

BAGHJAN WELL # 5 BLOWOUT

Damage Assessment and Restoration Plan of Dibru Saikhowa National Park

and

Maguri-Motapung Wetlands



**FINAL REPORT OF EXPERT COMMITTEE
TO THE HON'BLE SUPREME COURT OF INDIA**

December 31, 2021

**Vide the order dated September 2, 2021 passed by the Hon'ble Supreme Court
in Civil Appeal No. 2201/2021**

Dedication

This report is dedicated to the persons and numerous species which perished or were affected by the Baghjan Well # 5 blowout accident in the hope that the recommendations herein will help address the injury caused and minimize the risk of such disasters ever happening again.

Acknowledgements

The Committee wishes to acknowledge the participation of the individuals and organisations, Government officials and agencies alike for offering their views and insights. The Committee also expresses gratitude to all the experts, scientists, nature enthusiasts and the local people who have participated in deliberations held through virtual and/or in-person meetings. The Deputy Commissioner, Tinsukia, the Superintendent of Police, Tinsukia and officials of the Environment and Forest Department, Government of Assam are thanked for their support and cooperation.

Cover Photograph:

Baghjan Blowout site as on June, 2020 (Left) and December 2021 (Right).

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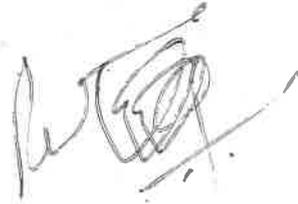
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Committee Members

Justice B.P. Katakey (Chairperson)



Dr. Ritesh Kumar



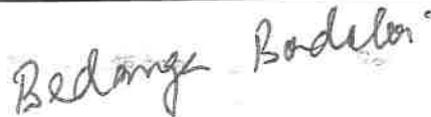
Mr. G.S. Dang



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Bedanga Bordoloi

Abbreviations

BGN#5:	Baghjan Well No. 5
BNHS:	Bombay Natural History Society
CoC:	Contaminants of Concern
CD:	Compact Disc
CGWB:	Central Ground Water Board
CPCB:	Central Pollution Control Board
CSM:	Conceptual Site Model
DDMP:	District Disaster Management Plan
DFO:	Divisional Forest Officer
DSBR:	Dibru Saikhowa Biosphere Reserve
DSNP:	Dibru Saikhowa National Park
EDC:	Eco Development Committee
EIAMS:	Ecosystem Inventory, Assessment and Monitoring System
GHG:	Greenhouse Gas
KLD:	Kilo Liter per day
MMW:	Maguri-Motapung Wetlands
MSDS:	Material Safety Data Sheet
MoEFCC:	Ministry of Environment, Forest and Climate Change
OIL:	Oil India Limited
OMCR:	One-Man Committee Report
PAHs:	Poly Aromatic Hydrocarbons
PCBA:	Pollution Control Board, Assam
PHC:	Primary Health Centre
RTC:	Remedial Target Criteria / Remediation Target Criteria
SoP:	Standard Operating Procedures
WII:	Wildlife Institute of India

Executive Summary

1. The Baghjan accident took place in a highly ecologically fragile Eastern Brahmaputra Landscape. The Dibru Saikhowa Biosphere Reserve, alongside which the blowout took place, provides habitat for thousands of species including the iconic One-horned Rhinoceros, the globally threatened bird Bengal Florican and White-winged Wood Duck, a migration corridor for elephants, as well as a crucial link and staging ground for the East and Central Asian Flyway for migratory birds. The Baghjan accident was not just a failure on the part of OIL in ensuring necessary health, safety and environmental safeguards, but equally responsible are:
 - a) Complete and comprehensive violation of the principles of eco-sensitive zone notification by Ministry of Environment, Forest and Climate Change, Government of India, leading to dangerous concentration of oil and gas producing wells in a highly environmentally sensitive and fragile area of Dibru Saikhowa Biosphere Reserve
 - b) Absence of any meaningful baselines and management plans for Maguri Motapung Wetlands and Dibru Saikhowa National Park, and a lackadaisical approach to management of these biodiversity hotspots
 - c) Ineffective ecosystem monitoring systems to assess ecosystem health, and absence of infrastructure even at the state level to monitor contaminants related with oil and gas industry
 - d) Lack of any mechanism for covering risks to human health, livelihoods and assets located within the vicinity of oil and gas production areas
 - e) Overlooking the risks posed by oil and gas industry in disaster risk reduction planning
 - f) No investment in capacity development (including site and situation specific Standard Operating Procedures) for handling the risks of oil and gas production related accidents

2. The blowout accident resulted in severe damage and contamination of the Maguri-Motapung Wetlands and parts of Dibru-Saikhowa National Park, as is indicated by the following facts discerned from surveys and assessments carried during February-June 2021:
 - a) The concentration of Poly-Aromatic Hydrocarbons in water, soil and sediments of Lohit, Dibru and Maguri-Motapung were significantly higher than those reported in other Indian and global studies on similar accidents. The drastic lowering of Dissolved Oxygen at many locations of the rivers, streams, Maguri-Motapung and other wetlands, in combination with high concentration of Poly-Aromatic Hydrocarbons resulted in large-scale mortality and morbidity of aquatic fauna. *Patches of oil still surface in parts of wetland despite several flood pulses in the landscape.*
 - b) The blowout caused serious sound pollution, way beyond the set standards, making the overall environment unsuitable for normal life for prolonged periods, and affecting several birds and mammal species.
 - c) Vegetation in a large area around Baghjan oil well#5 was sprayed with condensate. Morbidity and death of livestock, damage to crop fields and grasslands were recorded.
 - d) Abnormalities in feeding and behavior patterns of Hollock Gibbons were observed, including the unfortunate death of a young one.

- e) Dolphin abundance during declined by 89% in area surrounding Baghjan oil well#5. One dolphin was found dead in the Maguri-Motapung Wetlands due to poisoning by condensate.
 - f) Bird richness declined by 59% in grassland and 85% in wetlands. *The counts of migratory birds in the Maguri-Motapung wetlands is yet to recover to the pre-accident levels.*
 - g) Fish richness declined by 71% and abundance by 81%. Large scale death, excess mucous secretion descaling and bleeding was observed in fishes.
 - h) Species richness of odonates and lepidopterans declined by 26% and 48% respectively.
 - i) Herpetofauna loss was significant, 177 carcasses of 4 species were recorded upto 4 km from the accident site. No evidence of tadpole presence was recorded, in spite of the incident time being the breeding period of several species of herpetofauna indicate deaths of neonates.
 - j) Orchid flowering was severely delayed.
 - k) Fishers of the area reported a 70 - 80% decline in fish catch from the river and Maguri-Motapung Wetlands till date, severely impacting livelihoods.
3. The Baghjan accident poses two fundamental challenges for ecological restoration. Firstly, the concentration of environmental contaminants released by the blowout need to be brought to the levels which are safe for biota as well as communities dependent on the ecosystem. The interventions require taking into account the lack of baseline data on ecological communities present within the Dibru-Saikhowa Biosphere Reserve, especially those within the aquatic environs on Maguri-Motapung Wetlands, and the likely response to restoration. Secondly, the damage to ecosystem components and processes (such as death and injury to species, disturbance to habitats, altered migration pathways) need to be restored, which are likely to *take a much longer time frame. Various studies on insects, herpetofauna, fish, birds and mammals indicated it will take 2 to 21 years for species population to recover from losses due to condensate impact.*
4. The condensate from Baghjan well #5 spread in a 2 km radius, and contaminated the surrounding environment. Less than 2% of this area has been remediated, without systematic site characterization, and with focus largely on soil dimensions. The ongoing remediation sites are unprotected and not-demarcated, posing severe health and environmental hazards. Following recommendations are made for restoration of the accident site and its surroundings:
- a) Restoration needs to be guided by a Conceptual Site Model indicating the area of influence of the contaminant, and the relationship between contaminant source, pathways, and receptors. The model should be updated with new information from site monitoring.
 - b) All enabling works like topographic survey, site characterization, waste and debris segregation and removal, installation of groundwater monitoring wells etc. prior to any remediation works need to be completed by OIL.
 - c) OIL needs to pursue a risk-based clean-up approach adopting best available remediation technologies (biopiling, landfarming, volatilization and other non-invasive methods to remove LNAPLs, tree based phytoremediation combined with nature based methods etc.) to bring down the level of contaminants in all contaminated mediums. OIL and Pollution Control Board, Assam may conduct bench scale, field trials of various

remediation technologies options, risk assessments, operability studies, cost-benefit and sustainability analysis before designing the remediation strategy .

- d) It is recommended that OIL engages with national regulators and other stakeholders as early as possible in the process of site investigation and development of remediation strategies. Participatory approaches, with specific emphasis on community involvement should be ensured via a digital collaboration platform with all restoration related data.
 - e) In cases where remediation is not feasible or where the polluted area has high ecological or scientific value, OIL must determine the best site management and adaptation strategy to mitigate the risk to public health and the environment viz. monitored natural attenuation or exclusion.
 - f) Afforestation needs to be taken up in the area of influence (soon after remediation of the contaminated mediums), using native species, in consultation and participation of local communities.
 - g) An office of 'Contaminated site remediation and technology innovation' under PCBA may be established by the Government of Assam. The Office may be entrusted with the responsibility of management of the hazardous waste sites as per CPCB Guidelines to protect the environment and the health of the public at large.
5. Ecological restoration of DSBR should be targeted at assisting the recovery of the ecosystem that has been degraded and damaged by the Baghjan accident (while injury has been established, extent and pathways need to be further investigated through systematic studies). At the same time, abundant caution is advised prior to venturing into physical interventions for ecological restoration given the high ecological fragility of the Dibru Saikhowa Biosphere Reserve. The Committee therefore recommends:
- a) Systematic studies and monitoring to determine the current level of contamination within various components of the wetland and terrestrial area (water, sediment, vegetation).
 - b) Assessing the ecological restoration baseline (by involving expert agencies and with full stakeholder engagement) which would be tasked with: (a) Systematically defining a 'reference ecosystem condition' which would serve as a guide for ecological restoration; (b) Systematically defining ecological restoration indicators which would serve as a basis of assessing restoration effectiveness over long term; (c) Identifying restoration options – with specific focus on nature-based solutions which use native species; (d) Identifying monitoring indicators for all major ecosystem attributes (physical condition, species composition, ecosystem function) as well as threats and external exchanges; (e) Projecting resource requirement and institutional arrangements to implement restoration measures.
 - c) Constituting an 'ecological restoration steering committee' which would be tasked with reviewing and approving an ecological restoration plan, and monitoring the progress of implementation. The Committee may be set up under the District Commissioner (Tinsukia) and have representation of all major stakeholders (such as Pollution Control Board Assam, OIL, Forests, Fisheries, Tourism, Eco-Development Committee, local tour operators) and also have external restoration specialists on board.

- d) Undertaking systematic monitoring to ascertain that in multiple use areas the wetlands products (from buffer zone) are safe for human consumption. In case the studies determine that any of the wetland products are unsafe for human consumption, its harvest should be banned for a period as suggested by the study, and the dependent communities fully compensated for the loss.
 - e) Conducting epidemiological studies within the communities living in and around the DSBR to determine the effect of exposure to contaminants. The studies must take a long-term view – such as health risks created by carcinogens released by the accident. Accordingly, a system of comprehensive health insurance for all persons living in the zone of impact (we may consider all communities residing around the Maguri-Motapung Wetlands and Dibru Saikhowa National Park, as well as those residing within 5 km radius of the Baghjan well#5) may be put in place so that the health risks are covered. Similarly, the livestock may also be insured.
6. For the gains of restoration to persist over time, it is essential to put in place effective management arrangements for Dibru Saikhowa Biosphere Reserve which can ensure that the full range of biodiversity and ecosystem services of the biosphere reserve are delivered in perpetuity by limiting and managing impact of human-induced adverse change in the ecosystem. Within the aegis of Biosphere Reserve planning, following recommendations are made:
- a) The management plan of Dibru-Saikhowa National Park needs to be updated taking into account the diversity of habitats, the interconnectivity of the park with river, wetland ecosystems, other protected areas and the risks posed by developmental activities such as oil and gas production. The management may be structured to meet the following objectives: i) Secure National Park boundaries, ensuring its connectivity with landscape; ii) Inventory of biodiversity of DSNP; iii) Maintain and improve habitat quality to support diversity.; iv) Reduce people's dependence on resources from National Park by providing alternatives; v) Provide livelihood opportunities to stakeholders through engagement in eco-tourism activities; and, vi) Adaptive management.
 - b) The management of Maguri-Motapung Wetlands should strive to achieve 'Conservation and wise use of the wetland ecosystem to sustain and enhance its full range of ecosystem services and biodiversity'. The purpose is to: a) manage the wetland complex in entirety as an ecologically and regulatory harmonized unit; b) maintain and improve the habitats to sustain biodiversity including migratory waterbirds, as well as ecosystem services such as buffering against extreme events and support wetland-dependent livelihoods in a sustainable manner; and c) develop institutional arrangement at the site, district and state level to address and manage regulatory and policy-related issues. Management may be guided by following objectives: i) Maintain naturalness of wetland shoreline; ii) Maintain hydrological regimes connectivity aligned with key ecosystems processes (such as maintenance of habitat diversity); iii) Maintain and improve habitat quality to support diverse wetland-dependent species; iv) Maintain non-declining harvest of fishes, aquatic plants and other species of economic use derived from wetland and its surroundings; v) Provide livelihood opportunities to stakeholders through engagement in wetland based-

tourism activities; vi) Maintain compliance with all extant regulation; and, vii) Proactive stakeholder engagement in wetland management enabled by Communication, Education, Participation and Awareness Actions.

7. The Maguri Motapung Wetlands and its zone of influence must be delineated and notified as per the provisions of Wetlands (Conservation and Management) Rules, 2017. This responsibility rests with the Assam State Wetlands Authority.
8. The District Commissioner may be entrusted with the responsibility of designing the Maguri-Motapung Management Plan as per the guidance of the National Programme for Conservation of Aquatic Ecosystems of the MoEFCC, seeking support of expert agencies and with engagement of stakeholders. The Eco-Development Committee may be extensively consulted to ensure that the views, rights and capacities of local communities are built within the management plan. The management plan must *inter alia* define responsibilities of concerned line departments, research organizations, non-government organizations and community-based organizations in implementing various activities. Periodic monitoring of the management plan may be carried out by the Tinsukia District Wetlands Committee constituted under the aegis of Assam State Wetlands Authority.
9. The current District Disaster Management Plan of Tinsukia does not identify oil and gas production related risks in hazards, and ecosystems, such as Maguri Motapung Wetlands and Dibru Saikhowa National Park as elements of risk reduction. The plan needs to be urgently updated, with a detailed Hazard-Capacity-Vulnerability-Capacity Assessment being the basis, and healthy ecosystems considered as an integral part of the disaster resilience building interventions.
10. Given the high density of oil and gas operations in Eastern Brahmaputra Landscape, it is recommended that Standard Operating Procedures specifically for addressing oil and condensate spills in wetlands, terrestrial systems and ecologically sensitive areas such as DSNP is prepared in consultation with experts, and also drawing on international expertise.
11. Redressing the damage inflicted by Baghjan accident and also putting in place systems and institutional mechanisms so that the future risks for oil and gas related accidents are minimized, will require a cost of Rs. 1,196 crores. These include: a) the costs of ecological restoration of the accident site: Rs. 139 crore; b) ecological restoration of Dibru-Saikhowa Biosphere Reserve: Rs. 432 crore; and c) addressing livelihood and socioeconomic aspects related with restoration: Rs. 625 crore. The costs at a) and c) are directly attributed to the Baghjan accident and may be borne by OIL. The costs related with restoration of DSBR may be shared between the Government of Assam (as the ultimate custodian of the ecological assets with a direct responsibility of upkeep of these) and OIL (as a direct beneficiary of healthy ecosystems and an important stakeholder in ecosystem management).

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I: Background and Terms of Reference

1. A “blow-out” took place from Baghjan 5 well (BGN#5) of Oil India limited, Duliajan, Assam on 27 May 2020. The blow-out was followed by fire and explosion on June 9, 2020. As a consequence of the accident extensive damage and destruction was caused to parts of Dibru Saikhowa Biosphere Reserve (DSBR). The accident also resulted in widespread damages to nearby residents’ property, croplands and grasslands, and as well as created health issues among the residents, and death and disease amongst livestock.
2. The Hon’ble Supreme Court of India vide its order dated September 2, 2021 (of Civil Appeal No. 2201/2021) constituted a five-member Committee with the following terms of reference¹:
 - a) Interim determination of the damages within a period of one month so that a suitable direction can be issued to M/s Oil India to deposit the amount for facilitating remedial measures
 - b) To recommend other remedial measures and suggest suitable final remedial measures in the course of its eventful report to be submitted in three months
3. To facilitate the smooth functioning of the Committee, the Hon’ble Supreme Court directed the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, to depute a nodal officer. MoEFCC subsequently, vide office order dated September 14, 2021² informed the members of the Committee about the appointment of the nodal officer from Wildlife Institute of India (WII), Dehradun, India. The Committee however, initiated its work immediately on receipt of the order of Hon’ble Supreme Court.
4. Forming a part of the Indo-Burma Global Biodiversity Hotspot and the highly ecologically sensitive Eastern Brahmaputra Landscape, the DSBR (which spans³ 765 km² and encompasses Dibru Saikhowa National Park (DSNP) and Maguri-Motapung Wetlands (MMW)), is a critical ecological asset securing ecological and economic security of the entire region through their wide-ranging ecosystem services and biodiversity values (Map 1 and 2). Recorded species richness at DSNP include 36 mammals, 11 turtles, 18 lizards, 104 fishes, 23 snakes, 105 butterflies and nearly 500 bird species⁴. The

¹ Extracted from the Supreme Court of India Record of Proceedings dated September 2, 2021 in the matter of Civil Appeal No. 2201/2021 - placed at Annex 1

² Copy of MoEFCC order placed at Annex 2

³ Notified on July 28, 1997 with 340 km² as the core area and 425 km² as buffer area (as per Database on Protected Areas of India accessed at: http://www.wiienvis.nic.in/Database/br_8225.aspx)

⁴ Management Plan for Dibru Saikhowa Biosphere Reserve (2019-2024) of Forest Department, Government of Assam

Brahmaputra River and the DSNP serve as habitats of the Indo-Gangetic Dolphin⁵. In winter, the dried up river-bed and the sandbar (locally called *Char Chapori*) support grasslands which are excellent habitats for the critically endangered bird Bengal Florican⁶, while also serving as a migration route for the elephants in the Dibru-Dangori Elephant Corridor; and even tigers. This area is identified for Rhino reintroduction in Rhino vision 2021 of Assam⁷, its crucial part for elephant conservation, Bengal florican and white winged wood duck was reported from this area and need appropriate management to bring back these species which are highly endangered. This area also forms a crucial link and staging ground for the East and Central Asian Flyway identified for migratory bird species.

5. Located to the south of the DSNP (and within the DSBR), the MMW spans⁸ 15 km² constituting a mosaic of shallow marshes and swamps, intermittently inundated areas, wet grasslands and drainage channels. The presence of up to 57 macrophyte, 23 aquatic insects, 84 fish, 26 mollusc, and 118 bird species have been recorded here⁹, several of which have high conservation value nationally and globally. MMW has been enlisted as an Important Bird Area on account of its significance in sustaining the avian diversity of the landscape. The fish, plant and fodder resources and opportunities for recreation and tourism from the wetland sustain livelihoods of at least ten adjoining villages of about fifteen thousand people, besides being an important cultural icon of the region. The flood buffering, water purification and groundwater recharging capacity make MMW a critical natural asset for the entire landscape.
6. The region around DSBR is a hotspot of oil and gas production in Assam. In the Baghjan area alone, 31 wells have been drilled for hydrocarbon exploitation by Oil India, of which about 19 wells are in production¹⁰ as on date. Around 8 wells are located within the 2 km boundary of the National Park (Map 3). Oil & Gas exploration and production activities are increasing in this area to augment oil and gas production in the country and

⁵ Wakid, Abdul. "Status and Distribution of the Endangered Gangetic Dolphin (*Platanista Gangetica Gangetica*) in the Brahmaputra River within India in 2005." *Current Science* 97, no. 8 (2009): 1143–51. <http://www.jstor.org/stable/24111956>.

⁶ Rahmani, A.R., Islam, M.Z. and Kasambe, R.M., 2016. Important bird and biodiversity areas in India: Priority sites for conservation (Revised and updated). Bombay Natural History Society, Indian Bird Conservation Network, Royal Society for the Protection of Birds and BirdLife International (UK), 1992.

⁷ Indian Rhino Vision 2020 – Department of Forests and Environment, Government of Assam accessed at https://wwfin.awsassets.panda.org/downloads/indian_rhino_vision_2020.pdf

⁸ Computed from interpretation of Sentinel 2 Satellite Image of September 20, 2020 (Refer Map 5 in Chapter 5 of this Report)

⁹ As per Maguri Motapung Management Plan 2018-2022 prepared by the Office of Divisional Commissioner, Tinsukia

¹⁰ Information provided by OIL India vide their email dated December 6, 2021 in response to the data request by the Committee. OIL informed that the lease has been granted for an area of 71.5 km²

thereby a step towards reducing import dependency. There is an overall policy thrust to increase the share of natural gas (cleaner fuel) in the country's energy mix¹¹.

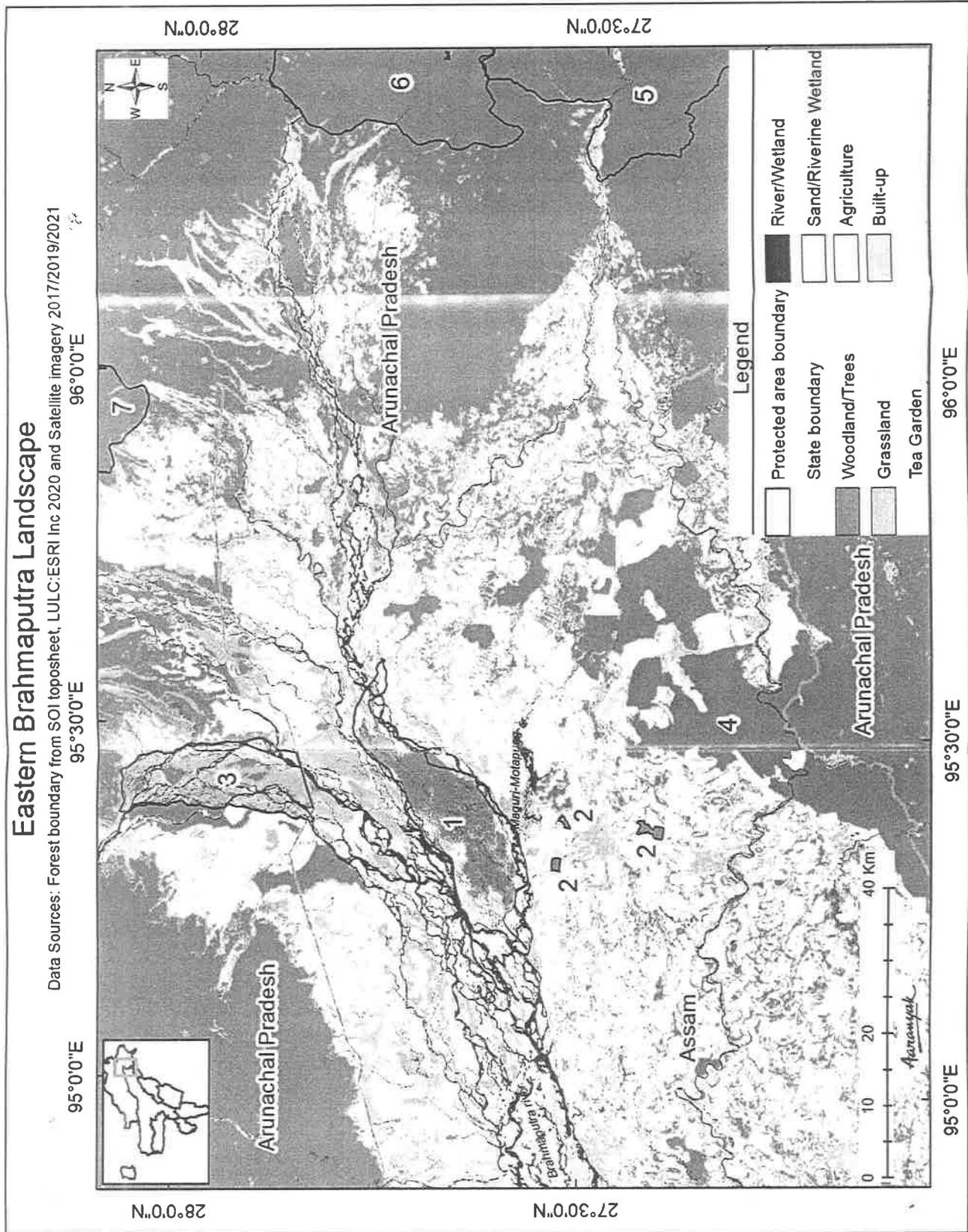
The Committee took-up the assigned job following the Hon'ble Supreme Court order and as directed by court it had submitted an interim report in sealed cover to the Registrar (Judicial), Supreme Court of India on October 20, 2021.

The current report forms the final report of the Committee, addressing the aforementioned terms of reference to the best of its abilities. The Committee met as many as 33 times to address the terms of reference assigned¹².

¹¹ India Hydrocarbon Vision – 2025 of the Government of India, accessible at <http://petroleum.nic.in/sites/default/files/vision.pdf>

¹² List of meetings at Annex 3.

