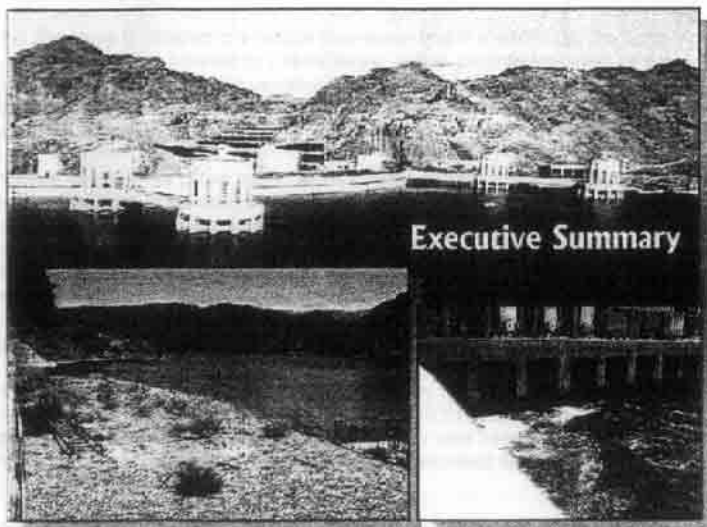


FINAL REPORT ON THE  
ENVIRONMENTAL IMPACT ASSESSMENT OF THE  
PROPOSED DEVELOPMENT OF MONA ESTATES AND  
BEVERLEY HILLS, ST. ANDREW ON  
THE NATIONAL WATER COMMISSION'S WATERSHED



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# FINAL REPORT ON THE ENVIRONMENTAL IMPACT ASSESSMENT OF THE PROPOSED DEVELOPMENT OF MONA ESTATES AND BEVERLEY HILLS, ST. ANDREW ON THE NATIONAL WATER COMMISSION'S WATERSHED

## EXECUTIVE SUMMARY

### 1.0 INTRODUCTION

The sites that have been identified for the proposed development are Mona Estates and Beverley Hills. Both areas share a common boundary and are located on the ridge top above the Mona Reservoir. The two plots identified by the Programme for the Resettlement and Integrated Development Enterprises (Operation PRIDE) adjoin one another resulting in a sea of residential lots surrounding the Mona Reservoir. The sites share a common boundary and therefore, they will be considered together for the purpose of this analysis.

The Mona Reservoir is situated in a natural depression that is sheltered by the Long Mountain Range. Long Mountain is covered by natural forest, and is currently identified as a watershed area by the Natural Resources Conservation Authority (NRCA) and as such is in need of protection. To the east, water drained from the Hope River Catchment area flows through an aqueduct to the Reservoir.

The proposed site consists of two areas: Mona Estates and Beverley Hills. Mona Estates is located along the ridge of the Long Mountain. Its western boundary is visible from Mountain View Avenue. The property is located to the north of a 56-acre property owned by the Ministry of Environment and Housing and a community informally known as "Back Bush". It is bounded to the north by the adjoining 42-acre Beverley Hills site. To the east lies property owned by the University of the West Indies (UWI). The Beverley Hills Extension site is located in the high income residential suburb at the top of Beverley Hills, adjacent to existing subdivisions on Rutland Drive, Montclair Close and Montclair Drive.

The amount of land being considered for development by Operation PRIDE totals 520 acres (210.5 hectares). Of the 520 acres owned, 196 acres (80.5 hectares) are proposed for development. The remaining 324 acres (133.2 hectares) have been recommended as land for Conservation. Each of the proposed developments is described below:

#### 1.1 Mona Estates

It has been proposed that the Mona Estates Development will blend and integrate with the three major developments that borders the site. Road linkages are to be created with Beverley Hills, the Karachi Development and the proposed Mona Estate in addition to Mona Road Access. It is proposed that this will be a moderate house and townhouse development to help enhance the existing properties.

In accordance with preliminary proposal by the Planners, it is expected that some 282 residential lots with an average lot size of 1390 m<sup>2</sup> (15,000 sq. ft) will be demarcated on the site with approximately three (3) to five (5) habitable rooms per lot. The proposed sub-division is on slopes varying from about 45° to almost flat. Driveways into some lots will be quite steep at about 30%. Approximately 30% of the sub-division are on the northern side of the Long Mountain Range, with the remaining 70% on the south side.

#### 1.2 Beverley Hills Extension

One hundred and eighty seven (187) lots ranging between 557.5 m<sup>2</sup> and 839.1 m<sup>2</sup> are proposed for construction on the Beverly Hills site. The infrastructural provisions will include roadways, drainage and sewerage systems.

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### 1.3 Legislative and Regulatory Framework

The following legislature governs the development of the site:

- a. Natural Resources Conservation Authority (NRCA) Act, 1991;
- b. The Town and Country Planning Act, 1987;
- c. The Water Resources Authority Act (1995);
- d. The Wildlife Protection Act (1945); and
- e. The Public Health Act.

## 2.0 APPROACH AND METHODOLOGY

The Environmental Impact Assessment (EIA) was conducted based on field investigations and the compilation of information on the existing resource base of the project site and its environs. The possible impacts of the proposed development of the site were evaluated. The consultants had discussions with Operation PRIDE to obtain information on the proposed Mona Estates and Beverley Hills Developments. The Consultants also had discussions with the NRCA and the Water Resources Authority regarding the proposed project. Based on this analysis, an EIA report was prepared. The report outlines the possible environmental impacts of the proposed housing development and the recommended mitigative measures to minimize these impacts.

More specifically the following tasks were undertaken:

- a. Description of the proposed project;
- b. Legislative and regulatory considerations;
- c. Description of the environment (physical, biological and socio-economic);
- d. Assessment of the potential environmental impacts of the project;
- e. Assessment of the long term vs short-term use of the area;
- f. Determine and analyze alternatives in terms of potential environmental impacts and cost/benefit analysis;
- g. Outline feasible and cost-effective mitigation measures to prevent or reduce significant negative impacts;
- h. Develop an Environment Management/Monitoring plan.
- i. Facilitate inter-agency coordination, public, NGO and CBO participation.

## 3.0 RESOURCE ASSESSMENT

The physical characteristics that are described include climate, topography, geology, drainage, water quality, ecological environment and natural hazard vulnerability. The findings are presented below:

### 3.1 Geological Overview

The area under review is part of an uplifted section of the Wagwater Sequence, which forms a southeast/northwest trending limestone mountain, namely the Long Mountain. The proposed development site occupies the central part of the hill and is situated due south of the very upscale development known as Beverley Hills.

