APPENDIX T

Sustainability as it Applies to the Sewer System Master Plan/Evaluation Tools

Appendix T presents many of the key sustainability issues that were considered as part of the Sewer System Master Plan and information about the evaluation tools.

Defining Sustainability

There are various definitions or concepts to describe "sustainability." In 1987, the World Commission on Environment and Development (now known as the Brundtland Commission) developed the most commonly used definition of sustainability: "…development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs." (World Commission on Environment and Development, 1987). The World Commission on Environment and Development's Key Concepts for Sustainability include:

- Today's needs should not compromise the ability of future generations to meet their needs
- A direct link exists between the economy and environment
- The needs of the poor in all nations must be met
- In order for our environment to be protected, the economic conditions of the world's poor must be improved
- In all our actions, we must consider the impact upon future generations

Lundin, et al. (1999) defined sustainable urban water systems as those that do "not have negative environmental effects even over a long term perspective, while providing required services, protecting human health and the environment with a minimum of scarce resource use."

The SFPUC has defined sustainability as the framework through which it will responsibly manage the resources under its care, protect public health and balance its social and environmental responsibilities to the citizens and community, while providing cost effective services to its ratepayers.

Triple Bottom Line

The Triple Bottom Line, a phrase coined by John Elkington in 1994 (Elkington, 2004), is variously described as the Three E's – Equity, Economy, Environment, or as People (society), Planet (environment), and Prosperity (economics). The concept of the Triple Bottom Line asserts that in order to achieve sustainability, environmental and social issues and impacts must be considered along with economic issues in decision-making.

Triple Bottom Line is not a definition of sustainability, but rather a useful tool for describing its multi-dimensional character, as well as a way to organize sustainability issues to ensure each dimension is given due consideration by planners and policymakers. The Triple Bottom Line has become the preferred approach to public sector full cost accounting.

Sustainable Urban Infrastructure

Urban infrastructures, such as the City's wastewater system, face complex and often conflicting issues relating to financial resources, technology changes, regulatory requirements, short-term and long-term solutions, etc. Sustainability is an additional goal to be incorporated into the existing engineering design and management (Sahely, et al., 2005). Describing a "sustainable" wastewater and stormwater system and identifying the gap between the current system and a vision of a sustainable system allows for development of specific strategies to close that gap.

Sustainability Criteria Development

The concept of sustainability for the master planning effort is defined as the collection and treatment required to protect public health and the environment that minimizes the use of resources (e.g., maximizes benefits through the conservation of resources).

SSMP goals and objectives and sustainability principles were used to develop Sustainability Criteria for the SSMP projects. The Sustainability Criteria were grouped into the following four categories (**Figure** T-1) following Sahely, et al. (2005):

- Engineering - addresses the requirements for technical viability, conformance with minimum industry standards, ability to implement, and operation and maintenance reliability.
- Social - considers accessibility, acceptability, and health and safety.
- Economic - relates to the expenditures (capital, operation, and maintenance) and investment in innovation.
- Environmental - addresses factors that have an impact on the environment; includes resource use and residuals production.

The Sustainability Criteria used in the SSMP are presented in **Table** T-1, organized by SSMP goals and objectives. The pairings of parameters and units of measurement for a given objective form the basis for assessing the alternatives developed during the master planning process.

The performance parameters under each evaluation criteria were selected to ensure that performance in one category doesn't diminish it in another, or at least to make the tradeoffs evident. For example, focusing exclusively on improving water quality may lead decision-makers to overlook energy use, air quality, or worker health impacts, or to miss opportunities for providing wildlife habitat or other benefits as part of their strategy. Also, optimizing only criteria within the environmental category improves environmental performance but potentially compromises economic sustainability by making the system unaffordable (Balkema, et al,, 2002).

The Sustainability Criteria/performance parameters were selected with these considerations in mind:

- Sufficiently comprehensive to cover all relevant aspects of sustainability, including those difficult to quantify;
- Non-redundant;
- Relevant to the "decision domain" of the SFPUC, without losing the links to long-term and global issues that are at the heart of sustainability;
- Applicable to the range of alternatives being considered;
- Qualitatively or quantitatively measurable;

- Meaningful and relevant to stakeholders – criteria and their related performance measures should be transparent and easily understood; and
- Concise enough to be manageable and effective for communication.

