Central Environmental Authority

Supplemental Environmental Impact Assessment Report for Second New Kelani Bridge Project (Retaining Of the Radioactive Meterial Disposal Facility Of the Sri lanka Atomic Energy Board at the Existing Location With Strengthening of the Structure)

Final Report

January, 2016

Submitted by:

Road Development Authority

TABLE OF CONTENTS

Table of Contents	**ii**	
List of Figures	**v**	
List of Tables	**vi**	
Abbreviations	**vii**	
Abstract	**viii**	

CHAPTER 1: INTRODUCTION

1.1	Background of the project	1
1.2	Objective and Justification of the project	2
1.3	Objective of the Supplementary Environmental Impact Assessment Report	7
1.4	Methodologies and technologies adopted in SEIA report preparation	8
1.5	Government policy regarding the project	10
1.6	Preliminary clearances/approvals for the project obtained	12
1.7	Compatibility of the proposed project with the proposed developments	13

CHAPTER 2: DESCRIPTION OF THE PROPOSED PROJECT AND REASONABLE ALTERNATIVES

2.1	Project Location	15
2.2	Project Components	18
2.2.1	Details of the radioactive material storage facility	18
2.2.1.1	Types of radioactive material to be handled, stored	18
2.2.1.2	Method of storage	19
2.2.1.3	Management of the radioactive material storage facility	20
2.2.1.4	Minimum safe buffer zone requirement from such activities	21
2.2.1.5	The existing laws, regulations, norms, guidelines	21
. 2.2.2	The layout plan of the project	21
2.2.2.1	Radioactive material storage facility, handling, loading, unloading areas	21
2.2.2.2	Office, security building, buffer zone to be maintained	21
2.2.3	Water requirement including quantity & quality and source/s	23
2.2.4	Types of wastes generated from the radioactive material storage	23
2.2.5	Safety measures to be maintained	23
2.2.6	Security arrangements to be maintained	23
2.2.7	Other resources/requirements needed.	23
2.2.8	Details of any phased development activities envisaged	23
2.3	Construction Procedure	24
2.4	Operational procedure	25
2.4.1	Operational activities, operational responsibility	25
2.4.2	Responsibility of providing security	26
2.5	Evaluation of Alternatives	26

CHAPTER 3: DESCRIPTION OFTHE EXISTING ENVIRONMENT

3.1	Project site	30
3.2	Soil and Geology of the Project Area	30
3.3	General Meteorological Characteristics of the Project Area	30
3.4	Drainage Patterns of the project area	34
3.5	Flood Levels of the Area	34
3.6	Noise and Vibration levels	36
3.7	Human settlements and land use of the area	37
3.8	Transport systems (roads/bridges)	37
3.9	Any other such as susceptibility for natural hazard such as floods	39

CHAPTER 4: ASSESSMENT OF ANTICIPATED ENVIRONMENTAL IMPACTS

4.1	Risks of exposure to high radiation	41
4.2	Risks of accidental release of radiation	41
4.3	Impacts on the environmental components	42
4.4	Impacts on environment due to discharge/disposal of other liquid/solid material	43
4.5	Impacts to the facility by construction and operation of New Kelani Bridge	43
4.6	Socio-cultural and socio-economic benefits to the country	48
4.7	Impacts due to construction of the Spent Source Storage Facility	48

CHAPTER 5: PROPOSED MITIGATORY MEASURES

5.1	Mitigating ground vibration during construction	49
5.2	Mitigation measures to ensure safety of Facility during construction of the Bridge	52
5.3	Mitigating vibration due to vehicular movements during operation of the Bridge	52
5.4	Ensuring the safety of the Facility during operations of the Bridge	53
5.5	Mitigating risks due to natural and other hazards	54
5.6	Moving the Radioactive material to the new location	55
5.7	General control measure to ensure protection from radiation	55
5.8	Emergency response system/safety arrangement	56
5.9	Standard Procedures to follow to ensure radiation safety	58
5.10	Risk Assessment	60
5.11	Strategies to Manage Sealed Spent Radioactive Sources	66

CHAPTER 6: ENVIRONMENTAL MONITORING PROGRAMME **73**

CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS **78**

Annexes:

Annex 1. Terms of Reference

Annex 2. List of preparers of the SEIA Report

Annex 3: Other Documents

- Annex 3-1a. Conditions laid down by the Atomic Energy Regulatory Council (SLAERC)
- Annex 3-1b. Approval from the Board of Atomic Energy Regulatory Council (SLAERC)
- Annex 3-2. Acceptance of the building plan by the SLAEB
- Annex 3-3.Layout plan and Requirements for the Spent Source Storage Facility specified by the SLAERC
- Annex 3-4: Details of Borehole Logs at the locations for the two piers
- Annex 3-5: Detailed drawings:
    - i. existing location of the SLAEB
    - ii. proposed location of the proposed Spent Source Storage Facility
    - iii. layout plan of the proposed Spent Source Storage Facility premises
    - iv. layout plan and details of the Spent Source Storage Facility

List of Figures

Figure 1a	Location of the existing SLAEB building and the Spent Source Storage Facility (See Annex 3-5 for a larger scale drawing)	5
Figure 1b	Site layout plan for the new Spent Source Storage Facility	6
Figure 2	Location map of the existing SLAEB premises where the Spent Source Storage Facility is located	16
Figure 3	Location of the existing Spent Source Storage Facility within the SLAEB premises	17
Figure 4	Building plan for the new Spent Source Storage Facility	22
Figure 5	Part demolition of the existing source storage facility (Alternative 1)	28
Figure 6	Soil Map of the Project Area	31
Figure 7	Geology map of the area	32
Figure 8	Drainage pattern of the area	33
Figure 9	The ground profile of the project site along a transect crossing the Kelani River	35
Figure 10	Predicted Floods of Kelani River	35
Figure 11	Land use map of the area	38
Figure 12	Recent flood levels recorded at Nagalagam Street	39
Figure 13	Flood Propagation map	40
Figure 14	Sections proposed for the Bridge and the ramp bridges	53
Figure 15	Management options for sealed spent radioactive sources	71

List of Tables

Table 1	Government Institutions that are affected by construction of the New Kelani Bridge	2
Table 2	Properties of radionuclides those are stored in the Spent Source Storage Facility	19
Table 3	Noise measurements made at two locations close to the project site	36
Table 4	Vibration measurements made at two locations close to the project site	37
Table 5a	Subsurface characteristics at RD P1	44
Table 5b	Subsurface characteristics at RD P2	44
Table 6	Typical range of structural responses from various sources	45
Table 7	Typical range of particle acceleration range that can occur for pile vibration	46
Table 8	Vibration Source Amplitudes for Construction Equipment	47
Table 9	Recommended vibration levels	50
Table 10	Siskind Vibration Damage Thresholds	51
Table 11a	Risk Probability for WBD	62
Table 11b	Severity score	63
Table 12	Severity score for Extremity and Skin Doses	63
Table 13	Likelihood of the incident occurring	64
Table 14	Risk Rating	64
Table 15	Risk scores and actions needed as a result of heightened risk	65
Table 16	The limit for radiation exposure	66
Table 17	Risk Assessment	67
Table 18	Environmental Monitoring Plan	73

Abbreviations

AEA	Atomic Energy Authority
AMSL	Above Mean Sea Level
BS	British Standards
CEA	Central Environment Authority
CKE	Colombo-Katunayake Expressway
EA	Environmental Assessment
EIA	Environmental Impact Assessment
GoSL	Government of Sri Lanka
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
ISO	International Organization for Standardization
JICA	Japan International Cooperation Agency
My/H&HE	Ministry of Highways and Higher Education
NEA	National Environmental Act
NKB	New Second Kelani Bridge
PAA	Project Approving Agencies
ppv (PPV)	Peak Particle Velocity
RDA	Road Development Authority
SEIA	Supplementary Environmental Impact Assessment (SEIA)
SLAEB	Sri Lanka Atomic Energy Board
SLAERC	Sri Lanka Atomic Energy Regulatory Council
SSR	Specific Safety Requirements
STF	Special Task Force
TOR	Terms of Reference
UDA	Urban Development Authority

Abstract

Shifting of the Atomic Energy Authority building and the existing Spent Source Storage Facility is needed before the construction of the New Second Kelani Bridge as it is located within the project area. Approval of the Environmental Impact Assessment for the New Second Kelani Bridge has already been obtained by the RDA from the Central Environment Authority on 27th August 2013, however, it has been recognized that a supplemental EIA has to be carried out for retaining the Spent Source Storage Facility at the present location with the transfer of all the radioactive sources to a newly constructed building and construction of new accommodation facilities (together with security office) within the existing Sri Lanka Atomic Energy Board premises at Orugodawatta. Shifting of the Facility to a different location within the same premises, and transfer the radioactive sources to the new Facility is recommended considering the dilapidated nature of the existing facility. Shifting the facility to a location away from the present location is not acceptable due to public protests.

The spent radioactive source storage facility will be managed by the Sri Lanka Atomic Energy Board (SLAEB) under regulatory controlled conditions of Sri Lanka Atomic Energy Regulatory Council (SLAERC). The method of management is storing them under safe and secured conditions using internationally recommended methods.

Almost all of the stored radioactive sources are received from governmental and non-governmental organizations (radiation facilities that use radioactive sources) for temporary storage until their final disposal. Some of the temporary stored sources will be transported to their original destinations (original suppliers) for final disposal. Most of the heavy containers having radioactive sources will be handled (moving, loading and unloading) by using a pellet truck. The sources will be transported under the approval of SLAERC following international radioactive material transport regulations. There is no water requirement for operations of the Spent Source Storage Facility other than for firefighting, and general use of the workers/security personnel at the facility. There is no waste generated at the facility. It stores shielded solid radioactive sources only.

These sources will be stored under shielded conditions and leakage radiations from the shield must be below the acceptable limits. Method of storage is using delay and decay principle for

low half-life radioactive sources under shielded condition and the long half-life radioactive sources will be stored under special conditions. The layout of the new Spent Source Storage Facility has been based on the guidelines provided by the Sri Lanka Atomic Energy Regulatory Council (SLAERC) to ensure safety against any radiation leaks and to guarantee that appropriate security is been continuously provided to the facility. This facility will be managed by the SLAEB under regulatory controlled conditions of Sri Lanka Atomic Energy Regulatory Council.

The building will be designed conforming to the guidelines provided the SLAERC. The RDA will be the project Proponent for the construction and will bear the responsibility of the construction. Once the construction is completed, the facility will be handed over to the SLAEB, after obtaining the necessary approvals from the SLAERC for moving the radioactive sources to the new Spent Source Storage Facility.

Cracks appearing on the walls and the slab of the Spent Source Storage Facility due to ground vibration during pile construction, and damage to the Facility during the operation of heavy machinery/vehicles during construction are seen as potential Impacts during construction that may lead to radiation leaks/contamination. These impacts can be effectively mitigated by following local and international guidelines to prevent any excessive vibration occurring due to construction activities especially during pile and pier construction. Erection of fences and vibration barriers, and limitations imposed on vehicular movement, and operations of machinery can also effectively mitigate negative impacts.

General risks due to exposure to radiation - during and after construction of the bridge can be seen as another significant impact. Safety & health of workers due to exposure to radiation (prolonged exposure to ambient levels) can be mitigated using appropriate shielding, area designation and providing proper protective clothing and equipment, regular checks for radiation exposure, proper training on handling radioactive material. Safety of the general public can be ensured with the use of appropriate shielding, area designation and placing of appropriate warnings. Measuring of ambient radiation and taking proper precautions, if needed. Safety and health of workers and the general public due to exposure to high radiation can be ensured by preparing Emergency Response Plans that will be formulated in line with the provisions of the Act. In addition, facilities and resource needed to face accidents will be procured.

Safety procedures will be followed to ensure Radiation Safety as instructed by the SLAERC following the guidelines and Standards of International Atomic Energy Agency (IAEA). Regulations for safe transport of Radioactive Material, Safety Standards Series No. SSR-6 will be strictly adhered to. Radioactive workers will be provided with proper safety clothing and equipment and proper security will be provided while radioactive material is being transported.

No material radioactive will be disposed. However, contaminated sources may be disposed by third parties, if no proper mechanism is available for them. SLAEB will undertake storage of spent sources in the proposed facility, if needed, with proper instruction obtained from the SLAERC.

Impacts during construction of the bridge and afterwards due to incidents affecting the security of the premises can be listed as: Unauthorized access, theft of radioactive material, sabotage by individuals or groups and due to social unrest, which can be effectively controlled by providing proper security measures. Proper security personnel will be placed. Surveillance systems, CCTV cameras, alarm systems, etc. will be in place. Security measure will be reviewed regularly, and the SLAERC and the Ministry will be kept updated. SLAEB will request the Minister to provide support for enactment of proper security measures. The new facility will have a high fence and a parapet wall (8 ft. high) built around the property, which will provide better security. The new facility will be built with concrete, which will withstand vibrations,

Impacts due to hazards/accidents during and after construction of the bridge are very remote. Construction of the ramp bridge with steel girders, strengthening the walls to withstand high impact, raising the walls by extra walls, and imposing strict speed limits along the ramp bridge (max. 40 km/h) has been proposed. Proper drainage management plan will be implemented. The doors of the Facility are sealed to prevent any water entering it. The floor levels have been raised by 600 mm above the final formation ground levels. The location of the facility is above 100-year flood levels and there is only a very remote chance that the facility will be flooded. Fire and smoke detectors will be installed. Fire reels will be provided.

In conclusion, retaining the Spent Source Storage Facility at the present location with the transfer of all the radioactive sources to a newly constructed building and construction of new accommodation facilities (together with security office) within the existing Sri Lanka Atomic Energy Board premises at Orugodawatta would not lead to significant environmental impact, provided that mitigation measures as specified in the report are properly implemented and subsequently monitored.

As recommendations the following can be listed:

Proper planning of the new Spent Source Storage Facility is needed: This should be done according to the conditions laid down by the SLAERC. In addition, the specifications for the new facility building and the premises would comply with IAEA Standards and guidelines, hence, following these for specifications will ensure radiation safety, proper installation of security surveillance systems, appropriate enactment of security measures, including guards, easy facilitation and prompt action to be taken in cases of emergency, sabotage, accidents, etc. and will ensure smooth operations of the facility.

Follow the Vibration Standards and limit any construction activities which produce excessive levels of vibration by following standard practices. The safety of the facility has to be ensured during the movement of heavy machinery during construction of the bridge.

During storage, ensure radiation safety by following Standards, Guidelines and good practices as suggested by the SLAERC. The sources should be transported under the approval of SLAERC following international radioactive material transport regulations.

Proper monitoring of environmental impacts (including radiation levels), safety and security measures is needed to ensure proper operations of the Facility. Also, the Risk Assessments have to be carried out as a regular exercise, which would enable the SLAEB to identify any mitigation measures to be taken when and where appropriate.

CHAPTER 1. INTRODUCTION

1.1 Background of the project

The development of transport infrastructure is a major Government Policy and there is a marked improvement in the country's transport network with the introduction of expressways and also rehabilitating and widening the existing road network etc. Currently, existing traffic demand around the Kelani Bridge is considerably high and anticipated demand will not be able to cater to this traffic and in turn it may also affect the life span of the existing bridge. To increase the transport efficiency in the environs of New Kelani Bridge and the solution as the nexus between CKE and the city transport network a six-lane bridge across the Kelani River adjacent to the existing New Kelani Bridge will be constructed under the Second New Kelani Bridge Project.

The Cabinet of Ministers has given their approval to undertake the construction of proposed New Second Kelani Bridge with relocation of government organizations, dwellings and other infrastructure. Under the proposed project a six-lane bridge across the Kelani River with associated ramps structures, will be constructed for Traffic Improvement

The project has now **completed** its feasibility level studies which can be broadly separated into three stages, i.e. (1) Review of present traffic status in and around the New Kelani bridge and the draft plan (prepared during prefeasibility), (2) Developing basic design plans (3) Carrying out environmental and social assessments and (4) Project review and preparation of the final report.

The Road Development Authority (RDA) under the Ministry of Highways and Higher Education (My/H&HE) is planning to commence the project at the beginning of 2017 after relocation of government organizations and dwellings. Approval of the Environmental Impact Assessment for the New Second Kelani Bridge was obtained by the RDA from the Central Environment Authority on 27th August 2013.

1.2 Objective and Justification of the project

The proposed project is located in a densely populated area including government and private institutions within Colombo and Gampaha districts. Some religions and culturally important structures are also located within the project area. The majority of these structures are either huts or permanent structures which are in rudimentary nature. The census survey carried out in the project area found that there are 395 families occupying these structures. The total population affected will be 1743 (including heads of families).

Atomic Energy Authority, Automobile Engineering Training Institute Kelanithissa power station, RDA quarters and a building belonging to the State Development and Construction Corporation are the major government facilities located within the project area (See Table 1).

Table 1. Government Institutions that are affected by construction of the New Kelani Bridge

Institute	Degree of impact
Atomic Energy Authority	80% of the main building will be affected as the port access road interchange will locate within this area
Main workshop of Automobile Training Centre	80% of the main building will be affected as the port access road interchange will locate within this area
Kelanithissa power station	Only the parapet wall will be affected
RDA quarters	RDA quarters 80% affected

Shifting of the Atomic Energy Authority building and main workshop of Automobile Engineering Training Institute are the two major adverse impacts on government facilities located within the project area. Shifting these two government institutions have been within the scope of the new Kelani Bridge project. Therefore, the RDA, as the project proponent, is exploring the most appropriate plan of action to relocate these institutions considering all the feasible options and alternative which would satisfy the needs of all the stakeholders.

Objective of the Proposed Project

To retain the Spent Source Storage Facility at the present location with the transfer of all the radioactive sources to a newly constructed building and construction of new accommodation facilities (together with security office) within the existing Sri Lanka Atomic Energy Board premises at Orugodawatta.

Justification of the Proposed Project

Peaceful use of ionizing radiations and radioisotopes for the socio-economic development of the country is performed by SLAEB under license from the SLAERC which is the national regulatory authority empowered for the establishment of requirements for the protection of persons and the environment against risks associated with exposure to ionizing radiation and for the safety and security of sources and facilities.

The existing building and the land of the Sri Lanka Atomic Energy Board (SLAEB)complex belong to the Urban Development Authority (UDA) and it was leased out by the SLAEB (formerly occupied by the Atomic Energy Authority).The construction of the proposed Kelani Bridge requires demolition of the existing office complex of the SLAEB (see Table 1.1). Accordingly SLAEB is required to be moved from the existing location to the proposed new site at the IT Park at Halbarawa, Malabe.

As a part of the project Cabinet of Ministers has given their approval to relocate the SLAEB to the new location (IT Park, Malabe) ensuring the service provided to general public and to the country without interruption with proposed national transport development project (Cabinet Paper No. 14/0277/526/002 and Memorandum dated 24.02.2014). In addition, the Sri Lanka Atomic Energy Regulatory Council (SLAERC) has granted approval to the construction of the building for SLAEB at the IT Park, Malabe.

All the facilities of SLAEB complex including administrative buildings, laboratories, radioactive waste storage and accommodation facilities scheduled to provide through the project at a cost over Rs. 420 million. The construction activities of new SLAEB complex were started within the proposed IT Park at Halbarawa in 2015. During the initial stage of the construction at

Halbarawa, protest made by the public in the area against the relocation of radioactive waste storage from existing location to new location was a significant issue that had to be resolved, for the smooth continuation of the project.

Although, SLAEB is originally planned to relocate the entire complex (together with the Spent Source Storage Facility), the SLAEB and the RDA have jointly decided to retain the Spent Source Storage Facility at the current location due to certain public protests regarding the Storage Facility relocating at the new site at Halbarawa. Therefore, the SLAEB is planning to shift only the Administrative and Laboratory buildings to the proposed location at Halbarawa.

Further, construction of proposed New Kelani Bridge is possible and will not be affected by retaining the Spent Source Storage Facility in Orugodawatta premises. Considering all these issues, the SLAEB, SLAERC and RDA have decided to retain the Spent Source Storage Facility at the current location at Orugodawatta and shifting all other facilities to the new location at Halbarawa, Malabe.

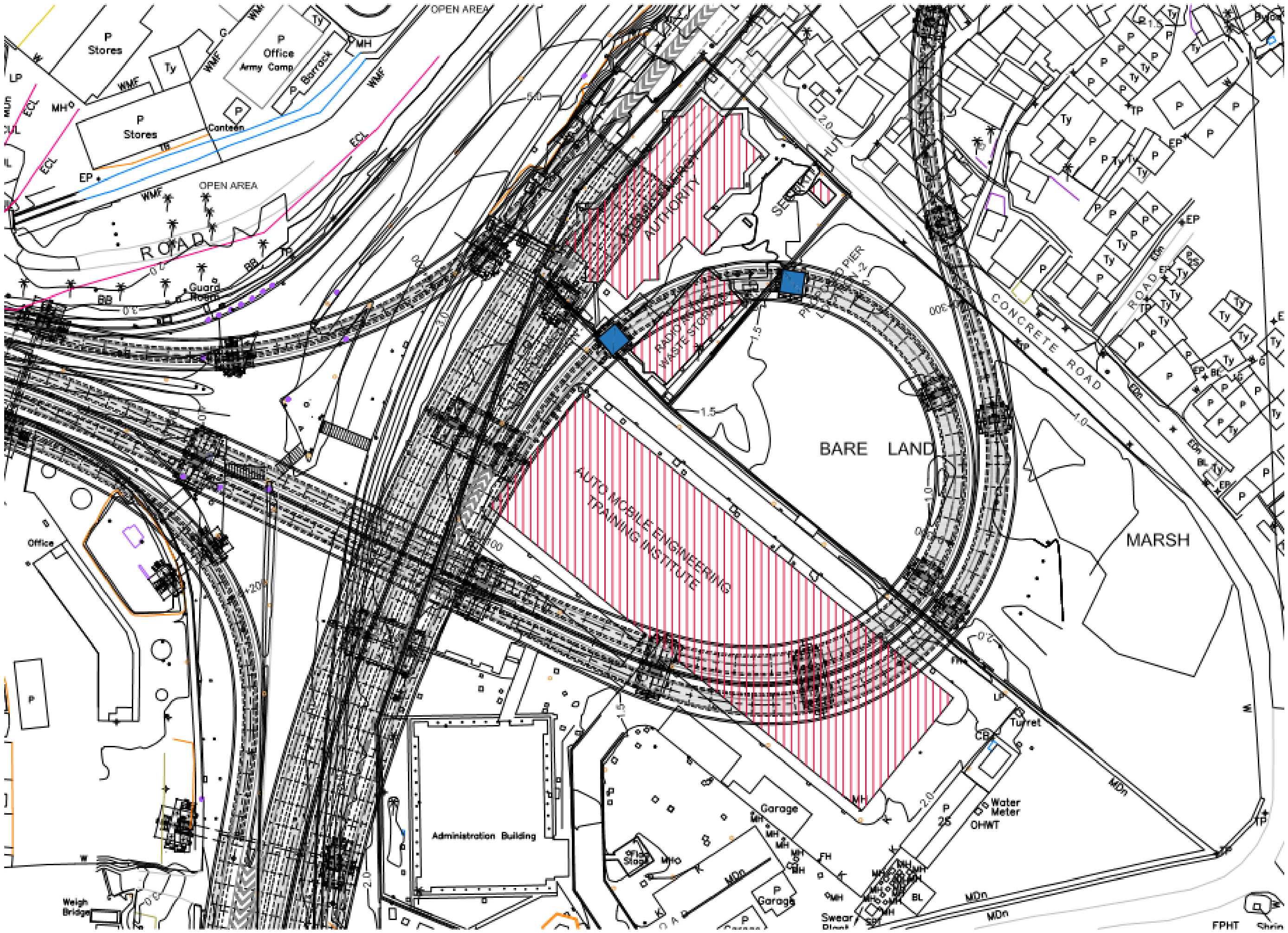
Out of the newly established two institutions, the Sri Lanka Atomic Energy Regulatory Council (SLAERC) has been shifted to a new location at Kelaniya area. Since all the activities regarding the Spent Source Storage Facility is undertaken by SLAERC, it is not necessary to relocate the storage facilities at Halbarawa SLAEB premises.

Project Scope

Please refer to Alternative analysis and the selected alternative (Section 2.5)

The scope of work for this project could be summarized as follows:

1. Construct a new building to be used as the Spent Source Storage Facility at the same premises at Orugodawatta (Location is shown in Figure 1a, b)
2. Construction of new security facilities closes the entrance of the premises (See Figure 1b).



