DESCRIPTION OF THE ENVIRONMENT

3 DESCRIPTION OF THE ENVIRONMENT

3.1 LAND USE AND GEOLOGY

3.1.1 LAND USE

The primary focus of this EIA report centers around the establishment of new bauxite mines, a new loading station, rehabilitation of a railway transport corridor and other related aspects of the industry in the North Manchester area.

These establishments are recognised as requiring access to and the use of significant amounts of space, some of which may be in use for residential, commercial, farming or other uses. In this section we utilise combinations of historical data and information with observations, ground-truthing and knowledge of the area. The culmination of our efforts is summarized in Figure 3-1 below.

3.1.1.1 TOPOGRAPHY

The topography of Manchester is undulating with escarpments and highlands of which the most prominent are the Carpenters Mountains, Mile Gully Mountains, May Day and Don Figuerero Mountains.

3.1.1.2 AREA AND LAND COVER

The parish of Manchester occupies an area of 791.6 sq.km, while the proposed mining area covered under SEPL 530 occupies an area of 74 sq.km.

Manchester accommodates a scattering of villages and other urban settlements. Mixed cultivation is confined to the northern regions. Bauxite deposits have impacted on the levels of mixed cultivation. Large areas in the valleys are now used as pasture lands, some areas are in woodland and ruinate providing poor grazing for small herds of cattle and goats.

Citrus is cultivated in some areas as are mixed crops such as corn, coffee, Irish potatoes, pimento. Upland areas are cultivated in ackee, breadfruit, mango, cocoa, etc.

The Northern area comprises forests and forest reserves, within conservation areas.

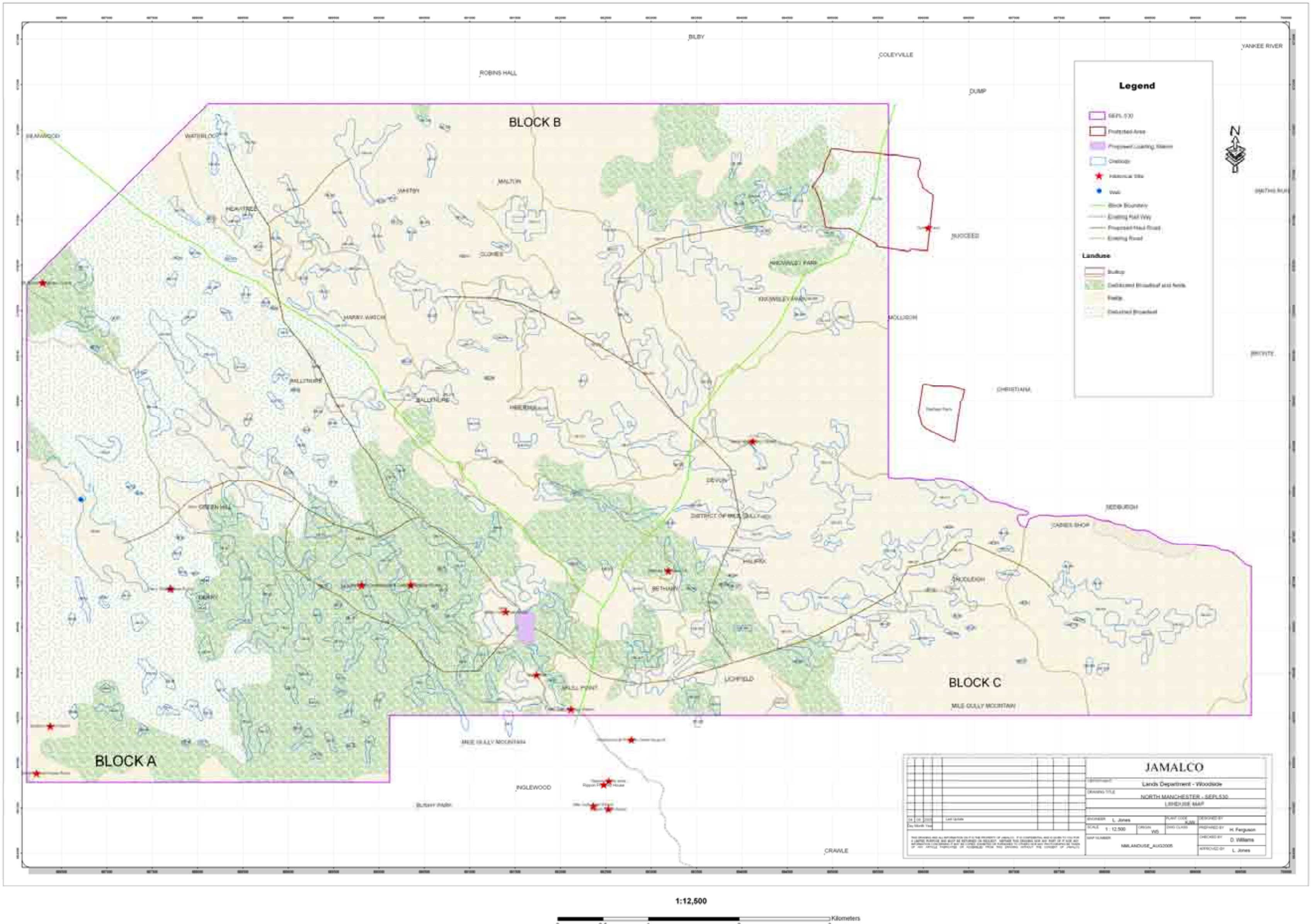


FIGURE 3-1: LAND USE MAP FOR SPL 530

3.1.1.3 LAND CAPABILITY

Agricultural land capability in Manchester varies between classes I, II, III and V. The following table identifies the suitability of each class. (Table 3-1 below)