The area rises very steeply from the west i.e. along Mountain View Avenue, to a height in excess of 1450 feet above sea level and then grades in a much gentler manner to the northeast, where it adjoins the Karachi, Mona and University of the West Indies properties.

Within the proposed **Mona Estates** development, the area is floored by very hard micritic limestone, with a well-developed honeycombed and jagged surface. The micritic limestone is extremely competent, but some degree of brecciation (crushing) is noted along and surrounding the fault lines within the regions of faults. This is especially intense along the northern margin

where the material is loose, friable, incompetent and lends itself to quarrying at several points using only the ripping technique. The area is interspersed with small gently sloping or nearly flat-bottomed depressions filled by red terra rossa/lateritic soils.

The **Beverley Hills** subdivision is floored by a partially bedded, heavily jointed fractured limestone. The development of V-shaped valleys are closer to and in some instances penetrate into the development site, indicating that the softer, erodible material is more pervasive here than in the Mona Estate development.

The limestone covering the Mona Estate site is of the Newport Formation, which is classically described as bioclastic/micritic limestone (consisting of cemented clasts of fossils). The limestone displays case hardening and is partially recrystallized. The Newport Formation is conformably underlain by other members of the White Limestone Group, namely the Walderstone/Brownstown Member and the Troy Limestone, both of which outcrop in the nearby Beverley Hills and Karachi areas respectively to the north and northwest.

Regionally, the Long Mountain is part of the Wagwater Belt, which is a SE-NW trending trough defined by two major faults: the Wagwater and the Plantain Garden Fault systems. The area is described as an 'area of major down warping' that is characterized throughout by extensive and intensive faulting and folding.

There is sufficient historical evidence (Ahmad, 1993) that the Wagwater trough is earthquake prone since the primary boundary faults are considered to be seismically active. There are indications of much movement along the faulted northern boundary of the study area, where the rocks are highly shattered, yielding a loose agglomeratic mass with fragments of primary limestone embedded in a finer grained, grounded limestone matrix.

### **3.2 Hydrological (Surface and Groundwater) Overview**

The project area is located within the Hope River Watershed and forms part of the smaller Long Mountain Watershed area. The site is underlain by the highly permeable Newport and Walderston-Browns Town Limestone Formations. Consequently, there are numerous micro solution features and sub-surface drainage dominate.

On the eastern slopes of the mountain range the limestone consist of marl and brecciated limestone and surface drainage features are well defined by seasonal gully courses. The drainage system is not as well developed on the western slopes. There are no perennial stream/spring on or close to the site.

The Mona Reservoir, with a capacity of 800 million gallons is located on the eastern side of the Long Mountain range. Water is supplied to the reservoir primarily from the Hope and Yallahs Rivers. Runoff from Long Mountain and the proposed site for the development flow into the reservoir subsequent to rainfall events. However, this area cannot be considered a significant catchment for the reservoir. **However, the Long Mountain watershed contributes to the recharge of the four National Water Commission's wells located on the Long Mountain.**

The Newport and the Walderston-Browns Town Limestone Formations combine to form the **Long Mountain Limestone Aquifer**. The elevation of the groundwater table above sea level is approximately 152 m (500ft) or 305 m (1000 ft) below the highest point at the site. Based on the limited groundwater level data, the groundwater flow direction is expected to be south south-west.

There are four wells operated by the National Water Commission (NWC), from which approximately 5.0 million gallons per day (MGD) of groundwater will be abstracted from this aquifer for domestic water supply. These wells are Beverley Hills, Hamstead Road Long Mountain and Rennock Lodge. **Discussions with the Water Resources Authority** indicate that these wells are charged by the Long Mountain aquifer and as such preservation of that aquifer is vital to the quantity and quality of water to be found in these wells.

The water quality data for these wells, supplied by the NWC show that the aquifer is contaminated and has elevated levels of nitrate, sulphate, chloride, sodium and magnesium. The nitrate concentrations, (7.1–31.7 mg/l) of the Beverley Hills, Hamstead and Rennock Lodge wells exceed the Natural Resources Conservation Authority's (NRCA) ambient water quality standards of 0.1 - 7.5 mg/l. In the case of the Long Mountain Well, the nitrate concentration is close to the NRCA's standard (7.1–7.4 mg/l). The levels of nitrate in the wells are however less than the World Health Organization's (WHO) guidelines of 45 mg/l for potable water. The elevated level of nitrate in these wells is a clear indication of contamination of the aquifer by sewage, most likely from the use of absorption pits in the general area and demonstrates the vulnerability of the aquifer to pollution.

### 3.3 Natural Hazard Vulnerability

There is evidence of **slope failure** on an exposed quarry face, at the foot of the slope immediately behind the reservoir. The Consultants also observed tilts and cracks in the embankment wall of the reservoir along its western side. Tilting of the reservoir wall may possibly be caused by slope/ground movement due to lateral earth pressures exerted on the wall and is an indication of ground instability in the vicinity of the western section of the reservoir.

There is also the potential of slope movement occurring on the lower section of the eastern slope in the Newport Limestone, in which the rocks are extensively fractured and fragmented.

Ground/Site conditions that favour **earthquake** amplification and increase seismic intensity are: (a) ground consisting of soft soils; (b) reclaimed land and (c) areas of thick alluvium. These conditions are generally absent on the project site. However, sites located on or near major geological faults tend to increase groundshaking at these locations. The project area is located in close proximity to a number of geological faults and of great interest is the fault parallel to the eastern slope of the Long Mountain below the foot of the hill. The January 1993 earthquake affected the area, causing damage to the National Water Commission's filter Plant, and ground cracks along the embankment road on the southwestern section of the Mona Reservoir and triggered a large rock slide in the limestone quarry located near the reservoir.

Problems of **flooding** are not a cause for concern at the project site. Slopes are moderate to steep and drainage is normally confined to subsurface flows. However, our study indicates that there will be a 50% increase in surface runoff as a result of the proposed development. Therefore, there may be flooding in communities such as Beverley Hills, Hampstead Park and College Common.