LAYOUT PLAN OF THE AEB COMPLEX AND PROPOSED BRIDGE
SCALE-1:500

Figure 1a. Location of the existing SLAEB building and the Spent Source Storage Facility (See Annex 3-5 for a larger scale drawing)

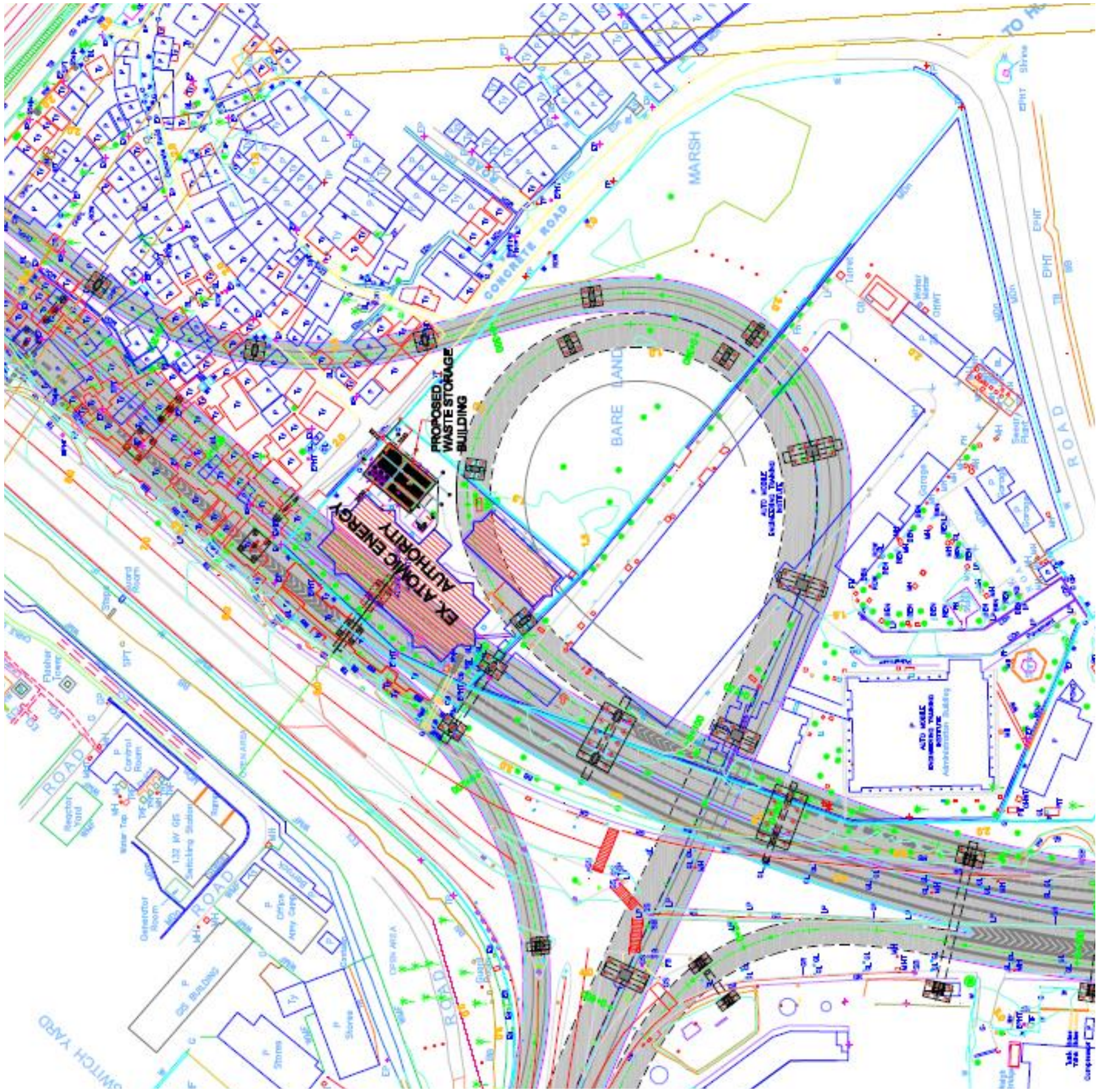


Figure 1b. Site layout plan for the new Spent Source Storage Facility (See Annex 3-5 for a larger scale drawing)

1.3 Objective of the Supplementary Environmental Impact Assessment (SEIA) Report

Under provisions of Part IV C of the NEA No. 47 of 1980 and subsequently stipulated in Gazette (Extra Ordinary) No. 772/22 dated June 24, 1993 the Government of Sri Lanka (GoSL) made Environmental Assessment (EA) a legal requirement for a range of development projects. *The Second New Kelani Bridge Project – A Project for Traffic Improvement around Existing Kelani Bridge* was listed as a prescribed project under the category of "Involuntary resettlement exceeding 100 families, other than resettlement effected under emergency situations. This EIA report was prepared by Oriental Consultants Co., Ltd, Japan Katahira & Engineers International, Japan Consulting Engineers and Architects Associated (Pvt.) Ltd., Sri Lanka and was submitted by the Road Development Authority in July 2013, based on the Terms of Reference (TOR) issued by CEA while conforming to the guidelines of JICA Environmental and Social Considerations 2010.

- Report Requirement: Supplemental report to the EIA report dated August 2013

Retaining the radioactive spent source storage facility of the Sri Lanka Atomic Energy Board at the existing location was not an activity which was proposed at the time of submission of the above EIA report. Once the decision was taken to retain the Spent Source Storage Facility at the same location at Orugodawatta, the RDA sought the approval of the CEA for the proposed project. Subsequent to this request of the RDA, the CEA together with other stakeholders have taken a decision that the proposed project of retaining the Spent Source Storage Facility has to undergo a supplemental EIA (SEIA) and a TOR has been issued (See Annex 1).

Therefore, the main objectives of the SEIA study is to describe the existing biological, social and physical environment of the project area, identify and differentiate significant adverse and beneficial impacts of the project, develop feasible mitigation measures with suitable monitoring programme to minimize the adverse impacts. This SEIA will enable an effective environmental impact management during the construction and the operational stage of the project. The SEIA report will require approval from the Central Environmental Authority (CEA) as well as from JICA for the execution of the project.

This EIA report has been prepared based on the Terms of Reference (TOR) issued by CEA dated 09.12.2015 (please refer Annex 1).

1.4 Methodologies and technologies adopted in SEIA report preparation

General Methodology

The EIA was prepared by a team of consultants based on desk studies as well as field studies to obtain relevant latest field data on the biological, social and physical environment.

The methodology for this EIA consists of:

- Understanding the nature of the project through the site visits, discussions with SLAEB, taking part in the introductory meetings with the SLAEB & RDA etc.
- Study all the relevant documents such as the EIA report of the 2nd New Kelani Bridge, Atomic Energy Regulations which are applicable to Sri Lanka, Radiological emergency preparedness plan developed and implemented by stakeholders etc.
- Study the conceptual drawings, survey plans etc. related to the proposed project
- Approval granted by the SLAERC for safe use of radioactive materials and ionizing radiation and their associated programmes.
- Proposing mitigation measures to alleviate the possible construction and operational impacts and the social impacts.

The report has been prepared in order to provide information pertaining to environmental and social dimensions of the project to decision makers, relevant stakeholders in Sri Lanka, and the Central Environmental Authority to make informed decisions that are in the best interests of the country and its people.

The SEIA Report is structured as follows:

1. An analysis of the potential options that would achieve the project objectives. This is followed by a discussion of their potential environmental implications.

2. A presentation of the significant potential impacts of the project on physical, biological and social environments, as well as a discussion of effective mitigation measures to alleviate adverse impacts, both during construction of the Spent Source Storage Facility and its subsequent operations. Impacts on the storage facility due to construction of the Kelani Bridge will also be a main focus. In addition, the impacts of vehicular movements along the bridge are also discussed.
3. The development of a project/site-specific Environmental Management Plan (EMP), which sets out an environmental management and a monitoring program to identify the environmental effects of the project as it proceeds, as well as to describe techniques to implement mitigation measures.

Finally, keeping with its goal of implementing a participatory approach, this IEE report furnishes the general public with the information it needs to understand the potential environmental implications of the project as well as proposed mitigation measures.

Environmental impacts and mitigation measures were initially identified based upon a brainstorming session conducted by the EA preparers in collaboration with the SLAEB officials, Consultants of the New Kelani Bridge Project and the RDA. These impacts and proposed measures are based on past professional experience of team members, expert opinion, acquired experience and knowledge base of the officials of the SLAEB and relevant published literature, especially of the International Atomic Energy Agency (IAEA).

Qualitative classifications of impacts as ‘low’, ‘moderate’ and ‘high’ were made mainly based upon expert opinion, referencing environmental criteria such as standards and threshold values, where applicable (for example, IAEA guidelines on radioactivity levels). Criteria such as duration of impact, reversibility of impacts, aerial extent, and magnitude were evaluated as part of the classification.

Recommendations for the management of potential impacts focus on two areas: (a) avoiding/minimizing the occurrence of short term impacts through standard best practices – the EMP focuses primarily on this aspect and sets out a number of safeguard measures to be adopted by the contractor to proactively avoid negative impacts; and (b) minimizing the effects of long term impacts through project implementation that avoids irreversible environmental changes.

The monitoring plan sets out a program to establish baseline conditions with regard to critical environmental parameters. As a result, any significant adverse changes that occur due to project activities will be detected early on. This allows not only continuous monitoring, but also the implementation of necessary mitigation measures.

1.5 Government policy regarding the project

The Atomic Energy Authority (AEA) was established under the Act. No 19th in 1969. All the administrative buildings and other related facilities including laboratories and radioactive Spent Source Storage Facility are located at No. 60/460, Baseline Road Orugodawatta, Wellampitiya. The total land area of the AEA complex is 142 perches and it is a prominent landmark at the entrance to the Colombo city close to the Kelani Bridge and opposite the Kelanitissa Power Station.

The Sri Lanka Atomic Energy Authority Act, No. 19 of 1969, has been repealed and two institutions: The Sri Lanka Atomic Energy Board (SLAEB) and The Sri Lanka Atomic Energy Regulatory Council (SLAERC), have been established by the Sri Lanka Atomic Energy Act, No. 40 of 2014. The new Act was published as a Supplement to Part II of the Gazette of the Democratic Socialist Republic of Sri Lanka of 07th, November 2014.

Currently, SLAEB is a Statutory Body functioning under the Ministry of Power and Renewable Energy. Radiation and Radioisotope Technology has a wide range of applications in many fields that can make significant contribution to the development of health, agriculture, industrial, energy, environment sectors in Sri Lanka. The Atomic Energy Board (SLAEB) has the responsibility of facilitating the utilization of this technology in the above-mentioned sectors in the country.

The responsibilities and functions of the SLAEB

a. Utilize radioactive materials and ionizing radiation either along with complimentary techniques or otherwise, for medical, environmental, agricultural, industrial and other peaceful purposes and for scientific and technical advancement as the case may be required for national development:

b. Carry out research relating to the application of ionizing radiation, whether along with complimentary techniques or otherwise;
c. Ensure that adequate facilities and arrangements are made available for the appropriate training of the staff of the Board and of the officers of any other relevant institutions;
d. Provide on request and where it considers it appropriate, to any relevant government institution or any non-government institution whether national or international, and to the general public, information relating to the utilization of nuclear technology or other radioactive materials, where available depending on availability;
e. Promote the establishment of professional organizations and societies to assist in the application of ionizing radiation, whether along with complimentary methods or otherwise and provide where available any connected services;
f. Construct and operate research centers, laboratories and pilot plants in the field of nuclear technology, radiological applications and other related areas;

The SLAERC is responsible for the regulation of practices involving ionizing radiation, the safety and security of sources and the Non- Proliferation of nuclear weapons and the safeguards as follows:

a. Establish requirements for the protection of persons and the environment against risks associated with exposure to ionizing radiation and for the safety and security of sources and facilities, as appropriate;
b. Take all appropriate steps to ensure the protection of persons and the environment from harmful effects due to any source, nuclear material and other radioactive material and ensure the security of such material and facilities; and
c. Ensure compliance with International Standards and obligations in the field of nuclear energy, which are required to be complied with by Sri Lankan regulation.

Therefore, continued and uninterrupted operation of the Spent Source Storage Facility is vital and a pre-requisite to achieve the above stated functions of both the SLAEB and the SLAERC.

Therefore, the government has a priority interest in providing and facilitating procedures for uninterrupted operations and functioning of both the above institutions.

At the same time, any delays in implementing the proposed work under the Second New Kelani Bridge Project will also have a bearing on Government's plans for utilization of the bilateral funding secured for the purpose of implementing the Second New Kelani Bridge Project. Therefore, there is urgency in finding a solution to locate the Spent Source Storage Facility so that there will be no delays in implementing the Second New Kelani Bridge Project.

Hence the project conforms to the Government's policies and plans.

1.6 Preliminary clearances/approvals for the project obtained from the state agencies such as Sri Lanka Atomic Energy Regulatory Council and conditions laid down by such agencies in granting such clearances/approvals.

National Environmental Act (NEA) No 47 of 1980 and its amendments (Act No. 56 of 1988 and Act No. 53 of 2000)

Under provisions of Part IV C of the NEA No. 47 of 1980 and subsequently stipulated in Gazette (Extra Ordinary) No. 772/22 dated June 24, 1993 the government of Sri Lanka (GoSL) made Environmental Assessment (EA) a legal requirement for a range of development projects. The list of projects requiring an EA in the form of Environmental Impact Assessment (EIA) or Initial Environmental Examination (IEE) is prescribed in the above Gazette notification.

In addition, the Gazette notification includes a list of line ministries and agencies that are designated as Project Approving Agencies (PAA). The PAA's are responsible for the administration of the EIA process under NEA. Further amendments to the NEA stipulated environmental approvals for material extraction, emissions, noise and vibration levels.

The Second New Kelani Bridge Project has been listed as a Prescribed Project under the NEA and the proposed project for retaining the Spent Source Storage Facility at Orugodawatta has to undergo a Supplemental EIA.

Preliminary approvals needed for the project and any conditions laid down by state agencies in granting preliminary clearance for the project

Following approvals will be needed for the project and it is intended to secure all such approvals through this EIA Process.

1. Conditions laid down by the Atomic Energy Regulatory Council (SLAERC) – See Annex 4
2. Approval from CEA (EIA Approval) and JICA
3. Approval from Local Government Authorities
4. Condition laid down by the Road Development Authority - MOU with SLAEB
5. Any conditions laid down by the UDA, who owns the land

1.7 Compatibility of the proposed project with the proposed/planned developments within the area including the planned highway

The land has been allocated to the Atomic Energy Authority (AEA) by the UDA for establishment of the AEA. The AEA complex was constructed in year 2001 including Spent Source Storage Facility as it is at the current location. Based on the Consultant's preliminary planning documents and the proposed construction methodology, there is no major disturbance to the existing spent source storage facility from the proposed 2nd New Kelani Bridge project. Therefore, the proposed alternative to shift the location and construct a new building for the Spent Source Storage Facility is compatible with the development plan (viz., Second New Kelani Bridge Project).

Note:

The following terminology which is listed in the Sri Lanka Atomic Energy Act, No. 40 of 2014 will be used throughout this report. The meanings of the terminology are as interpreted in the above-mentioned Act. Some of the interpreted terminologies are given below:

“**accident**” means any unintended event including operating errors, equipment failures and other mishaps, the consequences or potential consequences of which are not negligible from the point of view of protection and safety

“**exposure**” means the act or condition of being subject to irradiation by ionizing radiation, and can be either external exposure (irradiation by ionizing radiation by sources outside the body) or internal exposure (irradiation by ionizing radiation by sources inside the body);

“**facility**” means any irradiation installation, mining and raw material processing sites such as uranium mines, radioactive waste management sites and any other places where radioactive material is produced, processed, used, handled, stored or disposed of on such a scale that consideration of protection and safety is required;

“**incident**” means any unintended event including operating errors, equipment failures, initiating events, accident precursors, near misses or other mishaps or unauthorized act malicious or non-malicious, the consequences or potential consequences of which are not, negligible from the point of view of protection or safety from ionizing radiation;

“**licence**” means a licence issued by the Council granting authorization to conduct of a practice, which is not a practice exempted under section 19 of this Act;

“**radioactive material**” means any material emitting ionizing radiation which is subject to the regulatory control of the Council;

“**radioactive source**” means radioactive material that is permanently sealed in a capsule or closely bounded in a solid form and which is not exempted from regulatory control and also means any radioactive material released if the radioactive source is leaking or broken;

“**radioactive waste**” means material in whatever physical form, remaining from practices or interventions that contains or is contaminated with radioactive material and has a radioactivity or radioactivity concentration higher than the level set for clearance from regulatory requirements and for which no further use is foreseen;

“**security**” means the prevention and detection of and response to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear or other radioactive material or their facilities;

“**source**” means anything that may cause radiation exposure by emitting ionizing radiation or releasing radioactive material

CHAPTER 2. DESCRIPTION OF THE PROPOSED PROJECT AND REASONABLE ALTERNATIVES

2.1 Project Location

Location: Sri Lanka Atomic Energy Board, 640, Baseline Road, Orugodawatta, Wellampitiya (See Figures 2 and 3)

Divisional Secretariat Division: Kolonnawa

GN Division: Wadullawatta 510A

Local Authority: Kolonnawa Urban Council

Land extent: 142 perches

Ownership of the land: Currently the ownership is vested with the Urban Development Authority. However, with the acquisition of land for the New Kelani Bridge project the land becomes the reservation for the Bridge/Road networks. Therefore, the control of the land ownership will be vested with the RDA, however, the ownership of the land will subsequently be transferred to the SLAEB.

Figure 2. Location map of the existing SLAEB premises where the Spent Source Storage Facility is located

Figure 3. Location of the existing Spent Source Storage Facility within the SLAEB premises

2.2 Project Components

2.2.1 Details of the radioactive material storage facility and other facilities such as offices to be established within the project site.

The relevant details are given below:

2.2.1.1 Types of radioactive material to be handled, stored including their nature, quantity/quality, half-life etc.

The proposed source storage facility will be used for storage of spent radioactive sources used by different radiation facilities in the country for security of those sources and public safety.

These include:

- Used Radium-226 sources
- Iridium-192 sources
- Cobalt-60 sources
- Cesium-137 sources
- Americium-241/Beryllium neutron sources
- Americium- 241 lightning arresting devices

All the stored radioactive sources are in the form of solid materials in sealed capsules with protective shielding. Details of the available spent radioactive sources are as follows:

1) 4.5 Grams of Radium-226(half-life: 1,600 years) needles which were used in hospitals are kept in 9 drums (200 L) with additional concrete shielding in order to avoid any leakage. This conditioning process was carried out with the assistance of International Atomic Energy Agency (IAEA).
2) Four capsules contained following radioactive sources

   Capsule-1: Neutron Sources (Am-241/Be, Pu/Be)-

   Capsule-2: Cesium 137 (Cs-137) (half-life: 30 years)

   Capsule -3: Strontium 90 (Sr-90) (half-life: 28.8 years)-28 nos.

   Capsule -4: Cobalt -60 (Co-60) (half-life: 5.3 years)

   A Lead shielded container containing Americium-241 (Am-241) (half-life: 432 years) sources removed from smoke detectors.
3) 06 nos. of lighting arresting devises which contained Am-241 and Ra-226 Sources

Table 2. Properties of radionuclides those are stored in the Spent Source Storage Facility

Characteristics	Unit	^{60}Co	^{137}Cs	^{192}Ir	^{90}Sr	^{226}Ra	^{241}Am
Half-life	years	5.3	30.2	0.2	28.6	1600	432
Energy							
Alpha	MeV	–	–	–	–	b)	5.86
Beta max.	MeV	0.31	1.2	0.67	0.54 (2.3)a)	b)	–
Gamma	MeV	1.17 1.33	0.66	0.32 0.47		b)	0.07
Ambient dose equivalent rate, H*(10)c)	mSv·m²/h·GBq	0.37	0.092	0.131	–	0.283	0.019
Half value layer (HVL) of lead	mm	12	6	5.5	–	14	0.2
Dose factord)							
Ingestion	Sv/Bq	3.4 E-9	1.3E-8a)	1.4 E-9	2.8 E-8	2.8 E-7a)	2.0 E-7
Inhalation	Sv/Bq	1.7 E-8	6.7E-9a)	4.9 E-9	7.7 E-8	2.2 E-6a)	2.7 E-5

a) Short lived daughter products have been taken into account.
b) In the decay chain there are alpha energies up to 7.7 MeV, beta energies up to 2.8 MeV and main gamma energies up to 2.4 MeV.
c) For ambient dose equivalent rate, *H**(10), see Ref. [5]. Values are given for 1 m distance from source.
d) For dose factors see Ref. [3].
For half-life values and radiation characteristics see Ref. [6].

Source: IAEA TECDOC-1145 (Published in 2000)

2.2.1.2 Method of storage of radioactive material. Give specification of the radioactive waste storage facility and method of storage of each type of radioactive source.

Spent radioactive sources store in properly shielded containers (Lead, Concrete etc.) under safe and secured conditions. While Short half-life spent sources are stored in normal lead shielded containers, long half-life sources store in specially designed shielded containers. (e.g., Radium-226, Americium-241 stored in reinforced concrete shielded 200 liter steel drums).

The proposed facility for the storage of short half-life radioactive sources will consist of the following:

- Three concrete pads of 1,300 mm x 1,300 mm (600 mm thick – from the finished ground level), with 4 holes (300 mm diameter, 300 mm depth) with 40 mm thick concrete lids (300 mm diameter).

- Three concrete pads of 1,300 mm x 1,300 mm (600 mm thick – from the finished ground level), with 9 holes (200 mm diameter, 300 mm depth) with 40 mm thick concrete lids (200 mm diameter).

There will be two separate chambers (approx. 10 m x 3.5 m) for the storage of both long half-life and short half-life spent radioactive sources. The sliding door of the storage 1 will have a 4-mm thick lining of lead sheets. The sliding door of the storage room 2 will have a 4-mm thick lining of steel sheets.

All the walls of the storage building will be constructed with 600 mm reinforced concrete. The height of the walls will be 2.5 m and will be constructed to the slab level. The slab of the building will be of reinforced concrete (200 mm).

The entire building will have a final formation level of 600 mm from the ground level. The main entrance and the emergency exit will have a ramp at an appropriate slope for ease of transporting the material. The main entrance and emergency exit will have roller shutters. All the rooms will have mechanical ventilation provided with two or three exhaust fans in each chamber. There will be fire reels installed at appropriate locations.

A security office will be constructed at the premises for providing security. This will be located at a distance more than 6 m, to comply with the IAEA guidelines.

2.2.1.3 Management of the radioactive material storage facility including method/s of transporting, handling, loading, unloading of radioactive sources. Give specification for such transporting, handling, loading and unloading.

The spent radioactive source storage facility will be managed by the Sri Lanka Atomic Energy Board under regulatory controlled conditions of Sri Lanka Atomic Energy Regulatory Council. The method of management is storing them under safe and secured conditions using internationally recommended methods.

Almost all of the stored radioactive sources were received from governmental and non-governmental organizations (radiation facilities that use radioactive sources) for temporary storage until their final disposal. Some of the temporary stored sources will be transported to their original destinations (original suppliers) for final disposal. Most of the heavy containers having radioactive sources will be handled (moving, loading and unloading) by using a pellet truck. The sources will be transported under the approval of SLAERC following international radioactive material transport regulations. (Regulations for the Safe Transport of Radioactive Material, issued 2012 – Specific Safety Requirements – SSR 6, IAEA, Vienna).

In addition, Clause 26 of Sri Lanka Atomic Energy Act, No. 40 of 2014 (Compliance with requirements established for transport of radioactive material) has to be adhered to.

2.2.1.4 Minimum safe buffer zone requirement from such activities

These sources are stored under shielded conditions and leakage radiations from the shield must be below the acceptable limits.

The spent radioactive source facility will be designed to give maximum safety with adequate thickness of shielding materials (concrete/lead and steel) to cut off radiation to acceptable levels for general public. Therefore, there are no radiation exposures outside the storage building and no effects to the other land users such as those who travel along the highways and human settlements. There is no specified safe buffer zone requirement for handling of spent radioactive sources. However, in general, 6m buffer zone will be kept for maximum safety from the storage facility (including the security office).

2.2.1.5 The existing laws, regulations, norms, guidelines on the above all and compliance with the same need to be given.

The existing law for handling of radioactive sources including wastes is the Sri Lanka Atomic Energy Act No 40 of 2014 and Atomic Energy Safety Regulations No 1 of 1999.

2.2.2 The layout plan of the project, indicating all the project components such as;

2.2.2.1 Radioactive materials storage facility, handling, loading, unloading areas

These details are provided in Figure 4.

2.2.2.2 Office, security building, buffer zone to be maintained.

These details are provided in Figure 1b.

There will be a security hut located at a distance more than 6 m away from the Spent Source Storage Facility.

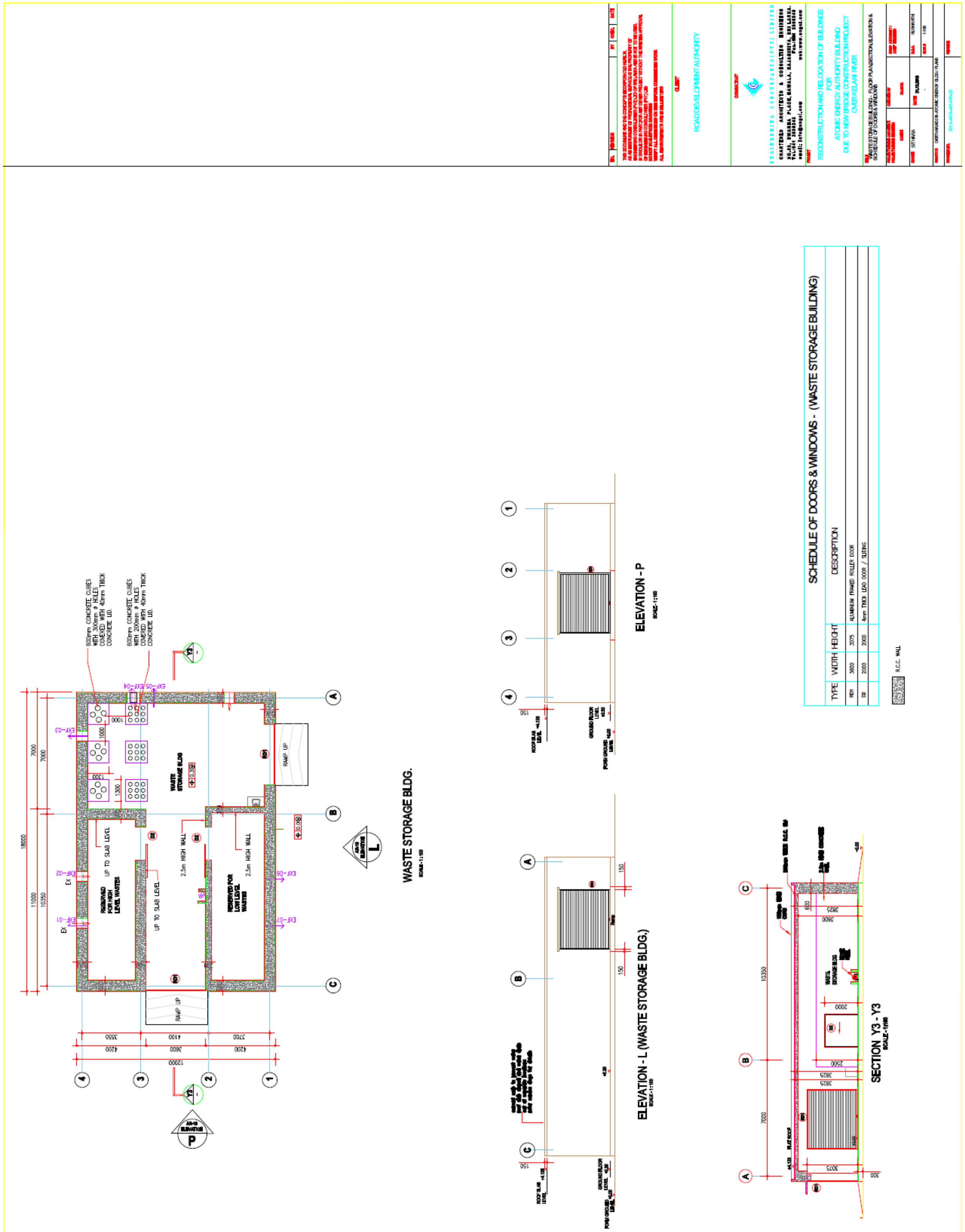


Figure 4: Building plan for the new Spent Source Storage Facility (See Annex 3-5 for a larger scale drawing)

2.2.3 Water requirement including quantity & quality and source/s. (if any)

There is no water requirement for operations of the Spent Source Storage Facility. However, water supply is needed for:

- Fire fighting
- General use for the security personnel and others who visit the premises: for drinking, washing, etc.