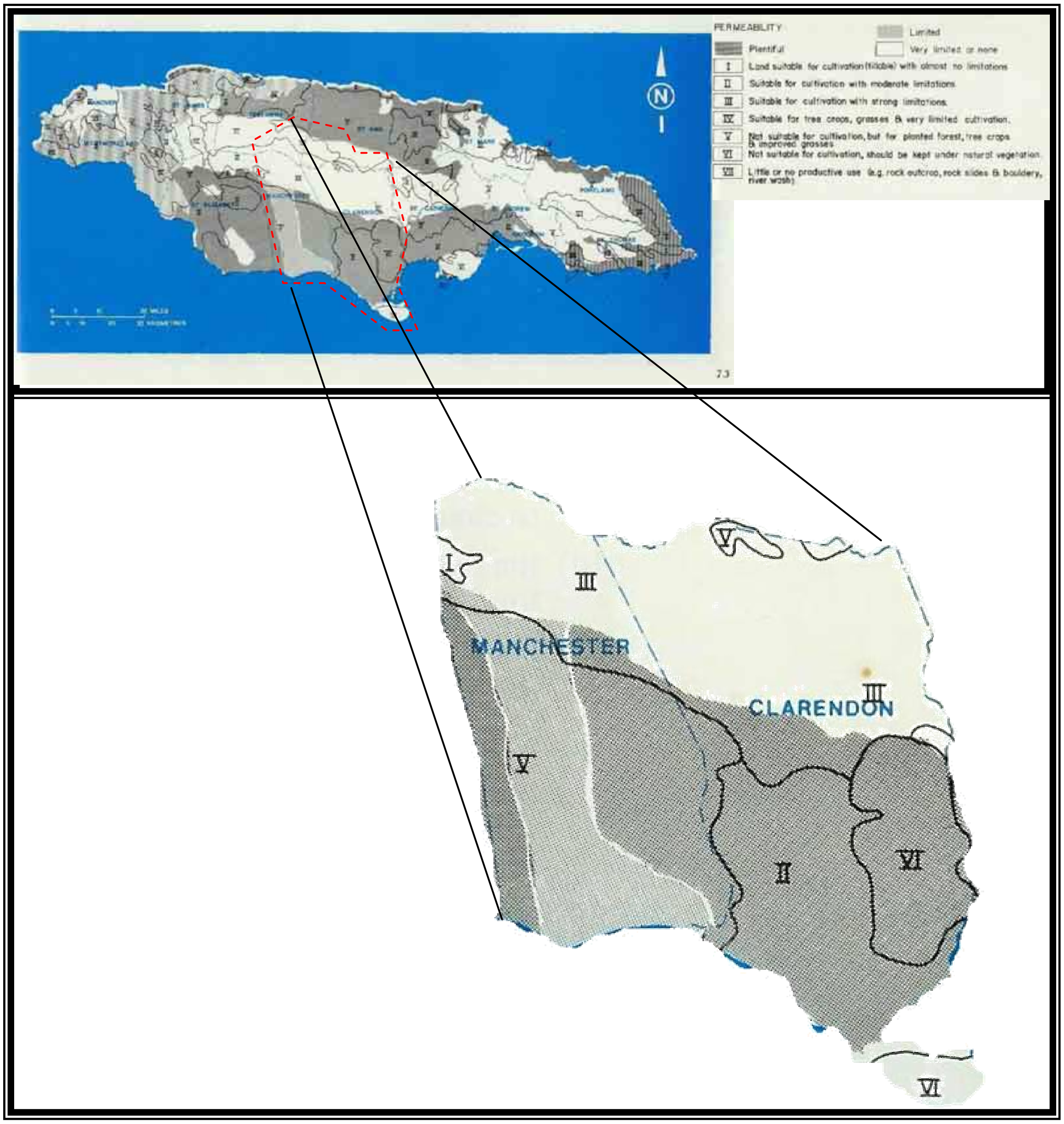


FIGURE 3-2: AGRICULTURAL LAND CAPABILITY[1]

[1] **Jamalco**, *Environmental Impact Assessment for 2.8 Million Metric Tonne Per Year Efficiency Upgrade At Jamalco,* Conrad Douglas and Associates Limited, July 2004

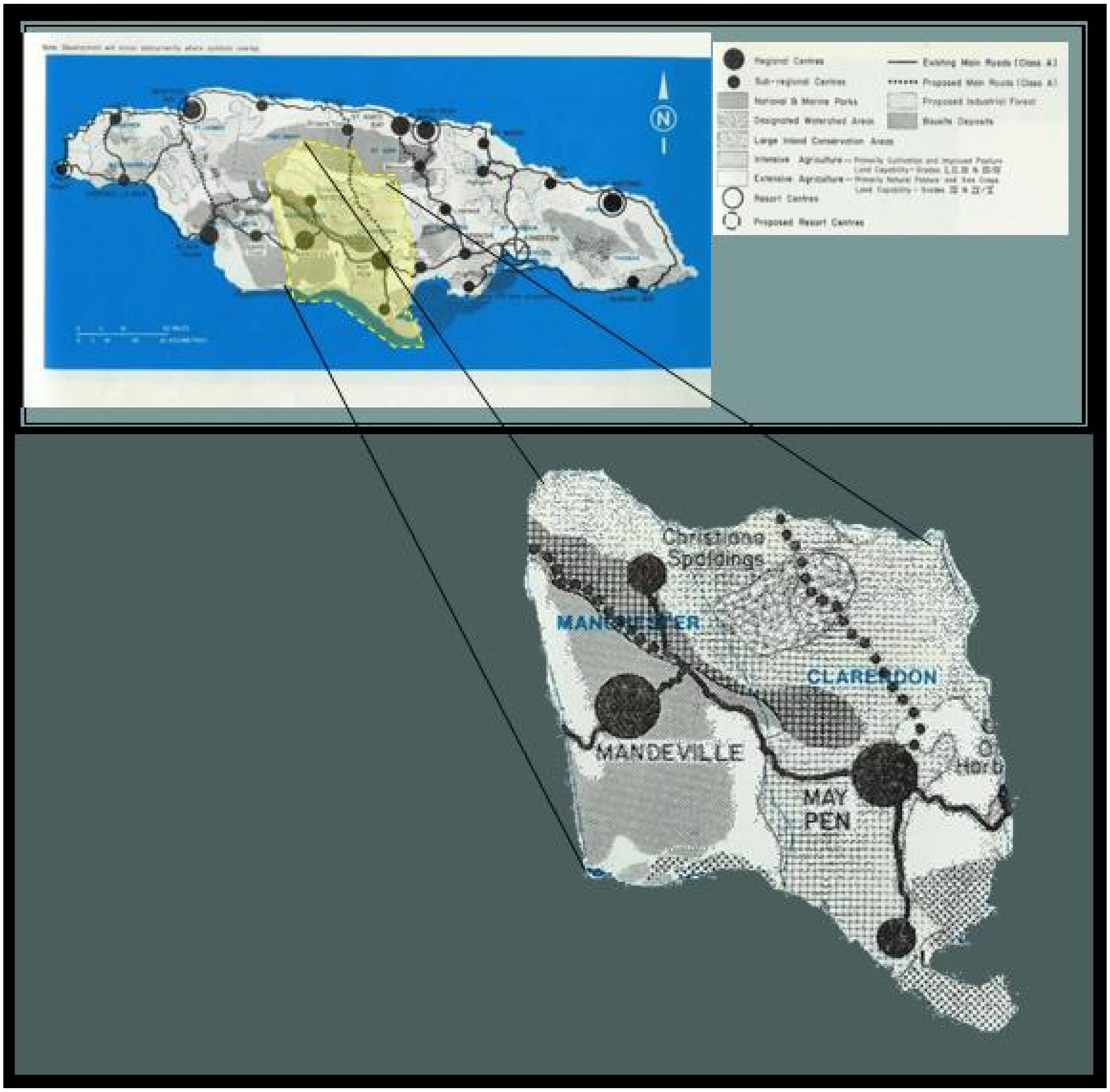
TABLE 3-1: AGRICULTURAL LAND CAPABILITY[1]

