

NATIONAL  
BUILDING  
RESEARCH  
ORGANISATION

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2020 **ANNUAL  
REPORT**

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*The Annual Report 2020 was approved by the NBRO Interim Management Committee (IMC) on its meeting held on 24<sup>th</sup> February 2021*

## About NBRO

National Building Research Organisation (NBRO) was formed on 5<sup>th</sup> March 1984 following a Cabinet Decision taken on 29<sup>th</sup> September 1983. Today, after nearly 37 years in existence, the NBRO stands out as a leading R & D institution, a reputed technical service provider and the national focal point for landslide risk management.

NBRO is a multi-disciplinary institution, having six technical divisions namely in the alphabetical order, Building Materials Research & Testing Division, Environmental Studies & Services Division, Geotechnical Engineering & Testing Division, Human Settlements Planning & Training Division, Landslide Research & Risk Management Division and Project Management Division, supported by the Administration Division, Finance Division, ICT & Program Unit and Internal Audit Unit.

As a reputed research institution, NBRO conducts research related to its scope of work and also as requested by stakeholder institutions. The General Treasury provides sufficient funds for this research work and the research outcome is published annually. Being the national focal point for landslide risk management in Sri Lanka NBRO carries out activities of identification of slope instability, assessment of associated risk, mapping of hazardous zones, monitoring of ground movement in landslides and rainfall in landslide-prone areas, issuance of landslide early warning, mitigation of landslides and unstable slopes and building of awareness of landslide hazard. In addition, NBRO issues Landslide Risk Assessment Reports (LRAR) for all construction and development activities in landslide-prone areas in the country as the mandated institution.

NBRO as a self-funded institution meets its recurrent expenditure, by earning revenue by the provision of testing and technical consultancy services to the general public, public sector institutions, private companies and international institutions. With its ISO accredited and best-equipped soil-testing laboratory in the country, NBRO performs as the leading institution for geotechnical engineering investigations and conducts investigations of most large infrastructure development and landslide mitigation projects in the country. NBRO also carries out as fee-based services: the testing of building materials for suitability in construction, assessment of landslide & disaster risk, planning of human settlements & developing cost-effective disaster-resilient housing; testing of water, wastewater, soil, sediment, air and stack emissions; assessment of building condition & structural integrity, and various other related studies as technical consultancy services that bring in NBRO its much needed revenue.

People seek NBRO assistance when confronted with a diversity of problems in their living environment, be that due to rumbling mountains, soft grounds, polluted air, contaminated water, poor construction and substandard building materials etc. NBRO as a dutiful service provider together with technical experts from various disciplines is always geared up to provide suitable solutions to maintain and improve the quality of life of all citizens.

## Executive Report



**N**BRO continued fulfilling its duties and responsibilities fully and to the best of its ability in 2020 in spite of COVID-19 pandemic situation prevailed in the country. Though working conditions during pandemic situation were challenging NBRO being a responsible government institution duly accomplished the assigned tasks. In consideration, I take great privilege to compile and present this Annual Report and the Financial Statement of NBRO for the year ended on 31st December 2020.

The year 2020 had a fewer incident of landslides when comparing to previous years. In 2020, a few notable rockfall, slope and retaining wall failure incidents were reported in Ratnapura, Kegalle and Matale districts and NBRO took preassigned roles of monitoring, early warning for evacuation and mitigation.

NBRO continued the on-going projects implemented as Disaster Risk Reduction measures, expecting to complete them in the next 2 to 3-year period. The AIIB-assisted project Reduction of Landslide Vulnerability by Mitigation Measures Project is a mega project that NBRO expects completion by 2023. In this project, 147 sites have been selected for carrying out mitigation work covering locations near schools, hospitals and important buildings, major roads and railway line etc.

In spite of difficult circumstances imposed by the pandemic and consequent reduction in

development activities, NBRO managed to implement projects as planned and also provide technical consultancy services and laboratory testing service to customers. The total income from provision of testing & consultancy work was Rs. 387.0 Mn. In 2020, NBRO recorded a turnover of Rs. 771.0 Mn resulting in a profit of Rs. 30.2 Mn thus managing its financial performance while maintaining institutional stability.

Maintaining high standards seems to give NBRO a leading edge when procuring competitive contracts. Though in trying conditions due to prevailing pandemic, NBRO always thrived to assure the quality and timely delivery of outputs of technical consultancy and testing work. Accreditation of all the three laboratories to ISO 17025 was maintained and all the due internal and external audits were conducted on time. Training programmes for staff further supported the quality management effort. Accreditation of investigations conducted by other divisions to ISO 17020 as an inspection body and to ISO 17065 as a certification body has been planned and necessary work is now in progress.

The approved cadre of NBRO was maintained and when necessary, recruitment of staff was done as per requirements of projects undertaken. By the end of December 2020, the staff strength was 402.

In the beginning of year 2020, the NBRO held the annual Industry Consultation Meeting with its stakeholders to learn the research needs in industry for incorporating them in the Research and Development programme. NBRO accordingly utilized the annual government allocation of LKR 12.8 Mn. for research in 2020 and invested the allocation of Rs. 9.8 Mn for procuring laboratory and field equipment effectively for research purposes. The R&D studies in 2020 covered a wide range of subject areas and details are

given under the Research & Development Programme in this report.

The SATREPS project assisted by the Government of Japan from 2019 to 2023 is expected to improve landslide research capacity of NBRO.

### CONTRIBUTION TOWARDS NATIONAL DEVELOPMENT

NBRO carries out an important duty as the national focal point for landslide studies. Hazard and risk maps are produced and used in the national physical planning and development activities. Issuing of early warning is a very important duty carried out by NBRO.

NBRO as an assigned duty, issues Landslide Risk Assessment Reports (LRAR) with technical recommendations to local government bodies for granting approval for construction or development activities in landslide hazard-prone areas in 14 districts. In 2020, 6085 reports were issued after necessary investigations.

Several international donor agencies and institutions extended their assistance to NBRO in 2020. Importantly, Japan International Cooperation Agency (JICA), the World Bank, Asian Disaster Preparedness Centre (ADPC), Norwegian Geotechnical Institute (NGI), and Asian Infrastructure Investment Bank (AIIB) continued to provide their assistance to landslide risk management endeavour of NBRO. In addition, United States Geological Society, Bath University, University of Salford and Huddersfield University too assisted NBRO.

NBRO continued to implement landslide mitigation work. These works include mitigation of identified potentially hazardous landslides that threaten settlements, and the stabilization of roadside slopes, identified unstable slopes close to rail tracks and slopes around schools and vulnerable public buildings.

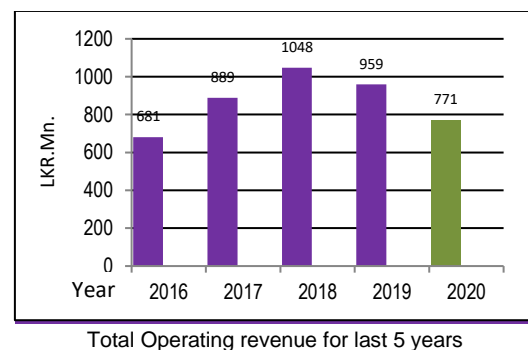
### EXTENDING NBRO EXPERTISE

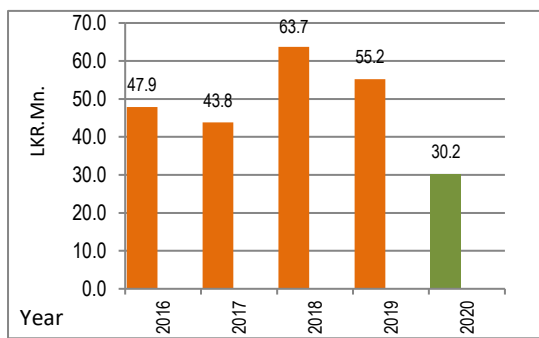
In the conversion of failed Meethotamulla Waste fill into a recreational park by the Urban Development Authority, the NBRO provided necessary technical services to establish geotextile layers, leachate extraction piping and gas vents. NBRO further provided its expertise in stabilizing slopes in Kandy - Mahiyangana road, in Southern Expressway and in other major road networks where some projects were implemented under Climate Resilience Improvement Program (CRIP) of the World Bank and Landslide Disaster Protection Project (LDPP) with JICA assistance.

NBRO provides its technical support to the Government programme to resettle the victims of recent landslide and flood disasters, and the persons living in areas with high risk in disaster resilient settlements in safer areas.

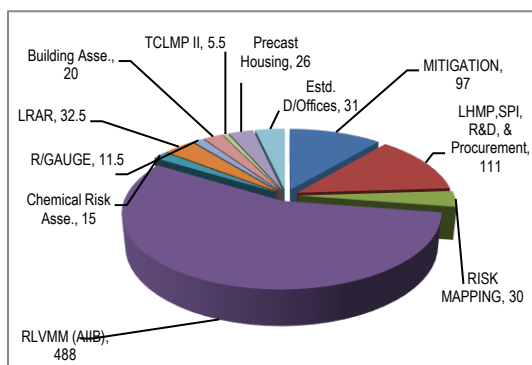
### REVENUE

NBRO mainly meets its recurrent expenditure with the revenue it generates all the time by provision of consultancy & testing services offered to state and private sectors. Landslide risk assessments are done by NBRO regularly on a fee-based service as well. NBRO also receives funds for implementing mitigation projects, mapping, special landslide investigations, other govt. funded projects and donor-funded projects. NBRO has been able to earn a net profit each year since 2010.





Profit &amp; loss record for last 5 years



Govt. Grant for projects &amp; programs – 2020

### CONSTRAINTS

The following are identified as constraints.

- ✚ A bill to establish NBRO has been drafted but not yet approved.
- ✚ NBRO being a government organization, finds it difficult to be very competitive in bidding for consultancies.
- ✚ Payment for extended working hours at NBRO is restricted.
- ✚ Retaining skilled & experienced staff and recruiting qualified technical staff are becoming increasingly difficult due to higher benefits offered by other employers

### INITIATIVES FOR PRODUCTIVITY IMPROVEMENT

The following actions have been taken to enhance institutional performance in the year 2020.

- ✓ Accreditation of all three laboratories maintained
- ✓ Institutional technical capacity strengthened through technical cooperation projects

- ✓ Design unit of NBRO strengthened to work in landslide mitigation projects
- ✓ Capacity for geotechnical risk assessments of high-rise and large building complexes enhanced ensuring safety of adjoining properties

### FUTURE PLANS

- Expect carrying out landslide mitigation & related capacity enhancement
- Expect accelerating the preparation of hazard maps and risk profiles
- Expect carrying out condition assessment of important buildings as a disaster reduction measure
- Expect continuing studies on chemical hazard management
- Expect promoting recently prepared guidelines to construction industry
- Expect starting construction of new buildings for district offices as these are now in rented buildings

### APPRECIATION

I take this opportunity to thank Hon. Chamal Rajapaksa the State Minister of National Security, Home Affairs and Disaster Management and General (Retd) Kamal Gunaratna, Secretary of the State Ministry of National Security, Home Affairs and Disaster Management, and Chairperson of Interim Management Committee (IMC) of NBRO, Addl. Secretary, Major General Sudantha Ranasinghe whose direction and guidance have paved NBRO the way to this success.

I also wish to thank members of the IMC and Audit & Management Committee, the Director Generals of Department of Budget, Department of General Treasury, National Planning Department, External Resources Department (ERD), Disaster Management Centre, Department of Meteorology, Geological Survey & Mines Bureau and Director National Disaster Relief Services Centre (NDRSC) who deserve great appreciation.

At this juncture our gratitude is also extended to our international stakeholders, the World Bank, UNDP, JICA, ADPC, NGI, AIIB, USGS,

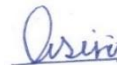


SATREPS of Japan, THINKlab of University of Salford UK, Huddersfield University and Bath University and all the local collaborating institutions and universities for providing technical and financial assistance for various projects and programs. In addition, I express my sincere thanks to our local stakeholders and valued customers for their continued confidence on us.

I am grateful to the dedicated employees of NBRO without the help of whom we will not be able to perform so well and achieve the challenging targets set so high for the 2020. Above of all, superiority of our performance is

attributed to this remarkably competent team, their knowledge, skills and professionalism which is the backbone of NBRO.

We will continue working cooperatively to improve the NBRO performance further in the coming years and accomplish the mission and objectives set by our Annual Action Plan. We are sure that our team members will be very supportive of each other and collaborate across teams in sharing ideas and achieving great outcomes.



