APENDICE M

Actualización del Estudio de Selección de Sitio

Noviembre 2010

Declaración de Impacto Ambiental – Preliminar

Planta de Generación de Energía Renovable y Recuperación de Recursos

BARRIO CAMBALACHE DE ARECIBO

EnergyAnswers Arecibo

Site Selection Study

Preliminary Environmental Impact Statement

Renewable Power Generation and Resources Recovery Facility

CAMBALACHE - ARECIBO

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1 EXECUTIVE SUMMARY

The Puerto Rico Solid Waste Management Authority (Autoridad de Desperdicios Sólidos, ADS, for its acronym in Spanish) has developed an integrated infrastructure program to provide environmentally sound and cost-effective solid waste management services for Puerto Rico. The solid waste program policy includes the development of a Dynamic Itinerary for Infrastructure Projects (Dynamic Itinerary) to develop and implement infrastructure strategies to manage Puerto Rico's solid waste in a safe and efficient manner for the next 25 years, in compliance with regulations.

The Dynamic Itinerary states the importance of increasing the deviation rate and establishing waste-to-energy facilities to provide additional processing capacity and to extend the remaining life of the infrastructure system for the management of the MSW. The Dynamic Itinerary includes, among other strategies, the development of two (2) thermal processing technology facilities to successfully implement the strategy of diverting waste from disposal in landfills. It includes the development of:

- A 1,350 ton per day facility in the North West Region to become operational in 2012 and
- A 1,560 ton per day facility in the North East Region to become operational in 2013.

Energy Answers International participated, in late 1990s and early 2000s, in a partnership to establish a Renewable Power Generation and Resources Recovery Facility and promote an eco industrial resource recovery park (RRP) in Old Cambalache Sugar Mill-Global Fibers in Arecibo, Puerto Rico. The RRP would have consisted of several satellite industries utilizing energy and materials recovered by the Renewable Power Generation and Resources Recovery Facility.

Energy Answers International proposes now to build a Renewable Power Generation and Resources Recovery Facility to provide critical resource recovery oriented solutions for the management of solid wastes in Puerto Rico.

As part of the planning phase of the original Renewable Power Generation and Resources Recovery Facility and RRP, a site selection study was conducted to identify a potential site for its location. One of the philosophical objectives guiding location and site preferences of the study was to look for Brownfield and inactive industrial or physical disturbed sites that would be suitable for recovery and the proposed use, avoiding undisturbed properties. Accordingly, 33[1] potential site locations were identified and evaluated before selecting the Renewable Power Generation and Resources Recovery Facility and RRP site. Note that a substantial portion of these types of sites in Puerto Rico are situated at the confluences of the coastal plains and river valleys and are frequently subject to flooding. At the same time, they are relatively far from developed or settlement areas.

This document constitutes a Site Selection Study Update which evaluates the original 33 potential site locations using the latest available baseline information and revised location criteria to identify the most adequate sites for the proposed Renewable Power Generation and Resources Recovery Facility.

A tiered four (4) phases analysis was used which included:

- Exclusion Analysis - Excluded those sites with location characteristics that are protected by precautionary policies and regulations from the land use and environmental perspective

[1] The Original Site Selection Study reflects 32 sites because the Caribbean Oil and Old Paper Mill / Bottling Factory were considered as one (1) site. Also, the former Global Fibers paper mill parcel located in the Old Cambalache Sugar Mill and Vicinity area was the parcel evaluated in this study since it was identified as the Power Generation and Resources Recovery Facility location back in 2001.

- Inclusion Analysis - Included sites with specific desirable project driven characteristics that are necessary for the viability and proper execution of the Renewable Power Generation and Resources Recovery Facility
- Suitability Analysis Using GIS Based Suitability Model – Classified and described the level of suitability of the sites identified in the previous phase
- Comparative Assessment - Compared and ranked the most suitable sites

A Technical Experts Team identified, in the Inclusion Analysis, six (6) sites that met the majority of the Inclusion Criteria or otherwise reasonable engineering measures could be implemented. Those sites, according to the Suitability Analysis, were all classified as High and Medium Suitable. Since no sites were classified as Low Suitable all High and Medium Suitable sites were further evaluated in the Comparative Assessment. This assessment evaluated project specific parameters such as philosophical objectives, project parameters, community and regional considerations and project timetable and feasibility.

The three (3) top ranked sites of the Comparative Analysis represent the most adequate sites for the proposed RFF.

1. Old Cambalache sugar mill and vicinity in Arecibo
2. Phillips Petroleum Plant Area in Guayama
3. Old Paper Mill/Bottling Factory in Guaynabo

The resultant ranking confirms or validates the results of the original Site Selection Study that identified the former Global Fibers paper mill parcel within the Old Cambalache sugar mill and vicinity area as the preferred site for the location of a Renewable Power Generation and Resources Recovery Facility.

Notice that the identification of the most adequate highest ranking sites is not an absolute recommendation in the sense that no site will comply with all siting criteria. Adequate site engineering and design, on-site construction practice and operation become crucial to compensate those criteria not met.

Location of a Renewable Power Generation and Resources Recovery Facility will necessarily follow the usual planning and permitting criteria for locating a large-scale regional MSW processing facility. As part of this planning and permitting process specialized studies needs to be conducted to identify the potential environmental impacts associated to the proposed facility. Design and operation measures should be aimed to mitigate or compensate any of the siting criteria not met by the proposed site for the Renewable Power Generation and Resources Recovery Facility. Such measures should be based on regulatory accepted Best Management Practices.

2 INTRODUCTION

In late 1990s and early 2000s, Energy Answers International participated in a partnership to establish a Renewable Power Generation and Resources Recovery Facility and promote an eco industrial resource recovery park (RRP) in Old Cambalache Sugar Mill-Global Fibers in Arecibo, Puerto Rico. The RRP would have consisted of several satellite industries utilizing energy and materials recovered by the Renewable Power Generation and Resources Recovery Facility. The Renewable Power Generation and Resources Recovery Facility was proposed to be located in the former Global Fibers paper mill parcel within the original Old Cambalache Sugar Mill and Vicinity area.

As part of the planning phase, a site selection study was conducted to identify a potential site for the Renewable Power Generation and Resources Recovery Facility and RRP. One of the philosophical objectives guiding location and site preferences of the study was to look for Brownfield and inactive industrial or physical disturbed sites that would be suitable for recovery and the proposed use, avoiding undisturbed properties. Accordingly, 33[2] potential site locations were identified and evaluated before selecting the Renewable Power Generation and Resources Recovery Facility and RRP site. Note that a substantial portion of these types of sites in Puerto Rico are situated at the confluences of the coastal plains and river valleys and are frequently subject to flooding. At the same time, they are relatively far from developed or settlement areas.

Energy Answers International proposes now to build a Renewable Power Generation and Resources Recovery Facility to provide critical resource recovery oriented solutions for the management of solid wastes in Puerto Rico.

This document constitutes a Site Selection Study Update which evaluates the original 33 potential site locations using the latest available baseline information and revised location

[2] The Original Site Selection Study reflects 32 sites because the Caribbean Oil and Old Paper Mill / Bottling Factory were considered as one (1) site.

criteria to identify the most adequate sites for the proposed Renewable Power Generation and Resources Recovery Facility. The following subsections provide a more detailed description of the original Site Selection Study. Also, current solid wastes management situation in Puerto Rico and related public policy of the Puerto Rico Solid Waste Management Authority is discussed in this introductory section. Finally, a brief description of the proposed Renewable Power Generation and Resources Recovery Facility and the purpose of this site selection study update are presented.

Background

Description of the original proposed Eco Industrial Park, that included a Renewable Power Generation and Resources Recovery Facility

The RRP was planned as a park setting that would enable the full utilization of all recovered energy and materials from this facility as well as minimization and/or elimination of discharges to the environment (zero waste philosophy).

A Site Selection Study, completed in 2001, led to the identification of a site in Arecibo out of 33 potential site locations. The planning efforts of this project were abandoned, nonetheless, due to changes in solid waste management focus by the incoming government administration at that time.

Energy Answers International (EAI) proposes now a Resource Recovery Facility (the Renewable Power Generation and Resources Recovery Facility or the Project). The Renewable Power Generation and Resources Recovery Facility will be designed to process 2,100 tons per day (TPD) of Process Refuse Fuel (PRF); shred MSW into PRF; combust PRF; and generate approximately 80 MW of electricity. The plant will also be designed to combust up to 20% auto shredded residue (ASR), tire derived fuel (TDF), or 50% shredded urban wood waste (UWW) as supplementary fuel. The bottom ash and fly ash streams will be separately handled and processed. Bottom ash will be processed to recover ferrous and non-ferrous metals, and produce Boiler Aggregate BA™, a light weight aggregate substitute. Local market conditions

and public policies will determine the demand for this aggregate substitute. Fly ash will be conditioned and disposed of in a landfill.

PRF processing technology developed by Energy Answers maximizes the recovery of energy and marketable materials from MSW and other non-hazardous commercial and light industrial waste streams. This technology has been implemented at the SEMASS Resource Recovery Facility located in Rochester, Massachusetts. SEMASS has been in commercial operation since January 1989 and was substantially expanded in 1993. Annual performance test results for SEMASS demonstrate that extremely low emission rates can be consistently achieved without compromising maximum resource recovery.

Brief description of the original Site Selection Study, that lead to the identification of a site in Arecibo

On February 2001, a Site Selection Study entitled: "A Comprehensive Site Selection Process for an Eco-Industrial Park in Puerto Rico" was completed. This study comprised of the following phases:

- Phase I-Island-Wide Search and Review and Initial Rating
- Phase II-Detailed Assessment of Top-Rated Locations and Preliminary Concept Development
- Phase III-Refined Assessment of Identified Sites and Selection of Project Site

A brief description of the study is summarized below.

In order to search for suitable sites, a listing of major requirements for a resource recovery park was formulated. Minimum size of such a park, type of land suitable for it, its relationship to the island transportation network, relationship to local communities were some of the factors. An island-wide screening process using accepted mapping techniques, as of year 2001, provided simultaneously a generalized map of the island showing geographical areas suitable and unsuitable for further exploration. Through careful review of aerial photographs, US Geological Survey (USGS) topographic maps, site visits and special over flights, thirty-three

(33) physically disturbed sites (brown fields, inactive industrial sites, etc.) were identified for the assessment. The application of suitable evaluation criteria to these sites resulted in a short-list of a few sites for more detailed planning and analysis, these sites were:

- Aguada – Old Coloso Sugar Mill-
- Arecibo – Old Cambalache Sugar Mill, Global Fibers Paper Mill and Vicinity
- Vega Baja – Old San Vicente Sugar Mill
- Yabucoa-Humacao – Roig Sugar Mill, Sun Oil Refinery Site and Union Carbide

As a part of the evaluation of the short-listed sites, preliminary site planning at the resource recovery park concept scale was completed to provide an early indication of "goodness-of-fit" of the site as well to identify certain additional data and analysis needs for continuing planning and evaluation of these sites.

A numerical scoring system was employed to rank the sites and the information was subjected to review by project stakeholders and local experts from a full range of relevant disciplines. The end result of this process was the choice of a "best" site as well as a potential alternate site.

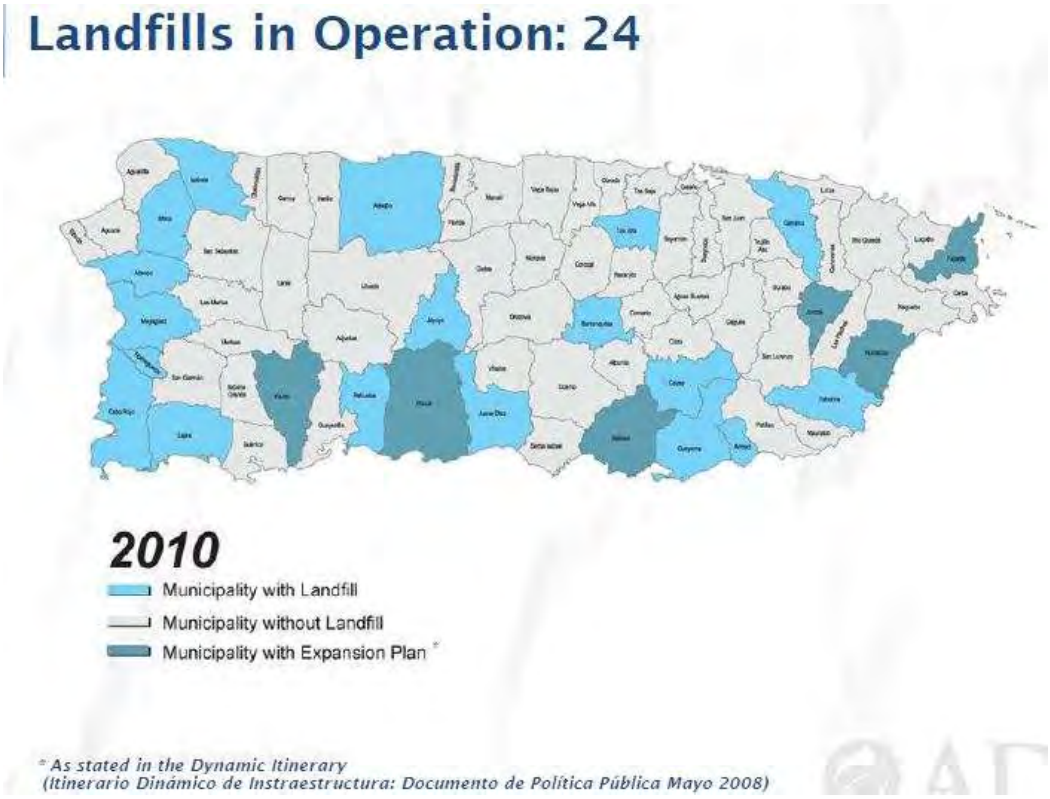
From both the individual category scores and total scores, the site chosen in Arecibo, the site of the Global Fibers Paper Mill and immediate vicinity, was far superior to the nearest alternative site.

Current waste management situation in Puerto Rico and related public policy of the Puerto Rico Solid Wastes Management Authority

The Puerto Rico Solid Waste Management Authority (*Autoridad de Desperdicios Sólidos*, ADS, for its acronym in Spanish) has developed an integrated infrastructure program to provide environmentally sound and cost-effective solid waste management services for Puerto Rico. The solid waste program policy includes the development of a Dynamic Itinerary for Infrastructure Projects (Dynamic Itinerary) (2008). The main objective of this Itinerary is to develop and implement infrastructure strategies to manage Puerto Rico's solid waste in a safe and efficient manner for the next 25 years in compliance with regulations. It will provide strategic guidance for the development of the appropriate infrastructure needed according to the technology and the environment.

The Dynamic Itinerary provides an overview of the existing solid waste management system. The Puerto Rico solid waste management system serves seventy-eight (78) municipalities that generate almost four million tons per year of residential, industrial, and commercial waste. It consists of: several programs that help with the source reduction/reuse and recycling of this waste; materials recovery facilities (MRFs); compost plants; transfer stations; and thirty-two (32) operating landfills. According to the Puerto Rico Solid Waste Management Authority there should be only 24 remaining landfills in operation by the end of 2010. These landfills are currently managed by private and public entities. The following figure shows the landfills that should be in operation by the end of year 2010.

Figure 1: Landfills in Operation by the End of Year 2010



This snapshot of the projected operating landfills by the end of 2010 may not be completely accurate, and it depends on the actual closure schedule of several landfills in 2010.

