CHAPTER 1 Introduction

1.1 Background

Protecting sediment quality is an important part of restoring and maintaining the biological integrity of our Nation's waters as well as protecting aquatic life, wildlife and human health. Sediment is an integral component of aquatic ecosystems, providing habitat, feeding, spawning, and rearing areas for many aquatic organisms. Sediment also serves as a reservoir for pollutants and therefore a potential source of pollutants to the water column, organisms, and ultimately human consumers of those organisms. These pollutants can arise from a number of sources, including municipal and industrial discharges, urban and agricultural runoff, atmospheric deposition, and port operations.

Contaminated sediment can cause lethal and sublethal effects in benthic (sediment-dwelling) and other sediment-associated organisms. In addition, natural and human disturbances can release pollutants to the overlying water, where pelagic (water column) organisms can be exposed. Sediment pollutants can reduce or eliminate species of recreational, commercial, or ecological importance, either through direct effects or by affecting the food supply that sustainable populations require. Furthermore, some sediment pollutants can bioaccumulate through the food chain and pose health risks to wildlife and human consumers even when sediment-dwelling organisms are not themselves impacted.

The extent and severity of sediment contamination in the U.S. has been documented in the National Sediment Inventory (NSI)[1] and through other historical information. The NSI screening evaluation of sediment contamination data indicates that associated adverse effects are probable in thousands of locations throughout the country. The results emphasize the widespread need to address sediment contamination in the U.S.

1.2 Significance and Use of this Manual

Sediment quality assessment is an important component of water quality protection programs. Sediment assessments commonly include physicochemical characterization, toxicity tests, and/or bioaccumulation tests, as well as benthic community analyses. USEPA's NSI, for example, collates this information to develop a biennial report to Congress on sediment quality in the United States, required under the Water Resources Development Act of 1992. The use of consistent sediment collection, manipulation, and storage methods will help provide high quality samples with which accurate data can be obtained for the national inventory and for other programs to prevent, remediate, and manage contaminated sediment.

It is now widely known that the methods used in sample collection, transport, handling, storage, and manipulation of sediments and interstitial waters can influence the physicochemical properties and

[1]The National Sediment Inventory, or NSI, is the database of sediment quality information used to develop EPA's 1997 Report to Congress, *The Incidence and Severity of Sediment Contamination in Surface Waters of the United States*, *Volume 1: National Sediment Quality Survey* (U.S. EPA, 1997a). The database is updated periodically with new available information on sediment quality at sites throughout the U.S. **http://www.epa.gov/OST/cs/report.html**

the results of chemical, toxicity, and bioaccumulation analyses. Addressing these variables in an appropriate and systematic manner will help assure more accurate sediment quality data and facilitate comparisons among sediment studies.

This Technical Manual provides current information and recommendations for collecting and handling sediments for physicochemical characterization and biological testing, using procedures that are most likely to maintain *in situ* conditions, most accurately represent the sediment in question, or satisfy particular program needs, to help ensure consistent, high quality data collection.

1.3 Applicability and Scope of this Manual

This manual is intended to provide technical support to those who design or perform sediment quality studies under a variety of regulatory and non-regulatory programs. Information is provided concerning general sampling design considerations, field and laboratory facilities needed, safety, sampling equipment, sample storage and transport procedures, and sample manipulation issues common to chemical or toxicological analyses. Information contained in this manual reflects the knowledge and experience of several internationally-known sources including American Society for Testing and Materials (ASTM), Puget Sound Estuary Program (PSEP), Washington State Department of Ecology (WDE), United States Environmental Protection Agency (USEPA), US Army Corps of Engineers (ACOE), National Oceanic and Atmospheric Administration (NOAA), and Environment Canada. This manual attempts to present a coherent set of recommendations on field sampling techniques and sediment/interstitial water sample processing based on the above sources, as well as extensive information in the current peer-reviewed literature.

As the scope of this manual is broad, it is impossible to adequately present detailed information on every aspect of sediment sampling and processing for all situations or all programs. Nor is such detailed guidance warranted because much of this information (e.g., how to operate a particular sampling device or how to use a Geographical Positioning System (GPS) device) already exists in other published materials referenced in this manual. Furthermore, many programs have specific sampling and sample processing procedures. While an attempt is made to give examples from different programs, the manual repeatedly instructs the reader to check their own specific program requirements.

Given the above constraints, this manual: (1) presents an organized discussion of activities involved in sediment sampling and sample processing; (2) alerts the user to important issues that need to be considered within each activity; and (3) gives recommendations on how to best address the issues raised such that appropriate samples are collected and analyzed. An attempt is made to alert the user to different considerations pertaining to sampling and sample processing depending on the program need (e.g., dredge remediation versus status and trends monitoring).

Figure 1-1 presents a flow chart of the general activities discussed in this manual. The organization of these activities reflects the desire to give field personnel and managers a useful tool for choosing appropriate sampling locations, characterize those locations, collect and store samples, and manipulate those samples for analyses. Chapters are written so that the reader could obtain information on only one activity or set of activities (e.g., subsampling or sample processing), if desired, without necessarily reading the entire manual. Many sections are cross-referenced so that the reader is alerted to relevant issues that might be covered elsewhere in the manual. This is particularly important for certain chemical or toxicological applications in which appropriate sample processing or laboratory procedures are associated with specific field sampling procedures.

