

## TABLE OF CONTENTS

### **1. CONVENTIONAL FACILITIES OVERVIEW**

- 1.1 Introduction
- 1.2 Project Goals
- 1.3 Project Description
- 1.4 The Design Process
- 1.5 Work Breakdown Structure
- 1.6 Method of Accomplishment

### **2. SITE / CIVIL**

- 2.1 Design Criteria
- 2.2 Site Description
- 2.3 Campus Planning
- 2.4 Access, Traffic, Parking
- 2.5 Vibration Survey
- 2.6 EMI / RFI Survey
- 2.7 Geotechnical Survey
- 2.8 Topographical Survey
- 2.9 Existing Site Utilities
- 2.10 Existing Facilities
- 2.11 Preliminary Design

### **3. ARCHITECTURE**

- 3.1 Design Criteria
- 3.2 Architecture
- 3.3 Functional Program
- 3.4 Space Program
- 3.5 Preliminary Design

#### **4. SUSTAINABLE DESIGN**

- 4.1 Design Criteria
- 4.2 Sustainable Design Overview and Approach
- 4.3 Sustainable Site
- 4.4 Water
- 4.5 Energy
- 4.6 Materials
- 4.7 IEQ
- 4.8 LEED Status
- 4.9 LEED Project Checklist

#### **5. STRUCTURAL ENGINEERING**

- 5.1 Design Criteria
- 5.2 Soil Conditions
- 5.3 Design Loads
- 5.4 Structural System

#### **6. MECHANICAL ENGINEERING - HVAC SYSTEMS**

- 6.1 Design Criteria
- 6.2 Design Conditions
- 6.3 Utility Systems
- 6.4 HVAC Systems
- 6.5 Air Handling Units – General
- 6.6 Air Distribution
- 6.7 Exhaust Systems
- 6.8 Distribution Systems
- 6.9 Miscellaneous Heating / Cooling Devices
- 6.10 Energy Conservation
- 6.11 Automatic Temperature Control
- 6.12 System Testing and Balancing
- 6.13 Vibration

6.14 Commissioning

## **7. MECHANICAL ENGINEERING – PLUMBING**

7.1 Design Criteria

7.2 Plumbing Systems

7.3 Preliminary Design

## **8. FIRE PROTECTION**

8.1 Design Criteria

8.2 Preliminary Design

## **9. PROCESS SYSTEMS**

9.1 Design Criteria

9.2 Preliminary Design

## **10. ELECTRICAL ENGINEERING**

10.1 Design Criteria

10.2 Site Utilities

10.3 Interior Power Distribution

10.4 Grounding

10.5 RFI and ELF EMI Mitigation

10.6 Vibration Isolation

10.7 Radiation Protection

10.8 Exterior Lighting

10.9 Interior Lighting

10.10 Special Systems

## **11. ENVIRONMENT, SAFETY AND HEALTH**

11.1 Scope and Content

11.2 Building Code Analysis

11.3 Other Codes and Standards

- 11.4 Preliminary Hazards Analysis
- 11.5 Fire Protection
- 11.6 Pressure Safety
- 11.7 Industrial Hygiene
- 11.8 Biological Safety
- 11.9 Electrical Safety
- 11.10 Other Environment, Safety and Health Issues

## **12. CODE ANALYSIS**

- 12.1 General
- 12.2 Applicable Codes and Standards
- 12.3 Occupancy Classifications
- 12.4 Construction
- 12.5 Interior Finishes
- 12.6 Means of Egress
- 12.7 Elevators
- 12.8 Ramps

## **13. ROOM DATA SHEETS**

### **APPENDICES**

- A1 – Preliminary Geotechnical Report
- A2 – Preliminary Vibration and Acoustic Report
- A3 – Preliminary EMI/RFI Site Assessment Study Report
- A-4 – HVAC Calculations (under separate cover)
- A-5 – Hourly Whole Building Energy Analysis

# 1 CONVENTIONAL FACILITIES OVERVIEW

## 1.1 Introduction

The NSLS-II conventional facilities will provide the structures and systems necessary to enable installation and operation of the accelerator and experimental beamlines. The conventional facilities must be designed and constructed to enable the world-leading performance objectives of the project mission. Furthermore, the conventional facilities must be constructed on an aggressive schedule that enables installation of the accelerator systems and experimental beamlines in accordance with the project schedule goals. Lastly, the conventional facilities must meet the functional and aesthetic goals of creating an economically vibrant research facility that achieves technical excellence and is adaptable to the varied and changing requirements of the user community. This report describes the scope and design considerations for the NSLS-II conventional facilities.