The Dynamic Itinerary considered the diversion programs that have been implemented and the existing facilities, as well as the proposed changes to optimize these. It also projects the waste generation for the next 25 years. It evaluated operating landfills and identified potential landfill expansions, considering applicable regulatory location restrictions to determine the potential expansion capabilities of these systems.

The following figures present a summary of the landfills that are projected to be operating in Puerto Rico by the years 2014 and 2020

Figure 2 : Landfills in Operation by the End of Year 2014

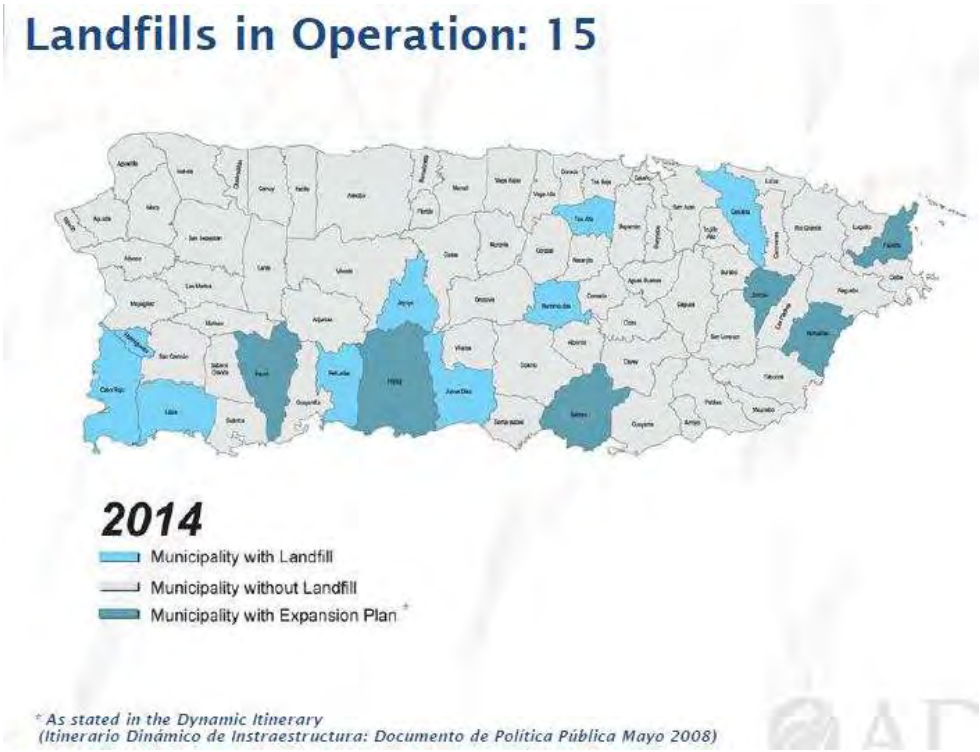


Figure 3: Landfills in Operation by the End of Year 2020

As it can be seen from the previous figures, the ADS expects most of the remaining landfill facilities to close in the next decade. This consolidation in the number of disposal facilities creates an urgent need for Puerto Rico to develop alternate ways of managing and disposing of its solid waste.

The Dynamic Itinerary includes, among other strategies, the development of two (2) thermal processing technology facilities to successfully implement the strategy of diverting waste from disposal in landfills. It includes the development of:

- A 1,350 ton per day facility in the North West Region to become operational in 2012 and
- A 1,560 ton per day facility in the North East Region to become operational in 2013.

Proposed Renewable Power Generation and Resources Recovery Facility

Energy Answers International (EAI) proposes a Renewable Power Generation and Resources Recovery Facility, as indicated before. The primary goal of the proposed Project is to provide resource recovery oriented solutions for the management of solid wastes. A brief description and illustration of the proposed Renewable Power Generation and Resources Recovery Facility is included below.

An approximately 2,100 ton-per-day of combustible PRF of the Renewable Power Generation and Resources Recovery Facility is proposed. The Renewable Power Generation and Resources Recovery Facility will mainly process Municipal Solid Waste (MSW) and produce 80 MW of electrical power and a number of by-products including bottom ash (used as construction aggregate), conditioned fly ash, and recovered ferrous and non-ferrous metals. A parcel for a Renewable Power Generation and Resources Recovery Facility of this size occupies 30 to 50 cuerdas[3]. Additional land area can be used as buffer to other surrounding land uses.

The principal components of the project are the following:

- Waste Processing
- Energy Recovery and Air Pollution Control Facilities
- Ash Processing
- Supporting Facilities (Water Treatment Plant, Auxiliary Fuel Tank, etc)
- Storm Water Management and Flood Water Protection
- Offsite Facilities (Electrical Transmission Line, etc.)

The location of a facility of this nature has several requirements that are project driven. These include considerations on distance to:

- Settlement Areas
- Process Water Supply
- High Voltage substation for power production interconnection

[3] A *cuerda* is equivalent to 0.971 acre. A 50 cuerdas parcel is equivalent to 48.68 acres.

- Major Highway Network
- Sanitary Sewer Line with adequate capacity
- Wastewater treatment plant with adequate capacity

Purpose of this Study Update

The purpose of this study update is to reevaluate each of the original 33 potential site locations that led to the selection of the Arecibo Site, to identify the most adequate sites for the proposed Renewable Power Generation and Resources Recovery Facility. This will be executed by applying currently available baseline information and revised location criteria. The 33 original sites are listed below.

Name		Site ID
1	San Juan Landfill and Vicinity, San Juan	1
2	Puerto Nuevo Pier Arena, San Juan	2A
3	Caribbean Oil, Bayamón	2B
4	Old Paper Mill/Bottling Factory, Guaynabo	2B
5	Guaynabo Landfill, Guaynabo	3
6	Old Canóvanas Sugar Mill, Canóvanas	4
7	Old Fajardo Sugar Mill, Fajardo	5A
8	Roosevelt Roads Naval Reserve Base, Ceiba	5B
9	Humacao Landfill, Humacao	6
10	Roig Sugar Mill and Vicinity, Yabucoa	7A
11	Sun Oil Refinery and Vicinity, Yabucoa	7B
12	Abandoned Union Caribe Site, Yabucoa	8
13	Arroyo Sugar Mill, Arroyo	9
14	Philips Petroleum Plant Area, Guayama	10
15	Aguirre Sugar Mill; Jobs Power Plant, Salinas	11
16	Camp Santiago US Reservation, Salinas	12
17	Fort Allen US naval Base, Juana Díaz	13
18	Mercedita Sugar Mill, Ponce	14
19	Puerto Rican Cement - Spent Quarries, Ponce	15A
20	Ponce Landfill, Ponce	15B
21	Old Commonwealth Oil Refining Co., Peñuelas-Guayanilla	15C
22	Old Guánica Sugar Mill, Guánica	16
23	Coloso Sugar Mill and Vicinity, Aguada	17A
24	US Navy Reservation, Carrizal, Aguada	17B
25	Central La Plata, San Sebastián	17C

	Name	Site ID
	Old Ramey Air Base - Pta Borinquen Site, Aguadilla	18
27	ALCO Site, Hatillo	19
28	Granado Rum Distillery, Arecibo	20A
29	Old Camuy Sugar Mill	20B
30	Old Plazuela Sugar Mill, Barceloneta	22
31	Old Monserrate Sugar Mill, Manatí	23
32	Old San Vicente Sugar Mill and Vicinity, Vega Baja	24
33	Old Cambalache Sugar Mill, Global Fibers and Vicinity, Arecibo	21

A Geographic Information System (GIS) was used as the analytical tool for the update. Section 2 of this study update explains the application of the GIS tools. The location criteria are detailed in referred Section 2, for the corresponding phases of this Study.

The updated study will become part of the supporting studies for the environmental review and other approval process for the proposed facility.

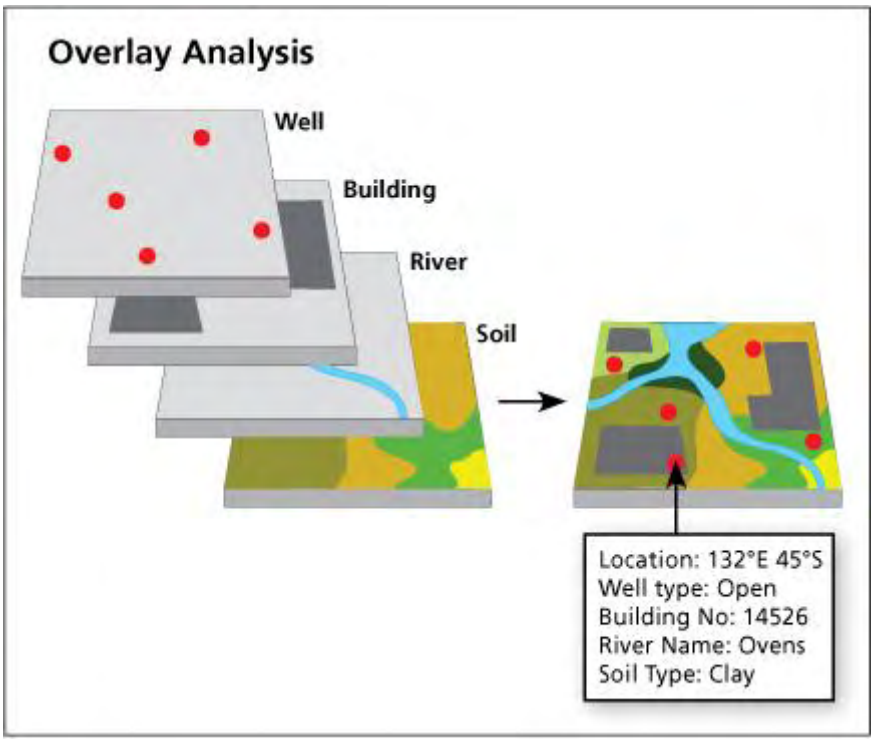
3 METHODOLOGY

Description of GIS Tool

The Geographic Information System (GIS) is a computer software used to capture, store, update, maintain, analyze, and graphically display referenced geographic data and information. As indicated before, this study update uses GIS to re visit the original 33 potential site locations by applying up-to-date baseline information and revised location criteria.

GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. One of the main capacities of this technology is the integration of different data layers, a process called overlay. At its simplest, this could be a visual operation, but analytical operations require one or more data layers to be joined physically. This overlay, or spatial join, can integrate data on soils, slope, vegetation, land ownership or any other geographical information; serving as a tool to simultaneously evaluate different information layers for a given area. (Figure 4 shows a graphical example of this tool.)

Figure 4: GIS Overlay Analysis



Source: Demap Cartographic Design, 2010.

The GIS tools offer other more sophisticated applications, some of which were used in this Study. Such applications are further discussed in the following section under Description of the Methodology by Study Phases).

Overall description of the Methodology

Baseline information

The digital data used by the GIS system for the analysis is information that is readily available and accessible from the various Puerto Rico and Federal Government agencies. It should be noted, that this data should be assessed in detail during the environmental review process that should be completed at a later stage. However, within this study update, the readily available data was considered to be sufficiently accurate to provide an acceptable framework for this study update.

Description of the Methodology by Study Phases

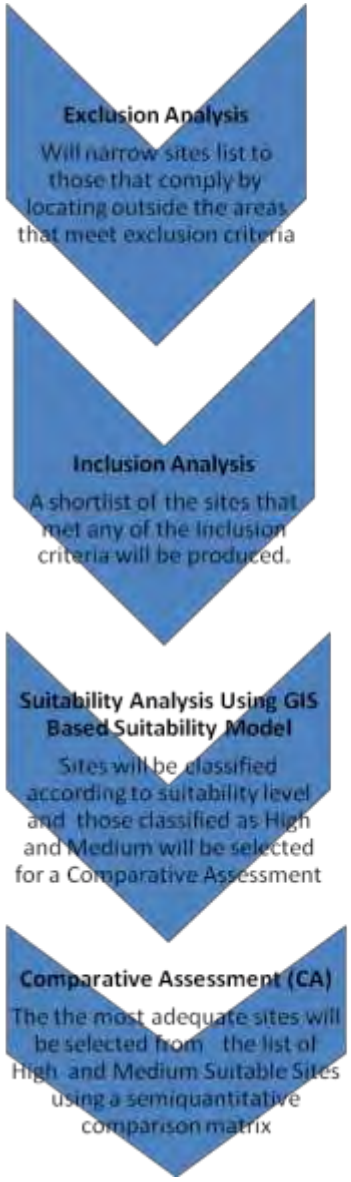
The development of the methodology and criteria applied in the selection effort was based on the following principles:

- A precautionary approach was maintained when impact assessments demonstrated a strong probability of severe and irreversible detrimental economic, societal, and/or environmental effects.
- Decision making relating to environmental and safety concerns was based on the best information and scientific understanding available.
- Safety, environmental and economic considerations were fully integrated to assure that the environment and present human needs were supported without jeopardizing the needs of future generations.
- Sustainable environmental development was maintained incorporating environmental, social, and economic considerations.

The methodology applied for this site selection study update was divided in four (4) phases (**Figure 5**) showing a flow chart for the site selection process):

- Exclusion Analysis using GIS
- Inclusion Analysis using GIS and Subjective Analysis by an independent Technical Experts Team to Generate a Shortlist of Sites
- Suitability Analysis using GIS Based Suitability Model to classify inclusion sites as High, Medium or Low Suitable and identifying the High and Medium suitable sites
- Comparative Assessment of High and Medium Suitable Sites by the independent Technical Experts Team for the identification of the most adequate sites

Figure 5: Flowchart of Site Selection Process



- Original Sites list = 33 sites
- Exclusion criteria (e.g.) Karst Terrain for Priority Conservation, Fault Zones, Natural Reserves, etc.
- Analysis will result in (a) a generalized potential inclusion area and (b) exclusion areas. The exclusion areas will be compared to the 33 sites list. Those sites that lay in the exclusion areas will be eliminated from further analysis.

- Generalized potential inclusion area will be further analyzed to identify sites that met any of the specific desirable characteristics (Inclusion criteria) necessary for the viability of the RRF.
- Inclusion criteria (e.g.) - Flat Land, Process Water Supply, Proximity to Major Highway Network, etc.
- An Independent Technical Experts Team will comparatively analyze Inclusion Criteria that are met for each site to select a shortlist of sites to be further analyzed in the next phase: Suitability Analysis.

- The Sites that resulted from the Inclusion Analysis will be classified according to suitability level (High, Medium and Low).
- Suitability Criteria - Factors that make land adequate for developing an RRF (e.g.) - Relative Flat Land, Away from Settlement Clusters, Out of Flood Prone Zones, etc.
- The sites classified as High and Medium will be further evaluated using a Comparative Assessment (CA).

- The independent Technical Experts Team will compare High Suitable Sites using a semi quantitative matrix (+/0/X) to assign favorability to each Comparison Parameter. The values are as follow: += 1=favorable review; 0=0=neutral review; and X=-1=non favorable review. The information will then be summarized in an evaluation matrix.
- CA Criteria: Industrial Sinergies, Brownfield/Marginal Lands Use; Protection of Aesthetic and Sensitive landscape etc.
- Based on the results of this evaluation, the Technical Experts Team will recommend a preferred site.

A. Exclusion Analysis

The Exclusion Criteria constitute those location characteristics that are protected by precautionary policies and regulations from the land use and environmental perspective. The Exclusion Analysis will narrow the sites original list to those that comply by locating outside areas that meet the following exclusion criteria.