Both the above two purposes are currently fulfilled by the National Water Supply & Drainage Board and the services will be continued to be obtained.

2.2.4 Types of wastes generated from the radioactive material storage facility (if any) including their quantity, quality, level of contamination by radioactive substances/radiation etc. The method of containment, treatment and final disposal of such wastes.

There is no waste generated at the facility. It stores shielded solid radioactive sources only.

2.2.5 Safety measures to be maintained at the radioactive material storage facility both during construction and operation stages.

The existing safety measures will be continued without interruption as mentioned below (Section 2.4.2 and Sections 5.7 & 5.8).

2.2.6 Security arrangements to be maintained at the radioactive material storage facility both during construction and operation stages.

The existing security arrangement will be continued without interruption as mentioned below (Section 2.4.2 and Sections 5.7 & 5.8). See Annex 3.1 for conditions laid by the SLAERC.

2.2.7 Other resources/requirements needed.

None

2.2.8 Details of any phased development activities envisaged (if any).

There is no phased development anticipated.

2.3 Construction Procedure

Construction activities, construction responsibility of the radioactive material storage facility etc. and the staff (workforce) requirement.

The sequence of construction will be as follows:

1. Construction of the building for the Spent Source Storage Facility (See Figure 4 for the building layout and Figure 1b, 2 for the location) – this will commence immediately after the necessary approvals are obtained.

   The building will be designed conforming to the guidelines provided the SLAERC (See Annex 3). The contract for the construction will be awarded following standard tender procedures. The RDA will be the project Proponent for the construction and will bear the responsibility of the construction. Once the construction is completed, the facility will be handed over to the SLAEB, after obtaining the necessary approvals from the SLAERC for moving the radioactive sources to the new Spent Source Storage Facility.
2. Transfer of Radioactive material to the newly-built Spent Source Storage Facility
3. Demolition of the exiting storage facility
4. Demolition of the existing SLAEB administration building – soon after the SLAEB shifting to the new location (currently under construction) at IT Park, Malabe.
5. Construction of the piers and the bridge decks and Kelanitissa Junction - The construction will commence in January 2017 and complete at the end of 2019.

The construction of Kelanitssa Junction includes construction of bored pile foundation, construction of reinforced concrete piers and erection of steel box girders. This entire open space will be used for temporary storage yard for construction equipment and materials including steel segments of box girders and portal frame piers transported from offshore. Also the site office and laboratory facility will be located within this area.

The details of construction plan and schedule will be prepared by the Contractor. General construction sequences will be as follows:

1) After mobilization, the area will be cleared and storage yard will be paved.
2) Construction of bored piles will start with driving steel casing penetrating into soft soil by a vibratory hammer. Then, inside the casing will be excavated up to the base rock. Reinforcing

cages will be installed inside the 1.2 m diameter bore hole and concrete will be filled to complete the pile work. This process will be repeated for the remaining piles.

3) After completion of piles, prior to excavation for footing, sheet piles will be driven, followed by excavation and concreting of pile caps. Then, reinforced concrete piers will be constructed on the pile caps.
4) After completion of piers, preparatory work for erection of girders will start in 2018. Temporary steel bents supporting the steel box girders will be installed between the piers. Steel segments (ab. 10 m long, 29 tons) will be installed by a lifting crane and the segments will be bolted together at the connections. Painting will be then applied at the connection surfaces.
5) Casting concrete for deck, pavement and miscellaneous work will continue until December 2019 to complete the bridge.

The safety of the radioactive source storage facility building during construction shall be secured. As the safety precaution measures, the Contractor shall establish the construction zone to keep safety distance for workers and construction equipment. Security fence will be built around the radioactive source storage building. In addition, there will be an 8-feet high parapet wall with barbed wire fencing at the top.

2.4 Operational procedure

2.4.1 Operational activities, operational responsibility of the radioactive material storage facility and the staff (workforce) requirement.

The spent radioactive source storage facility is operated by the SLAEB. The operation procedures consist of the following:

2.4.1.1 Temporary storing of spent sources until exporting to original destination

i. Receiving spent sources from user facilities as per regulatory requirements.
ii. Stored under safe and secured conditions until remove from the storage facility

2.4.1.2 Long Term storage

i. Receiving spent sources from user facilities as per regulatory requirements.
ii. Measurement of leakage radiation levels and contamination levels.

iii. Conditioning of the sources if required (storage of such sources under safe conditions such as storing inside the concrete shielded stainless steel drums or storing inside the lead shielded containers etc.)
iv. Carry out radiation surveys annually or when necessary outside and inside the storage facility.

There will be no staff, other than the security personnel, positioned at the Facility. SLAEB Radiation Protection staff will visit the facility for regular inspections. The SLAERC officers will also visit the facility for regulatory inspections. The SLAEB obtain annual license from the SLAERC for operation of the facility.

2.4.2 Responsibility of providing security for the above facilities including access control for unauthorized persons.

The responsibility of providing security to the above facility will be on the hands of SLAEB (refer Clause 5 of the Sri Lanka Atomic Energy Act No 40 of 2014). The SLAEB will ensure that security will be provided and access controlled to the facility with properly placed security systems and guards for 24h/7d. Security surveillance system will be operated under the supervision of Certis Lanka Security Solutions (Pvt.) Ltd. In case of security emergency situations the Special Task Force (STF) will be called.

Establishment of requirements for the safety and security of sources and facilities is the responsibility of the SLAERC (Clause 10, and Chapter IV: Safety and Security of Sources, Sri Lanka Atomic Energy Act, No. 40 of 2014).

2.5 Evaluation of Alternatives

(a) <u>Siting alternatives:</u>

Relocating the facility at a different location is not feasible due to continued protests made by the public, though unwarranted. Therefore, the alternatives are considered siting the Facility at different locations in the same premises at Orugodawatta.

The SLAEB spent radioactive source storage building is located underneath the planned Kelanitissa Junction consisting of ramp bridges. Two alternatives have been considered for the Spent Source Storage Facility:

Alternative 1: Retain the existing building and continue to use it as the Spent Source Storage Facility and demolish only the accommodation unit. In addition, build a security hut close to the entrance of the premises (See Figure 5).

The closest foundation is approximately 9.8 m away from the waste storage building and the ramp bridges will be built to have a 4 m clearance above the top of the waste storage building (See Figure 2).

Alternative 2: Shift the location and build a new building for the Spent Source Storage Facility at the same premises, transfer the radioactive material and then demolish the existing building. In addition, build the accommodation & security unit close to the entrance of the premises (See Figure 1b).

The Consultants have recommended shifting of the waste storage building away from the ramp bridge as shown in Figure 1b. By this shifting, risk associated with construction as well as other operational activities will be minimized.

Considering the impacts due to construction activities and vibration due to pile driving the preferred alternative would be 2. Negative impacts due to locating the facility just beneath the ramp bridge will also be eliminated by choosing this option.

(b) Design alternatives, technology selection, construction techniques, etc.

No alternatives are considered here, as the design of the building has to conform to the requirements as proposed by the SLAERC based on IAEA Guidelines and Regulations. The size of the building has been decided based on the requirements of the SLAEB considering the present and future demand for storage of spent sources. Therefore, no design alternatives have been considered. Alternatives for construction techniques will be considered at the time of selection of contractors. However, the nature of construction of the small-scale building does not require consideration of alternatives.

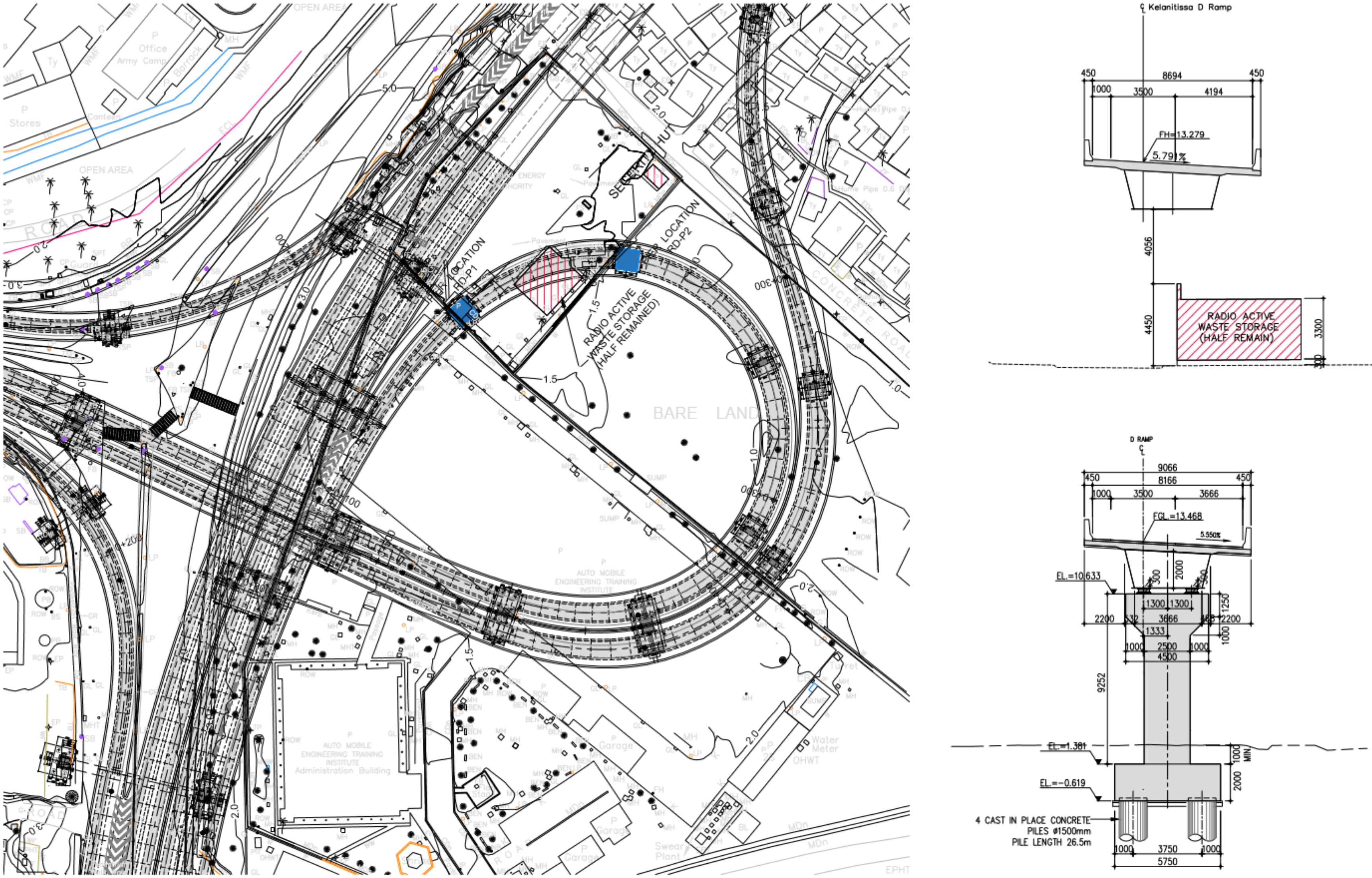


Figure 5. Part demolition of the existing source storage facility (Alternative 1)

(c) Alternative of not construction of the project

The present building used as the spent source storage facility has been built more than 25 years back and does not conform to IAEA Guidelines. The masonry walls are not suitable for such a facility. Moreover, there are many cracks that have appeared on walls. Therefore, there is an urgent need to construct a new Facility conforming to IAEA safety standards. Therefore, constructing the new facility is a need in terms of environmental protection. Therefore, construction of the new facility will ensure that there are no risks of radiation to ensure safety, which means that people and the environment is protected against ionizing radiation risks and the safety of facilities and activities that give rise to radiation risks is ensured.

Recommendations:

Therefore, construction of the new Facility will ensure safety against radiation. Alternative 2 (as described above) is recommended, which is to shift the Facility to a different location within the same premises, and transfer the radioactive sources to the new Facility.

CHAPTER 3: DESCRIPTION OFTHE EXISTING ENVIRONMENT

3.1 Project site

The project site is a plot of 142 perches, flat terrain (See Figure 2). The administrative building, spent source storage facility and the security hut are located within the premises. Topography of the area consists of relatively flat terrain which consists of flood plain areas, slightly elevated areas of congested urban character. Existing approximate ground level in the project area is approximately 5.0 m AMSL (based on GTOPO30 Data).

3.2 Soil and Geology of the Project Area

The predominant soil types in the area are alluvial soils in variable drainage and texture in flat terrain and Red Yellow Podzolic soils with soft and hard Laterite in rolling and undulating terrain. The main geology strata type is undifferentiated Proterozoic gneiss: poorly exposed under the thick residual soil, alluvium and paddy clay which belongs to "Vijayan complex". The soil map and the geology map are presented in Figures 6 and 7.

3.3 General Meteorological Characteristics of the Project Area

Rainfall: Rainfall in the area conforms to a Bi-Model pattern where monsoon seasons take place in two phases, as May to August and October to January. In May, the area experiences its highest level of precipitation. Rainfall during this period is highest in May and June and begins to get lower in the middle months of July and August. Dry season is a hot and humid lasting from December to March. The lowest rainfall level is observed during February.

Temperature: The weather is fairly temperate throughout the year. However, from December to March the weather remains fairly dry. The average temperature is 28 ºC and the maximum temperature is 31 ºC.

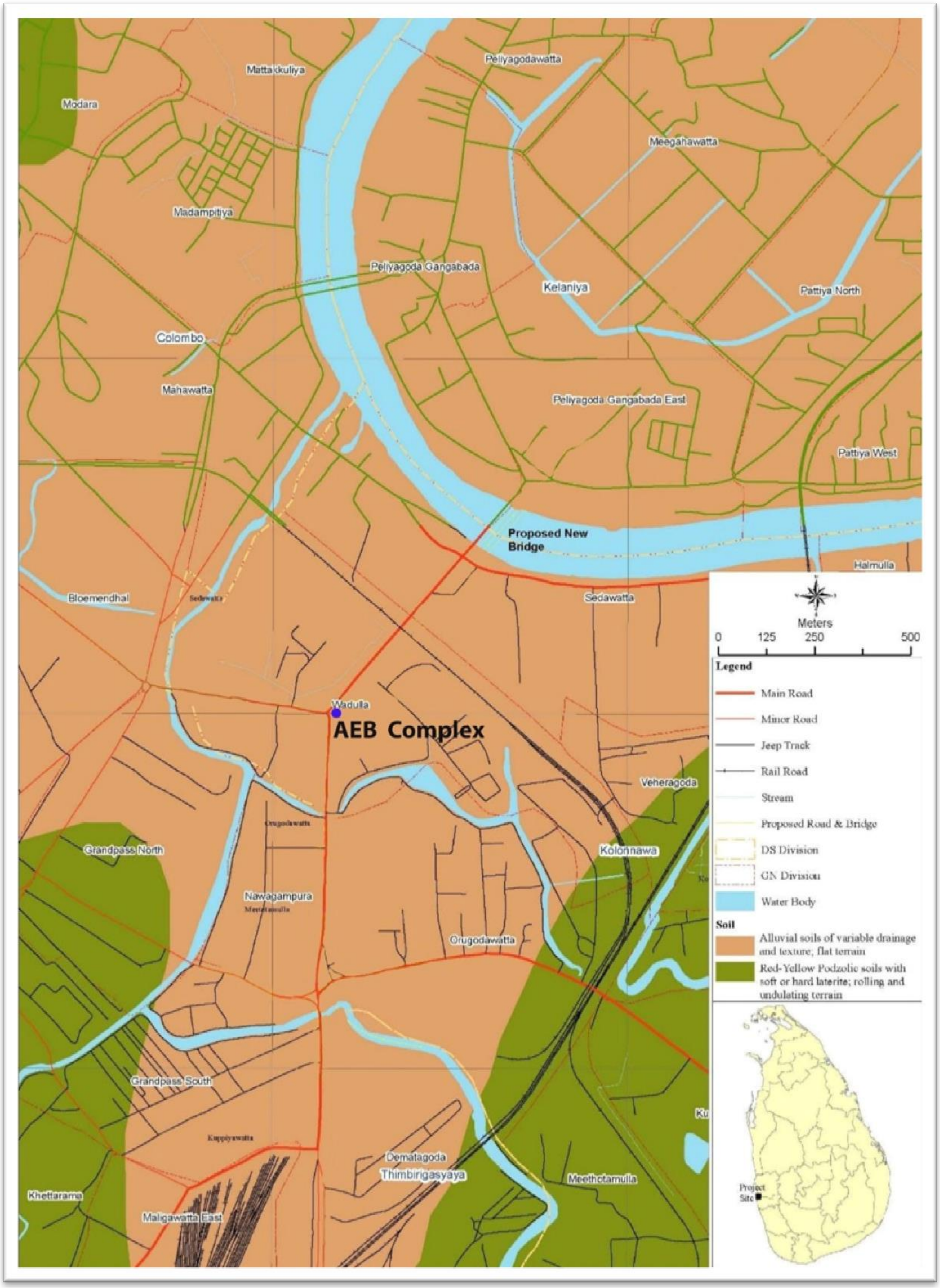


Figure 6. Soil Map of the Project Area (Source: Panabokke C - Soils of Sri Lanka)

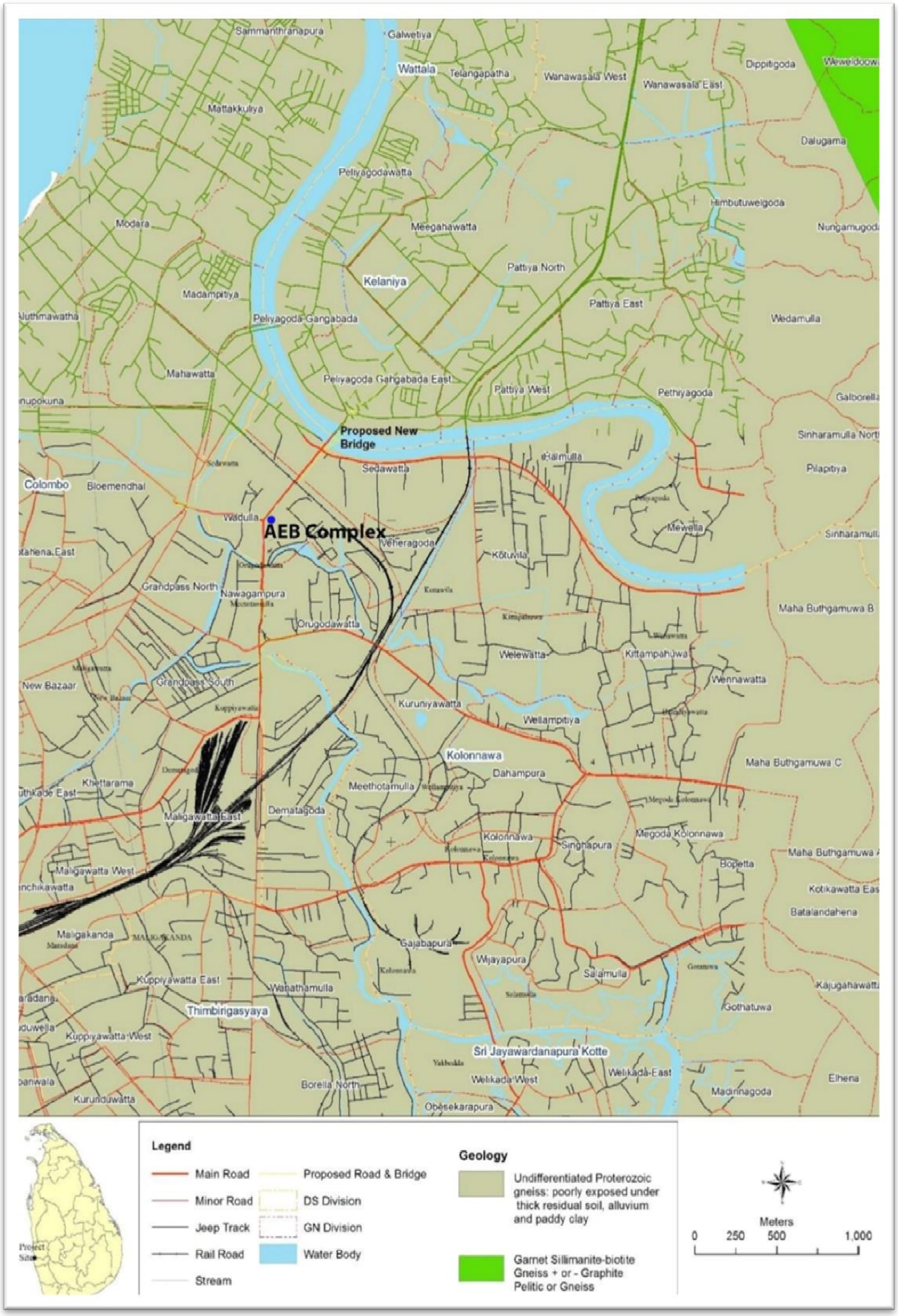
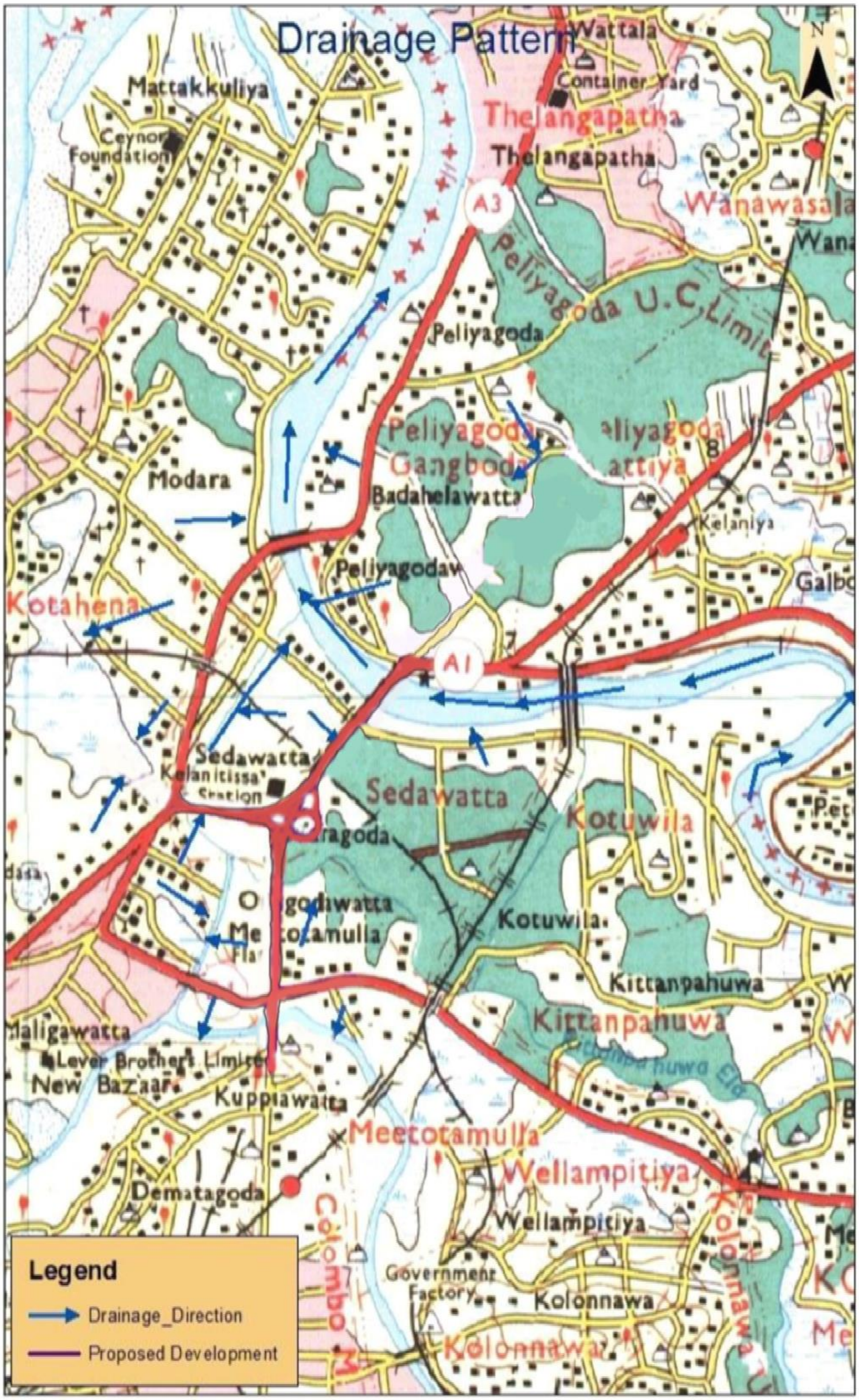


Figure 7. Geology map of the area (Source: Geology of Sri Lanka, P.G. Cooray)



Drainage Pattern of the project area

Figure 8. Drainage pattern of the area

3.4 Drainage Patterns of the project area

The project area is about 480 m away from the Kelani River ('as the crow flies') and the surrounding is high ground area (approximately 5.0 AMSL – see Figures 8 and9) compared to the surrounding. The drainage pattern of the southern part of project area is directed towards the canal which flows from southwest towards northwest direction and then to Kelani River. The drainage pattern of the eastern part of the project area flows directly to Kelani River and then to see through the Kelani River outfall. The drainage pattern of the project area is depicted in Figure 8 above.

3.5 Flood Levels of the Area

Severe Floods [Recorded at Nagalagam Street] AMSL:

June 1837: 13.50 ft.

June 1947: 12.85 ft.

May 1922: 12.60 ft.

Since 1837, 9.00 ft. level has been exceeded 20 times while 8.00 ft. level has been reached/exceeded 25 times (incl. above).