LAND CLASS	CAPABILITY	PERMEABILITY
I	Suitable for cultivation (tillable) with almost no limitations.	Plentiful
II	Suitable for cultivation with moderate limitation	Plentiful
III	Suitable for cultivation with strong limitations (See Plate 3-1 below)	Very limited or none
V	Not suitable for cultivation, but for planted forest, tree crops and improved grasses	Limited
VI	Not suitable for cultivation – should be kept under natural vegetation.	Plentiful


PLATE 3-1: YAM FARMING (LEFT), YAM FARMING AND HOUSES ON BAUXITE LAND

3.1.1.4 DEVELOPMENT STRATEGY

The long term land management and development strategy is to allow for available resources to be used in a manner that ensures maximum economic benefits without contravening the general principles of conservation. In this regard there are definitions of growth centres for urbanization and conservation. Land uses include agriculture, national & marine parks, watershed areas, industrial forests, resort centres and bauxite deposits. (Figure 3-3)



<u>FIGURE 3-3: DEVELOPMENT STRATEGY[1]</u>

Physical, social and economic growth and development over the last 30 years, have been influenced by the bauxite/alumina industry through Alcoa, Alpart, and other foreign interests largely enhanced by Alcan of Canada (now Windalco). Mandeville, the parish capital, has become a strong financial and commercial location as also an important administrative centre which continues to experience growth.

Residential and commercial uses are developed in urban areas designated as villages, district centres, sub-regional centres and regional centres. The latter three are classified in the National Physical Plan 1978-1998.

In addition, there are scatterings of linear and star shaped villages along roadways and road intersections throughout Manchester, which have not been classified as growth points, though they continue to sprawl, leap frog and become conurbations.

3.1.1.5 INDUSTRIAL

Light industrial land use is confined to the hierarchy of rural/urban settlements and linear occupancy along district, sub-arterial and arterial roads. Heavy and special industrial plants include bauxite processing plants at Kirkvine (Windalco) and at Halse Hall (Jamalco).

Transportation and access routes, e.g. all classes of roads and railway lines link all urban centres and also penetrate agricultural areas, national parks and conservation areas.

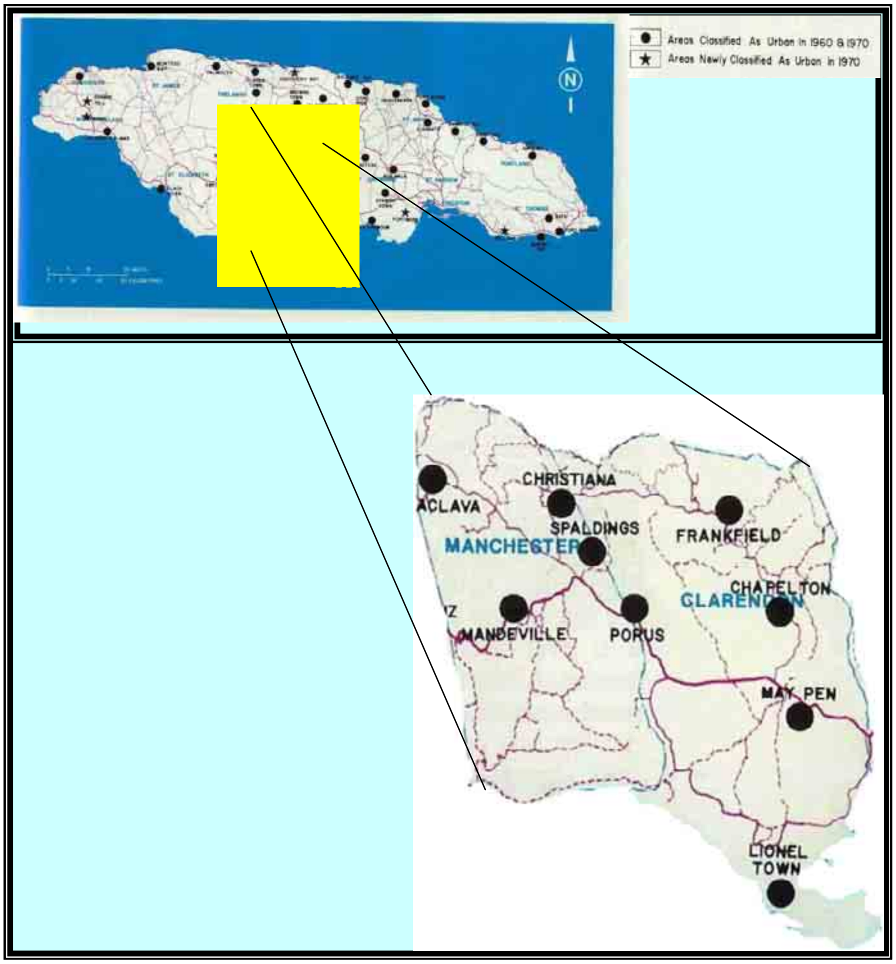


FIGURE 3-4: AREAS CLASSIFIED AS URBAN[1]

3.1.2 URBAN SETTLEMENT DEVELOPMENT

TABLE 3-2: Urban Settlement Develpment

MANCHESTER – HEIRARCHY OF GROWTH CENTRES		
District Centres	**Sub-Regional Centres**	**Regional Centres**
Mile Gully	Christiana	Mandeville
Williamsfield	Spaldings	
Medina		
Ballynure		

3.1.2.1 PARISH COUNCIL/LAND USE ZONING

Manchester is covered by a Development Order and subsequently falls under the aegis of the Town and Country Planning Act. Thus any form of development requires an application to the relevant Local Planning Authority (Parish Council) for permission to carry out building, engineering and mining operations or change in the use of land or buildings.

There are no specific demarcated zones for land use, but there are general statements of intended uses, supporting requirements and standards.

3.1.3 AESTHETICS

There are several areas of outstanding natural beauty, visual and recreational amenity, and therapy. There are also areas which are aesthetically appealing and spiritually inspiring. The views from Spur Tree over the slopes toward the Alligator Pond and Canoe Valley coastal areas are magnificent. In additional there are remarkable 360° scenic views from the North Manchester Highlands

A wide variety of microclimates exits throughout the parish, ranging from cool climatic conditions in Northern Manchester to warmer, drier conditions towards the southern coast of the Parish. The areas under study are adequately provided with transportation infrastructure – roads, railway; power transmission; and social infrastructure – hospitals (Mandeville, Spaldings), police stations, post offices, some government offices, schools, etc.

3.1.4 POTENTIAL USES

The Parish of Manchester is a designated watershed area. Some areas are designated as national parks and protected areas. Some are likely to be zoned for specific classification of industrial uses and buffer zones to avoid conflict and potential nuisances between industrial and residential users.

Most of the potential land uses in Manchester consists of future mining areas, existing mining areas and mined out lands for rehabilitation, forests and grassland.