Parameter	
1	Karst Terrain for Priority Conservation
2	Priority Conservation Areas According to DNER, Natural Heritage Program
3	Fault Zones
4	Historical and Archeological Sites
5	Wetlands
6	Landslide prone areas
7	Federal Lands
8	Natural Reserves
9	Soils of agricultural significance
10	Coastal Barriers
11	Schools

Notice that the flood zones were not included in the list of parameters for the Exclusion Analysis since development on this zone is possible without significantly affecting regulatory flood levels when appropriate site configuration design and mitigation measures are implemented. Therefore, this parameter is better evaluated in the Suitability Analysis phase of this study update which allows to weight the various flood zone conditions.

Earthquake risk was considered, but not included as an evaluation criterion in any of the phases of this Study Update, since the danger of earthquakes is similar for the whole main Island. Puerto Rico is located in a zone of contact between the North America the Caribbean tectonic plate, this contact has generated a series of faults around and across the island some superficial (5 - 10 kilometers) and others deep (up to 180 km). Tremors therefore occur in all areas of the island. The southwestern region is most active and the faults are more superficial which lies why the movements feel stronger in this area. Regarding the danger of earthquakes, at this moment the building code of construction of Puerto Rico (Uniform Building Code, 1997) establishes two (2) zones of danger (on a scale from 0 to 4, where 4 indicates the maximum danger), the Virgin

Table 1 Exclusion Criteria

Parameter		Data Type	Buffer[4]	Reference
1	Karst Terrain for Priority Conservation	Polygon	No buffer	Department of Natural and Environmental Resources (DNER), (2008) delimitation.
2	Priority Conservation Areas According to DNER, Natural Heritage Program	Polygon	50 meters buffer	DNER (2009), delimitation. Buffer criteria for development near caves, based on Puerto Rico Planning Board (PB), Planning Regulation Number 4 Conservation Districts, Section 33.07.
3	Fault Zones	Polyline	60 meters buffer	USGS (2001), delineation. Buffer criteria from the Environmental Quality Board (EQB) Non Hazardous Solid Waste Management Regulation, (Nov/1997)
4	Historical and Archeological Sites	Point	10 meters buffer	State Historic Preservation Office (SHPO) and Institute of Puertorrican Culture (ICP for its acronym in Spanish) (2010) archives of mapped archaeological/cultural sites, point features
5	Wetlands	Polygon	No buffer	US Fish and Wildlife Service (USFWS) (2010) National Wetland Inventory, delimitation.
6	Landslide prone areas (moderate high and highest)	Polygon	No buffer	USGS, Watson H Monroe (1979).
7	Federal Lands	Polygon delimitation	No buffer	Bureau of Land Management in partnership with US Forest Service (2010).
8	Natural Reserves	Polygon	50 meters buffer	DNER (2003) and buffer criteria for development near caves Puerto Rico Planning

[4] An arbitrary 10 meters buffer was established for point features necessary when using GIS systems for execution of an exclusion analysis.

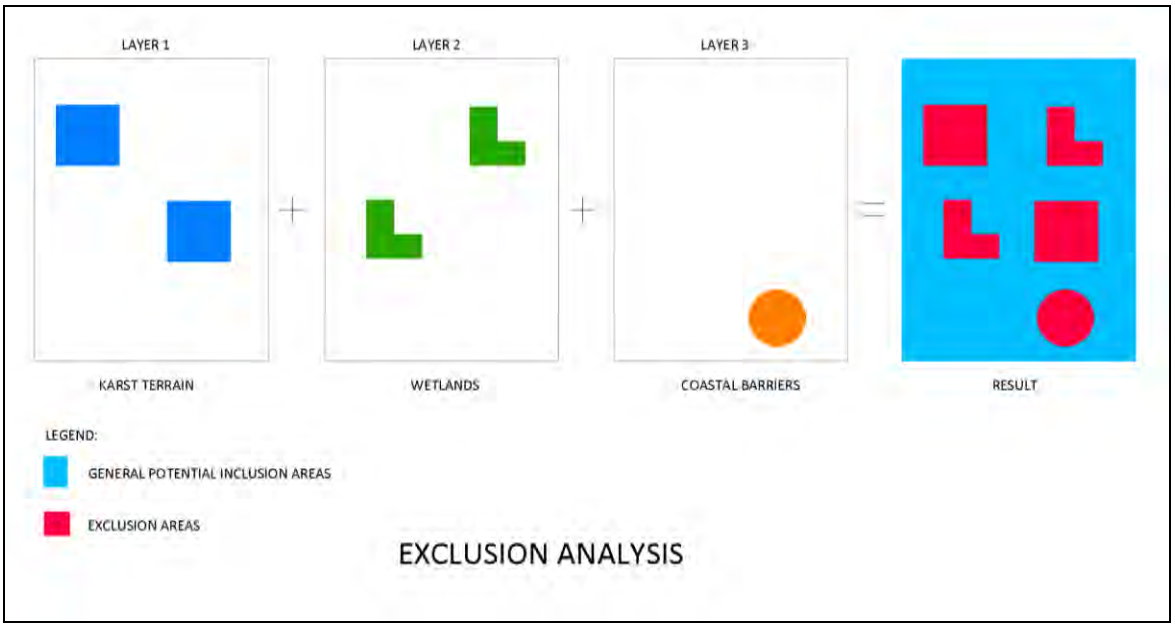
Parameter		Data Type	Buffer[4]	Reference
				Board, Planning Regulation Number 4 Conservation Districts (Section 33.07)
9	Soils of agricultural significance (Class I to IV)[5]	Polygon	No buffer	Natural Resources Conservation Service (NRCS) (2010)
10	Coastal Barriers	Polygon	No buffer	Federal Emergency Management Agency (FEMA) (2009)
11	Schools	Point	200 meters buffer radius	Buffer from PRPB Planning Regulation Number 4 Section 6.05. School location data from Puerto Rico Planning Board/CSA(2010)

After completing the Exclusion Analysis, two types of (2) areas were defined:

- exclusion areas; and
- generalized potential inclusion areas.

The following figure illustrates the Exclusion Analysis concept.

Figure 7: Exclusion Analysis



[5] Developed areas were removed from this layer. (Puerto Rico Planning Board/CSA, 2007)

The resultant exclusion areas area was compared to the thirty-two sites that were identified in the original Site Selection Study. Those sites that lay in the exclusion areas were eliminated from further analysis.

B. Inclusion Analysis

After completing the Exclusion Analysis a generalized potential inclusion area resulted, as indicated in the previous section. Such area was further analyzed to identify sites with specific desirable characteristics that are necessary for the viability and proper execution of the Renewable Power Generation and Resources Recovery Facility. Those location characteristics, that are Project driven, and therefore considered desirable for the Project purposes, constitute the Inclusion Criteria. Refer to the table below.

Table 2 Inclusion Criteria

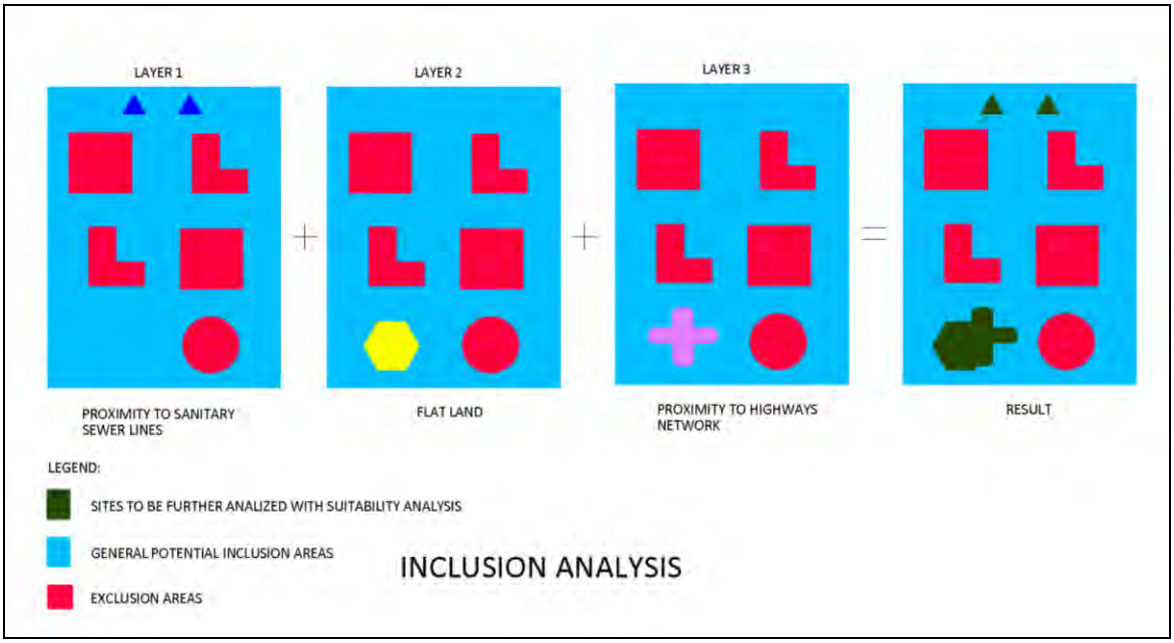
Parameter		Criteria and Type of Data	Reference
1	Flat Land	Less than 21 % slope. Project driven. Polygon.	US Corps of Engineers (2004), LIDAR data.
2	Process Water Supply (effluent from wastewater treatment plants, surface water, or potable water main with minimum 12 inches diameter)	Less than 3 miles. Project driven. Polygon.	US Fish and Wildlife (2010), USGS (2009) and Puerto Rico Planning Board/CSA (2009)
3	Proximity to Major Island Highway Network	Less than 3 miles. Project driven. Polygon.	Puerto Rico Highways and Transportation Authority, 2009.
4	Accessibility to a 115KV or 230 KV substation[6] for power production interconnection point with Puerto Rico Electric Power Authority (PREPA)[7]	Less than 2,000 meters and available right of way. Project driven. Polygon.	Puerto Rico Planning Board, 2003.
5	Accessibility to an electric power source (38 KV substation) for minimum electrical consumption	Less than 2,000 meters. Project driven. Polygon.	Planning Board, 2003.
6	Proximity to Sanitary Sewer Line with minimum 12 inches diameter with adequate capacity	Less than 3 miles. Project driven. Polygon.	Puerto Rico Planning Board, 2001.
7	Wastewater treatment plant with adequate capacity	Less than 3 miles. Project driven. Polygon.	Puerto Rico Planning Board, 2001.

[6] The available digital database does not include 230 kv substation. However, 230 kv substations are adjacent to 115 kv substations.

[7] Puerto Rico electric system is an integrated system with all power plants supplying power to an integrated grid. Most PREPA generation capacity is in the southern portion of the island.

The Inclusion Analysis identified those areas that comply with any of the aforementioned Inclusion Criteria. The following figure illustrates the Inclusion Analysis concept.

Figure 8: Inclusion Analysis



The resultant general potential inclusion areas were further analyzed to identify sites that meet any of the Inclusion Criteria. Those sites that do not meet any of the inclusion areas will be eliminated from further analysis.

A summary table was generated identifying the Inclusion Criteria that were met for each site. A Technical Experts Team comparatively analyzed this table to select a shortlist. This team was composed of experts with the following expertise areas:

- Architect with background and experience in environmental design
- Electrical engineer with experience in the environmental field
- Civil engineer with Ph.D. in hydrology and experience in the environmental field

Notice that this objective approach allows for not to eliminate those sites that do not meet specific Inclusion Criteria that could be addressed by implementing reasonable engineering measures.

The resultant sites objectively selected by the Independent Technical Experts Team were further analyzed using a GIS based Suitability Model. This GIS application is described in the following section.

C. Suitability Analysis

The ArcGIS Spatial Analyst was used for suitability modeling. Suitability modeling involves calculating optimal site locations by identifying possible influential factors, creating new data sets from existing data, reclassifying data to identify areas with high suitability, and finally aggregating these data into one logical result of optimal suitability (Koikai, 2008). The model predicts areas that are away from settlement clusters as well as proximity to major electrical substations, among others.

The concept of the geographic data format that is used in the suitability modeling is presented below to introduce the suitability model discussion. Traditionally spatial data has been stored and presented in the form of a map. Three basic types of spatial data models have evolved for storing geographic data digitally. These are referred to as:

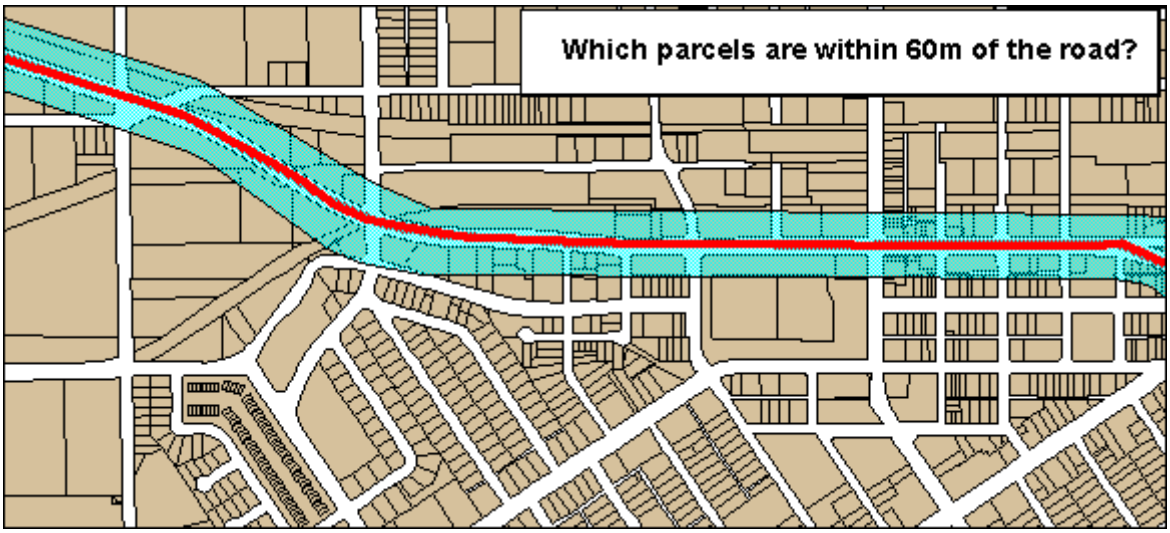
- Vector
- Raster
- Image

The following diagram reflects the two (2) primary spatial data encoding techniques. These are vector and raster. Image data utilizes techniques very similar to raster data, however typically lacks the internal formats required for analysis and modeling of the data. Images reflect pictures or photographs of the landscape (Buckey, 2010). The following figure illustrates how a vector and a raster GIS will represent a real world landscape.

Islands, Culebra and Vieques are in a "4" zone and the island of Puerto Rico in a zone 3 (Puerto Rico Seismic Network, 2010).

The buffer concept is used to apply some criteria in this analysis. A buffer is a zone of a specified distance around features in a geographic layer. Buffers can be set at constant or variable distance based on feature attributes. Such distances are based on applicable local and federal policies and regulations and/or professional judgment. The resulting buffer zones form polygonal coverages. The following figure illustrates the buffer concept.

