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BATCH PLANT ENVIRONMENTAL ASSESSMENT AND BEST MANAGEMENT PRACTICES (BMP)

CCECC HEADQUARTERS COMPLEX, ST GEORGE, ANTIGUA

Submitted to the Development Control Authority
Antigua and Barbuda

March 25, 2021

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Submitted to the

Development Control Authority

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By

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CCECC HEADQUARTERS COMPLEX
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EXECUTIVE SUMMARY

CCECC is a China-based construction and engineering company that has been engaged in several projects in Antigua. The company acquired land in St. George, Antigua to construct its regional headquarters. The complex will include residences and a recreational complex, in addition to the headquarters building. Groundbreaking was held in September 2020, and the project is scheduled to be completed by the end of 2021. To facilitate the construction, a batch plant was set up on-site to provide concrete for the development.

In early 2021, the DCA requested an environmental assessment, particularly of the batch plant operations. The CCECC approached Deborah Brosnan & Associates with this request. The focus for the environmental assessment approved by DCA in consultation with DoE was a targeted environmental evaluation to identify any major environmental impacts and mitigation strategies needed. A main emphasis was on identifying Best Management Practices (BMPs) for the batch plant operation.

An initial site visit was conducted on February 10, 2021, and a landscape and vegetation survey was completed on March 1, 2021. Field surveys were conducted on 2 acres (0.8ha) and these assessments were enhanced by drone imagery conducted over 11 acres. Remote sensing via Google Earth was used to assess historic and current land use and condition.

The site is located in North Sound, in the eastern portion of St. George, Antigua (Lat/Long: 17.1095°N, 61.7839°W). The site is relatively flat, with some gentle grades. No watercourses were found on or adjacent to the site. The nearest waterway is a tributary of Fitches Creek, about 0.3 km from the project site, and the nearest coastline is 0.6 km from the project site in Parham Harbor.

The CCECC has deployed an HZS50 model batch plant manufactured by Shandong Yuanyou Heavy Industry Technology Co., Ltd. The plant is capable of producing 50 m^3 of concrete/hour and is equipped with two cement silos. This is a medium-sized batch plant that is commonly used. It is intended to be operational until the headquarters are completed, which is scheduled for the end of 2021. After that time, CCECC indicates that it intends to demobilize the plant.

Typically, environmental concerns with batch plants center on landscape/vegetation clearing, water, and air pollution (dust management). Transport truck noise and traffic are additional impacts that are of lesser concern here as all activity is on-site.

The site has been cleared and developed several times since at least 2003 and prior to CCECC acquiring the location. Abandoned buildings and debris were present on the site from previous activity. The site was not pristine when work commenced by CCECC.

Vegetation consists mostly of opportunistic, and invasive plants and no sensitive species were observed. As a result, the environmental impact on the vegetation is minimal. However, the site, which will be a major headquarters location, should be vegetated, particularly with native species, to support water management, provide ecological benefit, and beautify the property.

A series of simple but regular BMPs are described, and that will help with environmental site management and environmental compliance.

The main concern is the fate of the concrete washout water. The assessment team recommends that the water be retained in impermeable basins where solids and water can be separated and recycled on-site. Simple concrete washout areas can easily be constructed or brought to the site prefabricated. Additionally, the batching area is subject to spills and should be equipped with an impermeable liner to protect the local environment. A grass swale is recommended, and swale features can also be considered for long-term water management. Water management BMPs outlined will reduce water loss, improve environmental conditions, and save CCECC money in water costs.

Dust control measures are in place, and during the site visits, little dust was observed in the area and on adjacent vegetation. However, especially during the dry season, the aggregate stockpiles and loose soil on-site may become sources of airborne dust; CCECC should monitor these areas and take corrective action as necessary to manage dust.

Erosion is not a concern in relation to the batch plant but the stockpiles of sand are located on the site. These loose fill piles can be protected from erosion during heavy rains via a silt fence and impermeable covering

Solid waste needs to be properly disposed of using the existing Antigua facilities.

Noise pollution will not exceed normal construction levels. However, maintaining construction hours between 8 a.m. – 5 p.m. will minimize any potential impacts to neighboring properties.

Construction and batching are expected to be completed by the end of 2021. At that time, the plant will be disassembled, and environmental precautions (as outlined) should be used. In addition, the site should be cleaned up of all waste materials. Landscaping at this stage can add ecological and aesthetic value, as well as improve water management for the regional headquarters (reducing costs). Where possible, the CCECC should consider creating unique ecological and biodiversity features.

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BATCH PLANT ENVIRONMENTAL ASSESSMENT

Project Background

CCECC is a China-based company working in international contracting. Originally formed in 1979 as an outgrowth of the Foreign Aid Department of the Ministry of Railways of China, the company has since evolved into a large-scale state-owned enterprise working in over 50 countries and on a diversity of heavy construction projects, including railways, highways, bridges, buildings, and municipal works.

CCECC has been involved in several major construction projects in Antigua over the years, including the V.C. Bird Airport terminal and the St. John's Port Modernization project. Recently, CCECC identified Antigua as a site for a regional headquarters. A plot of land in St. George, Antigua was obtained by CCECC, just north of Sir Vivian Richards Stadium (Figure 1) for the complex. The complex will include residences and a recreational complex, in addition to the CCECC headquarters building (Figure 1). The current construction site is approximately 8.3 acres (3.4 ha) (Figure 2).

Figure 1. Architectural rendering of CCECC Antigua Headquarters.

CCECC Construction Site and Batch Plant Location, St. George, Antigua (March 11, 2021).

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Figure 2.

A groundbreaking for the project was held in September 2020, and construction is ongoing and scheduled to be complete by the end of 2021. To facilitate the construction, a batch plant was set up on-site to provide concrete for the development.