The proposed project from JAMALCO includes the establishment of new mines, a new loading station and transportation corridors connecting the mines ultimately to the refinery in Halse Hall, Clarendon. The area to be mined is identified in the National Physical Plan 1978 – 1998 as Region D, the Manchester-Clarendon Region (Figure 3-5). Manchester has been extensively zoned and leased for bauxite mining operations.

FIGURE 3-5: PLANNING REGIONS[1]

3.2 GEOLOGY

3.2.1 Geological History

3.2.2 Geomorphology

There are three main geomorphologic features in the Manchester area of the Rio Minho basin, Manchester Highlands sub-basin.

- The rugged and well dissected Cretaceous volcaniclastics to the north (of Christiana)
- The highland areas of Tertiary limestones with different stages of karstic development
- The flat Pleistocene-Recent river alluvium along the South Manchester coastline between Round Hill in the east and Old Womans Point in the west

3.2.2.1 Landforms On The Cretaceous Volcaniclastic Area.

The landforms are rugged and highly dissected. The dissection of most of the Cretaceous Central inlier is related to the Rio Minho River and its Tributaries. The Rio Minho flows to the east through Clarendon to the sea.

3.2.2.2 Landforms Of The Limestone Areas

The following landforms related to the karst areas can be recognized.

1) Karstlands of high relief with glades not well developed to the west of Mandeville

2) Karstlands of low relief with high cone density i.e. glades not well developed and dolines have little bauxite cover (west of Spur Tree)

3) Karstlands on steep slopes with collapsed features (concentric area from Spur Tree along the Coast and north to St. Jago west of the Milk River)

4) Karstlands with ridges and cones separated by bauxite filled glades (Manchester Plateau)

5) Flat sloping high level plain covered with thick bauxite soil (Roberts Run-Bousue area)

The areas showing the most mature karstic features are the northern and western sections of the Manchester Highlands; the proposed mining area (SPL 530) is one such area. (See Figure 3-6)

3.2.3 STRUCTURE

3.2.3.1 GENERAL

The Manchester Highlands area is situated on the south central section of the Clarendon Block, which is delineated on the east and west by the NW-SE trending Wagwater and Cambridge – Santa Cruz faults, respectively. The E-W Duanvale fault system defines the northern boundary. The bedding planes of the Newport Limestone seem to indicate a general shallow (5^0 – 10^0) dip to the east. The Manchester Highlands is in fact, tilted slightly to the east.

3.2.3.2 FAULTS

Two main sets of faults cut the Manchester area. They trend:

- NNW- SSE and
- E-W

Mid-Miocene normal faulting initiated a subdivision of the area into elongated blocks trending NNW-SSE and late Pliocene-early Pleistocene tectonics produced renewed movement along old features. East of the Mile Gully synclinal axis step-faulting is consistently down to the west, while to the west of the axis, down-throw is to the east. The pattern again changes at the Spur Tree Fault, which down-throws to the west. This is believed to be related to the Spice Grove anticline. Thus an intimate relationship between faults and folds is found suggesting that they are genetically related. It appears that the Mile Gully syncline is the centre of collapse of a graben structure of which the Williamsfield Trough is but a part.

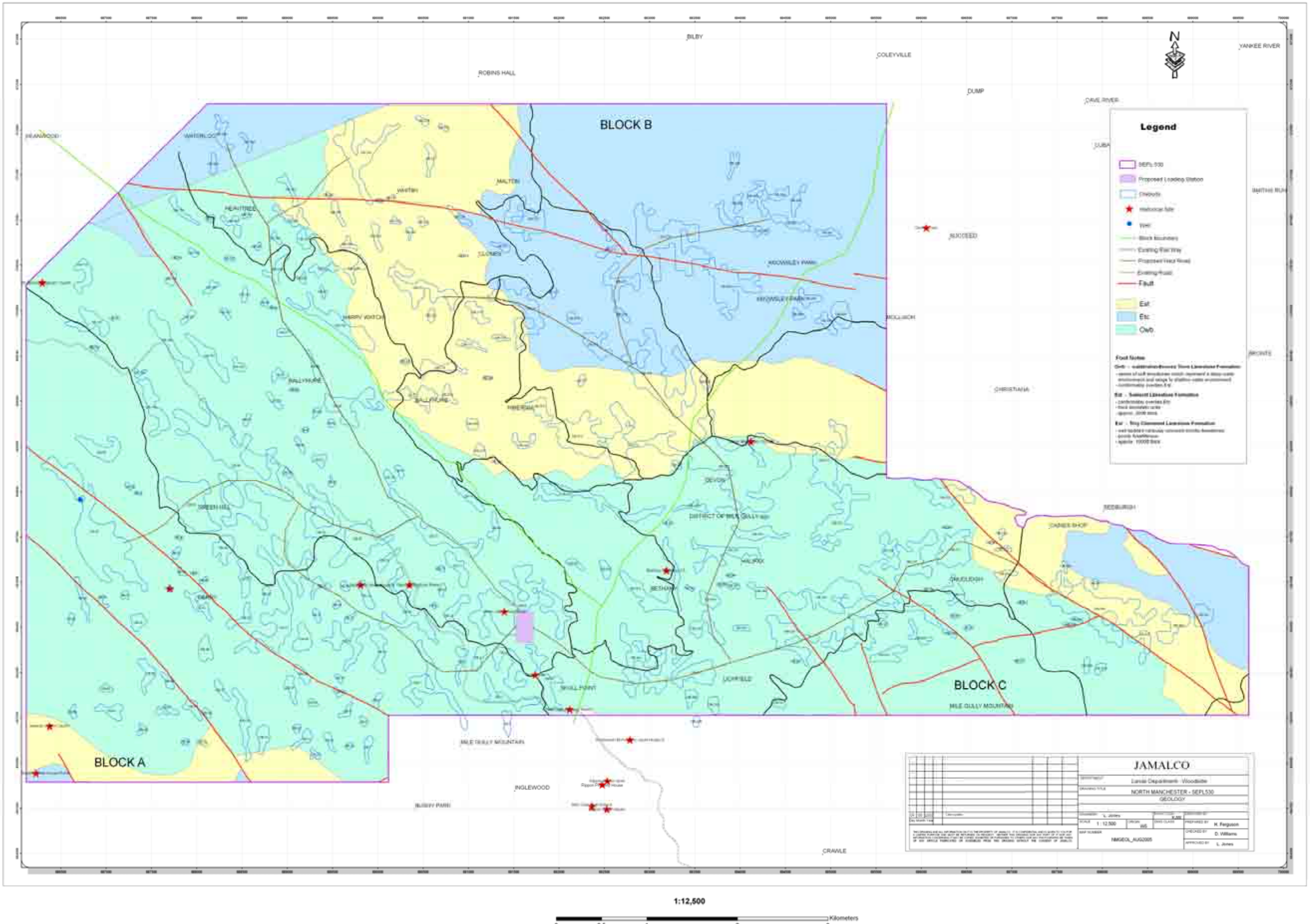


FIGURE 3-6: GEOLOGY FOR SPL530

The complementary NE-SW faults are generally poorly developed, and only become important as crushed zones (which have implications for groundwater flow) in the southern and western Manchester Highlands.