In terms of hazards from **hurricanes**, the proposed developments of Beverley Hills and Mona Estates may be at risk because they both lie on the ridge of the Long Mountain. Strong winds that are usually generated during hurricanes can cause property damage to roofs and other infrastructure (depending on the construction methods used). These developments are susceptible to the onslaught of a hurricane primarily because there are no natural wind buffers present. The removal of large trees for construction purposes will exacerbate the situation.

### 3.4 Ecological Overview

The results of the entomological survey indicate that there was **one** rare and endangered species - the leaf cutting or mushroom growing ant (*Trachymyrmex jamaicensis*). The leaf cutting ants **have not been recorded anywhere else in Jamaica** and is a newly discovered species. This ant lives in other places of the Long Mountain region. The other species represented in the area were not endangered and were either common or found in other areas of the city.

The number of birds and species recorded were modest, especially in the dry limestone forest covering the upper ridge. The three highest bird counts were made in the wet and wooded flat land between College Common and the Mona Reservoir.

A study of the vegetation of the two proposed sites was conducted. The area may be categorized as follows:

- a. Dry-Semi evergreen Thicket;
- b. Dry Semi-evergreen Forest; and
- c. Disturbed Vegetative Region.

Near the top of Long Mountain was a fairly level stretch of grassland with an open cover of Logwood and *Cassia emarginata* trees. The presence of the grassland is undoubtedly explained by the invasion of grasses after the original cover had been removed.

The Long Mountain vegetation (Site 1) is considered to be a mixture of Dry Semi-evergreen Thicket, mostly on its eastern slope, and Dry Semi-evergreen Forest at its ridge and part of the Western Slope. The vegetation of the Long Mountain area is characterized by the prevalence of xerophytic forms. The Dominant species at Site 1 are *Tecoma stans* (Torchwood) and *Croton linearis* (Wild Rosemary). There are human impacts at this site evidenced by the presence of cattle, cut tree stumps, garbage, etc

The Beverly Hills vegetation (Site 2) is classified as being a mixture of Dry semi-evergreen thicket and Dry semi-evergreen forest. It is similar to the Long Mountain area (Site 1) with respect to flora. However, the area is more disturbed than Site 1 and as such the floristic composition and species dominance is different. This is due to the lack of soil in the area resulting from human impacts involving vegetation clearance. The substrate consisted mainly of exposed honeycomb rocks as the soil had been eroded due to lack of vegetation. Shrubs and trees dominated in the area, specifically *Rhoecyathus spathaceus* and *Bumelia* sp. Also identified in the area were two endemic plants, *Tabebuia riparia* and *Thrinax parviflora*.

The area south of the Mona Reservoir is utilized for subsistence farming by the local community. Crops grown include *Citrus sinensis* (sweet orange), *Musa acuminata* (banana) and *Blighia sapida* (ackee). In areas where the vegetation has not been cleared *Acacia tortuosa* dominates. It should be noted also that the area is used as pasture land for cows and goats.

A number of rare and endemic species were noted in the areas surveyed. These include: *Coccoloba* sp., *Morinda royoc*, *Passiflora* sp. *Tournefortia ulmiflora*, however no endangered species were identified in the ecological survey.

### 3.5 Land Use and Socio-Economic Overview

The existing legal framework within which the proposed development will take place, is the 1966 Kingston Development Plan and Development Order. The 1966 Kingston Development Order clearly indicates that the remaining area of the Long Mountain excluding Beverly Hills is zoned for **Public Open Space**. This was based primarily on the following reasons:

1. To serve as a visual amenity in the area. The 1966 Development Order recognized that conservation play a vital role in providing open space/recreation for urban dwellers. Such recreation includes picnicking, hiking and various forms of wildlife observations. As such, the Long Mountain region was designated as a public open space. Therefore, the project site is important for scenic value, outdoor recreation, watershed protection, wildlife preservation and scientific study;
2. To protect the Long Mountain Watershed that contributes to the recharge of the wells located at the foothills of the Long Mountain.

Both the proposed Mona Estate and Beverly Hills residential developments would be located atop the Long Mountain, which is situated in the northeastern corner of the Liguanea Plain. The surrounding land uses are predominantly residential interspersed with commercial and educational. These educational institutions include tertiary, secondary and primary level institutions. The proposed developments are both residential in nature, but the site for the Mona Estate and Beverly Hills developments are not zoned for housing. These sites are zoned for Public Open Spaces.

It should be noted that the area under consideration is zoned as a **Public Open Space**. Even if approval is granted to change the zoning, it may not be advisable to develop housing on the property because it represents one of the last oases in the Kingston and St. Andrew area and serves as a buffer between St. Andrew and the Down Town Kingston Industrial areas.

Etzel (1978) argued that more open space is needed as the population density increases. A high population density with little open space creates aggression. He indicated that the ratio of open space per 1,000 inhabitants in Kingston is 2.32 acres per 1,000 inhabitants. Etzel (1978) argued that Kingston had an inadequate amount of open space and that steps should be taken to improve this situation. He argued that the ratio of open space per 1000 inhabitants should be increased to 4 acres per 1,000 inhabitants. Therefore, if one were to utilize Long Mountain or part thereof for housing, one would further reduce the available open space in Kingston particularly at a time when there are plans afoot to utilize part of Hope Gardens for housing.

Long Mountain has also been extensively used as an ecological site for nature enthusiast and scientists alike. Therefore, it holds not only an ecological value but has a social value to the community. The area has also been extensively used as an ecological site for nature enthusiast and scientists alike. Therefore, it holds not only an ecological value but has a social value to the community.

The 1991 Population Census (STATIN) estimates the population of Kingston and St. Andrew at 643,801 persons. Based on the location of the proposed developments the communities that would be potentially impacted include Mona Heights, Beverley Hills, College Commons and August Town. The Enumeration District in which the site is located has an estimated population of 18,843 persons.

**Over 50% of the respondents in Mona and College Commons, felt that they would not be adversely affected by the housing development on the Long Mountain. Twenty two percent (22%) felt they would be affected or severely affected, the remaining 24% were uncertain. Fifty one percent (51%) of the respondents felt the effects of the proposed development would be negative, 14% felt the effect would be negative, 34% gave no response.**

Members of the **Beverley Hills Citizens Association** have expressed concern about the proposed development, especially the new Beverley Hills development. They have indicated that they have been in contact with the Ministry of Environment and Housing, the Kingston and St. Andrew Corporation and also the National Water Commission to express their grievances. The main issues of concern are outlined below:

- The project may increase the demand for water on the existing Mona Reservoir;
- Improper disposal of solid waste and sewage might lead to the contamination of the Mona Reservoir and the underlying groundwater resources;
- There may be damage to housing from blasting rocks during site preparation;
- There may be increased traffic flows through Montclair or Rutland Drive and the Beverley Drive area;
- Damage to the watershed;
- Crime may increase in the area; and
- Loss of aesthetic beauty from the Long Mountain and the possible site for a playground for children of the existing community.