In early 2021, the Department of Environment (DoE) of the Government of Antigua and Barbuda (GoAB) approached the Development Control Authority (DCA) seeking an assessment of the environmental impact related to the setting up of a batch plant for the construction of the CCECC headquarters facility. The CCECC approached Deborah Brosnan & Associates with this request in February 2021. Deborah Brosnan & Associates made a site visit to assess the conditions on-site on February 10, 2021. The approach for the environmental assessment approved by DCA in consultation with DoE was a targeted environmental assessment to identify any major environmental impacts and mitigation strategies needed, with an emphasis on identifying Best Management Practices (BMPs) for the batch plant operation through the completion of work on-site. Deborah Brosnan & Associates worked with CCECC to complete the work in March 2021.

Methods

An initial site visit was conducted on February 10, 2021. A landscape and vegetation survey was completed on March 1, 2021, and covered 2 acres (0.8 ha). These assessments were supported by drone imagery carried out on March 11, 2021, covering 11 acres (4.5 ha) (Figure 3). Remote sensing via Google Earth was used to assess historical, as well as current land use.

Figure 3. Area assessed by field surveys and drone imagery in March 2021.

Project Site

The site is located in North Sound, in the eastern portion of St. George, Antigua, about 0.5km north of Sir Vivian Richards Stadium (Lat/Long: 17.1095°N, 61.7839°W). The adjoining properties directly to the west and south of the entrance to the project site each have a single private residence. The building to the south is located approximately 0.09 miles (0.14km) from the batch plant and that to the west at a distance of 0.03 miles (0.05km). No other development was observed on neighboring properties.

The main sand and gravel storage and commercial site, occupying c 9.3 acres, is located c.0.22 miles (0.35km) to the southeast of the property. The site is relatively flat, with only gentle grades throughout the site. No watercourses were found on or adjacent to the site. The nearest waterway is a tributary of Fitches Creek, about 0.3 km from the project site, and the nearest coastline is 0.6km from the project site in Parham Harbor.

Historic aerial imagery of the site obtained via Google Earth shows that the area has been disturbed and developed several times prior to being acquired by CCECC for their headquarters construction. In 2003, the site was a grass-dominated field with few trees, suggesting that the site was cleared prior to this time since the surrounding area is tree-dominated.

By 2005, small trees and shrubs were growing on the site. However, much of this area was later cleared to construct several buildings on the site between 2005 and 2011. These buildings still exist on-site today. Areas of cultivation visible in satellite imagery from 2014 are overgrown in imagery from 2017 and are cleared of vegetation in imagery from 2018.

After this time, CCECC acquired the site for their regional headquarters. An official groundbreaking ceremony was held in September 2020.

Figure 4 shows the site changes at the site area from 2002 to the present day.

Figure 4. Aerial imagery of project site, 2003 – 2018, showing several cycles of clearing, building, and overgrowth.

The 2011 Sustainable Island Resource Management and Zoning Plan for Antigua and Barbuda classified the land as an agricultural zone (Figure 5) based on the quality of the soils as determined in a 1992 survey. The site does not appear to have been used for intensive agriculture recently, although portions of the site appear to have been cultivated in the past. Residents on the adjacent land are known to raise livestock.

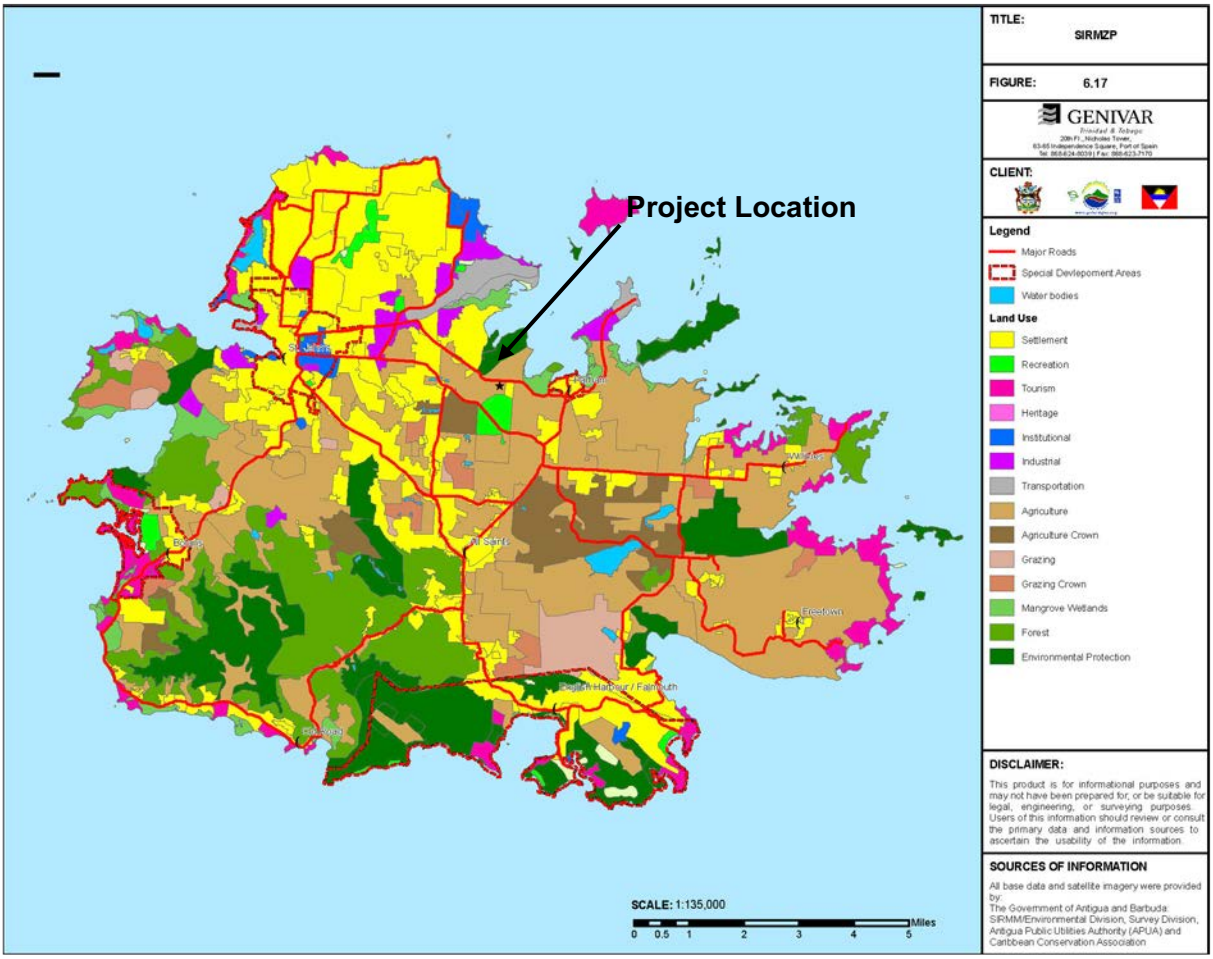


Figure 5. Sustainable Island Resource Management and Zoning Plan (Source: GENIVAR, 2011).