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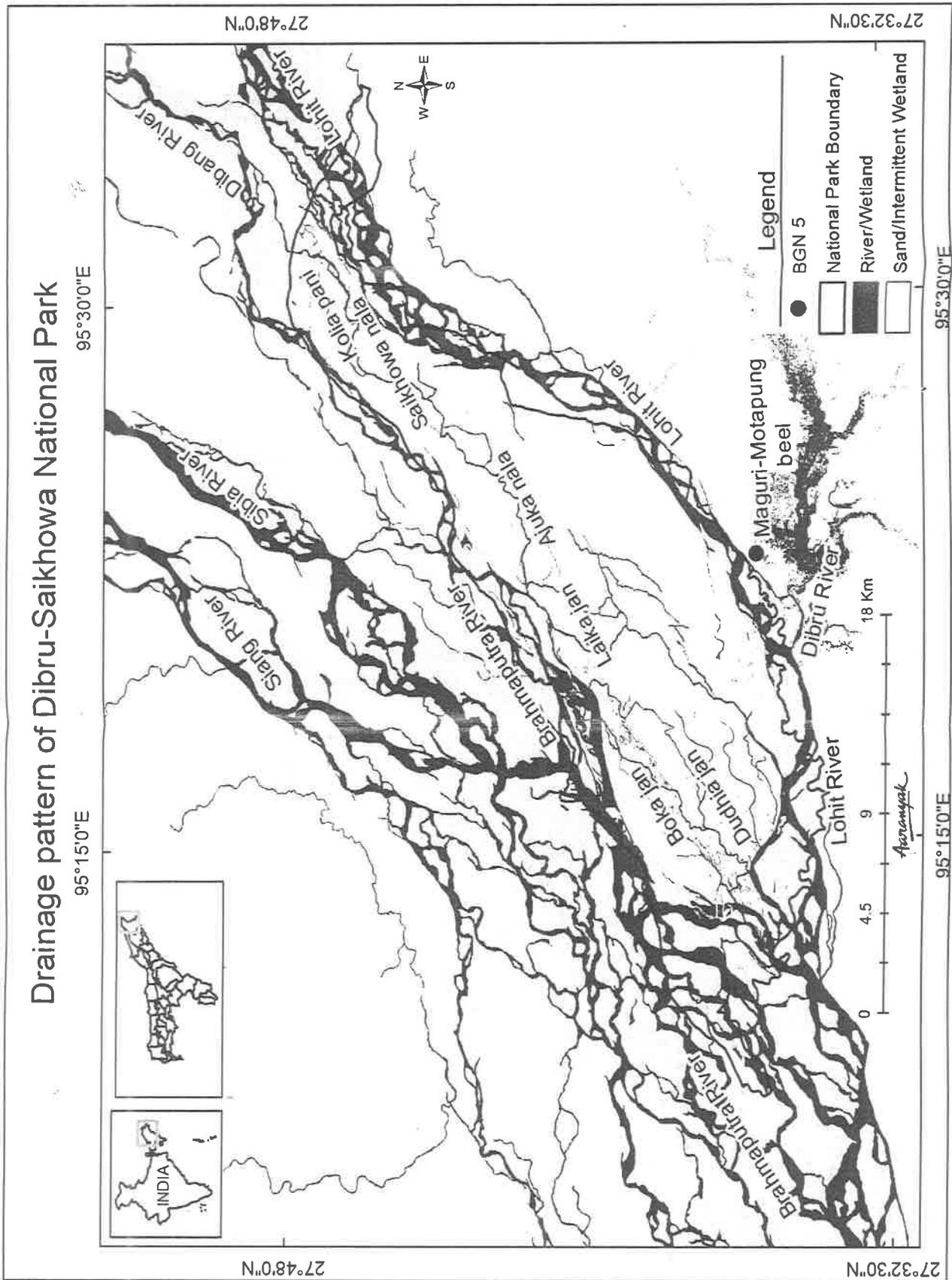


Map 1: The Eastern Brahmaputra Landscape (1: Dibru-Saikhowa National Park, Assam; 2: Padumoni RF (WLS), Assam; 3: Bharjan RF (WLS), Assam; 4: Borajan RF (WLS), Assam; 5: Poba Reserve Forest, Assam & Arunachal Pradesh; 6: Pasighat Reserve Forest, Arunachal Pradesh; 7: D'Ering Wildlife Sanctuary, Arunachal Pradesh)

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Drainage pattern of Dibru-Saikhowa National Park



Map 2: Drainage pattern in Dibru Saikhowa National Park (Map based on interpretation of Sentinel 2 Satellite Image of September 20, 2020)

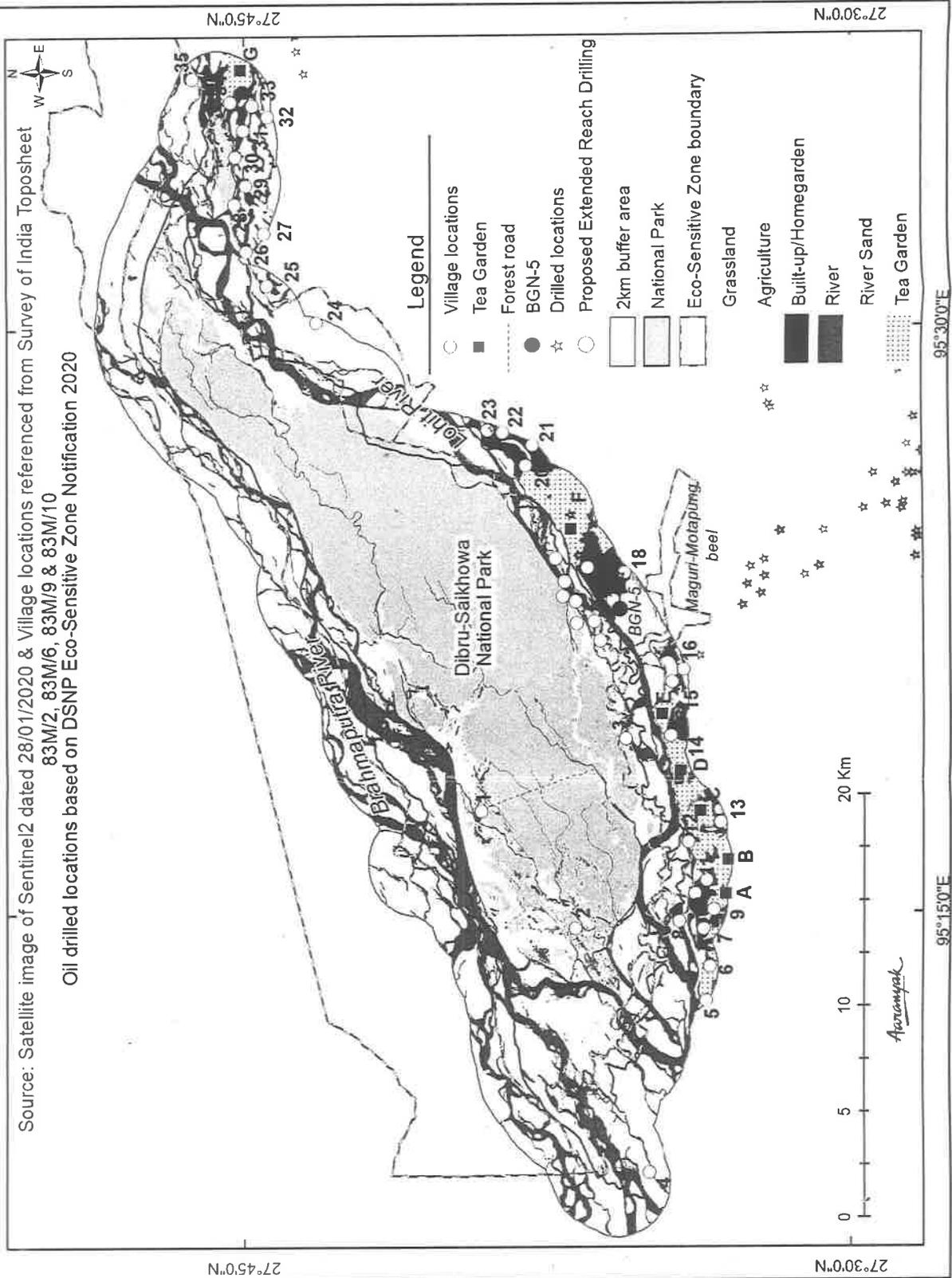
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Distribution of Villages in and around Dibru-Saikhowa National Park (2 Km buffer), Assam

95°30'0"E

95°15'0"E

Source: Satellite image of Sentinel2 dated 28/01/2020 & Village locations referenced from Survey of India Toposheet 83M/2, 83M/6, 83M/9 & 83M/10
 Oil drilled locations based on DSNP Eco-Sensitive Zone Notification 2020



Map 3: Location of villages in and around 2 km buffer of Dibru-Saikhowa National Park

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2: Approach and Method

The overall approach of the Committee is guided by the 'do no harm' principle. In the context of Baghjan, this principle implies that the ecological restoration interventions and pathways should avoid exposing people and ecosystems to additional risks, while also taking into account the broader context and mitigate potential negative effects on the social fabric, the economy and the environment.

The generic framework of enquiry adopted by the Committee for assessing the environmental damage and recommending restoration measures is presented in Fig. 1:

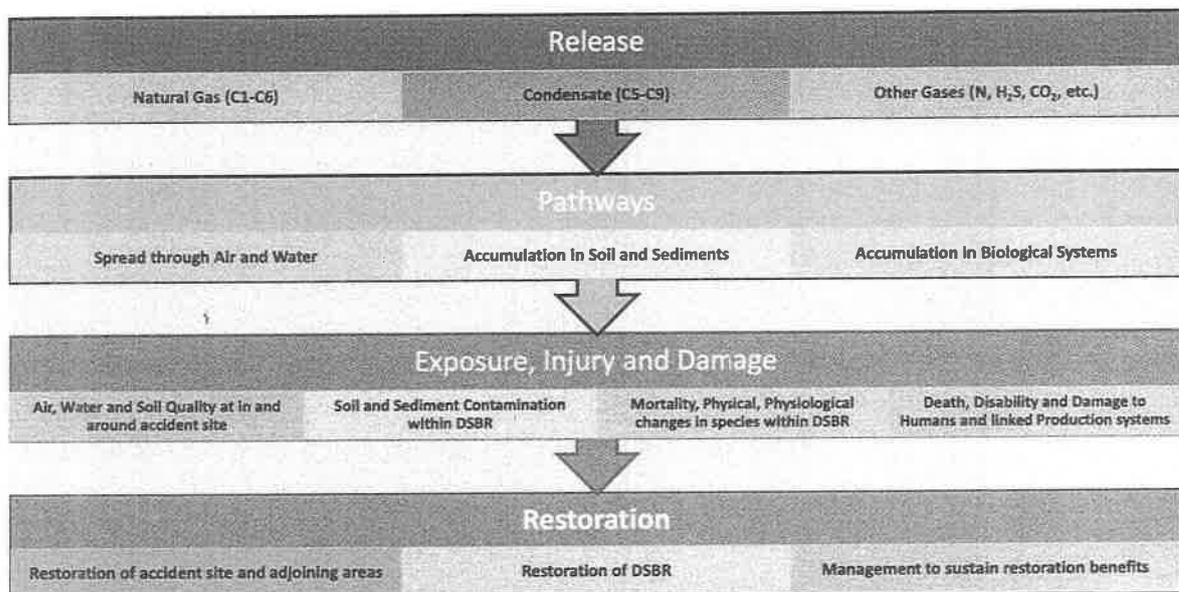


Figure 1. Framework for Damage Assessment and Restoration planning

The Committee did not commission any new assessment or sample investigation, rather depended on the interpretation of the existing studies which provide the required baseline for determining environmental damages. Given the short time frame, the Committee felt that these investigations would not be fit for purpose, and were highly likely to have limited replicability and comparability. It may be prudent to invest resources in systematic sampling guided by the needs of designing and monitoring the effectiveness of ecological restoration. Such sampling designs are to be prepared as part of the assessments recommended to precede restoration and management interventions discussed in the subsequent sections of the report. The Committee used the following datasets for framing the restoration plan:

- a. Data on contaminants and pathways reported in various studies carried out during

- and after the Baghjan blowout¹³
- b. Ecological data and observations from DSBR
 - c. Photographs and other direct observations of damages as reported in various studies and reports. Photos taken during the Joint public-private participatory survey conducted by the office of Deputy Commissioner, Tinsukia in Nov, 2021
 - d. Audio-visuals of the accident site¹⁴
 - e. Direct observations from two field visits held during 7-11 October and 15-18 November 2021
 - f. Stakeholder consultation meetings¹⁵.

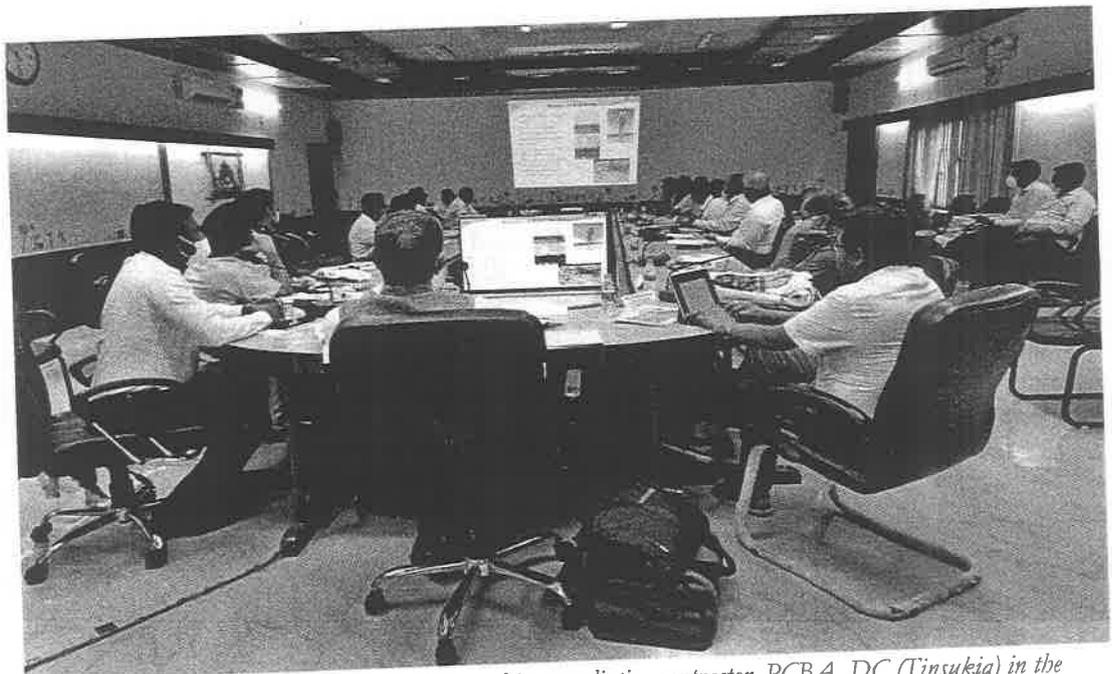


Figure 2: Meeting of the Committee with OIL and its remediation contractor, PCBA, DC (Tinsukia) in the conference hall of Deputy Commissioner, Tinsukia on Oct 8, 2021

¹³ List of studies consulted is placed at Annex 4.

¹⁴ Documentary - Inside the Burning (accessed at <https://www.youtube.com/watch?v=hl53ExX8s7g>; Movie - Oil's Inferno accessed at <https://www.youtube.com/watch?v=WLyZGMd0SY>)

¹⁵ List of stakeholder meeting is at Annex 5



Figure 3: Hybrid (virtual and in-person) meeting of the Committee with OIL and its remediation contractor, PCBA, DC (Tinsukia) in Dibrugarh on Oct 9, 2021



Figure 4: Committee at BGN#5 accident site on Oct 8, 2021



Figure 5: Stakeholder meeting and visit to Erasuti Village, DSNP buffer on Nov 17, 2021



Figure 6:: Committee visit to the Maguri Motapung Wetland on Oct 8, 2021



Figure 7: Stakeholder consultation at Chai Seed Resorts, Tinsukia on Nov 16, 2021



Figure 8: Committee interacting with Head of Dadbia Village at Forest Range Office near Guijan Ghat, Tinsukia on Nov 17, 2021

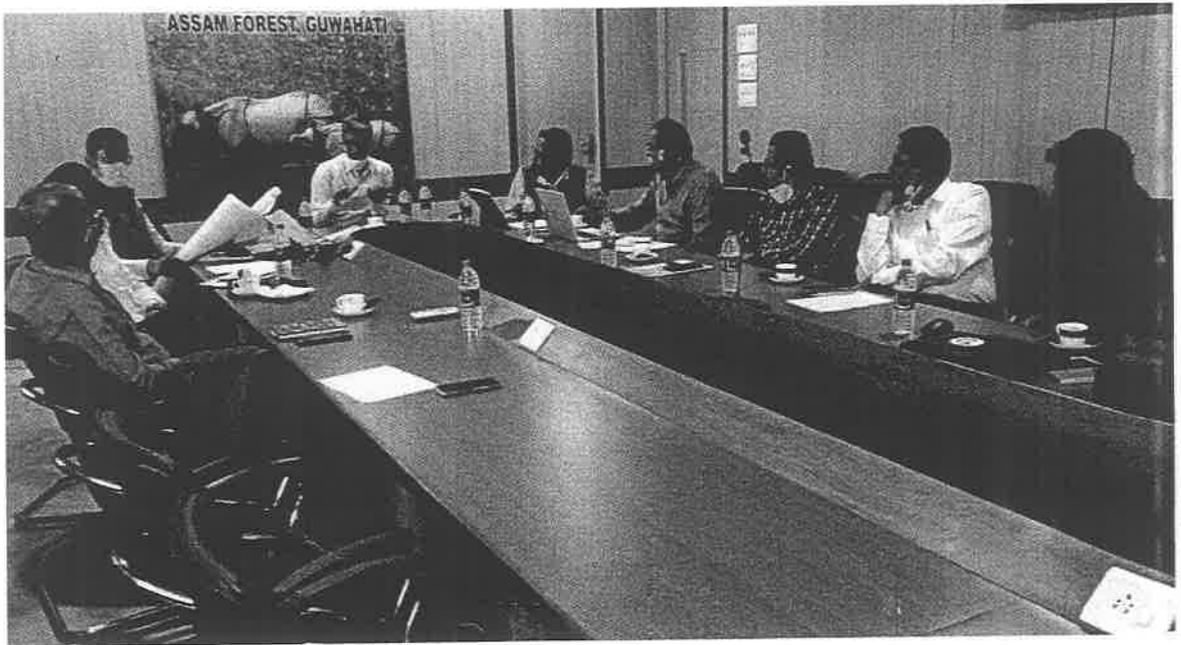


Figure 9: Consultation with subject-matter experts at Forest Department Head Quarter, Aranya Bhawan, Guwahati on Nov 19, 2021



Contaminated Soil at top layer

Clean Soil in bottom of pit

Soil profile view

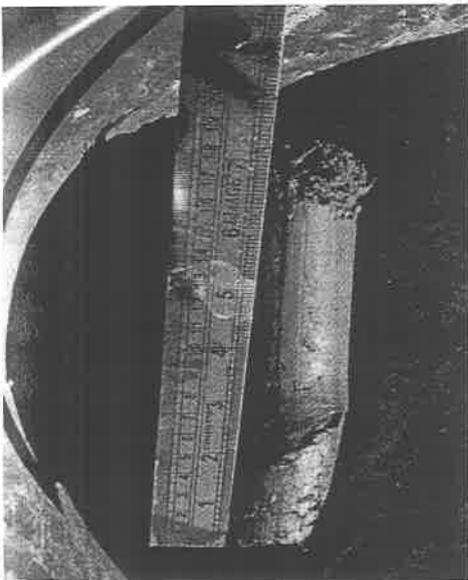


Figure 10: Soil profile photographs received from OIL on Dec 4, 2021 based on soil sampling on Nov 30-Dec 3, 2021. Soil probes were injected to depth upto 25 cm and visually contaminated soil were encountered at depths of 7 cm to 13 cm

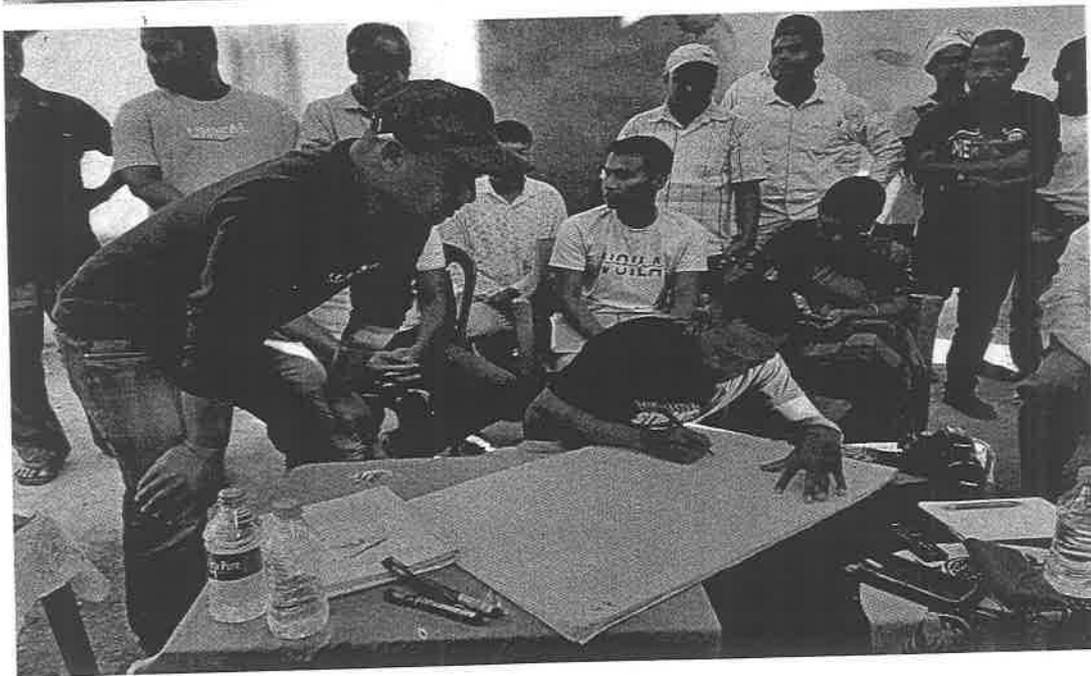
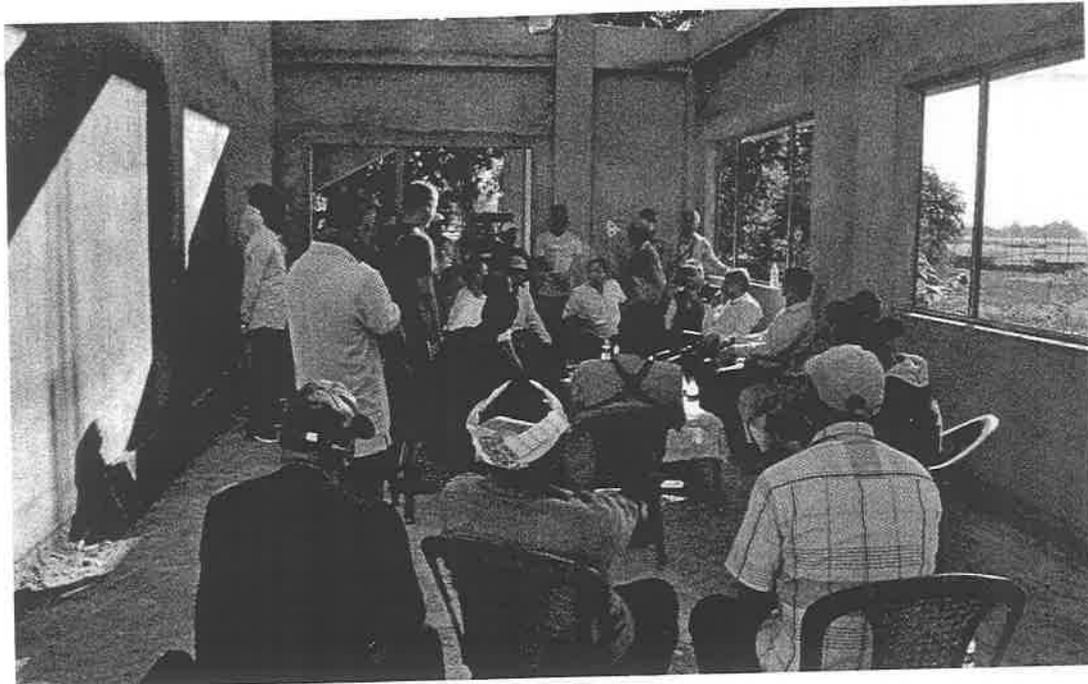


Figure 11: Stakeholder consultation with fishers and small tea growers of Motapung Village on Nov 17, 2021

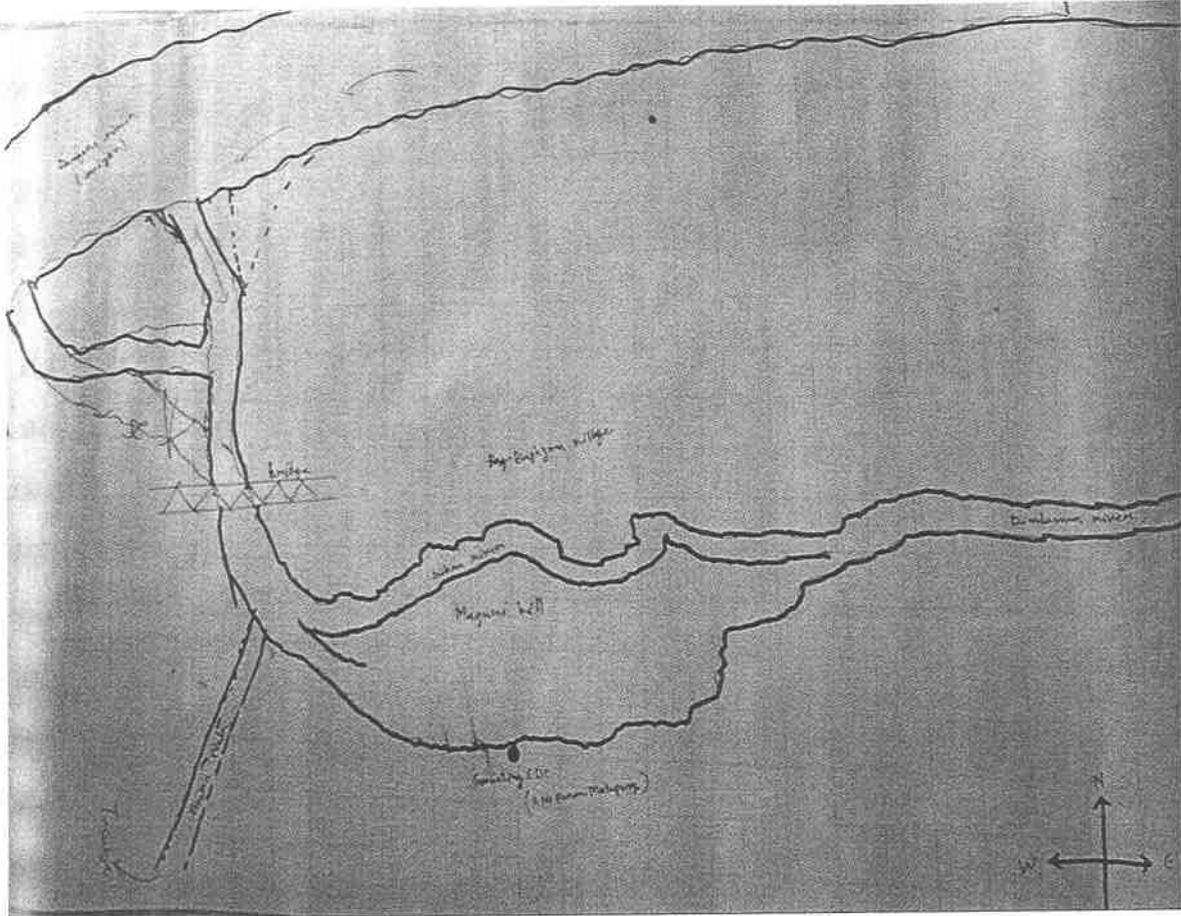


Figure 12: A hand drawn sketch of Maguri-Motapung Wetlands by EDC in the meeting of Nov 17, 2021

12. The Committee has based its ecological restoration approach on the international principles and standards for the practice of ecological restoration¹⁶. Highlighting the role of ecological restoration in connecting social, community, productivity, and sustainability goals, these Standards provide recommended performance measures for restorative activities for industries, communities, and governments. These Standards also provide a list of practices and actions that guide practitioners in planning, implementation, and monitoring activities. These also include discussion on appropriate approaches to site assessment and identification of reference ecosystems, different restoration approaches including natural regeneration, consideration of genetic diversity under climate change, and the role of ecological restoration in global restoration initiatives.
13. The Baghjan accident poses two fundamental challenges for ecological restoration. Firstly, the concentration of environmental contaminants released by the blowout need to be brought to the levels which are safe for biota as well as communities dependent on the ecosystem. However, there is considerable uncertainty on ecological communities present within the DSBR, especially those within the aquatic environs on MMW, and the likely response to restoration interventions. Secondly, the damage to ecosystem components and processes (such as death and injury to species, disturbance to habitats, altered migration pathways) need to be restored, which are likely to *take a much* longer time frame. The Committee therefore has taken a long-term view of the restoration challenge (while also indicating priority steps to be taken for the same), and also delved into ecosystem management aspects, required to sustain the benefits of restoration.
14. DSNP and MMW are complex social-ecological systems. Human societies living in and around this region are embedded within the ecological and biophysical processes taking place within the DSBR, MMW with Brahmaputra River and its network which provides the overarching hydrological and ecological connectivity. The Committee has therefore taken a landscape lens, recognizing the connectivity between these ecosystems, and with human species and production systems which are interlinked and embedded within.
15. The above-mentioned principles also recommend that for the gains of ecological restoration to persist over time, it is essential to put in place effective management arrangements which can secure that the full range of biodiversity and ecosystem services of these ecosystems are delivered in perpetuity by limiting and managing impact of human-induced adverse change in the ecosystem. The Committee has therefore also

¹⁶ Gann, G.D., McDonald, T., Walder, B., Aronson, J., Nelson, C.R., Jonson, J., Hallett, J.G., Eisenberg, C., Guariguata, M.R., Liu, J., Hua, F., Echeverría, C., Gonzales, E., Shaw, N., Decler, K. and Dixon, K.W. (2019), International principles and standards for the practice of ecological restoration. Second edition. Restor Ecol, 27: S1-S46. <https://doi.org/10.1111/rec.13035>

strived to propose a management framework for DSBR (DSNP and MMW).

16. In order to support planning for ecological restoration, the Committee sought expert services to map the Eastern Brahmaputra landscape, wherein the subject ecosystems (DSNP and MMW) and oil and gas exploration and production facilities are located. These maps also enable understanding of the habitat quality and diversity, and the ongoing anthropogenic drivers of adverse change in these ecosystems. All such maps and statistics have been included in their respective sections.

17. The Committee also conducted extensive interviews and review of documentation of various stakeholders related with ecosystem management and Oil and Gas operations. These included review of management plans, SoP, monitoring records and procedures.

18. Ecosystems are inherently complex, wherein 'surprise' rather than 'predictability' is the norm. Not all effects of contaminants or damage to ecosystem processes are observable within a short time period. The Committee has therefore been guided by a 'precautionary approach' drawing from experiences of members, experts from related disciplines, and published information on similar incidents.

19. Evidently, OIL faced a similar situation due to blowout at Dikom, Dibrugarh district in 2005¹⁷, wherein hundreds of families had to flee from the Dikom tea gardens and adjoining villages, and it took nearly twenty days to douse the fire. The Committee deemed fit to visit the site to assess the degree of restoration done and standards adhered to. The visit was done on November 16, 2021. As per information provided by officials of OIL, the site around the blowout well was bioremediated over a period of time and contaminants reduced below their threshold limits. Presently, a major part of the site has been converted into a water treatment plant of capacity 1500 KLD (Kilo Liter per day). The treated water is pumped to the oil production well / site for reinjection in the oil reservoir to enhance oil production. Another part of the blowout site has been utilized for putting up a sludge recycling plant. On the day of visit, the sludge recycling plant was not operational, and no sludge was found in the sludge bioremediation pond. The site visit and interactions with the staff put OIL in a poor light in terms of complying with the environment safeguards. Additionally, the Committee visited another abandoned well site at Talap, Tinsukia where OIL along with NERIST have developed a rehabilitated plot with native plant species post-bioremediation.

¹⁷ S.Maji, S. Chakraborty, Y.R. Singh and P.K. Paul (2012). Surveillance over a Blowout Region using NRMS repeatability : A case Study from Dikom Field in Upper Assam Basin. Accessed from https://www.spgindia.org/spg_2012/spgp248.pdf

20. The Committee reviewed the management plans, Standard Operating Procedure (SoP) and monitoring systems to assess their adequacy to mitigate and contain risks. Recommendations have been made to strengthen these systems.
21. The overall costs of ecological restoration have incorporated the following elements:
- a) Ecological restoration of Baghjan Blowout Site
 - b) Ecological restoration of MMW and DSNP, including:
 - a. Preparing management plans and SoP
 - b. Managing DSNP and MMW to ensure that the gains of restoration persist
 - c. Establishing a monitoring system to be able to assess efficacy and efficiency of suggested restoration and management measures
 - c) Addressing community health and livelihoods aspects linked with ecological restoration and management
22. The Committee clarifies that the costs indicated herein are not an imputation of economic value of damages. The ecological assets and livelihoods at risk are 'priceless' – and it is the fundamental duty of the State to protect these assets as per the provisions laid down under Article 48-A of the Constitution of India, and the doctrine of public trust.
23. During the course of assessment of environmental damages, the Committee recognized several lapses in environmental clearance procedures, environmental management planning, monitoring systems, disaster management and others. Recommendations on these aspects have also been made with an intent that addressing these might be crucial in averting such disasters in future.