Recent flood levels, AMSL:

June 1989: 9.20 ft.

June 1999: 6.60 ft.

June 2008: 5.90 ft.

6.00 ft. level has been exceeded only once, since 1990.The project site is located above approximately 5.0 m AMSL level, according to Satellite terrain data (SRTM 30 m resolution Arc 1.5), which is above 13.50 ft. flood level that was experienced in June 1837.

Predicted flood levels for different return periods were obtained from the stations Nagalagam Street and Kelanimulla close to which the Spent Source Storage Facility will be constructed. Using water level data available at the Irrigation Department Hydrology Division, flood frequency analysis has been carried out (see Figure 10).

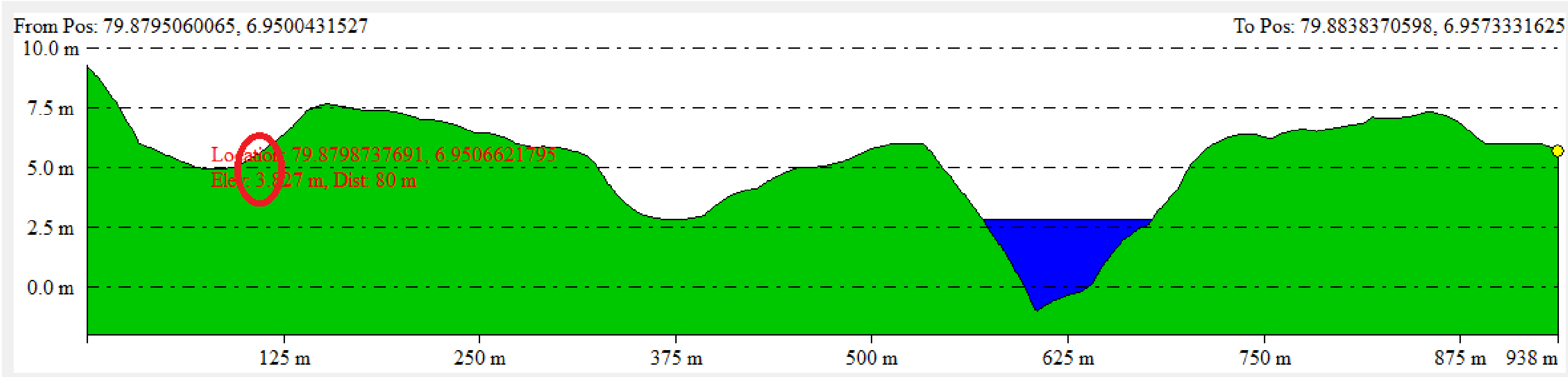


Figure 9. The ground profile of the project site along a transect crossing the Kelani River (Source: SRTM 30 m resolution Arc 1.5)

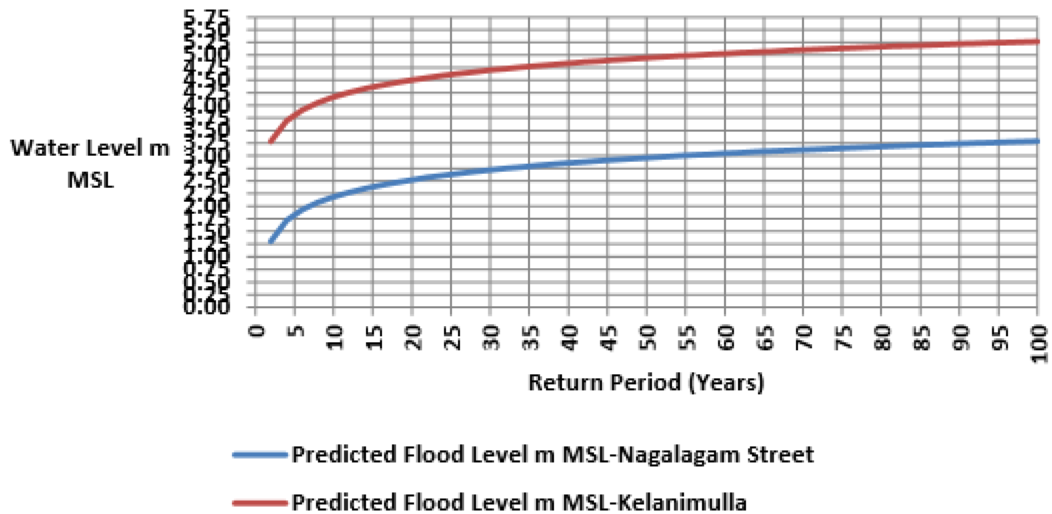


Figure 10.Predicted Floods of Kelani River (Source: Base Data from Department of Irrigation, The figure was extracted from the EIA Report prepared for Second New Kelani Bridge Project)

3.6 Noise and Vibration levels

Noise:

High noise levels have been recorded in the project area. Movement of vehicles is the main source of noise. Based on the observations, the project area could already be classified as a high noise area. Measurement of noise level has been conducted close to the project area during the EIA study for the Second New Kelani Bridge Project on April 5-6, 2013 during 4 times (morning, afternoon, late afternoon and nighttime) per day of observation. The maximum value of the noise level is given in Table 3.

Table 3. Noise measurements made at two locations close to the project site

Location	Morning			Afternoon			Evening			Night		
	L_{eq}	L_{50}	L_{90}	L_{eq}	L_{50}	L_{90}	L_{eq}	L_{50}	L_{90}	L_{eq}	L_{50}	L_{90}
1	80	75	71	77	74	70	78	70	67	75	71	65
2	66	64	61	65	61	58	64	61	58	59	58	57

Location 1:At the roadside of the New Kelani Bridge Road, Close to the Shanchi Viharaya, Wellampitiya. 06^0 57' 01.14'' N 079^0 52' 40.02'' E

Location 2:At the roadside, close to the premises of Mr. H.A Piyasena, No.31/10, Orugodawatta, Wellampitiya. 06^0 56' 53.90'' N 079^0 52' 44.60'' E

[Source: EIA Report for The Second New Kelani Bridge Project (2013 July)]

Vibration:

Measurement of vibration level has also been conducted for the above-mentioned EIA. The location of vibration measurement has been selected such as the vicinity of existing bridge piers. The measurements have been done on April 5, 2013 during 4 times (Morning, Afternoon, Evening and Night time) per day of observation. The vibration levels at two locations close to the project area are given in Table 4.10. Measured vibration levels at the two locations were well within the intermittent vibration levels stipulated for type 1 structures (Multi-storey buildings of reinforced not designed to resist earthquakes) in the Interim Vibration Standard stipulated by the Central Environmental Authority of Sri Lanka.

Table 4.Vibration measurements made at two locations close to the project site

Location	Morning		Afternoon		Evening		Night	
	Frequency (Hz)	Vibration in ppv (mm/sec)	Frequency (Hz)	Vibration in ppv (mm/sec)	Frequency (Hz)	Vibration in ppv (mm/sec)	Frequency (Hz)	Vibration in ppv (mm/sec)
1	10-50	0.58	10-50	0.48	>50	0.72	10-50	0.52
2	>50	0.65	>50	0.56	10-50	0.69	10-50	0.49

Location 1:On the basement of the building of Shanchi Viharaya, New Kelani Bridge road. Wellampitiya. 06^0 57' 00.78'' N 079^0 52' 39.83'' E

Location 2:On the basement of the premises of Mr. M.J.M. Badurdeen, No 12, Baseline road, Orugodawatha. 06^0 56' 41.32'' N 079^0 52' 43.10'' E

[Source: EIA Report for The Second New Kelani Bridge Project (2013 July)]

3.7 Human settlements and land use of the area

There are 1,759 houses located in the Wadullawatta GN Division, out of which 240 houses are within the direct impact area of the Bridge project. There are more than 40 houses in the small strip of land between the present SLAEB building and the Kandy Road (A1). There are nearly 200 houses in within a radius of 500 m. almost all are semi-permanent houses of low-income communities.

Figure 11 shows the land use map of the area, which shows that the area is predominantly occupied by homesteads, mostly of low income communities. There are marshy areas as well close to the site, and a canal is located within 100 m. The Kelani River is located about 480 m away from the site.

3.8 Transport systems (roads/bridges)

The premises are located very close to the present Kandy Road (A1), and the Kelani Bridge is within a distance of 400 m from the site. There is a small bridge located within 100 m, just next to Kelanitissa Power Station.

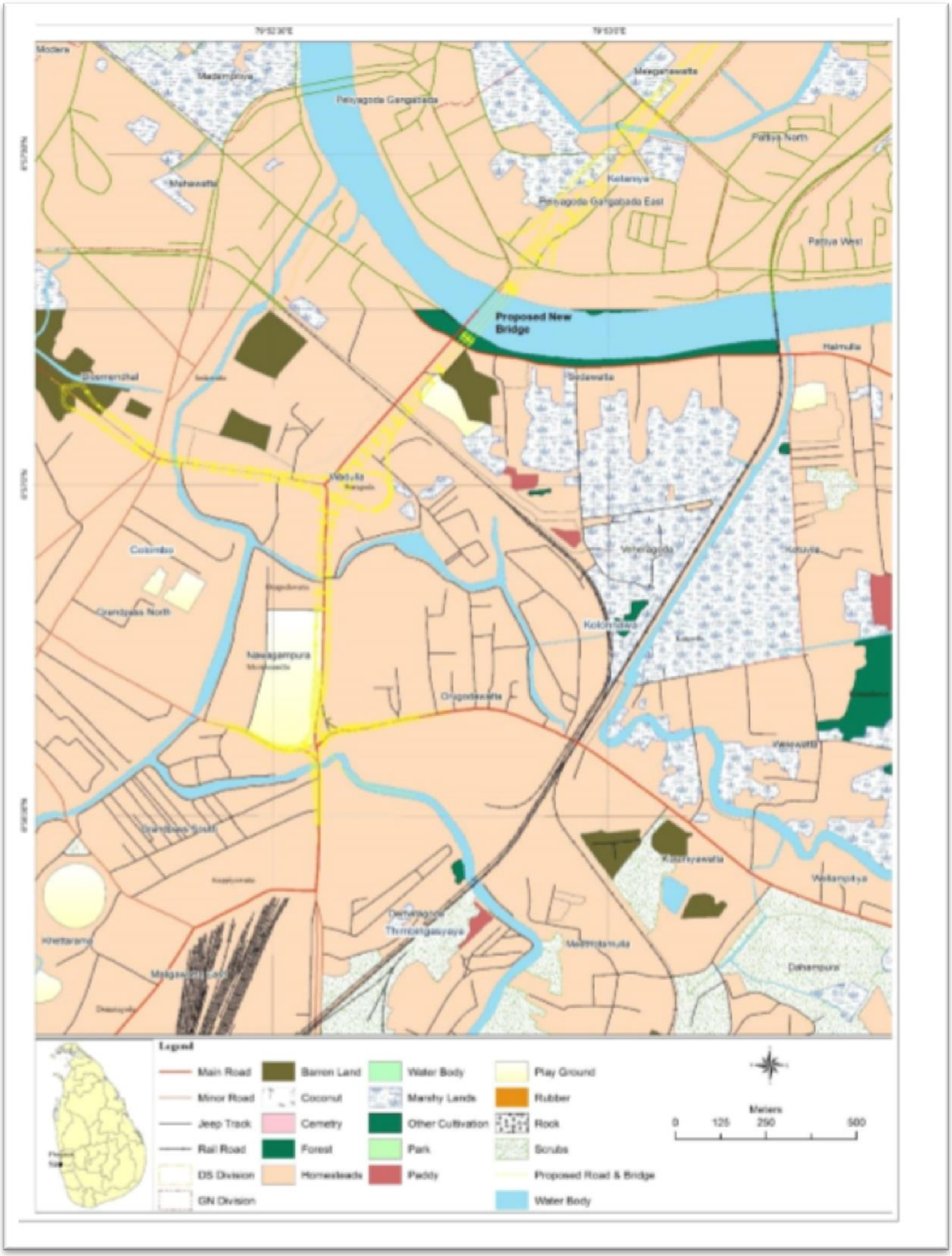


Figure 11. Land use map of the area

[Source: EIA Report for the Second New Kelani Bridge Project (2013 July)]

3.9 Any other such as susceptibility for natural hazard such as floods

Flooding is the only phenomenon which has occurred in the project area in a disaster level. Figure 12 gives the flood levels at Nagalagam Street which is downstream of the project area along with the Major and Minor flood level the Irrigation Department standard flood classification for the water level gauge at Nagalagam Street.

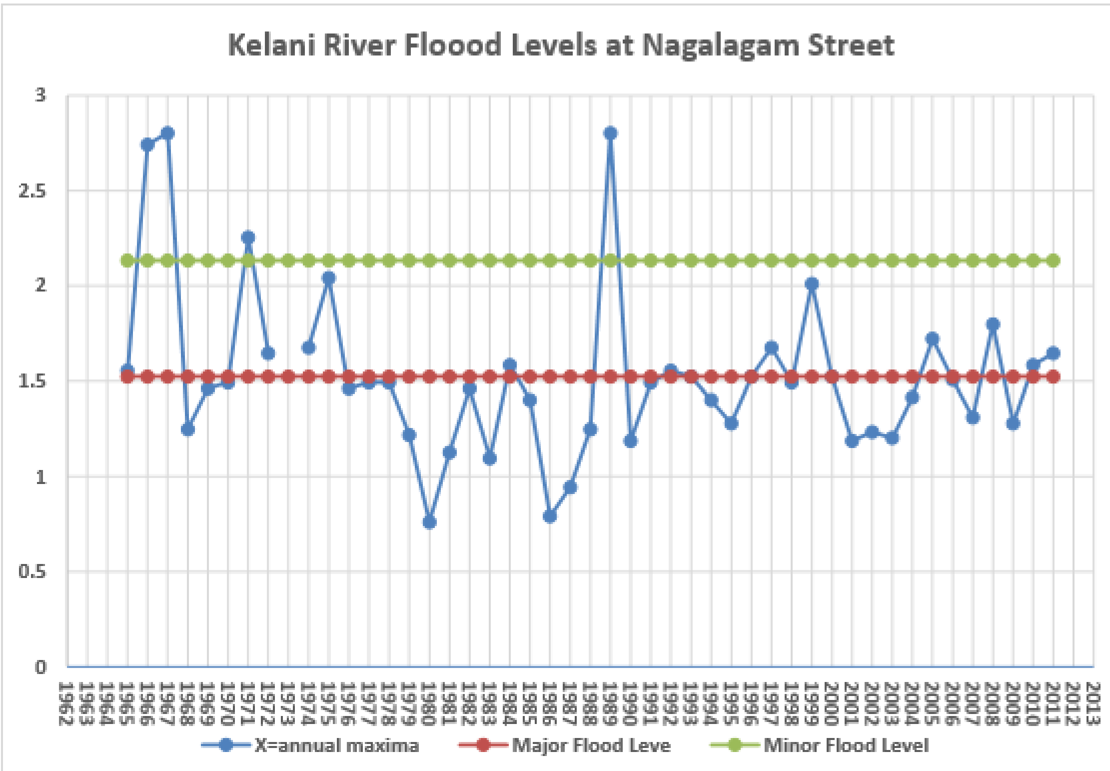


Figure 12. Recent flood levels recorded at Nagalagam Street

[Source: EIA Report for the Second New Kelani Bridge Project (2013 July)]

It is seen from the graph above (Figure 12) that floods in year 1966, 1967 and 1989 have not inundated the project area. As mentioned above in section 3,5, the project site is highland with compared to the periphery. The elevation is nearly 5.0 AMSL, and the biggest floods recorded have been about 13.5 ft. (in June 1837).

Also, Flood Propagation map (Figure 13) also shows that the project area is highest (denoted by green shading), and is above the 10-year flood levels.

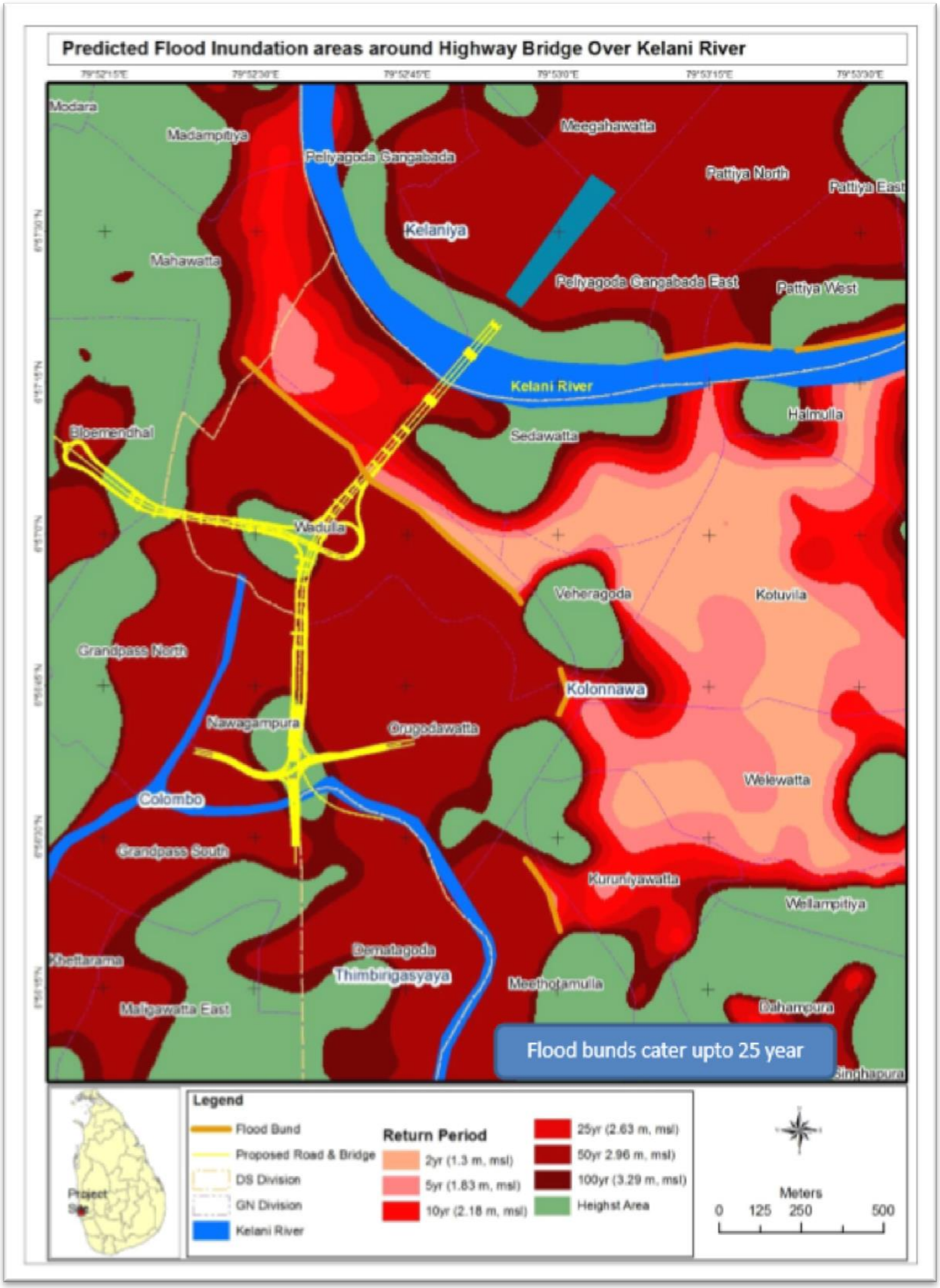


Figure 13. Flood Propagation map

[Source: EIA Report for the Second New Kelani Bridge Project (2013 July)]

CHAPTER 4: ASSESSMENT OF ANTICIPATED ENVIRONMENTAL IMPACTS

4.1 Risks of exposure to high radiation by employees, public, other socio economic and socio cultural attributes during transporting, handling of radioactive materials/wastes, operation of radioactive material storage facility

Spent radioactive sources are stored in maximum safe conditions with adequate shielding. Public are not allowed to handle radioactive sources. Therefore, risk of exposure to high radiation for public is very rare.

The potential exposures can happen for radiation workers during manipulating the sources for conditioning and storing. The workers are highly trained and educated for understanding radiation levels and contaminations. The workers are using radiation monitoring devises to protect from potential exposures. They are registered with the regulatory personnel monitoring surveillance programme and continuously use Personnel Monitoring Devises such as TLDs, Pocket dosimeters, Personnel Protective Equipment during operation. Therefore, the impact can be regarded as low.

Transportation will be done by the SLAEB with highly trained staff. Spent source packages will be transported in accordance with the international dangerous cargo transportation requirements. The dangerous sources will be transported under security conditions with the help of STF. Therefore, the impacts can be regarded as low.

4.2 Risks of accidental release of radiation due to any unusual occurrences/incidents such as accidents, fire, natural hazards etc.

The spent radiation source facility consists with solid shield sources only. There is no liquid or gaseous radioactive material will be stored. Therefore, accidental release to the environment cannot be happen.

However, following incidents could be expected as rare cases.

1. In case of fire at the waste storage facility, solid shielded source containers might be melted and some melted material can be released to the environment.
   - This is a rare case. Most of the source containers can withstand excessive heat. In such a case SLAEB will immediately take action and make remedial measures on on-site responding to the incident. The SLAERB will also be involved with the emergency response operations (See Chapter 5). The SLAEB will adopt whatever the provisions identified in the National Radiological Emergency Management Plan prepared in accordance with the provisions of the Sri Lanka Disaster Management Act, No.13 of 2005 (Refer Ch VII Clause 58(1) of the Sri Lanka Atomic Energy Act, No. 40 of 2014.
   - In such a case radioactive fallouts can be released to the environment and spread around the vicinity of the facility. If people are living around the vicinity they could be exposed to the radiation. As an emergency response procedure environmental monitoring will be carried out by the responders and protective measures taken such as evacuation, sheltering etc. based on the radiation prescribed levels.
   - During transportation of radioactive sources, the vehicle accident could be happen in public places. The SLAEB will be take necessary actions responding to the emergency. The dangerous sources will be transported on the escort service of STF.

A risk assessment has been carried out for the probability of having such incidents and is present in Section 5.8 and Table 11.As described in Sections 3.5 and 3.9, the only natural hazard that can occur is flooding; however, the frequency of occurrence is very low (not even for a 100-year flood).

4.3 Impacts on the environmental components such as air, soil, groundwater, surface water, storm water etc. due to contamination by radiation, radioactive material during transporting, handling, operation of radioactive material storage facility and due to unusual occurrences such as accidents, fire, natural hazards etc.

It is very clear that there is no any impact on the environmental components such as air, water, ground water, surface water, storm water or soil in operating the spent radioactive source facility. This storage is only for solid shield radioactive sources.

4.4 Impacts on the environment due to discharge/disposal of other liquid/solid material

There are no any discharges to the environment. The facility stores solid shield radioactive sources only.

4.5 Impacts to the radioactive material storage facility by construction and operation of the Second New Kelani Bridge Project

Impacts construction of the Bridge

There can be several impacts due to construction of the proposed bridge and approach roads. As described above, the Spent Source Storage Facility will be constructed using 200 mm thick solid reinforced concrete walls. A section of the approach road adjacent to the proposed radioactive waste storage structure will be constructed on piers. The above piers will be supported on cast in situ bored piles considering the subsurface conditions at the site. Two significant impacts can be identified:

1. Impacts due to pile constructions and construction induced vibrations.
2. Impacts due to movement of heavy vehicles and machinery
3. Other impacts due to construction of the bridge

1. Impacts due to pile constructions and construction induced vibrations.

It is evident from the borehole location plan that the piers referred to as RD P1 and RD P2 are the boreholes advanced close to the proposed Spent Source Storage Facility structure (refer to Annex 3-2 for borehole logs, and locations at the two piers). The subsurface at RD P1 and RD P2 consist of succession of strata as presented in Table 5a and Table 5b, respectively. Depth is measured from the existing ground surface. Ground water table is almost at the existing ground surface in both boreholes.

Table 5a: Subsurface characteristics at RD P1

Layer	Depth (m)	Description	SPT N	CR and RQD
1	0.00 – 3.00	Fill material	7	-
3	3.00 – 6.00	Loose to medium sand	2 - 4	-
2	6.00 – 7.50	Soft clay, organic clay, peat	4	-
4	7.50 – 14.00	Firm to very stiff clay	10 - 17	-
2	14.00 – 18.00	Soft clay, organic clay, peat	7 - 14	-
6	18.00 – 25.80	Completely weathered rock	> 50	-
7	25.80 – 30.10	Bedrock		CR : 56% - 100% RQD: 00% - 15%

Table 5b: Subsurface characteristics at RD P2

Layer	Depth (m)	Description	SPT N	CR and RQD
1	0.00 – 3.00	Fill material	1	-
2	3.00 – 6.00	Soft clay, organic clay, peat	0	-
5	6.00 – 9.00	Medium dense to very dense sand	13 - 16	-
3	9.00 – 19.50	Loose to medium sand	1 - 5	-
6	19.50 – 20.60	Completely weathered rock	> 50	-
7	20.60 – 27.20	Bedrock		CR : 70% - 100% RQD: 14% - 87%

It can be observed from the borehole record of RD P1 that the subsurface consist of weak soil layers up to a depth of about 7.50 m followed by relatively strong layers up to a depth of 18.00 m. Completely weathered rock and bedrock follow the above layers at RD P1.

Subsurface at RD P2 consist of very weak layers up to a depth of about 19.50 m. A strong medium dense to very dense sand layer of 3.00 m thickness is sandwiched between weak layers from 6.00 m to 9.00 m depth at RD P2. Completely weathered rock and bedrock follow the above layers.

Based on the subsurface characteristics at the site, it is proposed to support each pier of the bridge approach using four numbers of rock socketed cast in situ bored piles of 1.50 m diameter. According to the layout plan of the proposed radioactive source storage site, the minimum distance from the edge of the proposed structure to the pile installation site would be about 10.0 m.

In view of the above, it is anticipated that some vibrations would be generated during drilling through firm to stiff clay, medium dense to very dense sand and completely weathered rock layers. In addition, significant vibrations could be expected during rock socketing as well.