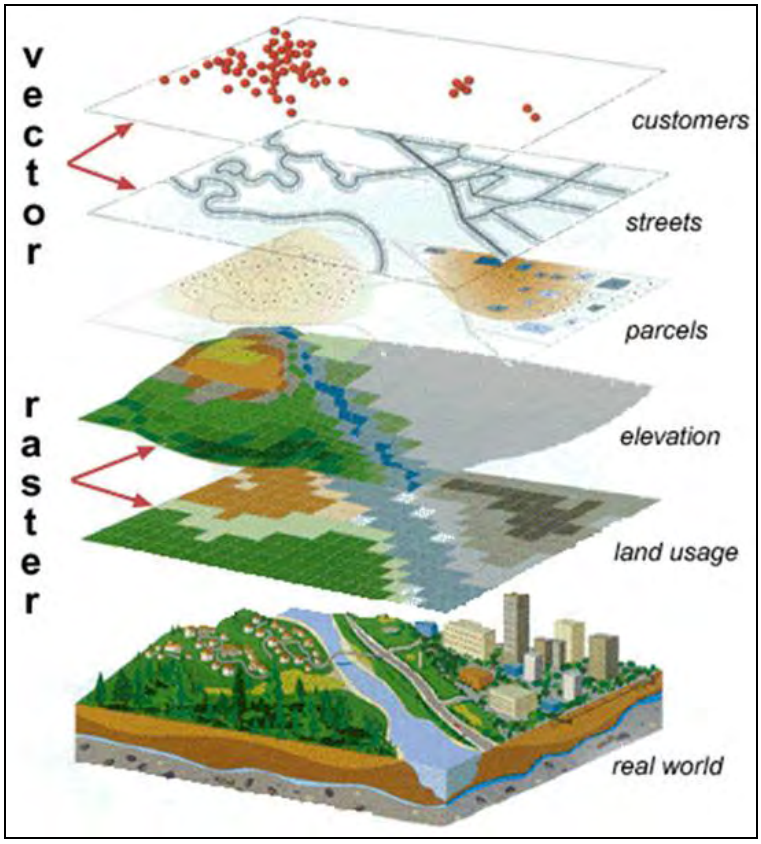
Figure 6: Buffer Concept



Source: Simon Fraser University Library, 2010.

Regulations related to the Exclusion Criteria were revised to verify if applicable buffer protection areas have been determined. There are not buffers established in current regulations for all criteria. However, buffer for some related criteria were applied (eg. caves applied to natural reserves, fault zones for landfill siting applied to a Waste to Energy System). The table below identifies those parameters where a buffer was applied. It also includes the reference of the data base for each criteria data, and buffer delimitation, where applicable.

Figure 9: Representation of the real world and showing differences in how a vector and a raster GIS will represent this real world



Source: City of Hopkinsville, 2010.

For this analysis new data was formulated, from existing data, using vector and raster data to create various criteria to serve as input for a site suitability model. The use of GIS analysis made it possible to consider Renewable Power Generation and Resources Recovery Facility sites based on a variety of factors and criteria such as relative flat lands, proximity to major electrical substations, among others. The model examined several suitability factors to identify feasible locations.

The suitability model involved three (3) steps:

1) Identification of site selection suitability factors,

2) Classification of suitability factors based on a ranked criteria, and

3) Weighting the factors selected and finally implementing the suitability model.

1. Identifying the Renewable Power Generation and Resources Recovery Facility Selection Suitability Factors

The first step for the analysis was to define the characteristics that make land suitable for developing a Renewable Power Generation and Resources Recovery Facility. For this analysis the following factors were considered:

Table 3 Site Selection Suitability Criteria and References

Criteria		Data Type	Reference
1	Relative Flat Land	Polygon	US Corps of Engineers (2004), LIDAR data.
2	Located away from Settlement Clusters	Polygon	Designated places US Census Bureau 2000
3	Out of flood prone zones	Polygon	Federal Emergency Management Agency (FEMA) (2009)
4	Proximity to Major electrical Substations	Polygon	Puerto Rico Planning Board, 2003.
5	Process Water Supply (effluent from wastewater treatment plants, surface water, or potable water main with min. 12 inches diameter)	Polygon	US Fish and Wildlife (2010), USGS (2009) and Puerto Rico Planning Board/CSA (2009)
6	Located in Open Setting with Prevailing Wind Direction Away from major settlements	Polygon	Ecosystems and Associates (1980) in Puerto Rico Solid Wastes Management Authority (2008, b). Designated places, US Census Bureau, 2000
7	Setback from proposed Non Industrial projects	Polygon	Planning Board, Puerto Rico Interactivo, 2010.
8	Proximity to Nearest Transfer Station (road distance)	Polygon	Puerto Rico Solid Wastes Management Authority. (May 2008, b).
9	Proximity to Nearest Household	Polygon	US Army Corps of Engineers, Aerial Imagery, 2007. Field visit, 2010.

Criteria		Data Type	Reference
10	Proximity to Nearest Recreational facilities	Polygon	Several: • National Oceanic and Atmospheric Administration (NOAA) et. Al. (2000) – recreational beaches • Puerto Rico Planning Board – recreational beaches, recreational centers and tourism interest sites • Tourism Company – hotels, parks and historical sites • Puerto Rico Conservation Trust – properties of this trust • National Parks Company – parks administrated by this company • www.dondees.com – municipal town squares, baseball fields and recreational parks
11	Adjacent prevailing land use (1,000 meters)	Polygon	CSA Photo interpretation. Based on US Army Corps of Engineers Aerial Imagery, 2007.
12	Proximity to Nearest Ocean Cargo Port	Polygon	Puerto Rico Ports Authority, 2010.
13	Proximity to Nearest Airport	Polygon	Puerto Rico Ports Authority, 2010.

2 Ranking Suitability Factors

The data layers used for the analysis and ranking of these layers are illustrated in **Table 4**.

The ranking metrics for the suitability preferences listed in Table 4 were rated as high (3), medium (2) and low (1).

Table 4 Site Selection Suitability Criteria and Ranking Values used for the Suitability Model

Suitability Values		Low Suitability (Score of 1)	Medium Suitability (Score of 2)	High Suitability (Score of 3)	Assigned Weight	Criteria
1	Relative Flat Land	Greater than 5 % slope	Between 2% and 5% slope	Less than 2 % slope	1	Project driven
2	Located away from Settlement Clusters	Less than 200 meters	Between 200 and 1,000 meters	Greater than 1,000 meters	3	Project driven
3	Out of flood prone zones	Located in the floodway (eg. AE) but it is possible to develop site without significantly affecting regulatory flood levels. Appropriate site configuration design and mitigation measures must be implemented.	Presents flood hazard but is outside of the floodway (e.g. A, A99, VE and AE)	Moderate or minimum flood hazard (e.g. X Zone)	2	Project driven
4	Proximity to Major PREPA electrical Substations (115 KV and 38 KV)	Greater than 1 mile	Between 0.5 and 1 miles	Less than 0.5 mile	3	Project driven
5	Process Water Supply (effluent from wastewater	Greater than 3 miles	Between 1 and 3 miles	Less than 1 mile	3	Project driven

Suitability Values		Low Suitability (Score of 1)	Medium Suitability (Score of 2)	High Suitability (Score of 3)	Assigned Weight	Criteria
	treatment plants, surface water, or potable water main with min. 12 inches diameter)					
6	Located in Open Setting with Prevailing Wind Direction Away from major settlements	No major settlements within area defined by a 0-200 meters radius and located downwind from site following direction of prevailing winds	No major settlements within area defined by 200-500 meters radius and located downwind from site following direction of prevailing winds	No major settlements within area defined by a 500-1,000 meters radius and located downwind from site following direction of prevailing winds	3	Project driven
7	Setback from proposed Non Industrial projects	Less than 200 meters	Between 200 and 1,000 meters	Greater than 1,000 meters	2	Project driven
8	Proximity to Nearest Transfer Station (road distance)	Greater than30 miles	Between 15 and 30 miles	Less than 15 miles	2	Project driven
9	Proximity to Nearest Household	Less than 200 meters	Between 200 and 500 meters	Greater than 500 meters	3	Project driven and PB 200-meter regulatory setback for schools (Puerto

Suitability Values		Low Suitability (Score of 1)	Medium Suitability (Score of 2)	High Suitability (Score of 3)	Assigned Weight	Criteria
						Rico Planning Board, Planning Regulation Number 4 Section 6.05)
10	Proximity to Recreational facilities	Less than 200 meters	Between 200 and 1,000 meters	Greater than 1,000 meters	2	Project driven and PB 200-meter regulatory setback for schools (Puerto Rico Planning Board, Planning Regulation Number 4 Section 6.05)
11	Adjacent prevailing land use (1,000 meters)	Commercial Residential, Tourism, Conservation	Non Commercial Residential, Tourism, Conservation	Industrial	1	Project driven
12	Proximity to Ocean Cargo Port	Greater than 25 miles	Between 10 and 25 miles	Less than 10 miles	1	Project driven
13	Proximity to Airport	Greater than 10 miles	Between 5 and 10 miles	Less than 5 miles	1	Project driven
Total					27	--

3. Measuring and Weighting Suitability Factors

The data layers used for Suitability Analysis were weighted according to how important they were to the analysis as a whole. These were subjective weights and rankings based on project driven criteria and knowledge of the area. The data layers were assigned influence and were ranked according to relative importance as follows:

- 3 classified as extremely important,
- 2 classified as very important and
- 1 as important.

4. GIS-Based Site Suitability Analysis

Suitability Analysis steps and operations used consisted of four (4) general steps:

1. Distance Buffers: The first step comprised creating multiple ring buffers for the layers (e.g. proximity to ocean cargo port, proximity to transfer stations, PREPA electrical substations, among others) according to the distance criteria noted in **Table 4**. Please refer to the aforementioned **Figure 6** that shows the concept of a buffer.

2. Vector Data to Raster Data Conversion: The second step in the spatial analysis involved the creation of raster data. All layers had to be converted from vector to rasters before the Spatial Analyst could be used to perform any type of analyses.

3. Reclassifying Values: Once all the data sets were buffered and converted to raster data, the reclassification tool was used to reclassify the data sets using the criteria of **Table 4**. The reclassification values used ranged from 1 to 3, with 3 being the most suitable and 1 being the least suitable. The areas that did not fall within the 3 reclassified groups were reclassified as No Data.

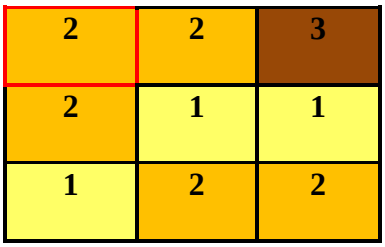
4. Weighting Data: Each input layer was ranked based on its importance and assigned a decimal weight. The total influence, or total weight, for all inputs equals 27.

The assigned influence-importance values were multiplied by the site zonal mean, resulting in a weighted factor (Table 4). To determine the Suitability Value for each site the following formula was used:

$$\text{Suitability Value} = \frac{\sum \text{Site Factor Zonal Mean X Weight}}{27 \text{ (Total Weight)}}$$

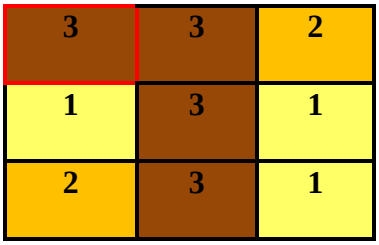
To find the suitable sites the data was calculated using the weighted overlay suitability model. The following figure illustrates the weighted overlay concept that is applied in a suitability model.

Figure 10: Weighted Overlay Concept



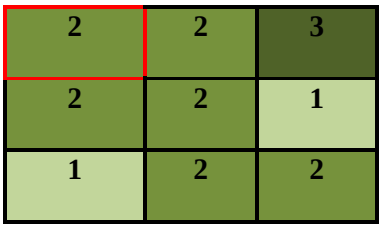
Location away from settlement clusters (Influence or weight = 0.75)

+



Relative flat lands (Influence or weight = 0.25)

=



Source: ESRI, 2010

In the illustration, the two (2) input rasters have been reclassified to a common measurement scale of 1 to 3. Each raster is assigned a percentage influence. The cell values are multiplied by their percentage influence (or weight), and the results are added together to create the output raster.

For an example of this concept, consider the top left cell (in red).

- The values for the two inputs become (2*0.75)= 1.5 and (3*0.25)=0.75.
- The sum of 1.5 and 0.75 is 2.25.
- Because the output raster from Weighted Overlay is integer, the final value is rounded to 2 (ESRI, 2010). The high suitability areas (3) reflected the darkest green.

Similar to the previous example, the weighted overlay suitability model demonstrated the suitability classification of the sites, based on the suitability criteria input. The weighted overlay suitability model particularly demonstrated the areas in the sites suitability levels as: high, medium or low. The suitability levels average was calculated for the sites in its entirety to reflect a single suitability level for each site.

A figure identifying each Site as highly suitable, medium suitable and low suitable was prepared. Those sites classified as High and Medium Suitable were identified and further evaluated using a Comparative Assessment, as described in the following section. Sites classified as Low Suitable will be eliminated from further analysis.

D. Comparative Assessment of Higher Suitable Sites by the independent Technical Experts Team

A comparative assessment was conducted among the High and Medium Suitable Sites, through an assessment matrix. The Comparison Parameters, which are listed below in this section, will be based on principles enunciated for the proposed Renewable Power Generation and Resources

Recovery Facility. In this assessment a semi quantitative approach (+/0/X) will be applied to assign favorability to each Comparison Parameter. The values are as follow:

+= 1;

0=0; and

X=-1

This Comparative Assessment was conducted by the independent Technical Experts Team.

For each parameter a ranking of a plus sign ("+") indicates a favorable review and a "x" sign indicates a non favorable review of that site. A 0 represents a neutral review. This form of ranking allowed for a practical method of comparison of one site versus another. No weights were assigned to the evaluated parameters.

The values expressed by each Expert were converted to numerals (eg. + = 1), tabulated and added for each criteria, for all Sites. Subtotals were calculated for the four (4) criteria topics:

- Philosophical Objectives,
- Project Parameters,
- Community and Regional Considerations and
- Project Timetable and Feasibility.

Subtotals were added up to obtain a total value for each Sites. Sites with the highest scores are considered more adequate for the proposed Renewable Power Generation and Resources Recovery Facility. The aforementioned information was presented in an evaluation matrix. Based on the results of this evaluation, the Technical Experts Team identified the most adequate sites for the proposed Renewable Power Generation and Resources Recovery Facility.

The following table describes the Comparison Parameters.

Table 5: Comparative Assessment of High Suitable Sites

Parameter			Site Considerations
1		**PHILOSOPHICAL OBJECTIVES**	
	1.A	Industrial Synergies	• Proximity to industrial facilities with the potential capability of creating some synergy with the Renewable Power Generation and Resources Recovery Facility
	1.B	Brownfield/Marginal Lands Utilization	• Optimization of Brownfield sites with marginal use. o Restores property to productive use, thus increasing property values o Increase job opportunities and local tax revenues o Improved public health and the environment o Utilize existing infrastructure o Improves a community's image and long-term sustainability
	1.C	Protection of Aesthetic And Sensitive Landscapes	• Limited impact to landscape by Renewable Power Generation and Resources Recovery Facility buildings and infrastructure • Minimal visual impact from residential settlements
	1.D	Provision of Power Generation Capacity in the North Coast[8]	• Contributes to provide power generation capacity in the North area which is limited in this portion of the island.
		SUB-TOTAL: PHILOSOPHICAL OBJECTIVES	
2		**PROJECT PARAMETERS**	

[8] Puerto Rico electric system is an integrated system with all power plants supplying power to an integrated grid. Most PREPA generation capacity is in the southern portion of the island. Therefore, in an event of loss of transmission lines between the North and the South, the North portion will probably suffer from an unavailability of enough power to supply its needs.