**Eng. (Dr.) Asiri Karunawardena**  
Director General

## Vision, Mission and Goals

### VISION

A nation living in a safer, sustainable & disaster resilient built environment

### MISSION

Reduce disaster risks through building resilience to ensure safer & sustainable built environment for all

### GOALS

- ✚ Goal 1: Achieve technical excellence in disaster risk assessment in related disciplines & subject areas
- ✚ Goal 2: Achieve legal status, statutory powers and the recognition in DRR in related disciplines and subject areas.
- ✚ Goal 3: Be an apex national entity in providing quality accredited testing & technical consultancy services in environmental, geotechnical engineering, building materials, resilient built environmental planning and resilient construction technology.
- ✚ Goal 4: Achieve excellence in Research and Development in DRR and in disaster resilient development technology & innovation.
- ✚ Goal 5: Establish national and regional cooperation and connectivity to promote and sustain DRR and resilient development science and technology
- ✚ Goal 6: Strengthen institutional capacity for effective disaster risk reduction in related disciplines & subject areas
- ✚ Goal 7: Achieve financial sustainability of NBRO for effective performance in DRR.
- ✚ Goal 8: Become the centre of excellence for landslide disaster risk management as the national focal point.
- ✚ Goal 9: Build disaster resilience through Climate Smart early warning technology
- ✚ Goal 10: Build disaster resilience through ecosystem-based risk mitigation technology
- ✚ Goal 11: Build disaster resilience through community science-based risk mitigation process
- ✚ Goal 12: Build disaster resilience through rehabilitation and reconstruction technology

## Management of NBRO

### MINISTER IN CHARGE OF THE SUBJECT

Hon. Chamal Rajapaksa  
State Minister of National Security, Home Affairs & Disaster Management

Presently a Cabinet approved Interim Management Committee (IMC) with Secretary of the line ministry as the Chairman guides and directs the administrative, financial and management functions of

### INTERIM MANAGEMENT COMMITTEE (IMC)

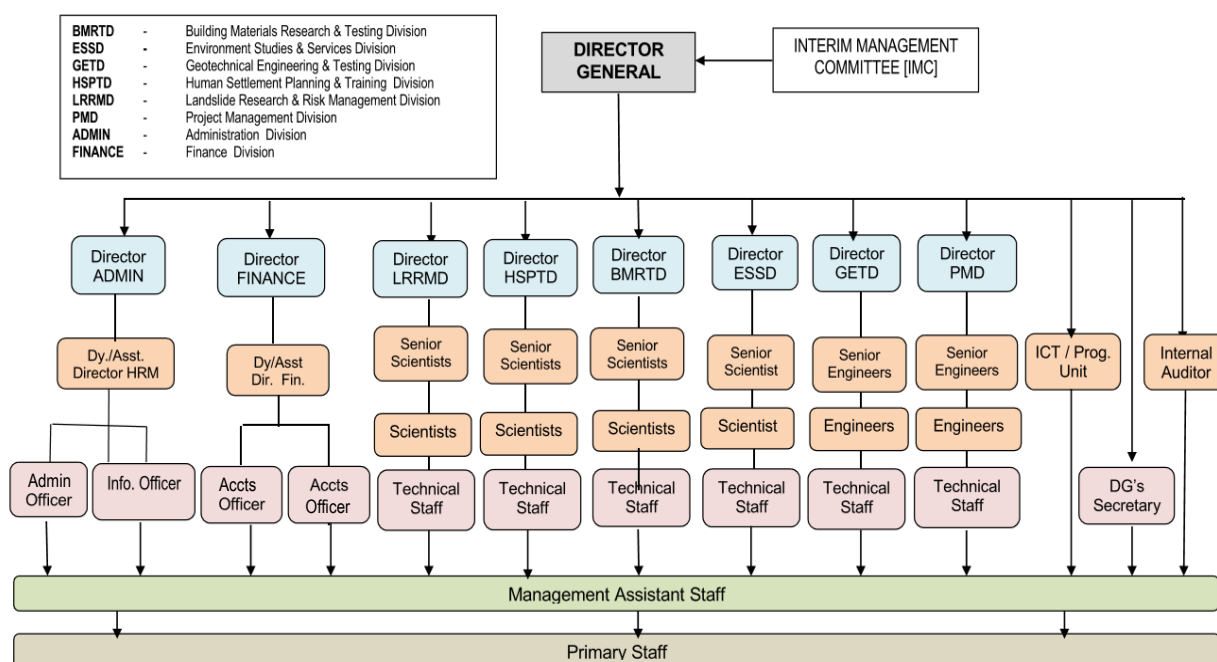
<b>Gen. (Retd) Kamal Gunaratna (Chairman)</b> Secretary, State Ministry of National Security, Home Affairs & Disaster Management	<b>Mrs. M. A. Nandani</b> Addl. Director General, Department of National Budget
<b>Major General Sudantha Ranasinghe</b> Director General, Disaster Management Centre	<b>Mr. H K Balachandra</b> Director General, Construction Industry Development Authority
<b>Dr. Sugath Yalegama</b> Addl. Secretary (Policy & Admin), Ministry of Urban Development & Housing	<b>Mr. H U R Fonseka,</b> Chief Accountant, State Ministry of National Security, Home Affairs & Disaster Management
<b>Mr. A K Karunanayake</b> Director General, Department of Meteorology	<b>Eng. (Dr.) Asiri Karunawardena</b> Director General National Building Research Organisation

### AUDIT & MANAGEMENT COMMITTEE

<b>Mrs. M. A. Nandani (Chairperson)</b> Addl. Director General, Department of National Budget	<b>Mrs. R A N D Ranatunge</b> Chief Internal Auditor Ministry of Disaster Management
<b>Mr. H K Balachandra</b> Director General Construction Industry Development Authority	<b>Mrs. A B R Amarakoon</b> Audit Superintendent Government Audit Branch
<b>Eng. (Dr.) Asiri Karunawardena</b> Director General National Building Research Organisation	<b>Mr. H U R Fonseka</b> Chief Accountant, State Ministry of National Security, Home Affairs & Disaster Management
<b>Mr. H. L. Ruwanthilaka</b> Internal Auditor National Building Research Organisation	<b>Mrs. Kumudu Randeny</b> Director (Finance) National Building Research Organisation



## Organisation Structure



### SENIOR MANAGEMENT OF NBRO

<b>Eng. (Dr.) Asiri Karunawardena</b>	Director General
<b>Mr. Kishan Sugathapala</b>	Director, Human Settlements Planning & Training Division
<b>Ms. Sardhanee V Dias</b>	Director, Environmental Studies & Services Division
<b>Mr. Kithsiri N Bandara</b>	Director, Geotechnical Engineering & Testing Division
<b>Ms. Sunethra Muthurathna</b>	Director, Building Materials Research & Testing Division
<b>Ms. Kumuduni Jayawardena</b>	Director, Project Management Division
<b>Dr. Gamini Jayatissa</b>	Actg. Director, Landslide Research & Risk Management Division
<b>Mrs. Kumudu Randeny</b>	Director, Finance
<b>Mr. Sarath Cooray</b>	Actg. Director, Administration

## Operational Highlights



In 2020, National Building Research Organisation (NBRO) together with International Landslide Consortium and with many important stakeholder involvements embarked on a five-year major research study supported by both Sri Lankan and Japanese governments. NBRO continued the implementation of other on-going projects: importantly the mega scale Reduction of Landslide Vulnerability by Mitigation Measures Project (RLVMMP) that was started in 2019. The Nature Based Landslide Risk Management Project with Asian Disaster Preparedness Centre was successfully completed. Many other projects started with several international stakeholder institutions (SATREPS, NILIM, SABO & USGS) in view of strengthening institutional capacity made considerable progress in spite of the adverse conditions prevailed in the country due to COVID-19 pandemic.

NBRO further strengthened the automated rain gauge network in landslide-prone areas and ground movement detection instrument network on moving landslides and with aid of such strengthening, continued to operate the Landslide Early Warning Centre at NBRO Head Office more efficiently and disseminating landslide early warnings timely and effectively. Development of automated rain gauges and related instrumentation locally was continued as an effort to expand and maintain these networks.

Industrial Consultation with stakeholders was held at the beginning of the year to devise the NBRO Annual Research and Development Programme. Research work continued with the guidance of the Research Committee though the NBRO Annual Research Symposium was not held in 2020 due to the pandemic situation prevailed.

NBRO is the research arm and the only technical agency in the Disaster Management Division of the line ministry. NBRO was able to provide solutions to many issues in the country especially utilizing combined capacities of multi-disciplined technical divisions backed by their modern facilities. NBRO's expertise is now offered as technical services mainly in the fields of geotechnical engineering, building materials technology, human settlements planning, environmental management & project management. NBRO specializes now in emerging fields to address many other issues in the country, especially in landslide mitigation technology, detecting ground subsidence, creating disaster resilience and promoting drought adaptation.

During the year under review NBRO carried out the following specific tasks in line with its designated functions and Annual Action Plan.

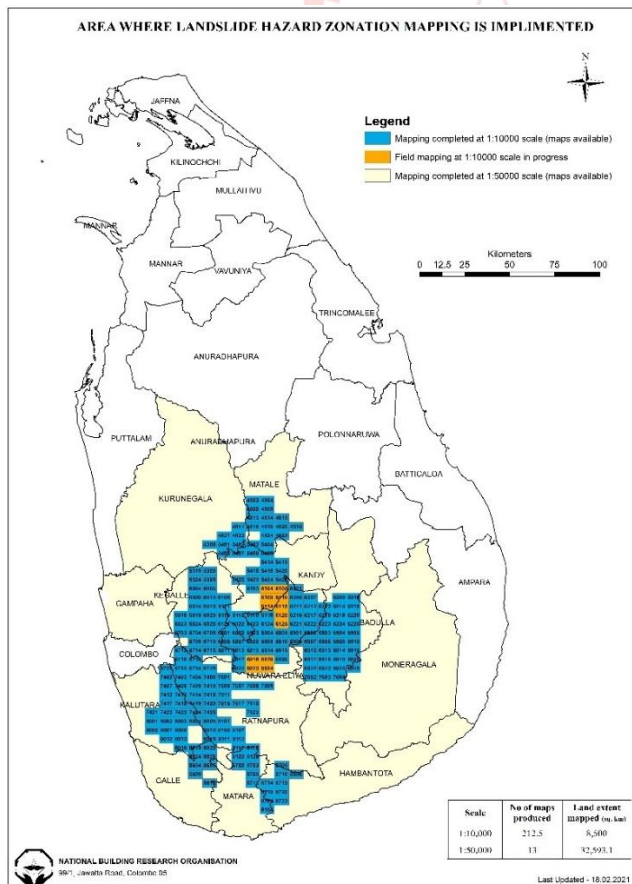
## GOSL Funded Projects

### Landslide Hazard Zonation Mapping Programme (LHMP)

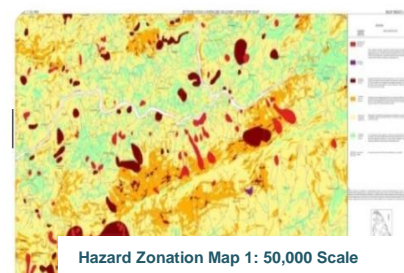
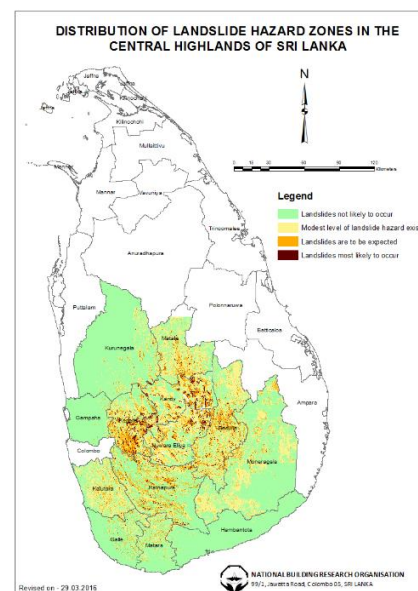
The government assigned NBRO to carry out landslide studies after severe landslides in 1985. Thereafter, NBRO started landslide identification and mapping work and subsequently, the Landslide Hazard Zonation Mapping Project (LHMP) was launched in 1992 with the assistance of the UNDP. Later, the project continued to this date with government funds identifying spatial distribution of landslide hazard and producing landslide hazard maps. Maps to the scale 1:50,000 have been prepared to cover a total of 32,593.1 sq. km in 13 districts identified as having the landslide hazard risk and in addition, maps to the scale 1:10,000 have been prepared to cover prioritized areas covering a total of 8,500 sq. km.

In 2020, the project received a Government grant of Rs. 20.0 Mn. and as the outcome, 7.5 map sheets each covering 40 sq. km in 1:10,000 scale were prepared in the district of Nuwara Eliya. Total area covered under 1:10,000 scale was 300 sq. km.

The maps produced by this project are used in the issuance of landslide early warning, and in landslide investigation work leading to hazard risk assessment, issuance of Landslide Risk Assessment Reports (LRAR), and identification and prioritization of potentially dangerous sites for mitigation. The maps are also used in national and regional level planning by various institutions. Most of these maps are available for downloading free of cost in the NBRO website ([www.nbro.gov.lk](http://www.nbro.gov.lk)).