Data from a traffic count conducted by the Ministry of Transport and Works in 1998 at the Old Hope Road/Munroe Road intersection indicated that the largest **volume of traffic** passes through the Old Hope Road/Munroe Road intersection during the middle of the day (4746 vehicles in one hour). Old Hope Road/South (traveling south towards the Seymour Avenue intersection) has the largest number of motor vehicles passing through the intersection during all (recorded) periods of

the day. This is a result of the high numbers of south bound traffic from the Matilda's Corner and from vehicles turning left from Munroe Road. Old Hope Road is a major thoroughfare with an average of 4,482 cars per hour (average of three peak periods, morning noon and night).

Traffic counts were taken by the Ministry of Transport and Works during the morning (8.00-9.00 A.M.) midday (1.00-2.00 P.M.) and afternoon (4.30-5.30 P.M.) peak hours on Thursday, June 17, 1999 at the intersection of Garden Boulevard and Mona Road. The highest volumes were observed during the afternoon peak hour on Mona Road, East (1,313) and West (1,074) of Garden Boulevard. The same pattern was duplicated during the morning peak hour at the easterly location but with a lower count (915). The lowest volumes were recorded on Garden Boulevard.

The new developments will add approximately 944 more vehicles to an already congested traffic system on Mona Road, Wellington Drive and Monroo Road (assuming two cars per lot in the Beverley Hills and the Mona Estates development). This is because access to and from the development is via Karachi Avenue and Beverley Drive that adjoins these other roads.

#### 4.0 POTENTIAL ENVIRONMENTAL IMPACTS

##### 4.1 *Physical Environment*

There should be moderate impacts on the **air quality** from the proposed development at Mona Estates and Beverley Hill, St. Andrew. During the construction of the access roads and the housing units, fugitive dust will be generated. The residents from the proposed Mona Estates and Beverley Hills Housing Development may be affected by the emissions from the Caribbean Cement Company. This would primarily affect those residents located on the southern border of the property.

There will be **noise impacts** from the proposed development at Mona Estates during the construction phase. Trucks transporting material and other heavy equipment to be used during construction would be the main source of noise pollution. Noise will also be generated from blasting activities, jack hammers, trenching machines, tractors, etc. Our study indicates that there will be negative impacts on surrounding areas, especially schools, through the activities of blasting. Noise will also be generated in the post construction phase due to increase traffic as a result of the two developments. Depending on the nature of the vehicular traffic (public or private) this may pose a problem to existing residents.

There will be some impacts on the ecological environment from the proposed development. These impacts include the loss of vegetation and habitat.

##### *Natural and Man-made Hazards*

There is potential of **slope movement** occurring in the lower section of the eastern slope in the Newport Limestone, in which the rocks are extensively fractured. Although a large section of this area will be left undisturbed, the cutting of roads on slopes behind the reservoir and the further opening of the existing quarry for construction material will expose these rock slopes to increased erosion and slope movement. Development of the gentler upper slopes will have little impact on slope instability, but there will be negative impacts if the lower, steeper slopes are disturbed for development purposes.

The Wagwater Belt, of which the site is a part, is regarded as being seismically active. This means that the area is prone to **earthquakes** of varying magnitudes. Whereas significant adverse effects would not be expected from the regular earthquake shocks, there is some field evidence that the rubbly unit bordering the site to the north could be affected by earthquake tremor to the extent that some degree of caving in and collapse might occur.



Anthropogenic hazards include vibrations from blast operations for the excavation of hard rock during the construction phase. This can have negative impacts on the surrounding environment including the National Water Commission facilities. These potential impacts include:

- possible damage to existing buildings that are in close proximity to blast operations;
- noise nuisance affecting Beverly Hills and surrounding communities;
- increased risk of slope movement on the potentially unstable limestone on the lower slopes overlooking the reservoir; and
- reducing the stability of the reservoir by increasing the risk of further damage to the embankment and increasing the possibility of opening up fissures that exist along the floor of the reservoir to cause leakage.

Damage to buildings in the immediate vicinity from fly rock and blast vibrations are cause for concern. In addition, the loosening of rocks on the lower easterly facing slopes overlooking the reservoir can occur increasing by the risk of rock slide/fall that can have negative impacts on the Mona reservoir.

*From observations of the faulted and fractured nature of the rock behind the reservoir in addition to damage caused to the road embankment during the January 13, 1993 earthquake it is evident that the geological fault which possibly runs beneath the reservoir provides potential problems of instability that can be further triggered by blast vibrations. Opening of sealed fissures on the floor of the reservoir can occur and cause uncontrolled leakages if blast are not properly controlled and monitored during the construction phase of the development.*

#### **Hydrological Impacts**

The proposed development will result in an estimated 50% increase in **surface runoff** from the site. The increase in surface runoff is expected to have negative impacts on drainage in communities such as Beverly Hills, Hampstead Park and College Common and may even result in localized flooding. The increase in surface runoff into the Mona reservoir and possible into the expanded reservoir could negatively impact the water quality in the reservoir.

An estimated 472 residential lots will be developed on the Mona Estates and the Beverley Hills development. Assuming five persons per lot and a domestic water rate of 65 imp. gal/person/day (0.295 m<sup>3</sup>/person/day), the **domestic water demand** of the proposed development is 153,400 imp. gal/day (415 m<sup>3</sup>/day). This demand represents an increased demand on the National Water Commission's system. This also places an increased demand on the National Water Commission's system.

Lots reserved for commercial purposes will also place an increased demand on the existing water supply.

#### **Sewage and Waste Water Impacts**

The four wells tapping the limestone aquifer presently show sewage pollution, primarily from the use of absorption pits. Therefore, these wells are vulnerable to sewage pollution. Therefore, on-site sewage disposal systems at the site would adversely affect **groundwater quality**.

