GUIDANCE DOCUMENT FOR VOLUME AND FLOW-BASED SIZING OF PERMANENT POST-CONSTRUCTION BEST MANAGEMENT PRACTICES FOR STORMWATER QUALITY PROTECTION

PLACER REGIONAL STORMWATER COORDINATION GROUP

MAY 25, 2005

Purpose and Introduction

This "Guidance Document for Volume and Flow-based sizing of Permanent Post-construction Best Management Practices for Stormwater Quality Protection" provides the recommended design methodology for volumetric and flow-based treatment control stormwater Best Management Practices (BMPs) for use in unincorporated Placer County, and the Cities within Placer County.

In 2004, a technical subcommittee to the Placer Regional Stormwater Coordination Group considered the volumetric and flow-based treatment control sizing methods allowed by the State in the NPDES small municipal General Permit, and recommends use of the following to its member agencies--Roseville, Rocklin, Loomis, Lincoln, Auburn, Colfax, and Placer County. The actual use of this recommended methodology by any particular jurisdiction is optional (although a jurisdiction may choose to adopt the methods independently of these recommendations)--each jurisdiction may modify or have additional requirements to these, prohibit use of proprietary devices or particular BMPs, etc. Please check with the jurisdiction where your project is located prior to proceeding with the use of this document, especially with respect to maintenance requirements which may affect a designer's choice of BMPs.

Placer County and its cities are subject to phase II of the National Pollutant Discharge Elimination System (NPDES) small municipal stormwater program. The program is part of the Federal Clean Water Act, administered in California by the Regional Water Quality Control Boards. One of the program requirements is the application of post-construction BMPs (permanent long-term design elements to prevent or reduce stormwater pollution) to all new and redevelopment projects. Although any NPDES water quality program must emphasize source control measures to prevent pollution from occurring in the first place, treatment control sizing criteria are necessary to define volumetric and flow-based devices where source control measures are not sufficient to achieve water pollution reduction to the 'maximum extent practicable', a technology based standard imposed upon the jurisdictions by the regulations.

The recommended volumetric sizing method is based upon the CASQA (California Stormwater Quality Association) New and Redevelopment Stormwater Best Management Practice Handbook 'method B'(so-called because it is method B of the attachment 4 to the State General Permit). The flow based sizing method is based upon the 'Flow Based Treatment Control BMP' method a from Attachment 4 of the State general permit, as applied by the CASQA BMP handbook.

Geographical area of applicability

These recommended methods apply to Phase II areas in Placer County, everything roughly west of and including Foresthill and Colfax. The volumetric method B uses rainfall data from Sacramento, therefore it should not be extrapolated beyond the Placer

County phase II region without consideration of whether the Sacramento data are appropriate to the project area.

Considerations

These methods do not pertain to SWPPP or construction site ("temporary") BMP sizing. Additional information about construction site BMPs may be obtained by contacting the Central Valley Regional Water Quality Control Board, by looking at CASQA (California Stormwater Quality Association) website, or by consulting with your local jurisdiction.

The methods described herein may change if the State alters its requirements. At the time of writing of this document, the authors have experiences with the Central Valley Regional Water Quality Control Board which suggest that future State permits may contain tighter requirements and disallow certain BMPs (or require advanced stormwater treatment) where they have proven ineffective (e.g. use of detention basins in areas where soils contribute suspended solids that will not settle out within the allowable drawdown times).

It is always the obligation of the project proponent/designer to design a system of source control and treatment control BMPs that effectively prohibits non-stormwater discharges, even if a jurisdiction does not rule out the use of a design method or device. It is the designer's responsibility to assure that the pollution prevention methods for a project will, in reality, function well, independent of whether the jurisdiction may or may not allow its use.

Source control methods must always be employed first, and treatment control used only where source control alone cannot prevent pollutants from coming off the site.

These methods may not be appropriate for larger and regional facility sizing due to a failure of the assumptions used in derivation--larger drainage areas generally have longer hydrographs than those used in the method. Although these methods will generally be adequate for most non-regional designs, it is the responsibility of the project engineer to verify that the assumptions inherent in the analyses are appropriate to the project circumstances.

