Appendix B – Land Use Mapping and Impervious Procedure

Land Use

Existing Land Use

Fairfax County maintains a parcel database file containing existing land use information and zoning categories for approximately 330,000 parcels, of which approximately 28,000 are within the Difficult Run Watershed. Each parcel has been assigned an existing land use code out of over 200 such numeric codes defined for the County.

In order to develop hydrologic and subsequent hydraulic models for the Difficult Run Watershed, land uses were grouped in accordance with standards developed for the Countywide Watershed Management Program. These generalized land uses group specific zoning designations based on consideration of impervious area. KCI subsequently reviewed the categories, then made adjustments to classify the data even further to include three additional new land use categories (golf course, institutional, and water). The groupings utilized in this plan are depicted in Table B.1.

Table B.1: Generalized Land Use Categories

Land Use	Code	Description
Open Space	OS	Parkland, privately owned open space, and vacant developable land. Extensive parking areas or buildings associated with parkland are included as LIC.
Golf Course	GC	Open space associated with golf courses.
Estate-Residential	ESR	Single-family detached homes with more than two acres per residence.
Low-Density Residential	LDR	Single-family detached homes with 0.5 to 2 acres per residences.
Medium-Density Residential	MDR	Single-family detached homes with less than 0.5 acres per residence and attached multifamily residential with fewer than eight dwelling units per acre.
High-Density Residential	HDR	Single-family and multifamily residential with more than eight dwelling units per acres.
Institutional	INS	Facilities open to the public, including churches, schools, libraries and county office buildings.
Low-Intensity Commercial	LIC	Office parks and commercial facilities developed in a campus-like setting. Also includes private recreational facilities such as swim clubs, tennis clubs, and buildings and parking associated with golf courses and parkland.
High-Intensity Commercial	HIC	Highly impervious commercial and office uses, including office complexes, shopping centers, strip malls, automobile dealerships and restaurants.
Industrial	IND	Industrial land use and industrial parks.
Water	WAT	Open water, lakes and ponds

Transportation right-of-way acreage was estimated by summing the acreage within a subwatershed that was not included in a parcel, and thus not assigned a land use category. Transportation land use is intended to include the roads and the land set aside on each side of the road for utilities, road improvements, etc.

It is important to estimate the transportation and water categories so as to measure the impacts of impervious surfaces on aquatic systems. Although golf courses are pervious by nature, runoff characteristics may be different than other open space.

Minor changes were made to the parcel-based land use map to improve the representation of land cover in the watershed. These changes included:

- Joining condominium parcels with the commonly owned areas, which were not coded in the parcel-based map.
- Splitting large parcels with two distinct land uses. For example, a large regional park which would have been coded Institutional, was split into Open Space for the undeveloped portion and Institutional for the portion with buildings, parking lots, and recreational facilities.
- Updating land use to the most current (2002) aerial photography.

Future Land Use

The parcel database file was also used to categorize future land use information for the Countywide Watershed Management Program. Each parcel was assigned a planned land use code as guided by the County's Comprehensive Plan and Map. There were 47 planned land use categories and 1 unclassified category.

KCI used the existing land use map as the base map for future land use. In many cases, the planned land uses corresponded roughly to the zoning for the same parcels. The actual zoning layer was also used and spatially joined to the planned land use layer (67 zoning codes and 1 unclassified description code). Where the planned land use and the zoned land use differed, the classification that provided the greatest density was used. Finally, the same grouping of standard land use classes were utilized in identifying and categorizing future land uses as were used in identifying existing land uses.

Within the boundaries of the Reston community, however, all parcels received a land use designation called "AVRES". The Reston Master Plan, developed in 1961, controls existing and future land use in the community. KCI updated the "AVRES" code in Reston to reflect the planned land use designation for the parcels in Reston, reflecting the amended Reston Master Plan (1989).

A comparison of existing and future land use designations showed inconsistencies between existing and future land use. For example, some parcels were classified as developed in the existing land use file and as open space in the future land use file. A closer review of the existing land use file showed that many of these parcels were buffers along commercial or residential uses but were classified as developed. Since these were shown as separate parcels in the base map, KCI assumed that these were set-aside requirements of open space for a subdivision or development.

As an exception, there were 23 records where 173 acres changed from a light-intensity commercial land use in existing to open space in the future land use layer. These records were parcels that were developed recreational areas that include basketball courts, tennis courts, etc. and associated parking. They should remain as a light-intensity commercial use for estimating the impervious surface, not as open space.