Table 6. Typical range of structural responses from various sources

Vibration forcing function	Frequency range Hz	Amplitude range µm	Particle velocity range mm/s	Particle acceleration range m/s^2	Time characteristic	Measuring quantities
Traffic road, rail, ground-borne	1 to 80	1 to 200	0,2 to 50	0,02 to 1	C/T	pvth
Blasting vibration ground-borne	1 to 300	100 to 2 500	0,2 to 500	0,02 to 50	T	pvth
Pile driving ground-borne	1 to 100	10 to 50	0,2 to 50	0,02 to 2	T	pvth
Machinery outside ground-borne	1 to 300	10 to 1 000	0,2 to 50	0,02 to 1	C/T	pvth/ath
Acoustic traffic, machinery outside	10 to 250	1 to 1 100	0,2 to 30	0,02 to 1	C	pvth/ath
Air over pressure	1 to 40				T	pvth
Machinery inside	1 to 1 000	1 to 100	0,2 to 30	0,02 to 1	C/T	pvth/ath
Human activities a) impact b) direct	0,1 to 100 0,1 to 12	100 to 500 100 to 5 000	0,2 to 20 0,2 to 5	0,02 to 5 0,02 to 0,2	T	pvth/ath
Earthquakes	0,1 to 30	10 to 10^5	0,2 to 400	0,02 to 20	T	pvth/ath
Wind	0,1 to 10	10 to 10^5			T	ath
Acoustic inside	5 to 500					

Key

C = continuous
T = transient (simplified categories, see **3.1** and **3.2**)

pvth = particle velocity time history

ath = acceleration time history

NOTE 1 The ranges quoted are extremes but indicate the values which may be experienced and which may have to be measured (see also note 3). Extreme ranges of amplitude of displacement and frequency have not been used to derive particle velocity and acceleration.

NOTE 2 The frequency range quoted refers to the response of buildings and building elements to the particular type of excitation. It is indicative only.

NOTE 3 Vibration values within the ranges given may cause concern. There are no standards which cover all varieties of building, condition and duration of exposure, but many national codes associate the threshold of visible effects with peak particle velocities at the foundation of a building of more than a few millimetres per second. A significant probability of some damage is linked to peak particle velocities of several hundred millimetres per second. Vibration levels below the threshold of human perception (see ISO 2631-2) may be of concern in delicate and industrial processes.

Table C.1 Summary of case history data on vibration levels

Ref. no.	Year and location	Soil conditions	Pile dimensions	Mode	Measured peak particle velocity (PPV) at various plan distances						
					Theoretical energy per blow	Plan distance	PPV	Plan distance	PPV	Plan distance	PPV
						m	$mm \cdot s^{-1}$	m	$mm \cdot s^{-1}$	m	$mm \cdot s^{-1}$
1	2000 New Orleans (USA) [57]	Very soft to soft clay 0 m to 10 m, soft to medium stiff clay 10 m to 20 m	U-shaped LX-16 sheet piles	Pressed-in steel sheet piles	N/R	4.8	2.5 to 4.3	24	< 0.5		
2	1992 Utrecht (Netherlands) [57]	—	U-shaped sheet piles	Pressed-in steel sheet piles	N/R	7.1	0.3 to 0.7				
3	2006 Blackpool	Made ground 0 m to 3 m, loose to very dense sand and silt 3 m to 17 m, firm to stiff clay 17 m to 25 m	244 mm diameter, 13.2 mm wall thickness, 11.5 m to 20 m long	Driven steel tubular piles	Estimated as 9810 J	5	12.32 to 13.91	10	8.45 to 8.76	20	4.32 to 5.4
4	2006 Blackpool	Made ground 0 m to 3 m, loose to very dense sand and silt 3 m to 17 m, firm to stiff clay 17 m to 25 m	275 mm square, 9 m to 10.2 m long	Driven precast concrete square piles	Estimated as 9810 J	5	10.16 to 11.4	10	6.41	20	4.32 to 5.6

Table 7:

Typical range of particle acceleration range that can occur for pile vibration

Source for Table 6 and 7: BS 7385-1:1990, ISO 4866:1990 Evaluation and measurement for vibration in buildings - Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings.

Typical range of particle acceleration range that can occur for pile vibration would be 0.2 – 50 mm/s (See Table 7). These vibration levels attenuated with distance, and based on the nature of the soil conditions.

According to historical data observed on pile driving, it has been noted that the peak particle velocities are in the range of 8.45 – 8.76 mm/s for ground which have loose to dense sand (similar soil conditions are observed at the two pier locations up to at least 19.5 m depth) at a plan distance of 10 m. The proposed Spent Source Storage Facility will be about 10 m away from the nearest pier (RD P2). Therefore, the peal particle velocities up to about 10.0 mm/s can be expected at ground level at a distance of 10 m.

2. Impacts due to movement of heavy vehicles and machinery

(a) Heavy vehicle movements and operation of machinery can cause vibration (See Table 8). Vibratory rollers can cause the maximum vibration, which is 0.210 in/sec (at 25 ft. distance).

Table 8. Vibration Source Amplitudes for Construction Equipment

Equipment	Reference PPV at 25 ft. (in/sec)
Vibratory roller	0.210
Large bulldozer	0.089
Caisson drilling	0.089
Loaded trucks	0.076
Jackhammer	0.035
Small bulldozer	0.003
Crack-and-seat operations	2.4

Sources: Federal Transit Administration 1995 (except Hanson 2001 for vibratory rollers) and Caltrans 2000 for crack-and seat-operations.

(b) There can be accidents happening near the Spent Source Storage Facility, however, this is a very remote possibility.

(c) Any fallout from machinery can damage the facility, which is again rare, and can be mitigated.

(d) Unauthorized access and trespassing can take place, which can be a threat to the facility. Again, occurrence of this is also very rare.

Impacts during Operations of the Bridge

The vehicular movements can induce ground vibrations (See Table 6), however, the vibrations can be expected to be much lower than the levels experienced during pile driving and operation of construction machinery during construction. Vehicles traveling on a smooth roadway are rarely, if ever, the source of perceptible ground vibration. However, discontinuities in roadway pavement often develop as the result of settling of pavement sections, cracking, and faulting. When this occurs, vehicles passing over the pavement discontinuities impart energy into the ground, generating vibration. In most cases, only heavy trucks, not automobiles, are the source of perceptible vibration. Trucks traveling over pavement discontinuities also often rattle and make noise, which tends to make the event more noticeable when the ground vibration generated may only be barely noticeable.

With proper safety procedure in place, there are no foreseeable impacts during the operations. The following can occur, however, the frequency of occurrence can be regards as very remote:

- Vehicle accidents happening on the ramp bridge, which can cause damage to the facility: this is a very rare occurrence.

4.6 Socio-cultural and socio-economic benefits to the country

The main reason for constructing the waste storage facility is for storage of spent radioactive sources used by different radiation facilities in the country for security of these sources and public safety. It is beneficial to the country to protect the public from unnecessary exposure to ionizing radiation. The facility is a result of the implementation of Atomic Energy legislation of the country.

4.7 Impacts due to construction of the Spent Source Storage Facility

The scale of the building is very small environmental impacts can be considered not significant.

CHAPTER 5. PROPOSED MITIGATORY MEASURES

5.1 Mitigating ground vibration during construction to prevent any damages to the Spent Source Storage Facility

Generally, having a distance of 9.4 m, effect of vibration due to driving casing/sheet piles and excavation will be diminished and there will be no harmful effect to the storage building.

However, prior to the commencement of any construction work, the Contractor will survey and check the condition of the waste storage building with attendance of SLAEB and RDA. Also the level of the vibration due to construction will be measured and confirmed jointly by SLAEB and RDA to ensure that the level of this vibration will not be harmful to the building.

The following local and international guidelines have been referred in providing the mitigating measures to prevent any excessive vibration occurring due to construction activities:

- Proposed air-blast over pressure and ground vibration standards for Sri Lanka – Central Environmental Authority, Pollution Control Division.
- BS 5228-2:2009 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.
- BS 7385-1:1990, ISO 4866:1990 Evaluation and measurement for vibration in buildings - Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings.
- BS 7385-2: 1993 Evaluation and measurement for vibration in buildings - Part 2: Guide to damage levels from ground-borne vibration.
- Transportation and Construction Vibration Guidance Manual (Report No: CT-HWANP-RT-13-069.25.3), California Department of Transportation Division of Environmental Analysis, Environmental Engineering Hazardous Waste, Air, Noise, Paleontology Office.

With reference to the above guidelines and considering the importance of the proposed radioactive source storage structure, it is recommended to maintain vibration levels on the base level and the roof slab level of the proposed structure below the values given in Table 9.

Table 9: Recommended vibration levels

CENTRAL ENVIRONMENTAL AUTHORITY
Pollution Control Division

2. Interim Standards for Vibration Control

Table 2.1: Interim Standards for vibration of the Operation of Machinery, Construction Activities and Vehicle Movements Traffic

Category of the structure as given in Table 1.1	Type of Vibration	Frequency of Vibration (Hz)	Vibration in PPV (mm/Sec.)
Type 1	Continuous	0 –10	5.0
		10-50	7.5
		Over 50	15.0
	Intermittent	0 –10	10.0
		10 –50	15.0
		Over 50	30.0
Type 2	Continuous	0 -10	2.0
		10-50	4.0
		Over 50	8.0
	Intermittent	0 –10	4.0
		10 –50	8.0
		Over 50	16.0
Type 3	Continuous	0 -10	1.0
		10 - 50	2.0
		Over 50	4.0
	Intermittent	0 - 10	2.0
		10 – 50	4.0
		Over 50	8.0
Type 4	Continuous	0 - 10	0.25
		10 – 50	0.5
		Over 50	1.0
	Intermittent	0 – 10	0.5
		10 - 50	1.0
		Over 50	2.0

Notes

1. Please see separate measurement methods
2. The values given above are in such a way that minor damage is unlikely as the nearby house/building

The Spent Source Storage Facility can be regarded as a Type 1 building and the limits applicable for Type 1 building for intermittent vibrations can be used. The expected vibration levels (ppv of 8.0 – 10.0 mm/sec) are much lower than the above maximum allowable limits; however, following procedures would be adhered to by the Contractors to ensure safety of the Spent Source Storage Facility. By adhering to the above maximum levels, the probability of minor damage happening to the Spent Source Storage Facility is very low (e.g., less than 5% when the ppv is 45 mm/s – See Table 10).

Table 10.Siskind Vibration Damage Thresholds

Damage Type	PPV (in/sec) 5% Probability	10% Probability	50% Probability	90% Probability
Threshold damage: loosening of paint, small plaster cracks at joints between construction elements	0.5	0.7	2.5	9.0
Minor damage: loosening and falling of plaster, cracks in masonry around openings near partitions, hairline to 3-mm (0–1/8-in.) cracks, fall of loose mortar	1.8	2.2	5.0	16.0
Major damage: cracks of several mm in walls, rupture of opening vaults, structural weakening, fall of masonry, load support ability affected	2.5	3.0	6.0	17.0

It is suggested to commence the piling work subjected to the following conditions.

i. An independent party to carry out a crack survey of the present status of the buildings before the commencement of the piling work and regularly monitor vibrations during the time period of the piling work and one week after completion of the piling work.
ii. If widening and propagation of the existing cracks or initiation of new cracks is noticed, piling work shall be stopped to review the situation.
iii. The piling contractor will abide by the followings:
    a. Only one piling rig is in operation at a given time and no vibration generating equipment be used at the site during the socketing for the piles is in progress.
    b. A clear time gap of one day between socketings shall be maintained.
    c. Minimum possible torque shall be applied during socketing and drilling for piles.
iv. If vibration levels exceed the recommended levels given in Table 9 even after adhering to the above guidelines, the excavation of a cut off trench close to the proposed structure shall be considered for minimizing the propagation of vibration towards the waste storage structure.

v. Vibration will be controlled at source and the spread of vibration will be limited, in accordance with Clause 8 of the BS 7385-1. Where processes could potentially give rise to significant levels of vibration, on-site vibration levels will be monitored regularly by a suitably qualified person appointed specifically for the purpose, particularly if changes in machinery or project designs are introduced. A method of vibration measurement will be agreed prior to commencement of site works, e.g. that specified in BS 7385-1.

vi. When potential vibration problems are been identified (if any), or when problems have already occurred, consideration will be given to the implementation of practicable measures to avoid or minimize those problems.

5.2 Mitigation measures to ensure safety of the Spent Source Storage Facility during construction of the Bridge

1. During erection of steel girders, special precautions will be taken to prevent falling of any construction materials on the waste storage building.
2. There will be a tall fence erected to safeguard the facility and to prevent any unauthorized access to the Spent Source Storage Facility
3. Extra care will be taken, and all the workers will be advised as to how precautions will be taken to ensure safety of the Spent Source Storage Facility

5.3 Mitigating vibration due to vehicular movements during operation of the bridge

Vibration due to vehicluar movement can be effectivey mitigated by making the road surface smooth. Vibration from vehicle operations is almost always the result of pavement discontinuities, the solution is to smooth the pavement to eliminate the discontinuities. This step will eliminate perceptible vibration from vehicle operations in virtually all cases. As the Spent Source Storage Facility is located under the ramp bridge, the speed of vehicles will be in the range of 40 km/h or lower, and vibrations can be expected to be mild.

The walls of the steel box girder will be strenghthended to withsatand high imnpct.

The superelevation of the ramp bridge is in the opposite direction from the location of the proposed location of the Spent Source Storage Facility . Moreover,the approach section of the highway towards the ramp briddgge also has its superelevation in the opposite direction with respcect to the proposed Spent Source Storage Facility. Therefore, chaces of any vehicles or heavy particles flaling off from the ramp bridge towards the Spent Source Storage Facility is very remote, and the lcoation can be consdiered very safe.

5.4 Ensuring the safety of the Spent Source Storage Facility during operations of the Bridge

In this feasibility study it is recommended to construct the ramps with Steel Box Girder. The ramp bridges will have a width of 6.9 m with two traffic lanes and a span of 30~60 m. The steel box girder will be strong enough to prevent any vehicles and objects falling off the road in unlikely events such as accidents.

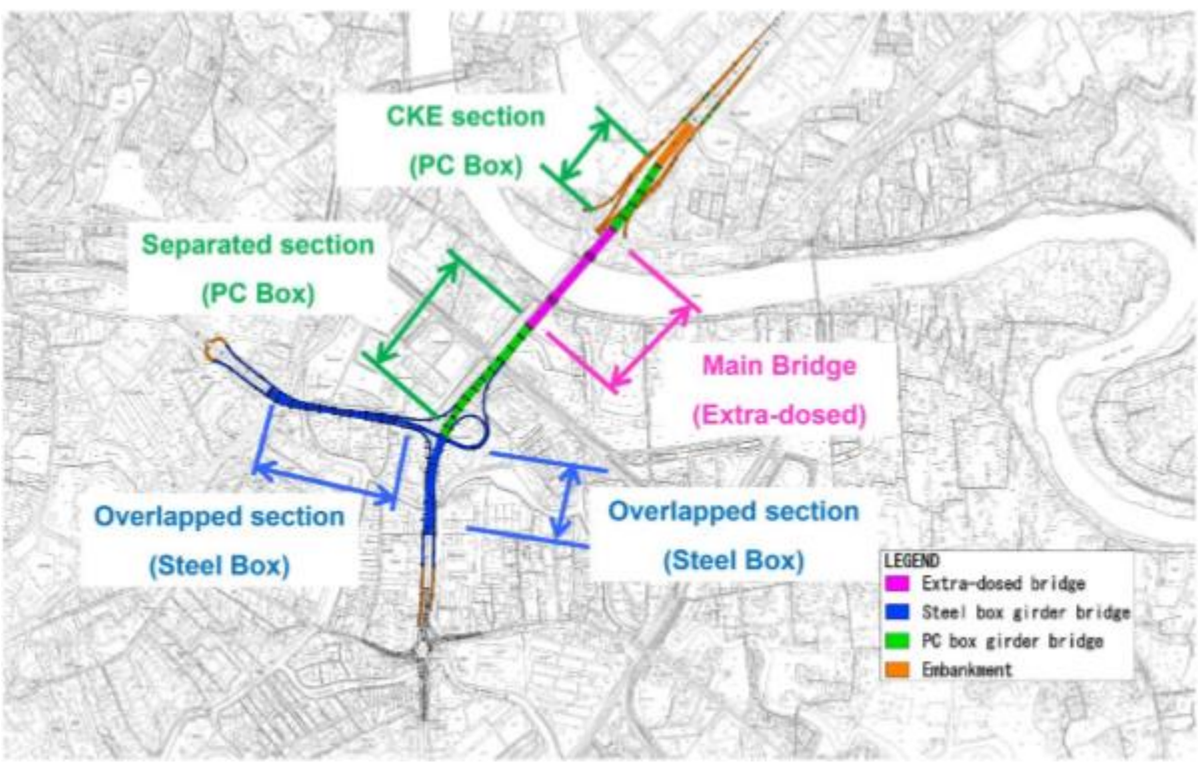


Figure 14. Sections proposed for the Bridge and the ramp bridges

5.5 Mitigating risks due to natural and other hazards

As described in Chapters 3 and 4, the only natural flood that could occur would be floods, however, the chances of flooding the site where the Facility is located is very rare. Therefore, no mitigation measures are needed.

However, a proper drainage management plan will be established for preventing local floods, The doors will be water proof. In addition, the final level of the building floor will be 600 mm above the final formation level of the ground.

The following will also be incorporated to ensure safety of the Facility:

- Fire reels will be provided to be used in case of fire and other emergencies.
- Surveillance cameras
- Security provided 24 hours by the STF
- Controlled access to the site and then to the Facility

5.6 Moving the Radioactive material to the new location and disposal of demolition waste of the existing facility

The SLAEB will inform the SLAERC about the schedule to move the radioactive material to the new location and will get the approval before moving.

The SLAEB will check whether the demolition waste of the existing facility is contaminated with radioactive material. If so, decontamination will be carried out immediately. The disposal of demolition waste has to be done with close consultation and approval of the SLAERC.

5.7 General control measure to ensure protection from radiation

Use of appropriate containment and shielding

State the type of shielding suitable for the radionuclide used (e.g. lead for I-131, Perspex for P-32). If shielding is adopted, it should have an appropriate thickness:

For example:

Gamma Radiation: The thickness of lead should be greater than or equal to the TVL of the radionuclide. However, the attenuated dose should still be checked to ensure that it does not exceed any dose limit as specified in International Atomic Energy Authority (IAEA) and The 2007 Recommendations of the International Commission on Radiological Protection.

Beta Radiation: 10mm of Perspex should provide adequate shielding for all Beta emitting sources excluding Y-90 and I-131.

The chance of contamination spread can be significantly reduced by ensuring that gloves are used and that all work is carried out on spill trays which are lined with absorbent materials. Movement of radioactive materials also needs to be considered to ensure that accidental spillages are not a regular occurrence and the chance of significant contamination from the spillage is minimized by adopting an appropriate movement procedure.

Area Designation

Risks can be effectively managed by way of indication what an area should be designated as. Sometimes after carrying out the risk assessment (See section 5.10), the area may change its designation. All this needs to be addressed in the space provided. An area can be designated as controlled or supervised for various different reasons. Areas need not be permanent. Some reasons for designating an area are as follows:

Controlled Area: If increased security and restriction of access to that area is required. e.g.,

- To reduce the spread of contamination this is likely.
- If a person is likely to receive a dose higher than the dose limits provided in The 2007 Recommendations of the International Commission on Radiological Protection

Supervised Area: to keep conditions under review to determine if the area needs to be controlled, e.g.,

- In labs where only small quantities of very low energy radioactive materials are used.
- To reduce the spread of contamination this may occur.

5.8 Emergency response system/safety arrangement plan for any release of radiation due to accidental fire, damages to structures of the storage facility giving special reference to possible damages that may cause by the construction and operation of the New Kelani Bridge Project any other natural hazard such as floods etc.

For emergency response, the SLAEB will adopt whatever the provisions identified in the National Radiological Emergency Management Plan prepared in accordance with the provisions of the Sri Lanka Disaster Management Act, No.13 of 2005 (Refer Chapter VII Clause 58(1) of the Sri Lanka Atomic Energy Act, No. 40 of 2014).

Furthermore, National Policy on Radioactive Waste Management, which would be formulated based on international norms by the Minister will be adopted to ensure safety against any radiation exposure (Refer Chapter VI Clause 54 of the Sri Lanka Atomic Energy Act, No. 40 of 2014).

O Types of emergencies which could be handled.

- Theft – In such a case Investigation is done as the first step. Then in order to find the lost source radiation surveys will be carried out using back packs and other radiation survey meters. Mobile Spectroscopy (Having detectors in a vehicle and travel), Arial monitoring (Detectors using in a helicopter) are the other methods used for intensive monitoring. Police and other national authorities are to be given the cooperation in such scenarios. There will be a fence built around the facility. In addition, there will be an 8-feet high parapet will constructed with barbed wire fencing at the top. In addition, the police will be alerted in case of emergency, which will be deployed in less than 30 minutes after reporting/alerting them.
- Flood – Structural designs and finished floor levels (as described in Section 5.3) are kept reasonably higher than the existing ground level. Hence the possibility of getting a flood is very low. In such a case detectors are used in order to measure the radiation level of the surroundings.

O Facilities available/required at the site for such handling.

- Backpack – radiation monitor
- Redeye – radiation monitor
- Contamination monitors
- In-situ gamma spectroscopic system
- Mobile gamma monitoring system
- Personnel Radiation Detectors
- Source recovery equipment and tools/shields
- Personnel Protective Equipment

o Methods of recovery, containment, treatment of contaminated environment

There is very low possibility of contaminating the environment by solid sealed sources. Since the liquid and gaseous radioactive sources are not used in this facility air and soil contamination cannot be expected.

○ **Analysis of the effectiveness of the measures proposed for mitigation of the effects of external events that could adversely affect the safety and security of the radioactive material storage facility**

- See Risk Analysis (Section 5.10)

5.9 Standard Procedures to follow to ensure radiation safety

Radioactive waste management programme and a monitoring programme should follow the following principles as established by the IAEA (1995), The Principles of Radioactive Waste Management, Safety Series No. 111-F, Vienna (1995):

Principle 1: Protection of human health

Radioactive waste shall be managed in such a way as to secure an acceptable level of protection for human health.

Principle 2: Protection of the environment

Radioactive waste shall be managed in such a way as to provide an acceptable level of protection of the environment.

Principle 3: Protection beyond national borders

Radioactive waste shall be managed in such a way as to assure that possible effects on human health and the environment beyond national borders will be taken into account.

Principle 4: Protection of future generations

Radioactive waste shall be managed in such a way that predicted impacts on the health of future generations will not be greater than relevant levels of impact that are acceptable today.

Principle 5: Burdens on future generations

Radioactive waste shall be managed in such a way that will not impose undue burdens on future generations.

Principle 6: National legal framework

Radioactive waste shall be managed within an appropriate national legal framework including clear allocation of responsibilities and provision for independent regulatory functions.

Principle 7: Control of radioactive waste generation

Generation of radioactive waste shall be kept to the minimum practicable.

Principle 8: Radioactive waste generation and management interdependencies Inter-dependencies among all steps in radioactive waste generation and management shall be appropriately taken into account.

Principle 9: Safety of facilities

The safety of facilities for radioactive waste management shall be appropriately assured during their lifetime.

In addition, all the procedure to ensure safety will follow the following:

1. ISO 2919:2012: Radiological protection - Sealed radioactive sources - General requirements and classification

ISO 2919:2012 establishes a classification system for sealed radioactive sources that is based on test performance and specifies general requirements, performance tests, production tests, marking and certification. It provides a set of tests by which manufacturers of sealed radioactive sources can evaluate the safety of their products in use and users of such sources can select types which are suitable for the required application, especially where protection against the release of radioactive material, with consequent exposure to ionizing radiation, is concerned. ISO 2919:2012 can also serve as guidance to regulating authorities.

The tests fall into several groups, including, for example, exposure to abnormally high and low temperatures and a variety of mechanical tests. Each test can be applied in several degrees of severity. The criterion of pass or fail depends on leakage of the contents of the sealed radioactive source. Although ISO 2919:2012 classifies sealed sources by a variety of tests, it does not imply that a sealed source will maintain its integrity if used continuously at the rated classification. For example, a sealed source tested for 1 h at 600 °C might, or might not, maintain its integrity if used continuously at 600 °C.

ISO 2919:2012 makes no attempt to classify the design of sources, their method of construction or their calibration in terms of the radiation emitted. Radioactive materials inside a nuclear reactor, including sealed sources and fuel elements, are not covered by ISO 2919:2012.

2. IAEA Standards, and Guidelines

- IAEA (1991). Nature and Magnitude of the problem of spent radiation sources, IAEA-TECDOC-620, Vienna, Austria.
- IAEA (1995). The Safe Use of Radiation Sources, Training Course Series No. 6, p. 302, Vienna, Austria.
- IAEA (1996). International Basic Safety Standards for Protection Against Ionizing Radiation and for Safety of Radiation Sources, Safety Series No. 115, Vienna, Austria.
- IAEA (2012). Regulations for safe transport of Radioactive Material, Safety Standards Series No. SSR-6 (ST-1, Revised), Vienna, Austria.
- IAEA (2000). Handling, Conditioning and Storage of Spent Sealed Radioactive Sources, IAEA-TECDOC-1145, Vienna, Austria.
- IAEA (1995). The Principles of Radioactive Waste Management, Safety Series No. 111-F, Vienna (1995)

5.10 Risk Assessment

With all the above factors taken into consideration, a risk assessment can be carried out.

Any occupational safety and health legislation usually demands that a risk assessment be carried out prior to making any intervention. Therefore, the shifting of the Spent Source Storage Facility to a new location also warrants a risk assessment be carried out prior to its implementation. This will ensure that the risk is managed to a level which is as low as is reasonably practical (ALARP). The assessment that has been carried out has focused on the following:

- Identification of hazards
- Identification of all the affected parties by the hazard and how they will be exposed to the hazard
- Evaluation of the risk
- Identification and prioritization of appropriate mitigation measures

The calculation of risk is based on the likelihood or probability of the harm being realized and the severity of consequences (See Figure 15 for the criteria).

Risk = Severity of Exposure x Likelihood (Frequency)

This assessment will be followed up, updated and reviews periodically by the SLAEB with close consultation of the SLAERC, whenever there is significant change in practices.

Once recommended controls are implemented, the risk has been re-calculated to determine the residual risk and to see whether it is acceptable to all the stakeholders.

Sample Risk Assessment

The following Risk Assessment has been carried out specific to this project only, and should be considered as indicative. The SLAEB will carry out a detailed and a comprehensive Risk Assessment prior to their commencement of operations at the new Facility.

