## **Monitoring Plan**

**Construction period**

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| --- | --- | --- | --- | --- | --- |
| **Environmental item** | **Item to be monitored** | **Monitoring site** | **Frequency** | **Method** | **Party in charge** |
| **Air quality** | H2S - CO2 | Borinquen Hotel and 4 sites (north, south, east and west) on the well base boundary | During testing period (weeks-one month): every three month (quarterly) and permanent monitoring station  | Field measurement | ICE |
| C:\Users\jovaler\AppData\Local\Temp\Dashboard-1.png |
| **Environmental item** | **Item to be monitored** | **Monitoring site** | **Frequency** | **Method** | **Party in charge** |
| **Noise** | Noise level | Borinquen Hotel, one site on the well base boundary (in the hotel direction), and 4 sites (north, south, east and west) in the vicinity of the power plant site.  | During testing period (weeks-one month): once/weekDuring power plant construction: monthly (with peak time for each construction job taken into account) | Field measurement | ICE |
| C:\Users\jovaler\AppData\Local\Temp\Dashboard-2.png |
|  |
| **Environmental item** | **Item to be monitored** | **Monitoring site** | **Frequency** | **Method** | **Party in charge** |
| Water quality | 1. pH, Electric conductivity (EC), Chlorides (Cl-)
 | Upper and lower streams of the Salitral rivers, upper and lower streams within the project area (AP) of the creek running.  | 1. During testing period: twice/testing period (weeks-one month)
 | Laboratory analysis of collected samples | ICE and External laboratory to hire by ICE |
|  |
| **Water quality** | 1. Oils and grease,
 | Outlet of the settling basin (construction work effluents). Only in the presence of machinery in the project area (AP) | 1. Oils and grease, every six months (semester) After 2 years, the continuation of monitoring will be reconsidered based on opinions of professional experts.)
 | Laboratory analysis of collected samples | ICE and External laboratory to hire by ICE |
|  |
| **Water quality** | 1. Hexavalent chrome (Cr+6), and Mercury (Hg) and COD
 | NOT APPLICABLE (NA) | NOT APPLICABLE (NA) | -------- |  |
|  |
| **Water quality** | 1. Arsenic (As)
 | Only in drinking water intakes | every six months (semester)After 2 years, the continuation of monitoring will be reconsidered based on opinions of professional experts.) | Laboratory analysis of collected samples | ICE and External laboratory to hire by ICE |
|  |
| **Environmental item** | **Item to be monitored** | **Monitoring site** | **Frequency** | **Method** | **Party in charge** |
| **Soil** | Complete analysis - Cadmium (Cd), Lead (Pb), As, Cr+6, Hg, etc. | Four points in the vicinity of a representative geothermal field | One year before construction starts, and once five years after operation starts | Laboratory analysis of collected samples | ICE |
| Four points in the vicinity of the power plant site  | One year before construction starts, and once five years after operation starts |
| Not applicable for this period. Monitoring in 2020. |
| **Environmental item** | **Item to be monitored** | **Monitoring site** | **Frequency** | **Method** | **Party in charge** |
| **Fauna and flora** | Plants and animals (birds, amphibians, reptiles, and mammals) | Area in the vicinity of wells and power plant site, the project site side of the national park, and gallery forest along the Salitral river | Monthly (with rainy and dry seasons, breeding seasons, etc. taken into account) | Visual observation records and photographs | ICE |
| **Results of monitoring and state of conservation of species, April – September 2019.**