3: An overview of findings of studies and committees on Baghjan Accident

3.1 Technical reports and studies commissioned after Baghjan accident

24. A number of assessments and studies¹⁸ have been conducted to ascertain the cause of the accident and its effect on the surrounding environment. These studies were mostly sponsored either by OIL or Govt. of Assam. Various committees constituted for the purpose of investigation submitted their investigation / study reports to the concerned authorities. Details of some of the reports are described briefly in the chapter.
25. A Committee of Experts, under the chairmanship of Justice B.P. Katakey, was constituted by the Hon'ble National Green Tribunal, Principal Bench, New Delhi in the matter of O.A. No. 43 of 2020 (EZ) and O.A. No. 44/2020(EZ) vide order dated July 2, 2020. The Committee's mandate was to investigate the cause of gas & oil leak, extent of loss and damage caused to human life, wildlife and environment, contamination of air, water and soil of the area of well and its vicinity etc. Based on the preliminary assessment, the committee submitted its report detailing its preliminary findings, on BGN#5 blowout and subsequent explosion / fire which led to extensive damage to both the publicly owned resources including the MMW, DSNP, the eco-sensitive zone including the water bodies, air, wildlife and the natural resources surrounding it. Additionally, the Committee tried to assess harm and damage to privately owned property of the survivors in the affected villages. The Committee recommended some interim measures including compensation for the affected families and individuals. For Restoration of DSNP and MMW, the Committee felt that it is necessary to set up a multidisciplinary team comprising of community members along with experts on wetland ecology, hydrology, fisheries, water birds' specialists and others who will formulate a restoration plan for the DSNP and MMW. The said report also consists of attachments / annexures e.g. reports of Wildlife Institute of India (WII), show-cause notices, reports of district administration, list of affected families etc.
26. Another report which is in quite detail is of Mr. M.K. Yadav, IFS, Additional Principal Chief Conservator of Forest (Wild Life) & Chief Wildlife Warden; One man Committee constituted by Govt. of Assam (OMCR). The report is produced in 3 volumes. Volume 1 of the said report is in two parts (Part I &II). Part I details OIL's Baghjan oil field, oil and gas production in India, Laws and policies. Part II covers blowout at BGN#5; details on flame temperature, height, acoustic power, chemical composition of natural gas and condensate and their chemical characteristics, atmospheric pollution, noise pollution and vibrations, thermal pollution, soil and water pollution, assessment of

¹⁸ List at Annex 4

biodiversity loss, assessment and impact on avifauna, dolphins and other mammals, fishes, herpetofauna, arthropods, impact of blowout on local population, livestock, crops and on other properties. Losses / damages (countable and uncountable) are detailed in the end along with conclusions drawn. Volume 2 of the report is the compilation of all the secondary material upon which Volume 1 is based. Volume 3 consists of public hearing notices, letters issued from One-man Committee, replies received, reports submitted by DFOs, OIL and annexures.

27. Most of the committees recommended that a comprehensive impact assessment should be carried out after the fire extinguishment to establish actual ground situation. A detailed discussion of damage assessment from the Baghjan accident is presented in Chapter 5 of the report.

3.2 An appraisal of information made available to the Committee by OIL

28. OIL has made certain information available to the Committee appraising various steps taken by it to collect the oil, disperse it, and reduce human exposure and injuries to natural resources. The Committee's observations based on such information are as follows:
- a. No containment measures were taken to avoid the spread of the spilled gas condensate. This was also confirmed by the OIL and its bio-remediation contractor during the interaction on October 10, 2021 at Dibrugarh. However, subsequent email communication with photographic evidence provided by OIL reveals that there were other contractors who were involved in the immediate response process. The Oil Spill Contingency Plan (OSCP) for onshore operations of OIL, issued in 2013, and its related implementation and updates appears to be lacking.
 - b. The emphasis of an agency engaged by OIL for improving agricultural productivity through application of chemical fertilizers and pesticides is misplaced in the context of soil contamination by condensate affecting directly the crop quality. The post blowout situation is not the problem of productivity only but the chances of contamination of the soil and groundwater. No attempt was made to trace the Contaminants of Concern (CoC) in any part of the affected landscape by the said agency.
 - c. Based on the interpretation of the study of selective reports, OIL Initiated recovery and bio-remediation work on some selected contaminated land and water sites in the vicinity of blowout i.e., BGN#5. Though a few sites in the affected area(s) have been remediated, the main area in and around the blowout site still awaits bioremediation. The blowout site however has been demarcated with fencing and is under constant CCTV surveillance since 4pm of December 14, 2021 as informed by OIL vide email dated December 16, 2021.

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4: Restoring the Blowout Site and Adjoining Areas of Influence

20. BGN#5, as per the information in writing furnished by OIL is situated over a plot of land measuring a minimum of 27.55 bighas (about 37,000 m²).¹⁹ As per reports submitted by OIL, 3.8 km² has been the area of influence or the gas condensate spread area. OIL being the perpetrator, it is their responsibility to ensure that no further damage is caused to the fragile ecosystem (above and underground), as well as to take immediate steps for repair of the damage caused.

30. To support restoration planning, a Conceptual Site Model (CSM) of the BGN#5 area and related damage pathway as well as receptors has been developed by the Committee based on the information furnished by OIL and is shown below (Fig. 12):

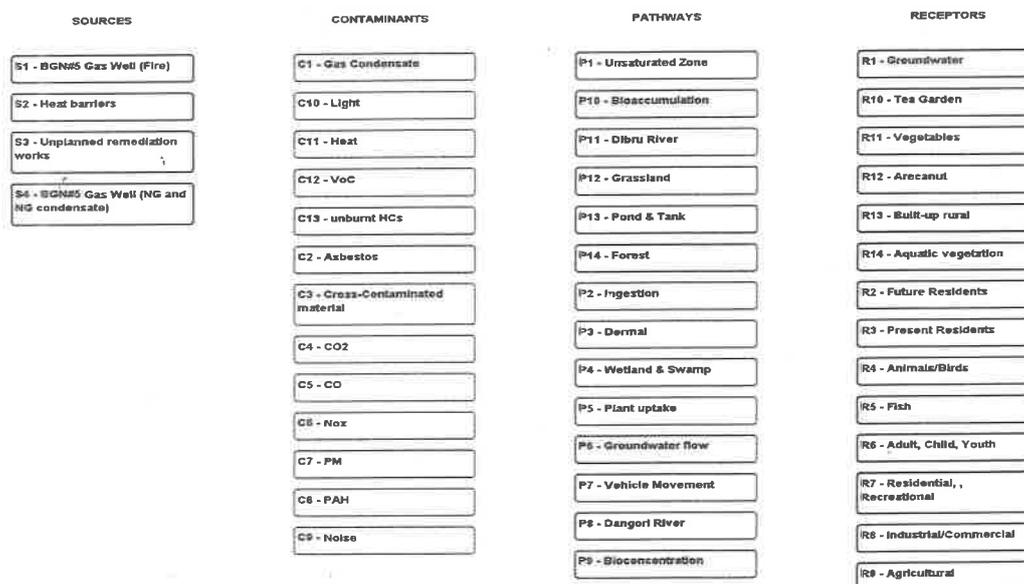


Figure 13: Conceptual Site Model

31. The BGN#5 blowout has been ascribed as one of the biggest on-shore blowout in the world in terms of the magnitude and complexity²⁰. The location with limited approach, the monsoon season, subsequent flood resulting disruption of road communication and spread of COVID-19 Pandemic during the entire operation posed challenging situations, however via collaboration with various stakeholders, OIL had overcome most of the hurdles through commitment, dedication and adaptability in the eventual killing of the

¹⁹ Reference of land documents shared by OIL via email dated Oct 12, 2021 is made available in Annex 7

²⁰ OIL Lessons Learned documentation referred to is included within the List at Annex 4

well albeit environmental concerns.

32. The blowout at BGN#5 resulted in contamination of BGN #5 site area referred above, land, surface water, wetland, vegetation and animals with the condensate from natural gas release. Petroleum or crude oil including gas condensate have toxicity which is harmful for living beings etc as per the Material Safety Data Sheet (MSDS).²¹
33. The landscape of BGN#5 consists of Protected Area (PA), wetlands, human settlements, homestead gardens, small and big tea gardens, agricultural land and grassland etc. Study conducted by OIL revealed that 0.72 km² area was affected due to spread of fire and 3.8 km² area was affected due to spread of condensate from the blowout. The post blowout period study carried out by OIL in Dec 2020, joint public private survey by District Commissioner officials in Nov 2021 and site visit by the present committee members in Oct and Nov 2021 in the above-mentioned affected area along with review of satellite data that there is an estimated 70,000 tonnes organic carbon currently in the soil of 3.8 km² area around BGN#5 and an estimated 90,000 tonnes could exist if the soil is restored.²² Further, a review of tree cover potential²³ and historical tree cover loss²⁴ was carried out.
34. OIL issued a work order²⁵ to a contractor on August 19, 2020 for bio-remediation of contaminated land and water areas. After submission of an interim report by the Committee in the Hon'ble Supreme Court of India suggesting some interim measures, the OIL has issued additional work orders on Nov 29, 2021 for bioremediation as well as environmental monitoring of the area of influence.²⁶
35. The Committee made the following observations during site visits the last being on Nov 18, 2021 along with the representatives of the District Civil and Police Administration, Tinsukia; Environment and Forest Department, Government of Assam; Pollution Control Board, Assam (PCBA) and OIL:
 - a. The capped well is buried and not visible.
 - b. Significant portion of the existing and accessible site is visually contaminated.

²¹ Microsoft Word - Condensate I5000a Rev.002 draft.doc (virol.com) (accessed on Dec 21, 2021)

²² Sanderman, J., Hengl, T. and Fiske, G.J., 2017. Soil carbon debt of 12,000 years of human land use. Proceedings of the National Academy of Sciences, 114(36), pp.9575-9580

²³ Bastin, J.F., Finegold, Y., Garcia, C., Mollicone, D., Rezende, M., Routh, D., Zohner, C.M. and Crowther, T.W., 2019. The global tree restoration potential. Science, 365(6448), pp.76-79

²⁴ Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A., Tyukavina, A., Thau, D., Stehman, S.V., Goetz, S.J., Loveland, T.R. & Kommareddy, A. (2013). High-resolution global maps of 21st-century forest cover change. Science, 342(6160), 850-853

²⁵ Contract 6114478/PDNO/2020 shared with the Committee by OIL

²⁶ Contract 6116828 shared with the Committee by OIL

- c. The area around the well has been roughly dressed up and fenced as on Nov 16, 2021.
- d. Significant quantities of hazardous wastes like asbestos pieces were found lying in the area adjacent to the blowout site which has recently been cordoned-off. Backfilling of effluent pits and contaminated material with mixture of construction debris, burnt vegetation and asbestos were observed in and around the blowout area. These sites need to be characterized and remediated.
- e. The site has pits closer to the well which are filled with brackish water, suggesting water contaminated with oil.
- f. Remediation sites (ongoing as well as completed) outside BGN#5 were without any sign board nor any enclosures to prevent harvest of possible contaminated biomass. People and cattle herds were moving around freely. Substantive grazing was also noticed.

In discussions with OIL's bio-remediation contractor during Oct, 2021, the Committee learnt that the bio-remediation had been limited to some (very small area mostly under private ownership) and not been implemented in the BGN#5 accident site as observed during the 1st visit (October 8-9) and even in the 2nd visit (November 15-18) and in wetland areas such as MMW and the drilling pad area and there is also a lack of clarity on the way forward. The contractor informed the Committee that some quantity of condensate/ oil was skimmed only from some part of a stagnant water body. A review of the authorized clean-up report signed by OIL and the bio-remediation contractor has several weaknesses, key being:

- a. Underestimation of volume of contaminated material. Hazardous material is still observed around BGN#5 Area at the time of writing this report. Refer Table 1 for few observations in and around BGN#5 as on Nov 15, 2021 when the committee visited the site for the second time, and subsequently in December 2021
- b. Inadequate site characterization and baseline assessment (inadequate sampling, no defined sampling strategy, incomplete field logs etc.). The site owner has shared on December 4, 2021 field logs related to a few soil, water, plant and fish samples collected by OIL's contractor in November and December, 2021
- c. Report does not include the Conceptual Site Model (CSM) or a model describing the geohydrology and geographical distribution of the contaminants
- d. Report does not include a delineation of the contaminants still present at the site.
- e. Assessment of pathways, exposure, impacts and contamination, site classification is not reported
- f. Screening and Response Levels are not clearly stated for all media tested
- g. No mentioning of waste or rubble encountered during sampling

- h. Site-specific remedial objectives for contaminated soils and/or groundwater and protection of aquatic environment not established
- i. Description of the post remediation measures not mentioned

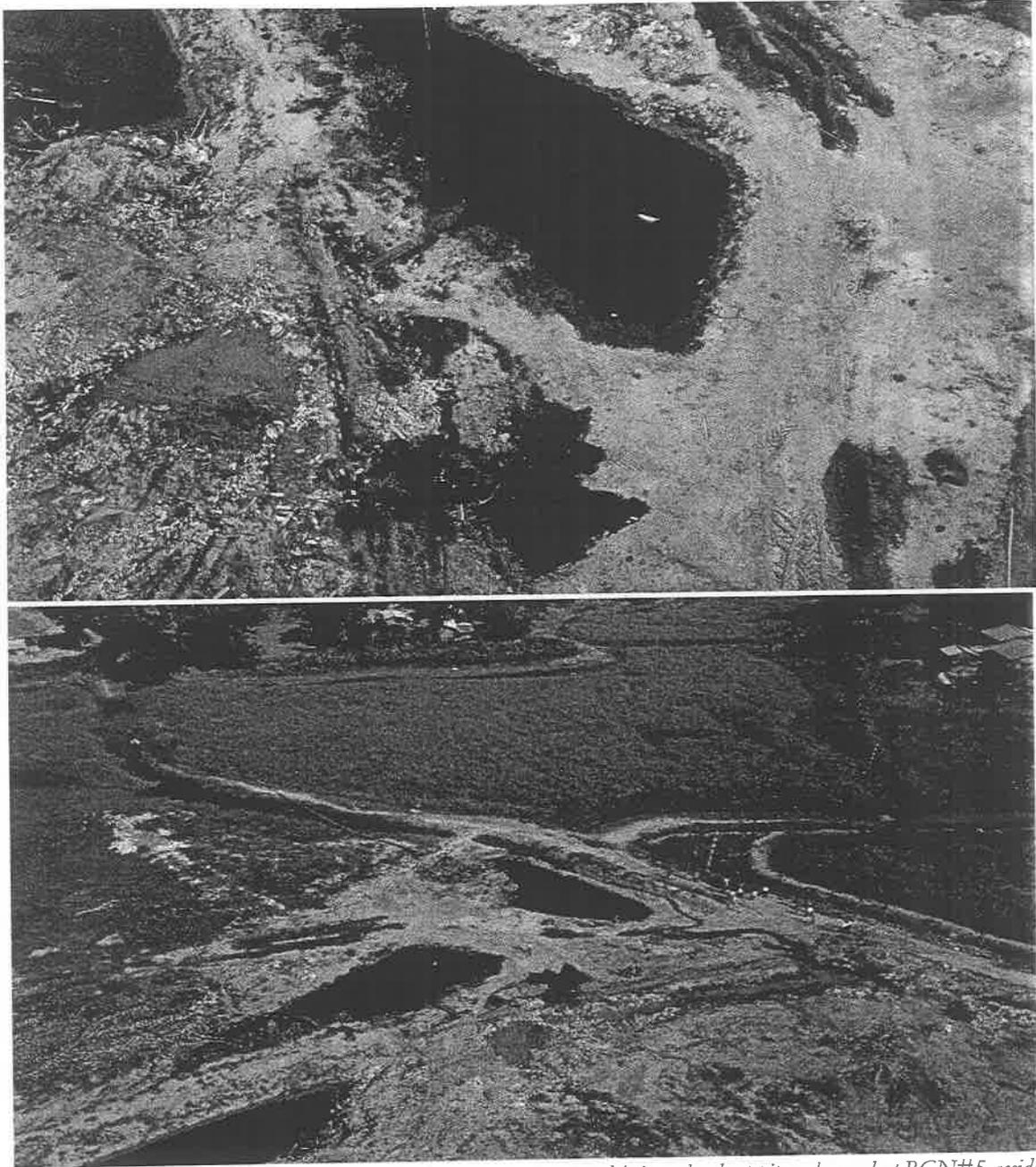


Figure 14: Aerial view of the hazardous waste material, construction debris, redundant pipes observed at BGN#5 accident site during the visit of the Committee on Oct 9, 2021

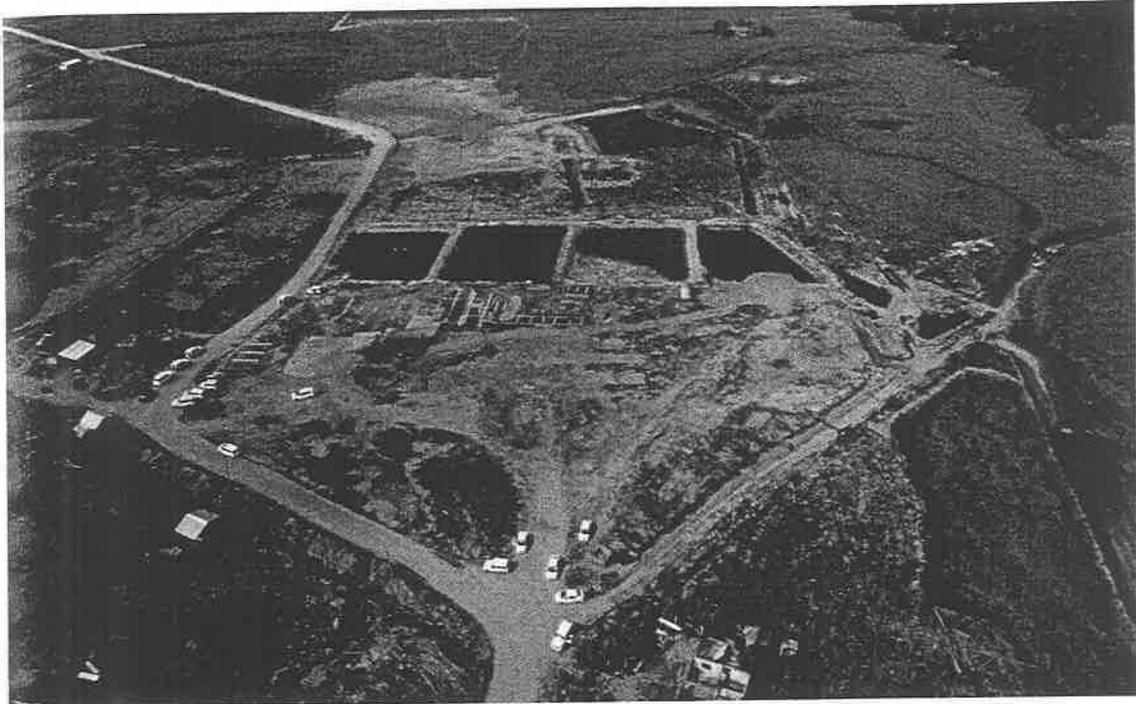


Figure 15: Aerial view of the BGN#5 Site during the Committee's visit on Oct 9, 2021



Figure 16: Aerial view of the BGN#5 site during the visit of the Committee on Nov 18, 2021

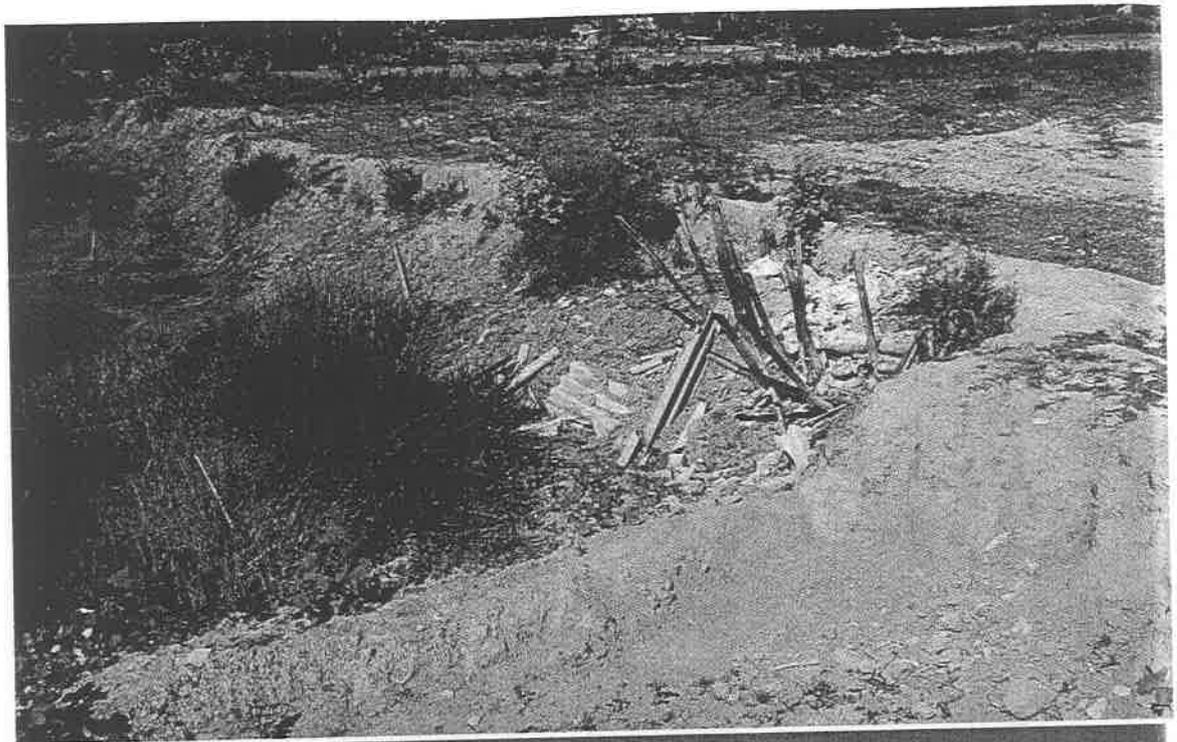


Figure 17: Potentially hazardous waste like asbestos and other debris observed by the Committee on the northwestern portion of BGN#5 accident site on Nov 18, 2021

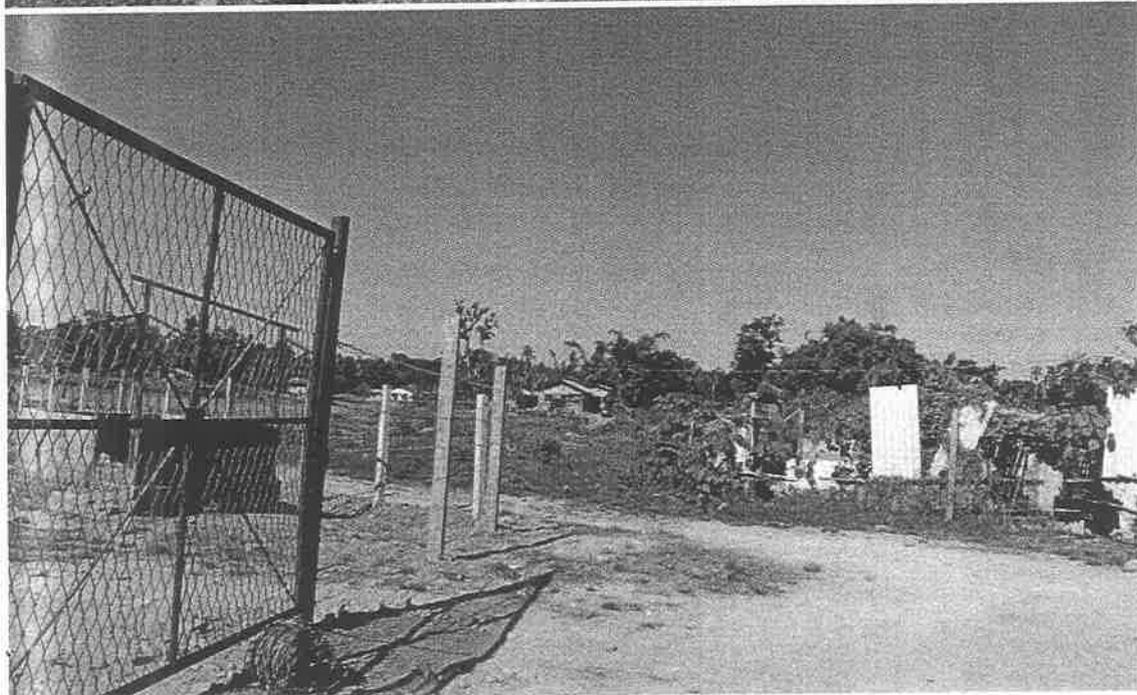
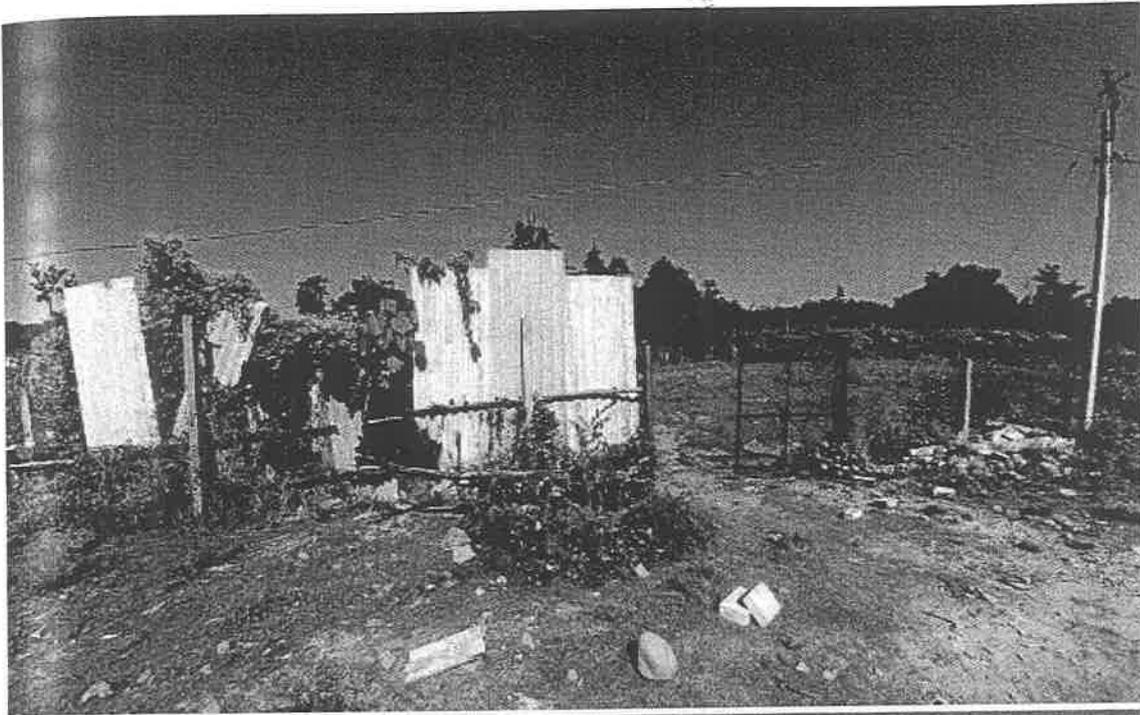


Figure 18: Asbestos lying unattended in-front of the newly installed gate at BGN#5 observed by the Committee on Nov 18, 2021

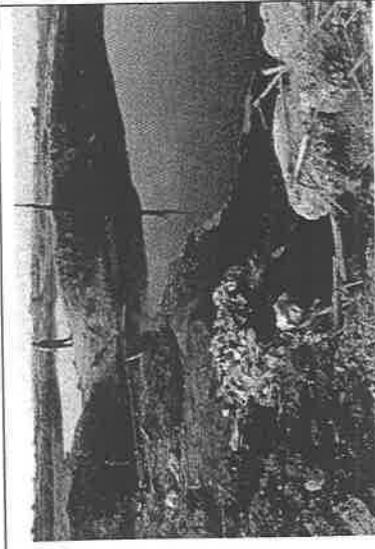
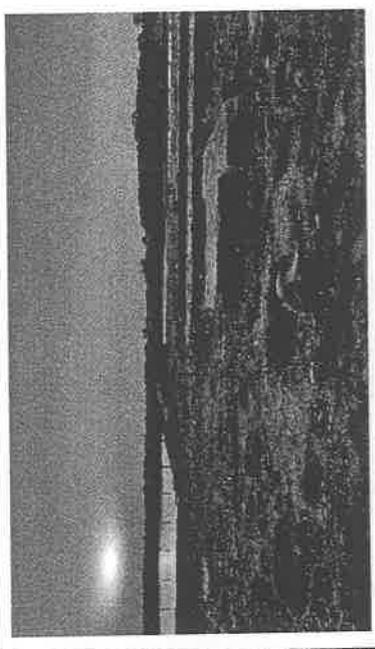
37. The bio-remediation contractor also admitted non-performance of any bio-remediation or site restoration activities on the blowout site (categorized as Heat Zone in their report). At the time of writing this report, the committee has been provided with evidence that the site owner has initiated a new contract for bio-remediation for BGN#5 accident site.
38. The Committee was surprised to note the inadequacy of infrastructure and human resources even in the government agencies like Pollution Control Board, Assam (PCBA) entrusted with the responsibility of enforcing pollution related regulation.²⁷
39. During the public hearings, the Committee was informed that flood pulses since the accident (nearly seven) may have aided rejuvenation of the BGN#5 blowout affected areas, as was observed in the grassland and aquatic macrophyte dominated areas. However, when the Committee enquired whether the contaminated area was sufficiently characterized and sampled for bacterial, other soil microbial communities and chemical analysis in order to evaluate the efficiency of the expected natural attenuation process, no quantitative assessments were reported to have been carried out. It is pertinent that OIL engages with experts in understanding the ecosystem components and processes better, especially microbial communities which are known to have significant role in aiding restoration.
40. Based on the discussion with PCBA and OIL, it is evident that the parties are planning an afforestation project in the Baghjan blowout site. A vital part of directing the management and clean-up of oil-contaminated ecosystems lies in understanding the impacts of oil on indigenous microbial communities and identification of oil-degrading microbial groups using both culture-dependent and molecular approaches and combining the same with tree-based remediation approaches. Utilizing such a combined approach for ecological restoration of gas-condensate impacted soil will help OIL deliver in line with Sustainable Development Goal 15-Life on Land²⁸.
41. The Committee in its interim report had suggested some measures to be taken by OIL at the accident site. The following table compares the status before and after the said report:

²⁷ [What We Do | Pollution Control Board | Government Of Assam, India](#) (accessed on Dec 21,2021)

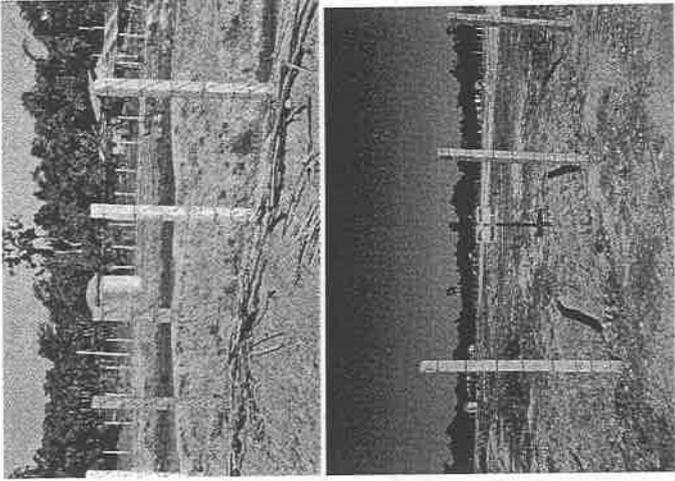
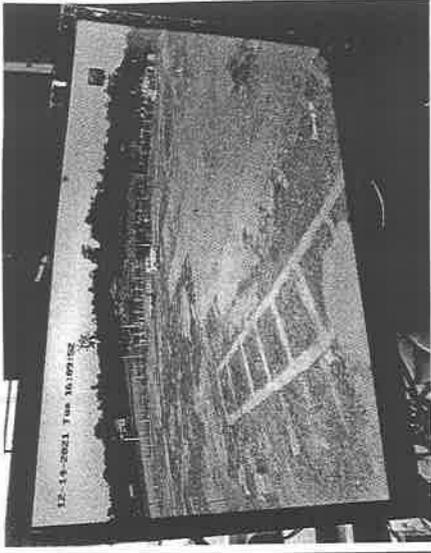
²⁸ <https://www.niti.gov.in/goal-15-protect-restore-and-promote-sustainable-use-terrestrial-ecosystems-sustainably-manage>

Table 1: Status of blowout site during the various visits of the Committee

Aspect	Status on 1 st Visit of the Committee (Oct 9, 2021) (at the interim report submission)	Status on 2 nd visit of the Committee (Nov 18, 2021) (after the interim report submission)	Status as on December 26, 2021 as reported to the Committee
Hazardous waste	Asbestos and other materials were left unattended in the main site	Approximately, 1 m ³ of asbestos have been collected from the plinth of BGN#5 and kept in 5 nos. of plastic container and temporarily kept in a fenced area inside BGN#5 plinth. The containers are placed over HDPE sheets at the bottom with CGI sheet roofing at top to avoid any further possible contamination due to rain. One sign board displaying "Hazardous Materials storage area" has been installed within the fenced area.	Appreciable quantity of asbestos is lying unattended around BGN#5 area. (These were probably used as heat barriers during the fire incident of BGN#5.)
Redundant pipes etc.	Anchor plates and exposed pipes were left on site which can cause potential slipping/tripping hazard	Anchor plates and exposed pipes have been cut and removed. 	A final scanning of the area for any other underground redundant pipes needs to be carried out.