1. Persons at Risk

The maximum number of employees/workers who may be involved in collection, transportation and in the operations within the Facility should be identified. All of them should be properly and extensively trained personnel on radiation safety. Also, note down all the "other persons involved" (not radiation workers) who may be affected by the collection, transportation and operation of the Facility (e.g., administrative staff other than technical staff who are routinely involved in the operations of the facility, security, general public, etc.).

2. Dose Assessment

The whole body and extremity dose rates (mSv/h) should be calculated using expert knowledge, past experience and international norms and Standards.

The maximum time to be spent has to be estimated with the radionuclide per year or per exposure session for both a whole body and extremity dose and the maximum activity to be used.

To calculate $E_{WB(b)}$ and $E_{EX(b)}$, the following assumptions are made:

Whole body dose $E_{WB(b)}$:The radiation work will be at an approximate distance of 30 cm from the body. If this is not the case, then the inverse square law must be used to correct for the distance used.

Extremity dose $E_{EX(b)}$: Radiation work entails handling radionuclide with direct contact thereby increasing the extremity dose.

These dose estimations are <u>before</u> control measures are put in place.

The data obtained from dose meter readings, the likely annual doses are calculated for the two situations **before** any control measures have been put in place. For those who are exposed intermittently, it may be more suitable to calculate the dose per exposure session rather than an annual dose which may be very difficult to estimate.

3. Determination of Severity Score for Whole Body Dose

<u>Step 1: Radiation Probability Calculation</u>

To provide a Risk Rating parallel with the scheme adopted for other risks, a pessimistic multiplicative risk probability (P) is set up looking at the number of people (*N)* involved in a work activity, and their estimated maximum annual whole body dose (*E)* arising from that work activity and the radiation risk probability coefficient (C). i.e., P = N x E x C

(Source: Risk assessment for a radionuclide area – Nuclear Medicine communications 2003, 24: 1017-31)

For effective doses less than or equal to 200 mSv, $C = 0.5 \times 10^{-4}$ otherwise $C = 1.0 \times 10^{-4}$

As the dose for most situations is < 200 mSv a year, C is normally 0.5×10^{-4}.

Table 11 has been simplified to include C. Therefore the Radiation Risk Probability (P) may be calculated using:

$$P = N \times E$$

P is for the whole body dose, not extremity or skin dose. P should be calculated before the control measures are in place and noted.

<u>Step 2: Obtaining the Severity Score *for Whole Body Dose*</u>

After calculating P, use Table 11a to obtain the appropriate severity level, using the column corresponding to the number of people affected. The colour/pattern obtained corresponds to a consequence score (1 – 5) given in table 2a. Note the score for each hazard in the boxes provided.

Table 11a. Risk Probability for WBD

Risk Probability		
Individual	**2 – 10 people**	**11 – 100 people**
> 2,000	> 20,000	> 40,000
200 – 2,000	2,000 – 20,000	20,000 – 40,000
20 - 200	200 – 2,000	2,000 – 20,000
2 - 20	20 – 200	200 – 2,000
0.2 – 2	2 – 20	20 - 200
0.02 – 0.2	0.2 – 2	2 - 20
< 0.02	< 0.2	< 2

Table 11b. Severity score

Severity score		
5	Catastrophic	
4	Major	
3	Moderate	
2	Minor	
1	Negligible	

(Source for Tables 11a and 11b: Risk assessment for a radionuclide area – Nuclear Medicine communications 2003, 24: 1017-31)

4. Determination of Severity Score for Extremity and Skin Doses

For skin and extremity doses, the consequence score can be obtained from Table 12.

(Do not multiple by number of persons involved.)

Table 12. Severity score for Extremity and Skin Doses

Severity score		Annual Dose (mGy)	Reasons for categorization
5	Catastrophic	> 50,000	Skin Necrosis
4	Major	2,000 – 50,000	Below erythema level
3	Moderate	150 – 2,000	500 : legal limit , < 2 Gy early transient erythema – ICRP85
2	Minor	50 – 150	< 150 : non classified level
1	Negligible	< 50	(100 mGy) No clinically relevant functional impairment – ICRP 103 including non-radiation worker (50 mGy)

5. Obtaining the Likelihood Score

The likelihood score (between 1 – 5) can be obtained from theTable13 for each hazard and then noted down in the boxes provided

Table 13. Likelihood of the incident occurring

Score	Frequency	Description
1	Rare	This will probably never happen or recur
2	Unlikely	Do not expect it to happen or recur but it is possible it may do so
3	Possible	Might happen or recur occasionally
4	Likely	Will probably happen or recur, but it is not a persisting issue / circumstance
5	Almost Certain	Will undoubtedly happen or recur, possibly frequently.

6. Obtaining the Risk Score

The risk is the likelihood of harm occurring together with an indication of how serious that harm could be.

Risk Rating = Likelihood score x Severity score

Using Table 14, find the risk rating (1 – 25).

Table 14. Risk Rating

SEVERITY	LIKELIHOOD				
	Rare (1)	**Unlikely (2)**	**Possible (3)**	**Likely (4)**	**Almost certain (5)**
Catastrophic (5)	5	10	15	20	25
Major (4)	4	8	12	16	20
Moderate (3)	3	6	9	12	15
Minor (2)	2	4	6	8	10
Negligible (1)	1	2	3	4	5

The risk rating (between 1-25) corresponds to a risk score as given in Table 15.

Table 15. Risk scores and actions needed as a result of heightened risk

Risk Score	Risk	Description
1	**Negligible risk (Very low priority)**	No action is needed
2-3	**Very Low risk (Low priority)**	Local investigation where appropriate by SLAEB
4-8	**Low risk (Medium Priority)**	Contributory factor(s) to be identified; discuss with SLAERC the need for any changes in practice, policies, procedures, education or training.
9-12	**Moderate risk (High Priority)**	Identify contributory factors. Discuss at a radiation governance meeting chaired by the SLAERC. Action plans to be monitored centrally under the supervision of SLAERC.
15-25	**High risk (Urgent action)**	Report incident immediately to SLAERC and the Ministry. Full investigation to be undertaken including interview with staff and identification of root causes. Action plans to be monitored by SLAEB and reported to the SLAERC and the Ministry.

Criteria for Risk Assessment as suggested by RoSPA in 2013 and the International Commission on Radiological Protection (2007)

(Source: RoSPA: Royal Society for the Prevention of Accidents)

7. Radiation Risk Quantification after control measures are in place

Assess what the doses will be (as above) after control measures are put in place and note these down. Again these values should be annual doses.

The limit for non-classified workers and members of the public are given in Table 16. Pregnant staff may come under the category of "members of the public" in this exercise. If any of the annual dose values after control measures have been adopted exceeds the respective limits given in Table 16 then further action needs to be taken reduce this to within the limits. If this is not possible, then the member of staff would need to be classified.

Calculate the risk probability (described above) using the dose estimations **post** control measures $E_{WB(a)}$ and $E_{EX(a)}$. Obtain the consequence score, the likelihood rating and the risk score as before (See Table 17).

Table 16. The limit for radiation exposure

	Non-classified Radiation workers (mSv)	**Members of the public (mSv)**
Whole body	6	1
Extremities	150	50
Skin (Contamination)	150	50

Source: ICRP, 2007. The 2007 Recommendations of the International Commission on Radiological Protection. ICRP Publication 103. Ann. ICRP 37 (2-4).

5.11 Strategies to Manage Sealed Spent Radioactive Sources

The following strategy has been suggested by the Handling, Conditioning and Storage of Spent Sealed Radioactive Sources IAEA, Vienna (2000) IAEA-TECDOC-1145. When a SRS is no longer to be used for its dedicated purpose, the following management options may be considered:

- Transfer to another user for application elsewhere;
- Return to the manufacturer/supplier;
- Storage for decay of sources containing radionuclides with short half-life, followed by discharge as non-radioactive material;
- Transportation to a centralized interim storage facility until a conditioning facility is available;
- Transportation to a central conditioning facility for conditioning followed by interim storage;
- On-site conditioning of the source (at the user's premises) followed by interim storage until a centralized storage/disposal facility is available;
- Transportation of the conditioned source to a disposal facility if available;
- Final disposal in a licensed repository.

An outline scheme for the management of spent (sealed) radioactive sources is given in Figure 15. This Table summarizes the principles discussed above.

Table 17. RISK ASSESSMENT

PROJECT	Retaining the radioactive material disposal facility of the SLAEB at the existing location under the 2nd New Kelani Bridge Project
BRIEF PROJECT DESCRIPTION	Shifting of the Spent Source Storage Facility of the SLAEB to a new facility at the same premises at Orugodawatta

The following risks have been initially identified. This should be reviewed continuously and managed during implementation

S- Severity/Consequence L-Likelihood R- Risk Rating (Please refer Figure 15, for the Risk Rating System)

IDENTIFICATION OF POTENTIAL RISK		INITIAL RISK ASSESSMENT			PROPOSED MITIGATION MEASURES	RESIDUAL RISK			MONITORING MEASURES
		S	**L**	**R**		**S**	**L**	**R**	
1	**Impacts during construction that may lead to radiation leaks/contamination**								
1.1	Cracks appearing on the walls and the slab of the Spent Source Storage Facility due to ground vibration during pile construction	3	3	9 Moderate risk	Following local and international guidelines referred to in Section 5.1, in providing the mitigating measures to prevent any excessive vibration occurring due to construction activities	1	2	2 Very low risk	Ground level vibration monitoring by the Contractor (during construction)
1.2	Damage to the Spent Source Storage Facility during the operation of heavy machinery/vehicles during construction	3	3	9 Moderate risk	Limitation of vibration, erection of fences and barriers, and limitations imposed on vehicular movement, and operations of machinery (see sections 5.2 and 5.3)	1	1	1 Negligible risk	Ground level vibration monitoring by the Contractor and proper scheduling of activities (during construction)
2	**General risks due to exposure to radiation - during and after construction of the bridge**								
2.1	Safety & health of workers due to exposure to radiation (prolonged exposure to ambient levels)	3	3	9 Moderate risk	Use of appropriate shielding, area designation and providing proper protective clothing and equipment, regular checks for radiation exposure, proper training on handling radioactive material (see section 5.7 and 5.9)	2	1	2 Very low risk	SLAEB to monitor the procedures, provide and instruct the employees who are involved in handling radioactive material.

2.2	Safety of the general public including the neighborhood due to exposure to radiation (prolonged exposure to ambient levels)	3	1	3 Low risk	Use of appropriate shielding, area designation and placing of appropriate warnings. Measuring of ambient radiation and taking proper precautions, if needed. (see section 5.9)	1	1	1 Negligible risk	SLAEB to measure ambient radiological parameters, and report to SLAERC at regular intervals.
2.3	Safety and health of workers due to exposure to high radiation (following accidents)	4	2	8 Low risk	Emergency Response Plans will be formulated in line with the provisions of the Act. Facilities and resource needed to face accidents will be procured.	4	1	4 Low risk	SLAEB to report to SLAERC regarding Emergency Response plans. Minister will be kept updated.
2.4	Safety of the general public including the neighborhood due to exposure to high radiation (following accidents)	3	2	6 Low risk	Same as above. Safety procedures will be followed to ensure Radiation Safety as described in Section 5.9.	3	1	3 Very Low risk	Same as above (2.3)
2.5	Exposure to radiation of workers during transportation and/or shifting of radioactive material	2	1	2 Very low risk	Regulations for safe transport of Radioactive Material, Safety Standards Series No. SSR-6 will be strictly adhered to. Radioactive workers will be provided with proper safety clothing and equipment,	1	1	1 Negligible risk	The producer needs to bear the cost of all the precautionary measures, SLAEB to undertake transportation, with necessary approvals from the SLAERC. The safety of the radiation workers will be monitored, by way of measuring the exposure levels (if any).
2.6	Exposure to radiation of general public during transportation and/or shifting of radioactive material	2	1	2 Very low risk	Regulations for safe transport of Radioactive Material, Safety Standards Series No. SSR-6 will be strictly adhered to. Proper security will be provided while radioactive material is being transported.	1	1	1 Negligible risk	
2.7	Environmental damage due to disposal of contaminated material disposal	4	2	8 Low risk	No material radioactive should be disposed. However, contaminated sources may be disposed by third parties, if no proper mechanism is available for them. SLAEB will undertake storage of spent sources in the proposed facility, if needed, with proper instruction obtained from the SLAERC.	4	1	4 Low risk	SLAEB should coordinate the activities with proper approvals from the SLAERC.

3	**Impacts during construction of the bridge and afterwards due to incidents affecting the security of the premises**								
3.1	Unauthorized access into the Spent Source Storage Facility	4	3	12 Moderate risk	Proper security personnel will be placed. Surveillance systems, CCTV cameras, alarm systems, etc. will be in place. Security measure will be reviewed regularly, and the SLAERC and the Ministry will be kept updated. SLAEB will request the Minister to provide support for enactment of proper security measures. The new facility will have two fences built around the property, which will provide better security. The new facility will be built with concrete, which will withstand vibrations,	4	1	4 Low risk	SLAEB to keep the SLAERC informed. Minister will be kept updated.
3.2	Theft	4	3	12 Moderate risk		4	1	4 Low risk	
3.3	Sabotage by individuals or groups	4	3	12 Moderate risk		4	1	4 Low risk	
3.4	Sabotage due to social unrest	4	3	12 Moderate risk		4	1	4 Low risk	The Monitoring committee (See Chapter 6) should monitor the adequacy of security measure to the facility and the Security Plans should be updated regularly, or if needed.
4	**Impacts due to hazards/accidents during and after construction of the bridge**								
4.1	Hazards due to operation of the bridge close to the Spent Source Storage Facility	3	2	6 Low risk	Construction of the ramp bridge with steel girders, strengthening the walls to withstand high impact, raising the walls by extra walls, and imposing strict speed limits along the ramp bridge (max. 40 km/h) – see section 5.4)	2	1	2 Very low risk	The RDA and Consultant will check the designs as mentioned in mitigation.
4.2	Flooding - Local	2	1	2 Very Low risk	Proper drainage management plan will be implemented. The doors of the Facility are sealed to prevent any water entering it. The floor levels have been raised by 600 mm above the final formation ground levels.	1	1	1 Negligible risk	The SLAEB will monitor the adequacy of the drainage network within and in the periphery of the facility.
4.3	Flooding - Hazard	2	1	2 Very Low risk	Floor levels have been raised by 600 mm above final formation ground levels. The location of the facility is above 100-	1	1	1 Negligible risk	No specific monitoring is needed.

				yearflood levels.				
4.4	Fire	2	2	4 Low risk	Fire and smoke detectors will be installed. Fire reels will be provided.	2	1	2 Very low risk	Fire detectors will be routinely checked.
4.5	Other hazards	-	-	-		-	-	-	

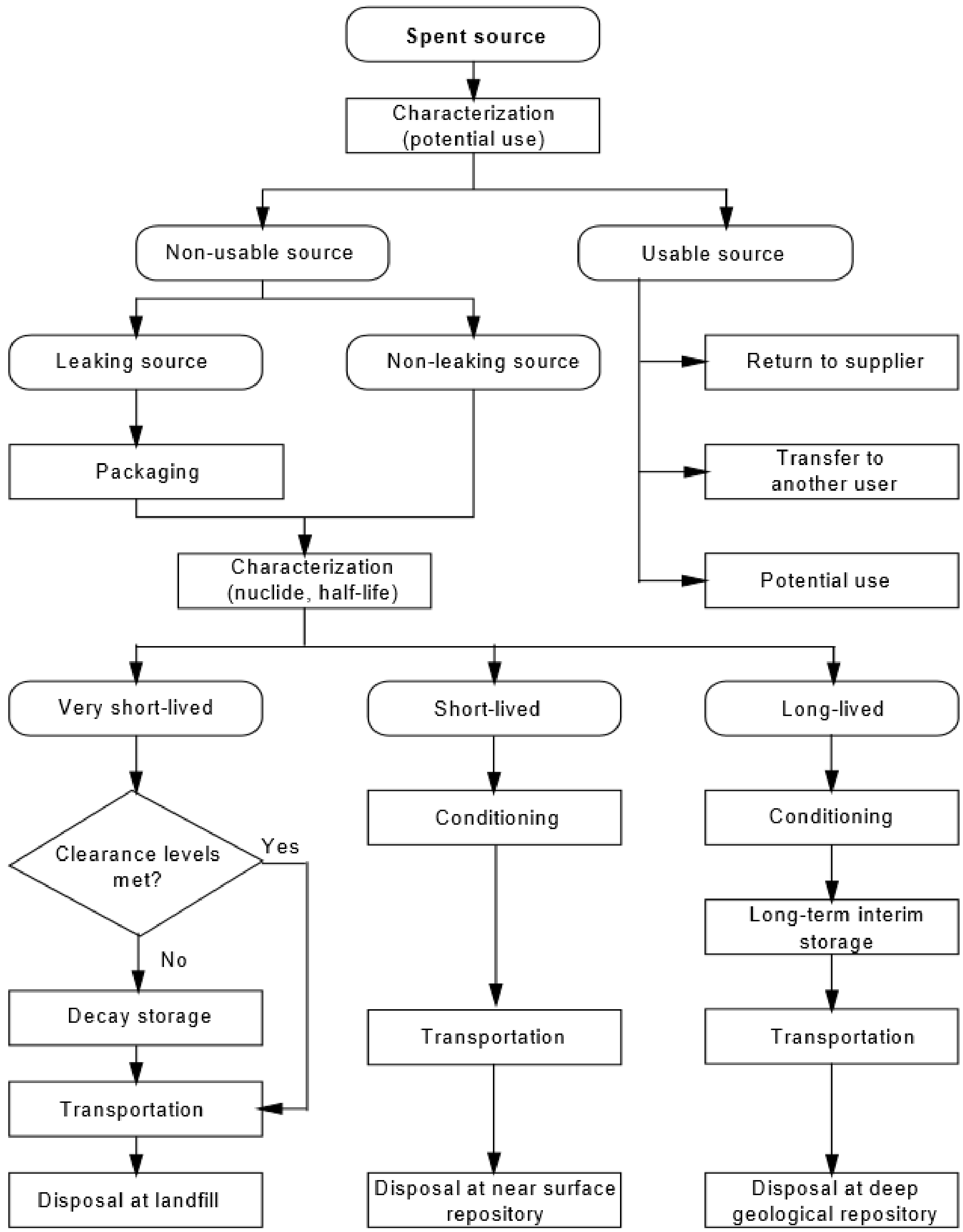


Figure 15. Management options for sealed spent radioactive sources

<u>Source:</u> Handling, Conditioning and Storage of Spent Sealed Radioactive Sources IAEA, Vienna (2000) IAEA-TECDOC-1145.

CHAPTER 6. ENVIRONMENTAL MONITORING PROGRAMME

Radioactive waste management programme and a monitoring programme will follow the following principles as established by the IAEA (1995), The Principles of Radioactive Waste Management, Safety Series No. 111-F, Vienna (1995) are described above in Section 5.8.

Environmental monitoring is required in order to make sure that the anticipated adverse impacts are kept minimal with the implementation of mitigation measures as and when required. The monitoring objectives are therefore focused on the mitigation of likely impacts. In addition, compliance with the existing regulations and legislation is also guaranteed. Table 18enumerates the summary of monitoring required for the relocation of Spent Source Storage Facility.

The Monitoring Program outlines the monitoring objectives, specific information to be collected (by sampling or other means) and the management of construction activities giving mitigation measures for abating or lessening potential environmental impacts. In addition, the parameters to be monitored continually during the project implementation period with the participation of relevant institutions and agencies are also detailed out.

A Monitoring Committee will be established to oversee the process (referred to as 'The Monitoring Committee'). This committee will comprise the following agencies/persons are proposed for monitoring the impact mitigatory process.

- Representatives of SLAERC, SLAEB and the Ministry of Power & Renewable Energy
- Representatives from the CEA

The Monitoring Committee during construction of the bridge will comprise of:

- Representatives of SLAERC, SLAEB and the Ministry of Power and Renewable Energy
- Representatives from the CEA
- Representatives from the RDA, the Consultant of the New Kelani Bridge Project
- Representatives from the Contractors

Table 18. Environmental Monitoring Plan

Specific issue	Monitoring Parameter	Monitoring Frequency and point	Total Time and Period	Responsible agency for monitoring; Facilities available with such agencies Availability of funds, expertise and facilities	Responsible Party for supervision
Radiation monitoring					
Gamma Radiation	(Background level Outside the storage) 1. Ambient Gamma Dose Rate (max. level: 0.2 µSv/h) Contamination Level (max. level: 4 Bq/cm^2)	• Once a year • At the time of sources inserted the storage Note: During construction of the piers of the bridge, the frequency will be once every week During the rest of the construction period the frequency will be once in two weeks Radiation monitoring will be done during the time	Each measurement is generally for 2 hrs.	<u>Responsible agency for monitoring:</u> SLAEB <u>Facilities available:</u> Gamma radiation monitors • Contamination Monitors • In-situ Gamma spectroscopy systems • Personnel Radiation Detectors • Passive dosimeters (TLD) Trained personnel for environmental monitoring and assessment is available at the SLAEB	SLAEB for on-site supervision SLAERC for Off-site supervision The results will be submitted to the Minister.

		of transfer of the radioactive material from the present storage to the new facility. The new facility has to be checked for any radiation leaks		Allocation of funds for environmental monitoring from SLAEB	
Monitoring of vibration					
Ground Vibration	Peak Particle Velocity (ppv) Refer: Proposed air-blast over pressure and ground vibration standards for Sri Lanka – Central Environmental Authority	1. During construction of the bridge: continuous 2. During operations of the bridge: continuous for a period of 3 months, and thereafter as and when needed	Continuous During construction and during operations of the bridge	<u>During Construction of the bridge:</u> Contractor Facilities will be made available by the Contractor Funds to be allocated as part of the project cost <u>During Operations of the bridge:</u> SLAEB	The Contractor to the Environmental Monitoring Officer of the Consultant. Consultant to report to the RDA The RDA to report to SLEAB and SLAERC
Cracks on the walls and slab	Crack width	Visual monitoring	Continuous During	<u>During Construction of the bridge:</u>	

of the Spent Source Storage Facility			construction and during operations of the bridge	Contractor Facilities will be made available by the Contractor Funds to be allocated as part of the project cost <u>During Operations of the bridge:</u> SLAEB	<u>During operations of the bridge:</u> SLAERC
Fire outbreaks	Fire detection	Continuous Inside the Spent Source Storage Facility	Continuous During the operational life of the Spent Source Storage Facility	SLAEB Fire sensors will be installed inside the Spent Source Storage Facility	SLAERC
Breach of Security	Duty rosters and discharge of duties and responsibilities during annual audits	Annually Immediately after such breach of security is detected Immediately after any	Continuous During the operational life of the Spent Source	SLAEB Representative of the IGP as part of responsibilities assigned by the Sri Lanka Atomic Energy Act, No. 40 of 2014	SLAERC Minister IGP

		complaints are made regarding breach of security Immediately after any incidents that may suspected be have occurred due to breach of security	Storage Facility		

CHAPTER 7. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

As discussed in this report in detail, retaining the Spent Source Storage Facility at the present location with the transfer of all the radioactive sources to a newly constructed building and construction of new accommodation facilities (together with security office) within the existing Sri Lanka Atomic Energy Board premises at Orugodawatta would not lead to significant environmental impact, provided that mitigation measures as specified in the report are properly implemented and subsequently monitored. Shifting of the Facility to a different location within the same premises, and transfer the radioactive sources to the new Facility is recommended considering the dilapidated nature of the existing facility. Shifting the facility to a location away from the present location is not acceptable due to public protests.

Construction of the New Kelani Bridge can be carried out without causing any negative consequences on the new Spent Source Storage Facility, notable vibration control measures enacted and structural stability of the building ensured by following relevant Standards, Guidelines and good construction practices.

Occurrence of natural hazards (e.g., floods) is a very rare incidence; however, proper mitigation measures are suggested even to ensure safety of the facility with unlikely events such as fire, sabotage, etc. Proper security measures, surveillance systems, emergency preparedness, contingency management plans, will ensure satisfactory functioning of the new Facility. .

Radiation safety can be ensured effectually and the SLAEB has the capacity to undertake the operations of the Spent Source Storage Facility. The risk assessment that has been carried out show that the residual risk is either ‘negligible risk’ or ‘very low risk’ with proper mitigation and subsequent monitoring measures are in place with effective implementation processes.

The proposed project will therefore be carried out together with the implementation of mitigation measures stated in this report. Following recommendations can be extracted from the foregoing description:

Recommendations

(a) Planning of the new Spent Source Storage Facility

This should be done according to the conditions laid down by the SLAERC (See Annex 3-1) and specifications provided by the SLEARC (See Annex 3-3)

Compliance with these conditions will ensure that SLAEB will abide by the condition identified by the Sri Lanka Atomic Energy Act, No. 40 of 2014. The specifications for the new facility building and the premises would comply with IAEA Standards and guidelines, hence, following these for specifications will ensure radiation safety, proper installation of security surveillance systems, appropriate enactment of security measures, including guards, easy facilitation and prompt action to be taken in cases of emergency, sabotage, accidents, etc. and will ensure smooth operations of the facility.

Elevating the floor level by 600 mm will ensure the facility will be above the flood levels.

(b) Guarantee safety by ensuring that the Spent Source Storage Facility is not affected during the construction of the New Kelani Bridge and subsequent operation of the bridge

Follow the Vibration Standards and limit any construction activities which produce excessive levels of vibration by following standard practices as suggested in Section 5.1.

The safety of the facility has to be ensured during the movement of heavy machinery during construction of the bridge. Also, ensure the safety of the facility during the operations of the bridge by following mitigation strategies as given in Section 5.3 and 5.4.

(c) During storage, ensure radiation safety by following Standards, Guidelines and good practices as suggested by the SLAERC (Annex 3-1) and Section 5.7 and 5.9.The sources should be transported under the approval of SLAERC following international radioactive material transport regulations.

(d) Make sure that the Security measures are adequate and would not be compromised at any instance in the foreseeable future (Section 5.8).

(e) Proper monitoring of environmental impacts (including radiation levels), safety and security measures is needed to ensure proper operations of the Facility. Also, the Risk Assessments have to be carried out as a regular exercise, which would enable the SLAEB to identify any mitigation measures to be taken when and where appropriate.