Parameter			Site Considerations
	2.A	Core Project Economics And Need	• Site adjacent to potential industrial customers • Present or programmed industrial investments
	2.B	Water Supply: Quantity and Quality	• Required quantity of water available and obtainable. • Quality of water source is adequate
	2.C	Property Availability	• Property is available
	2.D	Property Acquisition Costs	• Acquisition costs are likely to be relatively low or moderate
		SUB-TOTAL: PROJECT PARAMETERS	
3		**COMMUNITY AND REGIONAL CONSIDERATIONS**	
	3.A	Potential For Local Support	• Potential for Municipal government support
	3.B	Potential For Local Community Support	• Potential for community support
	3.C	Adverse Environmental impacts	• Area Air quality is not likely to be adversely affected by location • No adverse environmental impacts are expected on flora and fauna resources, etc). (Notice that other main environmental/cultural resources have been specifically evaluated on previous phases of this Study Update, such as: flood plains, wetlands, archeological, soils of agricultural significance, coastal barriers, karst terrains, natural reserves and DNER priority conservation areas. Distance to settlements clusters, recreational facilities and schools was also evaluated in previous Suitability Analysis Phase.)

Parameter			Site Considerations
		SUB-TOTAL: COMMUNITY AND REGIONAL CONSIDERATIONS	
4		**PROJECT TIMETABLE AND FEASIBILITY**	
	4.A	Licensability and Early Implementation Feasibility	• Site could be expected to be permitted considering regulatory requirements, including such key permits as air, water franchise, etc.
	4.B	Licensability and Early Implementation Feasibility	• Available nearby meteorological data (PREPA meteorological stations or others)
	4.C	Licensability and Early Implementation Feasibility	• Site air modeling study or current major source permit status indicates or suggest that one year air background monitoring will not be required
	4.D	Compatibility With Policy Objectives of SWMA and PREPA Policy Context	• Site located within northwest region as defined in SWMA's Dynamic Itinerary(Mayaguez to Arecibo)
		SUB-TOTAL: PROJECT TIMETABLE AND FEASIBILITY	
		GRAND-TOTAL: CUMULATIVE SCORE IN ALL CATEGORIES	

4 RESULTS

A. Exclusion Analysis

The Exclusion Analysis narrowed the original sites list to those that meet the Exclusion Criteria, as defined previously. The following table shows those sites that resulted from the Exclusion Analysis. These were further analyzed in the Inclusion Analysis.

	Name	Site ID
1	San Juan Landfill and Vicinity, San Juan	1
2	Puerto Nuevo Pier Arena, San Juan	2A
3	Caribbean Oil; Old Paper Mill/Bottling Factory, Bayamón	2B
4	Old Paper Mill/Bottling Factory, Guaynabo	2B
5	Old Fajardo Sugar Mill, Fajardo	5A
6	Humacao Landfill, Humacao	6
7	Roig Sugar Mill and Vicinity, Yabucoa	7A
8	Sun Oil Refinery and Vicinity, Yabucoa	7B
9	Abandoned Union Caribe Site, Yabucoa	8
10	Arroyo Sugar Mill, Arroyo	9
11	Philips Petroleum Plant Area, Guayama	10
12	Aguirre Sugar Mill; Jobs Power Plant, Salinas	11
13	Puerto Rican Cement - Spent Quarries, Ponce	15A
14	Ponce Landfill, Ponce	15B
15	Old Commonwealth Oil Refining Co., Peñuelas-Guayanilla	15C
16	Old Guánica Sugar Mill, Guánica	16
17	Coloso Sugar Mill and Vicinity, Aguada	17A
18	Granado Rum Distillery, Arecibo	20A
19	Old Camuy Sugar Mill, Camuy	20B
20	Old Plazuela Sugar Mill, Barceloneta	22
21	Old Monserrate Sugar Mill, Manatí	23
22	Old San Vicente Sugar Mill and Vicinity, Vega Baja	24
23	Old Cambalache Sugar Mill, Global Fibers and Vicinity, Arecibo	21

The following table shows those sites that were eliminated from further analysis:

4 RESULTS

A. Exclusion Analysis

The Exclusion Analysis narrowed the original sites list to those that meet the Exclusion Criteria, as defined previously. The following table shows those sites that resulted from the Exclusion Analysis. These were further analyzed in the Inclusion Analysis.

	Name	Site ID
1	San Juan Landfill and Vicinity, San Juan	1
2	Puerto Nuevo Pier Arena, San Juan	2A
3	Caribbean Oil; Old Paper Mill/Bottling Factory, Bayamón	2B
4	Old Paper Mill/Bottling Factory, Guaynabo	2B
5	Old Fajardo Sugar Mill, Fajardo	5A
6	Humacao Landfill, Humacao	6
7	Roig Sugar Mill and Vicinity, Yabucoa	7A
8	Sun Oil Refinery and Vicinity, Yabucoa	7B
9	Abandoned Union Caribe Site, Yabucoa	8
10	Arroyo Sugar Mill, Arroyo	9
11	Philips Petroleum Plant Area, Guayama	10
12	Aguirre Sugar Mill; Jobs Power Plant, Salinas	11
13	Puerto Rican Cement - Spent Quarries, Ponce	15A
14	Ponce Landfill, Ponce	15B
15	Old Commonwealth Oil Refining Co., Peñuelas-Guayanilla	15C
16	Old Guánica Sugar Mill, Guánica	16
17	Coloso Sugar Mill and Vicinity, Aguada	17A
18	Granado Rum Distillery, Arecibo	20A
19	Old Camuy Sugar Mill, Camuy	20B
20	Old Plazuela Sugar Mill, Barceloneta	22
21	Old Monserrate Sugar Mill, Manatí	23
22	Old San Vicente Sugar Mill and Vicinity, Vega Baja	24
23	Old Cambalache Sugar Mill, Global Fibers and Vicinity, Arecibo	21

The following table shows those sites that were eliminated from further analysis:

	Name	Site ID
1	Guaynabo Landfill, Guaynabo	3
2	Old Canóvanas Sugar Mill, Canóvanas	4
3	Roosevelt Roads Naval Reserve Base, Ceiba	5B
4	Camp Santiago US Reservation, Salinas	12
5	Fort Allen US naval Base, Juana Díaz	13
6	Mercedita Sugar Mill, Ponce	14
7	US Navy Reservation, Carrizal, Aguada	17B
8	Central La Plata, San Sebastián	17C
9	Old Ramey Air Base - Pta Borinquen Site, Aguadilla	18
10	ALCO Site, Hatillo	19

The **Appendix 1** includes the figures showing the results of this Exclusion Analysis.

B. Inclusion Analysis

The Technical Experts Team comparatively analyzed the Inclusion Criteria that were met for each site that resulted from the Exclusion Analysis. The Inclusion Criteria, previously discussed, are listed below:

	Parameter
1	Flat Land
2	Process Water Supply (effluent from wastewater treatment plants, surface water, or potable water main with minimum 12 inches diameter)
3	Proximity to Major Island Highway Network
4	Accessibility to a 115KV or 230 KV substation for power production interconnection point with Puerto Rico Electric Power Authority (PREPA)
5	Accessibility to an electric power source (38 KV substation) for minimum electrical consumption
6	Proximity to Sanitary Sewer Line with minimum 12 inches diameter with adequate capacity
7	Wastewater treatment plant with adequate capacity

The following table lists the sites that resulted from the Inclusion Analysis.

Sites	Comments from the Experts Supporting Inclusion of the Sites
1. Old Cambalache sugar mill and vicinity, Arecibo	Complies with most inclusion parameters with multiple options for process water. Its location in the northern portion of Puerto Rico seems like a plus. 115 kv and 230 kv power lines run within the vicinity. Complies with most inclusion parameters. The PREPA-Cambalache Power Plant, located in the vicinity at one mile distance, has 230kv and 115 kv substations. Also, 115 kv power lines run within the vicinity of the proposed site.
2. Coloso Sugar Mill and Vicinity, Aguada	Complies with most inclusion parameters, and is located in the northern portion of Puerto Rico. 115 kv and 230 kv power lines run within the vicinity. The Aguadilla-Victoria 115 kv substation is located approximately 1.5 miles away.
3. Phillips Petroleum Plant Area, Guayama	Complies with most inclusion parameters, although is located in the south, where PREPA already has more power generating capacity concentration. The PREPA-Jobos Gas Turbine Plant, located approximately 1000 meters away, has a 115 kv substation.
4. San Juan Landfill and Vicinity, San Juan	The fact that it meets all the inclusion criteria makes it an option. The PREPA-Puerto Nuevo Power Plant is located nearby. The Puerto Nuevo WTP in the vicinity is another convenience. Also, 115 kv power lines run within the vicinity of this site as well. Locations in the north coast of the Island where the highest power demand results in an added benefit.
5. Sun Oil Refinery Vicinity, Yabucoa	
6. Old Paper Mill/Bottling Factory, Guaynabo	Complies with most inclusion parameters with multiple options for process water. Its location in the northern portion of Puerto Rico seems like a plus. Perhaps the best site from the standpoint of connectivity to the highway systems and feeds of solid waste from east and west of Puerto Rico. Close to two PREPA Power Plants. Possible users of residual ashes within short distance.

The resultant sites objectively selected by the Independent Technical Experts Team were further analyzed using a GIS Based Suitability Model. The results of the Suitability Analysis are discussed in the next section.

C. Suitability Analysis

The Suitability Analysis Criteria, discussed previously, are listed below to facilitate the understanding of the Suitability Analysis results.

Criteria	
1	Relative Flat Land
2	Located away from Settlement Clusters
3	Out of flood prone zones
4	Proximity to Major PREPA electrical Substations
5	Process Water Supply (effluent from wastewater treatment plants, surface water, or potable water main with min. 12 inches diameter)
6	Located in Open Setting with Prevailing Wind Direction Away from major settlements
7	Setback from proposed Non Industrial projects
8	Proximity to Nearest Transfer Station (road distance)
9	Proximity to Nearest Household
10	Proximity to Nearest Recreational facilities
11	Adjacent prevailing land use (1,000 meters)
12	Proximity to Nearest Ocean Cargo Port
13	Proximity to Nearest Airport

The table below illustrates the results yielded by the Suitability Analysis.

Site	Suitability Value of the Sites
1. Old Cambalache sugar mill and vicinity	High – 2.5
2. Coloso Sugar Mill and Vicinity	Medium – 2.4
3. Phillips Petroleum Plant Area	Medium – 2.3
4. San Juan Landfill and Vicinity	Medium – 2.3
5. Sun Oil Refinery Vicinity	Medium – 2.2
6. Old Paper Mill/Bottling Factory	Medium – 2.1

The following figure graphically illustrates the Suitability Value of each Site (Low, Medium or High). This figure also illustrates the suitability values for all criteria evaluated for each site.

All sites were classified as High and Medium Suitable. Notice that no sites were classified as Low Suitable. Therefore, all sites were further evaluated in the next phase: Comparative Assessment.

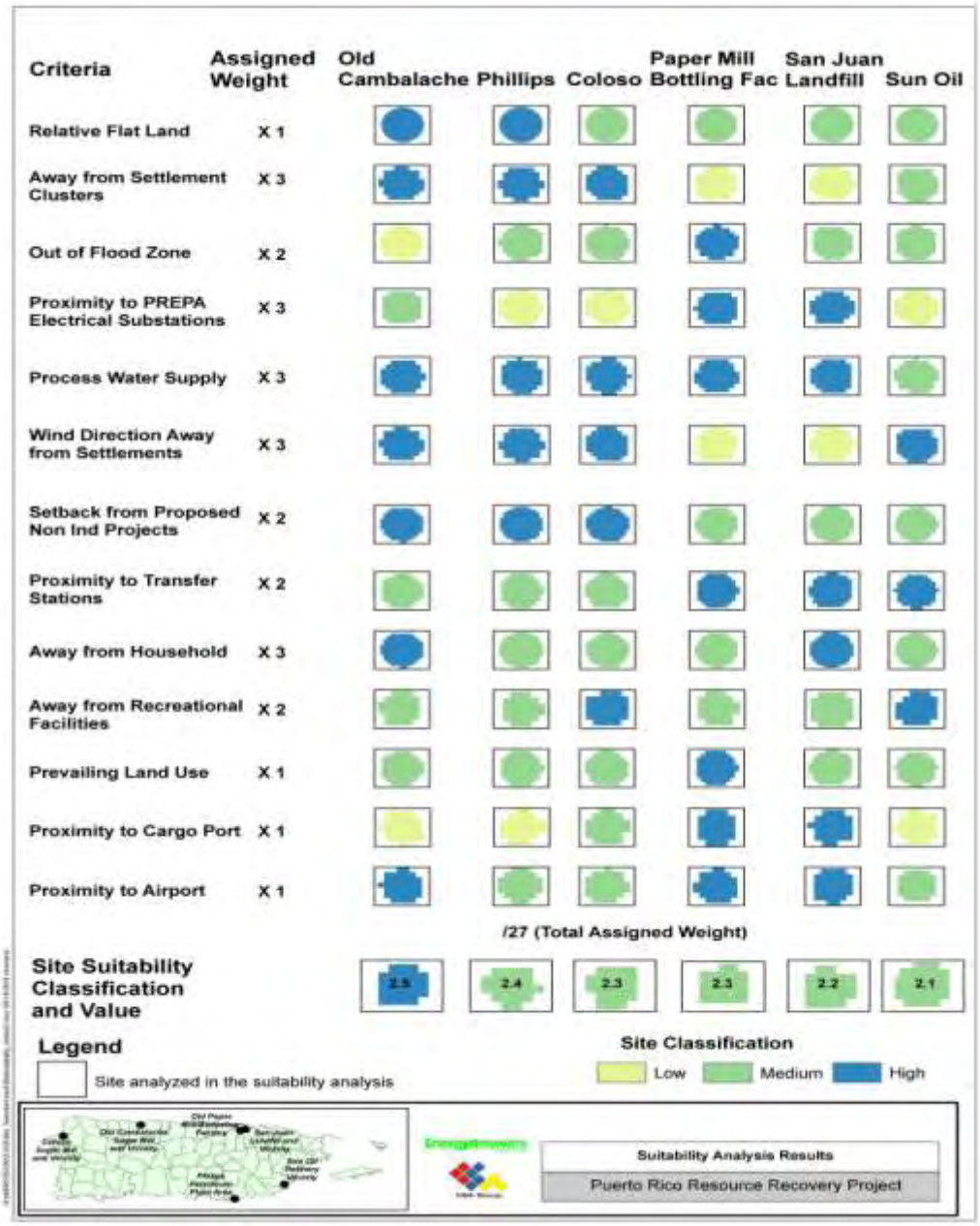


Figure 11 Suitability Analysis Results

D. Comparative Assessment

The following table illustrates the results of the Comparative Assessment of Medium Suitable Sites.