<p>Construction Debris and effluent pits</p>			<p>Debris removed partially. Effluent pits to be characterized, remediated and backfilled with clean soil</p>
<p>Contaminated Soil characterization and remediation</p>	<p>9000 m³ as per the clean-up report submitted by the OIL</p>	<p>7000 m³ of soil is currently being remediated as per the latest email by OIL. This along with the previous volume of soil amounts to approx 16,000 m³ of soil.</p>	<p>Logs indicate an average contamination depth of 10 cm. The 20 soil samples (lab results pending) were collected from an area of 12.56 km². Considering the above information, an estimated 1.26 million m³ of contaminated soil is pending remediation. Irrespective of sample results, OIL has to remediate a minimum area of 3.8 km² area of influence as defined by OIL. The volume of contaminated soil pending remediation considering the field logs is approximately 0.38 million m³ minus the previously remediated and ongoing remediation volumes.</p>
<p>Underground ecosystem</p>	<p>Fire may have affected soil microbiomes (bacteria, fungi etc.) directly via generated heat. Further, fire-altered soil properties have an indirect effect on soil microbiome. Fire usually decrease microbial biomass and alter microbial</p>	<p>No progress</p>	<p>No progress</p>

community composition. These changes can be tracked to recovery to pre-fire condition.

	<p>community composition. These changes can take decades to recover to pre-Baghjan blowout status. The committee has no information about any such studies undertaken by OIL.</p>		
<p>BGN#5 accident site</p>	<p>Not secured with fencing, signboards and video surveillance</p>	<p>The fencing and sign boards have been installed in the BGN#5 accident site covering about 37,000 m².</p> 	<p>Video surveillance system installed.</p> 
<p>Characterization and restoration of all impacted medium within</p>	<p>Approximately 1.6 km² area was being planned for remediation as per the clean-up report submitted by OIL</p>	<p>Patches of visual contamination were observed during the joint public private survey by foot as well via drone coordinated by the officials of the Deputy Commissioner (Tinsukia) in Nov, 2021 and</p>	<p>Enabling activities before remediation and restoration is ongoing. Materials and debris segregations and concrete, asphalt, piping, metals, concrete slabs, brick or wood must be</p>

42. The committee has not been able to see any concrete plan of action for restoration and therefore, recommends following measures to be taken by OIL urgently:

I. Responsible parties: OIL must ensure all site restoration activities are conducted in a safe, responsible and timely manner, as well as ensure via a collaborative online platform communicate about the implementation of the various site restoration and related monitoring projects.

Table 2: Responsibility Assignment Matrix (RAM) for Site Restoration

Designation	Agency	Responsibilities
Top Management (Chairman & Managing Director)	OIL	<ol style="list-style-type: none"> 1. Site restoration 2. Setting up of a cloud based collaborative restoration platform and 3. Share plan and progress in a transparent manner 4. Engagement with stakeholders
Chairman	Pollution Control Board, Assam	<ol style="list-style-type: none"> 1. Setting the timeline for restoring the area of influence /site impacted by the blowout. 2. Make sure OIL continues to pay the full cost of restoration for all sites impacted by its operations 3. Environmental Quality Assurance Quality Control plan implementation 4. Verify all data uploaded by OIL on plan /progress in the online collaboration platform
Addl. Chief Secretary to the Govt. of Assam, Mines & Minerals Department.	Government of Assam	Petroleum Exploration Licence / Petroleum Mining Lease and permit must not be issued/ discontinued for companies that do not have the financial means to restore the sites.
(1)Secretary MoPNG, Government of India, (2) The Director, Directorate of Petroleum (DoP), Government of India (3) The District Collectors, concerned districts.	Various agencies	<ol style="list-style-type: none"> 1. Ensuring all the above are adhered to and followed by OIL 2. Ensure compliance of all requirements under the relevant laws

II. Baseline Information: OIL must refer to all the relevant studies which contains the baseline information showing the pre-existing environment at the site. In Dec 2021, the site owner had initiated base sampling of contaminated materials in and around the 2 km radius of the BGN#5. OIL should publicly report on the results and also on the progress of remediation and restoration in the 3.8 km² area of influence:

Table 3: TPH Impacted Soil: Characterized Volumes

Location of soil sample	Concentration of TPH above Remediation Standards (mg/kg) or RBCL as proposed by OIL	TPH impacted soil (Characterized quantity) (m ³)
Within 2 km radius of BGN#5	PHC >10000 mg/Kg or similar to be proposed by OIL	1.26 million m ³ (based on field logs and pending lab results) minus the ongoing and completed bioremediation volume of 16,000 m ³
Area of influence of BGN#5 blowout i.e., 3.8 km ²	PHC >10000 mg/Kg or similar to be proposed by OIL	Not known. Approximately 0.38 million m ³ of potentially contaminated soil.

It is recommended that OIL shares all such data (lab results, photographs, volume estimation etc.) on a digital platform and help accelerate the global restoration movement²⁹ by connecting everyone, everywhere to local restoration. It is desirable that the platform connects stakeholders with scientific data to increase the impact, scale, and sustainability of restoration efforts. We believe that anyone can be a restoration champion, with OIL leading the way.

A grid-based sampling of the whole area of influence related to BGN#5 (gas blowout and related fire) into grids of 500 square meter each would have been a better approach to manage the area in a systematic manner given the visual variability of the contamination and considering the highly valuable ecosystem under the present scope of work. Further, OIL must develop a digital collaboration platform that provides all scientific data as well progress reports accessible to all stakeholder. Each grid or a number of grids may be a unique project that is either managed by OIL directly or jointly with other interested stakeholders. All such projects need to be presented via the common digital platform in the form of a rural restoration atlas.³⁰ This will also help ensure site specific remediation measures and not deal with a huge volume of contaminated material and avoid possible cross-contamination.

III. Goals and Objectives: The following objectives need to be enforced by the responsible parties:

- a) To repair damage done to the natural landscape as a result of oil operations

²⁹ The United Nations declared 2021 through 2030 as the Decade on Ecosystem Restoration, coinciding with the deadline to reach the Sustainable Development Goals (SDGs)

³⁰ Refer [Urban Nature Atlas \(una.city\)](#) or [Restor](#) for inspiration

over many decades and most importantly due to the BGN#5 blowout accident. Evaluating likely contamination and damage caused by the same to the ecosystem (above and underground), without any further delay using appropriate sampling strategy, on all existing crops, biomass and livestock-based products, underground ecosystem; and appropriately regulating harvest, sale and consumption of unsafe products, along with monetary compensation to producers as may be required. The committee at the time of writing this report has noted that OIL has collected some samples within a 2 km radius of BGN#5 i.e. around 12.56 km² and that lab results are awaited. Field logs³¹ shared with the Committee show that visual contamination of soil is still encountered as on Dec, 2021 i.e. almost 19 months post blowout. To rehabilitate a selection of contaminated features (within the 3.8 km² of the BGN#5 blowout areas of influence) to ecologically functioning areas that are able once again to support a typical range of native plant species. Cleanup operation needs to be enforced to remove any existing waste material within the BGN#5 facility to a proper end use/disposal site in accordance with environmental laws.

- b) Contaminants, if any in general, need to be reduced to a reasonable level to support future agricultural activities. To apply a risk-based methodology of remediation concurrent with recognized international protocols. (Refer Fig. 20. Risk based clean-up approach). Decreasing TPH concentration via dilution with uncontaminated soil should not be allowed. The most recent work completed by OIL near the BGN#5 site shows that OIL remediation contractor has resorted to the later.
- c) Any old metal structure/redundant pipes should be dismantled and disposed of at a licensed facility. (See Table 1 for status as on Nov 15,2021 and corresponding photo shared by OIL for Dec 26 2021)
- d) A full itinerary of all components, waste and products from the site to be maintained.
- e) A full Residual Management Plan, should be commissioned upon establishment of restoration levels in order to ensure that all products remaining on site will be managed responsibly and effectively.
- f) OIL may like to utilize the Baghjan remediation and restoration case as an opportunity to develop a local innovation in the area of nature-based solutions (NBS)³², with plants, micro-organisms, natural materials, solar energy being used to manage residual pollution. In this way, contaminated soil can be redeveloped soon after the conventional remediation of the top

³¹ Field Logs and Picture of Soil profile is placed in Annex 9

³² BAYOU VERDINE REUSE CASE STUDY, ECOLOGICAL REVITALIZATION ON THE BAYOU, BAYOU VERDINE IN CALCASIEU PARISH, LOUISIANA, NOVEMBER 2016 (epa.gov)

layer in combination with less intensive nature-based management of residual pollution.

IV. Work Plan

- a) OIL to establish a new Soil Remediation Group which is responsible for planning and execution of remediation and restoration projects in assets owned and/or operated by OIL.
- b) To cordon off all future remediation sites by installing appropriate fencing and signboard.
- c) Characterization of the probable contaminated site following appropriate sampling strategy. OIL along with other responsible parties must first develop site specific and objective metrics for the most important and immediate environmental, social and governance problems, rather than produce catchall reports that are often made up of inaccurate, unverifiable, and contradictory data.
- d) OIL to take measures to prevent vertical and lateral spread of contaminated materials, demonstrating no detrimental impact to adjacent potential receptors and/or dilution with clean material. OIL remediation areas must meet the objectives that include measures to protect (i) underlying clean soils, (ii) groundwater (iii) surface water; and (iv) air
- e) Boundary ditches and the streams to be maintained in a proper and responsible manner by OIL. The work plan for the site will follow standard site remediation practice and follow CPCB's contaminated site management guidelines.
- f) OIL to pursue a risk-based clean-up approach (Fig.20), engaging best available remediation technology to bring down the level of contaminants in all contaminated mediums. The four corners (or polygon points) of the completed remediation areas shall have a signage board measuring 1 m by 0.3 m indicating: BGN#5 blowout remediated area with the Sub-area number, Zone number and completion date together with the remediation identification number georeferenced. The delineation wooden posts must be strong enough to withstand long-term weather exposure effects. The signage board must be of metal with weather protection coating or aluminum.
- g) The existing pits/effluents pits after being remediated need to be backfilled with clean soil and regraded and compacted to the original ground level.
- h) OIL must ensure adherence of the following (i) Bioremediation progress monitoring and samples collection (ii) Bioremediation baseline and verification samples collection (iii) Verification duplicate samples collection (iv) installation of groundwater monitoring wells near bioremediation areas (v)

Collection of groundwater samples (vi) Collection of samples of irrigation water from each ing sources to be used for bioremediation (vii) air quality and dust monitoring (undertaken at the boundaries of the bioremediation areas)

- i) Restoration of the site using appropriate measures as per restoration plan along with joint monitoring of the sites by CGWB (Central Ground Water Board), PCBA and District Administration
- j) Conducting public awareness and training regarding risk reduction related to oil and gas exploration. OIL must install a video surveillance system around the remediation areas consisting of a number of video cameras with full view of the areas. The cameras shall be able to operate 365/24/7 and provide a reliable quality picture during night time and are required to have zooming capability and enough memory to store data for a period of at least 2 months. A sufficient number of cameras installed and maintained which should be enough to capture all bioremediation zones. Every three months (during remediation activities), OIL must officially submit to the Chairman, PCBA recordings/CDs containing all recorded time in sequenced series.
- k) The site must be examined by the responsible parties for a period of five years after remediation, including monitoring of boreholes, water bodies and any other environmental monitoring required under the CPCB guidelines related to contaminated site management.³²
- l) Re-vegetation: Maintaining greenery at the site using native species, after satisfactory achievement of site-specific Remediation Target Criteria (RTC) assessed via post-remediation sampling strategy. Revegetation may be carried out in a minimum of 4 ha using native species.

V. Monitoring and Maintenance Plan: The responsible parties must formulate a comprehensive monitoring and maintenance plan as well as ensure strict implementation as per the following:

- a) An annual site visit schedule for five years must be undertaken by Chairman, PCBA along with designated personnel from CPCB, Senior Management of OIL, Dy Commissioner, Tinsukia and the site remediation contractor.
- b) For each visit, the site should be monitored/ documented to evaluate the site's progress (photos, surveying, etc.).
- c) A summary of monitoring frequency of each media within the area of influence (gas condensate spread) is as follows:

Table 4: Monitoring parameters for site remediation

Media Monitored	Frequency
Soil	Monthly during bioremediation period
Groundwater	Semi-Annually (every six months)
Surface water	Semi-annually (every six months)
Gases	Monthly and then may be reduced to quarterly thereafter (every 3 months) as per Company approval (if successful bioremediation demonstrated)
Solid and liquid waste	As per requirement of PCBA and/or Waste Disposal Facility
Water (storage, supply & usage)	1 Test per source (pre- and post-bioremediation if any)
Air	Semi-Annually (every six months)

- d) Soil samples for the enabling works related to Baghjan site remediation must be analyzed at an NABL accredited laboratory as per Table 5 below.

Table 5: Indicative Parameters for soil monitoring for remediation sites

Parameter	Indicator
Biological	Bacterial Counts
	TPH Degradable Count (aerobic)
Chemical	TPH Criteria Working Group (TPH CWG)
	TPH (HEM)
	PAH (USEPA-16 + Coronene)
	Metals (As, Ba, Be, Cd, Cr [as Cr (III), Cr (VI) and total Cr], Cu, Hg, Ni, Pb, Se, V, Zn, Boron (Hot Water Soluble)
	Total Organic Carbon
	Alkalinity
	Available nutrients (PKN)
	Nitrate, Nitrite and Sulphate

	Chloride
	pH
	Salinity (SAR and EC)
Physical	Particle Size Analysis
	Percent Moisture
	Bulk Density and Porosity

- e) The Baghjan site and its adjoining area has public, private and OIL land. Hence the governance of the remediation and restoration project ideally needs to be Government-led. The office of Deputy Commissioner (Tinsukia) should be the initiating organization.
- f) Participatory approaches/ community involvement should be ensured via a cloud-based collaboration platform with all restoration related data.
- g) Monitoring of the site should be carried out and impact reports should be written upon completion of the annual visit to describe progress on the site.
- h) If any aspects of the site viz. vegetation, signboards, groundwater monitoring wells etc. are found to require maintenance or repair, this will be detailed in the report, signed by the responsible parties and a clear instruction will be given to all parties for the repairs/restoration to be carried out.
- i) As part of the restoration requirements, it is envisaged that this signed report would be given to the authorities as well as distributed internally by OIL. The site would be revisited after the timeframe set out for the repairs has passed and an update report on progress will be completed and signed.
- j) A certificate of restoration duly signed by all affected stakeholder that confirms that a particular site was restored in accordance with current standards and requirements, and any known contamination issues or hazards were mitigated needs to be uploaded to the cloud-based collaboration platform.
- k) OIL must improve the measurement and reporting of waste and related GHG emissions in an integrated, comprehensive, and auditable way.

43. The Committee recommends that the Government of Assam establishes an office of "Contaminated site remediation and technology innovation" under PCBA. The Office may be entrusted with the responsibility of management of the hazardous waste sites as per CPCB Guidelines³³ to protect the environment and the health of the public at large. In view of extensive oil and gas operations in the state, it is recommended that the existing infrastructure and human capacity of PCBA is substantially augmented.

³³ https://cpcb.nic.in/uploads/hwmd/MoEFCC_guidelines_contaminatedsites.pdf (accessed on 20th Dec,2021)

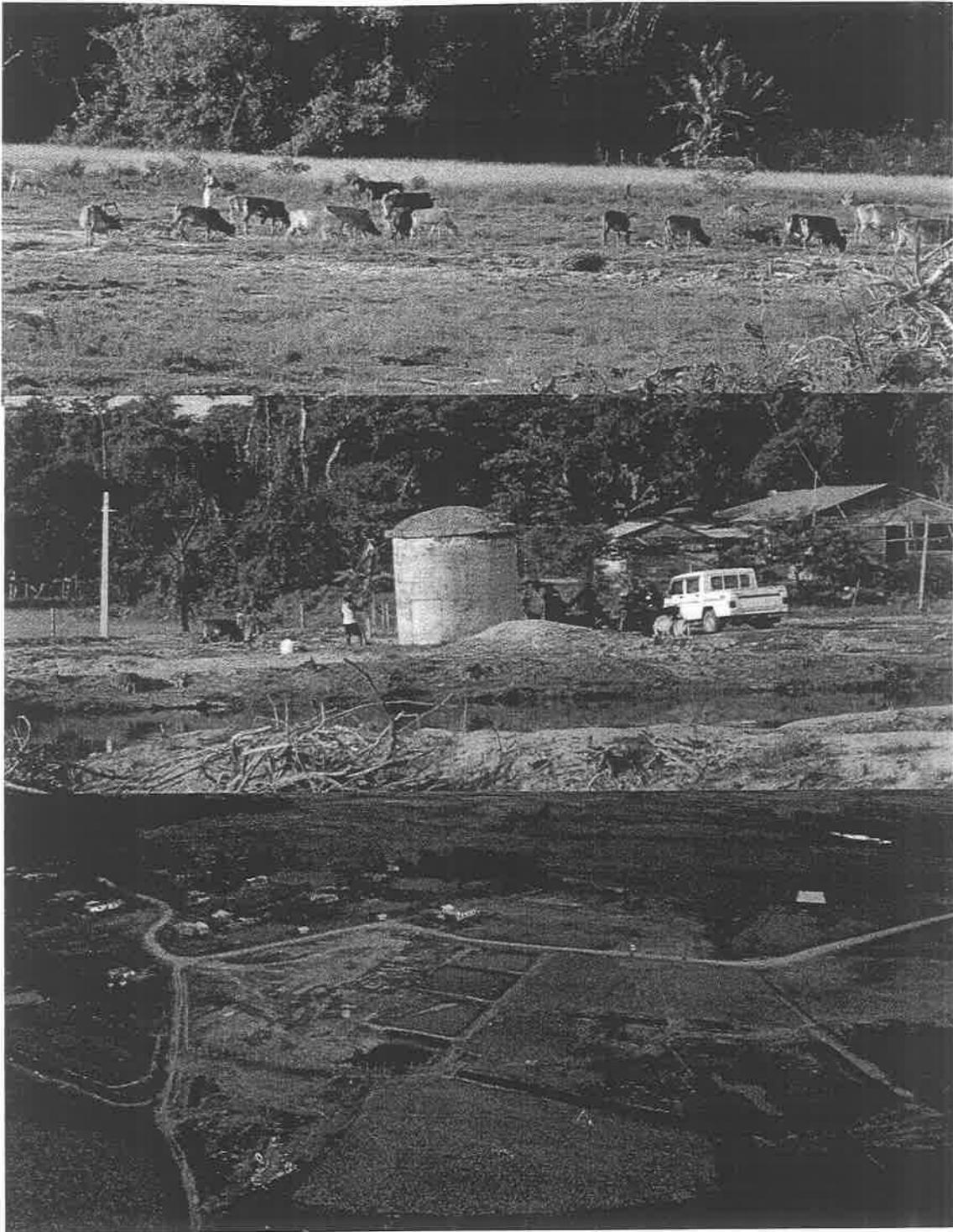


Figure 19: Human and livestock movement at the contaminated site observed during the visit of the committee on October 8-9, 2021 and extent of on-going site activities during committee visit on November 16-18, 2021

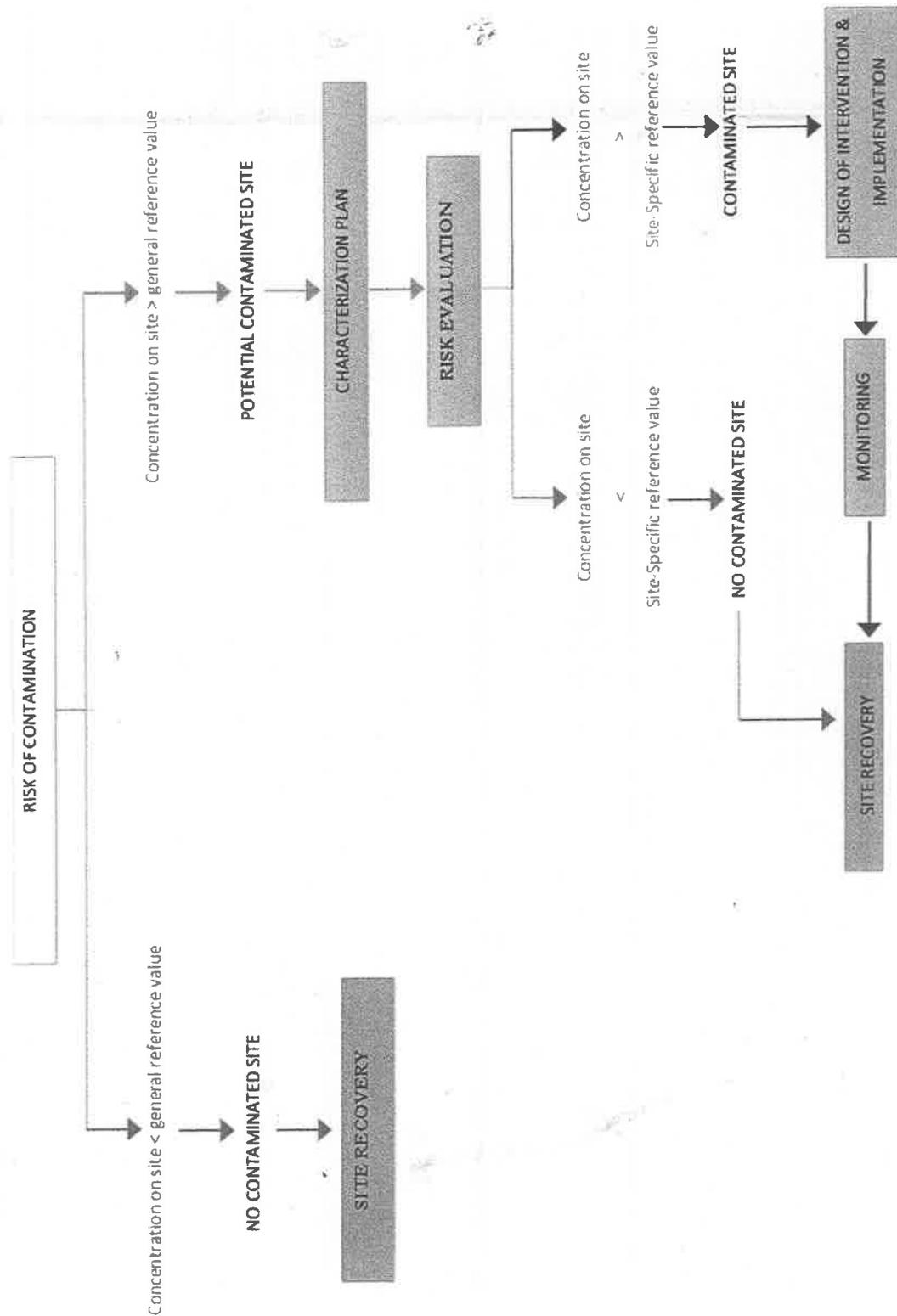


Figure 20: Risk based clean-up approach

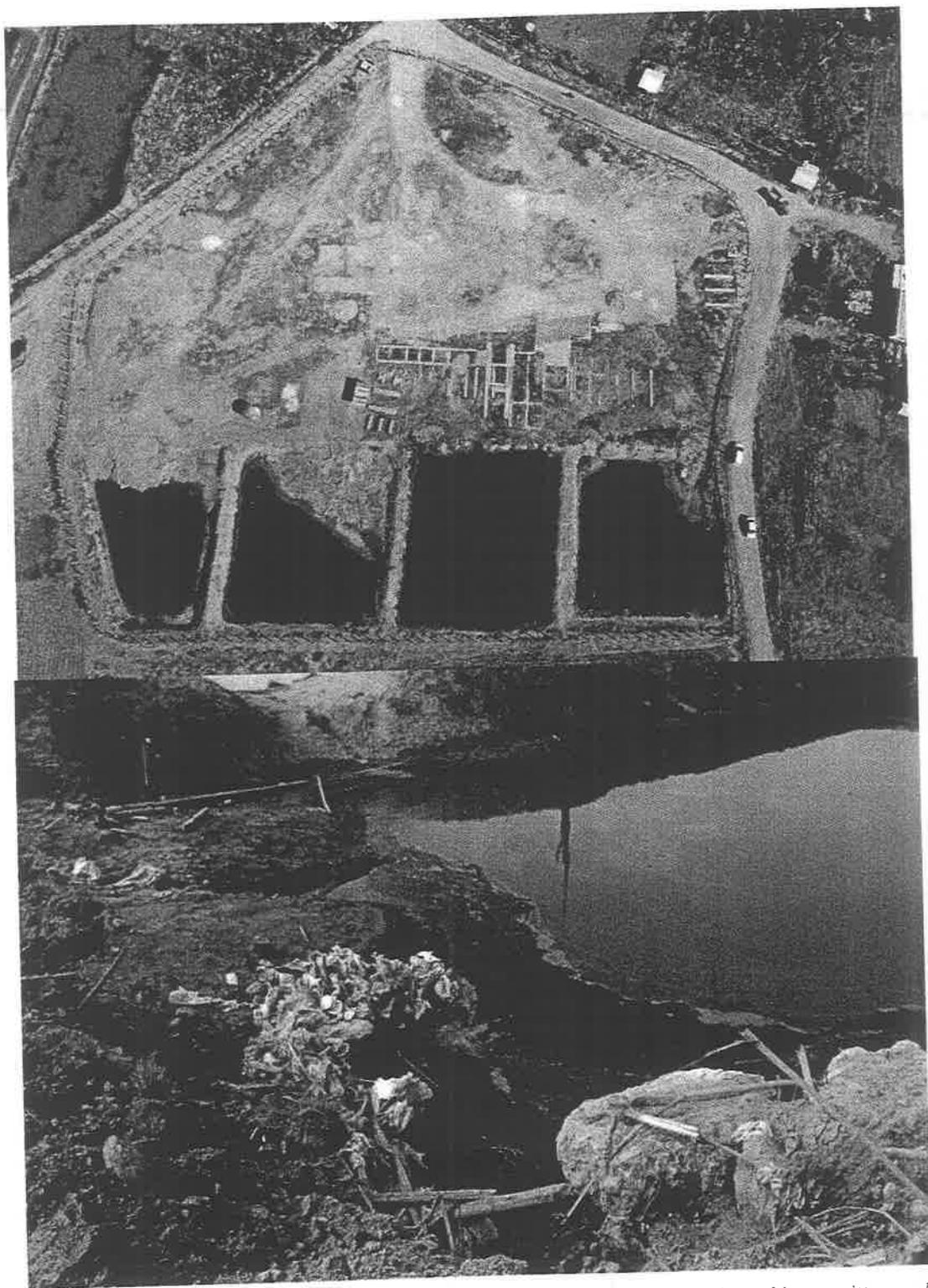


Figure 21: Effluent pits in BGN#5 accident with oily sludge and construction debris observed by committee members on Oct 8, 2021 and corresponding aerial view taken on Nov 18, 2021

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5: Restoring the Dibru Saikhowa National Park and Maguri Motapung Wetlands

44. The DSBR is located in Tinsukia and Dibrugarh Districts of Assam, India, with a small part of the Buffer Zone in Dhemaji District. Spanning 765 km², including DSNP as its core area (spanning 340 km² in Dibrugarh and Tinsukia Districts, Map 4) and surrounding river and fringe villages forming a buffer of 425 km², the DSNP is basically a floodplain of the River Brahmaputra (Map 4 and 5). The area lies in the Indo-Burma Global Biodiversity Hotspot and the Assam Plains Important Bird Area. Biogeographically, DSNP represents the North Eastern India – Brahmaputra Valley Biogeographic Province (9A), having rich diversity of life forms adapted to terrestrial, aquatic and arboreal ecosystems. The terrain of the park is flat and it is situated in the floodplains of the River Brahmaputra and River Lohit. The park is traversed by Dibru and Dangori and others rivers. The national park is inhabited by over 800 animal species³⁴, 71 tree species³⁵, 43 species of orchids³⁶ and over 60 plant species used as medicines³⁷. The Brahmaputra River and the park serve as habitats of the Indo-Gangetic Dolphin. In winter, the dried up river-bed and the sandbar (locally called Char Chapori) support grasslands which are an excellent habitat for the critically endangered bird Bengal Florican, while also serving as migration route for the elephants in the Dibru-Dangori Elephant Corridor; and even tigers. This area is identified for Rhino reintroduction in Rhino vision 2021 of Assam, its crucial part for elephant conservation, Bengal florican and white winged wood duck was reported from this area and need appropriate management to bring back these species which are highly endangered. This area also forms a crucial link and staging ground for the East and Central Asian Flyway identified for migratory bird species. This is a unique habitat in the world and very little is left in India and needs immediate attention for conservation.
45. Located to the south of the DSNP (and within the DSBR), the MMW spans 15 km² constituting a mosaic of shallow marshes and swamps, intermittently inundated areas, wet grasslands and drainage channels (Map 5). The current wetland regime has purportedly established after the massive flooding in the early nineties, resulting in submergence of the grassland habitats, and the lotic environs of the Lohit River and its

³⁴ DSBR Management Plan

³⁵ Joshi, R.K. Tree species diversity and biomass carbon assessment in undisturbed and disturbed tropical forests of Dibru-Saikhowa biosphere reserve in Assam North-East India. *Vegetos* 33, 516–537 (2020). <https://doi.org/10.1007/s42535-020-00135-4>

³⁶ Khyanjeet G, R.L. Borah, G. C. Sharma. Orchid flora of Dibru –Saikhowa National Park and Biosphere Reserve, Assam, India. *Pleione* 4(1): 124 - 134. 2010

³⁷ <http://nopr.niscair.res.in/handle/123456789/983>

tributaries gradually merging into the lentic environs of the wetlands near Lotapung village and subsequently merging again into the lotic environs of Dibru River. The name of the wetland is believed to have been derived from catfish *Clarius Batrachus* (called Magur in Assamese) found abundant here, and the Motapung village which abuts these wetlands. The diverse habitats enables MMW to support equally diverse lifeforms, which include at least 57 plant and 254 animal species³⁸, several of which have high conservation value nationally and globally. MMW has been enlisted as an Important Bird Area (IBA) on account of its significance in sustaining the avian diversity of the landscape. The fish, plant and fodder resources and opportunities for recreation and tourism from the wetland sustain livelihoods of at least ten adjoining villages of about fifteen thousand people, besides being an important cultural icon of the region. The flood buffering, water purification and groundwater recharging capacity make MMW a critical natural asset for the entire landscape.