Each jurisdiction may have different maintenance requirements. Although these recommendations contain a minimal recommendation for additional sediment storage volume beyond that required for water quality treatment, it is not intended to imply that this is sufficient for all circumstances. For example, satisfactory basin function is heavily dependent upon provision of appropriate maintenance. Soils, erosion rates, vegetation, accessibility etc. differ significantly throughout the County and cities, therefore, the project engineer must identify site specific maintenance requirements to determine the effect upon necessary design water quality.

Application and Use

Volumetric Method:

Volume based BMP design applies to BMPs where the primary mode of pollutant removal depends upon the volumetric capacity, such as detention, retention, and infiltration basins. These criteria specify the capture and infiltration or treatment of the 80^{th} percentile average annual rainfall volume (aka 80 percent capture ratio). For more information on the CASQA volumetric method B, see section 5 and appendix D of the CASQA New and Redevelopment Stormwater Best Management Practice Handbook.

Imperviousness C value The C value used in method B is a composite runoff coefficient based upon the imperviousness, and is estimated using the following equation:

Composite runoff value $C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$

Where i is imperviousness, a physical characteristic of the site. The third order equation above was calculated by the EPA in 1982 based upon data collected for the 'National Urban Runoff Program'. "C" in the above equation is not the same as the Rational method C, and the Rational method C must not be used.

Drainage Area and Imperviousness The drainage area for calculation of the BMP volume must include all areas that contribute runoff to the proposed BMP, including pervious areas, impervious areas, and off-site areas running onto the site, whether or not they are directly or indirectly connected to the BMP. Zero discharge areas, and self treatment areas that fully capture and/or treat the water quality flow or volume from that area may be removed from the calculation. These zero discharge/self treatment areas must be separated out and individual calculations provided to demonstrate capture and treatment adequacy. The imperviousness percentage, "i" in Graph 1 must be based upon the actual impervious percentage of the entire watershed area draining to the BMP, not including those areas demonstrated to be zero discharge or self treating. If a BMP will accept flow from offsite areas that are not immediately part of a development project, those areas must still be included in both the drainage area and impervious percentage calculation, but will reduce the impervious percentage if not developed with hard surfaces.

Drawdown time The methodology requires that either a 24 or 48 hour drawdown time be designated. Most designs should be based upon the 48 hour drawdown curve. Use of the 24 hour curve is limited to drainage areas with coarse soils that readily settle and watersheds where warming may be detrimental to fisheries.

Volume Calculation Volume calculation may be achieved by use of either graph 1 or graph 2. The graphs are equivalent and either may be used, however graph 1 has translated the site's imperviousness percentage into the composite runoff coefficient and goes directly from % imperviousness to unit volume. To use graph 1, enter the abscissa with the contributing watershed area's imperviousness percentage and read the unit volume from either the 24 or 48 hour drawdown curve, then multiply that value by the drainage area to determine water quality volume. To use graph 2, enter the abscissa with the composite runoff C value (which must be calculated separately)and read the unit

volume from either the 24 or 48 hour drawdown curve, then multiply by the drainage area to determine design volume.

Sediment Storage Basins receiving overland flow should be designed with an additional 5% sediment storage allowance in addition to the calculated water quality volume. This recommendation is based upon the assumption that one third of the basin may be disrupted each year to clean out sediment accumulation and growth. In general, basins should be cleaned in stages in order to avoid substantial disruption of the soil surface and re-suspending particles.

Flow-based Method:

Flow based BMP design applies to BMPs where the primary mode of pollutant removal depends upon the rate of flow thru the BMP, such as swales, sand filters, screening devices, and proprietary devices such as inserts.