Site clearance (removal of vegetation) will be carried out to undertake the construction phase of the project. Increase in surface **storm water runoff** is likely to occur during and after project construction and post construction phases. Additional storm water will be discharged into existing drainage channels to increase erosion on the lower slopes facing the reservoir, particularly where the extensively fractured and fragmented rock is loosely attached to the fine grain matrix and therefore highly erodible. From field observations, there are a number of drainage channels on the lower slope that are capable of carrying storm water laden with sediments directly into the reservoir during periods of high rainfall.

#### 4.2 Ecological Environment

There will be loss of vegetation as a result of the clearing of the site during site preparation. Some portions of the site are relatively disturbed because it is being used for subsistence farming by the community. The loss of vegetation will have indirect impacts on (a) Physical Environmental Factors; and (b) Biological Environmental Factors. These are discussed below:

##### a. Impacts on Physical Environmental Factors

Clearance of vegetation will decrease soil stability, hence increasing the possibility of associated hazards, example, flooding, erosion etc. This is of special concern due to the close proximity of the development to the Mona Reservoir since increased runoff and, hence, siltation reduces both the integrity and the actual capacity of the dam.

It will also have negative impacts (albeit minimal) on air quality as the soil is now more exposed to the elements (e.g. wind and rain). Therefore, it is evident that all activities requiring vegetation clearance (e.g. access roads, roadway and building construction, etc.) could also exacerbate the impacts on the physical environment.

##### b. Impacts on Biological Environmental Factors

Negative impacts may include changes in the forest structure because the environment would be more open to invasive species as the potential area impacted is increased (from cutting through the forest). The study found that the proposed buffer zone will not be effective because it is too small, already impacted and does not sufficiently protect the forest core. Other impacts include direct effects on rare and endemic species, tree fauna and the sensitive watershed habitat.

**No plant or animal species that appear on the endangered species list are threatened by the proposed development.**

#### 4.3 Land-Use and Socio-economic Impacts

Our research indicate that the proposed housing development will have the following socio-economic impacts:

- a. The development will provide additional amenities such as a community center, church and commercial area. Currently, many of the residents in the surrounding area utilize the services of the Liguanea area. Despite the additional amenities, it is anticipated that the development will place an additional stress on these services;
- b. Etzel (1978) indicated that the ratio of open space per 1,000 inhabitants in Kingston is 2.32 acres per 1,000 inhabitants, and argues that there is inadequate open space in Kingston. Therefore, if one were to utilize Long Mountain or part thereof for housing, one would further reduce the available open space in Kingston, particularly at a time when there are plans afoot to utilize part of Hope Gardens for housing. The area has also been extensively used as an ecological site for nature enthusiasts and scientists alike. Therefore, it holds not only an ecological value but has a social value to the community;
- c. It is expected that traffic congestion will increase in the Mona and Beverley Hills areas with the additional housing development. There does not appear to be sufficient capacity to accommodate this increased flow of traffic;
- d. The proximity of the developments to the Mona Reservoir clearly highlights serious contamination concerns and there is risk of contamination of the wells at the foot of the Long Mountain;

- e. The proposed development will provide short-term employment during the construction phase for persons living in Hermitage and August Town.
- f. There are a number of cultivated patches that would be affected by the development and as such the livelihood of those that cultivate the area could be affected, especially if this is the sole income of the families.

## 5.0 ANALYSIS OF OPTIONS

The report analyzed the options available and the impacts that each will have on the National Water Commission's operations and the Mona Reservoir. The following options are available:

1. the 'No-Go' option; and
2. to proceed with the development on the property.

### 5.1 Option 1: No-Go Option

Should the Developer decide not to proceed with the proposed development of the Mona Estate and the Beverley Hills areas, it is our considered opinion that the following would occur:

#### i) Preservation of Long Mountain as a Conservation Area

The Long Mountain Watershed would continue to serve as a conservation domain for naturalists, bird watchers and ecologists in general. **The leaf-cutting ant (which has not been recorded anywhere else in Jamaica and is a newly discovered species) would not be at risk of losing its habitat.**

To date, there has been public outcry over the preservation of public open spaces and green areas in the Kingston Metropolitan Region. Not proceeding with the development would allow for the preservation of this area.

#### ii) Reduction in Contamination Risks

The risk of contamination of the four wells at the base of the Long Mountain owned by NWC's would be reduced if the development does not proceed, and there would be no possible contamination of the Mona Reservoir. This is of primary concern because the National Water Commission has plans to utilize these wells to meet the supply deficit in the Kingston Metropolitan Area.

Secondly, the risk of soil erosion as a result of not removing vegetative cover to facilitate construction would be reduced. This would reduce the amount of loose sediments finding its way into the reservoir. A build up of sediment reduces the capacity of the reservoir and could also clog pipes and drainage outlets, increasing the maintenance cost of the reservoir to the National Water Commission.

#### iii) Issues of Squatting

Squatting in the Long Mountain may occur. Without proper infrastructure, it would present a risk to the physical environment and also the Mona reservoir. Risks would arise primarily from the improper disposal of sewage, solid waste and the clearing of vegetation (for the construction of dwellings, agricultural purposes, etc.). Squatting can be controlled through proper monitoring by the relevant government agency.

#### iv) Sewage Treatment and Disposal Issues

Based on the analysis done in the following sections, it shows that significant costs would be incurred by the Developer and the National Water Commission to properly sewer the site. Not proceeding with the development would eliminate these costs.

#### v) Traffic Issues

If the developer were not to proceed with the developments, then the impending stress that would be placed on the existing road network would be eliminated. Traffic congestion is of major concern to residents currently residing in the area. Currently, there is traffic congestion during peak hours. With an increase of cars into the community from this development, it would worsen.

The new developments will add approximately 944 more vehicles to an already congested traffic system on Mona Road, Wellington Drive and Monroe Road (assuming two cars per lot in the Beverley Hills and the Mona Estates development). This is because the only access to and from the development is Karachi Avenue that adjoins these other roads. Combined with traffic from the University of the West Indies, the problem will be exacerbated.

The existing road network cannot easily accommodate an increase in traffic flow. Roads leading from Beverley Hills can only accommodate single lane flow. To allow for free flow of traffic, road improvements would have to be made.

## 5.2 Option 2: Proceeding with the Developments

This option considers that the Developer will proceed with the proposed development of the Mona Estates and Beverley Hills areas. Should the decision be made to proceed with this option for development, then a number of issues have to be considered:

- a. Geotechnical Considerations;
- b. Options for Disposal of Sewage;
- c. Drainage Options;
- d. Water Supply Options; and
- e. Development of Roadways.