**Hazard Zonation Mapping Area**



### Landslide Risk Assessment Reporting Process (LRAR)

NBRO issues Landslide Risk Assessment Reports to local governmental authorities recommending whether to grant or not approval to a building permit or approval of a development project when sites are in landslide-prone areas. By 31<sup>st</sup> December 2020 the NBRO has received over 89,000 applications since the issuance first started in March 2011. The number of approvals issued in 2020 was 6,085 and the number of applications rejected for the entire period was 715. The NBRO charges a nominal fee to process an application, carry out necessary investigations and issue a report. The General Treasury provided Rs. 32.5 Mn in the year 2020 to cover the recurrent expenditure of this process and balance expenditure was borne by NBRO revenue as CSR.

Table : LRAR details since the process inception in March 2011

Progress of Landslide Risk Assessment Process for Building and Land Approval (Application LAB & LAD)-LRRMD-from 01.03.2011 to 31/12/2020 නායයාම් අවදානම් සහිත ප්‍රදේශ වල ඉදිකිරීම් හා සංවර්ධන කටයුතු සඳහා අනුමැතිය ලබා ගැනීමේ වැඩ පිළිවෙලෙහි ප්‍රගති සමාලෝචනය - 01.03.2011 සිට 31/12/2020 දක්වා										
(district) දිස්ත්‍රික්කය	1	2				3=1-(2a+2b+2c)	Pending Application Details (අතිරික්ත ඉල්ලුම්පත් පිළිබඳ විස්තර)			
		Total Applications Received (ලැබූ ඉල්ලුම්පත් සංඛ්‍යාව)	Total Applications work completed (වැඩ නිමකළ ඉල්ලුම්පත් සංඛ්‍යාව)				Total applications pending (අතිරික්ත ඉල්ලුම්පත් සංඛ්‍යාව)	Pending For initial Investigation (මූලික පරීක්ෂණ සඳහා)	Referred to revisit/detailed investigation විස්තරාත්මක අධ්‍යයනයට යොමු කිරීම සඳහා)	Documents Pending from Client (ඉල්ලුම්කරුගෙන් අදාළ ලියකියවිලි ලැබෙන තෙක්)
			2a Permission granted (අනුමැතිය ලබා දුන් ඉල්ලුම්පත්)	2b Permission not granted (අනුමැතිය ලබා නොදුන් ඉල්ලුම්පත්)	2c Applications rejected due to other reasons (වෙනත් හේතූන් මත අවසරය ලබා නොදුන් ඉල්ලුම්පත්)					
1 Kandy	20002	17614	313	1392	683	486	5	192		
2 Matale	8505	8325	17	33	130	106	10	14		
3 Nuwaraeliya	7474	7205	64	51	154	40	79	35		
4 Badulla	11976	11328	200	310	138	101	28	9		
5 Kagalle	11336	10780	62	432	62	3	0	59		
6 Rathnapura	11376	9829	38	1430	79	58	0	21		
7 Kaluthara	1105	1054	7	29	15	15	0	0		
8 Galle	15540	15444	8	23	65	63	2	0		
9 Matara/H'tota	2222	2206	5	7	4	4	0	0		
10 Kurunagala	26	25	0	0	1	1	0	0		
Total	89562	83810	714	3707	1331	877	124	330		

### Landslide Special Investigations (SPI)

District and Divisional Secretaries, and officials of governmental institutions often request NBRO to conduct landslide special investigations for the purpose of identifying risks in particular sites in relation to the safety of neighbouring human settlements, infrastructure and plantations and to provide immediate recommendations. A total of 3,460 landslide special investigations were performed in 2020. The General Treasury has provided Rs. 61.0 Mn for this work.

### Landslide Mitigation Program (GOSL Funded)

The landslide and slope instabilities needing mitigation have been identified by LHMP and SPI, and mitigation of 3 prioritised sites were completed as indicated below.

No	District	Project/Location	Cost (Rs. Mn.)
01	Badulla	Kahattewela Rahula Vidyalaya - Haputhale Phase II	23.75
02	Badulla	Rathkarawwa Maha Vidyalaya - Welimada	38.09
03	Ratnapura	Divisional Secretariate - Kiriella Phase I & II	12.38

### Development of Risk Profile for landslide prone areas

Landslide risk maps show landslide potential together with the expected losses in terms of casualties, if a landslide occurs. Landslide risk maps are developed by combining human settlements maps and landslide hazard zonation maps. These maps will serve as a tool to guide investments in development and utilization of lands susceptible to landslides. Flowing activities were carried out in 2020 out of 5 year planned work

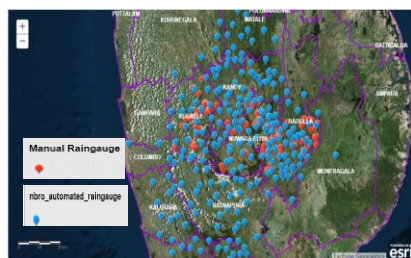
- Data collection on elements at risk (Kandy & Matale Districts) - 3100 Buildings
- Development of risk profile database (Ratnapura, Galle, Matara, Kandy & Matale Districts) - 27633
- Identification of potential lands for development (Landbank map) in Galle, Matara, Hambantota, Matale Districts - 10
- Establish community disaster management committees (Rathnapura) - 0
- Data collection on Special Investigation Locations - 5000
- Risk evaluation of 17 Schools exposed to landslides in Badulla District - 17
- Reduction of Landslide Vulnerability through Community Managed Implementation of Risk Reduction Measures in 20 communities - 0
- Data collection on additional buildings (2000 buildings) identified during risk evaluation of landslide exposure maps (Nuwara Eliya, Ratnapura, Matara, Kandy, Matale Districts) - 577
- Development of 35 DSD level risk profiles (Kegalle, Kalutara, Galle, Matara, Hambantota Districts) - 30
- Empower communities threatened by landslide hazards to act in sufficient time and in an appropriate manner (200 Communities in Badulla, Nuwara Eliya, Kegalle, Kalutara, Galle, Matara, Matale Districts) - 10

### Enhance real time landslide forecasting & early warning capacity by expanding automated rain gauge network.

A network of automated rain gauges for monitoring rainfall for effective landslide early warning has been developed: Triggering of landslides often occurs due to increase in soil moisture by high intensity rainfall. National Building Research Organisation issues landslide early warning by taking rainfall into consideration from weather forecasts issued by the Department of Meteorology and data acquired from the network of automated rain gauges of NBRO.

At present, a total of 300 automated rain gauges had been installed and in operation in the network and utilize the real-time data acquired from the network in the landslide early warning process. Landslide Early Warning Centre that functions on 24 hours a day basis during inclement weather, issues landslide early warnings to landslide vulnerable communities through the National Emergency Operation Centre of Disaster Management Center.





*Automated & manual rain gauges locations*



*Rainfall monitoring system at Early Warning Centre*

## Systematic assessment of chemical disaster risk in Sri Lanka

Occurrence of accidents in chemical using industries is showing an increasing tendency and exposure of vulnerable elements in the neighbourhood to this hazard could lead to man-made disasters. A systematic procedure for risk assessment is absent, and poor transparency on information to the public on overall situation makes the situation worse. Past incidents highlighted the gaps in current DM process and while understanding the potential for chemical disasters, the need has been strongly felt for introducing a chemical hazard mitigation framework and a sound legal framework on management of disasters associated with chemical accidents.

Risk assessment methodology for chemical using industries and a database platform have been developed to gather industry data for risk and impact assessment. The first volume of safety guidebook for five industrial chemicals was published. Workshops were conducted in order to identify authorities related to chemical disaster management and for the competency development of NBRO scientists and stakeholder organisations related to chemical disaster management with Eng. Tissa A. Dodangoda, senior lecturer at University of Moratuwa as a resource person and a consultant of the project.

## Developing a system for building assessment and condition reporting

State owned public buildings and owners of other buildings commonly used by the general public having factors such as older than design life, showing evidence of deterioration due to advanced age, having inferior structural integrity, suffered physical damage during a disaster, because of poor maintenance or resulted by impact of construction activities in the surroundings could be considered for the investigation to obtain a technical assessment report from NBRO and implement technical recommendations contained therein. NBRO carried out structural assessment and investigation of 75 buildings in 2020.

## Important building condition, damage and failure assessments by NBRO

### Assessment of damage and cost of restoration of ancient building in Kurunegala:

NBRO following a court order investigated the demolition of ancient building referred to as Bewaneka Hotel and other remains like the old drain that are of archaeological importance. This incident became a national issue raising country-wide protests. Report indicating cost of restoration was forwarded to relevant authorities.



*Damages to ancient building "Bewaneka" in Kurunegala*

### Collapse of a house at Buwelikada, Kandy:

A house at Sangamitta Mawatha, Buwelikada, Kandy collapsed causing damage to neighbouring houses and loss of life in September 2020. NBRO investigated the collapse and conditions of neighbouring houses immediately after the collapse and advised evacuation of neighbouring residents. NBRO continued investigations thereafter throughout the debris removal, and in addition, quality of building elements was checked and geotechnical investigations were performed to find out what caused the collapse. As built drawing was produced and structural analysis was carried out using 3D model to find out what structural action prevailed in various elements of the structure. Calculations and step-wise structural analysis were performed to study the stability of critical columns and ascertain mode of building failure. That suggested the collapse was triggered by structural failure of some of the critically loaded columns at the bottom level. Reports were forwarded to relevant authorities. This incident was followed by many requests for building condition assessment of houses in Kandy suspected as unstable and consequently, NBRO assessed 15 such houses.

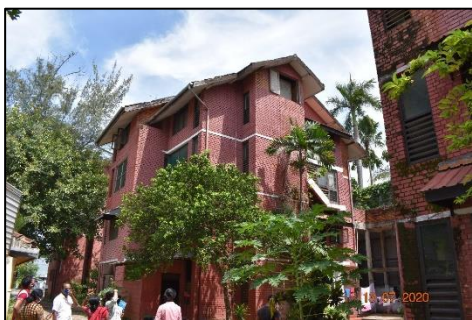


*Collapsed building at Buwelikada in kandy*



### Condition Assessment of Summit Flats Housing Complex:

NBRO on request, assessed houses of the Summit Flats Housing Complex located at Keppetipola Mawatha, Colombo 05. This complex has 176 houses that are presently occupied by parliamentary members and senior state officials. Quality tests on materials and required soil investigations were carried out. The houses were mainly found to be in a structurally sound condition whereas, major defects associated with the structural stability of stairways, elevated walkways and ramps were observed. NBRO duly notified relevant authorities the outcome of investigations and further gave in the report, suitable recommendations required for restoration.



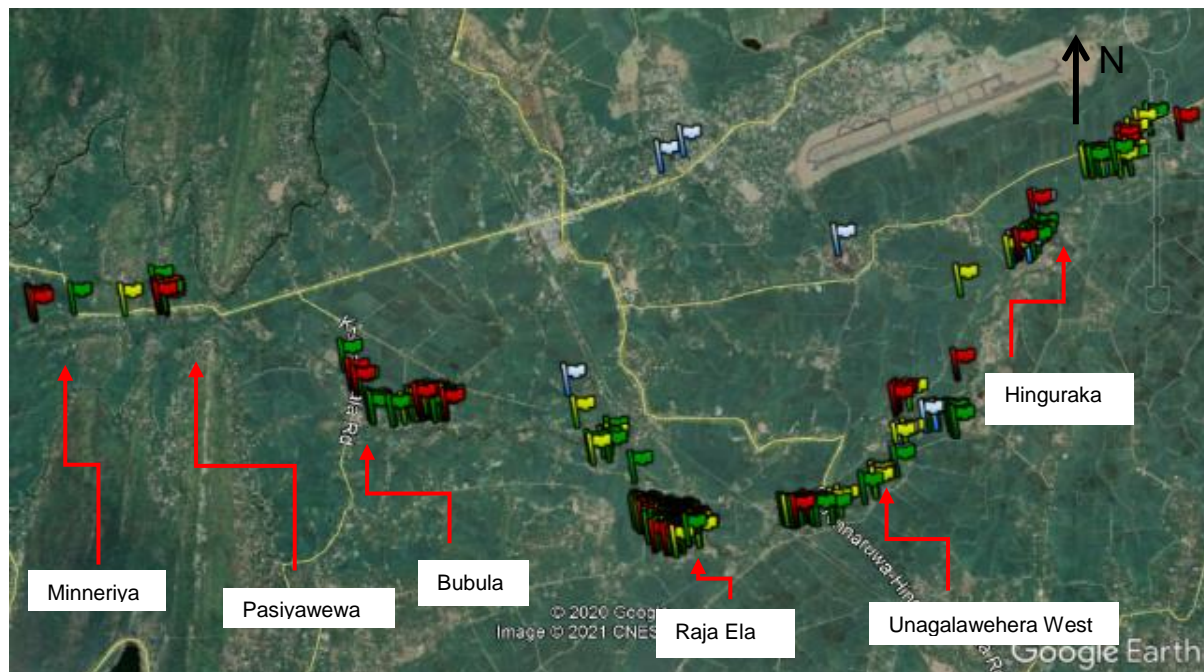
*Summit Flats Housing Complex located at Keppetipola Mawatha, Colombo 05*

### Recommendations to affected settlements in Higurakkgoda

The District Secretary, Polonnaruwa and other authorities informed NBRO that wall cracks appear in houses in 66 Bubula Grama Niladhari Division, 65 Pasiyawewa Grama Niladhari Division and 38 Raja-Ela Grama Niladhari Division in the Hingurakkgoda Secretariat Division in Polonnaruwa district, creating a hazardous situation to dwellers and requested NBRO to conduct necessary investigations. NBRO conducted geotechnical investigations in the area and found that some areas in this locality have expansive soil on the ground that expands with increasing soil moisture and contracts with decreasing soil moisture. As that can damage buildings constructed over them, this situation is considered as a geo-hazard. NBRO also conducted necessary building condition assessments of about 223 houses and issued reports advising evacuation of dwellers in some high risk houses and in addition, gave suitable recommendations on houses at high risk for demolition, houses at moderate risk that can be retrofitted and houses at low risk that can be repaired for safe occupancy. NBRO recommended suitable work procedures for said activities as well. NBRO expects constructing a disaster resilient model house that can withstand the expansive soil conditions for the purpose of showing prospective house builders and tradesmen in the area how to construct a new house suitable to this locality.