Parameter			Site Considerations	Old Cambalache sugar mill and vicinity Rating (+ /0 /x)	Coloso sugar mill and vicinity Rating (+ /0 /x)	Phillips petroleum plant area Rating (+ /0 /x)	San Juan Landfill and Vicinity Rating (+ /0 /x)	Sun Oil Refinery Vicinity Rating (+ /0 /x)	Old Paper Mill/Bottling Factory Rating (+ /0 /x)
1		**PHILOSOPHICAL OBJECTIVES**							
	1.A	Industrial Synergies	• Proximity to industrial facilities with the potential capability of creating some synergy with the Renewable Power Generation and Resources Recovery Facility	1	0	2	3	0	3
	1.B	Brownfield/Marginal Lands Utilization	• Optimization of Brownfield sites with marginal use. o Restores property to productive use, thus increasing property values	3	3	3	3	3	3

Parameter			Site Considerations	Old Cambalache sugar mill and vicinity Rating (+ /0 /x)	Coloso sugar mill and vicinity Rating (+ /0 /x)	Phillips petroleum plant area Rating (+ /0 /x)	San Juan Landfill and Vicinity Rating (+ /0 /x)	Sun Oil Refinery Vicinity Rating (+ /0 /x)	Old Paper Mill/Bottling Factory Rating (+ /0 /x)
			○ Increase job opportunities and local tax revenues ○ Improved public health and the environment ○ Utilize existing infrastructure ○ Improves a community's image and long-term sustainability						
	1.C	Protection of Aesthetic And Sensitive Landscapes	• Limited impact to landscape by Renewable Power Generation and Resources Recovery Facility buildings and infrastructure • Minimal visual impact from residential settlements	3	2	3	0	2	2

Parameter			Site Considerations	Old Cambalache sugar mill and vicinity Rating (+ /0 /x)	Coloso sugar mill and vicinity Rating (+ /0 /x)	Phillips petroleum plant area Rating (+ /0 /x)	San Juan Landfill and Vicinity Rating (+ /0 /x)	Sun Oil Refinery Vicinity Rating (+ /0 /x)	Old Paper Mill/Bottling Factory Rating (+ /0 /x)
	1.D	Provision of Power Generation Capacity in the North Coast[9]	• Contributes to provide power generation capacity in the North area which is limited in this portion of the island.	3	2	-1	3	-1	3
		SUB-TOTAL: PHILOSOPHICAL OBJECTIVES		**10**	**7**	**7**	**9**	**4**	**11**
2		**PROJECT PARAMETERS**							
	2.A	Core Project Economics And Need	• Site adjacent to potential industrial customers • Present or programmed industrial investments	-1	-1	2	2	0	3
	2.B	Water Supply: Quantity and Quality	• Required quantity of water available and obtainable.	3	3	3	3	2	3

[9] Puerto Rico electric system is an integrated system with all power plants supplying power to an integrated grid. Most PREPA generation capacity is in the southern portion of the island. Therefore, in an event of loss of transmission lines between the North and the South, the North portion will probably suffer from an unavailability of enough power to supply its needs.

Parameter			Site Considerations	Old Cambalache sugar mill and vicinity Rating (+ /0 /x)	Coloso sugar mill and vicinity Rating (+ /0 /x)	Phillips petroleum plant area Rating (+ /0 /x)	San Juan Landfill and Vicinity Rating (+ /0 /x)	Sun Oil Refinery Vicinity Rating (+ /0 /x)	Old Paper Mill/Bottling Factory Rating (+ /0 /x)
			• Quality of water source is adequate						
	2.C	Property Availability	• Property is available	3	2	2	0	2	2
	2.D	Property Acquisition Costs	• Acquisition costs are likely to be relatively low or moderate	1	1	0	0	0	0
		SUB-TOTAL: PROJECT PARAMETERS		**6**	**5**	**7**	**5**	**4**	**8**
3		**COMMUNITY AND REGIONAL CONSIDERATIONS**							
	3.A	Potential For Local Support	• Potential for Municipal government support	3	3	3	2	3	2
	3.B	Potential For Local Community Support	• Potential for community support	2	0	1	0	1	0
	3.C	Adverse Environmental impacts	• Area Air quality is not likely to be adversely affected by location • No adverse environmental impacts are expected	2	2	1	-1	1	-1

Parameter			Site Considerations	Old Cambalache sugar mill and vicinity Rating (+ /0 /x)	Coloso sugar mill and vicinity Rating (+ /0 /x)	Phillips petroleum plant area Rating (+ /0 /x)	San Juan Landfill and Vicinity Rating (+ /0 /x)	Sun Oil Refinery Vicinity Rating (+ /0 /x)	Old Paper Mill/Bottling Factory Rating (+ /0 /x)
			on flora and fauna resources, etc). (Notice that other main environmental/cultural resources have been specifically evaluated on previous phases of this Study Update, such as: flood plains, wetlands, archeological, soils of agricultural significance, coastal barriers, karst terrains, natural reserves and DNER priority conservation areas. Distance to settlements clusters, recreational facilities and schools was also evaluated in previous Suitability Analysis Phase.)						
		SUB-TOTAL:		**7**	**5**	**5**	**1**	**5**	**1**

Parameter			Site Considerations	Old Cambalache sugar mill and vicinity Rating (+ /0 /x)	Coloso sugar mill and vicinity Rating (+ /0 /x)	Phillips petroleum plant area Rating (+ /0 /x)	San Juan Landfill and Vicinity Rating (+ /0 /x)	Sun Oil Refinery Vicinity Rating (+ /0 /x)	Old Paper Mill/Bottling Factory Rating (+ /0 /x)
		COMMUNITY AND REGIONAL CONSIDERATIONS							
4		**PROJECT TIMETABLE AND FEASIBILITY**							
	4.A	Licensability and Early Implementation Feasibility	• Site could be expected to be permitted considering regulatory requirements, including such key permits as air, water franchise, etc.	2	0	1	-1	1	-2
	4.B	Licensability and Early Implementation Feasibility	• Available nearby meteorological data (PREPA meteorological stations or others)	3	-1	3	3	2	3
	4.C	Licensability and Early Implementation Feasibility	• Site air modeling study or current major source permit status indicates or suggest that one year air background monitoring will not	3	0	2	2	1	2

Parameter			Site Considerations	Old Cambalache sugar mill and vicinity Rating (+ /0 /x)	Coloso sugar mill and vicinity Rating (+ /0 /x)	Phillips petroleum plant area Rating (+ /0 /x)	San Juan Landfill and Vicinity Rating (+ /0 /x)	Sun Oil Refinery Vicinity Rating (+ /0 /x)	Old Paper Mill/Bottling Factory Rating (+ /0 /x)
			be required						
	4.D	Compatibility With Policy Objectives of SWMA and PREPA Policy Context	• Site located within northwest region as defined in SWMA's Dynamic Itinerary(Mayaguez to Arecibo)	3	3	-2	-2	-2	-2
		SUB-TOTAL: PROJECT TIMETABLE AND FEASIBILITY		**11**	**2**	**4**	**2**	**2**	**1**
		GRAND-TOTAL: CUMULATIVE SCORE IN ALL CATEGORIES		**34**	**19**	**23**	**17**	**15**	**21**

The Comparative Analysis performed by the Independent Technical Experts Team yielded the following order. .

Site
1. Old Cambalache sugar mill and vicinity, Arecibo
2. Phillips Petroleum Plant Area, Guayama
3. Old Paper Mill/Bottling Factory, Guaynabo
4. Coloso Sugar Mill and Vicinity, Aguada
5. San Juan Landfill and Vicinity, San Juan
6. Sun Oil Refinery Vicinity, Yabucoa

5 CONCLUSIONS

The purpose of this Study Update was to reevaluate each of the original 33 potential site locations that led to the selection of the Arecibo Site, to identify the most adequate sites for the proposed Renewable Power Generation and Resources Recovery Facility. A tiered four (4) phase analysis was used to:

- Exclude those sites with location characteristics that are protected by precautionary policies and regulations from the land use and environmental perspective
- Include sites with specific desirable project driven characteristics that are necessary for the viability and proper execution of the Renewable Power Generation and Resources Recovery Facility
- Classify and describe the level of suitability of the sites identified in the previous phase
- Compare and rank the most suitable sites

The Technical Experts Team identified, in the Inclusion Analysis, six (6) sites that met the majority of the Inclusion Criteria or, otherwise, reasonable engineering measures can be implemented. Those sites, according to the Suitability Analysis, were all classified as High and Medium Suitable. Since no sites were classified as Low Suitable all High and Medium Suitable sites were further evaluated in the Comparative Assessment. This assessment evaluated project specific parameters such as philosophical objectives, project parameters, community and regional considerations and project timetable and feasibility.

The three (3) top ranked sites of the Comparative Analysis represent the most adequate sites for the proposed RFF.

1. Old Cambalache sugar mill and vicinity, Arecibo – 34 points
2. Phillips Petroleum Plant Area, Guayama – 23 points
3. Old Paper Mill/Bottling Factory, Guaynabo - 21

The resultant ranking confirms or validates the results of the original Site Selection Study for the former Global Fibers paper mill parcel within the Old Cambalache Sugar mill and Vicinity area, as the preferred site for the location Renewable Power Generation and Resources Recovery Facility.

Notice that the identification of the most adequate site is not an absolute recommendation in the sense that no site will fully comply with all criteria described on the inclusion, suitability analysis and comparative assessments. Adequate site engineering and design, on-site construction practice and operation become crucial to compensate those criteria not met.

Location of a Renewable Power Generation and Resources Recovery Facility will necessarily follow the usual planning and permitting criteria for locating a large-scale regional MSW processing facility. As part of this planning and permitting process specialized studies needs to be conducted to identify the potential environmental impacts associated to the proposed facility. Design and operation measures should be aimed to mitigate or compensate any of the siting criteria not met by the proposed site for the Renewable Power Generation and Resources Recovery Facility. Such measures should be based on regulatory accepted Best Management Practices.

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Appendix 1

Figures Showing the Results of the Exclusion Analysis

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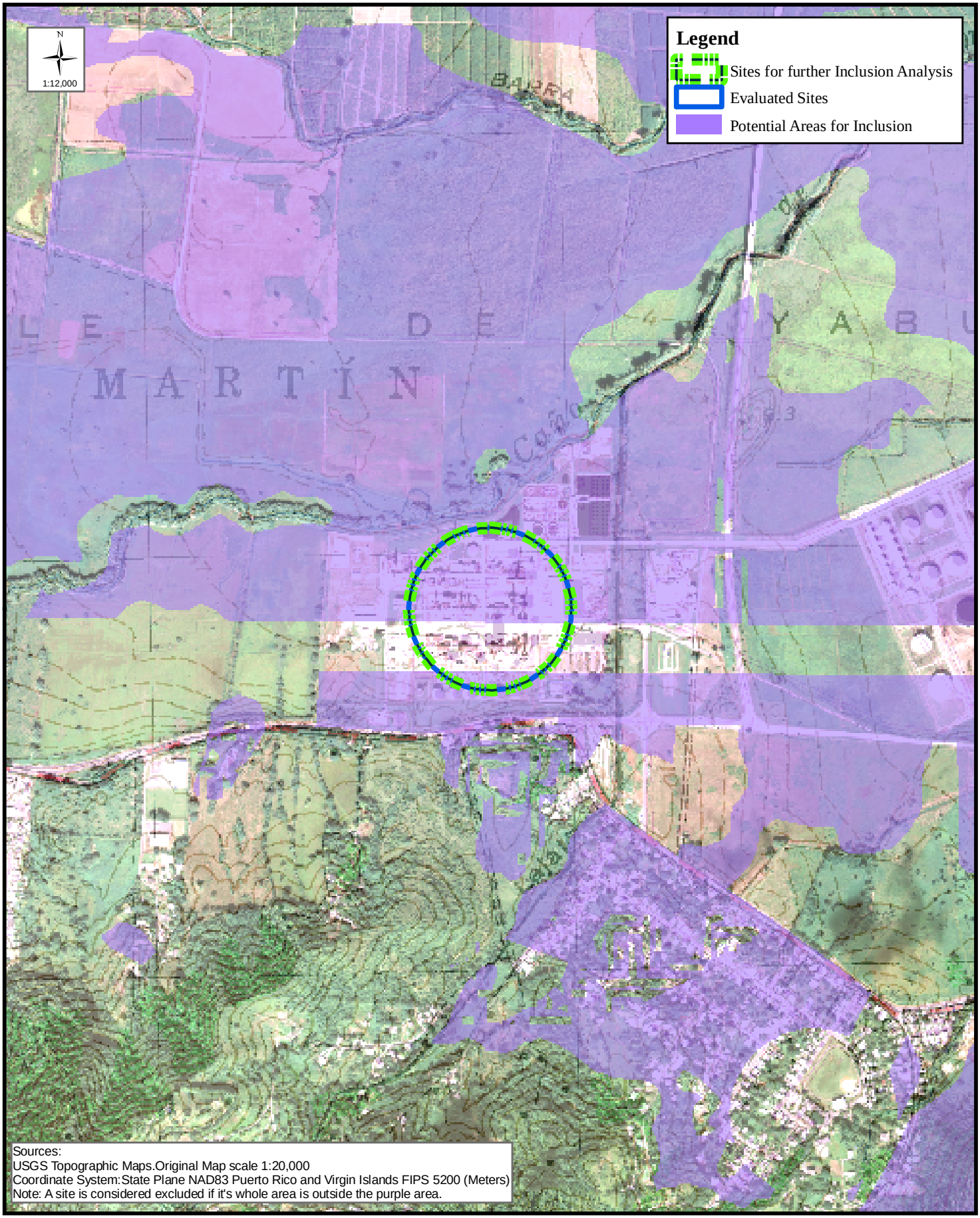

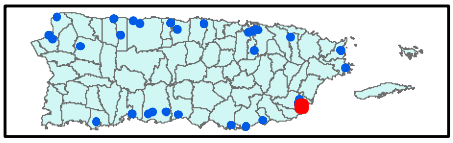

CSA Group

Sun Oil Refinery Vicinity

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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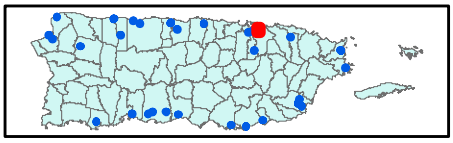

CSA Group

San Juan Landfill and Vicinity

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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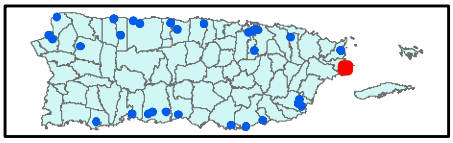
Sources:
USGS Topographic Maps.Original Map scale 1:20,000
Coordinate System:State Plane NAD83 Puerto Rico and Virgin Islands FIPS 5200 (Meters)
Note: A site is considered excluded if it's whole area is outside the purple area.