Environmental Baseline

Deborah Brosnan & Associates' field biologists completed a site visit on February 10, 2021, and field surveys on March 1, 2021, to assess the environmental conditions at the CCECC headquarters construction site and batch plant. Additional data were acquired by drone surveys and Google Satellite imagery.

During the field surveys, plant species and assemblages on the site and adjacent to the west roadway were identified, and their condition evaluated. The site is dominated by opportunistic and, in some cases, exotic invasive, plant species. This is likely the result of the historic land disturbance noted earlier. Most plants identified on-site are adapted to exploit freshly disturbed habitats and are commonly found in marginal habitat and edge zones. No sensitive vegetation species were observed on-site. Sensitive species are those species that are listed as threatened or endangered by the IUCN Red List, protected per the Antigua and Barbuda Environmental Protection and Management Act (EPMA) 2019, or are regionally endemic (as determined by Pratt et al., 1997). A list of plants observed by the field biologist on the site and the adjacent roadway is provided in Table 1. Photographs of the most common plant species are provided in Figures 6 and 7. No birds or wildlife were documented using the site during the assessment.

Table 1. List of plants observed on the CCECC site and along the adjacent roadway to the west.

Common Name	Botanical Name	Native
Tamarind Tree	*Tamarindus indica*	Yes
Spiny Sow Thistle	*Sonchus asper*	No
Cattle Tongue	*Pluchea carolinensis*	Yes
Sage	*Lantana camara*	Yes
Lion Head	*Leonotis nepetifolia*	Yes
Dunks	*Ziziphus mauritiana*	No
Banana	*Musa sp.*	
Yellowtops	*Flaveria bidentis*	Yes
Piss-a-bed	*Wedelia calycina*	Yes
Maiden Bush	*Momordica charantia*	Yes
Bellyache Bush	*Jatropha gossypiifolia*	Yes
Acacia	*Vachellia macracantha*	No
Indian Mallow	*Abutilon indicum*	Yes
	Melochia sp.	Yes
Neem	*Azadirachta indica*	No
Passion Fruit	*Passiflora sp.*	Yes
Grasses	(various)	Unknown

Figure 6. Photograph of *Lantana camara* and *Sonchus asper* observed on-site (March 1, 2021).

Figure 7. *Azadirachta indica* and *Tamarindus indica* observed along west roadway near CCECC site (March 1, 2021).

Water Resources

The site is located on the border of two watersheds, Fitches Creek and Parham (Figure 8). These watersheds were identified as critical by the SIRMZP (2011) because of the agro-ecological value of their surface water reserves and were identified as protected watersheds by the EPMA 2019. The report notes that these two watersheds combined provide 367.9 acres/ft of surface freshwater storage for agricultural use. The area is not a major source of groundwater production for the island. The closest body of water is a small pond, about 0.15km to the southwest of the site. A tributary of Fitches Creek runs within 0.3km west of the site, and the nearest coastal zone (Parham Harbor) is about 0.6 miles east and north of the site.