### 5.2.1 Geotechnical Considerations for Development

Development of Mona Estate and adjoining Beverley Hills is proposed to take place on the Newport and Walderston / Browns Town Limestone Formations. Most of the Mona Estate development will occur on the upper section of the easterly slope in the hard, massive Newport Limestone.

Excavation of limestone material in hard, massive Newport Limestone during site development phase will be necessary for the construction of access roads, building foundations and trenches for the laying of drainage and sewer pipes. In addition, manholes may be constructed as part of the design and construction of a sewerage system. In order to remove material for such purposes, blast method of excavation will be the main means of material extraction, while jackhammers will be used to supplement such activities. Because development of the hillside is proposed to be intensive, it is expected that large quantities of limestone material will be excavated during construction phase.

Blast vibrations from extraction activities can have negative impacts in the immediate environment if not properly controlled. These impacts are:

- possible damage to existing buildings that are in close proximity to blast operations;
- noise nuisance affecting Beverley Hills, College Commons and surrounding communities;
- increased risk of slope movement on the potentially unstable limestone on the lower slopes overlooking the reservoir; and
- reducing the stability of the reservoir by increasing the risk of further damage to the embankment and increasing the possibility of opening up fissures that exist along the floor of the reservoir to cause leakage.

Construction activities for Beverley Hills development located to the north of Mona Estate will be less intensive. However, excavation of rocks by blast method for construction purposes will need

to be carried out in some instances, while rocks on the margin of the lower eastern facing slopes may be removed by rip excavation.

#### A. Erosion Potential

Site clearance (removal of vegetation) will be carried out to undertake the construction phase of the project. Increase in surface storm water runoff is likely to occur during the construction and post-construction phases. Additional storm water will be discharged into existing drainage channels to increase erosion on the lower slopes facing the reservoir, particularly where the extensively fractured and fragmented rock is loosely attached to the fine grain matrix and therefore, highly erodible. From field observations, there are a number of drainage channels on the lower slope that are capable of carrying storm water laden with sediments directly into the reservoir during periods of high rainfall.

#### 5.2.2 Sewage Collection, Treatment and Disposal

There are a number of options for the collection treatment and disposal of sewage. The options are:

- i) On-site disposal;
- ii) Provision of a Treatment Plant exclusively for the project;
- iii) Connecting the proposed scheme to the NWC's Sewage Treatment System.

The report recommends that the proposed developments connect the **proposed scheme to the NWC's Sewage Treatment System**. In order to reduce the risks of groundwater pollution, a suitable option for the development is to tie into the existing NWC's Sewage Treatment System.

#### A. Problems Likely to Arise with Connecting the Proposed Scheme to the NWC's Sewage Treatment System

Although the development will be fully sewered, there remains the risk of uncontrolled flow of sewage into the environment. One possibility is the obvious blockage and overflow of a sewer. This situation is visible and can be corrected. However, the other situation is not as obvious and is much more difficult to detect and correct. Although the pipes and manholes will be leak checked after construction, there is still the possibility of leaks developing over time at joints and at manhole connections.

Leaking from a failed joint under normal conditions or increased leaking from a partially blocked sewer should be considered, as these leaks over time could reach the surface through the fractured rocks found in the project site area. This exposed sewage can then be transported via rainfall to lower regions of the development or the Mona Reservoir. **Therefore, the risk of sewage being washed into the reservoir or the wells at the foothills of the Long Mountain cannot be totally eliminated.**

Sewage collection is from the front of some lots and the back of others. This will impose additional costs due to the need for additional sewers. We have approximated the costs of sewers as \$5,700.00 per meter of roadway. **This estimate is about 30% higher than similar subdivision without rock, and about 70% higher than a subdivision where the two opposing lots discharge their sewage into a single collector in the roadway.**

The sewers behind the lots will be difficult to construct, and will require an easement on each affected lot or a way-leave for access and maintenance of the sewers.

If the development proceeds, another point of concern is the way in which the lots are eventually developed. As the subdivision will be sold as lots and **not** fully developed houses, the norm is for building of structures to take place over a number of years. Therefore, the situation may be created where a small number of houses in a remote location of the site will not offer sufficient sewage outflow even at peak flows for the sewer pipes to be self-cleaning. The expected solids consisting of faeces, paper, condoms and other disposal materials may not have sufficient water

for transport to the lift station. The expected solids dropout could over time create continued maintenance problems and ultimately increase the cost of maintaining the sewage system.

There may be problems created if too few houses are connected to the sewers. Firstly, during periods of low flows (at nights between 12 p.m. to 6 a.m.) very little sewage is available to the lift station, and if the facility were not designed to handle these low flow conditions, very long periods would pass to fill the pump well before pump drawdown occurs. This could lead to septic sewage formation in the pump well, creating odour problems.

The discharge from the force mains may also be septic as it may have an additional hour or more of retention in the pump main because of periods of low flow. The odour in the collecting manhole could be very offensive.

**Noise from the lift station** also poses another problem. The lift station will require an onsite standby generator. If not properly maintained, this noise from this piece of equipment can be quite disturbing at nights.

Of the total lots in the subdivision, sewage from approximately 160 lots on the south side of the hill will be diverted to a lift station for collection and pumping. This has implication for increased costs:

- a) **Power costs for pumping not normally associated with gravity flow systems:** It is estimated that this cost will be J\$690 per day assuming that the National Water Commission obtains power at US\$0.12 per kilowatt hours;
- b) **Capital Costs for establishing Pump Station:** There would be added capital costs to the developer associated with establishing a pump station for these 160 lots located on the south side of the hill; and
- c) **Maintenance Costs for the Pump Station:** The National Water Commission would be faced with an additional cost for maintaining the pump station. This cost would include electromechanical and plumbing maintenance, labour/ man power for station inspection & security, transportation, cleaning of the pit and sundries such as grease oil, etc. and is estimated at J\$250,000.00 per annum.

### 5.2.3 Drainage Options

Storm water runoff from most of the lots should be collected along paved gutters for discharge at various locations throughout the subdivision. The longest drainage path is approximated at 460m (1,500ft.).

The southwestern-side of the subdivision will discharge at a minimum of five locations. The stormwater will flow through undeveloped lands towards drainage systems in the Mountain View Avenue area. The subdivision on the northeastern-side of the mountain will likely discharge in nine locations. Four of these discharge points will flow towards the Mona Reservoir, while the other five will discharge towards College Commons.

