

2.8 Land Cover/Land Use

Land use and land cover of a watershed have a great influence on water quality and stream stability. The watershed's land cover directly impacts stream hydrology by influencing the amount of stormwater runoff. Forests, natural meadows and wetlands naturally absorb rainwater, allowing a portion of it to percolate back into the ground. However, impervious surfaces such as pavement, parking lots, driveways, hard-packed dirt roads and rooftops increase the amount of rainfall that flows over land and reduces the amount of rainfall that percolates into the soil to recharge groundwater wells and streams.

Impervious cover is a major influence on streams and stream life due to the way it changes the amount and duration of stormwater that gets to the stream. Generally, the more impervious surface there is in a watershed, the less groundwater recharge (which supplies summer low flows), and the greater the magnitude of storm flows (and related erosion in streambeds). In addition to degrading streams, watersheds with a high percentage of impervious surfaces are prone to larger and more frequent floods, which cause property damage through inundation, as well as ecological harm resulting from lower base stream flows.

The literature has documented the deleterious effects impervious surfaces have on biota (Limburg and Schmidt, 1990; May et al., 2000; Wang et al., 2001; Roy et al., 2005), stream stability (Booth, 1990; CWP, 1998; White and Greer, 2005; Wohl, 2005) and in-stream water quality (Groffman et al., 2004 and Deacon et al., 2005). For example, impervious surfaces can raise the temperature of stormwater runoff, which in turn reduces the water's ability to hold dissolved oxygen and harms some game fish populations, while promoting excess algal growth. Field observation, research and hydrologic modeling suggest a threshold of 10% impervious surface in a watershed, after which there is marked transition to degraded stream conditions (CWP, 1998 and Booth, 2000).

Certain types of pollution problems are often associated with particular land uses, such as sedimentation from construction activities. There has been a vast array of research demonstrating that as land uses become more urbanized (built), biotic communities decline in health (Limburg and Schmidt, 1990; Schueler and Holland, 2000; May et al., 2000; Wang et al., 2001 and Potter et al. 2005). Concentrations of selected chemical constituents, including

nitrate, in stream base-flow were strongly affected by the predominant land use in a large Hudson Valley study (Heisig, 2000). The decline of watershed forest cover below 65% percent marked a transition to degraded water quality (Booth, 2000). Based upon these results, land use/cover appear to be attractive attributes for long-term trend tracking. These results can then be correlated with in-stream water quality data and then used to focus best management practices towards the land uses with the greatest impact on water quality.

Land cover of the East Kill Watershed was analyzed using the LANDSAT ETM 2001 geographic information system (GIS) coverage created by the New York City Department of Environmental Protection (DEP) (Figure 2.8.1). The categories are comprised of 47 different classification descriptions. To simplify the data, land cover classifications have been grouped together and re-classified to convey the general land cover category that each classification falls



Figure 2.8.1. East Kill watershed

under. For example, the classification descriptions of central business district, residential, and industrial, among others, have been combined and re-classified as development.

In 2001, approximately 90% of the East Kill watershed was covered by coniferous, deciduous, or mixed forest, while development covered approximately 2.5% (Table 2.8.1 and Figure 2.8.2). Proper land use planning to direct development into priority areas while preserving sensitive areas should be utilized to limit the impact of future development and subsequent increases in impervious surfaces.

Land Cover Category	Acres	Percent Cover
Agriculture	228.26	0.98%
Development	582.04	2.51%
Dumps	0.01	0%
Exposed Soil	0	0%
Forest	20,808.70	89.71%
Herbaceous	191.34	0.83%
Managed Herbaceous	247.89	1.07%
Mined Lands	0	0%
Shrubland	684.25	2.95%
Water	103.97	0.45%
Wetland	348.60	1.50%
Total	23,195	100%

