-429***
Forest	**676**	**634**	***-42***	**929**	**820**	***-109***
Water	**93**	**95**	***2***	**143**	**145**	***2***

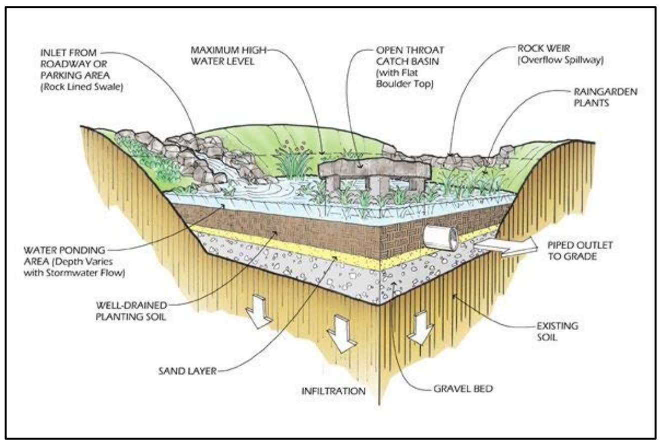
Table 9 illustrates the background information that should be contained in a plan regarding anticipated growth and other land use changes. This information then serves as the basis for predicting future impervious area percentages and stream quality. The table below provides quality and impervious area for the four named waters based on similar land use projections.

Waterway	Impervious Area		Quality	
	2016	2026	2016	2026
East Branch	8%	12%	Good	Fair
Smith Lake	15%	19%	Fair	Poor
Trout Run	2%	4%	Excellent	Good
West River	6%	7%	Good	Good

4. **If any named waters are or will be of Poor or Fair quality does the plan recommend actions for:**
   a. **Restoring the waters to a Good condition, and**
   b. **Provide the factual basis for the effectiveness of each action?**

The preceding table shows that the extent of buildings, streets, parking lots and all other impervious surfaces will increase in the four watersheds over the next ten years. The pollution and flood waters coming from each acre of new impervious surface will degrade about 660 feet of Excellent quality downstream waters.

A new approach to stormwater management known as Low-Impact Development (LID) has the potential to prevent aquatic resource damage. LID is also known as Environmental Site Design, Better Site Design, and by other labels. All variations prevent damage by treating impervious surface stormwater runoff with Highly-Effective Best Management Practices (HEBMPs), like the bioretention facility pictured here.



Bioretention - A Highly-Effective Best Management Practice

These BMPs reduce pollutant loads by 80% to 95%, prevent stream channel erosion and maintain the groundwater recharge supplying freshwater to wetlands, streams and other aquatic resources during dry weather. However, scientific research has not proven that the theoretical benefits of LID and Highly-Effective BMPs is actually achieved in the real world. Part of the uncertainty is due to BMP maintenance. Recent studies indicate that up to 25% of BMPs are failing due to poor maintenance and other factors. For the time being though it is assumed that the aquatic resource damage normally caused by each acre of impervious surface is negated if it drains to a Highly-Effective BMP.

Following are the actions proposed to gain the benefits of anticipated growth and to use development to improve all four named waters.

East Branch: All impervious surfaces created by future development in the East Branch watershed will drain to Highly-Effective BMPs. This action will keep the stream clean enough to continue serving as a place for children to splash, wade and play while their parents enjoy the adjacent park.

Smith Lake: A large, existing shopping center drains to the Lake. The center has declined and most of the stores are empty. Local officials have a plan for revitalizing the shopping center. The plan includes retrofitting existing impervious area so they drain to Highly-Effective BMPs. This action should eliminate the impact of the impervious surfaces which account for much of the Lake degradation seen over the past two decades. Hopefully this will improve the quality sufficiently that the Lake becomes appealing again for swimming and all other uses cherished by planning area residents. All impervious surfaces created by future development in the watershed will also drain to Highly-Effective BMPs.

Trout Run: The largest existing impervious area within the watershed is located on the campus of Blair High School. In exchange for an increased number of housing units, a local development company has agreed to retrofit the school building, parking lots and other impervious surfaces so they drain to Highly-Effective BMPs. This action may effectively reduce watershed impervious from above the 2% threshold for healthy Brook Trout populations to 1.5% which should allow for recovery to former levels. All impervious surfaces created by future development in the watershed will drain to Highly-Effective BMPs as well.

West River: As with the other three named waters, **a**ll future development in the land area draining to the River will be served by Highly-Effective BMPs. If all other watershed growth outside the planning area utilizes these same highly-effective BMPs then West River should continue in Good condition.