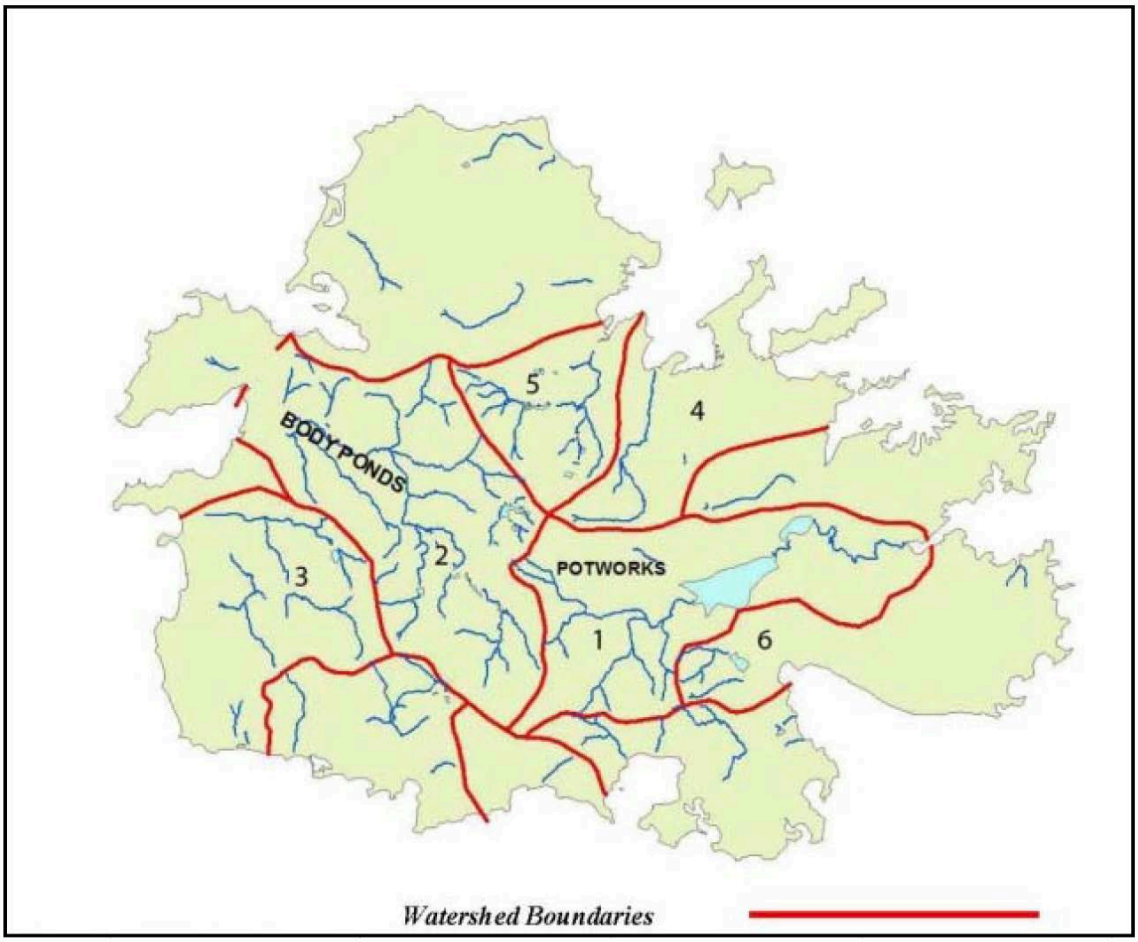


Figure 8. Watersheds on Antigua. Parham watershed is marked “4”, and Fitches Creek is marked “5” (Source: GENIVAR, 2011).

Construction Site

The construction site is approximately 8.3 acres in size. The area is bordered by improved roads to the north and east, an unimproved road (dirt road) to the west, and a private property to the south. The property is fenced to control access, with a single gate at the southwest corner of the site along the unimproved road allowing access. The batch plant is located just north of the gate. The active construction area is on the northern section of the site. Existing buildings from previous development remain in the southeast corner of the site and are being used for workshops, storage, or other space. There is debris and refuse from a previous development remaining on the site.

Batch Plant: Overview

A typical concrete batch plant mixes water, cement, fine aggregate (e.g., sand) and coarse aggregate (e.g., gravel,) and a small amount of supplemental materials in a large drum to create concrete (Figure 9). At most commercial-scale concrete plants, the cement is stored in silos and fed on a conveyor belt to a loading point where feeds of sand, gravel, and supplement join the cement feed. The feeds are dropped together through the drum into concrete trucks where they are combined with water. The concrete truck then drives to the construction site, further mixing the cement and water along the way. At large construction sites, concrete is often mixed on-site in a central mix drum and then transferred to a transport truck.

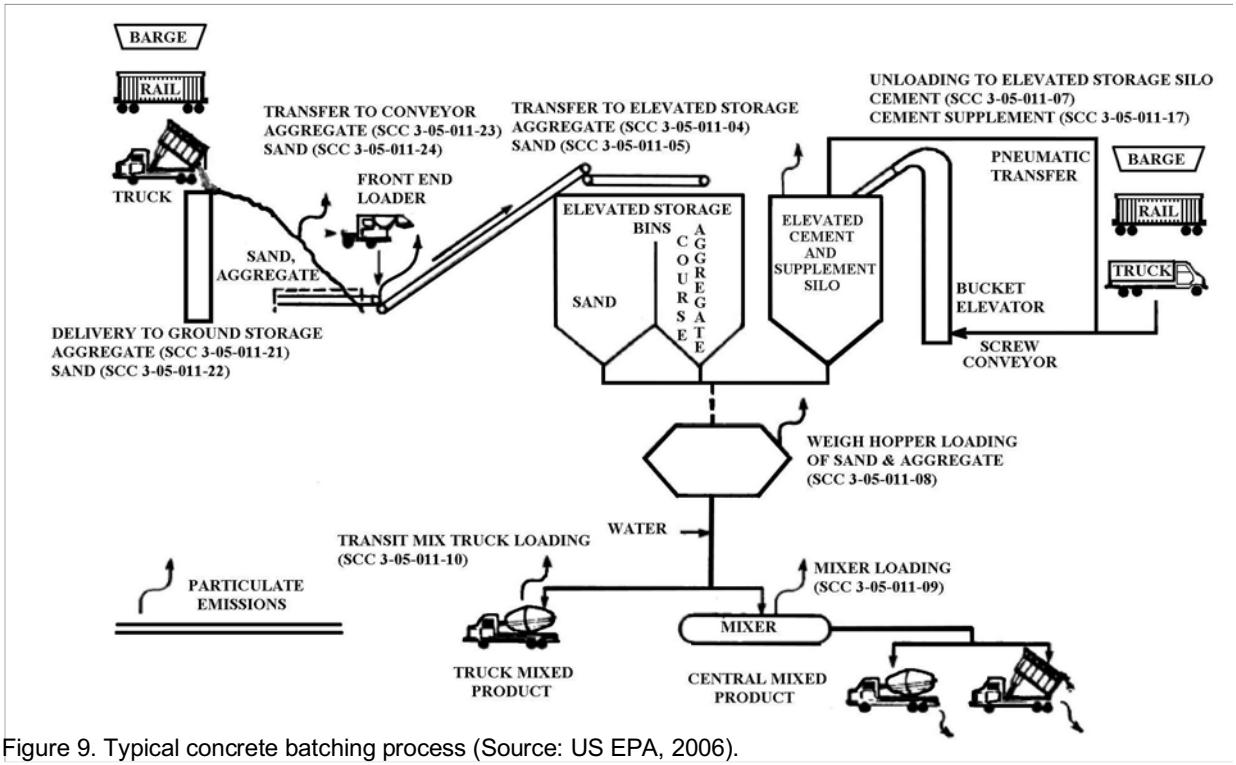


Figure 9. Typical concrete batching process (Source: US EPA, 2006).

The batch plant for the current project is an HZS50 model manufactured by Shandong Yuanyou Heavy Industry Technology Co., Ltd. The plant is capable of producing 50 m3 of concrete/hour and is equipped with two cement silos. Each silo is equipped with a dust collection system to control dust when cement is added to the silos and when the plant is in operation. All batching equipment is located on pilings above the ground. A 20 feet high fence equipped with a dust screen surrounds the batch plant area. The batch plant equipment is on concrete footings, though the surface below the batch plant is local soil. Stockpiles of aggregate are stored on-site near the batch plant and are partially protected from the wind by low walls.

