Association of
Metropolitan
Sewerage Agencies

Collection System Capacity-Setting Matrix

I. Introduction/Purpose

In an effort to increase the Environmental Protection Agency's (EPA or Agency) understanding of the methodologies used by collection system operators in making system capacity assessments, the Association of Metropolitan Sewerage Agencies (AMSA) conducted its *2002 Wet Weather Survey* (*Survey*). The data collected from the *Survey* were used in conjunction with interviews and team meetings of publicly owned treatment works (POTW) and collection system operators to identify the factors considered and the processes used by utilities to make capacity-related decisions in construction and rehabilitation of their collection systems. Based on this information, a matrix was developed to illustrate the capacity decision-making process.

The goal of the matrix is to document, in a stepwise fashion, sound engineering practices used by collection system operators in choosing the constructed conveyance capacity of their collection systems. This matrix does not prescribe the exact procedure for a capacity determination; rather, it provides to those outside the wastewater design community a guide to the issues examined and the engineering practices used throughout the decision-making process. It is hoped that by providing this insight into the capacity-setting process, regulatory authorities will be able to assess the reasonableness of a utility's capacity determinations, and thereby define when a wet weather-induced overflow is unavoidable for regulatory purposes.

II. Project Resources and Process

A. *2002 Wet Weather Survey*

AMSA conducted its *Survey* as the first phase of a much broader look into the complexities of POTW and collection system capacity issues and the enormity of the expenses associated with infrastructure upgrades and improvement. The *Survey* documented current collection system sizing and treatment plant flow management evaluations, practices and considerations among responding AMSA member agencies in the following three areas:

1. Factors evaluated, or criteria or procedures used, to establish peak design flow capacity in the collection system;

2. Factors evaluated, or criteria or procedures used, to determine if blending is an appropriate option for treatment of wet weather flows; and

3. How the maximum wet weather flow through the treatment plant is established in design and managed in-situ (including equalization/storage) to avoid wash out of active biological organisms.

AMSA distributed the *Survey* to its membership in March 2002 and received responses through April 2002. Eighty-four member agencies responded to all or part of the *Survey*. Seventy-five members completed all sections of the *Survey*.

B. Additional Information Collection

As a follow up to the *2002 Wet Weather Survey*, an e-mail survey was conducted of AMSA members requesting basic information on recent capacity-related projects. Telephone interviews of respondents were then conducted by members of AMSA's SSO Workgroup. Respondents were asked to describe the type of project, the factors considered and design standards applied, and the step-by-step process used to establish their capacity goal. The information obtained was then added to the information gleaned from the *2002 Wet Weather Survey*, and the process of creating an overall framework based on what was learned began.

C. Matrix Development Workshop

A small subgroup of the SSO Workgroup met in Washington D.C. in October, 2002 to flesh out the goals and structure of the project. The group arrived at certain fundamental principles, which are discussed below. Taking these and many other facts and experiences into account, the group decided to create a framework designed to answer the following question:

> *Given that all collection systems will have management, operations and maintenance (MOM) programs in place, can a framework be developed that, when applied, will result in collection system capability that protects public health and beneficial uses of receiving waters, and provides a clear defense should an overflow occur in the process of or after achieving the capacity goal?*

The group began formulating the framework by identifying the key steps in the capacity setting process. Once these key steps were identified, numerous actions to effectuate these steps were listed. The framework was then placed into a matrix format to provide a visual picture of the process.

The overriding imperative for the group was to ensure that the framework developed was inclusive of all of the various factors that could be considered and/or actions that could be taken to establish an appropriate capacity goal. The framework is not intended to be used as concrete, step-by-step instructions for the capacity-setting process. Instead, it is intended to be a compilation of the various methods used and factors considered to arrive at answers to critical questions in the capacity-setting process, recognizing the highly site-specific nature of collection system capacity needs.

III. Fundamental Principles

Appropriate collection system capacity, coupled with a comprehensive MOM program, can protect public health and beneficial uses of receiving waters while also providing enforcement protection for a public utility should an unavoidable overflow occur. The following fundamental principles were established to focus the issues and define the problem:

1. There can be no "one size fits all" capacity standard or planning process;

2. Grossly oversized sewers allow for the settling of solids, which can reduce the overall capacity of the sewer, result in formation of malodorous and/or explosive gases, and generally prevent implementation of an effective MOM program;

3. All collection systems will overflow under certain conditions; this is recognized by EPA in the current draft of the SSO Rule preamble. It is impossible and environmentally unnecessary to make all existing sewers water tight from a wet weather perspective;

4. Collection systems that have MOM programs in place will overflow less frequently; and

5. Significant wet weather flow infiltration is a legacy issue. Utilities are finding that collection systems constructed in the last thirty years are not showing these types of problems. Overflows will still occur, but at a much reduced level as infrastructure is repaired or replaced. Thus, as investments are made over time, the problem that we face now will be self-correcting.