Drainage discharge into the Mountain View Avenue area is of concern. With full development of the site storm flow could increase by 50%. On the Mona side of the Mountain, a fully developed cut off drain before the Mona Reservoir will become necessary as pollutants (silts, oil, garbage, etc.) into the water storage facility are now a definite possibility. Drainage into the College Common area will flow into the existing August Town Gully.

### 5.2.4 Water Supply Options

The water supply options available to the development include:

- a. Abstraction of water from wells; and
- b. Obtaining Water from the National Water Commission.

However, the report concludes that the Developer should obtain water from the National Water Commission. **Although it is technically feasible to tap into the National Water Commission's Facility, it is unlikely that there will be sufficient water to deal with the increased demand of the proposed development. Historically, there has been a shortfall from the Mona Reservoir, and this has resulted in regular water lock-offs in Mona, Beverley Hills, College Commons and its environs to conserve water. One such example is the reduction in storage as a result of reduced inflow in May, 1997. This period saw the Reservoir having only 38 days supply.**

It is anticipated that the Mona Estates site will require an additional 275,000 imp. gal storage facility. Gravity flow from this storage facility will be adequate to provide acceptable water pressure throughout the subdivision. For the Beverley Hills development, the increased demand in water supply suggests the need for an additional storage facility of 185,000 imp. gal.

### 5.2.5 Development of Roadways

Assuming an average side slope on the mountain of about 25% and the percentage rock in excavations at 70%, the cost for constructing roadways could average about \$13,300.00 per meter of roadway. This is 57% higher than similar construction in compacted earth. This cost would have to be met by the Developer in order to create suitable access to the development.

The EIA study indicates that there will be an increase in traffic flow should the developer proceed with the development. Not only does the contribution to increased traffic of the new development have to be considered but it should be noted that surrounding subdivisions such as the Pines of Karachi will contribute significantly to increased traffic. Combined with traffic from the University of the West Indies, the problem will be exacerbated and as indicated previously, many of the road networks are unable to easily accommodate existing traffic flows. Road improvements (widening of roads, installation of traffic signals, etc.) will be required to accommodate the increased flows.

## 6.0 ENVIRONMENTAL MITIGATION PLAN AND MONITORING PROGRAMS

### 6.1 Environmental Mitigation Plan

#### a. Development Controls

To mitigate against excessive erosion and possible landslides, the northeastern slope should be left undisturbed and therefore, no construction is recommended in this fractured rock zone. This recommendation affects primarily the Beverley Hills Development as much of the fractured zones are found in this area.

Although more difficult to control, debris flow and other water bearing sediment flows can be partially controlled by cut-off-trenches at the foot of the slope on the southwestern side of the Reservoir. To reduce surface water runoff from the site into the reservoir and the surrounding communities of Beverley Hills, Hampstead Park and College Common, runoff should be properly channeled into existing gullies. The removal of vegetation on steep slopes will exacerbate the potential for increased soil erosion and landslides. Therefore, where possible minimal vegetation should be removed to reduce this impact.

#### b. Control of Blast Vibrations

In order to control blast vibrations and minimize damage to structures and facilities in the immediate environment, peak particle velocity of the waves generated from blast operations should not exceed 1 inch per second. Seismographs should be used to monitor each explosion as a means of control. The experienced contractor should be required to have adequate insurance coverage as a prerequisite for undertaking the work.

## c. Construction and Post Construction Phases

### i. Fugitive Dust

The problem of fugitive dust formation due to the transportation and stockpiling of construction material (marl, sand and gravel) may be greatly reduced if the following mitigative actions are followed. During heavy winds or the transport of construction materials, the dust particles of any unpaved road may become airborne and add to dust pollution. To mitigate this problem, the unpaved roads should be properly rolled and sprinkled occasionally. During the transportation of all construction material, the material should be sprinkled with water and then covered with tarpaulin. This will reduce the potential for dust particles to become airborne.

The same procedures can be applied to construction material stored on site. During construction, workers should be protected by wearing dust masks.

### ii. Disposal of Construction Debris

Any construction material that has been used should be disposed of properly. If the waste is not disposed of properly this may pose a health hazard to the workers and surrounding community, (e.g. mosquito breeding in paint pans) but it is also aesthetically displeasing. Construction waste should be disposed by a suitable solidwaste collection system on or off site (eg at an approved dumpsite).

### d. Ecological Environment

Large trees on the property should be preserved for their aesthetic beauty and also as a habitat for bird species. Similarly, when landscaping the site after construction, invasive or exotic species should not be used in order to preserve the natural habitat of the area. The stated conservation areas should be monitored for squatting and cultivation. This will ensure that some of the existing vegetation is preserved and reduce the amount of soil erosion as a result of the removal of vegetation cover.

## 6.2 Environmental Monitoring Programme

### a. Water Quality

Testing for Biochemical Oxygen Demand (BOD), phosphates, nitrates, oil/grease, faecal and total coliform levels in the wells surrounding the site and also the intake pipes into the reservoir should be conducted on a monthly basis during the construction and post construction phase. This data can then be used as a comparison to determine the impacts, if any, of the proposed developments on the Mona Reservoir and the underground water system.

### b. Drainage

To ensure that the reservoir is not at risk from runoff from the proposed Mona Development, gullies that will channel the water should be regularly cleaned of debris and garbage. This will help to facilitate the free flow of water from the site to the designated areas, preventing undue siltation of the reservoir.

Similarly, a cut off drain before the Mona Reservoir will be necessary to protect the storage facility. Regular surveys should be conducted every quarter to check the suitability of the culverts for removing excess water from the site during periods of heavy rainfall.

## 7.0 CONCLUSION

The National Housing Development Corporation, formerly Operation PRIDE has proposed to develop the Long Mountain Region. The sites that have been identified for the proposed development are Mona Estates and Beverley Hills. Both areas share a common boundary and

xv



are located on the ridge top above the Mona Reservoir. The amount of land being considered for development totals 520 acres (210.5 hectares). Of the 520 acres owned, 196 acres (80.5 hectares) are proposed for development. The remaining 324 acres (133.2 hectares) have been recommended as land for Conservation.