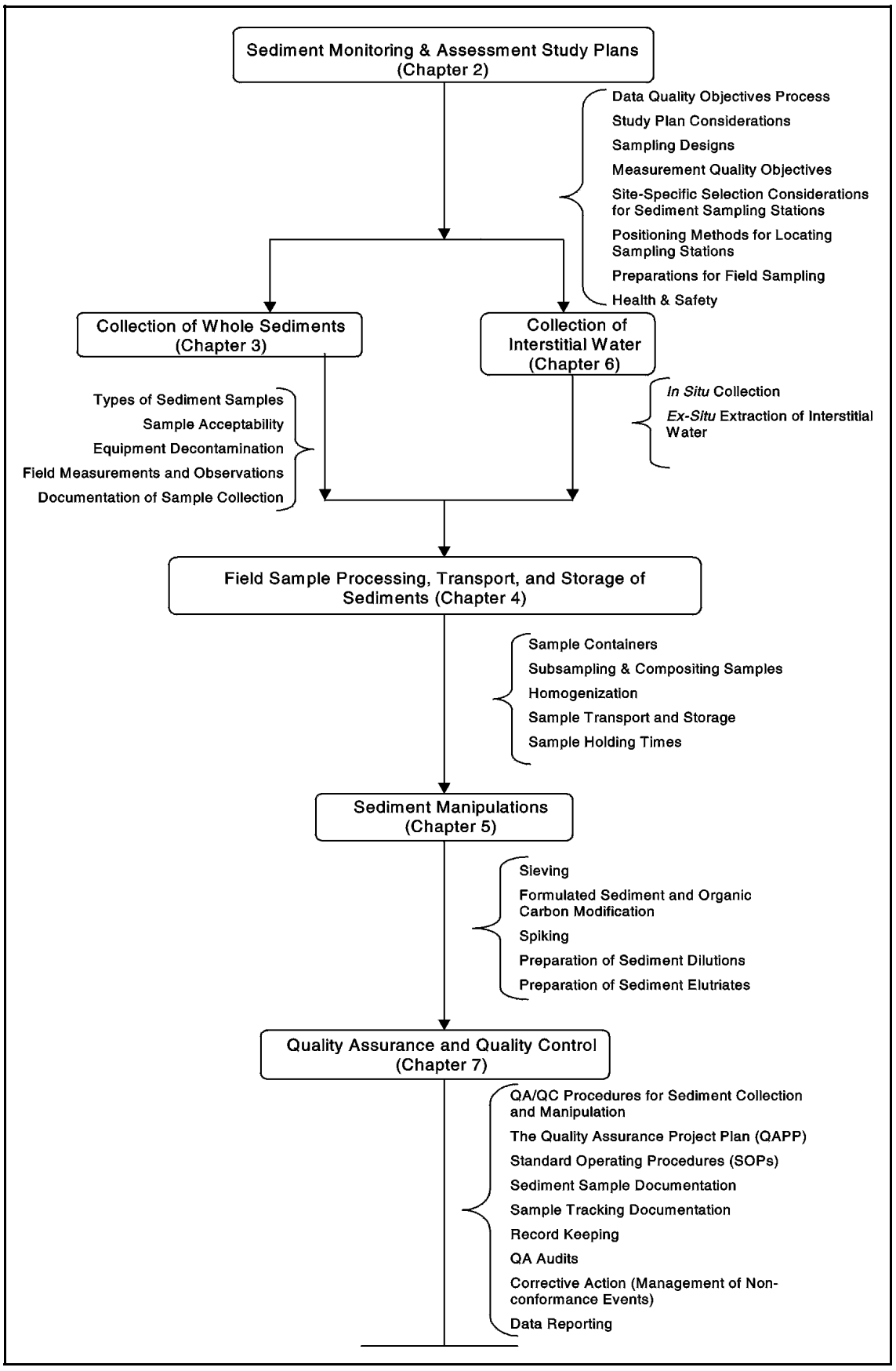

Figure 1-1. Flow chart summarizing activities for collection, storage, and manipulation of sediments and interstitial water.

The methods contained in this manual are widely applicable to any entity wishing to collect consistent, high quality sediment data. This manual **does not** provide guidance on how to implement any specific regulatory requirement, or design a particular sediment quality assessment, but rather it is a compilation of technical methods on how to best collect environmental samples that most appropriately address common sampling objectives.

Although the data from these samples might be used in environmental decision-making at a variety of levels, this manual does not address how data are to be used. The Foreword section summarizes a variety of EPA programs that assess sediment quality and may benefit from the methods described in this manual. Other Agencies and programs are also encouraged to consider these methods in order to generate consistent and high quality sediment data.

The information presented in this manual should not be viewed as the final statement on all the recommended procedures. Some of the areas covered in this document (e.g., sediment holding time, formulated sediment composition, interstitial water collection and processing) are being actively researched and debated. As data from sediment monitoring and research becomes more available in the future, EPA may update this manual as necessary.