## 1.2 Project Goals

The goals of the conventional facilities portion of the project support the overall goals of the NSLS-II project. These goals provide the guiding principals for preliminary design of the conventional facilities.

- World-class scientific capability
- Promote collaborative interaction
- Flexible building capability
- Economic construction and operation
- Sustainable design
- Phase construction to allow earliest start of accelerator installation

## 1.3 Project Description

The NSLS-II conventional facilities will be designed to provide the buildings, services and utility infrastructure needed to support the technical scope of the project and the mission of a high technology user facility. The selected site is at the southeast corner of the present intersection of Brookhaven Avenue and Groves Street. The facility will be proximate to the existing NSLS Building and the recently constructed Center for Functional Nanomaterials, (CFN) as indicated on the site plan, Figure 1.1.

The conventional facilities will consist of a Ring Building to house the accelerator and associated beamlines, an Injection Building for the compact booster, and linac, a two story Operations Center for the control room function, three Lab Office Buildings (LOB's) for beamline staff and the beamline user community, an RF Building, and five two story Service Buildings containing mechanical and electrical equipment. Additionally, the overall building complex is being planned to include two additional future Lab Office Buildings, the Joint Photon Science Institute (JPSI) Building and possible locations for future scientific buildings. An alternate for a third floor to the Operations Center is also being considered to provide office space for NSLS-II management and accelerator scientists. These additional buildings are considered alternate or future construction and are not included in the Program or Cost of the NSLS-II project.