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| --- | --- |
| **Group** | **State of conservation** |
| **Amphibian** | **CITES** | **IUCN** | **MINAE N° 40548- Regulations**  |
| *Agalychnis callidryas* | II |   | RP |
| *Craugastor fitzingeri* |   |   |   |
| *Diasporus diastema* |   |   |   |
| *Engystomops pustulosus* |   |   | RP |
| *Leptodactylus savagei* |   |   |   |
| *Lithobates forreri* |   |   |   |
| *Lithobates taylori* |   |   |   |
| *Lithobates warszewitschii* |   |   |   |
| *Pristimantis ridens* |   |   |   |
| *Rhinella horribilis* |   |   |   |
| *Sachatamia albomaculata*  |   |   |   |
| *Smilisca baudinii* |   |   |   |
| *Smilisca sordida* |   |   |   |
| **Birds** |   |   |   |
| *Amaurospiza concolor* |   |   |   |
| *Amazilia rutila* | II |   | RP |
| *Amazilia saucerrottei* | II |   | RP |
| *Amazona albifrons* | II |   | RP |
| *Amazona autumnalis* | II |   | RP |
| *Ammodramus savannarum* |   |   |   |
| *Arremonops conirostris* |   |   |   |
| *Arremonops rufivirgatus* |   |   |   |
| *Attila spadiceus* |   |   |   |
| *Aulacorhynchus prasinus* |   |   |   |
| *Basileuterus culicivorus* |   |   |   |
| *Basileuterus rufifrons* |   |   |   |
| *Brotogeris jugularis* | II |   | RP |
| Burhinus bistriatus |   |   |   |
| *Buteo plagiatus* | II |   | RP |
| *Calocitta formosa* |   |   | RP |
| *Campylopterus hemileucurus* | II |   | RP |
| *Cantorchilus modestus* |   |   |   |
| *Caracara cheriway* | II |   | RP |
| *Cathartes aura* |   |   |   |
| *Catharus mexicanus* |   |   |   |
| *Catharus ustulatus* |   |   |   |
| *Chiroxiphia linearis* |   |   |   |
| *Chlorostilbon canivetii* | II |   | RP |
| *Ciccaba virgata* | II |   | RP |
| *Colinus cristatus* |   |   |   |
| *Columbina passerina* |   |   |   |
| *Coragyps atratus* |   |   |   |
| *Crax rubra* | III | VU | RP |
| *Crotophaga sulcirostris* |   |   |  |
| *Crypturellus cinnamomeus* |   |   |   |
| *Dendrocincla homochroa* |   |   |   |
| *Dendrocolaptes sanctithomae* |   |   |   |
| *Dendrocygna autumnalis* |   |   |   |
| *Elanus leucurus* | II |   | RP |
| *Empidonax minimus* |   |   |   |
| *Eucometis penicillata* |   |   |   |
| *Eumomota superciliosa* |   |   |   |
| *Eupherusa nigriventris* |   |   |   |
| *Euphonia affinis* |   |   |   |
| *Euphonia hirundinacea* |   |   |   |
| *Eupsittula canicularis* | II |   | RP |
| *Galbula ruficauda* |   |   |   |
| *Geothlypis poliocephala* |   |   |   |
| *Habia fuscicauda* |   |   |   |
| *Henicorhina leucophrys* |   |   |   |
| *Henicorhina leucosticta*  |   |   |   |
| *Herpetotheres cachinnans* | II |   | RP |
| *Hylocichla mustelina* |   | NT |   |
| *Hylophilus decurtatus* |   |   |   |
| *Hylophylax naevioides* |   |   |   |
| *Lepidocolaptes souleyetii* |   |   |   |
| *Leptotila verreauxi* |   |   |   |
| *Megascops cooperi* | II |   | RP |
| *Melanerpes hoffmannii* |   |   |   |
| *Microcerculus philomela* |   |   |   |
| *Mionectes oleagineus* |   |   |   |
| *Momotus lessonii* |   |   |   |
| *Morococcyx erythropygus* |   |   |   |
| *Myadestes melanops* |   |   |   |
| *Myiarchus nuttingi* |   |   |   |
| *Myiarchus tuberculifer* |   |   |   |
| *Myiarchus tyrannulus* |   |   |   |
| *Myioborus miniatus* |   |   |   |
| *Myiodynastes luteiventris* |   |   |   |
| *Myiodynastes maculatus* |   |   |   |
| *Myiozetetes similis* |   |   |   |
| *Nyctibius jamaicensis* |   |   |   |
| *Nyctidromus albicollis* |   |   |   |
| *Patagioenas fasciata* |   |   |   |
| *Patagioenas flavirostris* |   |   |   |
| *Penelope purpurascens* | III |   | RP |
| *Peucaea ruficauda* |   |   |   |
| *Phaethornis longirostris* | II |   | RP |
| *Phaethornis striigularis* | II |   | RP |
| *Piaya cayana* |   |   |   |
| *Pitangus sulphuratus* |   |   |   |
| *Psarocolius montezuma* |   |   |   |
| *Pseudastur albicollis* | II |   | RP |
| *Psilorhinus morio* |   |   |   |
| *Pteroglossus torquatus* |   |   |   |
| *Pulsatrix perspicillata* | II |   | RP |
| *Ramphastos sulfuratus* | II |   | RP |
| *Ramphocaenus melanurus* |   |   |   |
| *Sporophila torqueola* |   |   |   |
| *Streptoprocne zonaris* |   |   |   |
| *Sturnella magna* |   |   |   |