*Cracks appear in houses in Higurakkgoda*



Google Map of the affected area (Green flags – low risk houses, Yellow flags – Moderate risk houses, Red flags – High risk houses)



## Research & Development Program

NBRO continued to receive the annual government research grant of Rs. 12.0 Mn in 2020. An Industrial Consultation to learn research needs of stakeholder institutions and construction industry was held on 7<sup>th</sup> February 2020 at the Distant Learning Centre (DLC) of Sri Lanka Institute of Development Administration (SLIDA) auditorium with the participation of about 50 invitees. With observations, comments and requests coming from stakeholders and industry, a comprehensive R & D programme was devised at NBRO having research projects with a prime focus on creating disaster resilience in the country.

The NBRO Research Committee continued to provide guidance to scientists to conduct their research projects with necessary assistance and facilities being given by the NBRO. In house monitoring of research progress continued as the circumstances did not permit gathering of usual audience at the research progress meetings. Because of the COVID-19 pandemic the usual Annual Research Symposium of NBRO in December was not held. The following table gives information of the R & D Projects of 2020.

### **R & D projects in 2020**

#### **Development of real-time air quality monitoring network in urban areas in Sri Lanka for air quality prediction and preparedness system**

With the increase in air pollution levels in urban areas it is becoming important to monitoring urban air pollution levels and identifying the risk involved. In this regard, continuous real-time air quality monitoring data is essential to understand the pollution sources, their contribution and other factors effect on the abnormal high pollution conditions. These data are essential to develop evidence-based warning system and pre-preparedness action plan to manage high risk situations.

The main objective of this research was to develop a low-cost real time monitoring network to measure the ambient air quality from different areas and display it in a user interface. The research team was successful in developing a sensor unit which utilizes advanced sensor technology including light based scatter principle and other advanced algorithms to accurately measure PM1.0, PM2.5, PM10, and CO<sub>2</sub>. The device is fully calibrated with digital output (UART and I2C interfaces) and the data gathered were validated against beta attenuate technology. This portable and user friendly device is capable of producing accurate measurements for a low cost and minimum maintenance. With its light-weight design, it can be perfectly integrated into a small spaces. The device has inbuilt real-time data storage and transfer facilities. The device is currently used in monitoring air quality in selected urban areas of Colombo, Gampaha, Kalutara, Kandy, Kurunegala, Rathnapura, Galle, Anuradhapura, Badulla, Puttalam, Jaffna, Vauniya and Nuwara Eliya in Sri Lanka. The data acquired through this system are provided free of charge to interested parties, policy makers and general public via digital means. In future, the data will be used to develop evidence-based warning system and pre-preparedness action plan to manage high risk situations with respect to air pollution and aware the general public through digital display units in three highest polluted urban areas and using mass media.



## **Hydrological functions of small tank eco systems and its role in sustainable water management**

The small Tanks (wewa) in the dry zone of Sri Lanka have been recognized as a promising climate adaptation solution due to tanks performance in sustainable water management over a thousand years. The uniqueness of the small tank systems is attributed to an array of hydro ecological functions exclusive to the system with respect to retaining free drainable water as soil moisture and free-standing water for periods longer than an ordinary surface water retention, and also due to groundwater recharging capability, and ability to nourish ecosystems and compensate evapotranspiration demand etc. This research explores the soil moisture variations in different hydro ecological zones of tank ecosystems during a long dry spell condition considering two small village tanks as a case study.

## **Determination of regional and local rainfall thresholds for landslides in Sri Lanka**

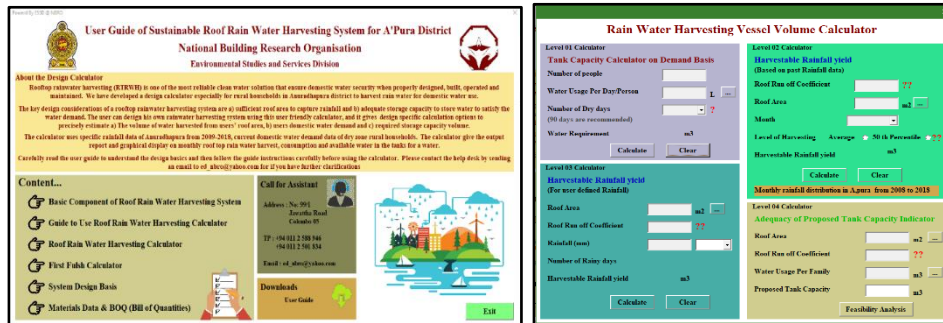
Landslides constitute one of the prominent geohazards that cause severe damage to property and loss of life every year across the world. Rainfall is identified as the most important and frequent triggering factor of landslides. Rainfall contributes to the triggering of landslides by the means of water infiltration into the subsoil, which causes an increase in pore water pressure and hence, a decrease in soil shear strength. Therefore, the determination of rainfall thresholds seems to be an essential work to develop an effective landslide early warning system. In this research, attempt was made to develop local rainfall thresholds for Kalu River Basin with the aid of past landslides and associated cumulative rainfall. 37 landslide events that occurred after 2015 were utilized and rainfall records were based on the 10 number of rain gauging stations within the basin. According to the obtained results, 89 % of the landslides in the study area were initiated with 2-4 hour intense rainfall which was followed by cumulative rainfall > 260 mm for a maximum of 3 days. The rest of 11% of landslides were initiated with sudden rainfall event with relatively low cumulative value <190 mm and high hourly rainfall value >70 mm. Further, these 11% of landslides were occurred in already unstabilized slopes indicating that intense short term rainfalls together with unstable slopes cause landslides even with relatively lower cumulative rainfall.

## **Sustainable roof-based rainwater harvesting system to overcome domestic water deficit condition in Anuradhapura**

According to latest analysis of climate factors of drought, a significant decrease in precipitation from the 30 year average is the main cause for drought. It has affected the dry zone districts of the country resulting drinking/domestic water scarcity, low enrolment for agriculture with negative impacts on the livelihood, health and wellbeing, and drawbacks on the economy.

Due to a wide range of factors pertinent to system reliability, roof-based rain water harvesting is not very much popular as a sustainable option among water stressed communities. Yet properly designed and operated rooftop rain water harvesting systems are a sustainable solution for managing domestic water stress in communities suffering from long-term water stress. The study conducted by NBRO revealed the performance of existing rain water harvesting (RWH) systems in many places in Sri Lanka is not functionally satisfactory due to inappropriate designs and wrong installations and not last for several years. Identifying the importance of establishing Roof rain water harvesting system (RRWHS) basically for the dry zone communities, study team has designed a sustainable RRWHS overcoming the challenges and series of issues in the existing systems.

As an output-oriented practical action research, rain water harvesting systems is applied to rural households in selected areas of Anuradhapura District.



## Building code for Sri Lanka



“Resilient Building Codes for Housing”. This study assess the building code practices of other countries and their past experiences. Most suitable adaptation approach of building code for Sri Lanka is also analyzed. A draft building resilience code/ Chapter was developed as an output and, the comprehensive document is developed and ready for publish.

Incidents of building collapses, fires and failures due to disasters is observed in an increasing trend in Sri Lanka. Need of building code for Sri Lanka was highlighted due to the growth in the construction industry associating with the construction of high-rise buildings, condominiums and large building complexes. Building code is a combination of many subject areas. Developing of building code is undertaken by the Central Engineering Consultancy Bureau (CECB). However, NBRO provide technical input on making the “Disaster Resilient Guidelines”. This research study was initiated to develop

## Development of cost-effective green masonry products using waste materials

(Utilization of textile waste in the manufacturing of paving blocks with improved shock absorption and water permeability characteristics)

Synthetic fibre blended textile (polyester spandex) offcuts generated from apparel industry is considered as a waste: currently it is incinerated as fuel in the cement manufacturing process and remainder ends up in illegal dumps.



Accordingly, fabric embedded paving block was developed by using optimum reinforcing effect of fabric fibers as at 26% by volume of the fabric-cement –sand mixture. Developed paving blocks were tested for the requirements specified in BSEN 1338: 2003, Concrete paving blocks-Requirements and test methods. As additional features, the developed paving block has the ability to reduce impact force by 20% which satisfying the requirement for outdoor sports surfaces for better foot comfort. Furthermore, water infiltration capability of developed fabric embedded paving blocks is 100 times higher than that of conventional concrete paving blocks that can significantly lower the surface runoff during heavy rains. Production cost of fabric embedded paving block depends on the scale of production, accordingly materials cost per paving block (200mm x 100mm x 60) is estimated as Rs.29.90. After completion of laboratory tests, as a field trial 500 nos. of paving blocks were laid to cover a footpath in NBRO head office and its performance was also at a satisfactory level.

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## Suitability of offshore sand sludge for value added building products

River sand, used as a raw material in construction industry, is being over extracted in Sri Lanka and this has progressed into adverse environmental impact. Therefore, as a solution to this raising issue, the offshore-sand was introduced as an alternative to river-sand by the Sri Lanka Land Reclamation & Development Corporation (SLLRDC) in 2002. During the processing of offshore sand, the sludge (OSS) is produced as a by-product which amounts to be about 150 cubes per month. Currently, the sludge is used either as land filling or is being dumped haphazardly. Landfill disposal of the offshore sands sludge (OSS) is also not economically viable because it drains the volume capacity of the land. Therefore, it is important to study the alternative uses of OSS, to be utilized as an economical and environmentally friendly feasible option, due to the similar mineralogical composition of offshore sand. This study is focused on identifying the material properties of the OSS, in order to identify the possibilities of utilizing of OSS as a raw material suitable in secondary applications of the construction industry apart from use as a land filling material.



OSS samples were collected from different places in the sand dump and characterized using XRF and other tests to determine the elemental composition and other physical properties. It revealed that the predominant compounds in the off shore sand sludge were  $\text{SiO}_2$  (49.5%) and  $\text{CaO}$  (32.6%). Loss of Ignition test results showed that the sludge had 0.99% of low value. Sludge Particle size range were determined as per BSEN standards and a predominant number of fine particles were between 0.5mm to 0.125mm. According to the BS 1744 standards fine content (2.17%) acid soluble sulphate (0.004%) and water-soluble chloride (0.003%) content were determined. These major properties are given a green light to further studies in the research. According to the test results OSS have ability to use as a filler material for tile adhesives which have high demand in the construction industry.

Therefore, as a next step of the research, NBRO is going to manufacture a tile adhesive using the OSS (filler aggregate) in laboratory scale. Manufactured tile adhesive samples will be tested according to the ISO 13007-2 standard to observe the compliance.



*Application of mortar prepared from offshore sand sludge*



## Development of test method and specification for coir geotextiles



Coir fibre is a widely available bio-degradable material in Sri Lanka which is used to produce bio degradable products for local and international markets. It was found that mainly five main manufactures are involved in the sector of manufacturing coir geotextiles. Coir geotextile mat is manufactured using hand twisted yarn as well as machine spun twine. It is used as a blanket to prevent soil erosion and it can be used for all soil bio-engineering and erosion control application in stream banks, slopes, wetlands, hillside soils and golf course development. The local manufactures are unaware of applicable test methods for coir geo-textiles and standardized methods

could not be found for Tensile Strength, Electrical conductivity and Durability which also have great significance. Indian standard IS 15868 (Parts 1 to 6) specifies test methods for natural fiber geotextiles which include mass per meter run, thickness, percentage of swell, water absorption capacity, shouldering resistance and mesh size. Therefore, developing suitable test methods for tensile strength, electrical conductivity and durability and observe the performance of coir geotextiles is beneficial for the coir base industries. In return, this will help to standardize the coir geotextiles production in the country.