Figure 22: Fishers in Maguri-Motapung Wetlands (by Committee, October 9, 2021)

³⁸ MMW Management Plan 2018-2022

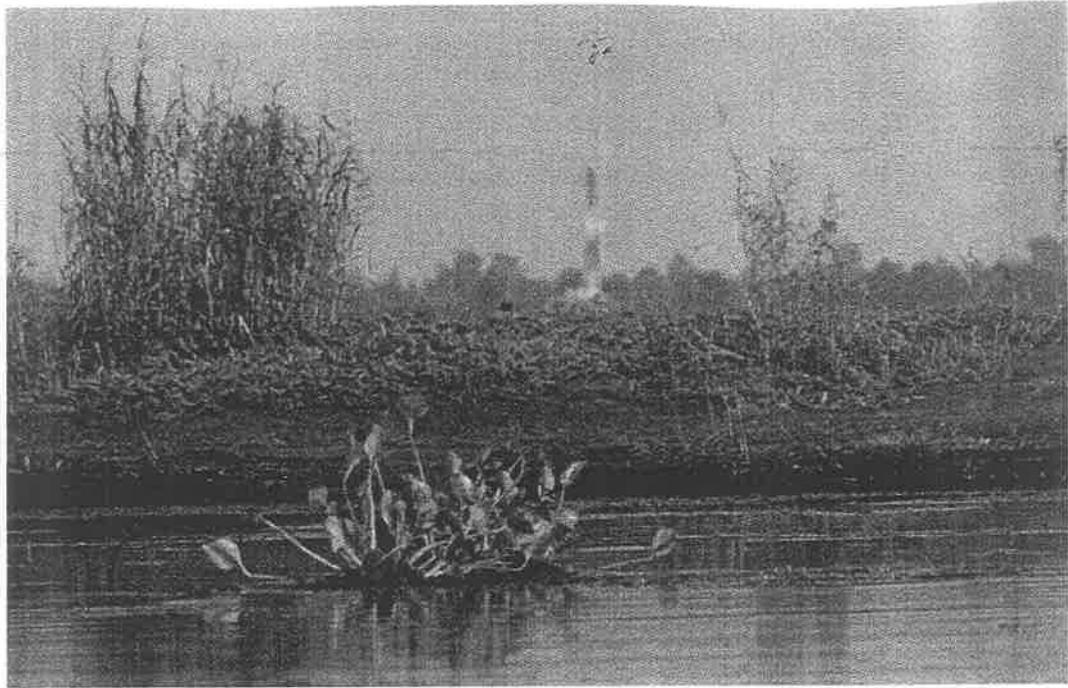
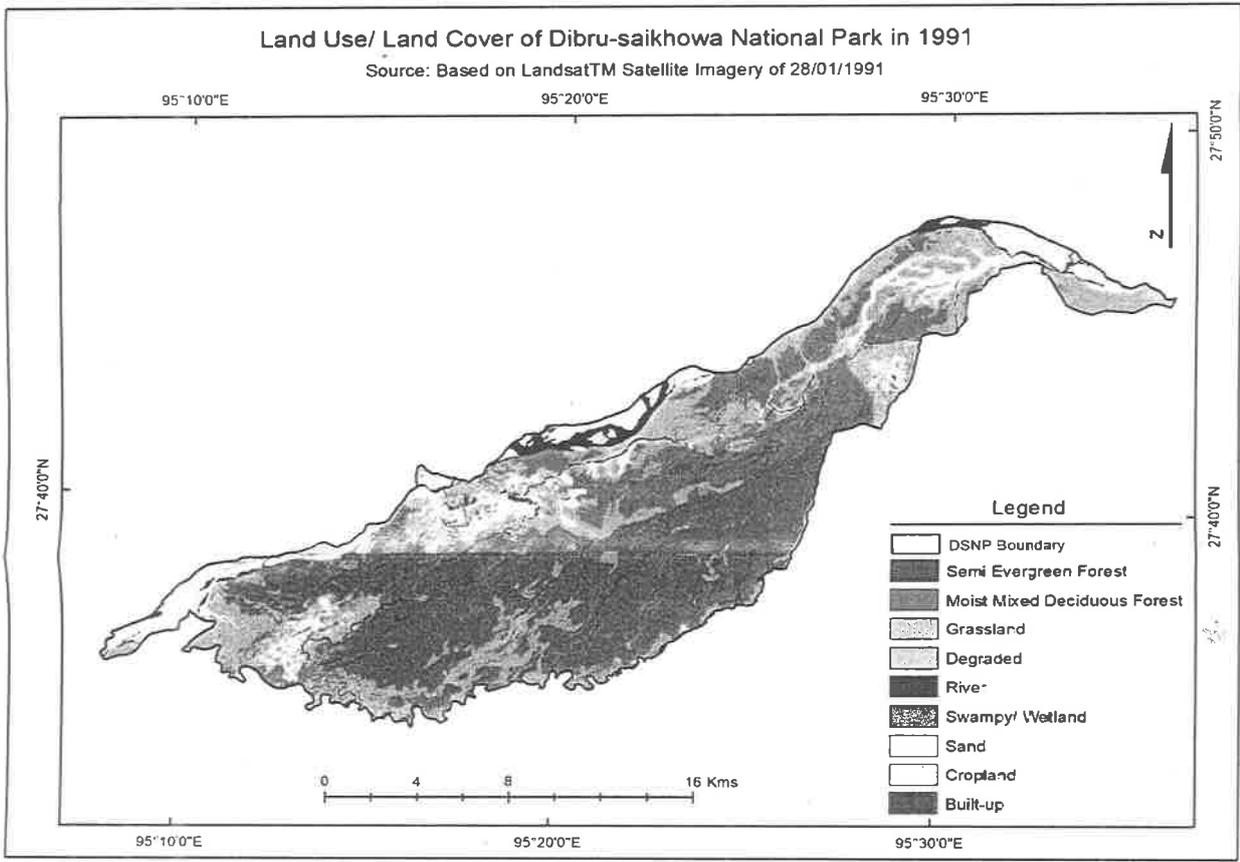
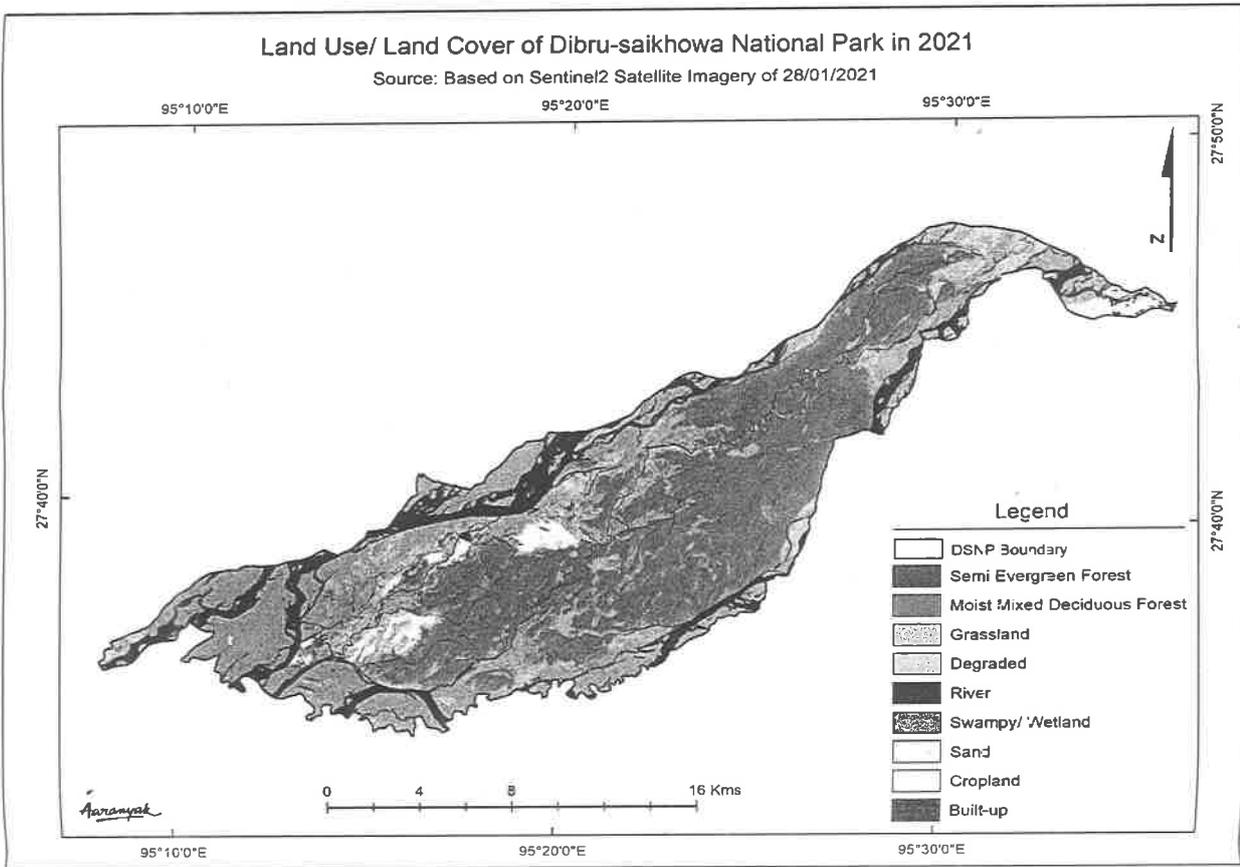


Figure 23: An operational oil well in the vicinity of Maguri-Motapurn Wetlands (by Committee, Oct 9, 2021)

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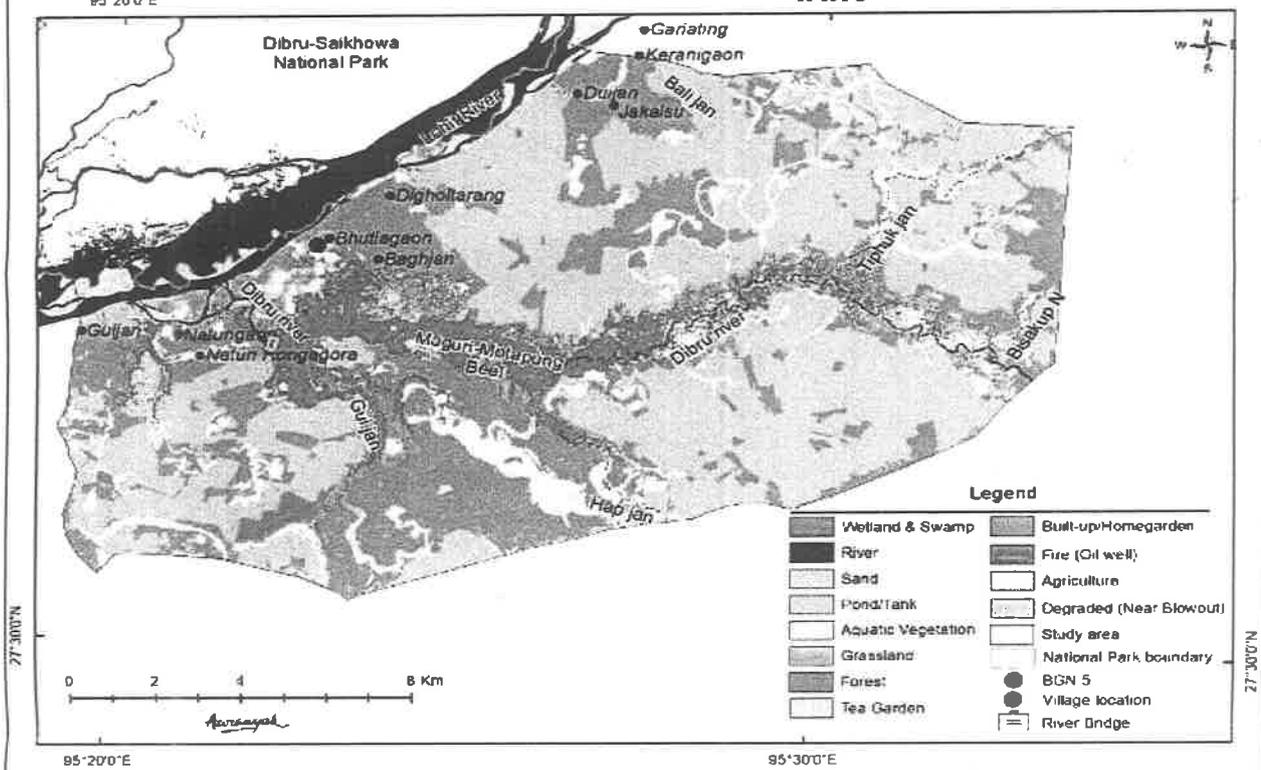


Map 4: Land use and Land Cover of the Dibru Saikhowa National Park (2021 and 1991)

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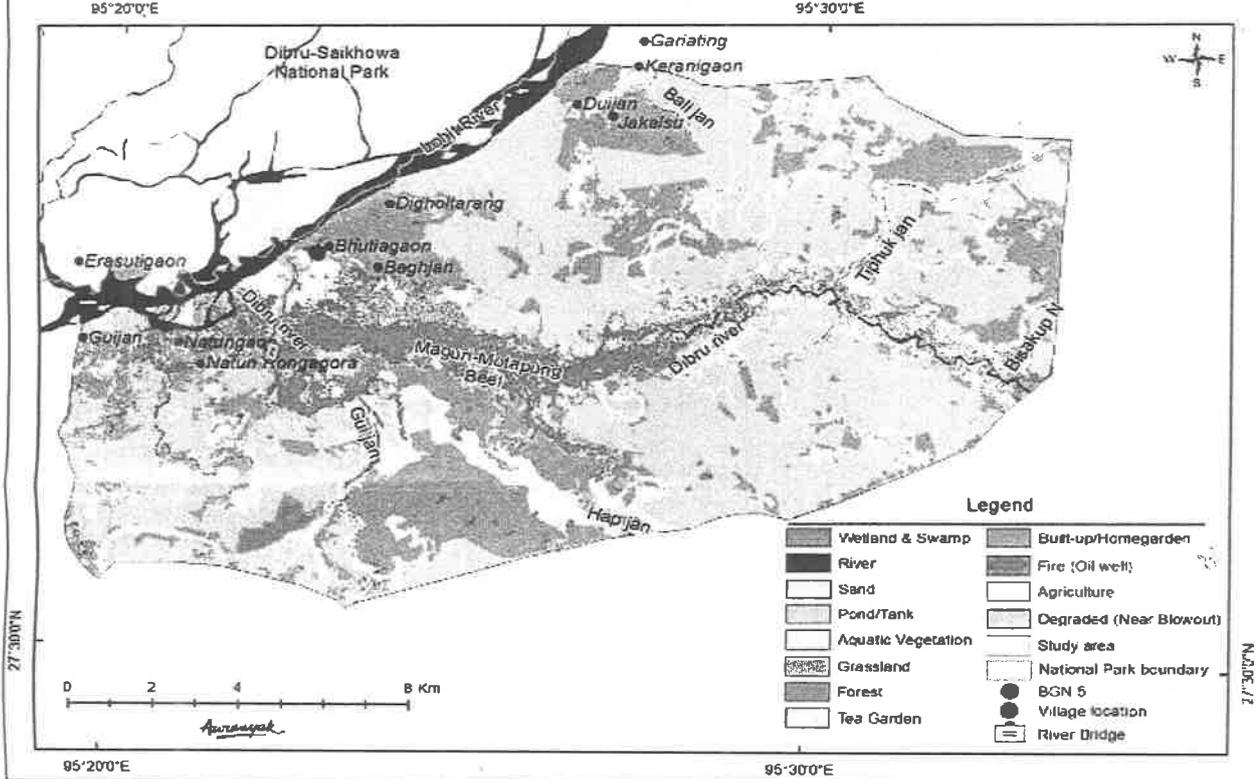
Land Use/ Land Cover of Maguri-Motapung area in 2020

Source: Based on Sentinel2 Satellite Imagery of 20/09/2020



Land Use/ Land Cover of Maguri-Motapung area in 2010

Source: Based on Landsat TM Satellite Imagery of 27/07/2010



Map 5: Maguri-Motapung Wetlands (2010 and 2020)



Figure 1

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Figure 24: A patch of oil on the surface of Maguri - Motapung Beel (November 17, 2021 observed by Committee)

5.1 The Baghjan accident and impact on wetland and surrounding forest area

46. The MMW is located around ~ 300 m south and southeast from BGN#5. Owing to its close proximity to the accident site, major parts of the wetland were subject to oil spill and condensate deposition, burning, sound pollution, high temperature and burning, seismic activities, and high concentration of toxic aerosols. Assessments done by WII and the DFO (Tinsukia) post-accident have extensive documentation on evidence of fish diseases and mortality, dolphin mortality, reduced sightings of several wetland species, and vegetation burning. Studies suggested toxic PAHs in water, soil sediments and fish tissues. These PAHs are of origin from gas condensate spillage and also formed from combustion and are carcinogenic³⁹, affect physiology of animals and reduce immunity. The wetland oxygen level declined due to condensate film formed on water during the time of accident resulting in large scale impact on aquatic life. The loud sound which is way above the prescribed limit even of industrial level is known to have effect on wide ranging species including humans. Community representations made to the committee included drastic reduction in fish catch, dip in ecotourism revenues and several impacts on health (of human and livestock), besides loss and damage of assets.
47. This section builds on the assessments and findings of various agencies which investigated damages from Baghjan accident⁴⁰ notably Wildlife Institute of India-WII (Ecological), OMCR (Comprehensive including several aspects of impact: Multiple agencies), ERM - Environment Scan Report (environmental aspects), The Energy Resources Institute-TERI (Soil, Water and Air pollution), Indian Institute of Technology, Guwahati-IIT (Impact on buildings), Assam Agriculture University-AAU (Agricultural productivity), Council of Scientific and Industrial Research-North East Institute of Science and Technology-CSIR-NEIST (Seismological and Geophysical) and PCBA (Water quality).
48. The sound produced during blowout was intense and studies by OMCR, IIT-Guwahati and Wildlife Institute of India (WII) provide conclusive proof that sound level produced was detrimental to human health and wildlife of the area. The sound pressure was way above the prescribed limits of human and animal hearing, it was equivalent to industrial noise and turbojet sound. Anthropogenic sound disrupts animal communication. This level of noise will adversely impact mammals, birds and insects, from disorientation to health issues. Animals would be stressed and would have behavioral and physiological changes.

³⁹ Material Safety Data Sheet at: <https://cdn.caymanchem.com/cdn/msds/700882m.pdf>

⁴⁰ List included as Annex 3

Gas and condensate were released during blowout (Polycyclic Aromatic Hydrocarbons (PAHs) present and formed during combustion). WII reports high concentrations of PAHs, 0.21 – 691.31 $\mu\text{g L}^{-1}$ in water and 104.3 – 7829.6 $\mu\text{g Kg}^{-1}$ in fishes⁴¹. The concentration of PAHs in water samples and fish tissues was found to be significantly higher than in previous studies conducted in India⁴² and elsewhere around the world. (ref value) As the event occurred during monsoon, the impact of hazardous condensate and chemicals spreading through water extended beyond the usual area of influence, causing widespread harm. PAHs specific toxicity results in a variety of biological dysfunctions in aquatic animals, including neoplasms, lower reproductive results and endocrine disruption causing immunotoxicity, post-larval growth, trans-generative impacts. PAHs presence in water also affects the female fishes as its exposure has been linked to lower plasma estradiol levels, suppression of vitellogenesis, lower ovarian estradiol production, and reduced fertility in female fishes⁴³. Thus, the PAHs concentrations found in this study must have caused severe toxic effects on fish, benthic organisms, and other aquatic animals. Condensate also has a wide range of effects on aquatic mammals, and it can be absorbed through various pathways, including cutaneous contact, inhalation, and ingestion; moderate to severe lung illnesses developed, resulting in lung abscesses, pneumonia, adrenal toxicity and pulmonary infections. The autopsy report of the Ganges River dolphin body found in the impact site matched with prior reports of PAHs effects on mammals. The WII has concluded that there has been mass mortality of species as a result of oil contamination, which has had a global impact on the high biodiversity area. PAHs also impact phytoplankton and zooplankton productivity having ecosystem wide impact on wetlands. The toxins released by the blowout may persist in soils and sediments, which, in addition to affecting current flora and fauna, will also affect the local population by posing a serious health risk in the future.

⁴¹ Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous anthropogenic contaminants, and are toxic, carcinogenic, and mutagenic to all organisms, including humans, and can be biologically amplified to high concentrations in food webs. Their lipophilicity, persistence, and high toxicity enables their accumulation in the tissues of nontarget living organisms. The main sources of these contaminants in the environment include forest fire, natural petroleum seeps, combustion of fossil fuels, coal burning, and use of oil for cooking and heating.

⁴² For example, Dhananjayan and Murlidharan in a study on PAHs in Mumbai Harbour in five species of fish report the concentration of total and carcinogenic PAHs in the range between 17.43 to 70.44 ng/g wet weight, and 9.49 to 31.23 ng/g wet weight, respectively, among the species tested. V. Dhananjayan, S. Muralidharan, "Polycyclic Aromatic Hydrocarbons in Various Species of Fishes from Mumbai Harbour, India, and Their Dietary Intake Concentration to Human", International Journal of Oceanography, vol. 2012, Article ID 645178, 6 pages, 2012. <https://doi.org/10.1155/2012/645178>

⁴³ Material Safety Data Sheet at: <https://cdn.caymanchem.com/cdn/msds/700882m.pdf>

50. OMCR assessed the impact on vegetation using drones, and reported plant leaves soaked in condensate, several tea plants were seen with dead leaves. Flowering and fruiting in several species have been impacted, new flowers appear to be falling off from the plants prematurely. The soil was found to be contaminated with condensate. Interviews with villagers by the Committee also indicated that vegetables and crops were impacted by condensate and were not usable. The wetlands and impinging grasslands are home to several flora and fauna, including wild buffalo, barking deer, and a variety of avifauna. It has been reported in OMCR findings that, about 64,000 kg of condensate containing heavy hydrocarbons might have fallen in a three-km radius of the blowout on the south side of the site over an estimated area of 589 ha. Nearly 24 ha around the flame was severely burnt and 102 ha partially burnt.
51. BNHS (mentioned in OMCR) suggested an average loss of around 26% of odonates and 48% of lepidopterans. Herpetofauna loss was also significant, 177 carcasses of 4 species were recorded. WII team found no evidence of tadpole presence in spite of the incident time being breeding period of several species of Herpetofauna. Various studies on arthropods indicated that it will take 2 to 21 years for species populations to recover from losses due to oil impact. Herpetofauna carcass was found from 0.5 to 6 km from the incident site.
52. Eighty-seven species of fishes were reported from Maguri-Motapung beels which were reduced to 25 species with widespread deaths of fishes. Dissolved oxygen level reduced significantly in beel in comparison to the control site. Fish species richness declined by 71% and abundance by 81%. WII report highlighted visible symptoms like discoloration, loss of scales, excess mucous secretion and bleeding in fishes due to oil toxicity. Global studies indicated it took several years before the system becomes functional and fish mortality declined.
53. OMCR and WII reported decline in bird diversity, death of several species. Asian openbill have not nested during blowout time and breeding of several other species of birds were impacted. Many wetland and grassland birds were not seen within 5 km zone of impact site. The bird richness declined by 59% in grassland and 85% in wetland (WII). Committee's visit to wetlands found only two species of wetland birds, Brahminy or shellduck and Cormorant. Even after one year of the accident, the migratory bird counts and population have not recovered to those observed in the recent past.
54. WII and OMCR recorded several mammal species Hollock gibbon, Squirrels, and Ganges dolphin being impacted by the accident. Death and reduction in their population was recorded within 5 km radius. Hollock gibbon female gave birth to a dead baby. Behavioral changes were recorded in gibbons. Ganges dolphin died due to toxicity of

condensate /PAHs and their population declined by 89% in Lohit-Siang confluence area. Wild Buffalos and deers reported to have moved away from impact site.

55. The entire region has been subject to several flood pulses (up to-seven) since the accident, and thereby it is likely that parts of the contaminants have even been washed downstream (especially from the channels wherein flows are relatively higher, and towards the Dibru River). Yet, in all likelihood, the condensate which was deposited on the vegetation may have continued to persist, and found its way into sediments, and as well as become part of the bio-geochemical cycles of the wetland ecosystems. During field visits to the MMW, patches of oil were observed to surface when the sediment (at one or two locations) was disturbed with boat paddles (Fig. 24). The Committee was not made aware of any study, dataset or monitoring of different components of wetland water, sediments and vegetation which indicated otherwise. As a matter of fact, no systematic tracing of the contaminants released from the accident was done within the wetland, nor an attempt made to understand their ultimate fate.

56. The wetland has a high livelihood dependency, with communities harvesting fish, molluscs and vegetables for home consumption as well as for sale. It is therefore critical to ensure that these products are safe to consume.

57. During interactions with the residents of the Erasuti village, decline in land productivity was indicated. Similarly, the fishers of Motapung Village indicated that the fish catch has considerably declined, especially of species such as Darikana (*Rasbora* sp), Singhee (*Heteropneustes fossilis*), and Magur (*Clarias Batrachus*). Similarly, the tour operators indicated a decline in waterbird populations using the wetland as habitat.

58. During interactions, the residents of Erasuti village, (a revenue village enclaved within the DSNP) informed the Committee about the damages to vegetables, crops and grasslands and woodlands. Livestock was impacted due to consumption of fodder contaminated by leaked gas-condensate. The Village Headman of Dadhia, a forest village in DSNP, however, did not allude to any damage caused due to the Baghjan accident.

59. Tour operators and local communities indicated that the number of migratory birds visiting the MMW have been considerably lower since the Baghjan accident. Delayed or very low flowering of orchids was also reported from the area.

60. Despite what has been discussed above, on the damage to DSNP, there is a clear need to conserve and sustainably manage this high biodiversity area, considering the fact that OIL has undertaken drilling activities even on the boundary of this Protected Area (PA).