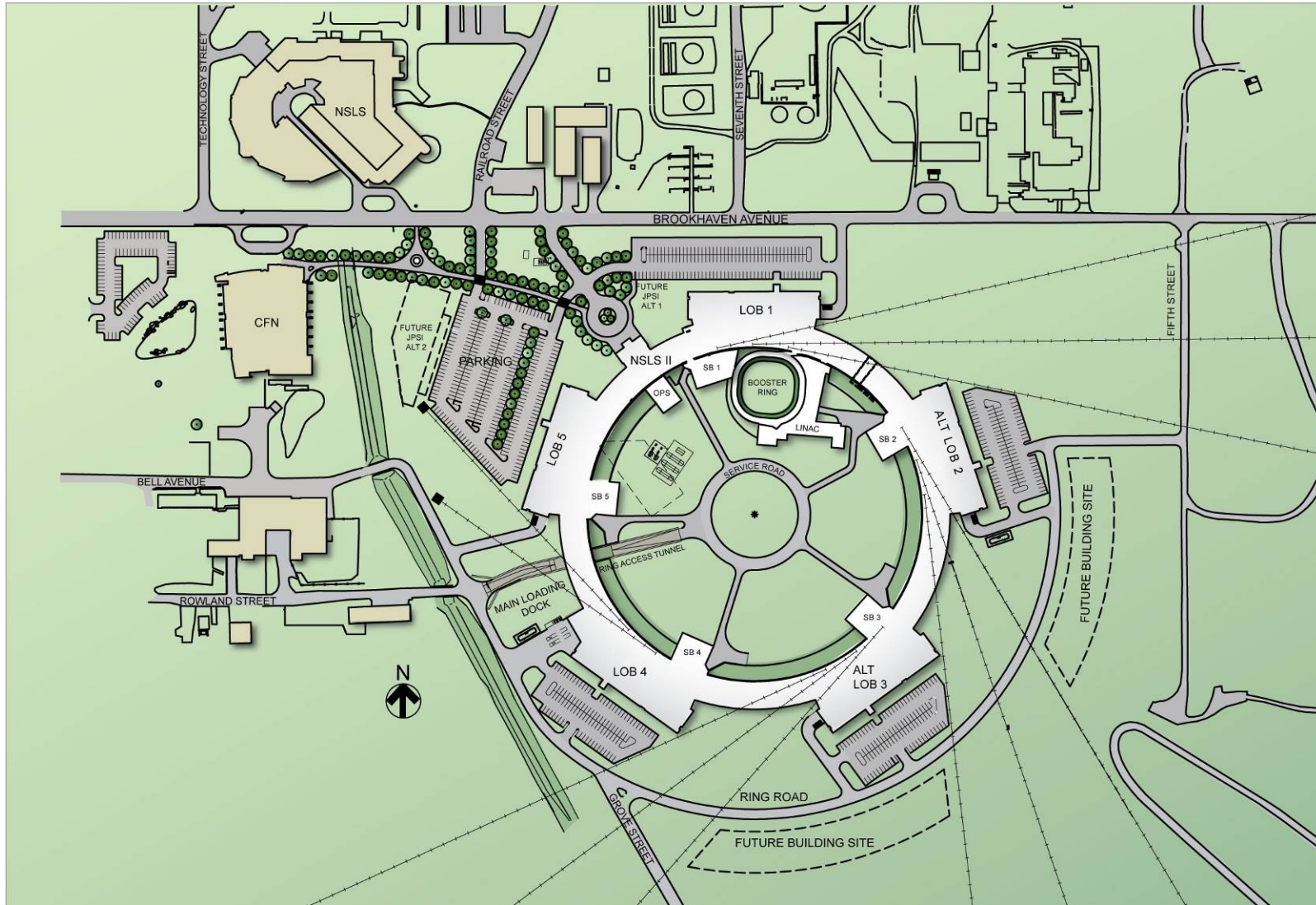


Figure 1.1 NSLS-II Site Plan.

An architectural rendering of NSLS-II, shown in Figure 1.2, indicates the preliminary design architectural theme for the facility. Figure 1.3 indicates the floor plan and functional relationships of the built-out NSLS-II complex. The approximate gross area for each of these buildings is shown in Table 1.1. The building program is discussed more fully in the Architectural Section of this report.