(f) Following proper management options for spent radioactive sources (refer Figure 15) can be recommended for minimizing the number of sources that need storage in the Facility.

Annex 1. Terms of Reference

TERMS OF REFERENCE

This ToR is valid only for one and half years from the date of issue.

This ToR is only a guideline document. Required information on impacts, mitigation measures etc. which will be useful in decision making should be incorporated in the EIA report based on the findings of the EIA study.

Project Name : Retaining of the radioactive material disposal facility of the SLAEB at the existing location with strengthening of the structure under the Second New Kelani Bridge Project.

Project Proponent : Road Development Authority

Project Approving Agency : Central Environmental Authority

Report requirement : Supplemental report to the EIA report dated August 2013

Report format :

Executive summary

1. Introduction
2. Description of the project (project alteration) and reasonable alternatives
3. Description of the existing environment
4. Anticipated environmental impacts of the project (project alteration)
5. Proposed mitigatory measures
6. Environmental monitoring program
7. Conclusion and recommendation

Annexure

- i. **Terms of Reference**
- ii. References
- iii. Sources of data & information
- iv. List of preparers including their work allocation and time schedules. (The report should be authenticated by the preparers)
- v. Complete set of relevant maps, tables, charts, layout plans and other details

2. INTRODUCTION

This chapter should include the following

1.1 Background of the project (Identify the development project to be assessed, a brief history of the project, its current status and timetable and the current status and progress of the planned road project).

1.2 Objective and justification of the project.

(Summarize the need or problem been addressed by the project and how the project is expected to resolve the problem)

1.3 Objectives of the Supplemental Report to EIA (SEIA).

(Specify the objectives of the assessment and the relationship of the results to project design and implementation)

1.4 Methodologies and technologies adopted in SEIA report preparation.

1.5 Government policy regarding the project.

1.6 Preliminary clearances/approvals for the project obtained from the state agencies such as Sri Lanka Atomic Energy Regulatory Council and conditions laid down by such agencies in granting such clearances/approvals.

1.7 Compatibility of the proposed project with the proposed/planned developments within the area including the planned highway.

3. DESCRIPTION OF THE PROPOSED PROJECT (ALTERATION) AND REASONABLE ALTERNATIVES

Following details should be given in order to get a clear picture of the project.

2.1 Project Location

- Location, indicating the Divisional Secretariat Division and the Local Authority within which the project site falls. Clear coloured and readable maps at appropriate scale or satellite images should be given in order to identify the exact location of the project.
- Land extent, ownership of the land (ownership of the land after implementation of the New Kelani Bridge project should be clearly indicated).

2.2 Project components

- Details of the radioactive waste storage facility and other facilities such as offices to be established within the project site. Details of the followings should be provided in this regard.
  - Types of radioactive material to be handled, stored including their nature, quantity/quality, half-life etc.
  - Method of storage of radioactive material. Give specification of the radioactive material storage facility and method of storage of each type of wastes.

- Management of the radioactive material storage facility including method/s of transporting, handling, loading, unloading of radioactive material. Give specification for such transporting, handling, loading and unloading.
    - Minimum safe buffer zone requirement from such activities to other land uses such as highways, human settlements etc.
    - The existing laws, regulations, norms, guidelines on the above all and compliance with the same need to be given.
- The layout plan of the project, indicating all the project components such as;
    - Radioactive material storage facility, handling, loading, unloading areas.
    - Office, security building, buffer zone to be maintained.

(The above layout plan should be depicted in the survey plan of the project area).

- Water requirement including quantity & quality and source/s. (if any)
- Types of material generated from the radioactive material storage facility (if any) including their quantity, quality, level of contamination by radioactive substances/radiation etc. The method of containment, treatment and final disposal of such materials.
- Safety measures to be maintained at the radioactive material storage facility both during construction and operation stages.
- Security arrangements to be maintained at the radioactive material storage facility both during construction and operation stages.
- Other resources/ requirements needed.
- Details of any phased development activities envisaged (if any).

2.3 Construction Procedure

- Construction activities, construction responsibility of the radioactive material storage facility etc. and the staff (workforce) requirement.

2.4 Operational procedure

- Operation activities, operation responsibility of the radioactive material storage facility and the staff (workforce) requirement.
- Responsibility of providing security for the above facilities including access control for unauthorized persons.

2.5 Evaluation of Alternatives

Describe reasonable alternatives considered in the course of developing the proposed project (e.g. Siting alternatives, design alternatives, technology selection, construction techniques etc.).

Include the alternative of not construction the project in order to demonstrate environmental conditions without it.

Compare alternatives in terms of potential environmental impacts, mitigatory measures, capital and operating costs, reliability, etc.

Comparison of the alternatives considered and recommendations should be given, including justification for selecting the proposed option from all the alternatives considered.

4. DESCRIPTION OF THE EXISTING ENVIRONMENT

STUDY AREA

The study area for the assessment shall include the following;

- Project site
- Any area beyond the project site where there is potential for environmental impacts

Special attention should be given to provide information on the following;

- Details on any incompatible socio –economic, socio cultural attributes as given below within the area influenced by the project activities together with the sensitivity (distance and significance).
- Human settlements
- Transport systems (roads/bridges)
- Any other such as susceptibility for natural hazard such as floods

5. ASSESSMENT OF ANTICIPATED ENVIRONMENTAL IMPACTS

This chapter should show the overall effects of the project on the individual environmental components including physical, biological and socio economic-cultural during the both construction (if any) and operation of the project. Impacts should be considered in terms of magnitude, severity, duration, frequency, risk and indirect effects.

Impacts should be addressed in the order of priority. Impacts that are significant should be quantified to the extent of possible using appropriate techniques.

Special attention should be given to the followings;

- Risks of exposure to high radiation by employees, public, other socio economic and socio cultural attributes during transporting, handling of radioactive materials, operation of radioactive material storage facility.
- Risks of accidental release of radiation due to any unusual occurrences/incidents such as accidents, fire, natural hazards etc. A risk assessment needs to be carried out for the probability of having such incidents.
- Impacts on the environmental components such as air, soil, groundwater, surface water, storm water etc. due to contamination by radiation, radioactive wastes during transporting, handling, operation of radioactive material storage facility and due to unusual occurrences such as accidents, fire, natural hazards etc.
- Impacts on the environment due to discharge/disposal of other liquid/solid materials.
- Impacts to the radioactive material storage facility by construction and operation of the 2nd New Kelani Bridge Project.
- Socio-cultural and socio-economic benefits to the country.

6. PROPOSED MITIGATORY MEASURES

- This chapter should set out the proposed measures to minimize the impacts identified in Chapter 4 to acceptable levels (in that order of priority) including conformity to laws, regulations, norms, guidelines. Mitigation methods should be defined in specific practical terms. A rationale should also be presented for selection of chosen mitigatory measures.
- Emergency response system/safety arrangement plan for any release of radiation due to accidental fire, damages to structures of the storage facility giving special reference to possible damages that may cause by the construction and operation of the New Kelani Bridge Project any other natural hazard such as floods etc. This plan should include;
    - Types of emergencies which could handled.
    - Facilities available/required at the site for such handling.
    - Methods of recovery, containment, treatment of contaminated environment (water, soil etc.)
    - Analysis of the effectiveness of the measures proposed for mitigation of the effects of external events that could be adversely affect the safety and security of the radioactive material storage facility.

6. ENVIRONMENTAL MONITORING PROGRAMME

A suitable monitoring programme including in-situ monitoring programme, parameters to be monitored, frequency of monitoring of such parameters, responsible persons/agency for monitoring in order to make a continuous assessment of the state of the environment should be given.

An effective reporting procedure should be outlined. Availability of funds, expertise, facilities for monitoring purpose should be mentioned.

7. CONCLUSION AND RECOMMENDATION

The environmental acceptability of the proposed project and key findings and

recommendations of the assessment should be given.

Any programme to improve general environmental conditions can also be stated here.

Annex 2. List of preparers of the SEIA Report

Table A 2. List of Preparers

Name	Designation	Signature
Eng. Dr. Jagath Manatunge	Team Leader/Environmental Specialist/Chartered Civil Engineer	
Dr. PM Digana Bandara	Environmental Specialist	
Eng. Dr. Nalin de Silva	Geotechnical Engineer	
Eng. Dr. Lalith Rajapakse	Hydrologist	
Officials of SLAEB and SLAERC	Radioactive and source information; security and safety issues, etc.	

Annex 3-1a: Conditions laid down by the Atomic Energy Regulatory Council (SLAERC)

ලිපිනය : තෙවන මහල, NCNDT ගොඩනැගිල්ල, අංක 977/18, නුවර පාර, බුලුගහ හන්දිය, කැළණිය, ශ්‍රී ලංකාව.

முகவரி : 3 ஆவது மாடி, NCNDT கட்டிடம், இல. 977/18, கண்டி வீதி, புழுகஹ சந்தி, களனி, இலங்கை.

Address : 3rd Floor, NCNDT Building, No. 977/18, Kandy Road, Bulugaha Junction, Kelaniya, Sri Lanka.

සභාපති / தலைவர் / Chairman : 94-11-3054804

අධ්‍යක්ෂ / பணிப்பாளர் / Director : 94-11-2987858

දුරකථන / தொலைபேசி / Telephone: 94-11-2987860

ෆැක්ස් / தொலைநகல் / Fax : 94-11-2987857

ඊ-මේල් / மின்னஞ்சல் / E-mail : officialmail@aerc.gov.lk

වෙබ් අඩවිය / இணையத்தளம் / Web : www.aerc.gov.lk

මගේ අංකය / எனது இல. / My No. AERC / Gen / 03 / B1/ 04

ඔබේ අංකය / உமது இல. / Your No.

14th January 2016

Project Director,
New Bridge Construction Project over the Kelani River,
Road Development Authority, No.981/5, B1, Diyawanna Place,
Sri Jayawardanapura Mawatha, Rajagiriya

Security Arrangements for Spent Source Storage Facility of SLAEB

This is to inform you that the following security arrangements should be provided to the spent source storage facility which will be listed as requirements to be implemented by the Sri Lanka Atomic Energy Board once the plan is approved by the Sri Lanka Atomic Energy Regulatory Council.

1. Protective Secured Main Gate with POPUP Barrier / Employee Entrance to be separated
2. Guard room with 24 Hour Security
   - CCTV Monitor
   - Alarm Monitor with Map and CCTV integration
   - Panic duress Button
   - Walkie Talkies
   - Torch
   - Siren Alarm
   - Mobile Panic Buttons
   - Console for all equipment.
   - Doors and Windows must be protected.
3. Complete Protected Perimeter Fence
   CCTV Perimeter Protection
4. Storage Building
   - Steel Protective Doors with two Paddlocks/Keylocks (highly Secured type)
   - Access Control - Bio Metrics plus card plus PIN for all entrance and exit doors with two man rule
   - Balanced Magnetic Switches on the doors
   - Panic duress Button in all rooms and all areas inside the building
   - Motion Sensors in All rooms
   - CCTV Camera Coverage of main entrance and exits from Outside
   - CCTV Camera Coverage of Main entrance and exits from inside
   - CCTV Camera Coverage in All rooms
   - Keypad Arm and Disarm inside the premises just near exit and entry points
   - Radiation Monitor integrated with Alarm System
   - CCTV Recording in secured Cabinet (60 days Storage)
   - Remote Alarm Monitoring Capability and CCTV Monitoring
   - Backup Power to cover 24 hours for all equipment installed
   - Tamper Switch for all panels and housings
   - Lightening protection

5. Safety Issues must be considered including firefighting/protection and Detection Equipment

6. Maintenance - At Least for Five Years

Thanking You,

Director General,
Sri Lanka Atomic Energy Regulatory Council

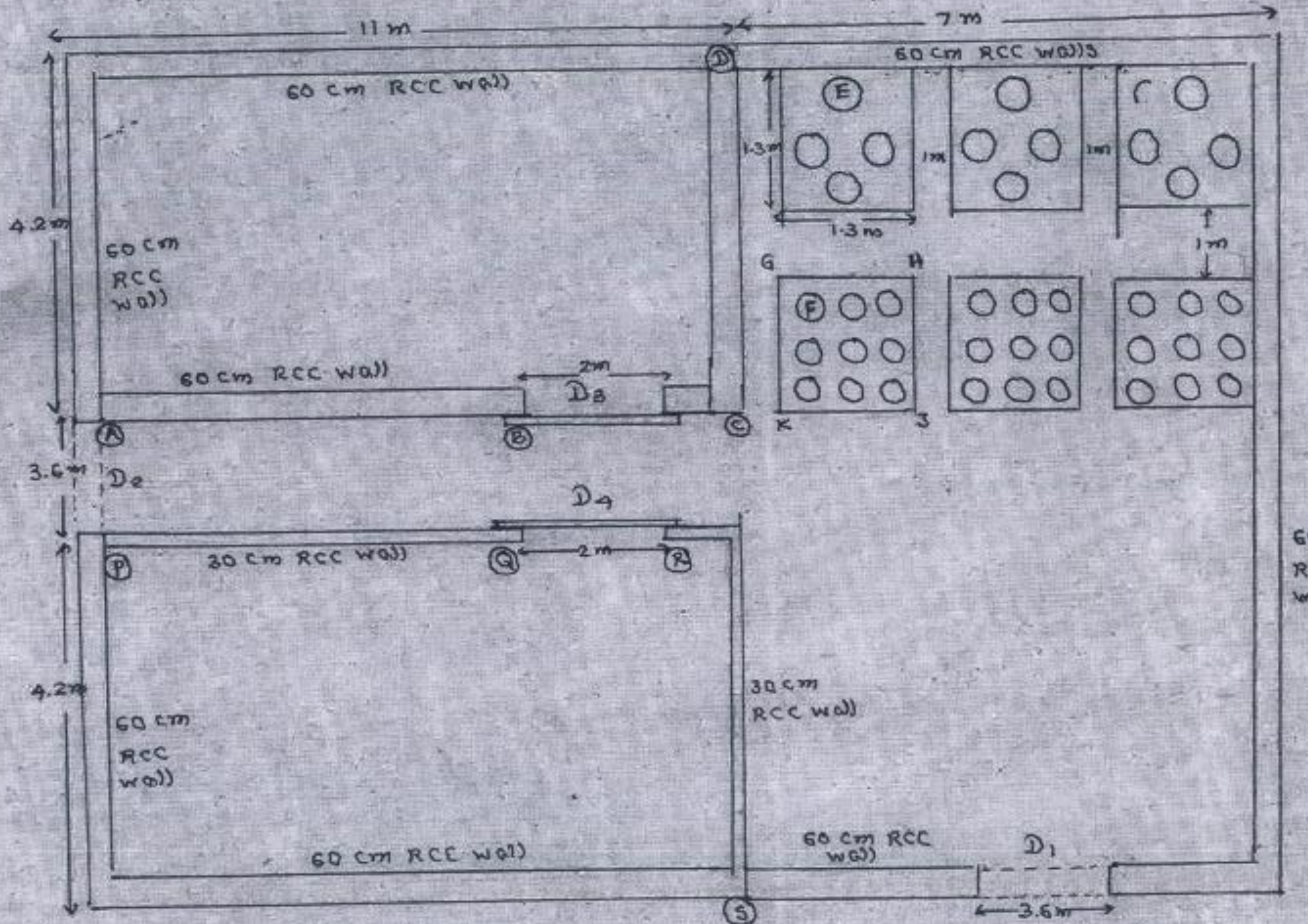
H.L. Anil Ranjith
Director General
Sri Lanka Atomic Energy Regulatory Council

Annex 3-1b. Approval from the Board of Atomic Energy Regulatory Council (SLAERC)

Pending

Annex 3 - 2. Layout plan and Requirements for the Spent Source Storage Facility specified by the SLAERC

PROPOSED RADIOACTIVE WASTE STORAGE BUILDING SLAEB



Total Area = 12 x 18 = 216 m²

To locate WS at AEB - Orugodawatta.

18.12.15
forwarded by
AERC

Specifications.

1) D_1, D_2 - Roller Doors.

2) D_3, D_4 - 4mm thick lead doors / sliding

3) The walls designated as AB & CD should be built up to the slab level.
Two exhaust fans should be fitted to the walls of the room for ventilation.

4) The walls designated as PQ & RS should be built up to 2.5 m from the finished floor level.
Two exhaust fans should be fitted to the walls of the room for ventilation

5) The thickness of the slab should be 20 cm concrete.

6) Concrete holes with concrete lids should be provided as per the specification given below.
Three exhaust fans should be fitted to this area.

<u>Hole - E</u> Diameter - 30 cm
Depth - 30 cm
<u>Lid</u> Diameter - 30 cm
Height - 4 cm

<u>Hole F</u> Diameter - 20 cm
Depth - 30 cm
<u>Lid</u> Diameter - 20 cm
Height - 4 cm

7) The height of the concrete cube designated as GHJK should be 60 cm from the finished floor level.

8) The minimum height of the foundation of the entire building should be 60 cm.

[signature] 18.12.2015
Kapila De Silva
Senior Scientific Officer
Atomic Energy Regulatory Council

Annex 3-3. Acceptance of the building plan by the SLAEB

විදුලිබල හා පුනර්ජනනීය බලශක්ති අමාත්‍යාංශය
மின்வலு மற்றும் மீள்புத்தாக்க சக்தி அமைச்சு
Ministry of Power and Renewable Energy

ශ්‍රී ලංකා පරමාණුක බලශක්ති මණ්ඩලය
இலங்கை அணுசக்தி அதிகார சபை
SRI LANKA ATOMIC ENERGY BOARD

අංක 60/460, බේස්ලයින් පාර, ඕරුගොඩවත්ත, වැල්ලම්පිටිය, ශ්‍රී ලංකාව.

இல. 60/460, பேஸ்லைன் வீதி, ஒருகொடவத்தை, வெல்லம்பிட்டி, இலங்கை.

60/460, Baseline Road, Orugodawatta, Wellampitiya, Sri Lanka.

මගේ අංකය / எனது இல. / My No.

ඔබේ අංකය / உமது இல. / Your No.

21.12.2015

Eng. DarshikaJayasekara
Project Director,
New Bridge Construction Project over Kelani River,
No 981/5B1, Diyawanna Place,
Sri JayawardanapuraMawatha,
Rajagiriya

Supplementary EIA (SEIA) to Retain the Spent Source Facility at the Same Location

Projects; **Relocation of Atomic Energy Authority (AEA) at Malabe and Expansion of its Office and Laboratory Facilities – Phase 1 & 2**

This refers to your letter Ref.MOH/NKB/ENG/MA1/AEB, addressed me and dated 14/12/2015 regarding the above subject.

We have no objection for including the location shown in the attached drawing as an alternative location for the **Spent Source Storage Facility** in the SEIA.

Please note that correct name of the facility is **"Spent Source Storage Facility"**.

Director General
Sri Lanka Atomic Energy Board

Annex 3-4: Details of Borehole Logs at the locations for the two piers

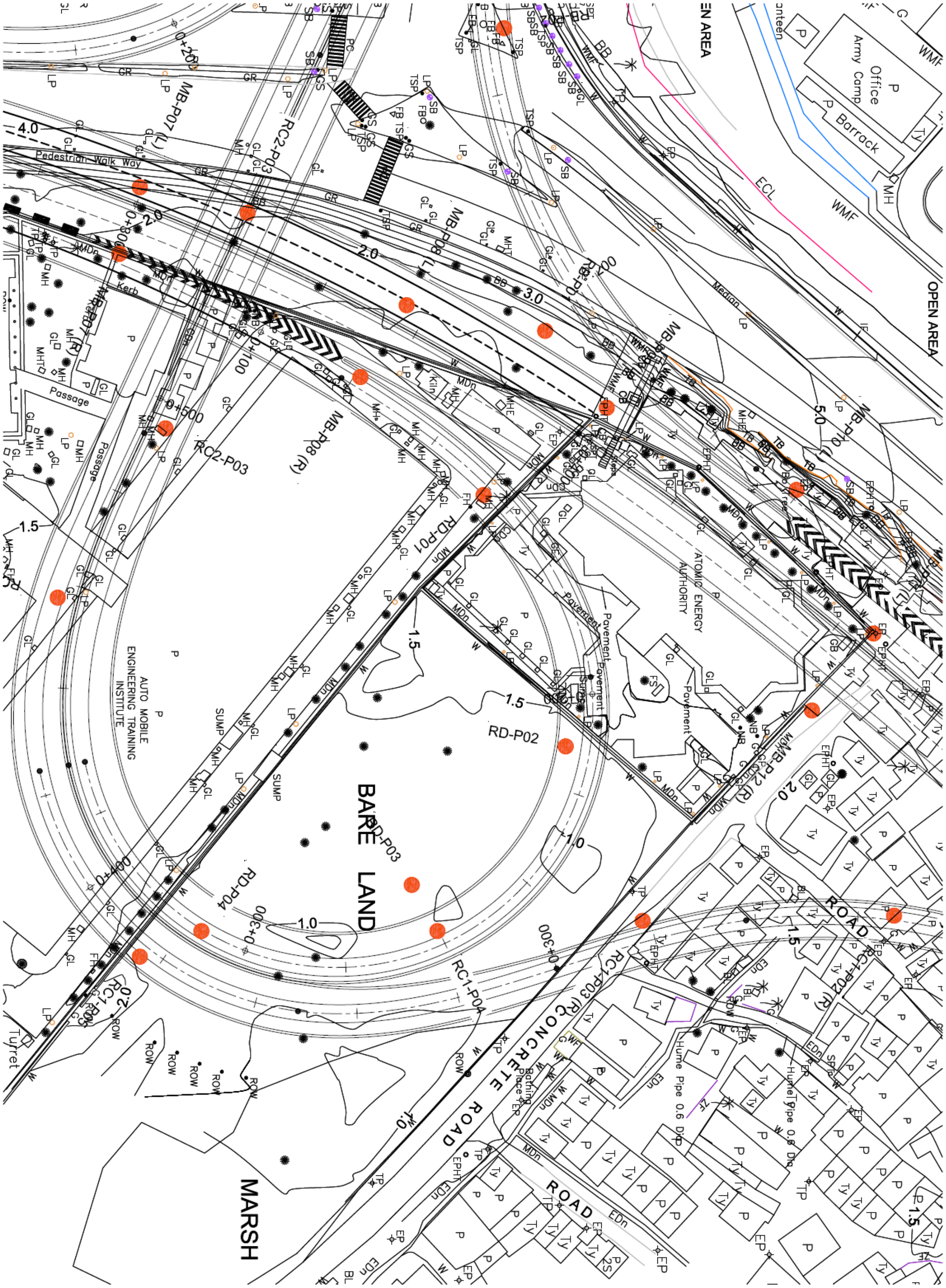
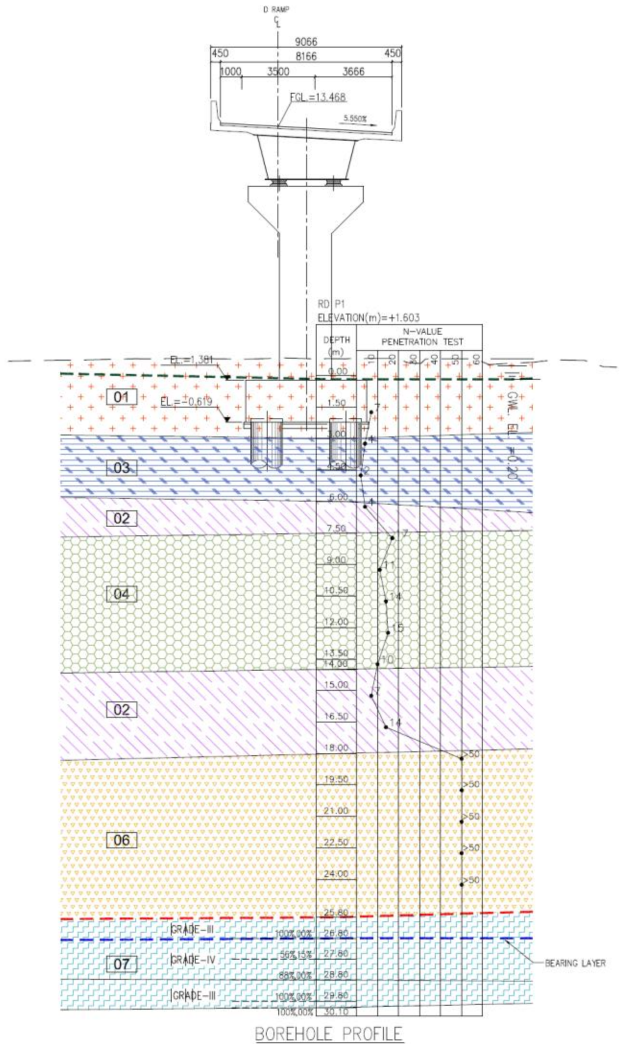


Figure 3-2-1. Borehole locations



BOREHOLE PROFILE

SCALE 1:200

LEGEND:

- 01 FILL MATERIAL MIXTURE OF SAND, SILT, CLAY OR GRAVEL
- 02 SOFT CLAY/ORGANC CLAY/ PEAT
- 03 LOOSE TO MEDIUM DENSE SAND
- 04 FIRM TO VERY STIIF CLAY
- 05 MEDIUM DENSE TO VERY DENSE SAND
- 06 COMPLETELY WEATHERED ROCKS
- 07 SLIGHTLY TO MODERATELY WEATHERED ROCK
- GROUND WATER LEVEL (GWL)
- ROCK LEVEL
- GRADE III OR ABOVE

Original Drawing Size A3

DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF HIGHWAYS, HIGHER EDUCATION AND INVESTMENT PROMOTION
Road Development Authority

Oriental Consultants Company Limited
Katahira & Engineers International
in association with
Consulting Engineers and Architects Associated (Pvt.) Ltd.
Project Management Associate International (Pvt.) Ltd.