Literature survey of this research have been done already to identifying the application of coir nets in erosion control and vegetation. And also survey for the manufactures and the exporters were done by online. This was important to identifying the issues mainly effected to their industries and exporting. Based on that information the path of the research was decided and part of testing has been already done to identify the possible ways of developing the test standard. This research is continuing to the year 2021.

## Air Quality Study on concentrations and significance of Chrysotile Asbestos fiber in household dust and household ambient environment in Sri Lanka

The project involves identification of airborne Chrysotile fiber levels at indoor and ambient environment in household at urban, sub urban and rural areas In Sri Lanka. The main objective of this is to examine air borne chrysotile fibers in the air within the household indoor and ambient environment in urban, sub urban and rural area of Colombo and Anuradhapura districts, identifying the possible relations between the use of Chrysotile fiber containing products and the airborne Chrysotile fiber levels and to establish a reasonable Indoor Air Quality guideline, if necessary. The project was awarded to NBRO by Ministry of Science, Technology and Research through the National Research Council of Sri Lanka on 27<sup>th</sup> February 2019 with project value of Rs. 4.98 Mn. The Ural Chamber of Commerce and Industry of Russia provided funds to Sri Lanka for this initiation. During the project period of two years, NBRO was able to complete the sampling of Asbestos, counting and analysis of fibres by using Phase Contrast Microscope method. Reports were submitted quarterly and one research paper was published. Currently compiling of the final project report and writing of two international research papers are in progress.



## Symposia

### International Symposium on Multi Hazard Early Warning and Disaster Risk Reduction (MHEW 2020)



International Symposium on Multi Hazard Early Warning and Disaster Risk Reduction (MHEW 2020) was successfully held as a virtual event from 14<sup>th</sup> to 16<sup>th</sup> December 2020 to promote availability and application of research, science and technology to promote implementation of Sendai Framework for Disaster Risk Reduction.

During this symposium, several key-note speeches and many presentations were done during plenary sessions and technical sessions. The Final Plenary Session was moderated by Prof. Dilanthi Amaratunga, Global Disaster Resilience Centre, University of Huddersfield, UK; Sisira Madurapperuma, Asian Disaster Preparedness Centre, Thailand, & Chathura Liyanaarachchige, Disaster Management Centre, Sri Lanka and with the participation of Prof. Kapila Perera, Secretary, Ministry of Education; Prof. Ranjith Dissanayake, Secretary, State Ministry of Rural Roads and other Infrastructures; General (Retd.) G.D.H. Kamal Gunaratne, Secretary of Defense, Ministry of Defense, Sri Lanka; Prof Ranjith Senaratne, Chairman, National Science Foundation of Sri Lanka; Major General Sudantha Ranasinghe, Director General of the Disaster Management Centre; and Dr Hemantha Herath, Deputy Director General (Health Services) Colombo in attendance and in this session, the MHEW and DRR Declaration was adopted.

One highlight of this conference was the Plenary Session on "Nature Based Solutions (NBS) for a Resilient Future" chaired by Eng. Dr. Asiri Karunawardena, Director General of NBRO. From this Plenary Session, the following key messages were given as inputs to the Final Plenary Session leading to Colombo Declaration on MHEW and DRR 2020:

1. NbS are useful and important, to meet the Ecosystem-based societal challenges and addressing associated risk arising out of ill effects of climate change and anthropogenic interventions that have resulted in degradation of the natural eco-system and reduced resilience of communities
2. Conventional solutions (structural measures) when incorporated with NbS can offer and add more value in mitigating the risk associated with hydro-meteorological disaster events. It can help in better management of eco-systems while mitigating the ill effects of climate change in the long run.
3. Investing in Nature based practices not only benefits in reduction of disaster risk and the climate change impacts, but also helps in providing other benefits, such as the livelihood enhancement, reduction of socio-economic vulnerabilities, protection of environment, preservation of natural resources etc. In this connection Communities can serve as agents for change, and it is the responsibility of authorities to take policy interventions which helps empowering the at-risk communities adequately.
4. It is crucial to take steps to improve the capacity to produce knowledge domestically and enhancing opportunities for sharing research outcomes widely. Further internationalization and modernization

of capacity building programs can ensure wider application, quality enhancement and sustainability.

5. Lot of interesting work connected with NbS concept is happening in Sri Lanka. But it is essential to have a coordinated effort to promote them widely. So better to develop a knowledge platform around this thematic area, so that all researchers, practitioners, professionals, academia will be able to share knowledge and experience.
6. Above mentioned facts are fundamental in mainstreaming of NbS into the climate and disaster resilience policies and strategies, and to help scaling up DRR and CCA interventions for sustainable development.



## Training Programmes, Seminars and Workshops

### Training and Awareness – 2020

#### **Study on Life two years after relocation: “Status quo of natural hazard induced displacements and resettlements in Sri Lanka”**

Study on Life two years after relocation: “Status quo of natural hazard-induced displacements and resettlements in Sri Lanka” was undertaken under the training and awareness component. Aim of this research study is to understand the impact of the disaster induced relocation on the affected people in the Kegalle district post the Aranayake landslide in 2016. This research study was a great platform in understanding the impact of relocation on people displaced due to landslides which enable to making recommendations on changes to be made in the relocation process. Study findings were disseminated among the delegates representing various government and non-government stakeholder organizations, professional bodies and universities involved in post-disaster re-construction work in Sri Lanka. Study findings also discussed among the District and Divisional Secretaries of Kegalle District. This study is a collaboration between Social Policy Analysis and Research Centre, University of Colombo and University of Huddersfield, United Kingdom and the National Building Research Organisation (NBRO) Sri Lanka.



#### **Online Short Course on “Sustainable Infrastructure”**

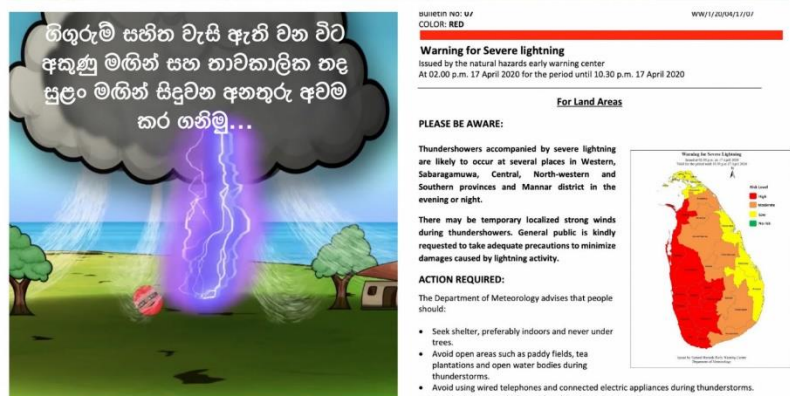
NBRO in collaboration with the University of New South Wales (UNSW), Australia organized an Online Short Course on “Sustainable Infrastructure”. This online short course was conducted by Dr. Sarath Mataraarachchi, Convener of Sustainable Built Environment, University of New South Wales, Australia. This course was held from 30<sup>th</sup> July 2020 to 16<sup>th</sup> October 2020. Officials from NBRO and the agencies comes under the Disaster Management Division of the Ministry of Defence participated in this online short course. This programme aims at capacity building of NBRO officials on the planning and management of sustainable infrastructure and public services in Sri Lanka.

#### **Virtual Capacity Development programmes throughout Work from Home Period**

Series of interactive sessions was arranged for the NBRO staff to acquire knowledge on diverse disciplines during the COVID – 19 crisis period of work from home. Below are the sessions held;

- “Innovations and Inventions” by Dr. Pathmakumara Jayasinghe, Senior Scientist, NBRO
- Motivational forum on COVID – 19 crisis. This session was hosted by Eng. Nishantha Kamaladasa, Senior Consultant, Former CEO of Distance Learning Centre

- ## Public Awareness Campaign on Landslide Early Warnings via Social Media

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## Major Consultancy Projects

### Clearing geotechnical issues in construction projects

NBRO conducts investigations and issues reports as requested by authorities such as UDA and Tourist Board, prior to them approving projects that involve construction of high-rise buildings and large building complexes where extensive excavation and foundation works are carried out and can impact negatively on neighbouring buildings.

Year	2017	2018	2019	2020
No. Reports & Renewals	32	38	20	09

### Issuing condition reports on buildings

NBRO conducts investigations to assess the condition of buildings and their structural integrity and then issues relevant reports as a fee-based service. This is done as per a client request or a court order. Often such services are required to assess damage to buildings caused by construction activities in adjacent properties. This process has been carried out for considerably long period by NBRO and the following table gives the details.

Year	2015	2016	2017	2018	2019	2020
No. Reports	42	60	148	116	124	116

### Study of Ambient Air Quality in Main Urban Cities in Sri Lanka

NBRO continued to study the ambient air quality in main urban cities in Sri Lanka by using passive air quality monitoring technique. Monitoring work of SO<sub>2</sub> and NO<sub>2</sub> was started in 2012 under the VETT program in Colombo, Gampaha, Horana, Rathnapura, Galle and Kalutara. Later, the monitoring was extended to Kandy, Kurunegala, Anuradhapura and Puttalam and PM 2.5 sampling program was also introduced. Collected data are used to enhance the NBRO Air Quality database.

### Investigation, Design & Providing Consultancy for Extension of Southern Expressway Project

Followed by a massive cut slope failure at Beliatta on L.H.S (double cut slope in 1km in length 52m in height) on Southern Expressway RDA requested NBRO guidance for implementation of slope stabilization measures at Ch/ 19+000 to 20+000 at Beliatta on Southern Expressway Construction Project. NBRO provided the following services. Total estimated cost of the work is Rs. 44.81 Mn.

- i. Geotechnical Investigation
- ii. Geological Exploration
- iii. Engineering Design for Slope Rectification
- iv. Providing consultancies, Construction Supervision for slope mitigation project



*Slope rectification work in in Southern expressway at Beliatta*



### **Construction of new technology concrete panel cost effective permanent houses for the conflict affected families in the Northern and Eastern Provinces of Sri Lanka**

NBRO was appointed as the Technical Consultant to the project for the construction of 28,000 concrete panel cost-effective houses for conflict affected families, starting with 1000 houses in Eastern Province. The project implementing agency is State Ministry of Rural Housing and Construction & Building Materials Industries Promotion and the Contractor is Yapka Developers (Pvt.) Ltd. NBRO signed a MoU with the Implementing Agency to provide five key technical services; conduct technical evaluations and develop technical specifications; conduct stakeholder awareness and training programs; condition assessment of lands; coordinate quality assurance of Building Materials; and construction monitoring and Payment Certification.

Proposed house will have a total floor area of 650 sq.ft and it is comprised of two bed rooms, living area, kitchen and a bath room with toilet. The specialty of the proposed housing technology is the ability to complete a house within 21 days with the use of ALC Panels for walls with minimum labor requirement and per house cost is Rs. 1.28 million.



Model House Constructed in Badulla Area



Construction of concrete panel houses in Kuchchuveli, Trincomalee

## Other Income Generating Activities

NBRO continued the provision of technical testing and consultancy services in the fields of landslide studies and services, geotechnical engineering, project management services, building materials, human settlements planning and environmental management and this work continued to strengthen the financial viability of the institution. Testing and consultancy services provided by NBRO are summarized below:

Activity/ Division	No. of consultancy jobs	No. of testing/Inv estigation jobs	Total Income Generated (Rs. Mn.)
Landslide Research & Risk Management Division	854	-	63.39
Geotechnical Engineering & Testing Division	160	134	157.52
Environment Studies & Services Division	216	265	52.78
Building Materials Research & Testing Division	-	2276	35.51
Project Management Division	116	75	48.91
Human Settlements Planning & Training Division	9	-	28.69
Other Revenue	-	-	53.65
<b>Total</b>			<b>440.45</b>



## Projects with Foreign / Donor Collaboration

### NBRO-JICA technical collaboration projects (Foreign Aid and Technical Cooperation)

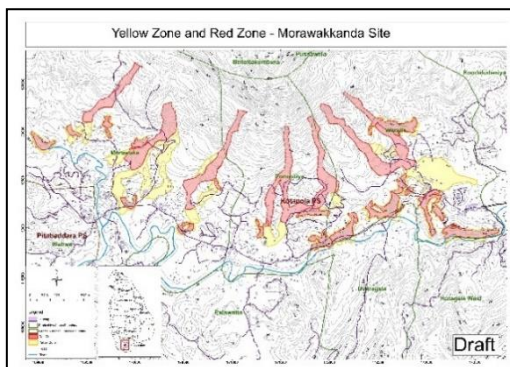
#### ➤ Technical Cooperation for Landslide mitigation Project (TCLMP-Phase I & II)

Mitigation work of 4 hazardous sites (landslide sites in Badulusirigama, Udamadura & Kandy and Alagumale rockfall site), had been completed under Phase – I of the Technical Cooperation for Landslide mitigation Project (TCLMP) with the assistance of JICA. The project works were carried out by NBRO, Koiwa Corporation and Earth System Science Limited with Nippon Koei working as the consultant.