IV. Explanation of Capacity Evaluation Components

A. Data Gathering

The first step in any capacity-setting evaluation is data gathering. The first series of boxes in the matrix represent various data gathering activities that can be undertaken to determine the current operational and regulatory status of the collection system and to identify the segments requiring additional capacity. These activities will lead to a determination of the appropriate capacity for the collection system.

The data-gathering phase is often a time-consuming and lengthy effort. A utility should establish appropriate methodologies to collect data for decision-making purposes. There are many options available. The most common options are discussed below.

1. Conduct Preliminary Assessment of Overflows
    - Develop a monitoring program
    - Conduct an evaluation and characterization of sources and quantity of flow
    - Conduct storm event sampling
    - Identify locations, frequency, quantity, and duration of overflows
    - Identify the overflow receiving stream

- Determine demographics at overflow sites

2. Determine Potential Impacts on Public Health and Environment
    - Determine existing beneficial uses of receiving waters
    - Check seasonal aspects of beneficial uses
    - Establish correlation of overflows and public health impacts
    - Compare frequency and duration of overflows with environmental standards on the ability of the receiving water to withstand short-term stresses
    - Develop a local effects monitoring study report
    - Determine the severity of the impact from overflows on beneficial uses
    - Assess accuracy of beneficial uses and evaluate need for a use attainability analysis (UAA)

3. Assess Existing Treatment Facilities and Collection System
    - Conduct a Sewer System Evaluation Survey (SSES) using available tools (e.g., smoke testing; TV inspection; physical inspections of storm system connections, leaks, corrosion, etc.; flow monitoring of basins and sub-basins; flow isolation; etc.)
    - Conduct collection system evaluations based on individual sub-basins
    - Evaluate treatment plant processes and capacities
    - Evaluate pumping facilities capacity

4. Conduct Hydraulic Modeling Correlated With Rainfall
    - Collect historical and current rainfall data
    - Correlate rainfall patterns with soil saturation
    - Document overflow locations
    - Calibrate model using field data and flow monitoring data, and overflow observations
    - Compare dry and wet weather modeling to determine influence of inflow and infiltration

5. Assess the Financial Status of the Utility and its Rate Payers
    - Identify current rates
    - Use benchmarking
    - Assess ongoing/pending projects
    - Assess other applicable regulatory requirements
    - Assess local budgetary restrictions
    - Assess affordability

6. Review Existing Applicable Federal/State/Local Regulatory and Design Standards
    - Determine design standards
    - Assess regulatory requirements

A sound and justifiable collection system capacity evaluation process will consist of several stages. When these stages are unified through a public planning process, the fundamental principles can be met and a reasonable and supportable capacity goal can be developed.

B. Preliminary Planning/Alternatives Identification

As the utility continues to collect data, it also begins the preliminary planning process. If the data support the need for a reduction in overflows in the system, alternatives to address the issues will be conceptualized and rough estimates of cost determined. Often, the public will be engaged in the alternatives analysis process to help build understanding and gain support for the needed improvements.

This is also the appropriate time to review the state established beneficial uses of receiving waters to determine if they are appropriate and reasonable for the water body and its actual uses. The utility, working in concert with state and local regulators and the community, should make this assessment. The conditions in the water body should be analyzed as they relate to conditions found during dry weather as well as the wet weather events that cause potential capacity related overflow situations.

If the beneficial uses in the receiving waters are not realistic during periods when wet weather overflows could occur, the utility might explore working with the regulators to perform a UAA for the affected water body to insure that appropriate levels of protection are employed. The UAA can utilize the information collected by the utility during the data-gathering phase of the capacity evaluation. Once complete, the UAA will result in standards that ensure a level of protection appropriate to protect water quality and public health.