Although it may not be shown in **Table** T-1, it should also be noted that parameters/units of measurement may also apply to more than one of the categories (technical, social, economic environmental) of the evaluation criteria. For example, the predicted number of flood events per year would affect both social and environmental criteria.

San Francisco Public Utilities Commission Sustainability Plan

The SPFUC has developed an agency-wide Sustainability Plan and Program (San Francisco Public Utilities Commission, 2007 & 2009a) that translate the goal of sustainability into an effective organizational management tool to provide SFPUC with a strategic framework by which to evaluate performance on cross-boundary issues and make decisions. It frames departmental issues and decisions around service sources and systems, current and future customers and their service needs, and the integration of the effects of those needs on our long-term environment, economy, and communities (often called "the Triple Bottom Line"). The SFPUC Sustainability Plan has performance indicators that measure its organizational performance, including indicators pertaining to the WWE. The WWE will continue to meet its organization goals, while also meeting the SSMP project-specific metrics described above.

Tools for Evaluation

Collection System Modeling

A new collection system hydraulic model was developed to evaluate the current system performance, to determine the effectiveness of changes made to improve system performance and minimize flooding, and to assess treatment alternatives. (SSMP Technical Memorandum, "Collection System Modeling BCM Joint Venture, 2009a). The model includes only the main interceptors and sewers. All conduits greater than or equal to 30 inches in diameter (or equivalent) were included in the model; exceptions were made from field information on a case-by-case basis.

The critical information for the SSMP analysis was combined sewer discharge (CSD) event counts, discharge volumes, and surcharging sites, indicative of flooding.

After calibration of the model to existing conditions, a baseline simulation was developed using a constructed typical storm year to assess current system performance. The results provided a point of comparison for any system improvements, especially in terms of flooding, CSD events, and overflow volumes.

Treatment Plant Modeling

Field tests and whole-plant BioWin™ simulation were used to determine the treatment plant capacity, the impact of process changes on effluent quality and process performance. (SSMP Technical Memorandum, "Biowin™ Modeling and Secondary Stress Testing at the SEP and OSP" San Francisco Public Utilities Commission, 2009b).