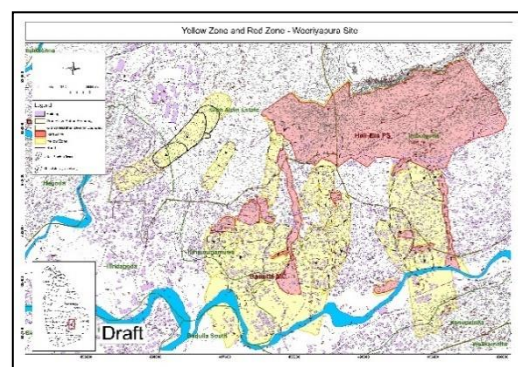
Phase – II of the TCLMP now referred to as Project “SABO” commenced as a three-year project aiming at capacity strengthening on the development of non-structural measures for landslide risk reduction in Sri Lanka with especial emphasis on conducting site specific hazard mapping and risk assessments, issuing landslide early warning at local level, improving existing observation system and alerts, and applying risk assessments of sediment disasters to land-use planning and development standards. At the beginning, three pilot sites from Kegalle, Badulla and Matara were selected for project implementation. In order to achieve the targeted outputs of the project, the following three working groups have been appointed.

Working group 1 (WG1)	-	Hazard Analysis and Risk Assessment
Working group 2 (WG2)	-	Sediment Disaster Early Warning System
Working group 3 (WG3)	-	Land Use Planning and Development Standards

**Under WG1**, the following works were carried out: review of the existing methodology on Landslide Hazard Zonation Mapping and Risk assessment; improving system for managing landslide disaster records; collecting and analyzing records of past landslide disasters; preparation of draft manuals on site specific hazard mapping and risk assessment; preparation of site specific hazard maps for the three pilot sites using Red zone and Yellow Zone concept; conducting landslide flow path simulation using Hyper KANAKO model for three pilot sites, and conducting site-specific hazard mapping in areas other than pilot sites. In addition, workshops, training and mini-seminars were conducted for the NBRO staff.

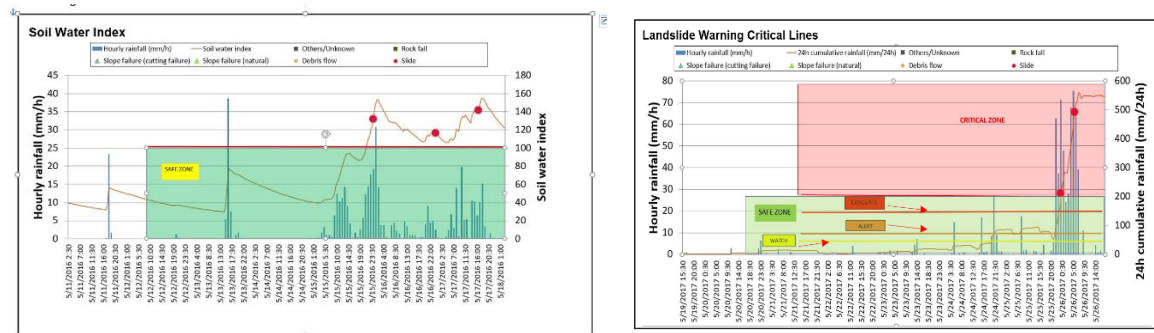


*Site Specific Hazard Output of Morawakkanda pilot site*



*Site Specific Hazard Output of Weeriyapura pilot site*

**Under WG2**, NBRO has completed some enhancement works of landslide early warning process for the improvement in efficiency of issuance the landslide early warning and rainfall monitoring activities, prepared a landslide inventory database using past landslide investigating reports and other available sources and the rainfall threshold calculation work has been carried out for all 12 landslide-prone districts with the available rainfall and landslide data. With this study, 24, 48, 72 hrs. One-hour rainfall threshold values and soil water index values were derived for the above areas. For the issuance of landslide early warning, the rainfall critical line which was obtained from combination of the short-time and long-time rainfall values can be utilized.



The identified rainfall thresholds should be updated with future landslide and related rainfall data to fine-tune the rainfall thresholds in Sri Lanka.

In Output 3, the Project has been discussing the appropriate land use and necessary governmental and local efforts in the area designated by the Yellow / Red zones. For instance, in Yellow zone, strengthening early warning and evacuation system should be enhanced by the central and local governments. In Red zone, new construction of buildings and/or public facilities must be controlled not to create New Risk.

These discussions should be done involving Local Authorities, Districts and DS Divisions as well as the central development agencies such as UDA. At the same time, it is also important to guide what kind of structural measures should be applied to develop the area designated by the Yellow / Red zones. Both the land use regulation and the development standards will be summarized in a "Guideline for Disaster Resilient Land Use Regulation / Development Standards" to apply in landslide-prone communities in the country.

## Development of early warning technology of rain-induced rapid and long-travel landslides in Sri Lanka - SATREPS (JICA)

The International Landslide Consortium (ICL) based in Kyoto University in Japan, a leading authority for landslide studies in the world and NBRO jointly applied to Science and Technology Research Partnership for Sustainable Development (SATREPS) of Japan Science and Technology Agency (JST), Department of International Affairs, the Government of Japan and to National Planning Department of Sri Lanka simultaneously for the approval of the project titled “Disaster risk reduction of rain-induced rapid and long-travelling landslides”. This five-year Japan-Sri Lanka joint project was approved for implementation in 2019-2023 period. This proposal proposes introducing advanced technology through the global partners of ISDR-ICL Sendai Partnerships 2015-2025, to disaster risk reduction of rain-induced rapid and long-travelling landslides. Several local and Japanese collaborating and support agencies participate in this project work and initial works have been already started. The expected outcomes are:

1. Technology of 24 hours in-advance prediction of heavy rainfalls and resulting ground water pressure build-ups is developed. A technology to identify locations of rain-induced rapid long-travelling landslides and their moving areas is developed.
2. Technology and framework for effective risk communication to community people living in mountains and local cities are developed.
3. A system for early warning of rain-induced rapid long-travelling landslides is developed by integrating the technologies mentioned above based on the joint research in the pilot study sites. The developed system with guidelines and manuals is provided for the use in other areas in Sri Lanka.
4. The above technologies that are developed will ensure the safety of the public and secure vulnerable communities from landslides and associated hazards.

Inception workshops of this project was held in Colombo. In 2020, project office was established in Tokyo and several NBRO scientists have been trained in Japan as capacity development. More training programmes for stakeholders have been planned and some scientists have been already nominated for future training. Data collection exercises will be started and it has been planned to strengthen the geotechnical engineering divisional laboratory with sophisticated equipment such Landslide Simulator.



*SATREPS Project Office, Tokyo*



*Launching project at NBRO*

## Nature-based Solutions (NbS) as an Innovative Landslide Risk Management Practice for Sri Lanka.

Nature-based Solutions (**NbS**) are defined as actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits. The importance of such solutions is highlighted in the Sendai Framework for Disaster Risk Reduction 2015-2030 as an effective technique to reduce disaster risk, adapt to climate change and strengthen community resilience. Numerous studies carried out in many Asian Countries confirm the crucial role of vegetation in minimizing the risk of landslides, reducing the erosion and in supporting vulnerable communities to cope with associated risks. In Sri Lanka, it was found that the application of nature-based approaches in landslide risk management is still limited. Hence, the World Bank launched an Analytics and Advisory Services project in Sri Lanka on Nature-based Landslide Risk Management with the partnership of National Building Research Organisation (NBRO). Asian Disaster Preparedness Center (ADPC) was assigned to provide implementation support and technical guidance in executing the project. This project will raise awareness and deepen the knowledge on the role of nature-based and hybrid (combination of nature-based and conventional engineering measures) solutions for landslide risk management within the country and a comprehensive analysis was conducted by scientific community in determining the contributory factors towards societal benefits of NbS.

Research carried out by NBRO under the current project was aimed at exploring the potential of the risk-informed NbS for mitigating the landslide hazard, stabilization of vulnerable unprotected slopes, and prevention of soil erosion in future. One of the findings of the project is that all types of landslides may not be able to mitigate through such nature-based solutions, but essentially there are number of potential application areas. NbS can be effectively used for mitigating risk in larger areas susceptible to landslide hazard, where application of conventional mitigation options is less cost effective. Among them are areas that have a potential for occurrence of shallow slow-moving landslides, larger areas left out due to appearance of symptoms of initiation of landslides, past landslide locations with signs of reactivation and areas that have a high landslide hazard potential as per hazard zonation mapping carried out by NBRO. Such areas become vacant due to landslide risk associated relocation and NbS can be effectively used for rehabilitation of such areas to ensure long term stability. It is true that the role of vegetation or soil bioengineering techniques in relation to deep-seated landslides is considerably smaller although reducing moisture content of soils by tree roots can still help avoid excessive soil water pressure build up.

Another important finding is that landslide hazards can be mitigated in a cost-effective manner when conventional engineering solutions are combined with nature-based solutions utilizing appropriate vegetation (Hybrid solutions) where plants species/vegetation constitute the major component in nature-based landslide risk management practices. Such hybrid solutions are more sustainable and can be introduced to counter the challenges arising from long term maintenance. Greening areas for getting higher aesthetic appearance is an additional benefit of these techniques.



*Example for the Hybrid solutions*



### Reduction of Landslide Vulnerability by Mitigation Measures Project (RLVMMP)

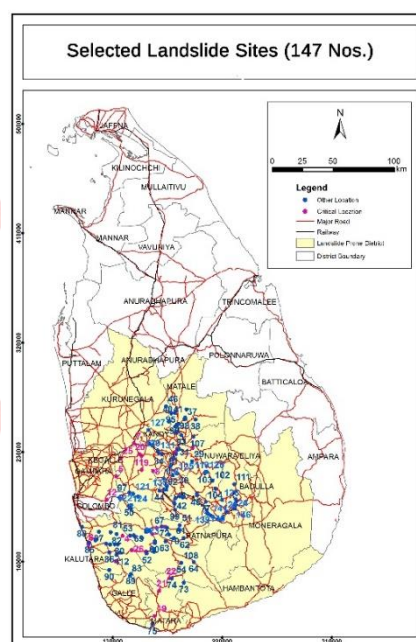
NBRO commenced the Reduction of Landslide Vulnerability by Mitigation Measures Project (RLVMMP) originated from Cabinet-approved Integrated Landslide Mitigation Programme. This mega project includes mitigation of identified high-risk landslide sites and also, roadside unstable slopes and unstable slopes along the railway lines in the hill country over 3 years. The main components of this project are:

- Civil work and associated design and construction supervision/management activities
- Policy and Regulation Enhancement
- Institutional Capacity Building
- Technical Support and Project Management

147 sites are requiring immediate mitigation, had been prioritized by NBRO jointly with local authorities, Road Development Authority, and Sri Lanka Railway.

The Project Management Unit continued its duties with the available project staff and with the assistance of NBRO supporting staff.

Province	District	No of Sites
Central	<u>Matale</u>	12
	Kandy	19
	<u>Nuwara Eliya</u>	14
North Western	Kurunegala	3
Sabaragamuwa	Kegalle	18
	<u>Ratnapura</u>	33
Southern	<u>Matara</u>	6
<u>Uva</u>	Badulla	19
Western	Colombo	1
	Kalutara	22
<b>Total</b>		<b>147</b>



Package 1 and Package 2 of Phase I have been awarded in the year 2020 to the selected contractors and the construction works of 11 Landslide sites have commenced in Ratnapura and Kalutara Districts. The civil work contract for Package 3 was also awarded and the construction works will be commenced in early 2021. Package 4 of Phase 1 was divided into three sub-packages, allowing more opportunities to local contractors considering the present COVID-19 situation and the tendering process on progress.



Landslide mitigation sites Durekanda (Left) & Galaboda (Right) in Ratnapura district

## ‘Mobilise Project



NBRO launched an international research collaboration with the THINKlab of the University of Salford, UK during the NBRO's annual research symposium 2019 in view of strengthening NBRO's digital capabilities to better respond to disaster risk reduction and disaster response capacities. The two parties worked together to understand NBRO's requirements for disaster risk reduction to develop

a focused set of digital environments and the THINKlab team provided the MOBILISE platform to NBRO. Later, applications were developed enhancing NBRO's capacity in advanced IoT technology, drones, modelling, simulation and visualisation in DRR activities. The University of Salford offered a PhD position to Mr. Dayan Munasinghe, Snr. Scientist at Human Settlements Planning & Training Division under this collaboration. Consequently, the MOBILISE platform has reached its maturity to fully integrate it with the existing digital infrastructure within NBRO. This collaboration was facilitated by the MOBILISE project ([www.mobilise-project.org.uk](http://www.mobilise-project.org.uk)) funded by the Global Challenges Research Fund (GCRF) in UK, for developing a digital infrastructure that can offer intelligence to a range of agencies to work together to reduce the impact of natural disasters on communities.

