Appendix A: Common Methods for Developing a Rate Structure

Background

As noted in the Technical Memo (TM), three basic methods for developing a rate structure were considered by the EFC: 1) Flat fees, 2) the Equivalent Residential Unit (ERU) method, 3) the Intensity of Development (IoD) method, and 4) the Equivalent Hydraulic Area (EHA) method (EPA, 2009).

The ERU method results in a consistent fee charged to properties based on the property type (e.g., single family residential, multi-family, commercial, and industrial). ERU rate structures are popular and an easy method to implement that accounts for some local conditions of imperviousness, but they do not consider the contributions of pervious surface area to stormwater runoff. Additionally, ERU rate structures are based only on a sample set of assessed impervious areas deemed representative of the larger community; they are not based on the actual imperviousness (or perviousness) of each property. Other methods that consider more continuous assessments of surface area (i.e., $/sqft) may be more equitable, especially in applying tariffs to larger properties with greater contributing surface area. Below, we provide further descriptions of the other two methods that address some of the ERU's shortcomings through alternative rate structures and additional data needs. For each, we assessed applicability of the method for California municipalities based on a review of literature and survey of available data.

Other Rate Structure Methods

Of the two additional methods developing stormwater fee rate structures summarized below, the EFC is developing an open-source data set for parcel-specific quantifications of pervious and impervious surface area in urban areas of the Region 9 territory. The classification methodology is being tested against training sets for two service territories. If successful, it will be applied to the entire region for use in more complex stormwater fee assessment methods.

Intensity of Development (IoD) Method

The ***Intensity of Development (IoD)*** method categorizes rates based on the relevant extent of their development, as represented by their assessed impervious surface area. Properties with less development (less imperviousness) might include light and medium residential land uses, while properties with more development (more imperviousness) could include commercial and industrial sites.

The fee structure is organized as a "sliding scale" so that properties with heavy development pay more. For instance, vacant properties or light development land uses might pay $0.10 per unit (1,000 sq. ft. or other metric), while properties with heavy development would pay more per unit.

While the IoD rate structure is based on representative blocks associated with impervious surface coverage, the method does require utilities to quantify the total area for each property and the amount of impervious surface area for the property. Additionally, it does not account for pervious surface area of properties, which can still contribute to stormwater runoff.

Equivalent Hydraulic Area (EHA) Method

Finally, the ***Equivalent Hydraulic Area (EHA)*** method assesses property-level stormwater fees based on a continuous fee structure that incorporates both impervious and pervious area. This requires utilities to calculate the area of pervious and impervious surface cover for each property in the service territory. The sum of these two values should be equal to the total property area.

Similar to the IoD method, a unit-based assessment rate ($/sq-ft or equivalent) is assigned to each property classification, often with a different rate for impervious areas and pervious areas. Pervious cover would have a significantly lower assessment rate, as it contributes less to stormwater runoff. Although this method is data intensive, it better attributes fees for stormwater services more equitably than the ERU method, which applies consistent fees across properties of many sizes. The EHA method also considers the contribution of pervious surface area, while the ERU and IoD methods typically do not.

Once impervious and pervious surface cover is determined for each property, a few approaches could be used in devising a fee structure. For instance, a single unit fee for pervious and impervious area ($/square foot or $/1000-sq-ft) could be devised based on the ratio of the entire cost of the chosen stormwater program (quantified through a procedure such as the *Total Costs Workbook*) and the utility service area. Alternatively, separate unit fees could be developed for perviousness and imperviousness of different property types (residential, commercial, industrial), which would assume that the activities of certain land use types contribute more per unit area to stormwater contaminants than other land uses. This approach could be useful to account for activities of commercial and industrial properties.

Data Requirements

The IoD and EHA methods both minimally require an assessment of property-level imperviousness. As noted, greater access to data and mapping software offers new opportunities for instituting rates based on these procedures. In particular, high-resolution and detailed geospatial data is required for:

1) Land cover and imperviousness from imagery,
2) Property (parcel) boundaries, and
3) Unique identifiers within a database that support the capacity to associate properties in a GIS file with utility billing records.

In California, recent developments to promote urban water use efficiency during the 2011-16 drought have led to several efforts to create statewide imagery datasets. The imagery data developed for these applications have additional potential for estimating land cover and imperviousness. Some areas of California, too, have high-resolution imagery available, such as Los Angeles through the Los Angeles Area Regional Imagery Acquisition Consortium (LARIAC).