There are two important sets of E-W trending fault zones which traverse the northern and southern boundaries of the area. The northern E-W crush zone, which passes through Spauldings, is believed to be the western extension of the Crawle River Fault, which Coates (1965) believes to have both lateral and vertical movement.

The Sixteen Mile Gully Fault extends from Round Hill in the east to Blenheim in the west. Several splay faults trending NNW-SSE join the Sixteen Mile Gully Fault.

A series of faults run parallel to the coast between Old Womans Point and Round Hill.

The two most important north-south trending faults are the Whitney and the Queen Town Hill Faults. Both faults are thought to be the east and west boundaries respectively of the Williamsfield “Trough” or “Graben”. This is discussed in more detail below.

3.2.3.3 WILLIAMSFIELD “TROUGH” OR GRABEN

A Graben is a “down faulted block generally linear, bounded by gravity faults”.

The Williamsfield Graben constitutes the major structural element of the Manchester Parish and the Rio Minho Hydrologic Basin. It is marked by a valley extending from Balaclava, St. Elizabeth through Mile Gully, Williamsfield, Porus and into Clarendon. The centre is marked by a line through Mile Gully, Williamsfield and St. Toolies to the scarp at St. Jago in Clarendon.

In the Balaclava area, the structure either shallows or dies out against the central inlier or the Crawle River Fault.

The Whitney Fault, which is considered to be the eastern boundary of the Williamsfield Graben, may be a gravity fault with its axial plane dipping to the west. The western boundary of the graben is considered to be the Queen Town Hill Fault which can be traced along the eastern border of the May Day Mountains, paralleling the Alligator Hole River in the south through

Mango Tree, and Broad Leaf where it curves to the WNW through Royal Flat to the north of Mandeville.

3.2.4 ECONOMIC GEOLOGY

The economic potential of the Manchester area depends largely on the bauxite deposits located atop the Manchester Highlands (Plateau) and developed from the weathering of the Karst landscape. Large areas of the May Day and the Carpenters Mountains are known to have bauxite deposits and are under licence to either Alcoa (Jamalco) or Windalco.

Black sand deposits occur along the coastal strip between Farquhars Beach to the west and Old Womans Point to the east. These sands are magnetic and the deposits contain both ilmenite and magnetite. The deposits at Old Womans Point lie on a platform some 6 metres above sea level.

The limestones and dolomites that cover the majority of the area are used sparingly and if used is mainly for aggregate and road construction. A full economic appraisal of the limestones needs to be undertaken in light of the increased demand for industrial minerals both locally and overseas.

3.3 HYDROLOGY

3.3.1 GENERAL

Underground water has been used in the Rio Minho Hydrologic Basin since the early 1900. The Manchester Highlands as a part of this basin is partially supplied with groundwater for domestic purposes, not from wells drilled on the plateau, but from wells drilled to the east at Porus and to the west at Pepper, St. Elizabeth.

The Manchester Highlands occupy an area of 358 km^2. The area is composed entirely of limestone of the White Limestone Group. The primary Limestone Formation is the Miocene aged Newport member.

The Limestone plateau rises steeply from the sea to an elevation of over 300 metres. The thickness of the limestone, as pointed out in the Geology section, is expected to be at least 1500 metres.

The limestone being highly karstified has no surface drainage except in small glades and only in the extreme rainy season.

Five (5) water supply wells have been identified in the environs of Northern Manchester. At present, Jamalco, the NIC, WRA and the NWC are in discussions to implement a water supply solution that will allow for improved supply of potable water to communities in the area and supply the mining operations (See Plate 3-2 and Figure 1-3)


PLATE 3-2: EXISTING WELL AT EVERGREEN (AREA FLOODED)

The wells identified are:

Well Name	Easting	Northing	Owner
Evergreen	685953	666568	Projects for People
Union	680467	668427	NWC
Oxford (Balaclava 2)	682768	671155	NWC
Union (Balaclava 1)	680467	668427	NWC
Evergreen Mile Gully	685770	667848	Windalco

3.3.2 HYDROSTRATIGRAPHY

A hydrostratigraphic unit is a geologic formation (or series of formations) which demonstrates a distinct hydrologic character. Geologic formations are classified either as aquifers or aquicludes.

Rock formations with sufficient permeability to support perennial well and/or spring production are classified as aquifers. Rock formations with low permeability and which do not support perennial well and/or spring yield are classified as aquicludes. Surface water is the main potential of aquicludes because of their low permeability.

Within the Manchester Highlands, the limestone aquifer is the principal hydrostratigraphic unit. It occupies an area of 358 km^2 or 21% of the area of the Rio Minho Hydrologic Basin. The entire South Manchester area has the limestone formation as the main aquifer. Figure 3-7 below illustrates the hydrostratigraphy of the Manchester Highlands, and Figure 3-8 illustrates the hydrostratigraphy for the proposed mining area (SPL530).