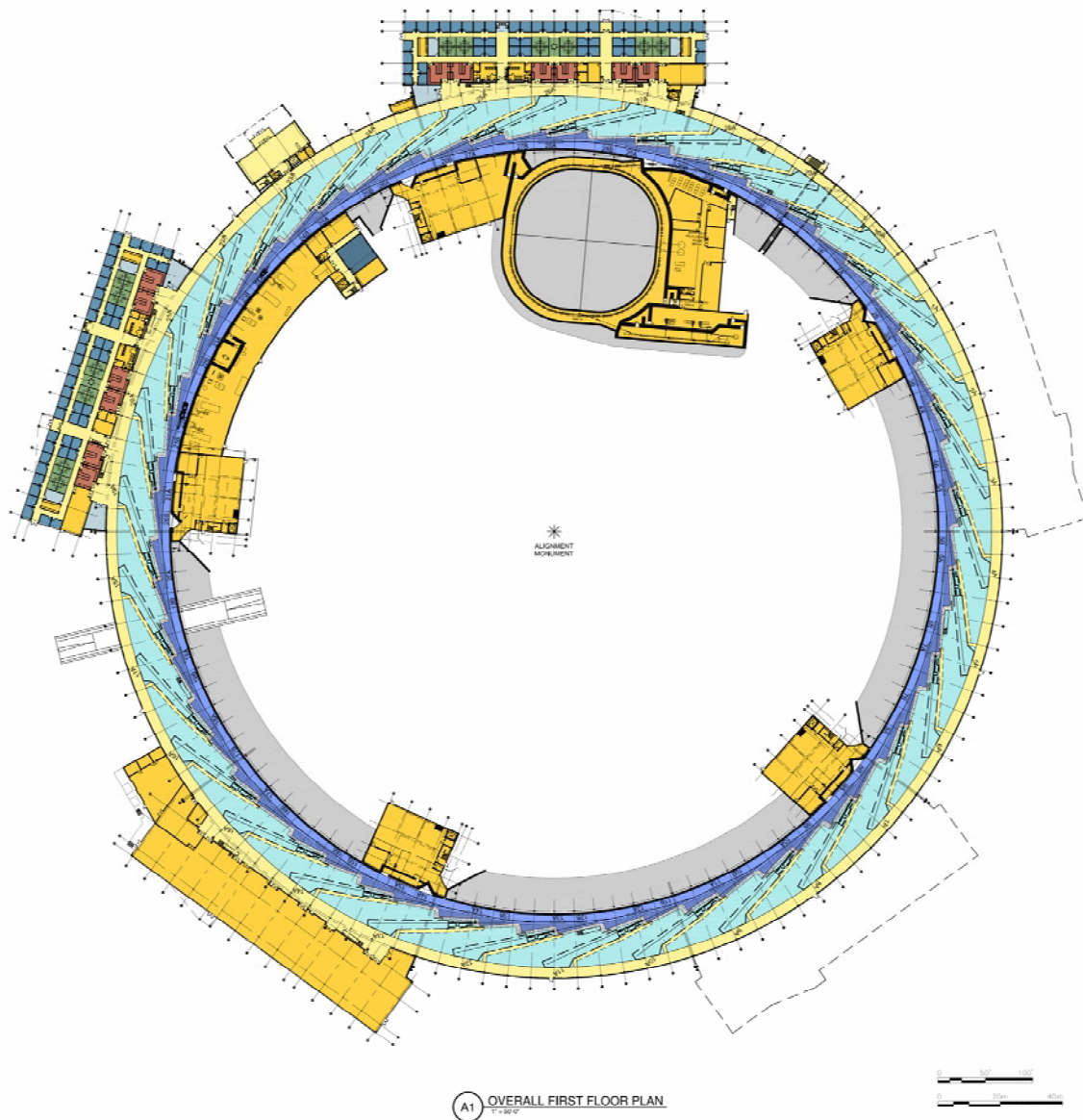
**Table 1.1 NSLS-II Area.**

Building Component	Net Area (ft <sup>2</sup> )	Gross Area (ft <sup>2</sup> )
Operations Center	9,232	11,600
Injection Building	17,693	24,440
RF Building	10,182	10,630
Ring Building	219,888	240,075
Service buildings (5)	48,130	53,640
Lab Office Buildings (3)	50,358	71,536
<b>Total NSLS-II</b>	<b>355,483</b>	<b>411,921</b>



**Figure 1.2** Architectural rendering of NSLS-II.





**Figure 1.3** NSLS-II Complex Layout – First Floor Plan.

## 1.4 The Design Process

The NSLS-II site, located at the present intersection of Brookhaven Avenue and Groves Street is at the eastern boundary of the Science and Technology zone in the BNL Master Plan. It is the last parcel in the Brookhaven Avenue corridor development plan. The site is well suited to construction of NSLS-II given its close proximity to the existing NSLS and CFN buildings and has many advantages in terms of constructability including a relatively level and mostly clear site, good geologic conditions, good access to utilities and low background vibration levels.. The NSLS-II site plan comprises the following: NSLS-II Ring Building Complex - the heart of the project where scientific experiments are conducted, the loop road circling around the building, allowing access to Lab Office Buildings and connected to a vehicle tunnel for emergency and maintenance vehicle access to the inner Ring road area, and the service drive inside the ring for vehicle



access to the Operations Center, Injection Building, Service Buildings and storage ring tunnel. For planning purposes, additional elements which are not part of this project, are indicated on the site plan. These include the proposed Joint Photon Science Institute and possible future scientific buildings.

The current site design supports the need for reasonable proximity to the existing NSLS and the CFN. The existing NSLS will continue to provide office and technical support space for NSLS-II staff, thus the NSLS-II footprint has been moved as far West and North (close to NSLS) to minimize travel distance for these staff. This siting also supports anticipated collaborative interaction of the CFN with NSLS-II. The proposed landscaped walkways link all building main entrances and outdoor interaction spaces encouraging exchange of ideas among scientists. In addition Groves Street is discontinued from Bell Avenue to Brookhaven Avenue to discourage through traffic near the NSLS-II building. There will be a formal drop-off, circle drive in front of the NSLS-II main entrance lobby at the Operations Center Building which would be highly visible from the main entrances to the CFN and existing NSLS buildings.