For properties, utilities must have an underlying billing database that contains unique identifiers for relating properties from state or regional geospatial files of parcels with billing records. The California Office of Planning and Research (OPR) developed a statewide parcel data set, which many municipal utilities have linked with billing records and even local tax assessor databases that contain property information. If utilities do currently have databases capable of relating the geospatial (property area and estimates of property-level impervious/pervious surface cover) and billing data, GIS analysis with geocoding can be performed to associate mailing addresses in utility databases with geospatial data. Many tools exist for geocoding, with more robust tools being proprietary. Geocoding to match addresses and parcels is an iterative process, with inconsistencies in address records often contributing to failed matches for some properties. Depending on the source data, match rates can range from less than 50% to 90% for initial matches. Thus, utilities with unique identifiers matched to regional or statewide geospatial parcel databases are better positioned to implement the IoD or EHA methods.

As part of this work to develop stormwater fees, the EFC compiled and assessed data from multiple sources that would support property-level estimates of imperviousness. Generally, available land cover

and imagery data ranges from low-resolution (30-meter) that is not adequate for property-level imperviousness assessments, to very high-resolution (3-inch) that is ideal for such assessments. Thirty-meter and 1-meter data are openly-available through national sources. Higher-resolution data (6-inch and 3-inch) is typically acquired by working with commercial imagery providers, which can assist in processing data to categorize various attributes such as building outlines, pervious and impervious surface cover, plant cover and trees, and irrigated area. Table 1 below details the available data sources surveyed for California related to stormwater fees.

Some stormwater municipalities purchase commercial imagery in support of estimating impervious and pervious surface coverage on properties in their service territory. For others, however, insufficient local resources exist to purchase data. In these territories, freely available imagery would be a cost-effective solution. The National Agricultural Imagery Program (NAIP) offers 1-meter imagery data that can be used to classify impervious and pervious surface area for properties. The EFC is currently working with partners and collaborators to develop an open-source statewide dataset for impervious surface coverage, which would support stormwater fee development activities by utilities throughout the state.

Equity Considerations

As noted in the TM, stormwater fees must incorporate equity considerations, using a Cost per Household (CPH) or similar measure that ensures as best as possible that disadvantaged communities are not unfairly burdened. In creating rate structures that more closely connect imperviousness (and potentially total property size with perviousness) and total fees, the IoD and EHA methods can help address some inequities of the ERU method by ensuring that larger properties contribute more revenue through fees.

Yet, such IoD block rates or continuous rate structures still may not fully alleviate disproportionate burdens on low-income households. As such, for either of these two methods, a similar procedure to estimate CPH and apply it to proposed rate structures is necessary. An adapted EPA FCA method would be organized as follows:

1) Calculate the CPH and determine its reasonableness using steps 1-5 of the “Conduct Financial Capability Analysis” section of the TM;
2) Assign a rate structure based on the adjusted CPH.
3) Calculate the average cost per household using the rate structure and property-level impervious/pervious surface area estimates for a high-detail geographic area, such as Census block groups, which have associated characteristics for Median Household Income.
4) Identify any areas of the utility service territory where average household costs exceed CPH. If these exist, devise low-income credit programs or adjust the rate structures accordingly to yield a similar amount of total revenue but alleviate disproportionate burdens on disadvantaged households.
5) If all areas of the utility service territory has average household fees (through the IoD or EHA method) that are less than or equal to the CPH, the devised fee structure can be retained.

Table 1: Available data sources in California for estimating fees using Equivalent Hydraulic Area (EHA) methods

Data	Source	Resolution	Availability and Comments
Land Cover and Imperviousness			
National Land Cover Database (NLCD)	Multi-Resolution Land Characteristics (MRLC) consortium	30-meter	Open-source, but too coarse for parcel-level assessments
National Agriculture Imagery Program (NAIP)	USDA Farm Service Agency	1-meter	Open-source. Requires image processing to identify imperviousness. Can be a source for determining property-level imperviousness, but many utilities are using much high resolution imagery.
LARIAC1 (2006), LARIAC2 (2008), and LARIAC3 (2011), and LARIAC4 (2016) Imagery	Los Angeles Region Imagery Acquisition Consortium (LARIAC) Program	4”-12”	Specific to LA County. Open-source for 2006, 2008, and 2011 (2016 version is available for purchase). Contains layers for buildings, terrain, tree cover, NDVI and solar, hillshading, color, imperviousness, and infrared imagery. Imagery at various resolutions from 4”-12”.
DWR purchased imagery data	California Department of Water Resources (DWR)	6-inch	Imagery purchased by DWR to support statewide assessment of irrigable and irrigated area in water districts in support of devising water budgets to meet requirements from EO-B37-16. Imagery data may be available in the future (2018) to assess impervious surface area across state agencies.
Google Earth	Google	varies	*Google Earth* software contains aerial imagery and tools to measure distance and area. The imagery is available, sometimes over time, and free but laborious for determining imperviousness for all properties in a utility territory.
Property (Parcel) Boundaries			
California statewide parcel database	California Office of Planning and Research (OPR)	n/a, shapefile	Developed by OPR with standardized identifiers for parcels and boundaries, which can be used to merge with utility databases and billing records.