The Long Mountain Range has been the focus of many nature enthusiasts and scientists since the mid-nineteen forties having been the last oasis in the urban area of the parish of St. Andrew. Bird and botanical watchers have used this particularly unique site as an area of intense study. The species found there are an indication that the area has been the home of flora and fauna that have had to recede into the mountainside for mere survival and therefore, houses some of the most unusual and unexpected species. Rare species of plants and animals such as the *Coccoloba* sp., *Morinda royoc* and the Leaf Cutting Ant (which have not been recorded anywhere else in Jamaica and is a newly discovered species) have been identified in the Long Mountain. The proposed housing development will reduce the habitats for these biota.

The 1966 Kingston Development Order clearly indicates that the remaining area of the Long Mountain excluding Beverley Hills is zoned for **Public Open Space**. This was based primarily on the following reasons:

1. To serve as a visual amenity in the area. The 1966 Kingston Development Order recognized that conservation plays a vital role in providing open space/recreation for urban dwellers. Such recreation includes picnicking, hiking and various forms of wildlife observations. As such, the Long Mountain region was designated as a public open space. Therefore, the project site is important for scenic value, outdoor recreation, watershed protection, wildlife preservation and scientific study;
2. To protect the Long Mountain Watershed that contributes to the recharge of the wells located on the Long Mountain.

Etzel (1978) indicated that the ratio of open space per 1,000 inhabitants in Kingston is 2.32 acres per 1,000 inhabitants. Therefore, if one were to utilize Long Mountain or part thereof for housing, one would further reduce the available open space in Kingston, particularly at a time when there are plans afoot to utilize part of Hope Gardens for housing. The area has also been extensively used as an ecological site for nature enthusiasts and scientists alike. Therefore, it holds not only an ecological value but has a social value to the community.

The proposed developments will increase the **threat of contamination to the Mona Reservoir**, primarily through sewage. Other threats include contamination from garbage, oil and surface runoff from the housing development. It has been estimated that surface runoff will increase by 50%. This is expected to have negative impacts on drainage in communities such as Beverley Hills, Hampstead Park and College Common and may even result in localized flooding. The increase in surface runoff into the Mona Reservoir and possible into the expanded reservoir could negatively impact the water quality in the reservoir.

The National Water Commission wells located on the Long Mountain are also at risk from sewage contamination. These wells have been identified for rehabilitation and de-nitrification in order to produce five million imp. gal./day to supplement the estimated shortfall in the Kingston Metropolitan Region (KMR). This is part of the programme being undertaken by the Ministry of Water to meet the supply deficit of 15 million imp. gal./day in the KMR.

The development is located to the north of a 56-acre property owned by the Ministry of Environment and Housing and a community informally known as 'Back Bush'. Back Bush is a severely economically challenged community and is renown for its volatile nature. Therefore, this poses a **potential security problem** for the development and its environs.

Of concern is the **increase in traffic** through the community of Beverley Hills, Mona and Old Hope Road. The existing road network does not appear to be able to support the potential increase in traffic flow on Mona Road and Wellington Drive. Road improvements (widening of

roads, installation of traffic signals, etc) will be needed to accommodate the increased traffic flow. Citizens have expressed their concerns in this regard and have indicated that the new developments will only exacerbate an increasing problem.

The study indicates that the development will also increase the demand for **water** by 153,400 imp.gal/day. Citizens have indicated that they already experience frequent water shortages during the summer months. An additional 372 units will only exacerbate the problem.

An **analysis of options** for water supply, sewage treatment and disposal, traffic issues and geotechnical consideration were done by the Consultants. This analysis shows that the best options for water supply and sewage treatment and disposal were:

- a. **Water Supply:** Obtain water from the National Water Commission's supply.
- b. **Sewage Treatment and Disposal:** The best option for the development is to tie into the existing NWC's Sewage Treatment System.

However, these options will create additional stress on the National Water Commissions water supply and sewage systems.

The study also revealed that there were a number of problems associated with the **sewage disposal**. These were:

- a. Although the development will be fully sewered, there remains the risk of uncontrolled flow of sewage into the wells at the foot of the Long Mountain and the Mona Reservoir;
- b. Sewage collection is from the front of some lots and the back of others. This will impose additional costs due to the need for additional sewers. We have approximated the costs of sewers as \$5,700.00 per meter of roadway;
- c. There may be problems created if too few houses are connected to the sewers. Under this scenario, during periods of low flows very little sewage is available to the lift station, and if the facility was not designed to handle these low flow conditions, very long periods would pass to fill the pump well before pump drawdown occurs. This could lead to septic sewage formation in the pump well and main, creating odour problems, corrosive and toxic gases; and
- d. Increased costs for the construction, operation and maintenance of a pump station for 180 lots located on the south side of the hill. Power costs are estimated at J\$690 per day, and maintenance costs are estimated at J\$250,000 per annum.

However, should the developer decide to proceed with the proposed housing development, the following **mitigation measures** should be implemented:

#### **Development Controls**

To mitigate against debris flow and other water bearing sediment flows cut-off-trenches at the foot of the slope on the southwestern side of the Reservoir are recommended:

To reduce surface water runoff from the site into the reservoir and the surrounding communities of Beverley Hills, Hamstead Park and College Common, runoff should be properly channeled into existing gullies.

Large trees on the property should be preserved for their aesthetic beauty and to provide a continued habitat for bird species. Similarly, when landscaping the site after construction, invasive or exotic species should not be used in order to preserve the natural habitat of the area.

#### **Water Supply**

The best option for the project is to utilize the existing water supply system provided by the National Water Commission (NWC). However, the **Mona Estate** site will require an

additional 275,000 imp. gal storage facility. The **Beverley Hills** site will require an additional 185,000 imp. gal storage facility.

The following **monitoring programme** should also be followed in order to ensure that the mitigation methods are effective:

#### **Water Quality Analysis**

Testing for Biochemical Oxygen Demand (BOD), phosphates, nitrates, oil/grease, faecal and total coliform levels in the wells surrounding the site and also the intake pipes into the reservoir should be conducted on a monthly basis during the construction and post construction phase. This data can then be used as a comparison to determine the impacts, if any, of the proposed developments on the Mona Reservoir and the underground water system.

#### **Drainage**

To ensure that the reservoir is not at risk from runoff from the proposed Mona Development, gullies that will channel the water should be regularly cleaned of debris and garbage. This will help to facilitate the free flow of water from the site to the designated areas, preventing undue siltation of the reservoir.

Similarly, a cut off drain before the Mona Reservoir will be necessary to protect the storage facility. Regular surveys should be conducted every quarter to check the suitability of the culverts for removing excess water from the site during periods of heavy rainfall.