5.2 Overview of current management and monitoring mechanisms

61. Being a part of the DSBR, the DFO (Tinsukia) serves as the nodal officer for MMW, while within the District, the District Commissioner is responsible for the overall health and upkeep of the wetland environment.
62. An Eco-Development Committee (EDC) has been constituted by the Forest Department to elicit active cooperation of local communities living in the buffer of DSBR, and to ensure their reciprocal commitment in conservation of the reserve and its buffer areas. As informed during the interactions with the committee on 17 November 2021, the EDC was formed in 2015 with 12 members. The EDC manages tourism activities, such as ensuring that all boat operators get a fair opportunity of income generation. The EDC has also placed dos and don'ts for the tourists and visitors, while visiting the wetland.



Figure 25: Aerial view of the Erasuti village (by Committee, Nov 17, 2021)

63. The Committee was provided with a copy of the MMW Management Plan (2018-2022) which has been prepared by the Office of the Deputy Commissioner. The plan has been prepared with a vision of 'restoring and maintaining the near-natural condition of the MMW, while ensuring the sustainable supply of ecosystem goods and services for local people'. The plan envisages activities for implementation in the permanent wetland area, flood affected area, and within human habitation around. A District Level Coordination Committee with Divisional Commissioner (Tinsukia) as Chairperson, and representation of Zila Parishad, Agriculture, Fishery, Veterinary, Handloom, Social Welfare, District Rural Development Agency, Forest, Tea Board and local communities.
64. DFO also provided the management plan of DSBR (2019/20 to 2023/24). The plan has the following management objectives:
- a) To ensure the persistence of existing wildlife through enhanced protection and habitat management
 - b) To work in tandem with all stakeholders for successful rehabilitation of Laika and Dadhia Forest Villages outside the core area
 - c) To ensure a highly dedicated and motivated workforce through capacity building and adoption of suitable welfare measure
 - d) To promote Eco tourism in a regulated manner so as to augment local livelihoods
 - e) To foster the spirit of continued research, especially experimental research to in order to avail scientific inputs for the park
 - f) To organize buffer folk so as to achieve consensus in implementation of eco development initiatives with the aim of reducing pressure on the core
 - g) To involve local fringe area villagers with the network under umbrella of Eco Development Committee (EDC)
65. DSBR has received funds (from Centrally sponsored schemes, Project Elephant, 12th Finance Commission, District development plan and non-plan) which varied from to Rs 22.06 lac to 157.93 lac between 2011 to 2021, on an average they received Rs 83.34 lakh in this period.
66. Plan recognizes inadequacy of funds and staff and thus its inability to effectively manage Biosphere Reserve. There is very little scientific research available and the plan has not envisaged any funding for applied research for its effective management. There is an urgent need to do so. The protection infrastructure is inadequate, training of staff for wildlife is nonexistent⁴⁴. The area is dynamic due to floods and current development around it, but management has not identified the issues and mitigation appropriately. Oil and gas well drilling and production operations have hardly any mention nor there is any

⁴⁴ There is a long pending issue of relocation of Dadhia and Laikia forest villages.

plan to deal with pollution or any accident.

67. During discussions with the Deputy Commissioner, the Committee was disappointed to learn that the MMW management plan had not been implemented, and there is also a lack of clarity on its formal approval. The EDC members could not confirm their participation in the management plan, rather failed to identify the document itself. The Committee was further surprised to find no budget or financial plans being part of the plan. Ideally, all wetlands management plans are supposed to be proposed to and approved by the State Wetlands Authorities (in this case Assam State Wetlands Authority). The plan period is nearing expiration (2022), and has several weaknesses, key being:

- a) Wetland area and its catchment has not been demarcated, and thus maps do not render spatial planning
- b) Baseline assessment on hydrological regimes, especially the flood pulses and connectivity with the river have not been carried out
- c) Measures for ecosystem conservation are of cursory nature. The plan does not suggest the ways in which the intrinsic values of the wetland will be conserved
- d) Management objectives and outcomes are not clearly stated, and no performance indicators have been suggested
- e) There is an over-emphasis on economic activities, making the plan very development orientated, underplaying conservation outcomes
- f) Monitoring mechanisms, indicators, systems and arrangements are defined very rudimentarily

68. The existing mechanisms for monitoring of MMW and DSNP are rudimentary. There is hardly any ecosystem level monitoring of DSNP – available information is largely limited to remote sensing based land use and land cover estimates, and population estimates of select species. Data on water chemistry reported by the PCBA for MMW is based on a single sample collected monthly. This is grossly inadequate, given that the wetland is a mosaic of diverse habitats (such as open water, vegetated, lentic and lotic patches), and a single datapoint is thereby misleading. Upon discussion with the Pollution Control Board officials, the Committee also learnt that the organisation does not have the required capacity and infrastructure to monitor the contaminants released in the accident.

69. Under the provisions of the Wetlands (Conservation and Management) Rules, 2017, it is required that the area of MMW and its zone of influence is properly demarcated, and a notification of activities prohibited, regulated and permitted within the wetland is specified following a due process of notification. This has not been complied with, and wetland regulation completely overlooked.

70. As per the provisions of the Disaster Management Act, 2005, each District is required to have a District Management Plan, with the District Disaster Management Authority (under the Chairmanship of the District Collector) as the institution responsible for implementation. The copy of the DDMP for Tinsukia was reviewed by the Committee, and it was observed that the Plan did not identify Oil and Gas production related risks in hazards, and ecosystems, such as MMW and Dibru Saikhowa as elements of risk reduction. Therefore, the DDMP is silent about the damages to ecosystems, and therefore does not have a SoP to act upon when faced with a disaster relating ecosystems. This needs to be urgently rectified, with a detailed Hazard-Capacity-Vulnerability-Capacity Assessment being the basis, and healthy ecosystems considered as an integral part of the disaster resilience building interventions.

71. OIL has no protocol in place to address oil/ condensate spills in wetlands, terrestrial system and ecologically sensitive areas such as DSNP. This is a critical lapse given the high intensity of oil and gas operations around the MMW and the DSNP. The SoP examined by the Committee were of generic nature, highly insufficient to address the impacts on sensitive ecosystems, in events such as the Baghjan accident.

72. The Committee examined the Terms of Reference of the studies / assessments commissioned by OIL for redressing the environmental damages. Unfortunately, the studies are not strategically designed, and may not address the pressing needs of ecological restoration and ensuring that the health of ecosystems is maintained in the long run, and the institutional and governance arrangements required for this purpose and put in place. The Committee is also of the opinion that merely creating species checklists would not be adequate, unless these are backed by a thorough understanding of the ecosystem components and processes which are required to sustain the species richness, the risks to such conditions and the risk reduction pathways.

5.3 Restoration framework for DSBR

73. The entire DSNP and MMW landscape evolves and functions in templates set by hydrological regimes, sediment and nutrients. As water moves through the MMW, the temporal spreading of flows lead of moderation of discharge and velocity; spatial spreading of flows leads to spreading of sediments and nutrients; exchange between surface and groundwater; and detention of water creates conditions for physical and biological processes which modify water quality and provide habitat for numerous life forms.

74. Floodplain environments such as DSNP and MMW are flood-pulse driven ecosystems. Periodic inundation influences the lateral exchange of water, nutrients and organisms between the river system and the wetlands structure their biota and productivity.

Floodplain wetlands play a critical role in the functioning of the river ecosystem. Thus, the damage to the MMW due to fire and spread of condensate would have impacted the Dibru River ecosystem.

75. Wetlands conservation espouses to achieve 'wise use' which is defined in the text of Ramsar Convention as the 'maintenance of its ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development' (www.ramsar.org). Wise use is about maintaining wetland values and functions in order to maintain their intrinsic values as well as benefits provided to the society, from an inter-generational point of view. The Baghjan fire incident poses two central challenges for MMW: a) addressing the damage and degradation of the ecosystem through ecological restoration; and b) putting in place effective management arrangements that would ensure that the wetland ecosystem continues to be in a 'healthy condition' to be able to sustain biodiversity and ecosystem services values.

76. Ecological restoration of DSBR needs to be targeted at assisting the recovery of the ecosystem that has been degraded and damaged by the Baghjan accident. The efforts have to be directed for enabling the degraded and damaged ecosystem to a trajectory of recovery that allows adaptation to local and global changes, as well as persistence and evolution of its component species. The following eight internationally accepted principles for restoration, singly as well as collectively, are relevant here and need to be adopted:

Principle 1. Ecological Restoration Engages Stakeholders

Principle 2. Ecological Restoration Draws on Many Types of Knowledge

Principle 3. Ecological Restoration Practice Is Informed by Native Reference Ecosystems, while Considering Environmental Change

Principle 4. Ecological Restoration Supports Ecosystem Recovery Processes

Principle 5. Ecosystem Recovery Is Assessed against Clear Goals and Objectives, Using Measurable Indicators

Principle 6. Ecological Restoration Seeks the Highest Level of Recovery Attainable

Principle 7. Ecological Restoration Gains Cumulative Value when Applied at Large Scales

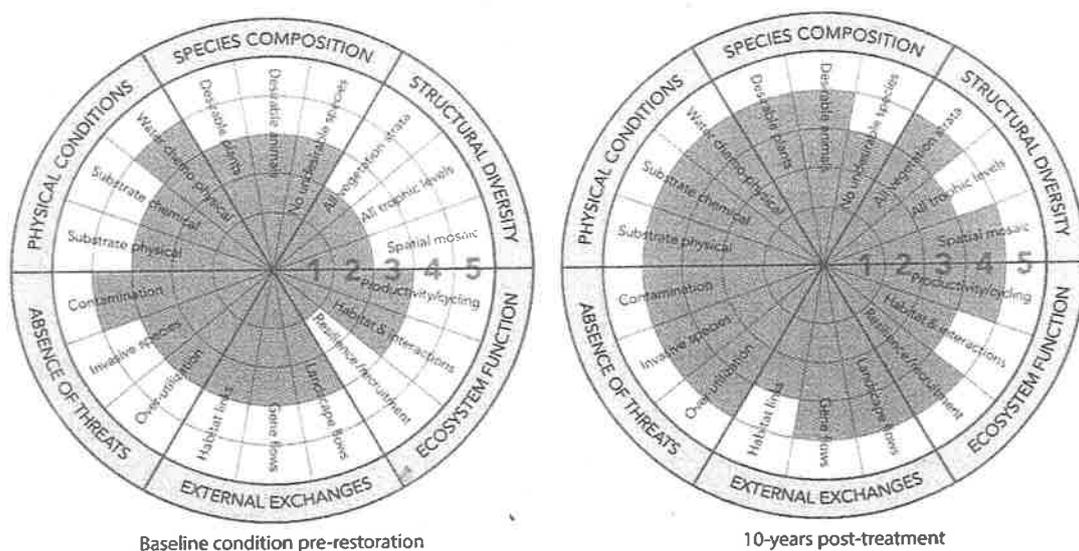
Principle 8. Ecological Restoration Is Part of a Continuum of Restorative Activities

77. Ecological restoration has to be guided relative to an appropriate reference model, regardless of time required to achieve the recovery. The reference model, which has to be built from multiple sources of information should characterize the condition of the wetland had it not been degraded or damaged (say prior to the Baghjan accident), and also accommodate the known or predicted change in environmental conditions in and

around the wetland (for example, the implication of intensification in tea cultivation in the buffer regions of the wetland). It is also stressed that reference conditions (pre accident) are not mere replication of historical condition, but one in which the native species and communities are able to recover, and continue to reassemble, adapt and evolve (Fig. 26).

For the gains of restoration to persist over time, it is also essential to put in place effective management arrangements which would secure that the full range of biodiversity and ecosystem services of the DSNP and MMW are delivered in perpetuity by limiting and managing impact of human-induced adverse change in the ecosystem. The management arrangements should also strive to ensure integration of DSNP and MMW biodiversity and ecosystem services in sectoral plans, such as disaster management, rural development, fisheries, tourism and others.

As stated in the earlier sections, the flood pulses since the Baghjan accident have greatly assisted in the discharging the contaminants and enabling reestablishment of vegetation, especially macrophytes. However, the severity of the accident was such that even more than a year, in parts of the wetland, oil film surfaces when the sediments are disturbed. It appears that the oil spill has also mixed with the wetland soil, thus indicating that the impacts are highly likely to be persistent and long term.



80. Figure 26: The ecological recovery wheel for conveying progress of recovery of ecosystem attributes compared with those of reference model. The left model indicates the levels of ecosystem attribute at the baseline level (to be defined prior to restoration)

81. Abundant caution needs to be exercised while deciding on restoration within ecologically sensitive environs such as MMW. For example, removal of wetland soils affected by

leaching of oil or any other chemical may also tend to remove benthic organisms, and allow for colonization of pioneer species and species invasion. At the same time, since several wetland products such as fish and vegetables are used for human consumption, it is important to ensure that these are safe for human consumption, as well as for wetland dependent species.

82.

The Committee proposes the following:

- a) Conducting systematic studies and monitoring to determine the level of contamination within various components of the wetland and terrestrial area (water, sediment, vegetation).
- b) Commissioning an ecological restoration baseline assessment (by involving expert agencies and with full stakeholder engagement) which would be tasked with:
 - (i) Systematically defining a 'reference ecosystem condition' which would serve as a guide for ecological restoration. The reference condition should be established for all major ecosystem attributes, using all knowledge systems (published science, indigenous and local knowledge, expert judgement), and take into views of all stakeholders
 - (ii) Systematically defining ecological restoration indicators which would serve as a basis of assessing restoration effectiveness over long term
 - (iii) Identifying restoration options – with specific focus on nature-based solutions which use native species
 - (iv) Identifying monitoring indicators for all major ecosystem attributes (physical condition, species composition, ecosystem function) as well as threats and external exchanges
 - (v) Projecting resource requirement to implement restoration measures
 - (vi) Suggesting an institutional arrangement to implement restoration measures
- c) Constituting an 'ecological restoration steering committee' which would be tasked with:
 - a) Approving an ecological restoration plan
 - b) Monitoring and review of progress of implementation of restoration plan
- d) Undertaking studies and systematic monitoring to ascertain that in multiple use areas the wetlands products (from buffer zone) are safe for human consumption. In case the studies determine that any of the wetland products are unsafe for human consumption, its extraction from the wetland should be banned for a period as suggested by the study, and the dependent communities fully compensated for the loss.
- e) Conducting epidemiological studies within the communities living around the wetland, and using the wetland resources, to determine the level of exposure and

health impacts. The studies should take a long-term view of the health impacts – such as health risks created by carcinogens released by the accident. Accordingly, a system of comprehensive health insurance of all persons living in the zone of impact (we may consider all communities residing around the MMW and DSNP, as well as those residing within 5 km radius of the BG-5) so that the health risks are covered.

83. The Committee recommends that the State Government constitutes a panel of experts (with a mix of national and local members) for implementing the aforementioned studies. Wherever required, assistance from renowned international experts and organizations (such as Society for Ecological Restoration and others) may be sought.

5.4 Management framework for DSBR

84. The current management plan for DSBR needs to be updated taking into account the diversity of habitats, the interconnectivity of the park with river, wetland ecosystems, other PAs and the risks posed by developmental activities such as oil and gas production (including the damages inflicted by Baghjan accident on MMW).
85. In this section, management frameworks for DSNP and MMW are elaborated, while recognizing that these form integral parts of DSBR.
86. A management framework for DSNP may be guided by following six objectives:

Table 6: Management Framework for DSNP

Objective	Strategy	Performance Indicator
a) Secure National Park boundaries, ensuring its connectivity with landscape	<ul style="list-style-type: none"> ● Write Management plan, plan duration should be for 5 years. ● create protection infrastructure and hire personnel for protection ● Survey of area and mapping ● Redefine Eco-sensitive zone. ● Reduce human impact 	<ul style="list-style-type: none"> ● Clear demarcation of boundary ● Updated map ● Security audit and staff performance ● Use of corridors by wildlife
b) Inventory of biodiversity of DSNP	<ul style="list-style-type: none"> ● Survey of Vegetation ● Survey of Fauna 	<ul style="list-style-type: none"> ● Use of technology to monitor flora and fauna ● Periodic monitoring data of status of wildlife

	<ul style="list-style-type: none"> • Hire or consult appropriate agencies and individuals for biodiversity assessment • Training of staff for biodiversity and population monitoring 	
c) Maintain and improve habitat quality to support diversity.	<ul style="list-style-type: none"> • Assess the extent of people's dependence including livestock and its impact. • Restrict the expansion of invasive species • Reintroduce species which have gone extinct • Maintain grassland habitats to support wild Buffalo and other species • Build capacity of staff, hire Veterinarian in identifying zoonotic diseases and responding as per a defined protocol 	<ul style="list-style-type: none"> • Mapping of invasive • Reduction in invasive area • Species count and biodiversity reports • Veterinarian position and trained staff • Establishment of reintroduced population of wild species • Vaccination of livestock using Protected Area and within 2km vicinity of DBSR
d) Reduce people's dependence on resources from National Park by providing alternatives	<ul style="list-style-type: none"> • Provide alternative sites to villages • Put in place a monitoring system to assess use of area • Strengthen Eco-development committee 	<ul style="list-style-type: none"> • Improvement in ground productivity • Positive change in biodiversity values
e) Provide livelihood opportunities to stakeholders through engagement in eco-tourism activities	<ul style="list-style-type: none"> • Create a cultural inventory of the region and implement a visitor education program • Promote community-led ecotourism, with focus on income generation at local level • Design and implement a systematic and inclusive Communication, Education, Participation and Awareness 	<ul style="list-style-type: none"> • Visitor education Program and material • Visitor Centre

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Table : A

Objectiv

a). Maintain wetland

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	Programme for people living in vicinity of park and tourists	
f) Adaptive management	<ul style="list-style-type: none"> Established mechanism for assessing management effectiveness (periodicity, resources) Monitoring system (plan, protocol, resources) Data management system for decision making 	<ul style="list-style-type: none"> Review of management effectiveness (after 3 and 5 years)* by external Data repository and use for management

5.5 Management framework for MMW

The management of MMW should strive to achieve 'conservation and wise use of the wetland ecosystem to sustain and enhance its full range of ecosystem services and biodiversity'. The purpose is to:

- Manage the wetland complex in entirety as an ecologically and regulatory harmonized unit;
- Maintain and improve, the habitats to sustain biodiversity including migratory waterbirds, as well as ecosystem services such as buffering against extreme events and support wetland-dependent livelihoods in a sustainable manner; and
- Develop institutional arrangement at the site, district and state level to address and manage regulatory and policy-related issues.

Management of MMW may be guided by following eight objectives, broadly aligned with key wetlands features⁴⁵:

Table 7: Management Framework for MMW

Objective	Strategy	Performance Indicator
a). Maintain naturalness of wetland shoreline	<ul style="list-style-type: none"> Prevent permanent construction on the wetland shorelines (ensure that a buffer of at least 50 m from the highest floodline observed in last 10 years) is maintained Ensure that wetland area is surveyed, maps prepared and entered into land records 	<ul style="list-style-type: none"> % shoreline which is devoid of any permanent construction Clear demarcation of wetland boundary

⁴⁵ A step-wise guidance for management planning of wetlands is provided in the MoEFCC's National Plan for Conservation of Aquatic Ecosystems, accessible at: <https://indianwetlands.in/uploads/NPCA-MOEFCC-guidelines-April-2019.pdf>

		<ul style="list-style-type: none"> • Incorporation of wetland area into land records
b). Maintain hydrological regimes connectivity aligned with key ecosystems processes (such as maintenance of habitat diversity)	<ul style="list-style-type: none"> • Maintain surface flow connectivity between river and wetland • Limit anthropogenically induced sedimentation • Maintain water quality to support ecosystem processes and services 	<ul style="list-style-type: none"> • Peak and lean water levels (as compared with historical trends) • Extent and periodicity of flood pulse • Sedimentation rates (as compared with baseline rates) • Effluent benchmarks maintained at least at CPCB Category D (propagation wildlife and fisheries)
c). Maintain and improve habitat quality to support diverse wetland-dependent species	<ul style="list-style-type: none"> • Maintain habitats for migratory waterbirds • Restrict the expansion of invasive and feral species • Protecting the nesting sites of waterbirds and fishes • Habitat mapping of Gangetic dolphins around the wetland complex • Maintain grassland habitats to support wild Buffalo and other species • Build capacity of local communities in identifying zoonotic diseases and responding as per a defined protocol • Develop a SoP for responding to avian diseases 	<ul style="list-style-type: none"> • Patch diversity (% habitat area under open water, emergent macrophytes, floating macrophytes, grasslands etc.) • Species count and composition
d). Maintain non-declining harvest of fishes, aquatic plants and other species of economic use derived from wetland and its surroundings	<ul style="list-style-type: none"> • Put in place a monitoring system to assess fish harvest, species richness and length and weight parameters of key economic species • Strengthen fisher cooperatives by building capacity, creating equitable representation, and clarifying roles and responsibilities of office bearers and members • Create, in consultation within Fisher Cooperatives and Department of Fisheries, a registration system for boats and major gears operating within MMW 	<ul style="list-style-type: none"> • Proportion of fish catch with respect to sustainable yield • Size variation with respect to mean length of key species in sustainable catch • Membership of fish cooperatives, and proportion of catch traded • Fisher incomes and access to fisher welfare schemes • Tourism visitation rates

e). Provide livelihood opportunities to stakeholders through engagement with wetland activities

f). Maintain compliance with all external regulations

⁴⁶ Refer Guide <https://indi>

	<ul style="list-style-type: none"> ● Restrict the number of fishers and fishing boat in line with sustainable fish catch ● Prevent introduction of exotic fish species within MMW ● Map breeding and spawning grounds, and migratory pathways of fish and ensure that these are protected ● Create sustainable culture fisheries opportunities within private ponds to wean fishers away from fishing within MMW ● Strengthen post-harvest and marketing infrastructure 	<ul style="list-style-type: none"> ● Tourism income, local employment generation
e). Provide livelihood opportunities to stakeholders through engagement in wetland based-tourism activities	<ul style="list-style-type: none"> ● Create a cultural inventory of the region and implement a visitor education programme ● Promote community-led ecotourism, with focus on income generation and local level, and aligning visitor behavior towards wetlands conservation and wise use ● Design and implement a systematic and inclusive Communication, Education, Participation and Awareness Programme for the MMW 	<ul style="list-style-type: none"> ● Income generation from sustainable use of wetlands ● Awareness levels of communities and local stakeholders on wetlands values and functions
f). Maintain compliance with all extant regulation	<ul style="list-style-type: none"> ● Delineate the MMW wetland regime based on a combination of ecological indicators (inundation regime, presence of hydrophytic vegetation and hydrocarbon soils). ● Delineate the zone of influence of MMW, taking into account the hydrological connectivity with the Brahmaputra River and DSNP ● Prepare draft notification of MMW as per the requirements of Wetlands (Conservation and Management) Rules, 2017 and place for approval of Assam State Wetlands Authority⁴⁶ ● Put in place a system of community wardenship, to augment formal surveillance by Forest Department 	<ul style="list-style-type: none"> ● No. of conflicts resolved ● No. of poaching incidents ● Cases of fishing using illegal gears and methods

⁴⁶ Refer Guidelines for Implementation of Wetlands (Conservation and Management) Rules, 2017, accessible at: <https://indianwetlands.in/uploads/final-version-and-printed-wetland-guidelines-rules-2017-03.01.20.pdf>

g). Proactive stakeholder engagement in wetland management	<ul style="list-style-type: none"> • Creating a multi-stakeholder platform involving all key stakeholders as forum for discussing major management issues related to wetlands, conveying management interventions, and seeking feedback 	<ul style="list-style-type: none"> • Number of stakeholders participating proactively in wetlands management
h). Adaptive management including climate risks and monitoring plan	<ul style="list-style-type: none"> • Established mechanism for assessing management effectiveness (periodicity, resources) • Monitoring system (plan, protocol, resources) • Inclusion of climate risks within management planning 	<ul style="list-style-type: none"> • Review of management effectiveness (after 3/5 years)* • Updating the health card periodically

5.6 Ecosystem Inventory, Assessment and Monitoring System

89. Conservation of DSNP and MMW is predicated on maintenance of its ecological character, and retaining those critical ecosystem components and hydrological processes that underpin ability to provide wide ranging ecosystem services, as well its resiliency. Thus, having a system to describe, monitor and detect changes in ecological character of DSNP and MMW is critical to support decision making for these ecosystems. Equally important is putting in place a system to assess effectiveness of management that is put in place, so that complementing institutional arrangements are also ensured.

90. Developing a monitoring plan for DSNP and MMW requires addressing the following inter-related requirements of inventory and assessment:

- Establishing the ecological character baseline (inventory)
- Establish status, trends and threats using inventory information (assessment)
- Assess changes in status and trends, including reduction in existing threats or appearance of new threats, or even changes in management effectiveness (Monitoring⁴⁷)

91. It is imperative therefore to put in place an integrated Ecosystem Inventory, Assessment and Monitoring System (EIAMS) to address the overall information needs for ecosystem

⁴⁷ Monitoring is expected to be hypothesis driven (for example, deterioration in water quality due to a specific pollution source), and applied for management. Non-hypothesis driven collection of information is termed as surveillance, and plays an equally important role in management by helping discern underlying trends or risks of adverse change in ecological character.

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management, and to provide a robust decision support system for the same. The ambit of monitoring is also envisaged to include assessment of management effectiveness. The following are the specific objectives for establishing EIAMS:

- a) Developing up-to-date and scientifically valid information on status and trends of ecosystem features and influencing factors
- b) Establishing a baseline for measuring change in ecosystem components, processes and services
- c) Informing decision makers and stakeholders on the status and trends in biodiversity, ecological functioning and ecosystem services of the wetland
- d) Supporting compliance to national and state legal requirements and regulatory regimes
- e) Determining impacts of developmental projects on ecosystem components, processes and services
- f) Identifying risks to ecological character and support development of response strategies
- g) Assessing effectiveness of MMW and DSNP management

92. The state of MMW and DSNP is linked with the status and trends of its direct drainage basin, as well as the indirect River basin. Information requirements can therefore be organized along three spatial scales:

- MMW
- DSBR (of which MMW and DSNP form an integral part), and
- Eastern Brahmaputra Landscape

93. A hierarchical classification of inventory, assessment and monitoring needs for MMW and DSBR is presented in Table 8. The information needs for inventory are derived from the core datasets needed to establish a baseline on ecological character⁴⁸ for MMW, and contain all the essential ecosystem components, processes and services, as well as management related parameters that characterize the site. At the DSBR scale, the information requirement is related to geo-morphological and climatological setup, as well as biosphere region wide management arrangements, particularly those related to land and water resources. As the DSBR also serves as the zone of direct influence on the MMW, information needs to include land and water management practices which have direct influence on the wetland status; including assessing the habitat connectivity and water, sediment, energy and nutrient flux which influence its ecological character. Finally,

⁴⁸ Derived from the core inventory fields required for ecological character description as per Ramsar Convention Resolution X.15: Describing the ecological character of wetlands, and data needs and formats for core inventory: harmonized scientific and technical guidance. These fields have been further integrated into guidance related to information requirement for describing Ramsar site at the time of designation and subsequent updates (Ramsar Convention Resolution XI.8 and XI.8 annex 1)

at the Eastern Brahmaputra Scale, the information requirements pertain to climatic trends and wider ecosystem level connectivity at landscape scale. At all levels, information on institutional arrangements and management practices is included so as to enable creation of a baseline on sectoral programmes, and the linked stakeholders, which are likely / have an impact on the DSNP and MMW state.

94. Information needs related to assessment are aimed at deriving the status, trends and existing or likely threats to MMW and DSNP. At the site scale, the focus is on deriving ecological character change and ecosystem services valuations and trade-offs. At the DSBR scale, the focus is on deriving the land use change and implications for water, sediment and nutrient flux as well as connectivity between landscapes. At the Eastern Brahmaputra Landscape scale, the assessments are aimed at determining the climate induced risks to ecological character, ultimately aimed at developing a suitable response strategy for risk reduction and management. While not explicitly mentioned, strategic environmental assessments can be commissioned for any developmental project that has or is likely to have a negative impact on the wetlands.
95. The monitoring and assessment needs are envisaged to be addressed by a dedicated monitoring programme and specific research and assessment projects. Inventory, being based on collated information on identified wetland features and management practices, will be developed based on the monitoring and assessment information, as well as secondary sources.
96. Inventory, assessment and monitoring form an integral part of MMW and DSNP management, and thereby need to be placed as a core activity of the nodal agency entrusted with the task of ensuring conservation of these ecosystems. It is proposed that a dedicated programme under the aegis of Forest Department, and with support of line agencies (Department of Water Resources, Assam State Council for Science and Technology, Pollution Control Board, Department of Fisheries, Assam State Biodiversity Board and others) and research institutions is put in place.
97. Linkages also need to be developed so that data from the existing monitoring networks of different agencies (for example, river flow and flood extent information from Central Water Commission and Department of Water Resources; groundwater quality and quantity from Central Ground Water Board; select surface water quality parameters from Assam State Pollution Control Board) can be accessed and shared. Provision for participation of NGOs and civil society in monitoring programme should also be built, especially for socio-economics and livelihoods aspects and biodiversity monitoring (for example, waterbird census being implemented by NGOs under the aegis of Asian Waterbird Census and Important Bird Area Programmes).

8. In order to ensure conservation of DSBR and MMW, site managers must be able to anticipate risks, including those emerging and respond to these effectively and timely. This requires conducting regular and open management effectiveness assessment and learn from successes and failures. Management effectiveness assessment is thus recommended to be used as a tool for knowing how well a conservation area is being managed. Periodic assessments of management effectiveness for MMW and DSBR, and incorporation of its results, would improve planning management of the wetland. It would as well, pave the way for adaptive management, and promote accountability and transparency.

9. The assessment should ideally cover the following management stages:

- a) the **context** of managing the area (status)
- b) the **planning** strategies undertaken to achieve the management goals (appropriateness)
- c) the **inputs** required to support the plan (resources)
- d) the **processes** through which the management plan has been implemented (efficiency, appropriateness)
- e) the **outputs** generated as a result of the implementation (effectiveness); and
- f) the **outcomes** achieved with respect to the intended objectives (efficiency, appropriateness)

10. The process of assessment should be participatory, based on scientific and social evidence, and not have biased results. Most importantly, threats and opportunities that affect or may potentially affect the management, should be recognized within the framework of assessment. It is desirable that the management effectiveness assessment is carried out every two years, through an external agency and reported to the Forest Department and Assam State Wetlands Authority for their information and action.