The site has one concrete mixer truck that we were informed remains on-site. According to CCECC, most vehicles associated with the construction travel on-site only. However, from time to time, some trucks travel from the site to replenish the cement silos, haul away construction waste, and bring needed materials and supplies.

Environmental Impacts

Typically, the main environmental concerns associated with batch plants that are deployed on-site for a specific construction or development revolve around three main issues (Frederick 2018):

- **Land and Ecological Impacts** (from batch plant and associated construction and development). These are associated with land clearing involving the loss of important vegetation and biodiversity. Ongoing impacts occur from operations if significant dust is blown onto vegetation and causes damage to plant life and biodiversity.

- **Water-Related Impacts.** These fall into two main categories. The first is related to water consumption. Batch plants use large volumes of water for cement generation and equipment washing. Concrete production requires significant water usage, with a typical concrete mix containing about 15% water, or 150L of water per cubic meter of concrete produced (https://www.cement.org/cement-concrete/how-concrete-is-made). Operating at full capacity (50 m^3/hr.), the HZS50 plant would use water at a rate of 7500L/hr. Additional water is then needed for washing trucks and equipment. The second category relates to water management, including stormwater runoff from batch plant operations, truck-washing, and associated erosion concerns. Concrete washout water has a pH of around 12 (www3.epa.gov/npdes/pubs/concretewashout.pdf), and as a result, it can have negative impacts if discharged to local waterways via runoff or groundwater. The Antigua and Barbuda Environmental Protection and Management Act (2019) requires that the water be treated to bring the pH to within 6.5 – 8.5 before being released. In addition, aggregate stockpiles at the batch plant and fill piles in the construction area represent potential sources of sediment and nutrient-laden runoff on-site. Poor water management can lead to increased sedimentation and erosion, depending on-site profile and condition.

- **Air Pollution from the Development and Use of Batch Plants.** Particulate matter from materials used in the production of concrete contributes to air pollution. This can occur when a material is transported to and from the site, transferred within a site, or by wind conditions that stir up dust during plant operations. “Track-out” can also lead to air pollution issues. This phenomenon occurs when plants wash their trucks and vehicles on-site, and the wash water forms pools and mud. Concrete mixer trucks, aggregate delivery trucks, and other vehicles pick up concrete-based mud on their wheels. That mud is then carried or “tracked” out of the plant and deposited onto nearby roads. The mud dries out and becomes airborne when other vehicles drive over it.

Additionally, several non-pollution concerns can also arise (Frederick, 2018). These include:

- **Noise.** Noise is sometimes a problem for concrete plant neighbors. Typically, noise issues are not associated with the batch plant operations but with large concrete trucks that often arrive before dawn to pick up loads of concrete to take to construction sites. The idling of these early-morning arrivals and their reverse warning sounds can be noisy, in addition to spreading diesel fumes throughout the neighborhood.

- **Traffic.** The traffic of the trucks, depending on the roadway layout near the plant, can be a problem for the neighborhood, particularly when the trucks travel through or idle near residential areas. The site stockpiles and dusty roads can contribute sediment to rain that falls on them, causing muddy runoff to the nearby neighborhood if the runoff is not well-controlled by the plant.

These environmental concerns were evaluated, and BMPs were identified to minimize and mitigate potential impacts. However, because the batch plant is located on the construction site and for the sole purpose of headquarters construction, trucks do not travel off-site (for construction purposes). As such, the above non-pollution concerns are not critical in this situation, and as long as the batch plant does not supply off-site developments.

Biological Impacts

The site has been disturbed several times in recent years. Prior to construction, it was largely dominated by opportunistic or invasive vegetation. The field biologist identified no sensitive vegetation species on-site. As a result, there are few significant impacts to native species anticipated.

Air Pollution

During the site visits, dust from construction and batch plant activity was documented by the biologists as being present on-site. However, during the February 2021 and March 2021 assessments, no dust was observed on nearby vegetation adjacent to the site and along the road to the west of the batch plant. The predominant wind pattern in Antigua is E-W, and the greatest impacts from dust movement would therefore be expected in this area. Fencing downwind of the batch plant is equipped with a dust screen to a height of 20 feet (6.1m) to minimize dust blowing off-site and into adjacent areas. This screen height appears to be sufficient to minimize dust from the batch plant and vehicles. For instance, batch plant studies have found that the height of a dust plume will be about twice the height of the vehicle generating the road dust. To achieve approximately 50% control of the dust plume, the height of a barrier was thought to be at the height of the plume centerline. Based on the modeling, the agency found this height to be about 12 feet. (TCEQ Regulatory Guidance RG-056, December 2000).

During the survey and in one area along the west side road, there was evidence of track-out on roadside vegetation (Figure 10). However, this was a localized observation, and the finding of only one such incident indicates that, as long as concrete-truck traffic remains light and mostly on-site, this is not likely to be a significant contributor to air (dust) pollution or vegetation pollution off-site.

Figure 10. Example of track-out concrete splattering observed along west side road outside project site, (March 1, 2021). This is not expected to be a main concern during construction due to infrequent off-site travel.

Noise Pollution

Frederick (2018) noted that most noise issues associated with operating batch plants arise from the stream of trucks picking up concrete at batch plants. This is not the situation here. However, there will be a normal level of construction noise from plant operation, headquarters construction, and delivery of materials to the site to support these activities. Wiertelak (2017) measured average noise levels for construction equipment within 50 feet (Figure 11), and the findings indicate that noise pollution is manageable and should not be a significant impact on the wider area. In addition, according to CCECC, their batching operations occur only during normal business hours between 8.a.m and 5 p.m. Maintaining these hours will reduce any potential noise impacts from construction on the two neighboring residences.