Another important issue in development of the NSLS-II site plan was to maximize opportunities for installation of extra-long beamlines that would extend beyond the Ring Building walls and into the surrounding landscape. The NSLS-II orientation on the site, as well as the location of each LOB is influenced by the best possible location for these future extra long beamlines. Due to existing site topography and site access issues, the most preferable locations for the longest beamlines (up to several hundred meters) are in the easterly direction between LOBs 1 and 2, and southeast between LOBs 2 and 3. Opportunities for extra long beamlines of 100 – 200 meters are also available between LOBs 3 and 4 and between LOBs 4 and 5.

## **1.5 Work Breakdown Structure**

The work breakdown structure for the NSLS-II conventional facilities is shown in Figure 1.4.

### 1.05 | CONVENTIONAL FACILITIES

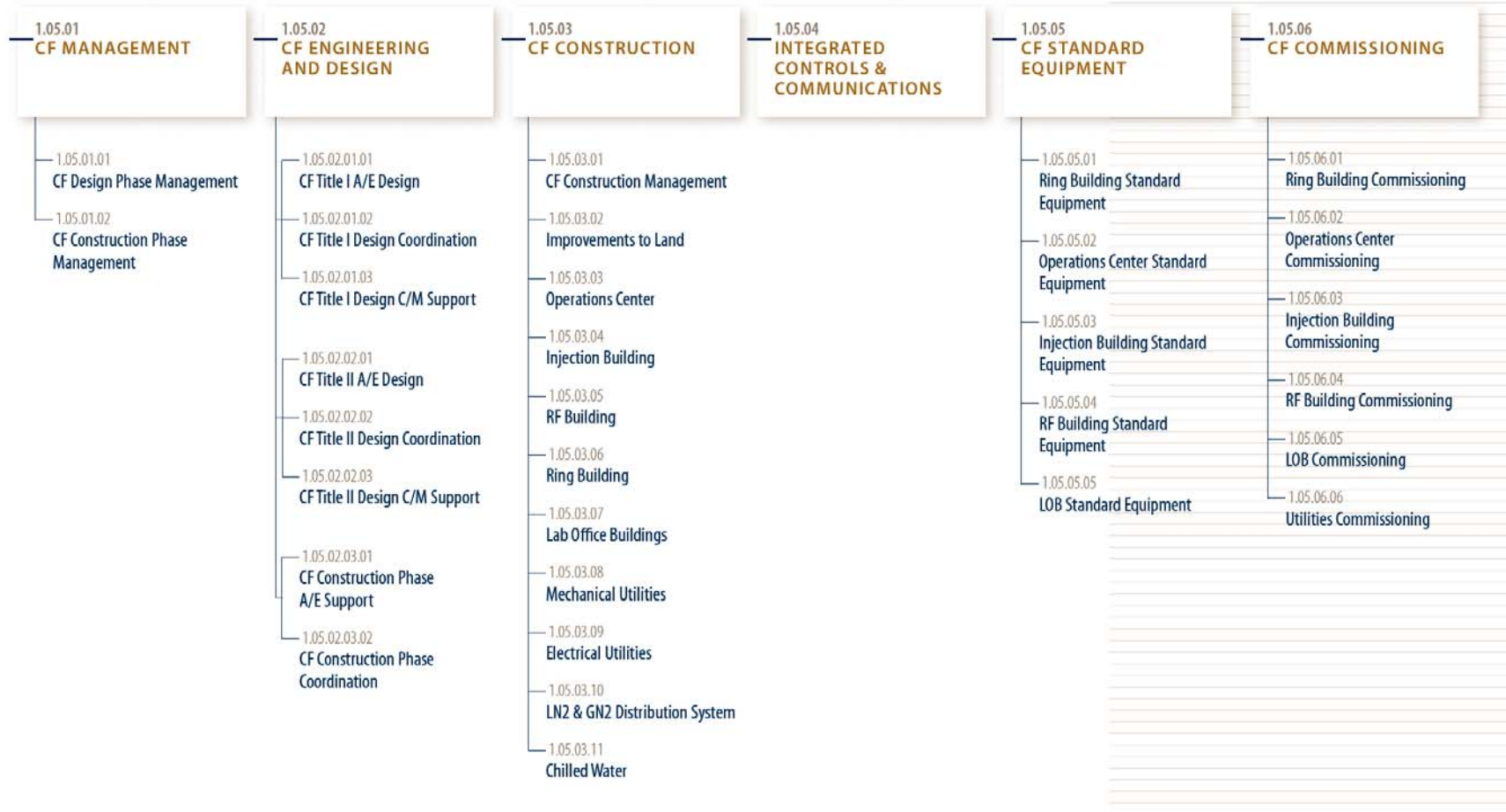


Figure 1.4 NSLS-II Conventional Facilities Work Breakdown Structure.

## **1.6 Method of Accomplishment**

### **1.6.1 Design**

Title I and Title II design of the NSLS-II conventional facilities will be performed by an A/E firm under contract to BNL. HDR Architecture has been competitively selected to provide design services for the NSLS-II main buildings and facilities. Title I and II design of the expansion of the Central Chilled Water Facility will be performed by Giffels Engineers. Each firm will also optionally provide Title III support services for shop drawing review, field verification and engineering support during construction.

Additional engineering support will be provided by BNL Plant Engineering Division to assure that new utility services and systems provided by NSLS-II are compatible with existing BNL utility systems and are properly interconnected.

The conventional facilities design team led by HDR includes the following firms:

- HDR Architecture, Inc.
- GEI Consultants, Inc.
- Colin Gordon Associates, Inc.
- VitaTech Engineering, LLC
- VJ Associates
- EMO Energy Solutions, LLC
- Municipal Land Survey, P.C.

### **1.6.2 Construction Management**

Construction management of NSLS-II conventional facilities will be performed by the NSLS-II conventional facilities team with staff augmentation support services from a competitively procured construction management firm. The joint venture of Liro/Gilbane has been selected to provide design phase construction management services. Procurement of construction phase construction management services will be via a competitive “best value” process awarded prior to award of the main construction contracts.