CSA Group

Roosevelt Roads Naval Reserve Base

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

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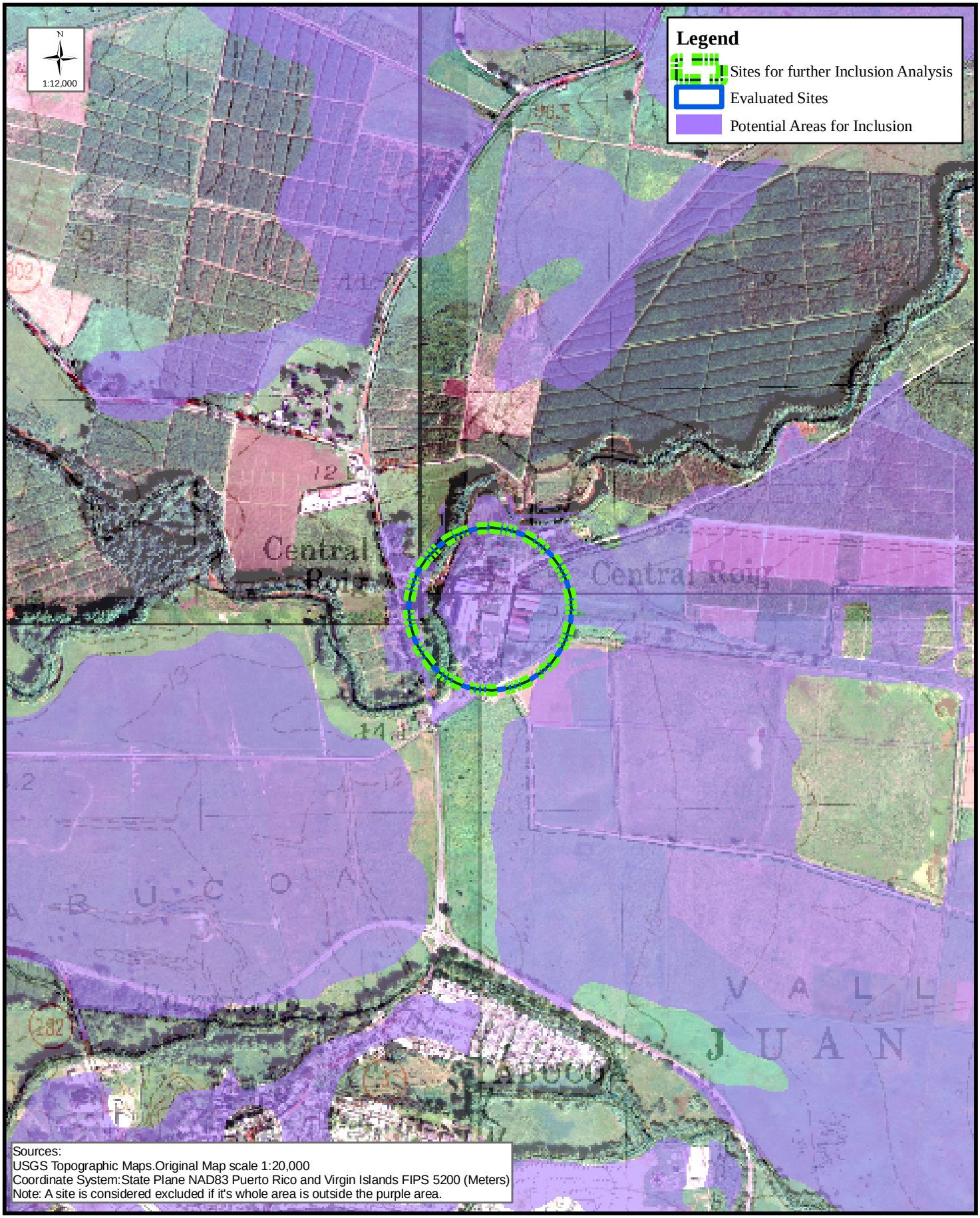

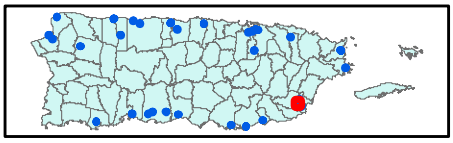

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Roig Sugar Mill and Vicinity

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

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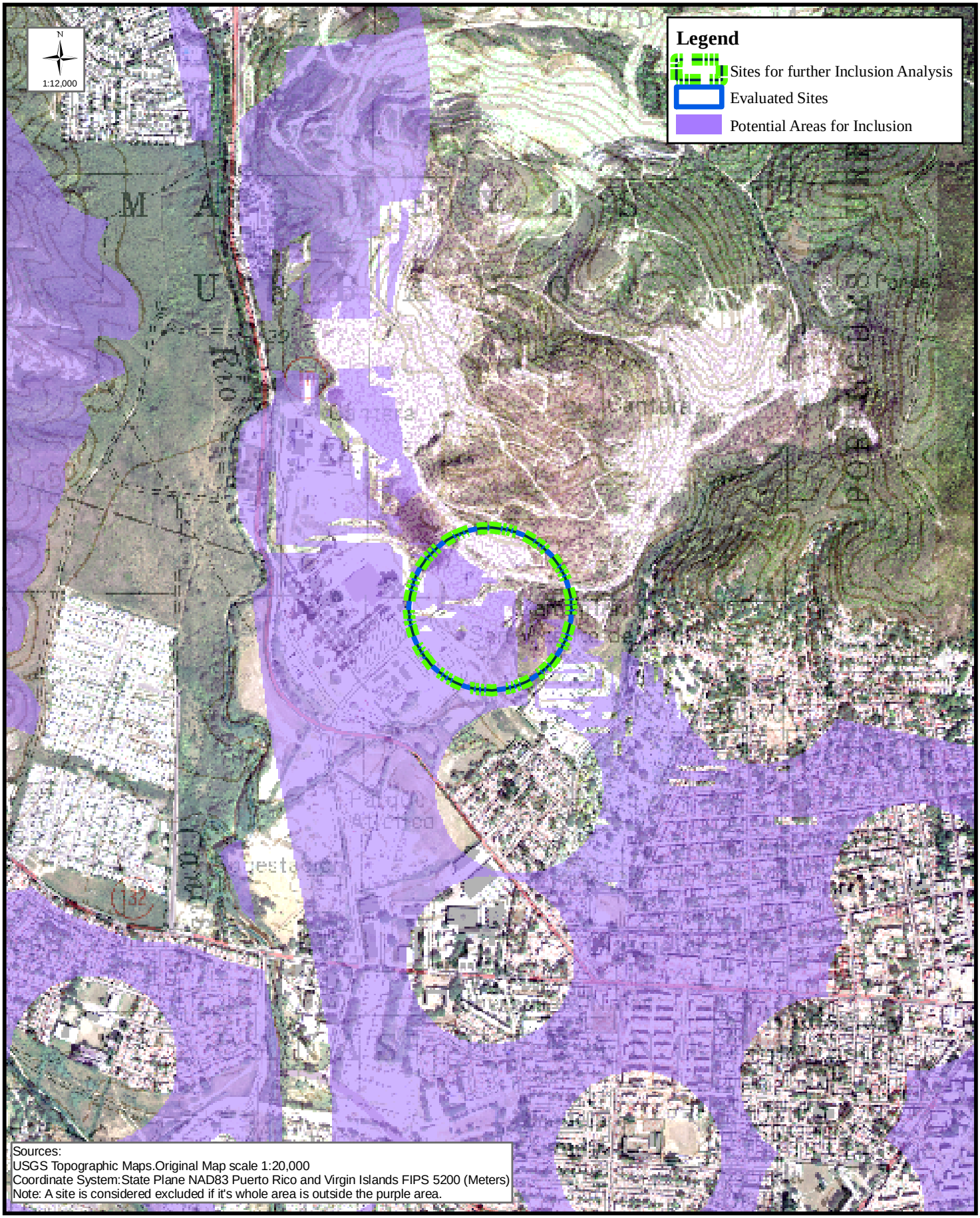

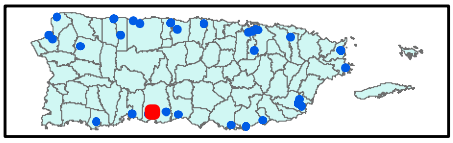

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Puerto Rican Cement - Spent Quarries

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

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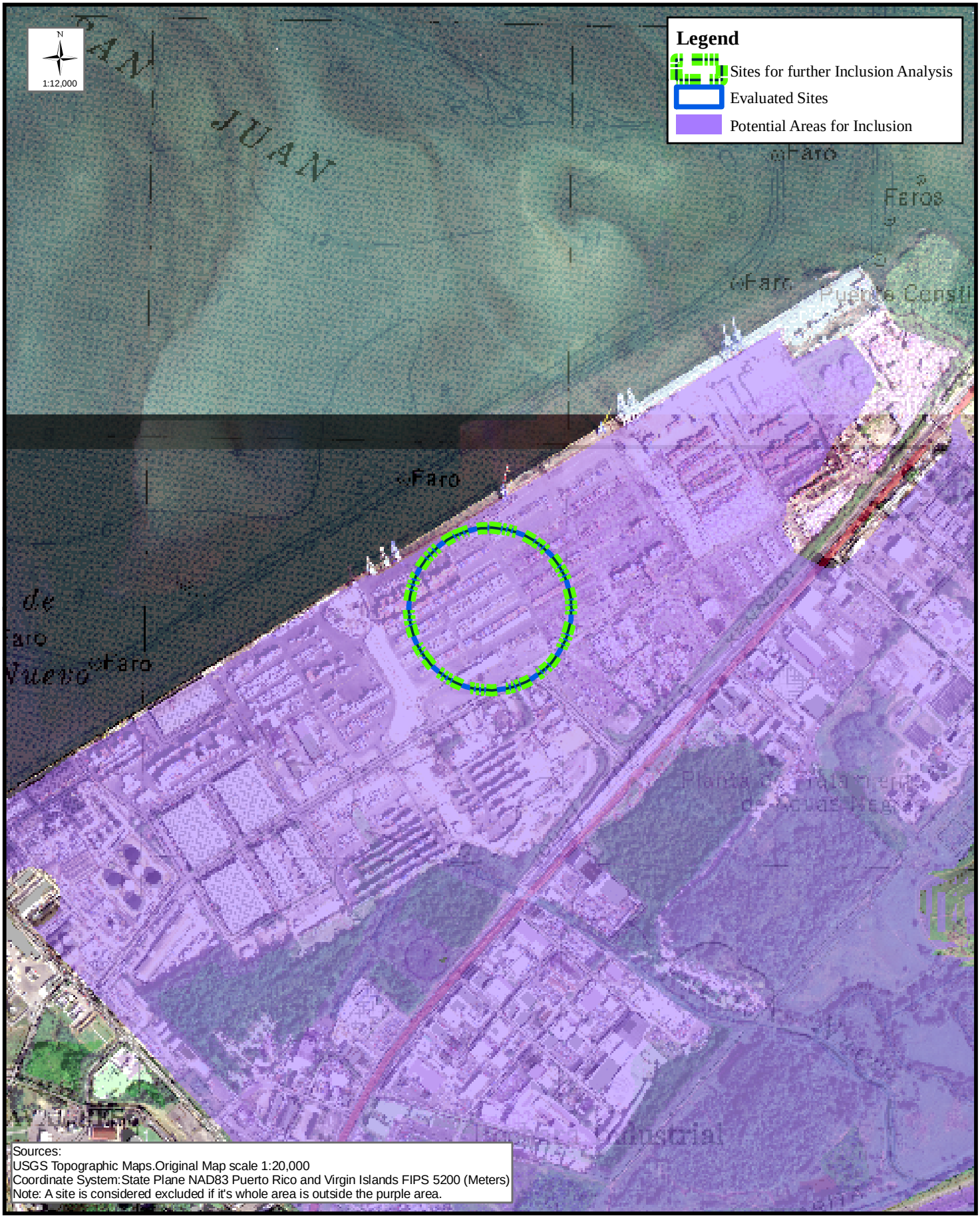

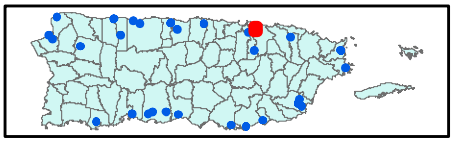

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Puerto Nuevo Pier Arena

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

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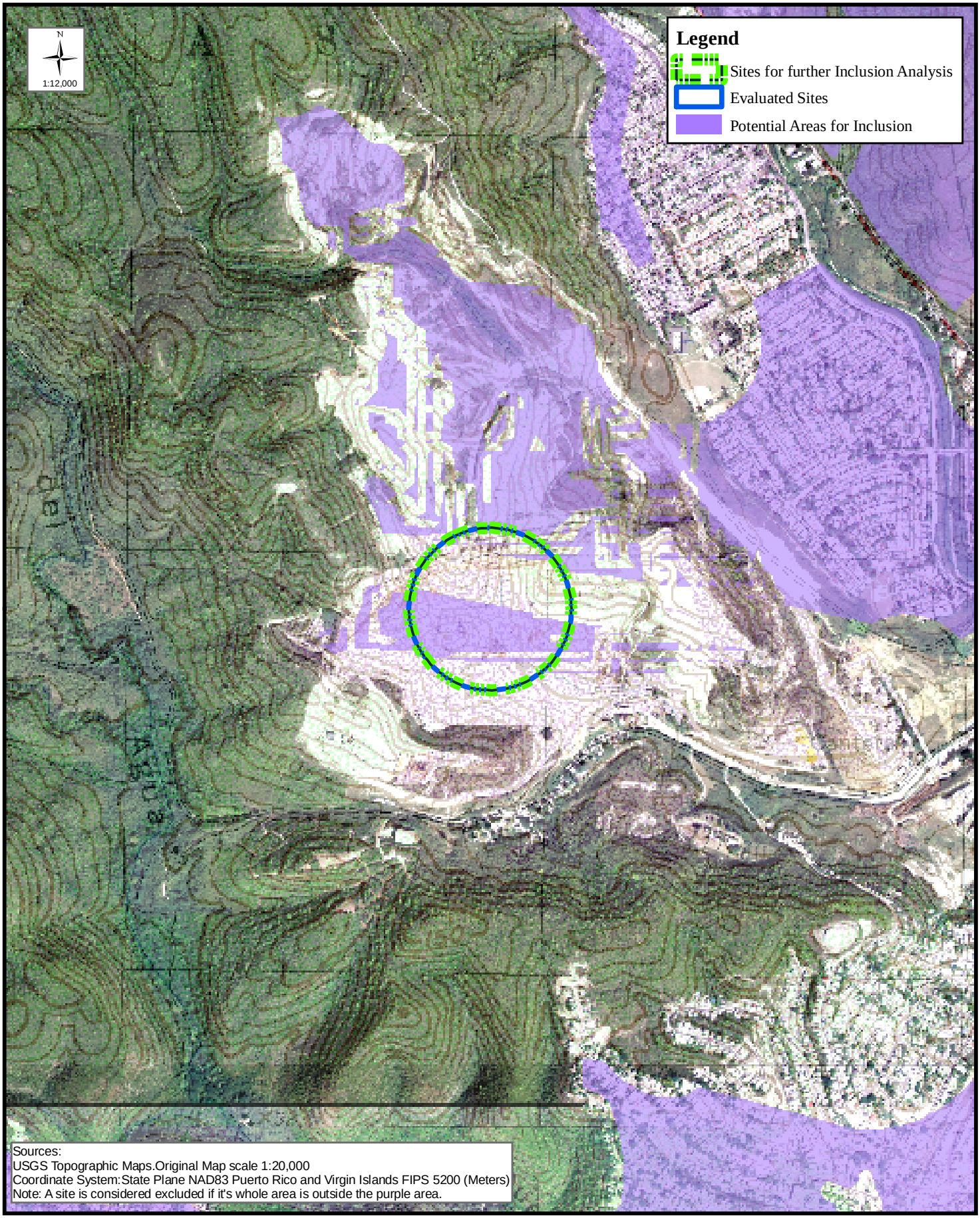

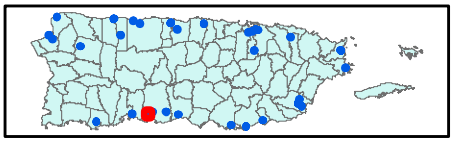

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Ponce Landfill

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

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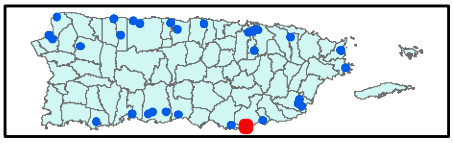

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Philips Petroleum Plant Area