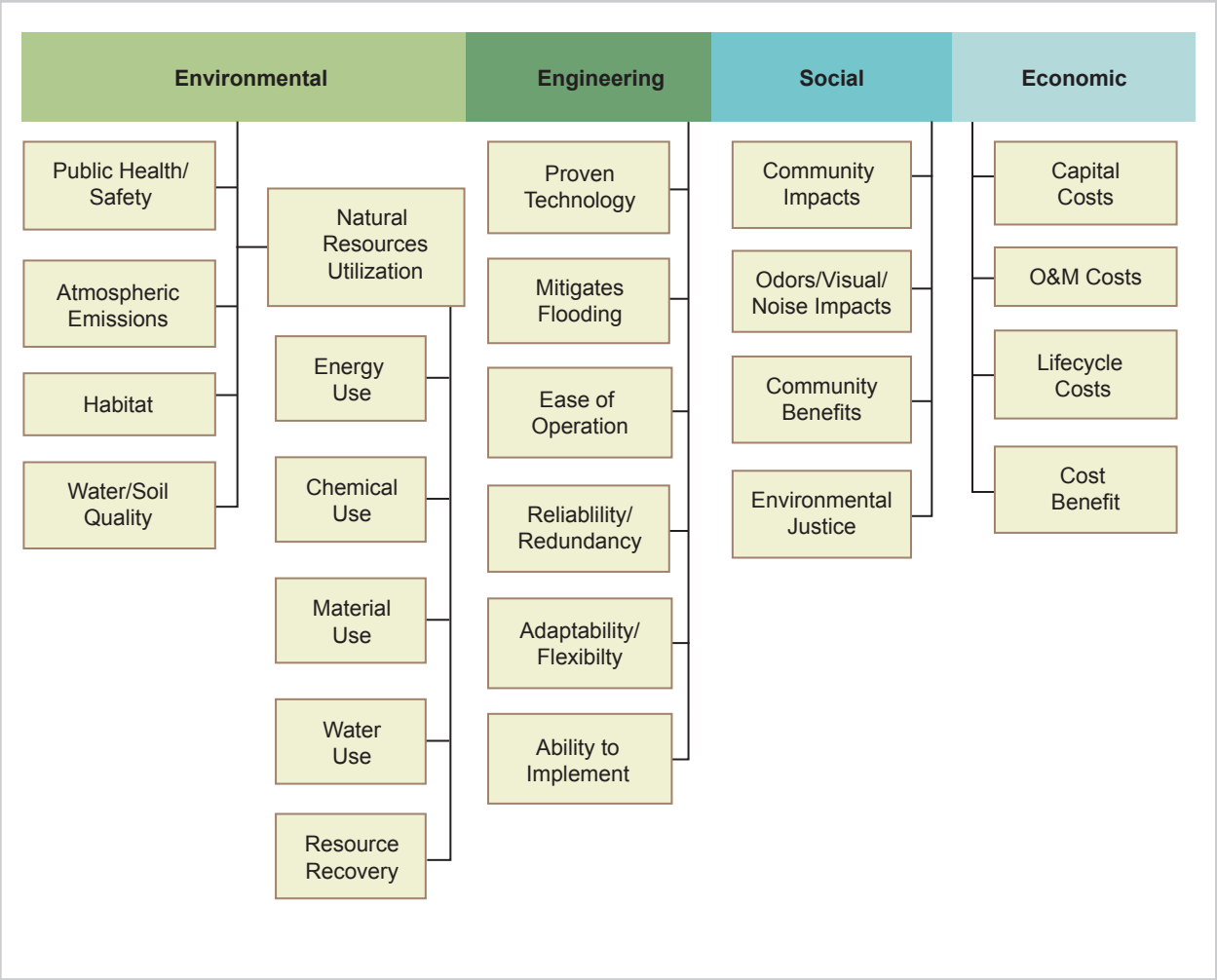

Figure T-1. Categories of Sustainability Criteria

Table T-1. SSMP Sustainability Criteria		
SSMP Objectives	**Parameter**	**Unit of Measure**
First Stage Analysis		
Engineering		
Improve Seismic Reliability	Meets current seismic codes	Yes/No
Improve System Reliability and Flexibility	Proven technology	Years of operation, comparable scale to WWE
	Ease of implementation	Years to implement
	Compatibility with existing systems	Yes/No
	Level of redundancy	Percent redundancy
	Ability to respond to regulatory or flow changes, or technological advances	Cost differential to implement response
	Existence of large-scale applications	Yes/No
	Complexity of operation	Scale based on complexity
Protect Worker Health and Safety	Acceptable ease of maintenance	Yes/No
	Adequacy of current staffing expertise for operation and maintenance	Achievable level of new training/experience needed (Yes/No)
	Operator safety	Scale based on inherent hazard of operations and maintenance
Second Stage Analysis		
Social		
Reduce Community Impacts	Community impacts	Days of construction disruption
	Odors, noise, and visual impacts	Impacts can be reasonably mitigated (Yes/No)
		Distance to nearest residence (feet)
	Odor potential	Scale based on process experience
	Reduce localized flooding	Protection from flooding for the 5-year storm
	Community amenities	Potential to provide parks/green open space
	Increase employment rate in nearby community	Number of local jobs created
	Disproportional impacts	Potential environmental justice issue (Yes/No)
	Average monthly sewer rate	Cost/month
	Footprint	Acres

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Table T-1. SSMP Sustainability Criteria		
SSMP Objectives	**Parameter**	**Unit of Measure**
Economic		
Minimize Impacts to Ratepayers	Capital, and operation and maintenance cost.	Cost
	Potential for external funding	Identified funding sources (Yes/No)
	Annual costs	Cost/MG treated
Environmental		
Promote Environmental Stewardship	Combined Sewer Discharges (CSDs)	Volume (MG) and frequency of CSDs
	Pollutants of Concern	Pollutant mass pounds per year
	GHG emissions	Emissions (tons per year)
	Biosolids reuse	Dry tons per year
	Adaptability to regulatory developments	Scale based on experience
Enhance Sustainable Use of Natural Resources	Water reuse	MG per year
	Energy use	kWh per year per volume wastewater treated
	Energy recovered and reused	kWh produced per year
	Exposure to hazardous materials	Scale based on hazard and exposure risk
	Chemical consumption	Tons/year
	Biosolids product quality	Based on market uses
Protect Public Health and the Environment	Compliance with environmental and public health regulations	Yes/No

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