Table 4.2, is from a planning document entitled [Montgomery County Coordinated Implementation Strategy](). This table shows the acres of existing

Table 4.2 Projection by Phase for Watersheds and Pollutants

							Permit/TMDL Targets	
Watershed	Fiscal Year	2015	2017	2020	2025	2030	2017	2020
Anacostia	Impervious Treated (acres)	1,421	2,393	3,364	4,272	4,544		
	ESD (% Impervious)	26%	44%	61%	69%	71%		
	Cost (Million $)	160	307	486	732	820		
	ESD (% Cost)	45%	62%	71%	78%	78%		
	Nitrogen	25%	39%	68%	89%	100%	81.8%	82%
	Phosphorus	27%	42%	77%	100%	100%	81.2%	81%
	Sediment	47%	72%	100%	100%	100%	87.5%	88%
	Bacteria	21%	33%	46%	59%	64%	87.9%	88%
	Trash	41%	65%	89%	100%	100%		
Rock Creek	Impervious Treated (acres)	1,541	1,961	2,381	3,625	3,989		
	ESD (% Impervious)	17%	28%	36%	57%	61%		
	Cost (Million $)	87	172	262	566	658		
	ESD (% Cost)	70%	79%	79%	89%	90%		
	Nitrogen	24%	30%	38%	55%	61%		
	Phosphorus	25%	30%	38%	54%	60%		
	Sediment	38%	50%	92%	100%	100%		
	Bacteria	21%	27%	33%	50%	55%	96.0%	96%
	Trash	17%	24%	31%	50%	55%		
Cabin John	Impervious Treated (acres)	187	380	570	1,018	1,018		
	ESD (% Impervious)	52%	72%	78%	87%	87%		
	Cost (Million $)	23	65	114	215	219		
	ESD (% Cost)	92%	91%	86%	90%	88%		
	Nitrogen	21%	27%	39%	55%	58%		
	Phosphorus	20%	26%	35%	49%	51%		
	Sediment	6%	17%	60%	91%	100%		
	Bacteria	16%	22%	27%	40%	40%	31%	31%
	Trash	6%	12%	19%	34%	34%		
Muddy Watts	Impervious Treated (acres)	237	237	237	237	237		
	ESD (% Impervious)	4%	4%	4%	4%	4%		
	Cost (Million $)	6	8	19	25	31		
	ESD (% Cost)	32%	27%	11%	8%	7%		
	Nitrogen	6%	7%	15%	18%	22%		
	Phosphorus	6%	7%	10%	12%	13%		
	Sediment	7%	8%	14%	17%	20%		
	Bacteria	0%	0%	0%	0%	0%		
	Trash	6%	6%	6%	6%	6%		
Great Seneca	Impervious Treated (acres)	901	921	941	941	941		
	ESD (% Impervious)	2%	2%	2%	2%	2%		
	Cost (Million $)	26	48	50	51	52		
	ESD (% Cost)	15%	8%	8%	8%	8%		
	Nitrogen	24%	41%	43%	44%	45%		
	Phosphorus	24%	32%	34%	34%	34%		
	Sediment	26%	41%	43%	44%	44%		
	Bacteria	0%	0%	0%	0%	0%		
	Trash	31%	32%	33%	33%	33%		

impervious area treated by various target years. It also shows the percent of impervious area draining to ESD (Environmental Site Design) practices which are mostly Highly-Effective BMPs. Table 4.2, and the accompanying text in the Montgomery County Coordinated Implementation Strategy provide the basis for the effectiveness of actions presented in the table.

5. **Does the plan show the quality of named waters with anticipated growth plus the effect of the actions?**

   The last table below shows the percentage of each of the four watersheds presently covered by impervious surfaces and current quality. The table also shows how the percentages will change with anticipated growth ***plus the effect of the recommended actions***. It is assumed that treating runoff with highly-effective BMPs resolves the negative effects of the impervious surfaces from which the stormwater flowed. As stated earlier, this assumption has a solid basis in theory but remains to be proven in fact. One of the uncertainties is how well BMPs will be maintained for decades to come. This factor is addressed in the Stormwater BMP Maintenance section of the CEDS Grading Growth Management & Land Use Plans webpage.

Water Body	**Actions** *HEBMP = Highly-Effective Best Management Practices*	**Impervious Area**			**Quality**		
		2016	**2026**	**2026 With Actions**	**2016**	**2026**	**2026 With Actions**
East Branch	New development uses HEBMPs	8%	12%	8%	Good	Fair	Good
Smith Lake	Shopping center redevelopment with HEBMPs; All other new development uses HEBMPs	15%	19%	11%	Fair	Poor	Fair to Good
Trout Run	Retrofit Blair High School with HEBMPs; New development uses HEBMPs	2%	4%	1.5%	Excellent to Good for Brook Trout	Good	Excellent
West River	All three above waterways drain to West River, so actions targeting these waterways benefits the River.	6%	7%	7%	Good	Good	Good