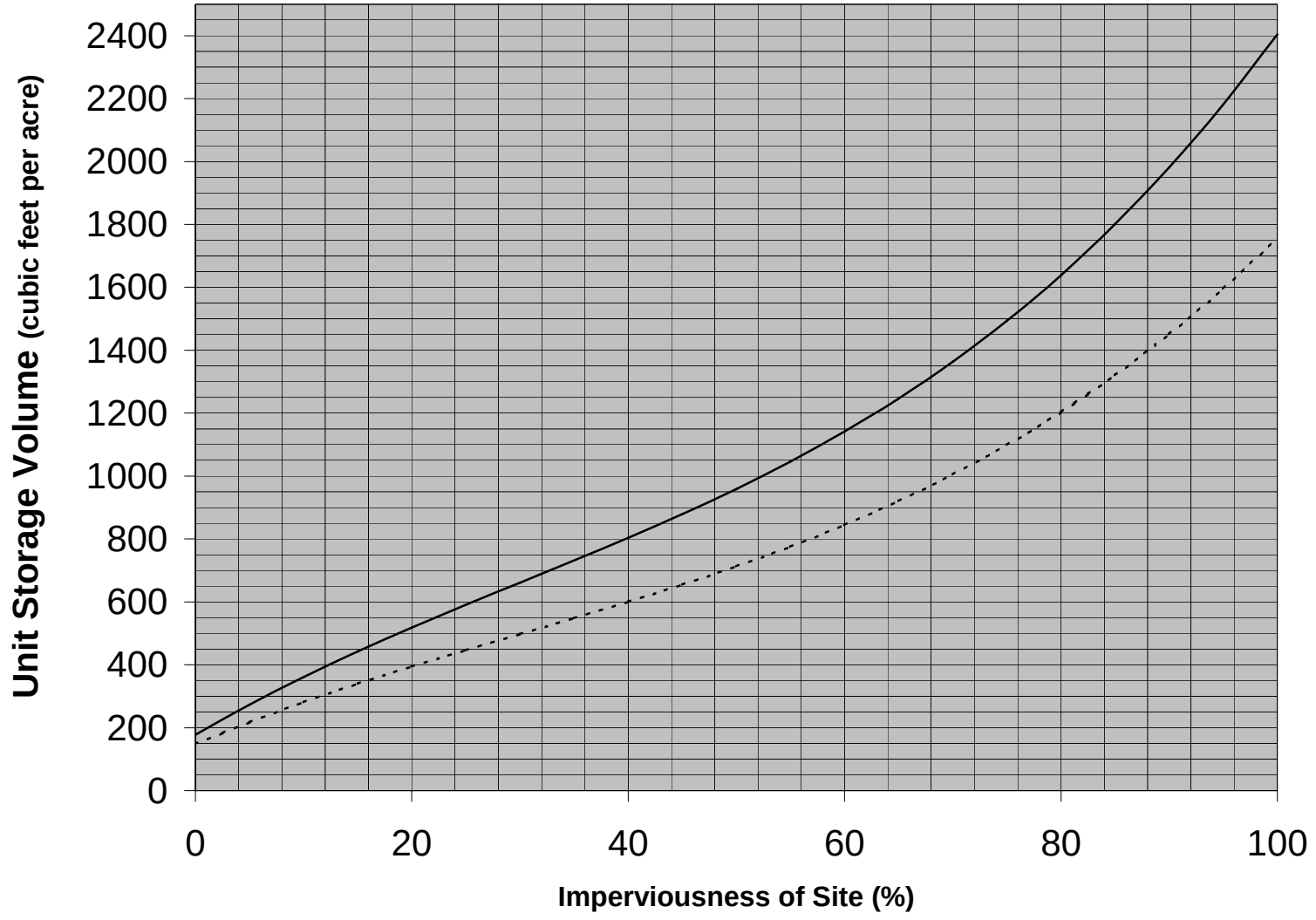
All flow-based water quality structures in the western Placer County phase II area are to be designed to a peak flow calculated using 0.2 inches per hour rainfall intensity. The CASQA BMP handbook (using the Sacramento curve) recommends the 0.2 to use as minimum value. This paper therefore recommends use of 0.2 inches/hour to assure consistency throughout the area and provide acceptable water quality benefits.

For more information on the California Stormwater BMP Handbook Approach flow-based approach, see section 5 and appendix D of the CASQA New and Redevelopment Stormwater Best Management Practice Handbook