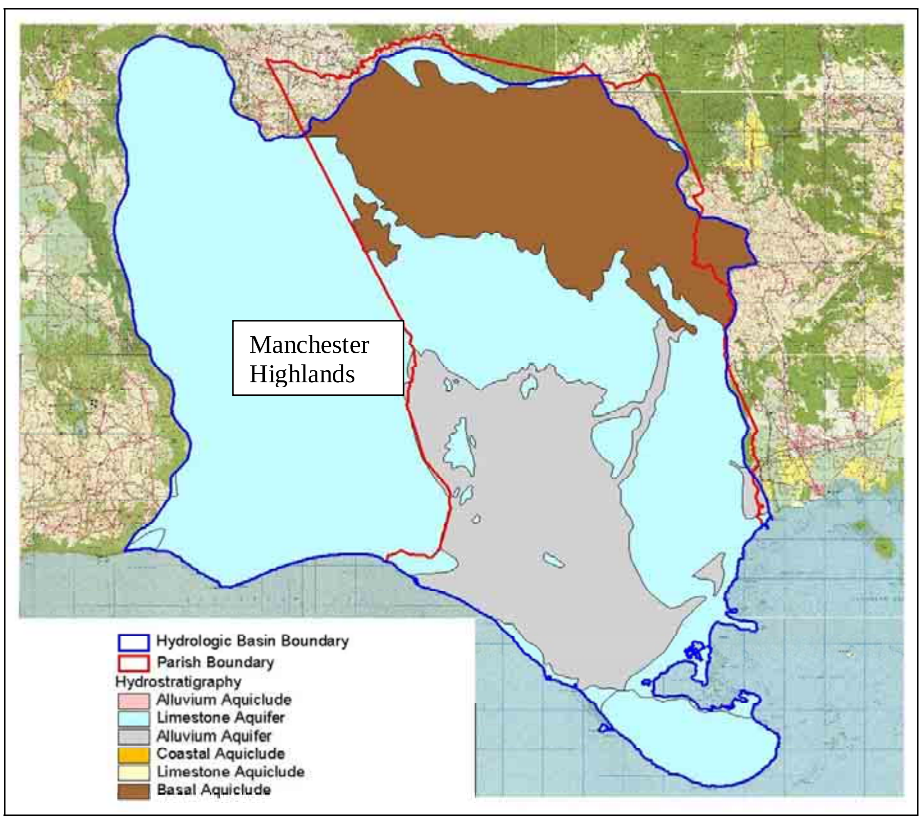


FIGURE 3-7: RIO MINHO HYDROLOGIC BASIN (INCLUDING MANCHESTER HIGHLANDS) HYDROSTRATIGRAPHY

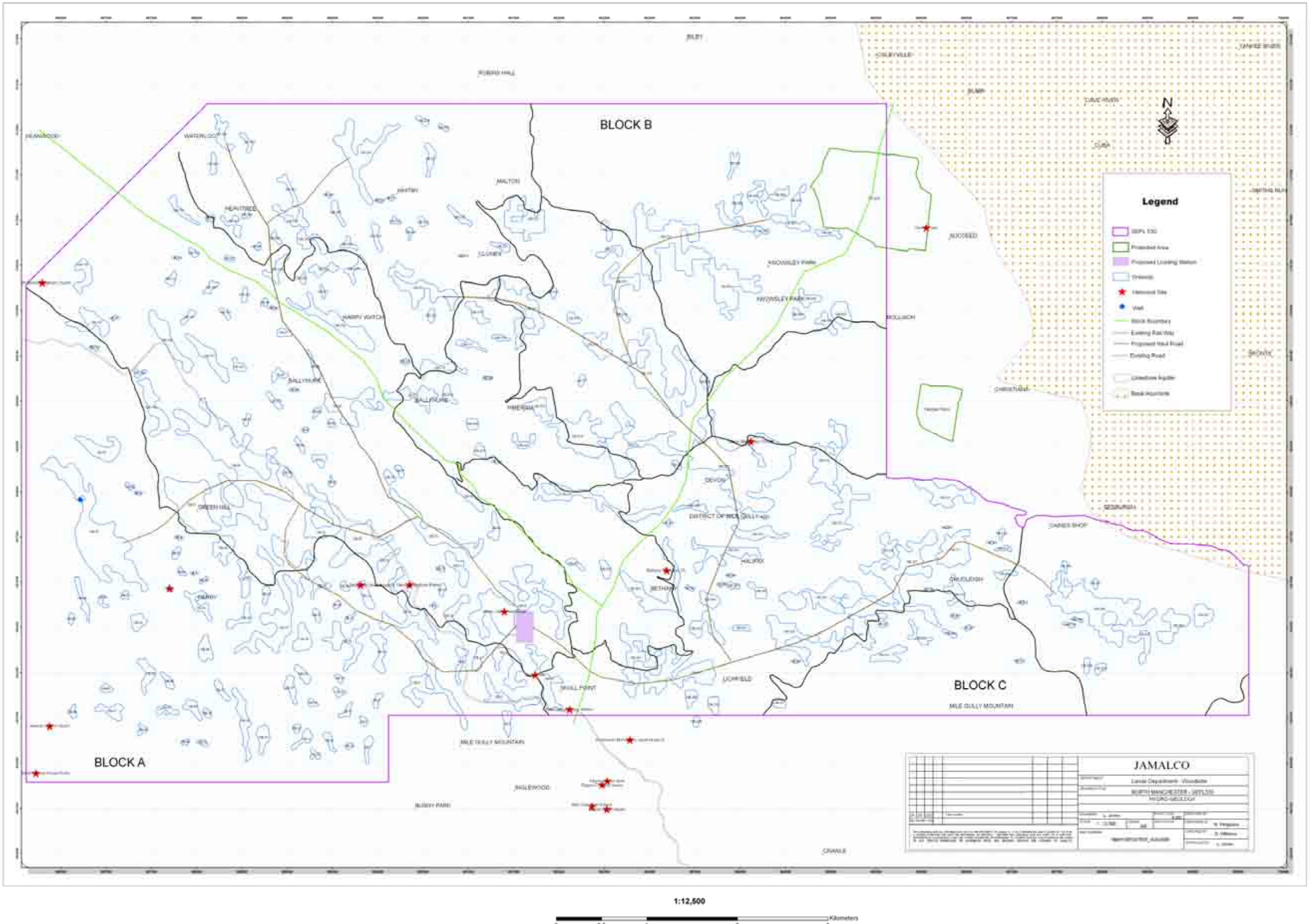


FIGURE 3-8: HYDROSTRAITIGRPHY OF SPL530

3.3.3 WATER RESOURCES POTENTIAL

The water resources potential of the Manchester Highlands falls into 3 types.

- Rainfall
- Surface Water Resources
- Ground Water Resources

3.3.3.1 RAINFALL RESOURCES

Average annual rainfall increases from 1000 mm at the coast to a maximum of 2045 mm at Mandeville in the north. Harvested rainfall was estimated at 0.45 Mm^3/yr (million cubic metres per year) and was used mostly on the Highlands where the unserved population was assumed to be 45,000 (NWC 1980). The rainfall supports groundwater recharge of 2.20 X 10^8 cubic metres per year and evapotranspiration of 3.4 X 10^8 cubic metres per year.

3.3.3.2 SURFACE WATER RESOURCES

There is no perennial or seasonal surface water sustained streams within the Manchester Highlands because of the high infiltration capacity of the limestone.

3.3.3.3 GROUND WATER RESOURCES

Groundwater occurs in a highly karstified limestone aquifer that outcrops over 98% of the Manchester Highlands. The aquifer is in direct hydraulic continuity with the sea in sections. The absence of a lithologic barrier at the coast together with the high transmissivity combines to produce a very low water table elevation with respect to sea level. Depth to water is in excess of 300 metres as proven by the well drilled at Victoria Town and boreholes drilled south of Battersea Mud Lake by Alcan to monitor water quality.

Aquifer discharge supports flow in four perennial streams along the coast, which sustains a 5.2 km^2 coastal swamp (part of Canoe Valley) being reserved as a National Park and a nature laboratory.