Important work in this project being the digitisation of the process of generating early warning messages and this has been an active collaborative research programme in 2020. NBRO first provided access to the MOBILISE technical team to a set of rain gauges to develop a workflow engine that manages early warning messages passing from NBRO to relevant authorities. As a result, district officers and Landslide Early Warning Centre of NBRO, the Disaster Management Centre and other authorities like District Secretaries, Divisional Secretaries, NDRSC, and Grama Niladhari Officers all receive personal login facilities to the EW system.

NBRO frequently use drone-based images in landslide risk management. MOBILISE platform allowed users uploading high-quality drone images to the platform and offered access to a range of interested parties and this facilitated sharing large files of information like drone images, zonation plans, and site layouts. This enhanced NBRO's ability to better collaborate with multiple stakeholders in community resettlement programmes and also, in the drone-based landslide mitigation monitoring activities. Using MOBILISE platform, a drone-based application was developed for construction monitoring in landslide mitigation sites to assist the ongoing mitigation in 147 locations that uses periodically captured drone images and videos to construct 3D models of such sites for the analysis by engineers. A set of virtual tools were developed for the engineers to conduct cross sectional analysis, soil cut & fill calculations and movement analysis. Results can be presented as a 2-D graph with several ground situation lines in drone images taken over different time periods. The soil, cut & fill volume calculation tool provides statistics as to how much soil is filled or removed in a particular site. Movement analysis provides the 3D movement of the selected location in time lapse, in which the user is required to observe the ground settlements, and horizontal movements of structures. Website: <https://nbro.mobilise-srilanka.org/>



Figure: Drone Data Visualization System

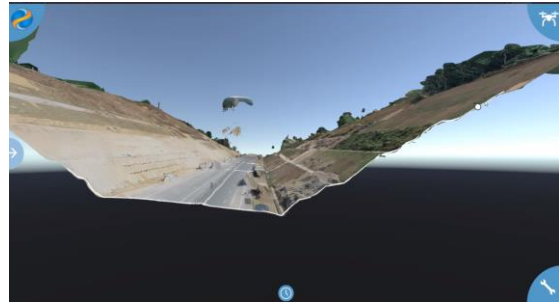


Figure: Ability to make cross sections

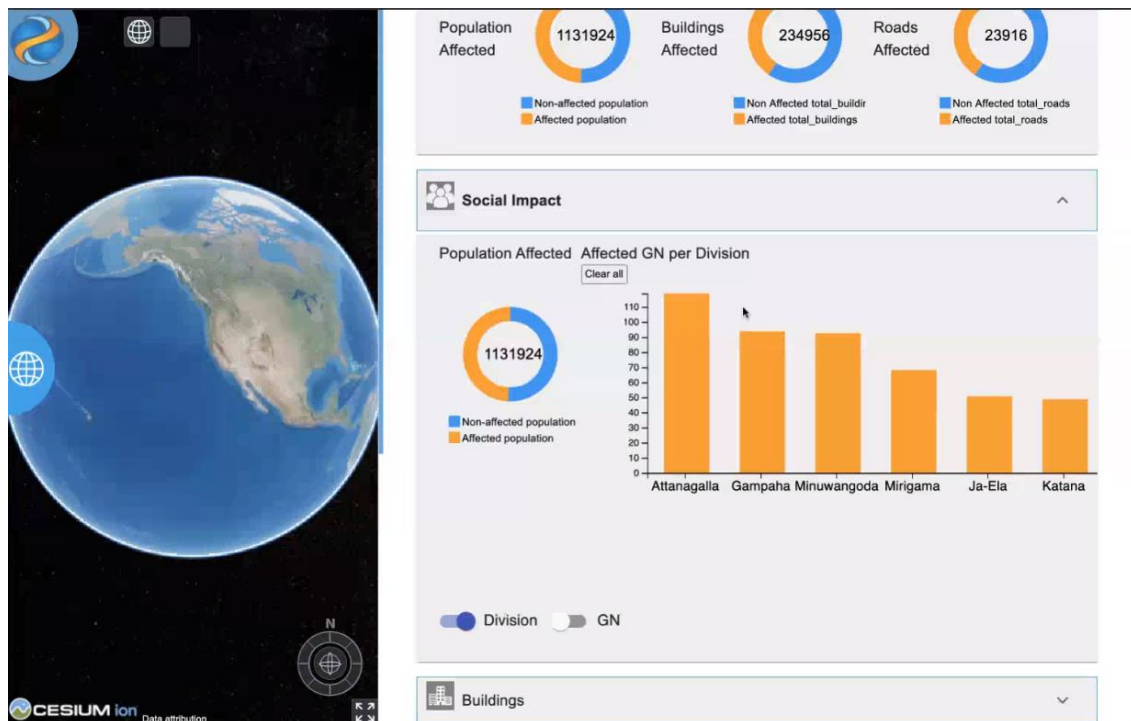


Figure 1: Mobilize System

### Technical Cooperation Project with USGS

A team from United States Geological Survey (USGS) visited NBRO in 2019 and discussions were held to assist NBRO on landslide risk management. A memorandum of understanding was signed between NBRO and the USGS to this effect. The team conducted a training programme for NBRO staff.

In October 2020, landslide monitoring equipment was donated and successfully installed by the NBRO team themselves, at a selected site in Bogahamadiththa, Badulla district. The previous experience and technical knowledge gained by the joint work sessions with the USGS served most valuable for a smooth installation of the new system.

These monitoring systems enable NBRO to remotely monitor parameters including soil moisture, pore water pressure, air temperature and real time rainfall at the installed sites. Data thus received by NBRO will be used for research purposes such as derivation of different parameter thresholds for the initiation of landslides in the area. NBRO further wishes to publish research papers on findings of the data analysis. The ultimate aim of this work is to issue targeted localized and regional landslide early warnings to the communities living in landslide prone areas, and in doing so, save more lives from the likely landslide incidents that their localities may incur in the future.





*Installation of monitoring systems in Badulla district*

## NBRO Publications

### Newsletters

#### Publication of Electronic Newsletters

6 numbers of Electronic Newsletters were published in year 2020. These newsletters contain;

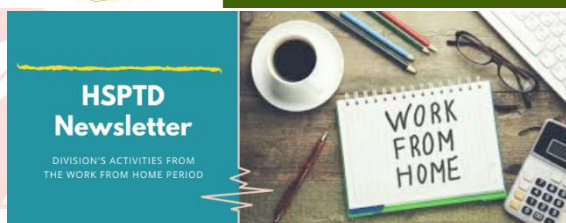
- (i) Publishing the work done during the period.
- (ii) Recording of daily presentations and its outcome
- (iii) Discuss thoughts of the team.

Newsletter can be access via below links;

<https://publicate.it/p/s67F6y143444>

<https://publicate.it/p/Q3qZ5t147301>

<https://publicate.it/p/jX6CeG141256>



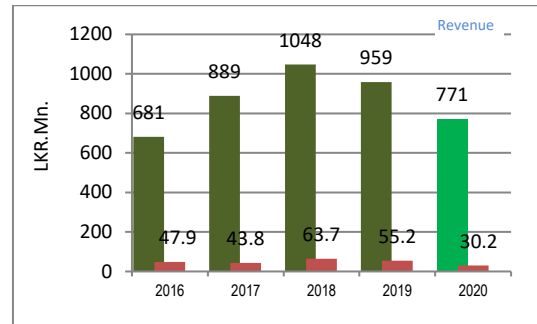
### Web applications

- 1 The drone Visualization system was developed under the MOBILISE platform and, initially, it is a stand-alone software that can upload the drone images, make 3D models and rotate them leading to the VR platform. This system will be used in the monitoring works of RLVMM Project with the support of THINKlab, School of Science, Engineering & Environment, Salford University.
- 2 Real Time Air Quality Monitoring Network in urban areas in Sri Lanka for air quality prediction and preparedness system

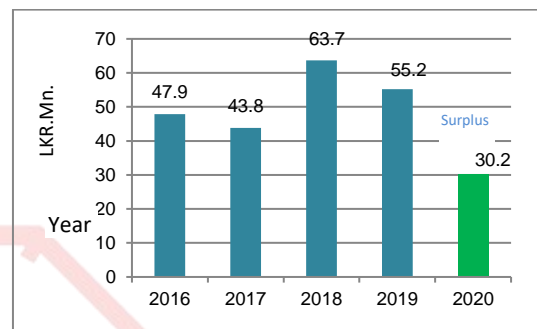
## Financial Highlights

In 2020, NBRO recorded consolidated revenue of Rs. 771.0 Mn. Revenue from customary NBRO services Rs. 387.0 Mn. in 2020. The institution depends mostly on this consultancy revenue generated to meet its recurrent expenditure.

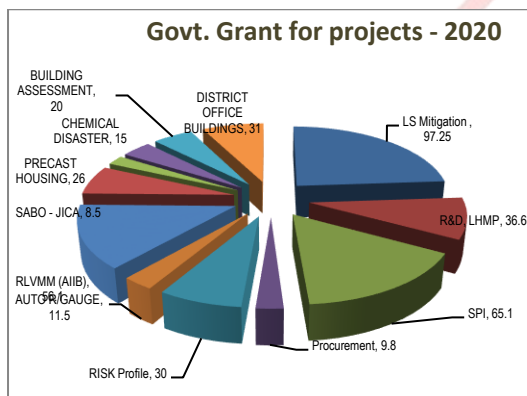
Rs. 331.0 Mn. has been utilized for projects and programs carried out in year 2020 under government grant. Nine district offices of NBRO have been functioning since March 2011 for issuance of Landslide Risk Assessment Reports for development work in landslide-prone districts. Rs. 32.5 Mn. was provided by the Treasury as recurrent expenditure and the balance requirement was met with nominal fee charged from applicants and rest by NBRO revenue.



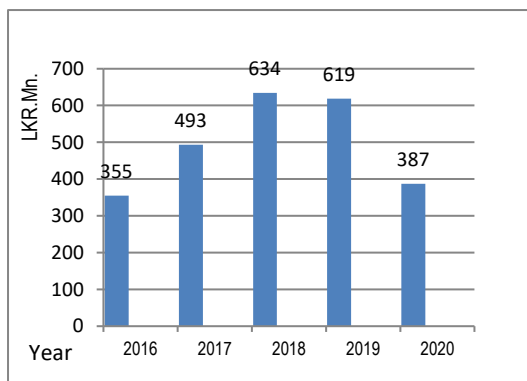
Total Operating Revenue vs net surplus



Net profit earning during 2016 - 2020



Government Grant for projects- 2020



Income by Testing and Consultancy

In addition, research grant for Landslide Hazard Mapping of Rs. 23.8 Mn, Research & Development Rs. 12.8 Mn, grant for Landslide Special Investigations of Rs. 65.1 Mn. and procurement grant for lab & field, office equipment of Rs. 9.8 Mn. was received from the Treasury.

The consolidated revenue for year 2020 was Rs. 771.0 Mn. while total consolidated expenditure for the corresponding period was Rs. 740.8 Mn. A net profit of Rs. 30.2 Mn. was recorded.

The expenses on personal emoluments for the staff strength of 402 plus daily paid employees was Rs. 455.0 Mn. in 2020 as against the staff strength of 490 plus daily paid employees was Rs. 539.0 Mn. In year 2019.

The institution growth and enhanced performance have been mainly due to the courageous effort of the management and the staff of NBRO.