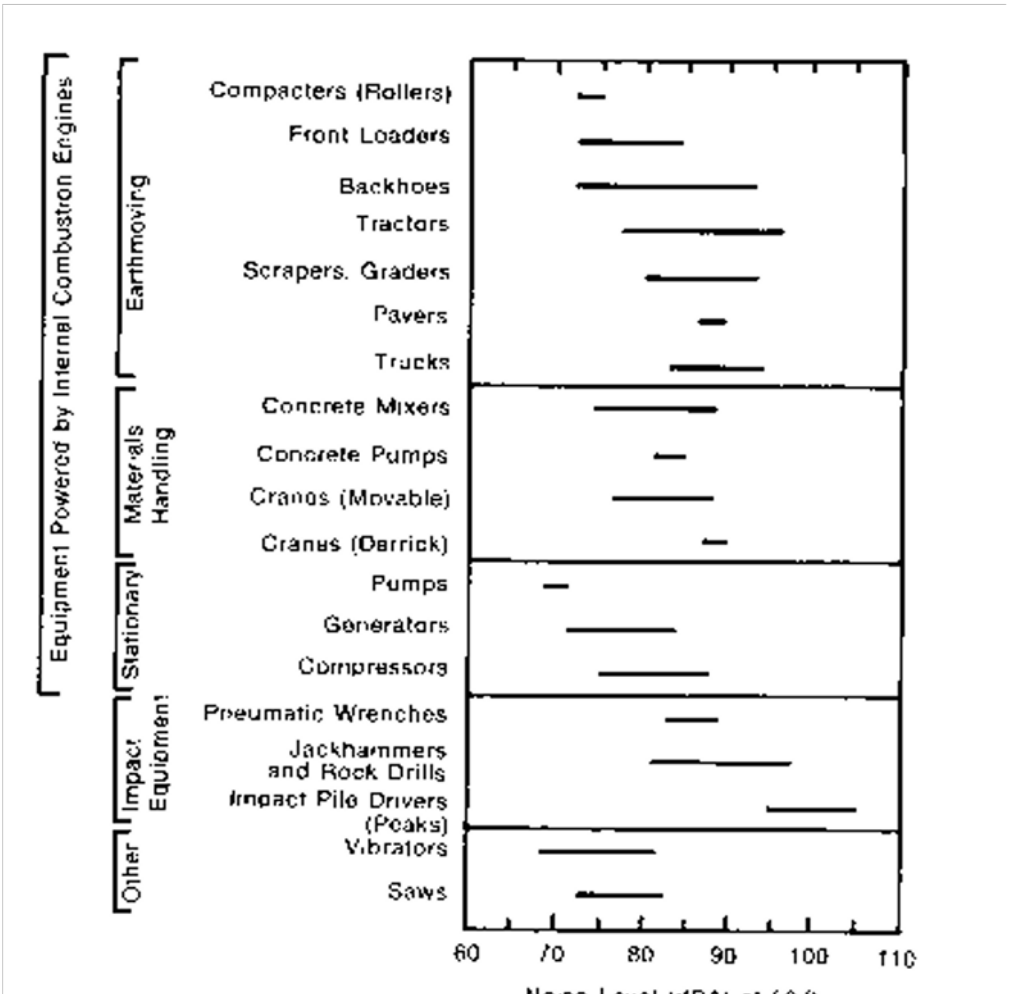


Figure 11. Noise dBA ranges for common construction equipment at 50 ft (15m) (Wiertelak, 2017 adapted from Bugliarello et al., 1976).

BEST MANAGEMENT PRACTICES

Vegetation/Landscape

The vegetation is not indicative of a pristine site. We recommend that the site be re-vegetated with native vegetation assemblages following construction. This will provide quality habitat for local species and minimize the irrigation needs for the site landscaping. It will also beautify the site. Best Management Practices (BMPs) for concrete washout, erosion and runoff control, and dust management (see below) should be followed to minimize any degradation of nearby habitats.

General Site BMPs

Several relatively simple BMP actions can have strong positive outcomes. Sweep the facility regularly, remove trash off the ground (providing garbage cans and educate employees to prevent littering), clean up oil spills or leaks, etc. Conducting monthly inspections to keep an eye on the facility are all basic but key BMPs that will minimize the risk of problems with compliance and operations of the batch plant. Existing drainage channels or culverts on-site should be covered to keep out concrete and debris.

Runoff and Sediment Control

BMPs to control runoff and erosion are essential on all construction sites to protect local waterways from sedimentation and pollutants. The most significant concern based on the site visits and remote assessments is implementing BMPs for the management of concrete washout water. Additionally, BMPs for water recycling and conservation during construction and operations will significantly reduce environmental risks, improve water quality, and reduce the need for water, resulting in lower costs to CCECC.

Create Containers for Washout Water and Runoff

This offers the best BMP solution to waterborne pollution management. During the site visit in March 2021, the biologist observed evidence that washout water is being discharged onto the bare ground in batch plant area between the plant and the access gate (Figure 12). Although concrete washout is not directly being discharged into waterways or groundwater, it could reach waterways via runoff or percolation.

The biologist alerted CCECC to this issue. In follow-up discussions with CCECC, they proposed moving concrete washout to an area that drains to an existing open tank on-site (Figure 13). As long as the tank is contained and water does not percolate into groundwater or soil, this appears acceptable.

Figure 12. Photograph of visible washwater runoff (Observed March 1, 2021).

Figure 13. Existing tank proposed to retain truck washwater.