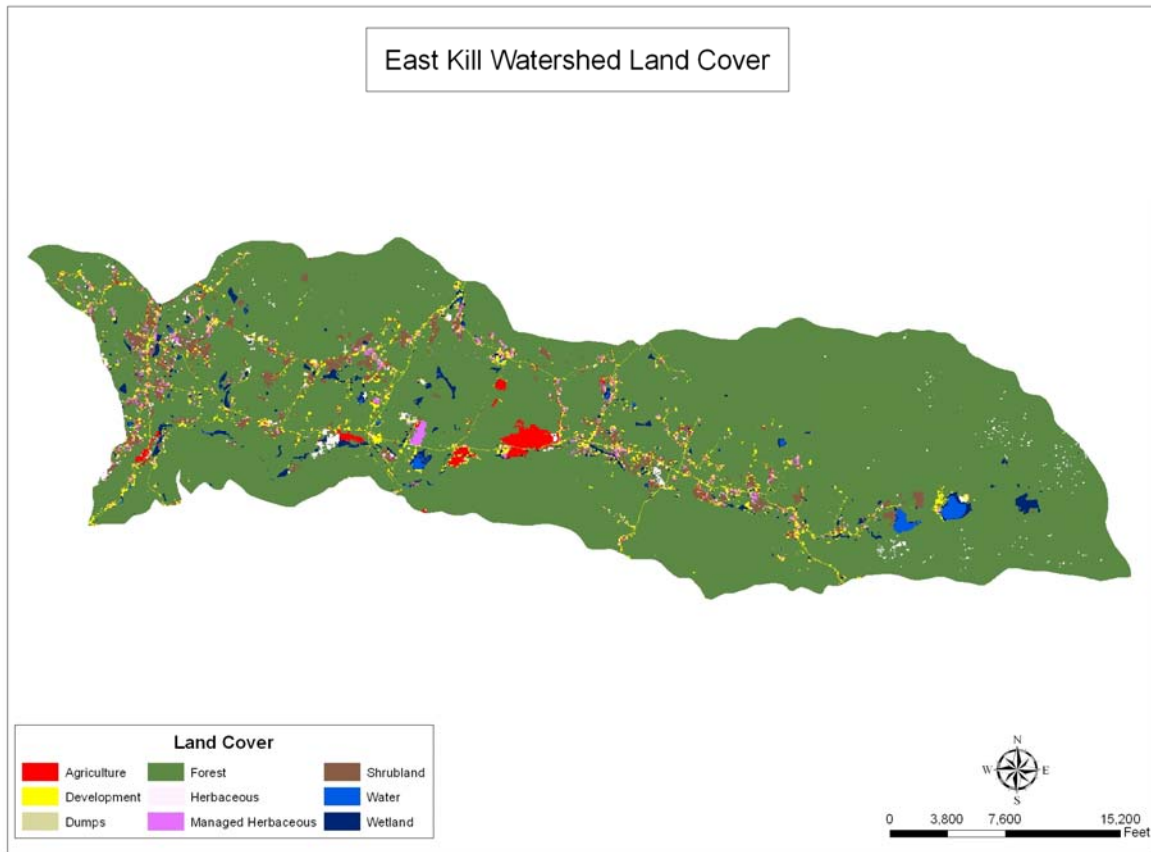


Figure 2.8.2. Land Cover of the East Kill Watershed in 2001. Large format map is available in the back pocket of this plan.

Protected Lands

To determine the percentage of parcels within the East Kill basin that were protected as Wild, Forested, Conservation Lands & Public Parks, the ownership and property use classifications as documented on records of the Greene, Schoharie and Delaware County Real Property Tax Service Departments, were analyzed. In 2006, approximately 34% of the East Kill Watershed lands were protected as Wild, Forested, and Conservation Lands & Public Parks. The primary owner of the protected lands was New York State with ownership of 82% of protected land in the East Kill Watershed. Under current State laws, these lands owned by the State will remain undeveloped. In 2006, approximately 0.3% of land within the Watershed was owned by New York City (Table 2.8.2).

Property Use Class		
	Acres	Percent
Wild, Forested, Conservation Lands & Public Parks	7,714	33.8%
NYC Owned Land	64	0.3%

References:

- Booth, D.B. 1990. Stream Channel Incision Following Drainage Basin Urbanization. Water Resources Bulletin Volume 26: 407-417.
- Booth, D. 2000. Forest Cover, Impervious Surface Area, and the Mitigation of Urbanization Impacts in King County, Washington. Center for Urban Water Resources Management, University of Washington, Seattle, WA.
- CWP. 1998. Rapid Watershed Planning Handbook: A Comprehensive Guide for Managing Urbanizing Watersheds. Center for Watershed Protection, Ellicott City, Maryland.
- Deacon, J.R., Soule, S.A., and Smith, T.E. 2005. Effects of Urbanization on Stream Quality at Selected Sites in the Seacoast Region in New Hampshire, 2001-03. United States Geological Survey Investigations Report 2005-5103, 18 p.
- Groffman, P.M., Law, N.L., Belt, K.T., Band, L.E., and Fisher, G.T. 2004. Nitrogen Fluxes and Retention in Urban Watershed Ecosystems. Ecosystems 7: 393– 403.
- US EPA, 2003 - Land Use Planning: <http://www.epa.gov/watertrain/protection/r2.html>

- Heisig, P. 2000. Effects of Residential and Agricultural Land Uses on the Chemical Quality of Baseflow of Small Streams in the Croton Watershed, Southeastern New York. Publication # WRIR 99-4173. United States Geological Survey, Troy, NY.
- Limburg, K.E. and Schmidt, R.E. 1990. Patterns of Fish Spawning in Hudson River Tributaries: Response to an Urban Gradient?. *Ecology* Volume 71 (4): 1238 – 1245. 05).
- May, C.W., Horner, R.R., Karr, J.R., Mar, B.W. and Welch, E.B. 2000. Effects of Urbanization on Small Streams in the Puget Sound Ecoregion. *Watershed Protection Techniques*, 2(4): 483-494.
- Potter, P.M., Cabbage, F.W., and Schaberg, R.H. 2005. Multiple-scale landscape predictors of benthic macroinvertebrate community structure in North Carolina. *Landscape and Urban Planning* 71: 77-90.
- Roy, A. H., Freeman, M. C., Freeman, B. J., Wenger, S. J., Ensign, W. E., Meyer, J. L. 2005. Investigating hydrologic alteration as a mechanism of fish assemblage shifts in urbanizing streams. *Journal of the North American Benthological Society* Volume 24 (3): 656-678.
- Scheuler, T.R. and Holland, H.K. 2000. Housing Density and Urban Land Use as Indicators of Stream Quality. In: *The Practice of Watershed Protection* 2(4): 735-739.
- Wang, L., Lyons, J., Kanehl, P. and Bannerman, R. 2001. Impacts of Urbanization on Stream Habitat and Fish Across Multiple Spatial Scales. *Environmental Management* Vol. 28(2): 255-266.
- White, M.D. and Greer, K.A. 2005. The effects of watershed urbanization on the stream hydrology and riparian vegetation of Los Peñasquitos Creek, California. *Landscape and Urban Planning*, Volume 74(2): 125-138.
- Wohl, E. 2005. Compromised Rivers: Understanding Historical Human Impacts on Rivers in the Context of Restoration. *Ecology and Society* 10(2): Article 2.