101. Implementing the monitoring strategy as outlined in the previous sections requires the following physical and human infrastructure support:

- a) Remote Sensing and GIS unit with advanced capabilities of remote sensing image processing, preparation of maps and maintenance of spatial datasets
- b) Ecological monitoring laboratory with capabilities for analysis of chemical, physical and biological properties of water and soil
- c) Database system for storing and retrieving monitoring and assessment data. The monitoring data would be stored along with metadata, as per the quality control procedures suggested in the following sections.
- d) Network of hydro-meteorological and water quality stations for hydro-biological monitoring

102. Deployment of the aforementioned resources can be done at a dedicated center for DSBR and MMW created at a suitable location within Tinsukia.
103. Reporting constitutes an important element of a monitoring programme. The intended user group, format, style and peer review requirement need to be set in the initial phases of set up of the monitoring programme. Periodic reports, for example as a part of the annual report of the Assam State Wetlands Authority should aim to provide a summary overview of the outcomes of monitoring. It is also recommended that the established protocol for monitoring endangered species using MSTRIPES software⁴⁹ is adopted for the region which is in use in several Protected Areas in Assam.
104. Outcomes of the wetland monitoring can also be published in the form of an ecosystem health report card. It should be developed such that it is easily understood by most importantly, the local lake community and general public. Visual representation of aspects of ecological health of the wetland and utilization of graphics to represent the collected data from monitoring activities, can help reach a wider spectrum of population. It is recommended that the ecosystem health report card is published biennially.
105. Outcomes of specific assessments, for example ecological character status and trends, economic valuation, environmental flows etc. could be made available in the form of technical report series, with an extended summary for general readership. As the monitoring programs get sophisticated over a period of time, real time monitoring options through use of satellite based data communication techniques can be explored.
106. A periodic review of the monitoring programme is required to determine the extent to which the objectives, particularly support to management is achieved, and the monitoring system remains relevant for the MMW and DSNP state (particularly in the light of emerging threats). The review process should also aim at increasing the sophistication of the monitoring system to be able to assess complex landscape scale processes affecting the ecological character of wetland and related management.
107. Review process should include documentation of the way wetland inventory, assessment and monitoring information is being used to support management planning and policy goals. Review should also include identification of appropriate mechanisms to ensure that wetland monitoring is continued in the event of a funding shortfall.

⁴⁹ MSTRIPES Software accessible at: https://wii.gov.in/mstripes_software

Table 8: Inventory, assessment and monitoring needs for conserving and managing MMW and DSBR

Information Scale	Information Purpose		
	Inventory	Assessment	Monitoring
MMW	<p>Physical setting (area, boundary, topography, shape, bathymetry, habitat type and connectivity)</p> <p>Climate (precipitation, wind, temperature, humidity)</p> <p>Water regime (inflow, outflow, balance, surface-groundwater interactions, inundation regimes, quality)</p> <p>Sediment regime (inflow, outflow, balance, distribution and transport)</p> <p>Wetland soils (texture, chemical and biological properties)</p> <p>Biota (plant and animal communities, conservation status)</p> <p>Energy and nutrient dynamics (primary productivity, nutrient cycling)</p> <p>Species interaction (invasion, competition, succession)</p> <p>Processes that maintain animal and plant population (recruitment, migration)</p> <p>Ecosystem services, stakeholders and trade-offs (Provisioning – water abstraction for various uses, fisheries, inland navigation; Regulating – flood moderation; Cultural – tourism and recreational values)</p> <p>Institutional arrangements (governance, formal and informal rights and ownership, application of acts and regulations)</p>	<p>Ecological character change (change in ecosystem components, processes and services – can also be derived based on assessment of indicators related to ecosystems, habitat, species and / or management)</p> <p>Land use land cover change in lake fringes</p>	<p>Impacts of land use land cover change in wetland fringes on water quality</p> <p>Changes in inundation patterns and impacts on vegetation</p> <p>Instances of oil and gas leakages and their impact on wetland ecosystem</p>

Table 9: Monitoring parameters for MMW and DSNP

Parameter	Indicator	Priority	Monitoring Method	Monitoring Frequency
Land Use and Land Cover				
Land use and land cover change within MMW drainage basin	% area under various land use and cover classes (agriculture, forest cover, settlements, wetlands)	High	GIS and Remote Sensing Radar sensed data	Once in 5 years
Hydrological regime				
Water and sediment flux	Water inflow	High	Monitoring at gauging stations	Daily
	Water outflow	High		Daily
	Sediment inflow	High		Daily
	Sediment outflow	High		Daily
Water holding capacity	Bathymetry	High	Bathymetric surveys	Once in 5 years
Inundation Regime	Seasonal fluctuation in waterspread area	High	Remote sensing	Every two years
Surface Water quality	Temperature	Medium	Standard procedures of APHA	Once in 15 days
	pH	High		Once in 15 days
	Dissolved Oxygen	High		Once in 15 days
	Specific Conductance	High		Once in 15 days
	Nutrients and Nutrient Cycling (Nitrate, Phosphate, Silicate)	High		Once in 15 days
	Cations and Anions (Calcium, Magnesium, Sulphate, Chloride, Fluoride, Sulphite)	High		Once in 15 days
	Chemical Oxygen Demand	Medium		Once in 15 days
	Transparency	Medium		Once in 15 days
	PAHCs	High		Once in 15 days

	Heavy metals (Arsenic, Mercury)	High		Once in 15 days
	Biological oxygen demand	Medium	Standard procedures of APHA	Once in 15 days
	Total Coliform	Medium		Once in 15 days
	Faecal coliform	Medium		Once in 15 days
Sediment quality	Texture	Low	Standard procedures of APHA	Once in a month
	pH	High		Once in a month
	Organic carbon	High		Once in a month
	Available nitrogen	High		Once in a month
	Available phosphorus	High		Once in a month
	Available calcium carbonate	Medium		Once in a month
Ground water quality	Water level	High	Methodology approved by Groundwater Estimation Committee (1997)	Monthly
	Conductivity	Medium		Monthly
	Total hardness	Medium		Monthly
	Chloride	Medium		Monthly
	Fluoride	High		Monthly
	Arsenic	High		Monthly
	Iron	High		Monthly

Ecosystem Processes and Biodiversity

Flora	Phytoplankton (diversity and abundance)	Medium	Taxonomic studies, Standard procedures in Central Inland Fisheries Research Institute Bulletin No. 10	Pre-monsoon, monsoon and post monsoon
	Periphyton	Medium		Pre-monsoon, monsoon and post monsoon
	Macrophytes (diversity and abundance)	High		Pre-monsoon, monsoon and post monsoon
	Species invasion	High	Habitat Sampling and Remote sensing (using high resolution data)	Pre-monsoon, monsoon and post monsoon

	Primary production	High	Standard procedures in Central Inland Fisheries Research Institute Bulletin No. 10	Seasonal
Fauna	Zooplankton (diversity and abundance)	Medium	Taxonomic studies, Standard procedures in Central Inland Fisheries Research Institute Bulletin No. 10	Pre-monsoon, monsoon and post monsoon
	Aquatic macro-invertebrates	Medium	Taxonomic studies, Standard procedures in Central Inland Fisheries Research Institute Bulletin No. 10	Once in 5 years
	Aquatic Insects	Medium	Taxonomic studies, Standard procedures in Central Inland Fisheries Research Institute Bulletin No. 10	Once in 5 years
	Fish diversity	Medium	Taxonomic studies	Once in 5 years
	Amphibians	Medium	Taxonomic studies	Once in 5 years
	Reptiles	Medium	Taxonomic studies	Once in 5 years
	Fish breeding, spawning and migration pattern	High	Specific assessments and tagging experiments	Once in 5 years
	Water Bird population and diversity	High	Census and Taxonomic studies	Annual
	Water Bird migration pattern	High	Species specific ringing and banding studies	Once in 5 years
	Avian disease	Medium	Surveillance	Annual
Habitat quality of bird congregation sites: - Number of nests or egg - Type of vegetation - Water level	Medium	Assessment of bird habitat quality and Standard procedures in Central Inland Fisheries Research Institute Bulletin	Annual	

	- Abundance of macro benthos		No. 10 (for macro benthos)	
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Socio-economics and livelihoods

Community dependence on MMW and DSBR ecosystem services	Number of households benefitting from water withdrawn from lake, Number of tourists visiting wetland and direct and indirect spending, Number of communities	High	Socio-economic survey/ Living Income Methodology	Once every 5 years
Livelihood status of wetland dependent communities	Physical capital, financial capital, social capital, human capital indicators of livelihood systems	Medium		
	Number of reported instances of conflicts	Medium		

6: Ecosystem Restoration and Management Costs & Financing

6.1 Restoration and Management Costs

108. The Committee is of the view that the Baghjan accident was not just a failure on the part of OIL in ensuring necessary Health, Safety and Environmental (HSE) safeguards. Equally responsible are:
- a) Complete and comprehensive violation of the principles of eco-sensitive zone notification by MoEFCC, GoI leading to dangerous concentration of oil and gas producing wells in a highly environmentally sensitive and fragile area of DSNP and MMW
 - b) Absence of any meaningful baselines and management plans for MMW and DSNP, and a lackadaisical approach to management of these biodiversity hotspots
 - c) Ineffective ecosystem monitoring systems to assess ecosystem health, and absence of infrastructure even at the state level to monitor contaminants related with oil and gas industry
 - d) Lack of any mechanism for covering risks to human health, livelihoods and assets located within the vicinity of oil and gas production areas
 - e) Overlooking the risks posed by oil and gas industry in disaster risk reduction planning
 - f) No investment in capacity development (including site and situation specific SoP) for addressing the risks of oil and gas production related accidents
109. In light of the above, the Committee recommends a comprehensive view of the impacts of Baghjan accident by taking a spectrum of actions ranging from direct restoration of the impacted area, as well as putting in place systems and institutional mechanisms so that the future risks for oil and gas related accidents are minimized, and in the unfortunate event of their occurrence, damages are contained. Unless these aspects are addressed, the efforts are only likely to be symptomatic and superficial. The following three cost-streams are therefore envisaged:
- a) Ecological restoration of accident site
 - b) Ecological restoration of DSBR (DSNP and MMW) to enable recovery of biota and ecosystem processes, including:
 - i. Designing management plans DSBR (DSNP and MMW) and SoP
 - ii. Implementing management plans at least for a period of 10 years so that the restoration gains persist
 - iii. Putting in place effective ecosystem inventory, assessment and monitoring system to assess the efficacy and efficiency of restoration and management arrangements
 - c) Addressing livelihoods and socio-economic aspects related with ecosystem restoration and management

110. The overall costs of implementing specific actions under the six cost-streams are presented in the following table. Wherever possible, the physical scope of work was defined based on field data as well as data secured from different agencies. For site restoration, cost norms were established by calling for quotes from agencies specialized in analytical services as well as referring to information on cost of remediation provided by OIL. Costs related to formulation and implementation of management and monitoring stations are indicated in the Table-10.
111. Redressing the damage inflicted by Baghjan accident and also putting in place systems and institutional mechanisms so that the future risks for oil and gas related accidents are minimized, will require a cost of Rs. 1,196 crores⁵⁰. These include:
- the costs of ecological restoration of the accident site: Rs. 139 crore;
 - ecological restoration of Dibru-Saikhowa Biosphere Reserve: Rs. 432 crore; and,
 - addressing livelihood and socioeconomic aspects related with restoration: Rs. 625 crore.
112. We hope that the lessons from applying ecological restoration of areas affected by the Baghjan accident can serve as a model for measuring and tracking other environmental and social outcomes arising from OIL's business operations.

⁵⁰ In the Interim Report, the Committee had indicated an estimate of Rs. 2,500 cr. However, the final costs are lower as we have factored in the positive impacts of the flood pulses on the environment, remediation work already undertaken by the agencies hired by OIL, reestablishment of area of influence and exclusion of costs of relocation of villages from the DSNP. All quantities used as a basis of costing are remeasurable. The costs related to implementation of management plans and a monitoring system are still ballpark and may be firmed up during the course of management planning.

Table 10: Detailed costing

Year	Amount (in Rs. Crore)	Physical	Rate	Unit	Components and Activities
Year 1					
Year 2					
Year 3					
Year 4					
Year 5					
Year 6					
Year 7					
Year 8					
Year 9					
Year 10					

Table 10: Detailed activity

Components and Activities	Base	Unit	Physical	Amount (p/ Rs. Crore)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
1. Ecological restoration of section site														
1.1 Enabling works														
a) Site characterization (Test Piling and Logging) in the 2 km radius area of influence or 12.56 sq km ^				138.53	71.50	40.17	26.07	0.00	0.00	0.02	0.02	0.02	0.02	0.02
b) Site Remediation Strategy development, bench-scale, field trials and actual remediation implementation including land lease	28	1000 m2	1,25,60,000	0.07	0.07									
c) Rehabilitation of site after remediation	1,050	m3	12,56,000	131.48	65.94	39.56	26.38							
d) Monitoring/Maintenance of Rehabilitation/Afforestation sites	50	m2	40,000	0.20		0.20								
e) Site Preparation and Management of potentially hazardous waste materials and other debris	30	m2	40,000	0.12		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
f) Baseline Sampling	1,000	per m3	6,000	0.60	0.60									
g) Remediation Sampling	23,000	per soil sample	1,256	2.89	2.89									
h) Post Remediation Sampling	12,000	per soil sample	40	0.05	0.05									
i) Miscellaneous including fencing, signages, Groundwater monitoring well installation	12,000	per soil sample	40	0.05	0.02	0.02								
1.2 (Cutting and disposal of burnt trees / tea bushes / bamboo etc. in and around ICGNH5)														
a) Excavation of 45 cm top horizontal soil from plinth and disposed off the excavated soil			Lumpsum	0.75	0.50	0.25								
b) Demolishing existing exposed pillars and disposed off the same			Lumpsum	0.45	0.25	0.20								
c) Filling all four effluent pits by remediated/clean earth			Lumpsum	0.01	0.01									
d) Dewatering and earth filling of water reservoir			Lumpsum	0.40	0.40									
e) Miscellaneous expenditure for poles, sheds, security hut etc.			Lumpsum	0.53	0.53									
1.3 Process documentation														
a) Video Surveillance in all remediation sites			Lumpsum	0.10	0.05	0.05								
b) Clean-up reports to responsible parties			Lumpsum	0.10	0.10									
1.4 Stakeholder engagement														
a) Workshop with public and agencies on restoration progress	50,000	Meeting/Workshop	60	0.30	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
2. Ecological restoration of ISEIR														
2.1 Baseline studies (zoology)														
				432.25	106.90	131.91	34.39	22.20	21.80	21.23	22.88	22.58	21.30	25.06
2.2 Contaminant monitoring														
				10.00	6.00	4.00								
2.3 Top-restoration committee														
				5.50	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
2.4 Website														
				0.50	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
				0.70	0.25	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Components and Activities

Components and Activities	Rate	Unit	Physical	Amount (in Rs. Crore)	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26	Y27	Y28	Y29	Y30
2.5 Management Planning and SOPs																		
a) Dithra Sakhiresa National Park				10.00	5.00	4.00	1.00											
b) Maguri-Mosepung wetlands				2.50	1.50	1.00												
c) Eastern Brahmaputra landscape				2.00	1.00	1.00												
d) District Disaster Management Planning (Upgradation)				5.00	2.00	2.00	1.00											
e) LMI Spill SOP Drafting				0.25	0.25													
				0.25	0.25													
2.6 Management of DSBR				110.17	20.25	13.11	9.13	8.66	8.97	9.20	9.63	9.99	10.36	10.76				
2.6.1 Surveillance																		
Departmental surveillance				28.30	2.25	2.36	2.48	2.60	2.73	2.87	3.02	3.17	3.32	3.49				
Community surveillance				25.16	2.00	2.10	2.21	2.32	2.43	2.55	2.68	2.81	2.95	3.10				
				3.14	0.25	0.26	0.28	0.29	0.30	0.32	0.34	0.35	0.37	0.39				
				0.25	0.25													
2.6.2 Notification of MMW under Wetlands (Conservation and Management) Rules, 2017																		
2.6.3 Management of DSNP				56.62	15.25	8.25	4.15	3.56	3.74	3.92	4.12	4.32	4.54	4.77				
a) Boundary delineation and demarcation				10.00	5.00													
b) Management of invasives				3.76	1.00	0.25	0.26	0.28	0.29	0.30	0.32	0.34	0.35	0.37				
c) Maintenance of trash and channels				3.76	1.00	0.25	0.26	0.28	0.29	0.30	0.32	0.34	0.35	0.37				
d) Livestock disease surveillance and vaccination				4.76	2.00	0.25	0.26	0.28	0.29	0.30	0.32	0.34	0.35	0.37				
e) Species augmentation and reintroduction (need-based)				27.05	5.00	2.00	2.10	2.21	2.32	2.43	2.55	2.68	2.81	2.95				
f) Information, education and communication activities				5.76	1.00	0.25	0.26	0.28	0.29	0.30	0.32	0.34	0.35	0.37				
g) Tourism promotion				3.54	0.25	0.25	1.00	0.25	0.26	0.28	0.29	0.30	0.32	0.34				
2.6.4 Management of MMW				25.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
a) Water management				2.50	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
b) Species and habitat				5.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
c) Fisheries Development				5.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
d) Communication, Education and Awareness				2.50	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
e) Community based tourism development				10.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Component and Activity	Rate	Unit	Physical	Amount (in Res. Cost)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
2.3 Fisheries Inventory, Assessment, and Monitoring System																
2.3.1 Establishment of a monitoring hub																
Instrument set up				25.00	14.50	108.55	24.00	12.25	11.50	11.80	11.20	12.44	12.49	12.49	12.50	12.50
Staffing				200.29	31.00	80.75	22.00	10.29	8.26	9.00	11.20	10.50	10.60	10.60	10.60	10.60
Training				10.00	25.00	15.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Setting up a Database Management System and data management protocols				62.80	5.00	5.25	5.33	5.79	6.08	6.30	6.70	7.04	7.39	7.76	8.10	8.40
				4.00	1.00		1.00				1.00					
				6.50	2.00	0.50	0.50	11.50	11.50	0.50	11.50	11.50	0.50	0.50	0.50	0.50
2.3.2 Assessment studies																
Biodiversity assessment (species, habitat)				17.00	10.20	6.50										
Hydrological assessment				5.00	3.00	2.00										
Fisheries assessment				5.00	1.00	1.00										
Ecosystem services assessment				5.00	3.00	2.00										
Coastline assessment				1.00	0.60	0.40										
				1.00	0.60	0.40										
2.3.3 Monitoring																
Monitoring protocol development				60.00	11.00	22.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Setting up of sampling stations				1.00												
Monitoring, reporting and review				30.00	30.00	30.00										
				18.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
3. Addressing floodproofing and infrastructure aspects																
3.1. Finance																
Health insurance (for 30 jobs cover for 10 years)	14,000	per person		28,000	31.50	31.50	31.50	31.50	31.50	31.50	31.50	31.50	31.50	31.50	31.50	31.50
Leasehold insurance (for 10 years)	5,000	per family		5,000	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Compensation for lost fishing days (if engaged)	2,50,000	per family		2,500	25.00	25.00										
Compensation for lost agriculture (if engaged)	2,50,000	per family		5,000	50.00	50.00										
Compensation for lost recreation (if engaged)	2,50,000	per family		2,000	20.00	20.00										
				1,15,800	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00	138.00

Notes:

* Considering 2 jobs and 10 jobs of agriculture 300 compensation (total cost) is provided by CRI as small dam (100 Dm, 200). All payments are a measurable and should be adjusted based on actual spend and actual volume of water stored. Beyond 1000m, volume of water stored is not measured and may vary. Job reports of the limited use characterization are required at the time of final report submission.

6.2 Financing

113. The Committee is of the opinion that the costs of ecological restoration (items a and c referred in para 111) are directly attributed to the Baghjan accident and should be borne by OIL. Costs related to ecological restoration of DSBR may be shared between Government (as the ultimate custodian of the ecological assets with a direct responsibility of upkeep of these assets) and OIL (as a direct beneficiary of healthy ecosystems and an important stakeholder in ecosystem management).
114. The amount given above has been worked out by the Committee on a conservative basis. OIL is an important energy sector organization and is contributing a lot towards development of the State of Assam and country as a whole. The amount will mainly be used locally for removing harmful contaminants from the soils of agricultural or grasslands as well for restoring and managing the wetlands. The State of Assam may also utilize these funds for effectively managing and maintaining the DSBR and Eastern Brahmaputra Landscape in such a good state that these continue helping in preserving the ecosystem of the area at large and continue to provide livelihood to the villagers living in and around these areas.

ITEM NO.1 Court 4 (Video Conferencing) SECTION XVII

S U P R E M E C O U R T O F I N D I A
R E C O R D O F P R O C E E D I N G S

Civil Appeal No(s).2201/2021

BONANI KAKKAR

Appellant(s)

VERSUS

OIL INDIA LIMITED & ORS.

Respondent(s)

(WITH IA No. 92866/2021 - APPLICATION FOR PERMISSION, IA No. 67426/2021 - EXEMPTION FROM FILING AFFIDAVIT, IA No. 67425/2021 - EXEMPTION FROM FILING C/C OF THE IMPUGNED JUDGMENT, IA No. 72570/2021 - PERMISSION TO FILE ADDITIONAL DOCUMENTS/FACTS/ANNEXURES, IA No. 67424/2021 - STAY APPLICATION)

Date : 02-09-2021 This appeal was called on for hearing today.

CORAM :

HON'BLE DR. JUSTICE D.Y. CHANDRACHUD
HON'BLE MR. JUSTICE VIKRAM NATH
HON'BLE MS. JUSTICE HIMA KOHLI

For Appellant(s) Mr. Siddharth Mitra, Sr. Adv.
Ms. Vasudha Zutshi, Adv.
Ms. Shruti Agarwal, AOR

For Respondent(s) Mr. Aman Lekhi, ASG
Mr. Harsha Peechara, Adv.
Mr. Ashish Kumar Tiwari, AOR

Mr. K.M. Nataraj, ASG
Mr. Gurmeet Singh Makker, AOR
Mr. Shailesh Madiyal, Adv.
Mr. Sharath Nambiar, Adv.
Vatsal Joshi, Adv.

Ms. Aishwarya Bhati, ASG
Mr. Ravindra Lokhande, Adv.
Mr. Sandeep Mahapatra, Adv.
Mr. T. Gopal, Adv.
Dr. Abhishek Atrey, AOR
Ms. Ambika Atrey, Adv.

Validly taken
21.09.2021
11:00 AM

**UPON hearing the counsel the Court made the following
O R D E R**

- 1 This appeal arises from a decision of the National Green Tribunal¹ dated 19 February 2021.
- 2 An oil 'blow-out' took place from Baghjan 5 Oil well of the first respondent, Oil India Limited² on 27 May 2020. As a consequence of the accident, extensive damage and destruction was caused to the biodiversity of Dibru Saikhowa National Park and Biosphere Reserve.
- 3 The NGT constituted a Committee of Experts chaired by Justice B P Katakey by an order dated 24 June 2020 to enquire into all aspects of the incident. In its preliminary report dated 24 July 2020, the Committee, *inter alia*, noticed that extensive damage was caused to (i) publicly owned resources, including Maguri-Motapung Wetland, DSNP, the eco-sensitive zone, including water bodies, air and wildlife; and (ii) private property of survivors in the affected villages.
- 4 The Expert Committee found that (i) OIL did not possess mandatory consent to establish and operate under Sections 25 and 26 of the Water (Prevention and Control of Pollution) Act 1974, and Section 21 of the Air (Prevention and Control of Pollution) Act 1981 when it started operations in Baghjan 5 Oil well in 2006. (ii) OIL does not have the requisite consent under the law to carry out drilling and testing of hydrocarbons in the specified well except for the years 2008-09, 2012-13 and 2018-19; and (iii) OIL does not possess authorization under Rule 6 of the Hazardous Waste (Management, Handling and Transboundary Movement) Rules 2016, which constitutes a violation of the conditions stipulated in the Environmental Clearance dated 11 May 2020.

1 "NCT"

2 "OIL"

- 5 By a subsequent progress report dated 31 October 2020, the Committee detailed widespread damage to the flora and fauna of the region, including:
- (i) Thirty five varieties of fish species belonging to thirteen families, many of which had been completely wiped out; and
 - (ii) A drastic decline in water oxygen content which has resulted in a high rate of destruction of marine life.
- 6 The report recommended a comprehensive impact assessment along with an integrated ecological restoration plan for bioremediation of hydrocarbons polluting the soil and the wetland.
- 7 When the matter was taken up by the NGT, it noted that about 9,000 persons who had been displaced were placed in camps at an outlay of Rs 11.20 crores. About 3,000 affected families were paid an amount of Rs 30,000 each, apart from Rs 12 lakhs which was paid to eleven families, whose houses were burnt. OIL had accepted its liability to pay Rs 68 crores as compensation under a tripartite agreement between OIL, the victims and the Deputy Commissioner in terms of letters dated 25 September 2020 and 2 December 2020. In this backdrop, the NGT did not proceed further on the issue of compensation. In view of the gravity of the accident, which resulted in a massive fire which continued for almost six months, the NGT constituted the following three Committees:
- (a) A six-member Committee headed by the Secretary, Ministry of Petroleum and Natural Gas to affix responsibility for the failures of those involved and present at the incident and to lay down a road map for ensuring compliance of safety protocols;

- (b) A seven-member Committee to enquire into non-compliance of statutory provisions, including the Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, the Hazardous Waste (Management, Handling and Transboundary Movement) Rules 2016 as well as the requirements of the Environmental Clearance in terms of the EIA notification dated 14 September 2006; and
- (c) A ten-member Committee headed by the Chief Secretary, Assam (with the Managing Director of OIL as one of its members) to assess the damage to and compensation for the restoration of Dibru Saikhowa National Park and Maguri-Motapung Wetland by taking over all surviving issues from the Committee chaired by Justice BP Katakey. The ten-member Committee was directed to submit its report within six months.

- 8 The dispute in the present appeal relates to the third of the above Committees which is chaired by the Chief Secretary, Assam.
- 9 During the course of the hearing, Mr Siddharth Mitra, Senior Counsel appearing on behalf of the appellant submitted that there is a genuine objection to the presence of the Managing Director of OIL as a member of the ten-member Committee. Moreover, it has been submitted that in laying down an extended time schedule of six months, the NGT lost sight of the urgency of the situation. Finally, it was also urged that the NGT has failed to direct any deposit towards the restoration of the environment in which event the work of restoration cannot commence in the immediate future.
- 10 This Court issued notice on 1 July 2021. On 23 August 2021, certain suggestions were placed before the Court on behalf of the appellant in regard to the re-

constitution of the Committee. Accordingly, the following order was passed:

"1 The petitioner has placed suggestions before this Court in regard to expert members who should be associated with the work of assessing the damage and providing remedial compensation on account of the loss which has been caused to the environment, including the loss of biodiversity as a result of the blowout which took place at the oil field of OIL. A copy of the IA containing the suggestions shall be emailed to Mr K M Nataraj, Additional Solicitor General appearing on behalf of the Ministry of Environment, Forests and Climate Change for his response on the next date of listing.

2 The Court has been apprised of the fact that four out of six experts who have been suggested by the petitioner are conversant with the subject matter, having been associated with the work of the Committee constituted by the National Green Tribunal, headed by Justice B P Katakey."

11 As the above order indicates, many of the experts, whose names have been suggested by the appellant, have been associated with the work which was assigned by the NGT by constituting an expert committee in the first place. We had requested Mr K M Nataraj, Additional Solicitor General to indicate after seeking instructions from the Ministry of Environment, Forests and Climate Change³ on whether and, if so, which of the names which have been proposed by the appellant would be acceptable to act as members of the Committee. In requesting Mr K M Nataraj to take these instructions, we must clarify that there is no doubt about the expertise of the members suggested by the appellant. The object, however, was to ensure that the work can progress with a sense of expedition so that the task of remediation can be taken up in the near future. MOEF&CC has responded in a fair and objective manner by accepting most of the suggestions.

3 "MOEF & CC"

12 After hearing Mr Siddharth Mitra, learned Senior Counsel appearing on behalf of the appellant, Mr K M Nataraj, Additional Solicitor General, who appears for MOEF&CC, Ms Aishwarya Bhati, Additional Solicitor General for the Ministry of Petroleum and Mr Aman Lekhi, Additional Solicitor General for OIL, we are of the considered view that the third Committee constituted by the NGT (as noticed earlier), needs to be reconstituted. The NGT has constituted a Committee consisting of ten members. Such a large Committee would find it difficult to convene meetings at relatively short intervals, which is necessary to ensure that the work of implementing remedial measures is taken up with expedition. The NGT has directed that the Chief Secretary of Assam should be the Chairperson of the ten-member Committee. Consistent with the responsibilities of office which are entrusted to the Chief Secretary, we are of the view that it would not be appropriate to assign the task to the Chief Secretary personally. The task before the Committee combines facets of an adjudicatory nature with expert domain knowledge on issues pertaining to environmental concern. The precautionary principle can be espoused by domain experts who have both knowledge and experience in ecological conservation. The work must be taken up with priority and every possible step has to be taken for restoration of the environment. OIL must bear the cost of restoration. The principle of strict liability has to govern. There can be no tomorrow until we preserve the environment here and now.

13 The NGT was in error in allowing the presence of the Managing Director of OIL as a member of the Committee. The terms of reference to the Committee include assessment of the damage to and restoration of Dibru Saikhowa National Park and Maguri-Motapung Wetland. Besides, the Committee is to take over all surviving issues from the earlier Committee. The presence of a representative of OIL as a Member of the Committee would lead to a conflict of interest and would not contribute to the fairness of the outcome. An entity against whom there are allegations of a dereliction obligations under the law cannot sit in judgment over

its own conduct. OIL can be heard by the Committee, but permit the presence of one of its senior officers would make it a judge in its own cause. OIL should not be a member of the Committee.