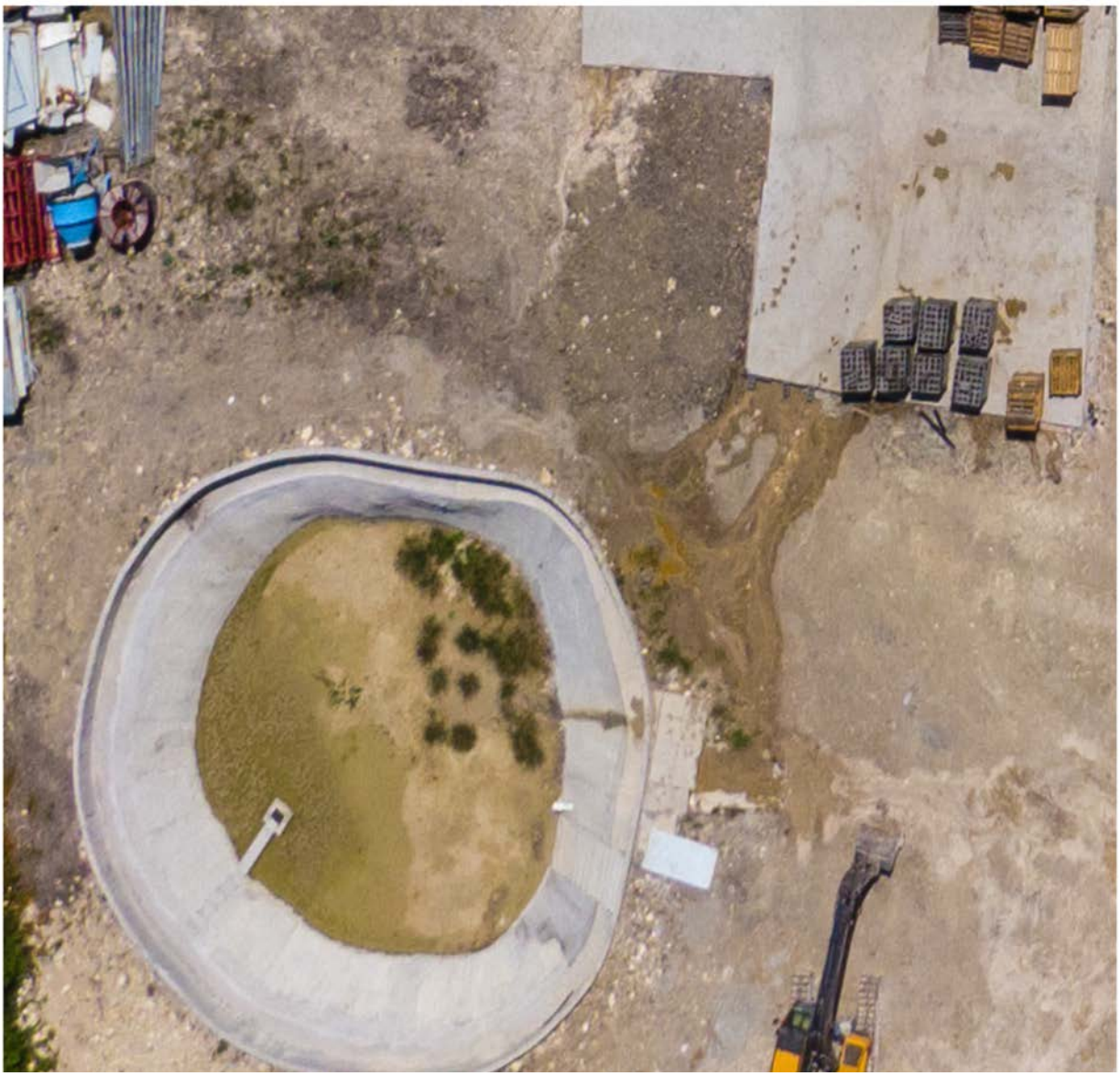
As a BMP, we recommend that concrete washout be collected in an impermeable basin, where water and solids can be separated to be recycled on-site. The basin should be able to retain washout water with sufficient freeboard to avoid overflow during a 20mm rain event. Examples of concrete washout areas are shown in Figure 14 below. A simple concrete washout area can be constructed using hay bales and an impermeable plastic liner. Prefabricated options made of metal or vinyl are also commonly used. Water and solids can be separated by natural settling, or a filter bag can be used.

The batching area itself is subject to spills or overflow. This area is currently located on bare ground. We recommend that an impermeable liner be used in the batching area to protect the local environment from spills and overflow. Spills should be cleaned up promptly, and materials should be recycled where possible.

Figure 14. Examples of concrete washout areas. Top: Roll-off metal container. Middle: Washout area constructed from hay bales and an impermeable plastic lining. Bottom: Vinyl washout area with filter bag to separate water from solid materials.

Construct a Grassed Swale

A constructed pond with impermeable sides is located on the east side of the site. The pond was partially wet when observed in March 2021, and it appears to be receiving runoff from an existing concrete pad that may be used to wash equipment (Figure 15). A grassed swale is recommended to convey drainage from the concrete area to the pond; this would trap sediment and impurities and improve the overall quality of the runoff water.



Runoff Pond on East Side of CCECC Construction Site and Batch Plant Location, St. George, Antigua (March 11, 2021).

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Figure 15.

Erosion

Based on observation of the site, erosion control is not a major concern with the batch plant operation. However, there are piles of loose fill on-site in the construction area (Figure 16) that that may be washed away during heavy rains or storms. These loose fill piles can be protected from erosion during heavy rains via a silt fence and impermeable covering (Figure 17). This will also stop sediment-laden runoff from spilling out of the site.

Fill Piles at CCECC Construction Site and Batch Plant Location, St. George, Antigua (March 11, 2021).

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Figure 16.

Figure 17. Example of fill pile protected with cover and silt fence to prevent material from running off in rains of blowing off during wind storms.

Water Management and Conservation

Because of the heavy water demand in concrete production, it is to CCECC's benefit, as well as being environmentally better, to capture and recycle this water. For instance, operating at full capacity (50 m3/hr.), the HZS50 plant would use water at a rate of 7,500 L/hour. Additional water is then needed for washing trucks and equipment and will ultimately be needed for landscaping, ground maintenance, and other services. Construction will increase the impermeable area of the site. We recommend that, in addition to water management for the batch plant, the final site design incorporates features to intercept or slow runoff from impermeable surfaces. For example, water draining from rooftops could be collected in cisterns to be used for irrigation, and runoff from paved areas can be directed into vegetated swales, slow infiltration into the ground, and trap sediment.

The site should also be vegetated as soon as possible following the completion of construction with native plantings to reduce the risk of erosion and to mitigate the runoff issue. These BMPs that support sound environmental and water management will also reduce costs to CCECC.