KCI compared the existing land use to the future land use in each parcel found in the watershed. Land use changes occurred in approximately 3,900 of the total records. A new field in the watershed database was created to show the change. If there was a land use change that suggested an unrealistic scenario, KCI made an adjustment after discussions with County staff. For example, if a higher-intensity use in the existing land use coverage shifted to a lower-intensity use in the future land use. KCI determined that this change was unrealistic given Fairfax County's growth trends. Table B.2 illustrates some of these situations. For 35 parcels (~42 acres), there was no future land use code assigned. In this instance, KCI looked at each parcel individually with the 2002 orthophotography and the existing land uses to recommend the best future land use for the parcel. In most cases, these parcels were very small and the future land use remained the same as the existing land use.

Table B.2 Initial and Final Changed Land Uses

Initial Changed Land Use (Existing – Future)	Final Changed Land Use (Existing – Future)	Initial Changed Land Use (Existing – Future)	Final Changed Land Use (Existing – Future)
ESR-HIC	ESR-ESR	IND-ESR	IND-IND
ESR-UNKNOWN	ESR-ESR	IND-LDR	IND-IND
GC-ESR	GC-GC	IND-LIC	IND-IND
GC-MDR	GC-GC	IND-MDR	IND-IND
GC-OS	GC-GC	LDR-ESR	LDR-LDR
HDR-ESR	HDR-HDR	LDR-IND	LDR-LDR
HDR-IND	HDR-MDR	LDR-UNKNOWN	LDR-LDR
HDR-LDR	HDR-HDR	LIC-ESR	LIC-LIC
HDR-LIC	HDR-HDR	LIC-HDR	LIC-LIC
HDR-MDR	HDR-HDR	LIC-LDR	LIC-LIC
HDR-OTHER	HDR-HDR	LIC-UNKNOWN	LIC-LIC
HDR-UNKNOWN	HDR-HDR	MDR-ESR	MDR-MDR
HIC-ESR	HIC-HIC	MDR-LDR	MDR-MDR
HIC-HDR	HIC-HIC	MDR-UNKNOWN	MDR-MDR
HIC-LDR	HIC-HIC	OS-OTHER	OS-OS
HIC-LIC	HIC-HIC	OS-UNKNOWN	OS-OS
HIC-MDR	HIC-HIC	WAT-ESR	WAT-WAT
HIC-OTHER	HIC-HIC	WAT-LDR	WAT-WAT
HIC-UNKNOWN	HIC-HIC	WAT-OS	WAT-WAT

Imperviousness

Existing Impervious Surface

Existing impervious area was estimated using planimetric roadway and building data. This provided an accurate measure of what surfaces were actually on the ground. In calculating the imperviousness, no distinction was made between connected and disconnected imperviousness.

Fairfax County 1997 planimetric data was used as the base layer. This layer included major and minor roadways in addition to building footprints. The layer was plotted on the 2002 orthophotography and any newly developed buildings, roadways, and parking lots were added.

The impervious areas for residential driveways and sidewalks were estimated. To estimate the total impervious surface area for sidewalks, the total sidewalk length was divided by 2 then multiplied by an assumed width of 4 feet to estimate the total area. For estate residential (ESR), low-density residential (LDR), and medium-density residential (MDR) land uses, driveways were added by creating a driveway factor. This factor was developed by sampling over 1000 acres across the three land uses. Driveways in the sampling areas were delineated and the ratio of driveway area to overall sample area was estimated. The values derived were ESR=3.2 percent, LDR=4.1 percent, and MDR=4.7 percent, respectively. These factors were then applied across the watershed by first multiplying the factor by the area and then adding that additional area to the total impervious area. Driveways for high-density residential and non-residential uses were not estimated.

Future Impervious Surface

Future imperviousness was estimated using a combination of planimetric mapping and an imperviousness factor based on land use. For areas of the watershed where no change was forecast, the imperviousness was calculated based on planimetric mapping, the same as with existing land use.

The impervious area for the areas that where land use was forecast to change were estimated by replacing the existing impervious area with the result of applying a proposed land use percentage to the changing area for each proposed land use. The proposed land use imperviousness percentage was estimated from the GIS data by measuring the impervious area in a sample of 10 percent of each type of land use. Average values were then estimated for each land use as shown in Table B.3.

Table B.3 Average Impervious Values for Land Use

Land Use	Future Imperviousness
ESR	4.8%
HDR	33.4%
HIC	66.0%
IND	39.8%
LDR	14.6%
LIC	20.7%
MDR	19.5%

The updated impervious percentages for each catchment shown in Table B.3 were determined by calculating the weighted average of the catchment imperviousness for each subwatershed. There is a general increasing trend from existing to future imperviousness with some minor reductions, which could be caused by the method used in the estimation of the proposed land use impervious percentage. Existing imperviousness was estimated from an individualized catchment approach while the proposed imperviousness was estimated based on averages through out the whole watershed. It was found that imperviousness might vary depending on the spatial location in the watershed for the same land use.