JICA FUNDED
NEW BRIDGE CONSTRUCTION PROJECT OVER THE KELANI RIVER
CONTRACT No: RDA/NKBCP/JICA/CS/04

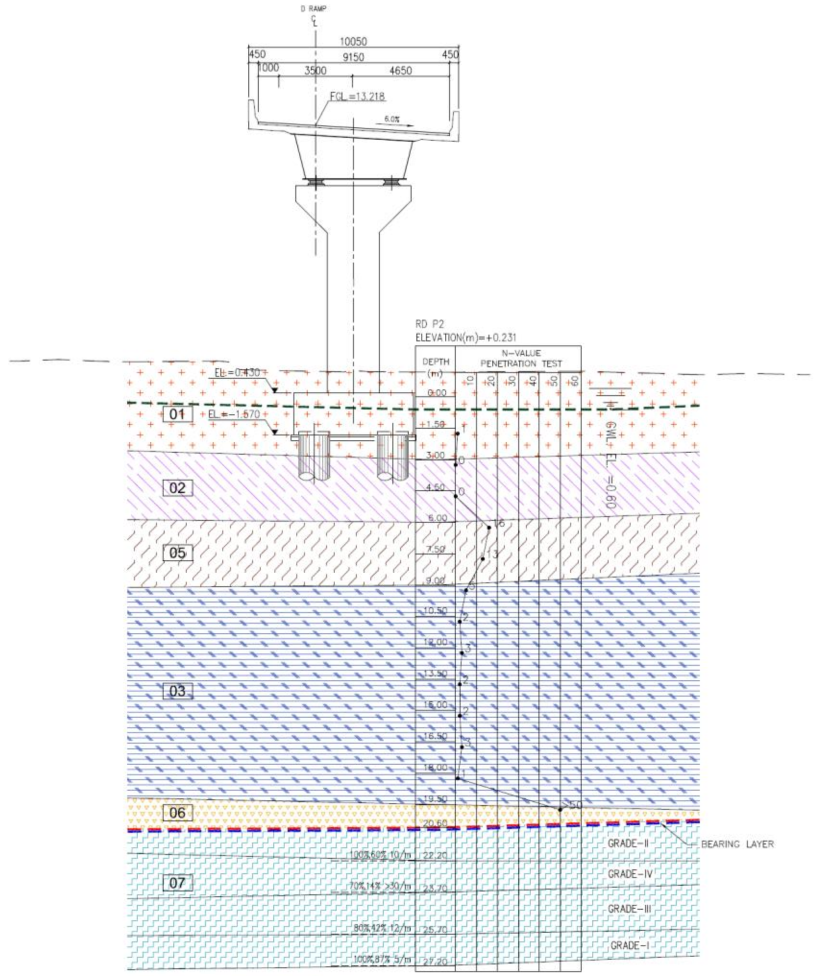
NO	DATE	DESCRIPTION
		DRAFT-1

DESD:
CHKD:
APPD:

BOREHOLE PROFILE AT RAMP D
(RD-P1)

DRG. NO : BH-001

S:\WORKING\IVONNE\MR.HASANTHA\FINISHED\(RAMP D 001) RD P1 BOREHOLE DATA.DWG, 2015-12-23



BOREHOLE PROFILE

SCALE 1:200

LEGEND:

01	FILL MATERIAL MIXTURE OF SAND, SILT, CLAY OR GRAVEL	
02	SOFT CLAY/ORGANC CLAY/ PEAT	
03	LOOSE TO MEDIUM DENSE SAND	
04	FIRM TO VERY STIIF CLAY	
05	MEDIUM DENSE TO VERY DENSE SAND	
06	COMPLETELY WEATHERED ROCKS	
07	SLIGHTLY TO MODERATELY WEATHERED ROCK	
	GROUND WATER LEVEL (GWL)	
	ROCK LEVEL	
	GRADE III OR ABOVE	

Original Drawing Size A3

DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF HIGHWAYS, HIGHER EDUCATION AND INVESTMENT PROMOTION
Road Development Authority

Oriental Consultants Company Limited
Katahira & Engineers International
in association with
Consulting Engineers and Architects Associated (Pvt.) Ltd.
Project Management Associate International (Pvt.) Ltd.

JICA FUNDED
NEW BRIDGE CONSTRUCTION PROJECT OVER THE KELANI RIVER
CONTRACT No: RDA/NKBCP/JICA/CS/04

NO	DATE	DESCRIPTION
		DRAFT-1

DESD:
CHKD:
APPD:

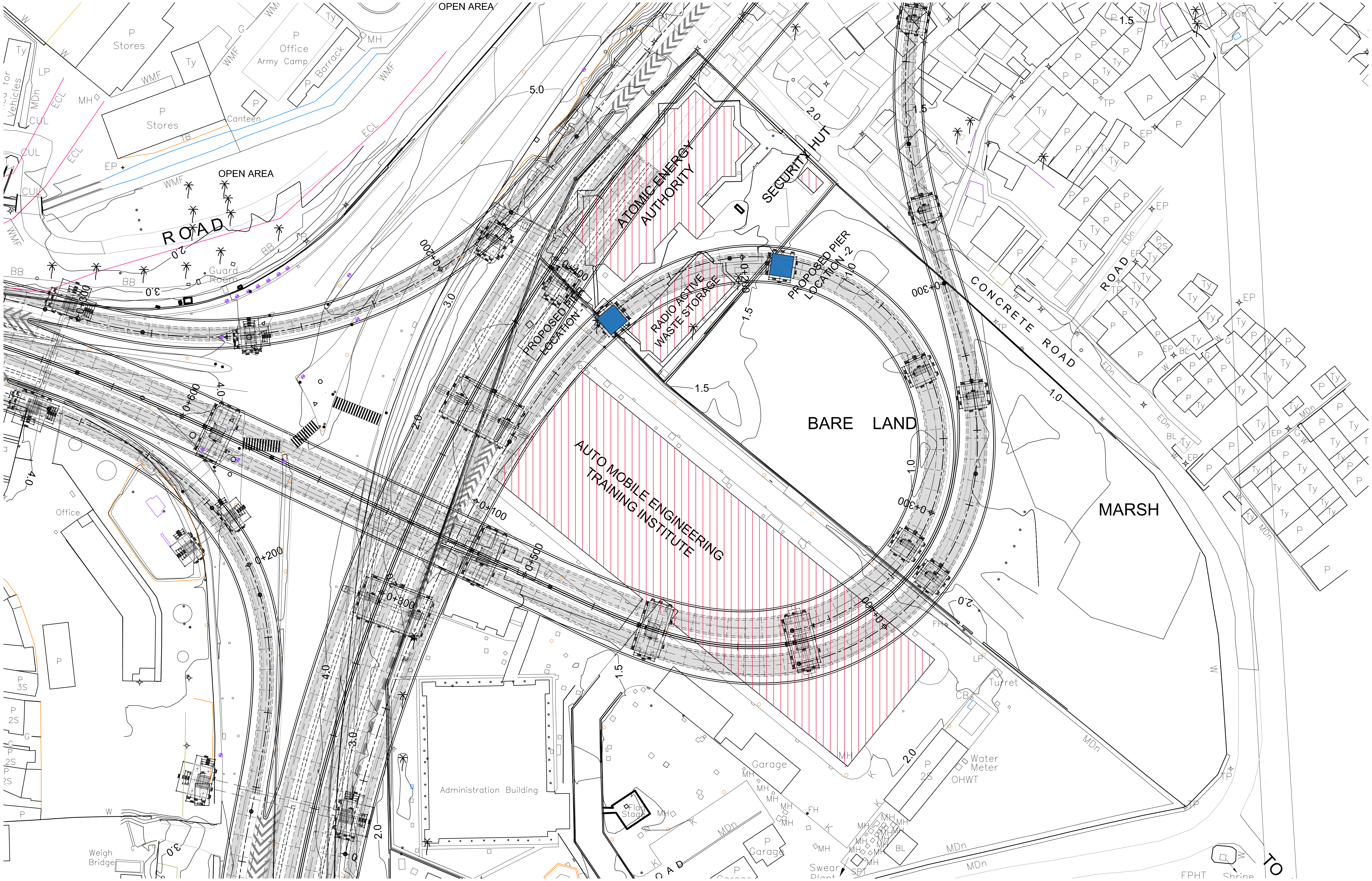
BOREHOLE PROFILE AT RAMP D
(RD-P2)

DRG. NO : BH-002

S:\WORKING\IVONNE\MR.HASANTHA\FINISHED\(RAMP D 002) RD P2 BOREHOLE DATA.DWG, 2015-12-23

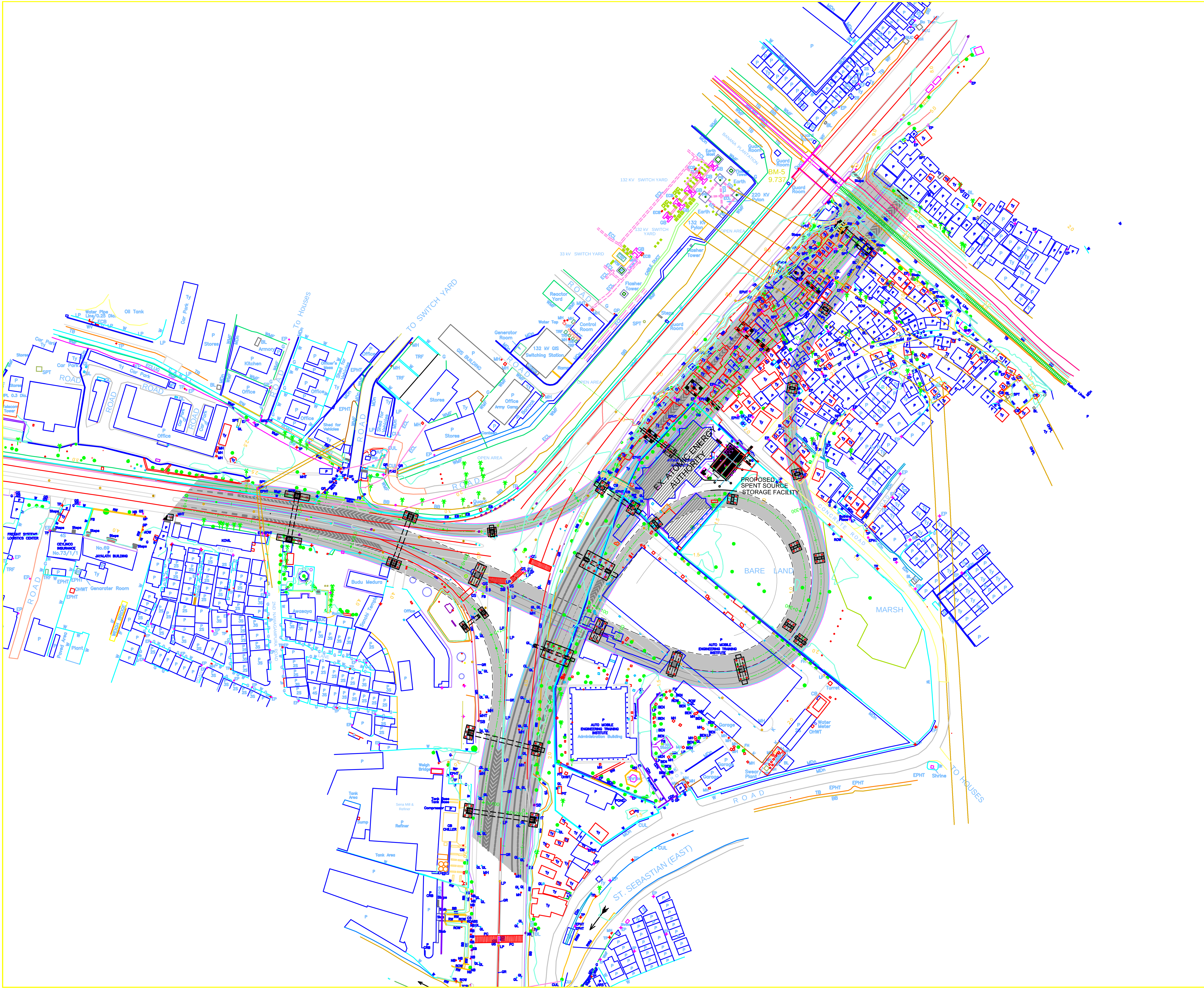
Annex 3-5: Detailed drawings:

- **i. Existing location of the SLAEB**
  - **(same as Figure 1a)**
- **ii. Proposed location of the proposed Spent Source Storage Facility**
  - **(same as Figure 1b)**
- **iii. Layout plan of the proposed Spent Source Storage Facility Premises**
- **iv. Layout plan and details of the Spent Source Storage Facility building**
  - **(same as Figure 4)**



LAYOUT PLAN OF THE AEB COMPLEX AND PROPOSED BRIDGE

SCALE-1:500



NOTE:
REVISED DRAWING AS PER FORWARDED REVISION DRAWING BY AERC ON 23.12.2015

NO.	REVISION	BY	CHEC.	DATE

DO NOT SCALE FROM DRAWINGS
VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING WORK
ALL MEASUREMENTS ARE IN MILLIMETERS

CLIENT

ROAD DEVELOPMENT AUTHORITY

CONSULTANT

ENGINEERING CONSULTANTS(PVT) LIMITED
CHARTERED ARCHITECTS & CONSULTING ENGINEERS
NO.03, SWARNA PLACE, NAWALA, RAJAGIRIYA, SRI LANKA.
Tel.:941 2806243 Fax.:0094 2806246
email: info@engcl.com web:www.engcl.com

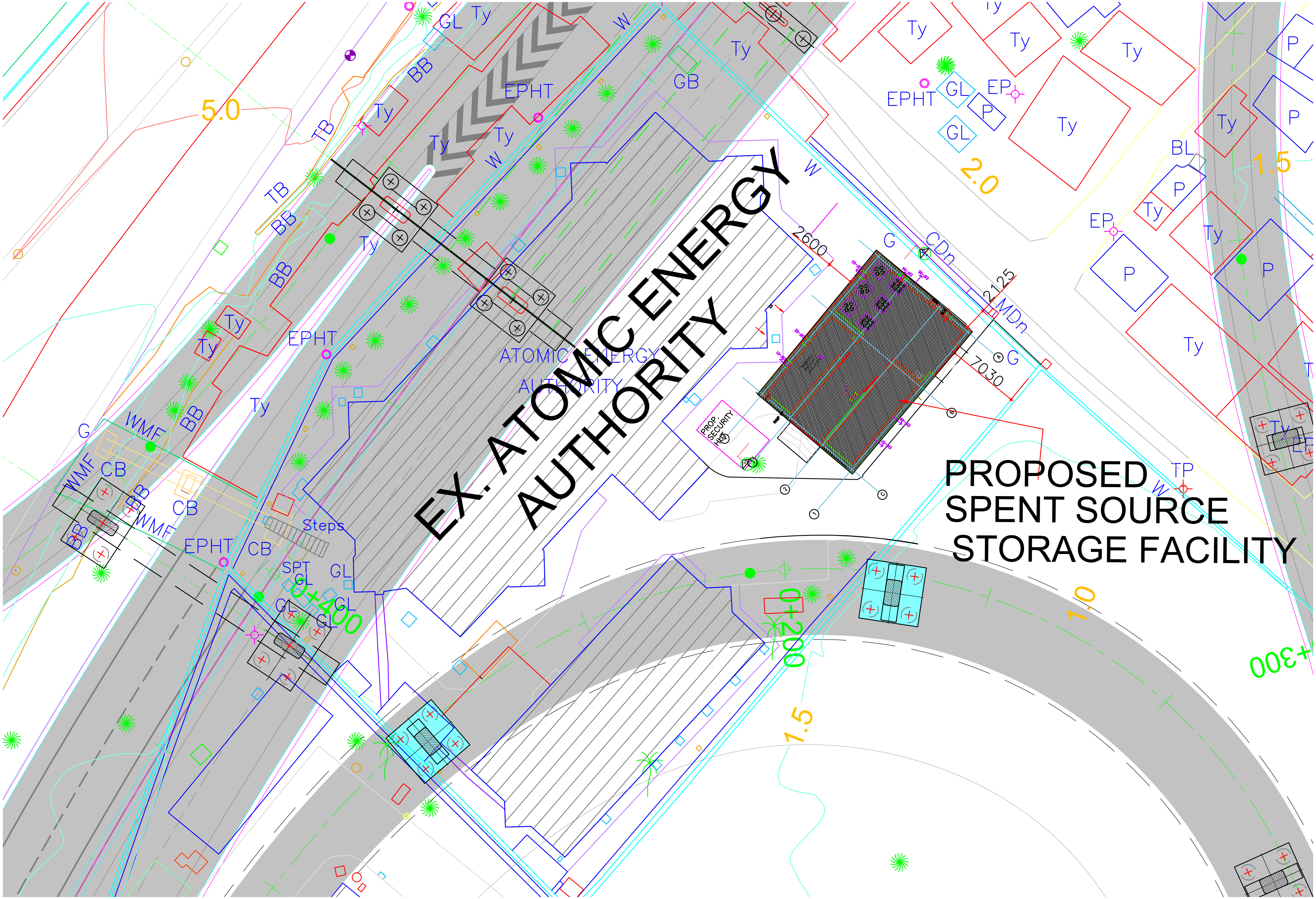
PROJECT

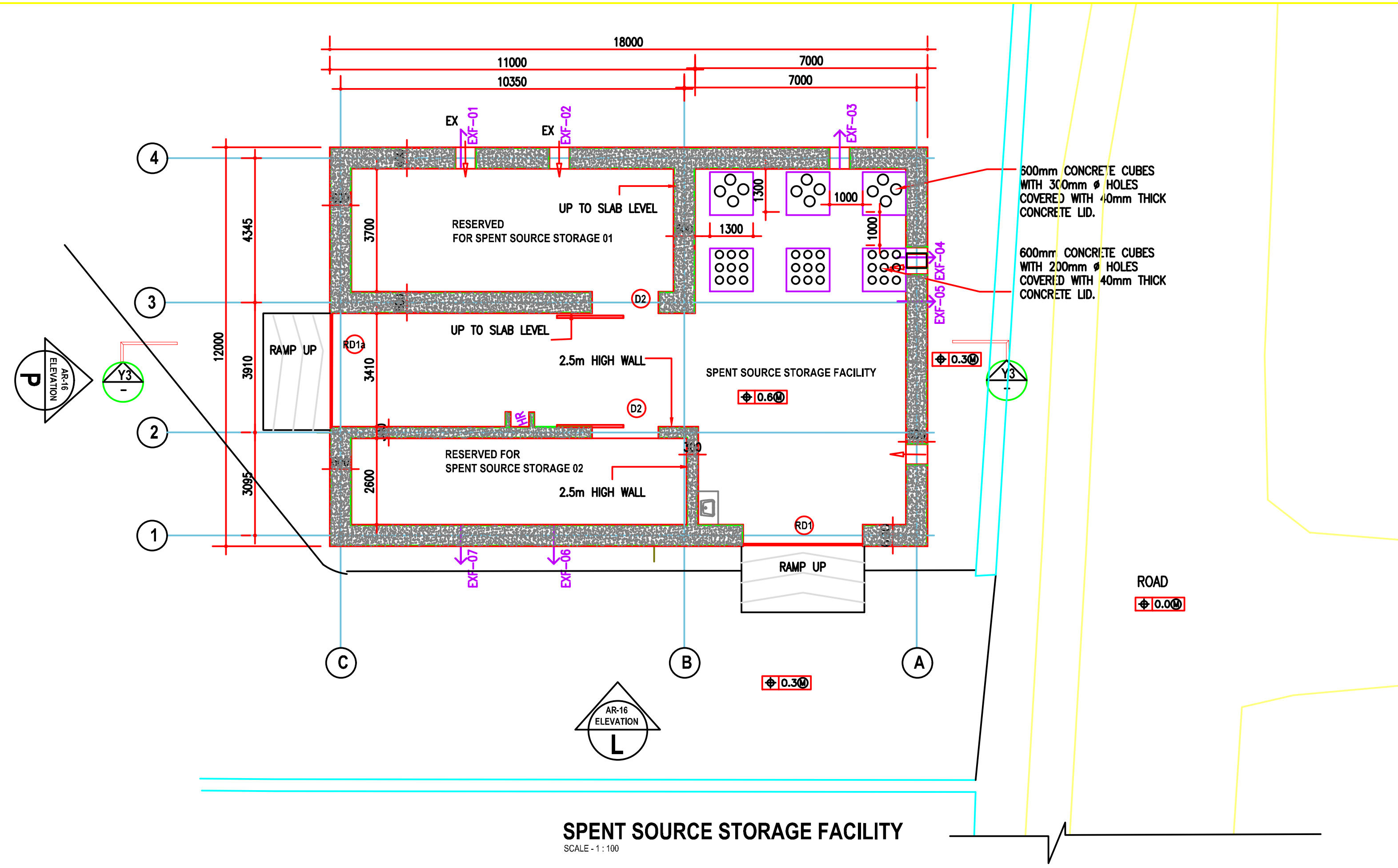
RECONSTRUCTION AND RELOCATION OF BUILDINGS FOR ATOMIC ENERGY AUTHORITY BUILDING DUE TO NEW BRIDGE CONSTRUCTION PROJECT OVER KELANI RIVER

TITLE

SPENT SOURCE STORAGE FACILITY - LOCATION PLAN AT ORUGODAWATTA

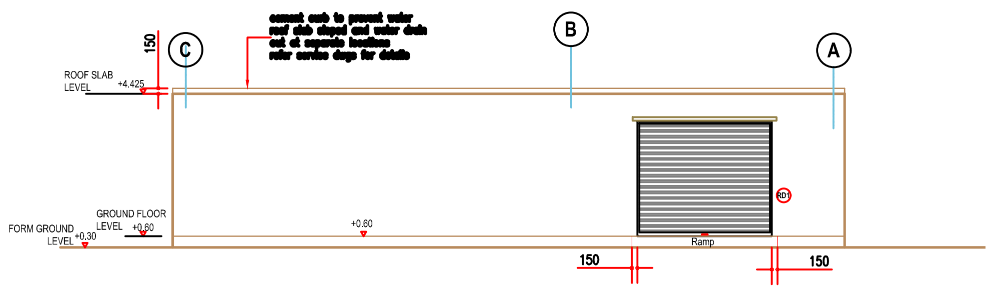
PROJECT/DESIGN ARCHITECT / PROJECT/DESIGN ENGINEER: KASUNI	CHECKED BY: RAJITHA	CHIEF ARCHITECT / CHIEF ENGINEER
DRAWN: SITHARA	DATE: 21.12.2015 -	D.O.A.: RUSHANTHI; SCALE: 1:1000
FILE PATH: D/SITHARA/3316-ATOMIC ENERGY BLDG / PLANS		
DRAWING NO.: 3316-AEA-AR-WS-01		REVISION


EX. ATOMIC ENERGY
AUTHORITY
PROPOSED
SPENT SOURCE
STORAGE FACILITY
ATOMIC ENERGY
AUTHORITY
PROP. SECURITY HUT
2600
2125
7030
Steps
0+400
0+200
+300
5.0
2.0
1.5
1.0



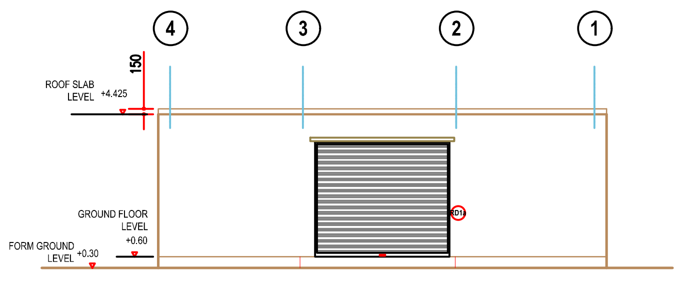
SPENT SOURCE STORAGE FACILITY

SCALE - 1 : 100



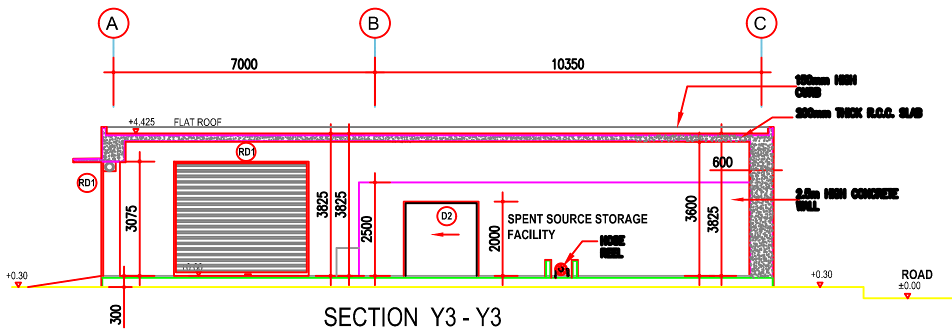
ELEVATION - L

SCALE - 1 : 100



ELEVATION - P

SCALE - 1 : 100



SECTION Y3 - Y3

SCALE - 1:100

SCHEDULE OF DOORS & WINDOWS - (SPENT SOURCE STORAGE FACILITY)			
TYPE	WIDTH	HEIGHT	DESCRIPTION
RD1	3600	3075	ALUMINIUM FRAMED ROLLER DOOR
RD1a	3410	3075	ALUMINIUM FRAMED ROLLER DOOR
D2	2000	2000	4mm THICK LEAD DOOR / SLIDING

R.C.C. WALL

NOTE:
REVISED DRAWING AS PER FORWARDED REVISION DRAWING BY AERC ON 23.12.2015

NO.	REVISION	BY	CHEC.	DATE

DO NOT SCALE FROM DRAWINGS
VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING WORK
ALL MEASUREMENTS ARE IN MILLIMETERS

CLIENT

ROAD DEVELOPMENT AUTHORITY

CONSULTANT

ENGINEERING CONSULTANTS(PVT) LIMITED
CHARTERED ARCHITECTS & CONSULTING ENGINEERS
NO.03, SWARNA PLACE, NAWALA, RAJAGIRIYA, SRI LANKA.
Tel.:941 2806243 Fax.:0094 2806246
email: info@engcl.com web:www.engcl.com

PROJECT

RECONSTRUCTION AND RELOCATION OF BUILDINGS FOR ATOMIC ENERGY AUTHORITY BUILDING DUE TO NEW BRIDGE CONSTRUCTION PROJECT OVER KELANI RIVER

TITLE

SPENT SOURCE STORAGE FACILITY - FLOOR PLAN,SECTION ,ELEVATION & SCHEDULE OF DOORS & WINDOWS

PROJECT/DESIGN ARCHITECT PROJECT/DESIGN ENGINEER: KASUNI	CHECKED BY: RAJITHA	CHIEF ARCHITECT / CHIEF ENGINEER
DRAWN: SITHARA	DATE: 21.12.2015 -	D.O.A.: RUSHANTHI; SCALE: 1:100

FILE PATH D/SITHARA/3316-ATOMIC ENERGY BLDG / PLANS

DRAWING NO. 3316-AEA-AR-WS-02 | REVISION