| *Thryophilus pleurostictus* |   |   |   |
| *Thryophilus rufalbus* |   |   |   |
| *Tinamus major* |   | NT | RP |
| *Trogon melanocephalus* |   |   |   |
| *Turdus assimilis* |   |   |   |
| *Turdus grayi* |   |   |   |
| *Turdus obsoletus* |   |   |   |
| *Turdus plebejus* |   |   |   |
| *Vireo flavifrons* |   |   |   |
| *Volatinia jacarina* |   |   |   |
| *Zenaida asiatica* |   |   |   |
| *Zenaida macroura* |   |   |   |
| **Mammals (Visual, Sherman, Mist nets and Camera trap)** |   |   |   |
| *Alouatta palliata* | I |   | EN |
| *Ateles geoffroyi* | I | EN | EN |
| *Canis latrans* |   |   |   |
| *Cebus imitator* | II |   | RP |
| *Didelphis marsupialis* |   |   |   |
| *Didelphis virginiana* |   |   |   |
| *Heteromys salvini* |   |   |   |
| *Nasua narica* | III |   |   |
| *Odocoileus virginianus* |   |   |   |
| *Ototylomys phyllotis* |   |   |   |
| *Potos flavus* | III |   |   |
| *Proechimys semispinosus* |   |   |   |
| *Puma concolor* | I |   | EN |
| *Sciurus deppei* | III |   | RP |
| *Sciurus variegatoides* |   |   |   |
| *Sphiggurus mexicanus* | III |   |   |
| *Sylvilagus floridanus* |   |   |   |
| *Tapirus bairdii* | I | EN | EN |
| *Tayassu pecari* | II | VU | EN |
| *Tylomys watsoni* |   |   |   |
| *Artibeus jamaicensis* |   |   | RP |
| *Artibeus lituratus* |   |   |   |
| *Artibeus phaeotis* |   |   |   |
| *Artibeus toltecus* |   |   |   |
| *Artibeus watsoni* |   |   |   |
| *Carollia castanea* |   |   |   |
| *Carollia perspicillata* |   |   |   |
| *Carollia sowelli* |   |   |   |
| *Carollia subrufa* |   |   |   |
| *Desmodus rotundus* |   |   |   |
| *Glossophaga commissarisi* |   |   |   |
| *Glossophaga soricina* |   |   |   |
| *Micronycteris microtis* |   |   |   |
| *Myotis albescens* |   |   |   |
| *Myotis keaysi* |   |   |   |
| *Platyrrhinus helleri* |   |   |   |
| *Pteronotus mesoamericanus* |   |   |   |
| *Rhogeessa bickhami* |   |   |   |
| *Cabassous centralis* |   |   | RP |
| *Caluromys derbianus* |   |   |   |
| *Conepatus semistriatus* |   |   |   |
| *Cuniculus paca* | III |   | RP |
| *Dasyprocta punctata* | III |   |   |
| *Dasypus novemcinctus* |   |   |   |
| *Leopardus pardalis* | I |   | EN |
| *Ototylomys phyllotis* |   |   |   |
| *Panthera onca* | I | NT | EN |
| *Pecari tajacu* | II |   | RP |
| *Tamandua mexicana* |   |   |   |
| **Reptiles** |   |   |   |
| *Boa imperator* | II | RP |   |
| *Bothrops asper* |   |   |   |
| *Coleonyx mitratus* |   | RP |   |
| *Corytophanes cristatus* |   |   |   |
| *Ctenosaura similis* |   |   |   |
| *Gymnophthalmus speciosus* |   |   |   |
| *Holcosus festivus* |   |   |   |
| *Holcosus undulatus* |   |   |   |
| *Norops biporcatus* |   |   |   |
| *Norops capito* |   |   |   |
| *Norops cupreus* |   |   |   |
| *Oxybelis aeneus* |   |   |   |
| *Porthidium ophryomegas* |   |   |   |
| *Sceloporus malachiticus* |   |   |   |
| *Sibon anthracops* |   |   |   |
| *Sphenomorphus cherriei*  |   |   |   |

I=Appendix I CITES, II=Appendix II CITES, III=Appendix III CITES, IUCN= The International Union for Conservation of Nature, CITES=The Convention on International Trade in Endangered Species of Wild Fauna and Flora, NT= Near Threatened, EN= endangered species, RP= species with reduced or threatened populations, VU= Vulnerable. **Wild animals monitoring. April-september, 2019.****Monitoring birds.**\\10.149.70.64\Data_RGE\GE\Gest-Soc-Ambiental\FOTOS-GMA\Gest_Biologia\2019\Borinquen\Monitoreo_fauna\Diurno_Aves_ruido\SETIEMBRE\T1\IMG_9438.JPG**Distribution of flora species by habits registered in the Borinquen Geothermal Field. March 2014 – september 2019.** |
| **Environmental item** | **Item to be monitored** | **Monitoring site** | **Frequency** | **Method** | **Party in charge** |
| **Waste\*** | Generated amount | Power plant construction site | Monthly | Total of generated amount (weight or volume) | Construction contractor |
| Not applicable for this period. In 2021 starts the construction of plant. |

\*Appropriate waste management including disposal of sludge will be implemented in accordance with Law for the Integrated Management of Residues (Law 8839), and in reference to Resolution No. 1948-2008-SETENA17 (page26).