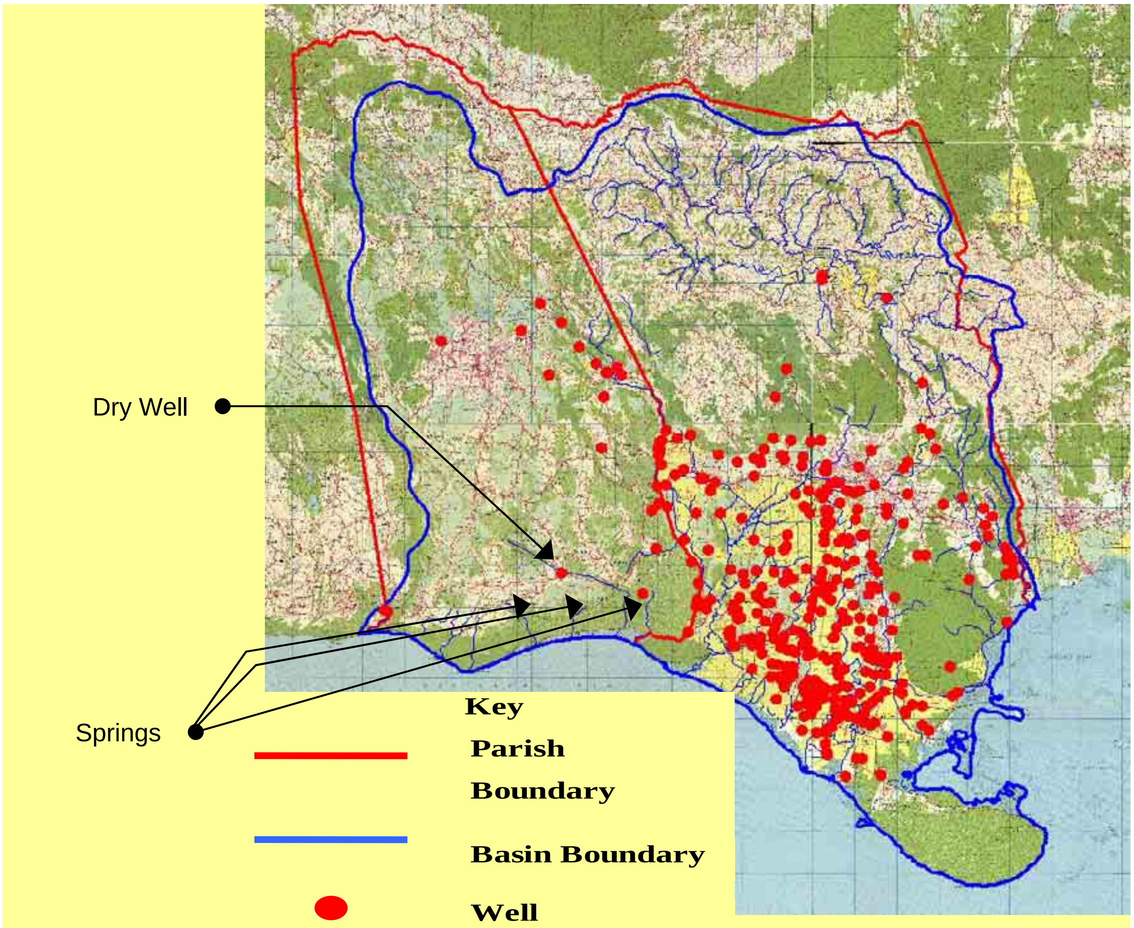


FIGURE 3-9: WELLS IN THE RIO MINHO HYDROLOGIC BASIN

3.3.3.4 WATER RESOURCES DEVELOPMENT

The majority of the population on the Manchester Highlands depends on rainwater harvesting to meet their domestic demands. Agriculture is 100% rainfed.

Only one production well has been successfully developed in the Manchester Highlands and this is the well at Victoria Town. This well has an average annual production of 0.10 Mm^3 and maximum monthly production of 0.02 Mm^3. In the dry season as aquifer recharge is reduced, the well yield falls significantly.

Water supply to the major urban centre, Mandeville, is from groundwater supplied by wells drilled at Porus, Manchester and at Pepper, St. Elizabeth.

The total annual production from the three (3) wells at Pepper is 7 Mm^3 while from 2 wells at Porus the annual production is 3.45 Mm^3.

The wells at Porus tap the groundwater flowing in the Williamsfield Graben, a preferred flow path for groundwater. The Queen Town Hill Fault, which extends from Balaclava in St. Elizabeth, creates a high permeable zone and a preferred flow path for groundwater. Several springs that support flow at the St. Toolies and in the Milk River rise along this fault. The Milk River is 100% supported by groundwater drained from the limestone aquifer.

The reliable yield of the Milk River is zero as in the dry season when aquifer storage is low and the NWC and Windalco Wells at Porus are pumping, the river goes dry. However, since the extreme rainfall events associated with tropical storms, Isidore and Lilli in 2002, the Milk River flow has not fallen below 0.18 m^3/sec (15,552 m^3/d) and this was recorded between July 31 and August 5, 2004.

Two wells have been drilled in the extreme north of the Manchester Parish outside the Manchester Highlands. One well, drilled to a depth of 114.3m by Alcan, is located at the bottom of a large depression (to reduce drilling depth and cost) at Evergreen which floods periodically once aquifer storage is exceeded.

The second well is drilled north of the Alcan well at a higher elevation above the flood levels. This well is privately owned and was drilled to a depth of 91.5m. The licenced abstraction from the Evergreen Alcan well is 540 m^3/d while that of the Evergreen private well is 545 m^3/d.

The Water Resources Authority has identified well sites at Green Hill – Evergreen to meet the demands of Christiana. However, none has been drilled, as the costs are prohibitive.

The unutilized safe yield of groundwater under the Manchester Highlands has been identified as 81Mm^3/year. Development of this potential will be difficult and particularly costly given the need for 600 m deep wells and the high risks of failure associated with the compartmentalized nature of the highly permeable zones in the limestone.

3.3.3.4.1 MANCHESTER HIGHLANDS SPRINGS

The Manchester Highlands Springs are located along the coastal strip west of Round Hill in Clarendon. The springs represent natural discharge from the karstic limestone aquifer storage of the Manchester Highlands. Low permeability alluvium deposited on the down faulted southern block, on which the 5.2km^2 swamp is located, functions as a barrier to groundwater flow forcing water table discharges to rise above sea level along the 18 km long limestone/alluvium boundary. The discharges flow through the swamp to the sea principally as the Alligator Hole River, Swift River, Two Rivers, Gramble River and Gut River. Along the remaining 13 km of coastal aquifer boundary, the alluvium is absent and the limestone is in direct contact with the sea. Here aquifer discharge is at or below sea level, directly into the sea.

Flow measurements (spot measurements) made by the Water Resources Authority between 1973to 1994 indicate a mean discharge of:

- 236,288 m^3/day for the Swift River
- 221,293 m^3/day for the Alligator Hole River
- 227,200 m^3/day for Two Rivers and
- 41,350 m^3/day for Gut River

Any additional groundwater development in the Manchester Highlands will reduce the outflow to the springs with an impact on the environment of the swamp that will become more saline.

3.3.3.5 WATER QUALITY

Water quality under the Manchester Highlands (Victoria Town well), at Porus within the Williamsfield Graben and at Evergreen indicates Calcium Bicarbonate type water. No contamination of water resources in the Manchester area has been noted except:

- Along the coastal zone where the seawater wedge has moved inland
- South of Battersea red mud lake at Windalco's Kirkvine Works where elevated sodium concentration has been detected.