### **1.6.3 Procurement & Contracting Plan**

Conventional construction will involve construction of the NSLS-II complex of buildings and improvements to land and utilities including expansion of the existing Central Chilled Water Facility. These will be procured generally as lump-sum competitively procured contracts to general contractors. It is anticipated that there will be one major contract for the complex of buildings to be constructed on the NSLS-II site and a series of smaller construction packages for specialized work scope that has clearly defined interface points with the main construction contract. The anticipated construction packages are:

1. Site Preparation - Certain aspects of the site preparation work will be contracted as an early package to clear and prepare the site, reduce risk of unforeseen underground conditions and reduce overall schedule duration of the main contract.
2. Ring Building Complex -The main Ring Building contract will encompass site development and construction of all the NSLS-II buildings and on-site utilities and systems.
3. Central Chilled Water - The Chilled water contract will expand the Central Chilled Water Facility to provide cooling capacity to NSLS-II. This will be jointly funded by BNL and NSLS-II

4. Electrical Substation – The electrical substation contract will expand the main site electrical substation to provide electrical power to NSLS-II

Additional smaller packages may be issued as advantageous to the project. The contractors will be selected based on a competitive evaluated bid whereby the award is given to the firm meeting all technical, management, financial, past performance record, and safety qualifications for the project at the best value.

#### **1.6.4 Construction Schedule**

The construction schedule for conventional facilities is fully integrated with the overall resource loaded schedule for the NSLS-II project. Design and construction of conventional facilities is essentially the critical path for the project until such time as beneficial occupancy of the buildings can be accepted and installation of the accelerator systems can begin. In order to enable earliest start of accelerator systems installation, the Ring building construction will be broken into phases enabling earliest completion of pentants (or 1/5 of the Ring Building circumference) and each pentant will be accepted as early as possible. Scheduling of installation of various utility systems has been coordinated to support this phasing.