C. Alternatives Refinement

Once all involved parties have reached agreement on appropriate, scientifically-based standards for the protection of the water body, the utility then reviews the alternatives available to meet these standards. The alternatives can include both engineering-based and best management approaches to standards attainment. Alternatives often include the following or a combination thereof:

- Relief sewer or interceptor construction
- Inflow and infiltration (I/I) rehabilitation
- Reduction of private property lateral flows
- Peak excess flow treatment facilities (PEFTF) and appropriate discharge standards
- Storage facilities and/or equalization tanks
- Hydraulic improvements at pump stations and/or treatment facilities
- Water conservation and public education
- Other site specific strategies tailored to local conditions and issues

To assess the adequacy and cost effectiveness of the identified alternatives, hydraulic modeling can be employed. Hydrographs representing various storm events are developed. Rainfall dependent inflow/infiltration (RDII) parameters for basins and sub basins are developed. These are then used to estimate locations and volumes of overflows during the previously modeled storm events. Using these models, utilities are able to target projects with the highest cost effectiveness ratio for maximum gain.

If the analysis determines that no combination of alternatives provides a cost effective solution that will lead to standards attainment, the utility must return to the regulators and community. The assumptions used to develop the standards and/or the UAA must be questioned and investigated further, ultimately leading to renegotiation of the applicable standards.

D. Implementation

The utility faces several hurdles in implementing system capacity improvements for wet weather. After selection of the preferred alternative, the utility must seek the approval of its governing body. This political process can be made somewhat less difficult if this group is actively engaged throughout the entire capacity determination process. Involving the community in the UAA and standards-setting process can also help build support.

Upon project approval, a detailed capacity-related capital improvement program (CIP) is developed by the utility. The CIP allocates project elements and associated costs over the schedule for attainment set by the utility and regulators. The CIP helps the utility determine its cash flow and provides a basis for it to seek additional revenue, such as rate increases, loans, bonds or grants. These options will be reviewed in accordance with local affordability rates. If median household income ratios or other affordability rules of thumb are exceeded, schedules will need to be adjusted to ensure rates are affordable.

Implementation of the CIP may need to extend over a period of many years, depending on the magnitude of the projects involved. The utility's customer service program may need to be modified to enhance public outreach and education relative to the program's impacts on the ratepayers. Construction may be disruptive to homeowners, and businesses along any construction routes may also be negatively impacted by a reduction in the number of customers.

The most critical element in the utility's implementation of a system capacity improvement program is the measurement assessment program. This program sets the metrics the utility will use on a defined time basis (such as annually) to ensure that financial, water quality and public health goals are being met as the projects are completed. Where metrics are not met after project completion, the plan must be adjusted to include additional alternatives for corrective action to meet the designated standards.

As projects are completed, the system is monitored and the capacity model is rerun to validate the system's increased capacity, the reduction in overflows and the attainment of designated standards. Once capacity in the upgraded system is deemed adequate, the routine ongoing MOM program is resumed, including annual capacity reviews. If the flows again exceed the system capacity, the utility begins the capacity evaluation process just described.