The Manchester Highland Springs exhibit high chloride concentrations. The Alligator Hole River has a mean chloride concentration of 920mg/l while the other rivers have mean chloride concentrations varying between 1340 to 2420 mg/l. The difference in quality seems to be related to the elevation of the discharge and the rate of flow. The Alligator Hole River discharges at a higher elevation than the others and a direct relationship between salinity levels, elevation and the Ghyben-Herzberg principle can be determined. The Ghyben-Herzberg principle governs the occurrence of saline groundwater in coaster aquifers.

Water quality data for the mentioned areas are found in Appendix II: Water Quality Data

3.4 AIR QUALITY AND WEATHER

3.4.1 AIR QUALITY

3.4.1.1 AIR QUALITY MANAGEMENT PROGRAM

Jamalco has developed and maintained an Air Emissions Management Program to ensure compliance with the Natural Resources Conservation Authority (NRCA) ambient air quality standards, pending air quality regulations, Alcoa Air Emissions standards as well as to conform with ISO 14001 requirements and the company's EHS policy.

There was no major air quality/weather monitoring station in Northern Manchester from which the consultant was able to acquire recent data. Since the proposed developments for the North Manchester are new, Jamalco will conduct extensive baseline air quality studies to be used for comparative analysis. Baseline data collection has begun and will continue until mining and transportation operations begin in the area. Once operations commence the data collection will be continued for monitoring purposes.

Complete high technology telemetry based weather stations will be established at key locations throughout SEPL 530 to measure and monitor weather and ambient conditions so that work in the area can be guided by factual information and allow for better protection of the communities from potential mining related negative impacts. Much like the weather stations at the refinery that Jamalco operates, newly established stations in North Manchester will provide data for the following parameters:

- Wind speed
- Wind direction
- Air temperature
- Barometric Pressure
- Ground temperature
- Precipitation and,
- Standard deviation of the Wind direction.

3.4.1.1.1 AIR EMISSIONS

The primary emissions anticipated in North Manchester from the mining operations will come from equipment and machinery operating in the mines and loading station. While not being deemed insignificant, it is not anticipated that any of these operations will generate significant amounts of air emissions that should be cause for alarm or concern to the citizens of the area. Air emission monitoring will be conducted in the North Manchester area and continued dialogue with citizens of the area will ensure that they are not being impacted.

3.4.1.1.1.1 *PARTICULATES*

Emissions of particulates are intermittently released as a result of mining activities, windblown dust associated with bulk material handling, transportation and stocking of raw material (bauxite).

Proven particulate control and dust suppression strategies have been employed at Jamalco facilities, which have significantly minimized particulate and fugitive dust emissions. These include but are not limited to the use of hooded conveyors, sprinkler systems and other irrigation techniques.

The mining locations will implement a number of fugitive emission control measures (all proven methods adopted by Jamalco at its operating facilities) inclusive of the following:

- o Controlling fugitive particulate emissions from storage piles through enclosures, covers or stabilization, minimizing the slope of the upwind face of piles where practicable. Confining as much pile activity as possible to the down wind side of piles.

- Limiting the size of loads to minimize loss of material to wind and spillage.
- Planting trees to establish wind breaks at critical points.
- Prompt removal of soil and other dust -forming debris from paved roads and scraping and compaction of unpaved roads to stabilize the road surface as often as necessary to minimize re-entrainment of fugitive particulate matter from the road surface.
- Vegetating open areas with grass.
- To the extent practicable restricting vehicular travel to established paved roads.
- Watering of unpaved roads and other unpaved open spaces as often as necessary to minimize re-entrainment of fugitive particulate matter from these surfaces.
- Maintaining good house keeping practices to minimize the accumulation of materials, which could become fugitive.

Only with the onset of mining operations and the implementation of dust minimising protocols and procedures will Jamalco be able to measure and report the impacts (if any) that the operations are having in terms of particulate air quality. Standard high volume Total Suspended Particulate (TSP) monitors will be established in the communities surrounding the mining areas.

3.5 WEATHER

3.5.1 REGIONAL SETTING/SPHERE OF INFLUENCE

3.5.1.1 PROPOSED MINING AREA

The proposed mining area is located in Northern Manchester in a general area extending from Medina in the southwest, to Cobbler in the southeast, following the Spaldings-Christiana main road to the Devon area then extending to Coleyville in the northeast and across to Waterloo and Comfort Hall in the northwest as indicated on Figure 1-1.

Major settlements in the sphere of influence of the proposed mining area include:

- Medina
- Hibernia
- Bethany
- Malton
- Derry
- Mile Gully
- Ballynure
- Comfort Hall
- Whitby
- Contrivance
- Chudleigh
- Devon
- Waterloo
- Coleville
- Harry Watch

This area comprises settlements of varying sizes and population, however, the bauxite deposits are distributed randomly throughout these communities and in many cases are void of human encroachment. The sphere of influence of the proposed mining activities is not anticipated to extend outside of the prescribed mining area.

3.5.1.2 MINING AREA CLIMATE

Mean annual average rainfall is 2,032 mm (80 inches) per year. The historical pattern has light rains in May, a summer dry season marked by brief but torrential thunderstorms, a main rainy season from September to November and a marked dry season from November to April. However, both annual totals and daily rainfall patterns are highly variable. The stationary weather system over central Jamaica in June and July 2002 produced two-thirds of the parish's annual rainfall in 15 days.

Annual rainfall gradients decrease from north to south and west to east. The northern mountains have the highest volumes, often in the form of heavy fog. In the center, Mandeville averages over 80 inches while amounts are lower in sheltered parts, such as Grove Place to the south.

No raw data and consequently no empirical assessment of the baseline air quality of the area is available for puiblication in this report. However, Jamalco recognizes the potential impact that their proposed operations could have on the air quality of the surrounding communities in North Manchester. Therefore, Jamalco has committed to the acquisition and installation of a state of the art weather station at the Green Vale loading station. This weather station will be telemetrically linked to the National Metereological Service and used to monitor the air quality of the area – ensuring that their potential point source operations are functioning within NEPA, International, and Alcoa standards.

3.5.1.2.1 WINDSPEED AND DIRECTION[2]

The wind rose plot shown in the contents of the visual presentation (see Figure 3-10 to Figure 3-12) represent or characterize the relevant meteorological data that is provided from the weather station at Kendal (Kirkvine). They effectively show the predominant wind directions and speeds within a predefined period of time. On a typical Wind Rose plot there is a basic compass layout with the four major directions North, South, East and West. A series of shapes usually plotted from the central axis represent the direction of the wind with a series of concentric circles, which represent the percentage of the time the wind blows in that characteristic direction. The colour of shape depicts the wind speed in the particular direction.

The results showed, for the entire year. a predominant Southerly wind direction that was at maximum speeds of 8.5 m/s 70% of the time.

[2] **Jamaica Bauxite Institute**, *Assessment of Dust Distribution in The Harmons, South Manchester Area During Pre-Mining Haul Road Construction*, Conrad Douglas and Associates Limited, April 2002