#### **1.6.5 Construction Safety**

Maintaining a safe work environment and the prevention of worker injury is paramount to the success of conventional facility construction. Specific construction safety measures are detailed in the Final Hazards Analysis and the ESH section of the project Preliminary Design Report. Among the measures that will be taken to assure worker safety are:

1. Selection of contractors based on a proven record of safety performance
2. Designation of dedicated full time safety oversight staff as part of the NSLS-II team, the construction manager and each contractor
3. Development and implementation of a robust and effective construction safety plan governing all work on the project that utilizes integrated safety management principles
4. Line management responsibility for safety and active oversight and intervention as needed
5. Use of construction safety incentives to motivate outstanding safety performance

#### **1.6.6 Quality Assurance**

The project will be conducted in accordance with BNL's site-wide Quality Assurance Program (QAP) that applies to all work conducted at BNL. The BNL QAP conforms to the requirements of Department of Energy (DOE) Order 414.1, Quality Assurance, and 10CFR 830 Subpart A, Quality Assurance Requirements. BNL's QAP consists of the following ten criteria:

- Program
- Personnel Training and Qualification
- Quality Improvement
- Documents and Records
- Work Processes
- Design
- Procurement
- Inspection and Acceptance Testing
- Management Assessment
- Independent Assessment

BNL's approach to satisfying the requirements of these criteria are delineated in the BNL Quality Assurance Program Description within the BNL Standards-Based Management System (SBMS). The NSLS-II design, construction and operation are subject to the QAP. A key element of the QAP is the concept of "Graded Approach", that is, applying an appropriate level of analysis, controls, and documentation commensurate with the potential to have an environmental, safety, health, radiological, or quality impact.

The NSLS-II QAP has been developed and addresses both the conventional and technical aspects of the project. This plan addresses project activities from design through construction, as well as commissioning and startup. The sections of the NSLS-II QAP applicable to conventional facilities address the basic design and construction of the building and utilities systems executed by the NSLS-II Conventional Facilities Division. Requirements of the NSLS-II QAP will flow down to contractors performing design and construction of conventional facilities.

### **1.6.7 Value Management**

Value Management (VM) will be performed for this project as required under DOE Order 413.3A, "Program and Project Management for the Acquisition of Capital Assets." An independent value management team will perform VM review during Title I design. A VM report will be provided to the NSLS-II Project Director for consideration and, where feasible, incorporation into project design documents.

The VM review will be a systematic review of the mature Title I design performed by an independent team of qualified consultants. The team will comprehensively review design elements and material selections with regard to their needed level of performance and quality. Alternate methods, elements and selections that meet the necessary performance and quality will be considered. The comparative first cost and life cycle cost of these alternatives will be determined and compared to the original design. A VM report will be prepared indicating alternatives considered, their respective costs and recommendations as to which alternatives should be implemented in the project design.

A Value Engineering Workshop was conducted with Liro/Gilbane and independent VE specialist hired by BNL on Wednesday and Thursday October 3<sup>rd</sup> and 4<sup>th</sup>, 2007. The results of this workshop are not finalized as of this writing but several VE items have been incorporated into the 100% Title 1 submission. They have been incorporated in one of two ways.

- The drawings and other documents were changed to incorporate the VE item.
- A note was added to the documents that addresses the VE item with the understanding that further design and/or investigation needs to be done to fully incorporate the VE item.

### **1.6.8 Commissioning**

An important element in the ultimate success of the NSLS-II will be proper commissioning of the facilities systems and instruments. The sensitivity of the storage ring and research beamlines requires that all systems and instruments achieve their maximum performance capability to fulfill the research mission. Additionally, any systems or equipment that can create environmental disturbance must be properly calibrated, balanced, tuned, or shielded to prevent detrimental impact to the research. During the design phase, a preliminary facility commissioning plan will be prepared to assure that appropriate commissioning requirements have been included in the NSLS-II design. The commissioning plan will:

- Present a schedule and sequence for start-up of building systems and instruments, including dependencies linked to the conventional or technical construction schedule.
- Identify safety approvals required prior to start-up
- Identify systems and instruments at the equipment level that will require commissioning.
- Identify references and sources of start-up procedures and performance, test and acceptance criteria for the instruments and equipment.

- Identify whether the equipment will be commissioned by BNL staff, contractor staff, vendor staff, or if the services of a specialty commissioning contractor are warranted.
- Identify the point at which equipment has been accepted and can be turned over to operations staff.
- Be updated during the design and construction phases as appropriate to reflect changes in equipment selection and performance.