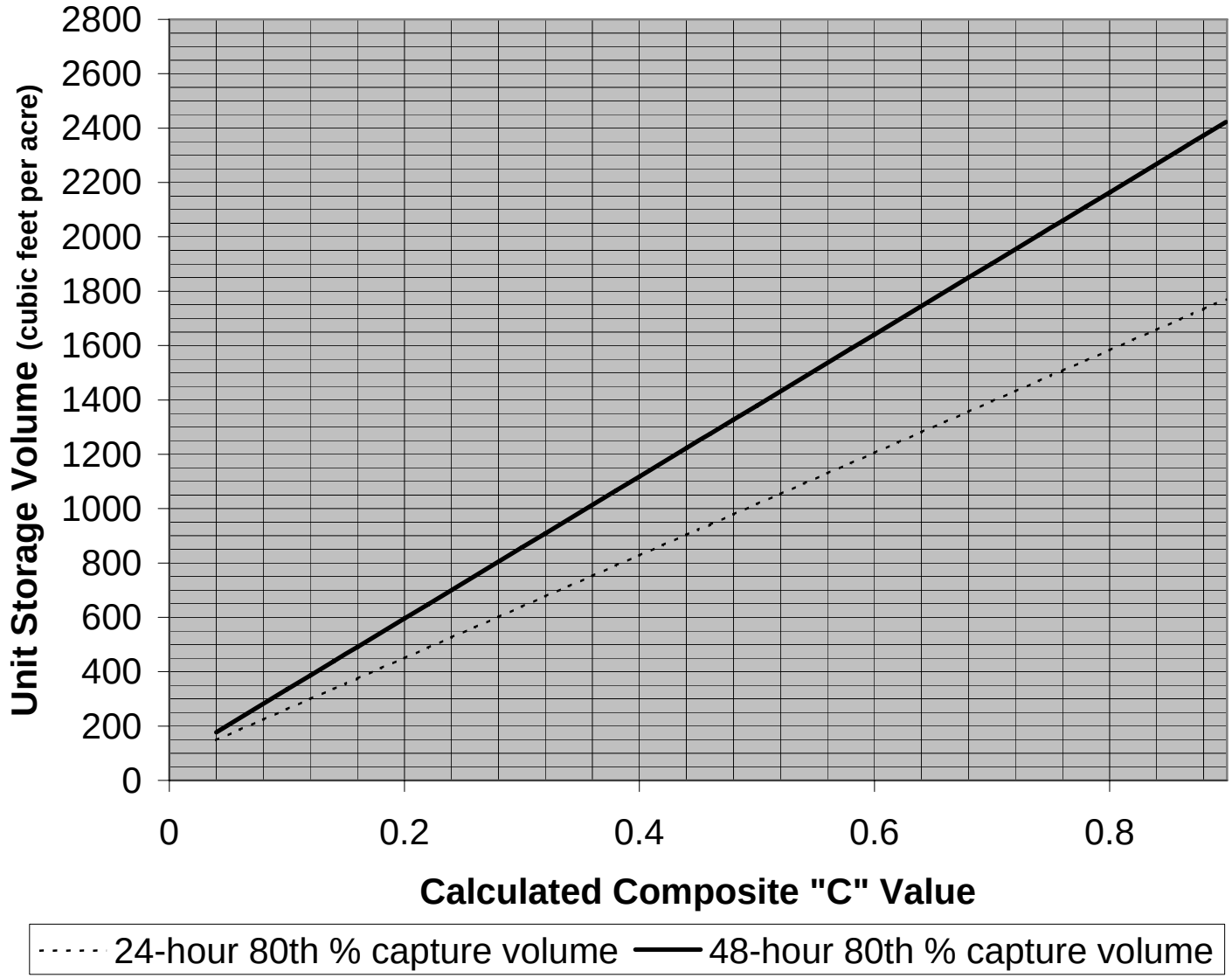
GRAPH 1

PLACER COUNTY - STORMWATER QUALITY VOLUME

WESTERN PLACER COUNTY AREAS ONLY



GRAPH 2
PLACER COUNTY STORMWATER QUALITY VOLUME
WESTERN PLACER COUNTY AREAS ONLY



References

EPA, (1983) Results of the Nationwide Urban Runoff Program, Final Report, U.S. Environmental Protection Agency, NTIS no. PB84-185545, Washington D.C.

Urbonas, B. R. et al. (1990) Optimization of Stormwater Quality Capture Volume, in *Urban Stormwater Quality Enhancement—Source Control, Retrofitting and Combined Sewer Technology*. American Society of Civil Engineers, New York, N.Y.

The CASQA New and Redevelopment Stormwater Best Management Practices Handbook, 2003, is available online at http://www.cabmphandbooks.com/

The State General municipal permit, including Attachment 4 with the post-construction requirements, is available at the website:
http://www.swrcb.ca.gov/stormwtr/docs/final_sm_ms4_fact_order.pdf