14 Consequently having heard counsel, we direct that the ten-member Committee constituted by the NGT shall be substituted by a Committee to be chaired by Justice B P Katakey, former Judge of the Gauhati High Court. Since Justice B P Katakey has already conducted a substantial amount of work in assessing the damage due to the accident, pursuant to the entrustment of the task by the NGT, there is no reason why the Committee should not have the benefit of the work which has already been done and the experience of its Chairperson. We accordingly direct that the Committee shall consist of the following members:

- (i) Justice B P Katakey, former Judge of the Gauhati High Court ...Chairperson
- (ii) Dr Ritesh Kumar, Director, Wetlands International South Asia
- (iii) Mr G S Dang, ex-Deputy Director, Indian Institute of Petroleum, Dehradun
- (iv) Mr Qamar Qureshi, Professor, Wildlife Institute of India
- (v) Mr Bedanga Bordoloi

15 The Committee is requested to take up the work at its early convenience and to submit its final report within three months. The Committee would be at liberty to co-opt or hear any other expert as is necessary for facilitating its task. The MOEF&CC shall depute a nodal officer to facilitate all logistical arrangements for the Committee. The Committee shall make an interim determination of the damages within a period of one month so that a suitable direction can be issued to OIL to deposit the amount for facilitating remedial measures. The Committee shall also be at liberty to recommend other interim remedial measures and

suggest final remedial measures in the course of its eventual report. To facilitate the work of the Committee, we direct OIL to deposit an amount of Rs 50 lakhs with the MOEF&CC within a period of one week from today so that necessary steps can be taken to facilitate the meetings and work of the above Committee. All concerned, including the Chief Secretary of the Government of Assam, the Central and State Pollution Control Boards and OIL are directed to cooperate with the Committee and to provide all logistical assistance to the Committee and its members to facilitate work. The officials of the Government of Assam shall also render all necessary assistance when called upon to do so.

- 16 The interim report shall be submitted in a sealed cover to the Registrar (Judicial) of this Court, upon which the present appeal shall be listed before this Court within two weeks of the receipt of the report for further directions.
- 17 List the appeal on 21 October 2021.

(SANJAY KUMAR-I)
AR-CUM-PS

(SAROJ KUMARI GAUR)
COURT MASTER

HSM-11/17/2021-HSM
Government of India
Ministry of Environment, Forest and Climate Change
(HSM Division)

Indira Paryavaran Bhawan
Jor bagh Road, Aliganj
New Delhi-110003

Date: 14th September, 2021

Office Order

Sub: Hon'ble Supreme Court Civil Appeal No(s). 2201/2021 related to chemical accident (fire) at Baghjan Oil Field, District - Tinsukia, Assam - Constitution of Committee in compliance with order dated 02.09.2021 - reg.

This refers to the chemical accident (fire) at exploration oil-well of M/s Oil India Limited at Baghjan Oil Field, District - Tinsukia, Assam on May 27, 2020. Hon'ble National Green Tribunal (NGT) (Eastern Zone Bench) heard the matter in O.A. No.43 / 2020 (EZ) (Bonani Kakkar Vs Oil India Limited & Others). An Expert Committee was also constituted vide Hon'ble NGT's order dated 24.06.2020 which submitted its report on 01.09.2020, 31.10.2020 and 10.12.2020. The Expert Committee concluded that the incident has caused severe damage to the surrounding habitations/ natural features like National Parks/ Water bodies/ wetlands etc.

2. The Hon'ble NGT vide order dated 19.02.2021 has disposed of the matter and constituted three (3) Committees to look into the aspects related to (i) fixing accountability of individuals (by MoPNG), (ii) non-compliance Water Act, 1974/ Air Act, 1981/ Environment (Protection) Act, 1986 (by MoEFCC), and (iii) damage assessment and restoration plan (by Chief Secretary, State Government). A copy of the Hon'ble NGT order is enclosed for reference. The final order of the Hon'ble NGT was challenged by the appellant in Hon'ble Supreme Court and accordingly, the Hon'ble SC had stayed the operation of the impugned judgment and order of the Hon'ble NGT dated 19 February 2021 vide its order dated 01.07.2021. The Hon'ble Supreme Court, vide order dated 02.09.2021, re-constituted the third committee mandated to undertake damage assessment and restoration plan related task (*order enclosed for reference*).

3. In pursuance of the Hon'ble SC order dated 02.09.2021 in civil appeal no. 2201/2021, the Government of India, Ministry of Environment, Forest and Climate Change hereby constitutes the following Committee for 'Assessment of the damage and restoration of Dibru Saikhowa National Park and Maguri-Motapung Wetland' as below:

Purpose	Committee
Assessment of the damage and preparation of restoration plan of Dibru Saikhowa National Park and Maguri-Motapung Wetland	1. Justice B P Katakey, former Judge of the Guwahati High Court - Chairperson 2. Dr Ritesh Kumar, Director, Wetlands International South Asia

Purpose	Committee
	3. Mr G S Dang, ex-Deputy Director, Indian Institute of Petroleum, Dehradun
	4. Mr Qamar Qureshi, Professor, Wildlife Institute of India
	5. Mr Bedanga Bordoloi, Soil Expert

3a. The 'Terms of Reference' for the above-mentioned Committees are governed in line with the order of the Hon'ble SC, as under:

- i. The Committee shall assess the damage and prepare the restoration plan of Dibru Saikhowa National Park and Maguri-Motapung Wetland.
- ii. The Committee shall make an interim determination of the damages within a period of one month so that a suitable direction can be issued to M/s OIL to deposit the amount for facilitating remedial measures.
- iii. The Committee shall also recommend other interim remedial measures and suggest final remedial measures in the course of its eventual report.
- iv. The Committee shall submit final report within three months of the issue of this order.
- v. The Committee can co-opt or hear any other expert as is necessary for facilitating its task.
- vi. The Committee shall be free to undertake site visits, if need be.

4. The Chief Secretary of the Government of Assam, the Central Pollution Control Board, the Pollution Control Board of Assam and M/s OIL are requested to extend all requisite cooperation to the Committee, in line with Hon'ble SC directions, and also provide required logistical assistance to the Committee and its members to facilitate work, whenever requested.

5. Wildlife Institute of India (WII) (under administrative control of MoEFCC) shall be the nodal agency for coordination. The Dy. Registrar (Administration), Sh P.K. Aggarwal, WII shall be the nodal officer on behalf of MoEFCC for coordination. WII shall extend required logistical and secretarial support to the Committee. The contact details of nodal officer are as below:

Sh. P.K. Aggarwal, Deputy Registrar
Wildlife Institute of India,
Post Box # 18, Chandrabani
Dehradun 248001 Uttarakhand
Email: pka@wii.gov.in
Tel: +91-135-2640114 to 15 Ext (110) / +91-135-2646110(D)
Fax: +91-135-2640117

6. The expenditure incurred towards the work undertaken by the Committee shall be met by the amount deposited by M/s OIL. In the interim, M/s OIL shall deposit a sum of ₹50 lakhs so that necessary steps can be initiated/ taken to facilitate the meetings and work of the above Committee. Hence, representatives of M/s OIL are also requested to coordinate with the Nodal officer to chalk out the modalities for deposit of ₹50 Lakhs.

7. The expenses towards TA/ DA, Sitting Fee etc. in respect of Committee members, shall be as per the Hon'ble Supreme Court orders/ guidelines/ rules in similar matters, if any, else

the same shall be governed by the Central Government norms. The official members may claim TA/ DA, if applicable. from their respective organizations.

8. This issues with the approval of Secretary (EF&CC).


(Ved Prakash Mishra)
Director

To:

(As per the list enclosed)

Copy for information to:

PS to MEFCC/ PPS to Secretary (EF&CC)/ PS to JS (HSMD)/ IFD/ GC/ Budget Division/SO (HSMD)/ Guard file

Mailing List

Hon'ble SC Committee Members

1. Justice B P Katakey (Chairman), Former Judge of the Gauhati High Court (*aspolacct@gmail.com*)
2. Dr Ritesh Kumar Director, Wetlands International South Asia (*ritesh.kumar@wisa.org*)
3. Mr G S Dang, ex-Deputy Director, Indian Institute of Petroleum, Dehradun
4. Mr Qamar Qureshi, Professor, Wildlife Institute of India (*qmq@wii.gov.in / qureshi1510@gmail.com*)
5. Mr Bedanga Bordoloi Soil Expert (*bedangamanage07@gmail.com*)

Central/ State Government Officials

6. The Chief Secretary, Govt. of Assam
7. The Chairman, Central Pollution Control Board
8. The Joint Secretary, HSM Division, MoEFCC
9. The Joint Secretary, IA Division, MoEFCC
10. The Inspector General (Wildlife), IPB, MoEFCC
11. The Inspector General of Forests (C), MoEFCC, IRO, Guwahti
12. The Chairman, Pollution Control Board, Assam
13. The Chairman- Managing Director, Oil India Limited
14. The Director, Wildlife Institute of India
15. Sh. P.K. Aggarwal, Deputy Registrar, Wildlife Institute of India – Nodal Officer


(Ved Prakash Mishra)
Director

Expert committee meetings - Details

Sr. No.	Meeting details	Mode / Attendees	Date	Place
1	Initiation of committee function	In person meeting / Committee members	September 7, 2021	At the office of Assam Police Accountability Commission, Guwahati
2	Discussion on action plan	Virtual meeting / committee members	September 8, 2021	-
3	Consultation / discussion with stakeholders	Virtual with stake holders	September 22, 2021	-
4	Planning for visit to the site and identification of the persons to be met and discussion with stakeholders	Virtual meeting / committee members	October 4, 2021	-
5	Planning for visits to the blowout site and discussion with stakeholders	In person meeting / Committee members	October 7, 2021	Dibrugarh, Assam
6	Meeting with stakeholders	In person meeting / Committee members, OIL, PCCB Assam, Forest Deptt., DFOs of Digboi, Tinsukia etc.	October 8, 2021	Dibrugarh, Tinsukia DC Office
7	Visit to blowout site and wetland MMW	In person meeting / Committee members with officials of OIL and PCBA etc.	October 9, 2021	Tinsukia
8	Visit to DSNP and presentation by DFOs	In person meeting / Committee members, OIL and Assam Govt. officials	October 10, 2021	Tinsukia

9	Discussion on further visits / actions	In person meeting / Committee members	October 11, 2021	Dibrugarh
10	Discussion on interim report	Virtual meeting / committee members	October 15, 2021	-
11	Preparation and finalization of interim report	In person meeting / Committee members	October 18, 2021	New Delhi
12	Preparation and finalization of interim report	In person meeting / Committee members	October 19, 2021	New Delhi
13	Planning of revisit to the site and nearby villages, discussion with villagers and fishers etc.	Virtual meeting / committee members	October 25, 2021	-
14	Discussion with Mr. M.K. Yadav, IFS	Virtual meeting / committee members	October 26, 2021	-
15	Discussion on interim report and identifying persons for visit to DSNP and MMW	Virtual meeting	November 3, 2021	-
16	Revisit to the blowout site, visit to DSNP and MMW	In person meeting / Committee members	November 15, 2021	Dibrugarh / Tinsukia
17	Visit to site of an abandoned well at Talap, visit to Dekom 5 blowout site and meeting / discussion with stakeholders	--do--	November 16, 2021	Tinsukia
18	Meeting at DSNP Forest Guest House check point with representatives of three nearby villages and visit to MMW	--do--	November 17, 2021	Tinsukia

19	Review of visits undertaken and summarising	--do--	November 18, 2021	Guwahati
20	Preparation of visits summary, discussion with forest officials on satellite mapping of DSNP and MMW at Forest Office, Aranya Bhawan, Guwahati and making of budget proposal	--do--	November 19, 2021	Guwahati
21	Initiation of report writing work and estimating the expenditure on various proposed management activities	--do--	November 20, 2021	Guwahati
22	Discussion on visits and preparation for the final report	Virtual meeting with stake holder	December 3, 2021	-
23	Reviewing the progress of activities identified for OIL by the committee	Virtual meeting with member Secy. PCBA and OIL team including their GM	December 4, 2021	-
24	Satellite map finalization and report writing work	In person meeting / Committee members with PCBA and forest officials	December 9, 2021	Guwahati
25	Report writing work	In person meeting / Committee members	December 10, 2021	Guwahati
26	Report writing work	In person meeting / Committee members	December 11, 2021	Guwahati
27	Report writing work	Virtual meeting / committee members	December 20, 2021	-
28	Report writing work	Virtual meeting / committee members	December 21, 2021	-

29	Report writing work	Virtual meeting / committee members	December 22, 2021	-
30	Report writing work	Virtual meeting / committee members	December 23, 2021	-
31	Report writing work	Virtual meeting / committee members	December 24, 2021	-
32	Report writing work	Virtual meeting / committee members	December 26, 2021	-
33	Report writing work	Virtual meeting / committee members	December 27, 2021	-

List of reports prepared by various authorities/organisations/committees

Sl. No.	Report title	Date of issue
1	Report submitted by CPCB on OIL and Gas Drilling and Extraction Industry	June, 2006
2	Pre drilling EIA study and Environmental Management Plan for North Hapjan-Tinsukia-Dhola area prepared by the department of Chemistry, Gauhati University on the basis of the study conducted during March -May, 2009 at the behest of OIL	-
3	Environmental Impact Assessment study and Environmental Management Plan for expansion of Gas Field Development in Tengakhat etc. area prepared by En-GEO Consultancy & Research Center at the behest of OIL	December, 2011
4	Safe operating Procedure containing Health, Safety and Environment (HSE) Policy of OIL Vol-I	March 30, 2012
5	Safe operating Procedure containing Health, Safety and Environment (HSE) Policy of OIL Vol-II	March 30, 2012
6	Standard Operating Procedure (SoP) of well serving pump of mobile rig prepared by OIL	Revised on December 1, 2017
7	Oil Spill Contingency Plan (OSCP) for onshore operation of OIL	June 1, 2013
8	Corporate Disaster Management Plan of OIL	Revised on June 2020
9	People's Bio-Diversity Register of Hapjan Anchalik Panchayat BMC prepared by Assam Bio-Diversity Board	2016
10	People's Bio-Diversity Register of Guijan Anchalik Panchayat. Prepared by Assam Bio-Diversity Board	April, 2017
11	Report of Halliburton Logging Service on Well No. 5	March, 2007
12	Lay out of well site prepared by OIL	August 2, 2017
13	Standard Operating Procedure (SoP) in respect of operation of rig engine of OIL	December 1, 2017
14	Executive summary of Assam State Bio-Diversity Strategy and Action Plan prepared by Assam Bio-Diversity Board	2017 to 2030

15	Letter issued by OIL to Dr. Ranjan Kr. Das relating to the public grievance in respect of Baghjan-Duliajan Crude Oil pipe line leakage incident occurred on 14/09/2018	October 24, 2018
16	Mutual Aid for Emergency Response Plan for Hazardous Industries in Dibrugarh and Tinsukia district, prepared by District Disaster Management Authority	Updated on April 3, 2019
17	Project report on monitoring of land subsidence due to Hydro-Carbon extraction in Assam conducted by National Remote Sensing Center and ISRO	June, 2019
18	Management plan for Dibru-Shaikhowa National Park prepared by the Forest Department, Govt. of Assam	2019-20 to 2023-24
19	Management plan of Bherjan-Borajan-Padumoni Wildlife Sanctuary prepared by DFO, Tinsukia Wildlife Division	2019-20 to 2023-24
20	EAI for extension Drilling and Testing of Hydro-Carbon at 7 locations under Dibru-Saikhowa National Park prepared by ERM India Pvt. Ltd. at the behest of OIL	December, 2019
21	Interim report of Seismological and Geophysical study at the Baghjan well blow site submitted by CSIR-NEIST at the behest of Govt. of Assam and OIL	-
22	Reports on ambient monitoring of Well No. 5 done by OIL	June 13, 2020
23	Original estimate by CSIR-NEIST	July 22, 2020
24	Assessment of air quality in the vicinity of Well No. 5 done by TERI	August 5, 2020
25	Final report of seismological and geographical study at the Baghjan well blowout site submitted by CSIR-NEIST	August 21, 2020
26	Inquiry committee report submitted by OIL Industry Safety Directorate (Ministry of Petroleum & Natural Gas), Govt. of India	August 26, 2020
27	Report on measurement of Thermal Mapping of Structure and Sonic Boom in Baghjan conducted by the Civil Engineering Department of IIT, Guwahati and submitted to OIL	August 28, 2020
28	Project proposal on assessment of air, water and soil quality submitted by CSIR-NEIST	September, 2020

29	Report submitted by High Level Committee of Ministry of Petroleum and Natural Gas, Govt. of India, of blow out at Baghjan Well 5	October 16, 2020
30	Report on impact of blow out in Dibru Saikhowa National Park submitted by DFO, Tinsukia Wildlife Division	October 21, 2020
31	Monitoring reports of noise level and ambient air submitted by PCBA	October 26, 2020
32	Final report prepared by OIL with the assistance of TERI for Remediation Services of contaminated soil and water bodies due to oil spillage resulting from the blow out of BGN#5	December 4, 2020
33	Note for approval and adoption of well Abandonment, Site Restoration and Reclamation Policy prepared by OIL	February 24, 2021
34	Agreement between International Union for Conservation of Nature and Natural resources (IUCN); Assam State Bio-Diversity Board and OIL for conduct of Bio-Diversity Impact Assessment Study at the proposed OIL site	May 4, 2021
35	Final report of Environmental Scan for BGN 5 blowout submitted by ERM to OIL	June 11, 2021
36	On site Emergency Response Plan of OIL	Updated on October 6, 2021
37	Table of Water analysis report of monthly sample monitored by PCBA from Maguri Motapung Beel	January to April & July, 2021
38	Presentation by PCBA on the incident of blowout at BGN 5 including annexures made before the Committee	October 8, 2021
39	Power point presentation of OIL to the Chairman and the Committee Members on assessment of damage and restoration at BGN 5 blowout area	October 8, 2021
40	District Disaster Management Plan 2021 of Tinsukia District	2021
41	Representation of the Presidents of Baghjan, Natun Rongagora and Barekuri EDC	October 8, 2021
42	Representation of the villagers of Baghjan village	October 8, 2021
43	Representation of the villagers of Baghjan and neighbouring villages	October 8, 2021
44	Representation of the villagers of Natun Rongagora village	October 8, 2021

45	Representation of the Director of WECO (Wild Life and Environment Conservation Organization), Borgaon	October 8, 2021
46	Holistic Field Development Plan of Baghjan area prepared by OIL	October 10, 2021
47	Equipment lay out of John Energy at BGN 5	-
48	Environmental manual for Oil and Gas Exploration and Production in OIL	-
49	Impact of oil well blow out at Baghjan oil field, Assam and resulting oil spill on surrounding landscape. Wildlife Institute of India, Dehradun	Update on July 15, 2020
50	i) Report (in 3 volumes) on damages to environment, biodiversity, wildlife forest and ecology on account of blow out and explosion at well no. BGN-5 Baghjan, Tinsukia Assam submitted by the one man enquiry committee appointed by the Govt. of Assam and headed by Mr. M. K. Yadava I.F.S. Addl. PCCF (Wildlife) & CWLW, Assam ii) Corrigendum of the report	February 10, 2021 June 23, 2021
51	First aid firefighting training. Oil India Limited	-
52	Training details of Executive	w.e.f. January 1, 2021
53	Baghjan Well No.5 Blowout Incident - Lessons learned.	-
54	Bioremediation of oil spill affected areas around well no. BGN#05	-
55	Broad point on lesson learnt during Baghjan well No.5 Blowout	-
56	Volume estimation based on sampling coordinate	October 2, 2021
57	Interim Report on Baghjan Well#5 Blowout by the Present Committee (submitted to Hon'ble Supreme Court)	October 20, 2021

List of meetings with stakeholders

Sr. No.	Meeting details	Mode / Attendees	Date	Place
1	Consultation / discussion with stakeholders	Virtual meeting with stakeholders	September 22, 2021	-
2	Discussion / interaction with stakeholders	Virtual meeting with stakeholders	October 4, 2021	-
3	Discussion / interaction with stakeholders	In person meeting / Committee members	October 7, 2021	Dibrugarh, Assam
4	Discussion / interaction with stakeholders	In person meeting / Committee members, OIL, PCCB Assam, Forest Deptt., DFOs of Digboi, Tinsukia etc.	October 8, 2021	Dibrugarh, Tinsukia DC Office
5	Discussions / interaction with villagers and fishers etc.	Virtual meeting / committee members	October 25, 2021	-
6	Discussions / interaction with stakeholders	In person meeting	November 16, 2021	Tinsukia
7	Discussions / interaction at DSNP Forest Guest House check point with representatives of three nearby villages and visit to MMW	--do--	November 17, 2021	Tinsukia
8	Discussions / interaction with stakeholders	Virtual meeting with stake holder	December 3, 2021	-

Material Safety Data Sheet of Natural Gas condensate

1. <https://whiting.com/wp-content/uploads/Natural-Gas-Condensate-Sweet-SDS>
2. [MSDS/Condensate-I5000a-Rev.002%20VITOL.pdf](#)

Details of Baghjan Land of OIL

<u>Location/ Project</u>	<u>Village</u>	<u>Mouza</u>	<u>P.P.No.</u>	<u>Dag No.</u>	<u>Area involved in Bigha</u>
Loc. TN/BGR#5	Baghjan	Hapjan	142	448(P)	0.1
		Hapjan		450(P)	0.15
		Hapjan		451(P)	0.15
	do	Hapjan	81	439(P)	1.26
	do	Hapjan	108	444(P)	1.55
	do	Hapjan	114	453(P)	0.09
	do	Hapjan	128	408(P)	0.22
	do	Hapjan	132	457(P)	0.6
	do	Hapjan	145	437(P)	0.14
	do	Hapjan	144	443(P)	1.96
	do	Hapjan	198	458(P)	1.24
	do	Hapjan	199	438(P)	0.31
	do	Hapjan	203	1322(P)	0.62
				1323(P)	0.06
				1324(P)	0.13
	do	Hapjan	202	1320(P)	0.21
				1321(P)	0.2
	do	Hapjan	204	449(P)	0.3
	Baghjan N.C. Gaon	Hapjan	No.1	100	6.75
	do	Hapjan	2 No.	101(P)	6.73
	Baghjan	Hapjan	208	430(P)	0.22
	do	Hapjan	207	434(P)	0.66
	do	Hapjan	-	436(P)	0.24
	do	Hapjan	-	442(P)	0.48
	do	Hapjan	207	1197(P)	0.09
	Baghjan N.C. Gaon	Hapjan	-	-	3.09
					TOTAL =

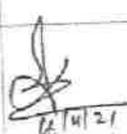
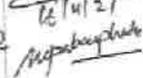
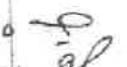
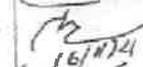
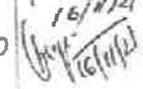
Content: i) Land Chart of Location TN (BGN -5).

ii) Cadastral map of the land involved in Location TN (BGN -5)

iii) 16 Nos. of Registered Sale Deeds of the involved land.

Attendance sheet of persons (Govt. officials, stakeholders and general public etc.) who attended the meeting

Meeting of the members with following persons ①
Attendance 16th November 2021 6:30 PM

Sr.No	Name	Department	Contact no	Signature
1	Dr. Ranjan Kr. Das	Vice-Principal Srinagar College	9435736364	 16/11/21
2.	Mridu Paban Phukan	Freelance Conservationist	813592482	
3.	Pranab Kr. Sarmah	Fishery department Tinsukia.	9435554335	 16/11/21
4.	Hemanta Phukan	Dist. Aquaculture Office Tinsukia	9706572530	
5.	Dr. Uddipam Phukan Das	Dist. Agriculture Office	8011923146	
6	Chaturghosh Chetia	Fishery	9678903780	
7.	Tilakraj Das	Fishery Dist. Office	8473887463	 16/11/21
8.	Khyanjit Gogoi	Orbit Society of Eastern Himalaya	9954819490	 16/11/21
9.	Ranamay Bhattacharyj,	Circle officer, Dumdooma.	8850184412	 16/11/2021
10.	Suranjita Sarmah	Circle officer (A), Dumdooma	7002871033	 16/11/2021

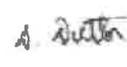
Meeting on 17th November 2021
Dabra Rup

S. No.	Name	Address/Dept.	Contact No.	Signature
1)	Haren Rega	Lanka Panna Goon Bosta	847188 6378	Haren Rega
2)	Jagat Kogashu	Lanka Rigbi	8011262861	OK
3)	श्रीमती जयश्री देवी		9954744719	
4)	विनोद पात्र		9678884548	
5)	श्रीजयश्री पात्र		9365401338	
6)	Sarot Pan	Lanka Panna	950832017	
7)	Anuj Pan	Gujjan Gehat	8638011643	Anuj Pan
8)	Meijanta korat	Act, Jaisalmer	9112331	
9)	श्री 21617 पात्र	विनोद पात्र		21617
10)	Su Houbol Des	Executive Gason		Houbol
11)	Ar. Khavir Chaghu	Gujjan	7751931793	
12)	श्रीमती 26 Anand	विनोद पात्र		
13)	विनोद पात्र	विनोद पात्र		
14)	Piresh Das	Gujjan Gante	7896724588 333	
15)	Ratra Pr. Mehi	Goon Bosta Lanka Panna	863873 1165	
16)	Santana Mechi	RPO, Gujjan Range.	995416321	
17)	Surajita Samrah	Circle Officer (A), Doondooa Rev. Circle	7002874033	Samrah
18)	Paman Gaurin	Committee member	941106002	
19)	Ranjana Pr. Das	Jimskia College	9435734344	
20)	Shyama Prasad Biswas	Retd Professor Dilimgarh Univ.	9435033479	

Meeting of Committee Members on 17/11/2021
(Mogori-Motapung)

S.No	Name	Address / Dept.	Contact No.	Signature
1)	Pradip Chakrabarti	Goriatling Vill.		P Chakrabarti
2)	Biswan Manna	Goriatling village	7002268771	B Manna
3)	Uttam Chakrabarti	Goriatling village	9365171863	U Chakrabarti
4)	Soumya Chakrabarti	Goriatling	60001936	Soumya
5)	সুস্মিতা চক্রবর্তী	২ নং পুরানি মতাপুং		সুস্মিতা
6)	Sri Kiran Lyman	১ নং পুরানি মতাপুং	99659288	Sri Kiran
7)	Ranu Manan Chakrabarti	1 No Purani Motapung	600052028	Ranu
8)	Juri Chulia	1 No Purani Motapung	8011221572	Juri
9)	Aditya Chakrabarti	DO	8011912896	Aditya
10)	Shikhar Kumar Naik	Baghjan T.E. line no. 9	8721966105	Shikhar
11)	Talents Kamlatter	Baghjan T.E	6026655707	Talents
12)	Zohid Chakrabarti	Goriatling		Zohid
13)	Alex Chulia	Goriatling	9365288087	Alex
14)	Anupom Chakrabarti	2 No Purani Motapung	9675160512	Anupom
15)	Santosh Chakrabarti	2 No Purani Motapung	8099902307 8-90814713	Santosh
16)	Tanuj Chakrabarti	"	600708167	Tanuj
17)	Balesh Prasad	2 No Purani Motapung		Balesh
18)	Ashok Prasad	2 No Purani Motapung	9101466028	Ashok
19)	Chenizram Chakrabarti	Goriatling village	7896890618	Chenizram
20)	Biswan Chakrabarti	Goriatling village	801124998	Biswan
21)	HUNAI Chakrabarti	EDC - M P -	9957010809	HUNAI
22)	Maimachuli	Goriatling		Maimachuli
23)	Purnaswar Chakrabarti	Goriatling -	7896530491	Purnaswar
24)	Jayanta Chakrabarti	Goriatling	9365708299	Jayanta
25)	Siddhanta Chakrabarti	Purani Motapung	967863537	Siddhanta

Meeting of Committee members with different stakeholders on 19-11-2023
 at Guwahati [Conference Room in the Head Quarter of Forest Deptt,
 Assam, Guwahati]

S.No	Name	Address	Department	Contact No Email	Signature
1	Sarbajit Sarma	Prof Assam Don BOBCO University Tapasia		9134994506 sarbajitsarma@bobco university.ac.in	
2	Prasanna Choudhury	House No 7, Alampur Road, Ghy-781007		9835079176 acchoudh@gnl.com	
3	Samir Ghosh	Wildlife Institute of India, Dehradun		941100812 sghosh@wildlife.org.in	
4	Ritesh Kumar	Netherlands International South Asia, A n. Reference Colony, New Delhi-110024		9811637446	
5	Bedange Bodoloi	44A, 2ND CACHAL PATH, DWARAKAPUR GUWAHATI		9957905741	
6	G.S. Dang	SF-4, Anand Villa Sports near Rd DSN -248001		9997168805	
7	Dilip Chetry	Aaranyak Guwahati-28 Assam		9435073898	
8	Amp Kumar Das	Aaranyak Guwahati-28 Assam		7577836 104	
9	Dhruba Dutta	61, Survey, Ajanta Park, Ghy		9473962708	

FIELD LOG

Contract NO :	PLACE	DATE	TIME	Sampler		Name & Sign (TERI)	Name & Sign (QIL)
				Temp (°C)	Duplicate		
6116306	BAGAL - S	22-10-21	8:30	TARUN SANKHA		Bijoyit Baruah	M. Subramanian S. K. Saha
	Equipment	Weather		Temp (°C)			
	Soil Core Cutter	Sunny		25.3			
Vertical Depth of Core Sample (cm)	Depth of Contamination observed in soil core (cm)	Soil Type	Colour	Odour	Moisture	Density	Sample ID /Detail
1		Alluvial	Dark Brown	Light Odour	Moist	Loose	
2							Composite Soil Sample No. - 2 E-952247.9 M-273550.5 Sample ID - Soil sample No - 2 { Composite sample contains 10 grab samples } within 15 Meter circumference
3							
4							
5							
6							
7							
8							
9						80cm	
10							
11							
12							
13							
14							
15							
16						15cm	
17							
18							
19							
20							
21							
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