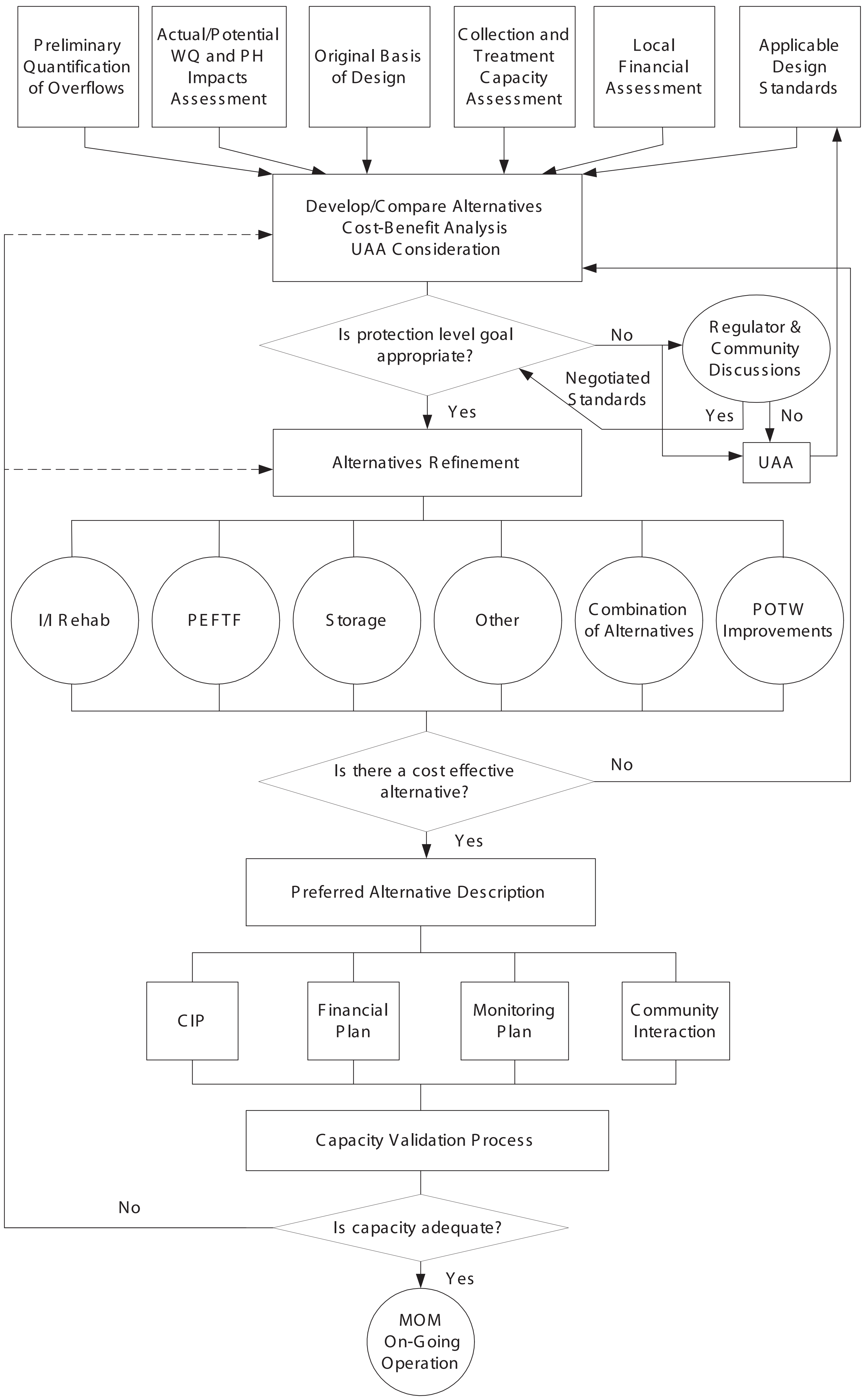
V. Conclusion

There is a process followed by utilities when determining alternatives to address system capacity issues, and the above described framework is intended to document that process in its many forms. The matrix is neither prescriptive nor all inclusive, but is adaptable to the needs of the community being served. There is no question, however, that the overall process yields positive results and, working in conjunction with a comprehensive MOM program, wet weather impacts to water quality and public health can be effectively minimized.

Given that all experts agree that a collection system cannot be made overflow free or waterproof, the regulator and the regulated utility must find a way to reach agreement that the utility has done all that it can to design, construct and operate an effective and compliant collection system. It is AMSA's belief that by using this matrix as a guide (but not a checklist), regulators can objectively assess whether the decision-making process utilized by collection system operators constituted sound engineering practice. With evidence of a comprehensive and well-maintained MOM program, a regulator has an objective compliance baseline to evaluate the utility's performance. In so doing, the prerequisites for finding an overflow to be unavoidable and inappropriate for enforcement are established. This gives both the operator and the regulator a clear standard from which to determine the system's goals, compliance and environmental benefit.

Attachment A

Collection System Capacity-Setting Matrix


Preliminary Quantification of Overflows
Actual/Potential WQ and PH Impacts Assessment
Original Basis of Design
Collection and Treatment Capacity Assessment
Local Financial Assessment
Applicable Design Standards
Develop/Compare Alternatives
Cost-Benefit Analysis
UAA Consideration
Is protection level goal appropriate?
No
Regulator & Community Discussions
Negotiated Standards
Yes
Yes
No
UAA
Alternatives Refinement
I/I Rehab
PEFTF
Storage
Other
Combination of Alternatives
POTW Improvements
Is there a cost effective alternative?
No
Yes
Preferred Alternative Description
CIP
Financial Plan
Monitoring Plan
Community Interaction
Capacity Validation Process
No
Is capacity adequate?
Yes
MOM On-Going Operation