Air Pollution and Dust Control

Dust is a common issue on construction and concrete batching sites. Particulate matter from unvegetated soils can be made airborne by vehicle and equipment movement and winds. Wind action can also pick up dust from unprotected aggregate piles. Dust becomes easily airborne at material transfer sites, as well. Filters on the cement silos and dust screens downwind of the batch plant are being used on-site to control dust currently. The stockpiles on-site are partially protected from the wind by low walls (Figure 18). The cement silos are replenished by closed trucks. During the two site assessments, vegetation on and adjacent to the site was relatively free of dust from the batch plant.

The dust control systems on the batch plant should be maintained and filters replaced, as needed. To further control dust, loads of raw materials (e.g., sand/aggregate) should be covered while being transported to the site, and the top layer of material should be damp for transport.

To minimize wind-driven dust movement around the coarse aggregate stockpiles, full enclosures should be built around the stockpiles. Until such time as these enclosures are built, regular spraying of the coarse aggregate stockpiles should be conducted for dust suppression, and stockpile height should be limited to reduce dust creation. Additionally, regular wetting of the batch plant grounds should be conducted to suppress dust, particularly during the drier months.

More generally, as an overall BMP (see above), dust from the construction site should be kept down using a spray truck, especially during drier periods.

Figure 18. Aggregate stockpile on-site.

Noise Management

The HZS50 batch plant is equipped with noise control systems; however, there are some on-site levels of noise produced by the batch plant operation and the ongoing construction activities. Activities are limited to normal business hours and will minimize any potential impacts to the residences located to the south and west of the site.

In addition, we recommend that noise safety protocols for employees working on-site per the World Bank's Environmental Health and Safety Guidelines for Workplace Noise Management be followed.

Solid Waste

Solid waste on Antigua is disposed of at Cooks Sanitary Landfill in the Five Islands area. Construction waste and refuse from previous development should be removed to Cooks Landfill following the completion of construction (Figure 19). Waste concrete from testing or spills should be recycled on-site. Hazardous materials (paints, oil, diesel, etc.) should be stored separately from construction waste on-site and disposed of properly at Cooks Landfill.

Any recyclable materials (PETE [#1] and HDPE [#2] plastics not used to store hazardous materials, aluminum, and steel cans) used on-site should be brought to the Antigua Barbuda Waste Recycling Corporation. Sewage waste from the site should be properly disposed of off-site.

Figure 19. Disposal of construction waste at Cooks Landfill.

Chemical Storage

All hazardous materials on-site must be stored properly and access-controlled to prevent spills and leaks. A safety data sheet (SDS) for each hazardous material stored on-site must be available. A spill prevention and cleanup plan should be in place on-site; employees should be familiar with the plan and trained in spill prevention and cleanup procedures. Any soils contaminated with hazardous materials should be disposed of in the same manner as the hazardous materials themselves.

A list and location of hazardous materials should be maintained by management. This is in the event of a fire or spill when this knowledge may prove essential to responders.

Human Health

Personal Protective Equipment (PPE) should be worn to mitigate adverse health impacts to workers. These include rubber gloves and boots that minimize skin contact with cement and a mask over the mouth to reduce impacts of dust inhalation (particularly from the crystalline form of silica which is mainly found in aggregates).

Additional occupational safety considerations include the use of hard hats, eye protection, on-site eye rinse stations, and the maintenance of a clean and hazard-free work areas.

Demobilization

At the completion of the project, CCECC indicated that it will demobilize the batch plant and removed it from the site. The model is considered a medium-sized batch plant that is designed for a level of site mobility. Demobilization protocols are generally available and should be followed.

Specific BMPs for demobilization include:

- During the process, cement and admixtures should be transported from the site in closed containers. Aggregate should be covered during transport, with the top layer damp to keep down dust.
- Any remaining contaminated water on-site should be treated in order to bring the pH to within 6.5-8.5 and to remove any industrial pollutants before being released.
- Measures should be taken to minimize the accidental release of cement and/or admixtures while dismantling and transporting the plant, and any spills should be cleaned up by trained workers immediately.
- The site should be thoroughly cleaned and revegetated.

CONCLUSION

The site has been cleared and developed several times. Prior to CCECC acquiring the location, abandoned buildings and debris were present from previous activity. This was not a pristine site when work commenced by CCECC and as a result of that, impacts are minimal

The batch plant is a medium sized plant and acommonly used model in construction efforts worldwide.

Vegetation consists mostly of opportunistic and invasive plants, and no sensitive species were observed. As a result, the environmental impact on the vegetation is minimal. However, the site, which will be a major headquarters location, should be vegetated, particularly with native species, to support water management, provide ecological benefit, and beautify the site.

A series of simple but regular BMPs that are described in this report will help with environmental site management and environmental compliance.

The main concern is the fate of the concrete washout water. The assessment team recommends that the water be retained in impermeable basins where solids and water can be separated and recycled on-site. Simple concrete washout areas can easily be constructed or brought to the site prefabricated. Additionally, the batching area is subject to spills and should be equipped with an impermeable liner to protect the local environment. A grass swale is recommended, and these features can also be considered for long-term water management. Water management BMPs outlined will reduce water loss, improve environmental conditions, and save CCECC money in water costs.

Dust control measures are in place, and during the site visits, little dust was observed in the area and on adjacent vegetation. However, especially during the dry season, the aggregate stockpiles and loose soil on-site may become sources of airborne dust; CCECC should monitor these areas and take corrective action as necessary to manage dust.

Erosion is not a concern but fill piles need to be properly protected during rain and wind storms. Solid waste needs to be properly disposed of using the existing Antigua facilities. Maintaining construction hours between 8 a.m. - 5 p.m. will minimize any potential and additional noise impacts to neighboring properties.

Construction and batching are expected to be completed by the end of 2021. At that time, the plant will be disassembled, and environmental precautions (as outlined) should be used. In addition, the site should be cleaned up of all waste materials. Landscaping at this stage can add ecological and aesthetic value, as well as improve water management for the regional headquarters (reducing costs). Where possible, the CCECC should consider creating unique ecological/biodiversity features.

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