## Statement of Financial Position

### STATEMENT OF FINANCIAL POSITION AS AT 31<sup>ST</sup> DECEMBER 2020

	Annex No	As at 31.12.2020		Rs. As at 31.12.2019
<b>Current Assets</b>				
Cash and cash equivalents	1		94,773,584	116,777,209
<b>Receivables</b>	2	477,982		477,982
Project Debtors				
Sundry Receivables	3	91,037,149	91,515,131	75,302,188
			<b>186,288,715</b>	<b>192,557,379</b>
Inventories	4		3,410,241	3,965,848
Receivables from staff	5		101,092,773	118,746,878
Pre-payments	5A		135,922,914	157,787,979
<b>Other Current Assets</b>				
Project work in progress	6	104,284,321		292,179,615
Term Deposits	7	469,321,082	573,605,403	463,912,823
<b>Non - Current Assets</b>			<b>1,000,320,046</b>	<b>1,229,150,522</b>
Infrastructure, Plant & Equipment	8	710,556,869		670,221,382
New Lab Building Working in Progress		391,734,775		333,811,858
Rathnapura Building Work in Progress		3,928,967	1,106,220,611	1,310,000
<b>Total Assets</b>			<b>2,106,540,657</b>	<b>2,234,493,762</b>
<b>LIABILITIES</b>				
<b>Current Liabilities</b>				
<b>Payables</b>				
Advance Received from Clients	9	319,910,612		514,260,662
Sundry payables	10	116,845,313	436,755,926	139,177,262
<b>Non – Current Liabilities</b>				
<b>Long term provisions</b>				
Provision for Depreciation	11	542,121,830		484,490,237
Provision for Gratuity & Bad debtors	12	105,257,332	647,379,162	93,534,997
<b>Total Liabilities</b>			<b>1,084,135,088</b>	<b>1,231,463,158</b>
<b>Net Assets</b>			<b>1,022,405,569</b>	<b>1,003,030,604</b>
<b>NET ASSETS / EQUITY</b>				
Capital contributed by Government & Other entities	13	588,731,489		599,526,190
Reserves – Revaluation Surplus		27,875,989		27,875,989
Assets acquired		2,264,498	618,871,976	2,264,498
Accumulated Surplus/ (Deficit)				
Surplus brought forward	14	373,363,926	373,363,926	318,124,023
<b>Surplus for the year</b>			30,169,666	55,239,903
<b>Net Assets / Equity</b>			<b>1,022,405,569</b>	<b>1,003,030,604</b>

## Statement of Financial Performance

### STATEMENT OF FINANCIAL PERFORMANCE FOR THE YEAR ENDED 31.12.2020

Rs.

Revenue	Annexure	Year 2020	Revised Budget 2020	Year 2019
<b>Revenue</b>				
Environmental Studies & Services Division	15	66,284,071	68,225,056	72,854,502
Geo Technical Engineering & Testing Division	16	157,524,997	181,000,000	235,338,251
Landslide Research & Risk Management Division	17	226,452,921	232,850,000	273,147,266
Human Settlement Planning & Testing Division	18	64,031,993	65,203,372	97,376,186
Building Material Division	19	35,505,706	36,000,000	40,648,623
Project Management Division	20	167,890,127	153,494,823	186,387,791
<b>Total Operating Revenue</b>		<b>717,689,815</b>	<b>736,773,251</b>	<b>905,752,619</b>
<u>Other Income</u>	21	53,654,050	50,000,000	53,120,424
<b>Total Revenue</b>		<b>771,343,865</b>	<b>786,773,251</b>	<b>958,873,043</b>
<b>LESS - Expenses</b>				
Salaries, Wages and Employee Benefits	22	454,787,074	490,094,565	538,893,390
Supplies and consumables used	23	235,814,360	225,124,614	326,542,078
Depreciation	24	6,478,138	8,000,000	9,244,961
Impairment of Property, plant and Equipment	25	13,065,378	10,910,071	16,333,344
Other Expenses	26	27,780,767	21,231,705	12,565,069
Finance Cost	27	48,482	3,881	54,298
<b>Total Expenses</b>		<b>737,974,198</b>	<b>755,364,836</b>	<b>903,633,140</b>
<b>Net Profit before Tax</b>		33,369,666	31,408,415	55,239,903
<b>Income Tax</b>		3,200,000		
<b>Net Profit after tax</b>		<b>30,169,666</b>	<b>31,408,415</b>	<b>55,239,903</b>



## Cash Flow Statement

### CASH FLOW STATEMENT FOR THE YEAR ENDED 31.12.2020

Rs.

	Year 2020	Year 2019
<b>Surplus / (Deficit)</b>	<b>30,169,666</b>	<b>55,239,903</b>
<b>Adjustments</b>		
Depreciation	6,478,138	9,244,961
Provision for Gratuity	17,539,828	19,906,232
Gratuity Payment	-5,817,493	-2,194,769
Disposal of vehicles	-	-
unrealized Interest Income	-46,168,030	-47,177,596
<b>Operating Surplus(Deficit)before working capital changes</b>	<b>2,202,110</b>	<b>35,018,731</b>
<b>Changes in working capital</b>		
Increase in Debtors	-15,734,961	-26,611,666
Increase in Receivable from Staff	17,654,105	-89,390,591
Increase in Pre payments	21,865,065	-33,599,420
Increase in Inventories	555,606	-222,667
Increase in Working In Progress	187,895,293	149,488,457
Increase in Deposits	-5,408,259	123,680,265
Money Received from Client	-194,350,050	-59,644,750
Increase in Sundry Creditors	-22,331,949	-3,733,738
<b>Net Cash flows from Operating Activities</b>	<b>-7,653,038</b>	<b>94,984,621</b>
<b>Cash flows from Investing Activities</b>		
Interest Income	46,168,030	47,177,596
Purchase of Fixed Assets	-100,900,638	-204,792,239
Disposal of Fixed Assets	23,268	1,500,000
<b>Net cash flow from Investment activities</b>	<b>-54,709,341</b>	<b>-156,114,643</b>
<b>Cash flows from Financing Activities</b>		
Government Grant (Procurement)	11,611,914	21,013,402
Other Government Grants	28,746,841	49,578,848
<b>Cash flows from Financing Activities</b>	<b>40,358,754</b>	<b>70,592,250</b>
Net change in Cash and Cash equivalents	-22,003,625	9,462,227
Cash and cash equivalents beginning of the period	116,777,209	40,116,143
<b>Cash and cash equivalents as at 31.12.2020</b>	<b>94,773,584</b>	<b>49,578,370</b>
<b>Note- Cash and Cash equivalents</b>		
Cash at Bank and hand	94,773,584	116,777,209
	<b>94,773,584</b>	<b>116,777,209</b>

## Notes to Accounts

### 1. Accounting Policies.

Financial Statements have been prepared by Complying with generally accepted Accounting Principles, Fundamental assumptions, Public Sector Accounting Standards and Accounting Standards introduced by the Institute of Chartered Accountants from time to time and also by considering the followings.

- (a) Going Concern
- (b) Consistently Application of Accounting Policies.
- (c) Revenue and expenses recognition on accrual basis.
- (d) Disclosure to deviations to Standards

### 2. General Accounting Policies.

#### 2.1 Depreciation Policies.

- (a) Depreciation is provided based on number of days used
- (b) Fixed assets are depreciated on Straight Line basis using the following rates.

Fixed asset type	%
Buildings	2.5
Machinery and Lab Equipment	20
Furniture & Fitting	10
Vehicles	20
General Office Equipment	20
Drawing Office Equipment	10
Tools	50
Library Books	5
Fire Extinguishers	10

- (c) Amortization for granted assets has been deducted from the carrying value of grants as stipulated in Sri Lanka Accounting Standards.

#### 2.2 Valuation of Closing Stock

Unutilized materials stocks have been valued at cost.

#### 2.3 Provision for Gratuity

Provision for gratuity is calculated in accordance with the Gratuity Act.

#### 2.4 Provision for doubtful Debtors

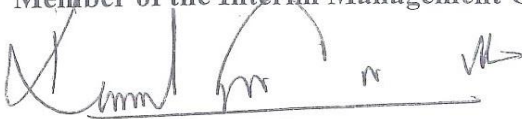
A provision has been made for doubtful debts on the basis of;

- (a) 1 % Provision for debts outstanding over 2-10 years.
- (b) 25 % Provision for debts outstanding over 10 years.

## Statement of Responsibility for Financial Statements in terms of Sec. 7A.

The Accounting policies & Notes to Accounts on pages 06 form an integral part of these Financial Statements. The Board of Directors is responsible for the preparation and presentation of these Financial Statements. These Financial Statements were approved by the Board of Directors and signed on their behalf.

### Member of the Interim Management Committee of NBRO



Kamal Gunaratne WWV RWP RSP USP ndc psc

Major General (Retd)

Secretary

State Ministry of National Security and Disaster Management

Chairman of the IMC

**General Kamal Gunaratne (Retd)**  
WWV RWP RSP USP ndc psc MPhil  
Secretary  
State Ministry of National Security,  
Home Affairs and Disaster Management



H. U. R. Fonseka

Chief Accountant

Disaster Management Division

State Ministry of National Security and Disaster Management

**H.U.R. Fonseka**  
Chief Accountant  
State Ministry of National Security,  
Home Affairs and Disaster Management  
Disaster Management Division  
Vidya Mawatha, Colombo 07.

### Chief Executive Officer of NBRO



Eng.(Dr.) Asiri Karunawardena

Director General


National Building Research Organisation

**Director General**

**National Building Research Organisation**

**No. 99/1, Jawatta Road,  
Colombo 05.**

### Chief Financial Officer of NBRO



K.K.H. Randeny

Director (Finance)

National Building Research Organisation

**K.K.H. RANDENY**  
DIRECTOR FINANCE  
NATIONAL BUILDING RESEARCH ORGANIZATION  
FINANCE DIVISION  
99/1, JAWATTA ROAD,  
COLOMBO - 05.



## Human Resource /Capacity Development

NBRO's Vision and Mission were set to develop its capacity to cater the Ministry's DRR needs. With this in view NBRO is in the process of legalizing the institution mission by an act and developing staff capacities to deliver high standard outputs. Human resource and infrastructure needs of the institution are becoming a matter of serious concern with the increasing responsibilities the institution shoulder at present.

Recruitment of new employees for essential vacant positions was done. In 2020, 7 employees in 2 categories were recruited.

No	Salary / Code	Staff Category	Approved Cadre	Staff Available (Permanent)	No of Vacancies (Permanent)	Staff Available (Other Basis)
1	HM 2- 3	Senior Manager ( CEO)	1	1	0	0
2	HM 1-3	Senior Manager	8	7	1	0
3	AR2	Senior Academic/ Scientist	25	21	4	0
4	MM 1-1	Middle Management	12	10	2	-
5	AR 1	Academic/ Scientist	124	110	14	26
6	JM 1-1	Junior Management	25	23	1	09
7	MA 2-2	Management Assistant (Tech)	36	32	4	06
8	MA 1-2	Management Assistant (Non Tech)	53	41	12	12
9	PL 1,2&3	Primary	102	83	19	21
	<b>TOTAL</b>		<b>386</b>	<b>328</b>	<b>57</b>	<b>74</b>

### RECRUITMENT, RETIREMENTS & RESIGNATION of PERMANENT STAFF IN 2020

No	Sal/ Code	Staff Category	No of Recruitment	No of Resignations	No. of Retirement
1	HM 1- 3	Senior Manager ( CEO)	-	1	-
2	HM 1-1	Senior Manager	-	-	-
3	MM 1-1/JM 1-1	Middle/ Junior Management	-	-	-
4	AR2	Senior Academic/ Scientist	-	2	-
5	AR 1	Academic/ Scientist	-	3	-
6	MA 2-2	Management Assistant (Tech)	-	-	-
7	MA 1-2	Management Assistant (Non Tech)	-	2	2
8	PL 1,2&3	Primary	-	1	5
	<b>TOTAL</b>		<b>-</b>	<b>9</b>	<b>7</b>



## NBRO Training/Attending Workshop/Seminar etc.

NBRO carried out various training programmes for its staff. Many staff members were sent for short term training programmes, workshops and seminars abroad. Some scientists were selected for masters programmes abroad.

### Foreign Training Opportunities in 2020

No	Name	Designation Division	Training Program	Period	Country
1	Mr. W.D.B.C. Abeywickrama	Scientist GETD	Master's Degree Program in Photogrammetry & Geoinformatics for the Academic Year 2020/21	02nd October - 31st March 2022	Germany
2	Mrs. K.M.S.K. Rajapaksha	Scientist ESSD	Master's Degree Program in Civil Environmental Engineering	25th September 2020 - 24th September 2022	Japan
3	Mrs. D.M.D.I.K. Ariyaratna	Scientist LRRMD	JICA Long Term Training (PhD) under Project on Development of Early Warning Technology of Rain - Induced Rapid and Long Travelling Landslides in Sri Lanka	12th October 2020 - 30th September 2023	Japan
4	Mr. S.H.S. Jayakody	Scientist (Engineer) GETD	JICA Long Term Training (PhD) under Project on Development of Early Warning Technology of Rain - Induced Rapid and Long Travelling Landslides in Sri Lanka	11th November 2020 - 30th September 2023	Japan

## PROCUREMENT OF EQUIPMENT

The grant of LKR 9.8 Mn. given by the General Treasury in 2020 to procure laboratory and field equipment for research for capacity building in NBRO was effectively utilized. Several major equipment including field accessories were procured under this grant. The key items are listed in the following table.

Division	Item
ESSD	Colorimeter, Ph Meter, Turbidity Meter, Sound meter, Air Sampling Pumps 6 No. CO2 Gas Detector, Multi-gas detector, VOC detector, Noise meter, Water quality checker
HSPTD	Phantom 4 RTK drone - 3 Matrice 210 RTK drone - 1

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