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

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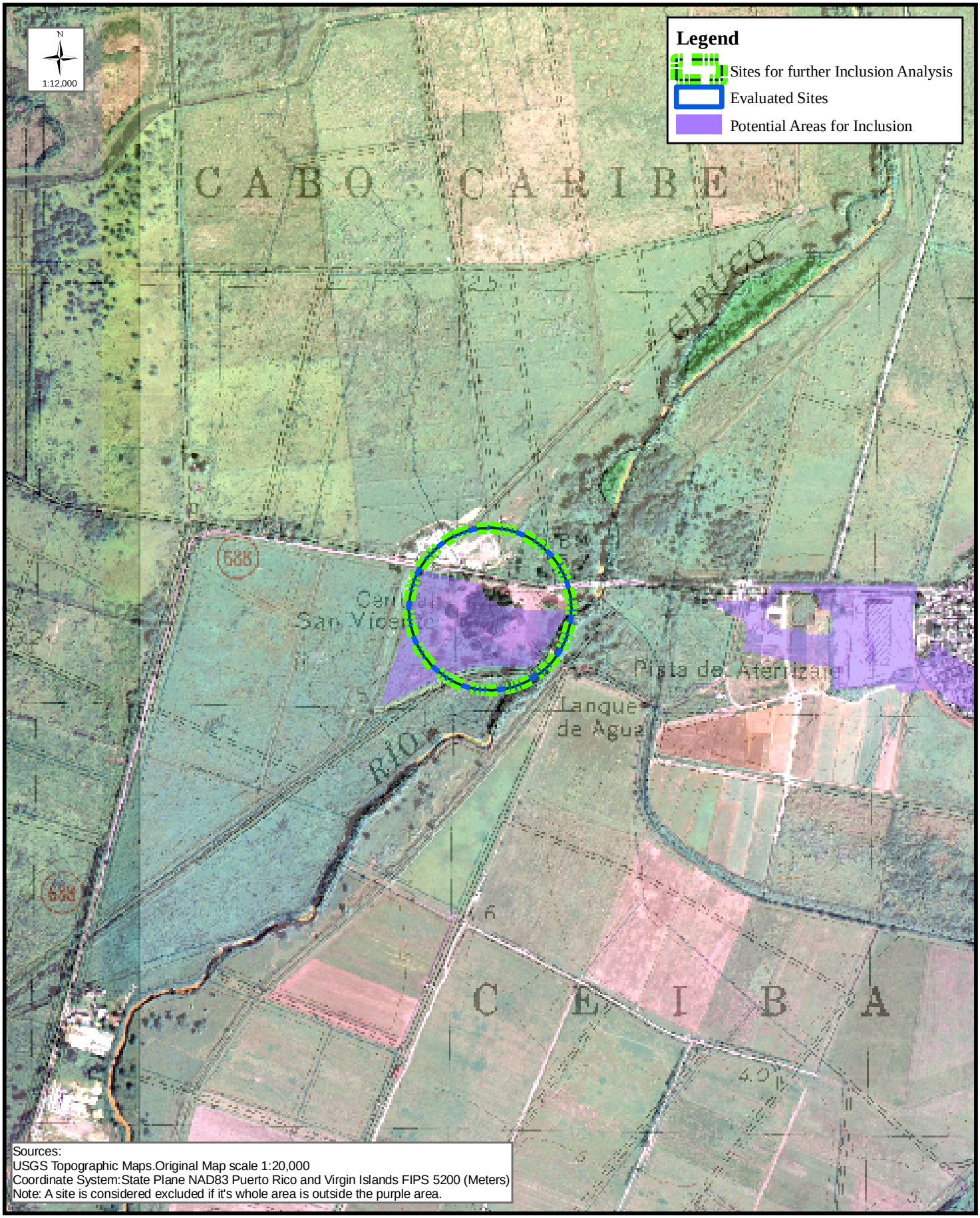

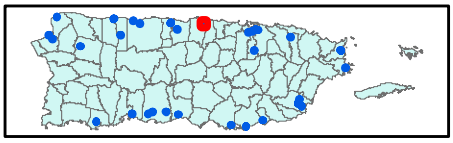

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Old San Vicente Sugar Mill and Vicinity

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

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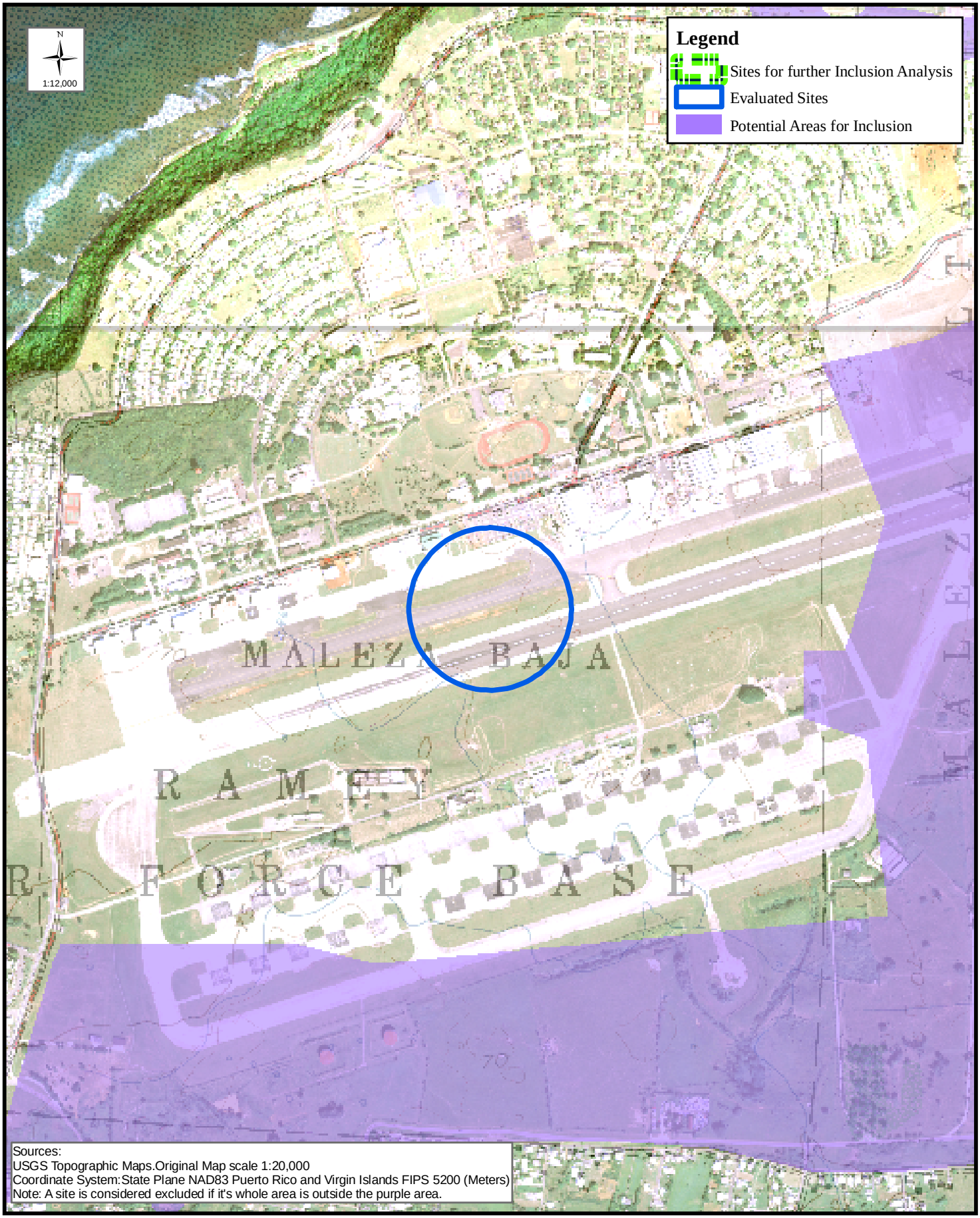

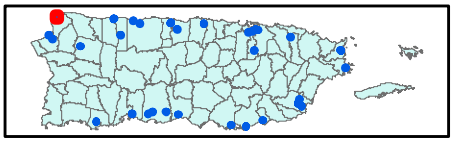

CSA Group

Old Ramey Air Base - Pta Borinquen Site

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

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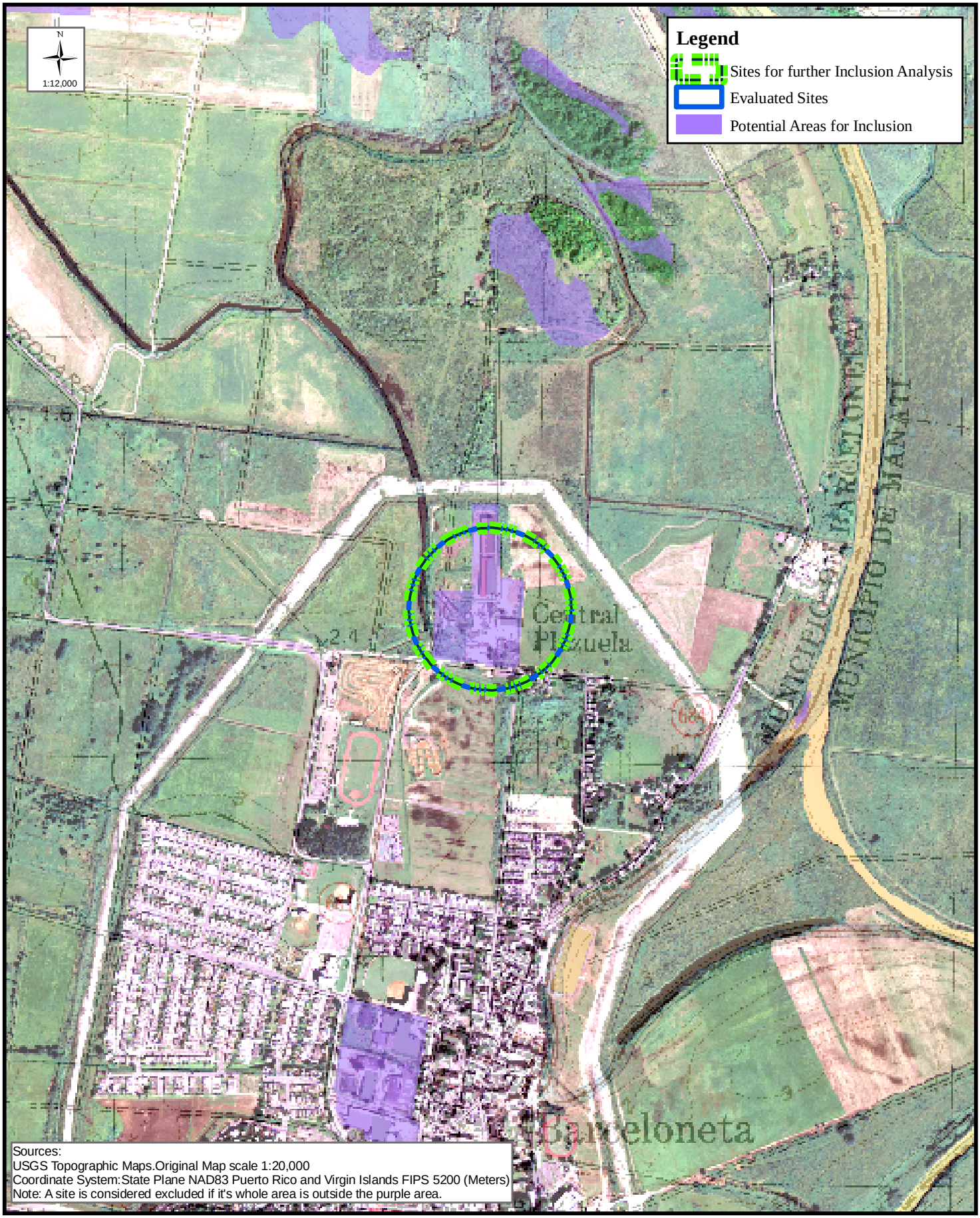

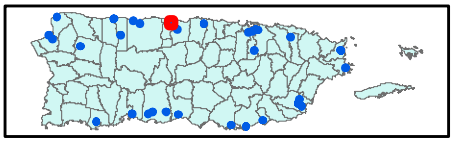

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Old Plazuela Sugar Mill

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

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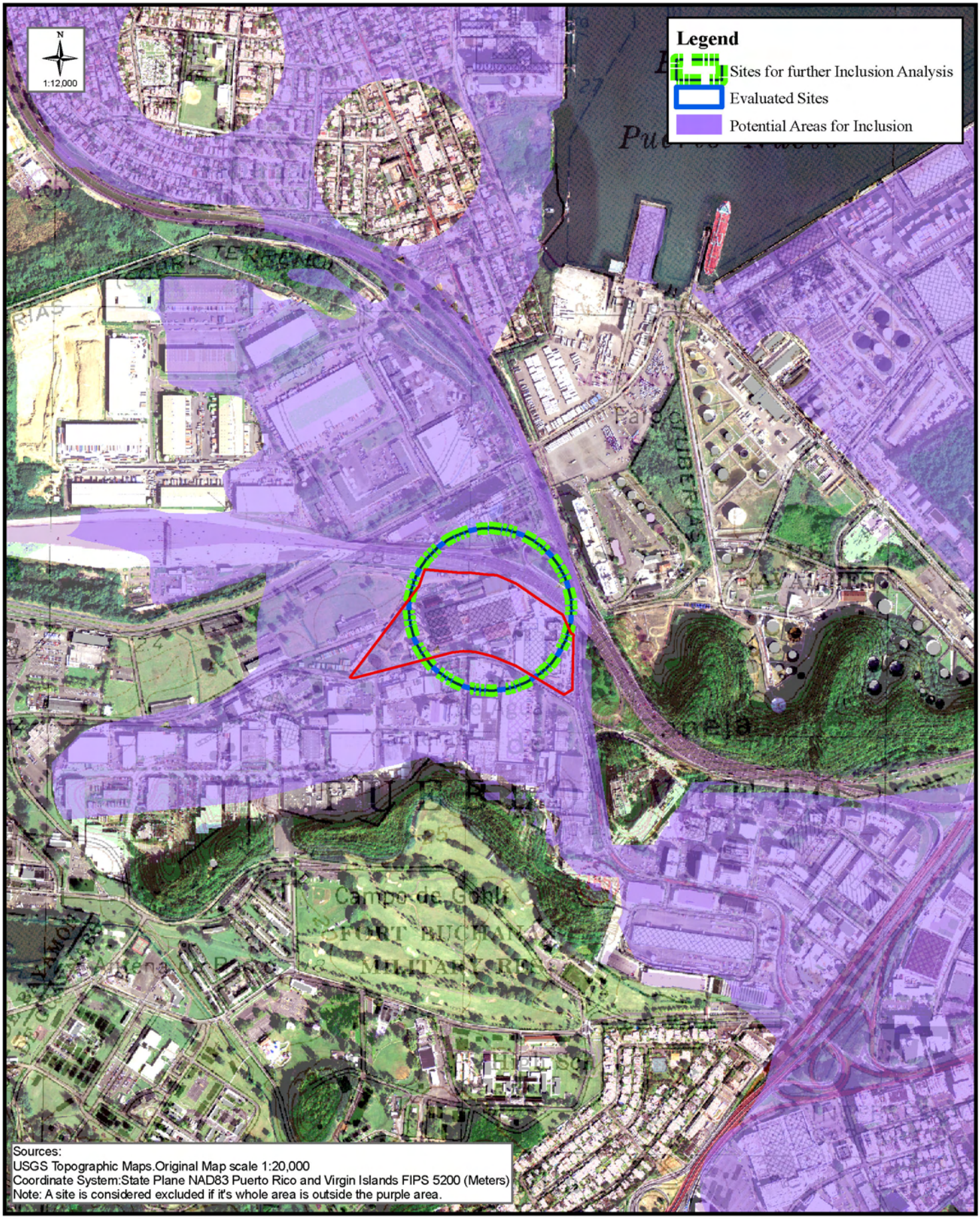

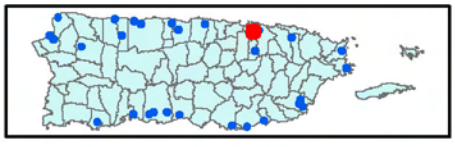

CSA Group

Old Paper Mill/Bottinling Factory

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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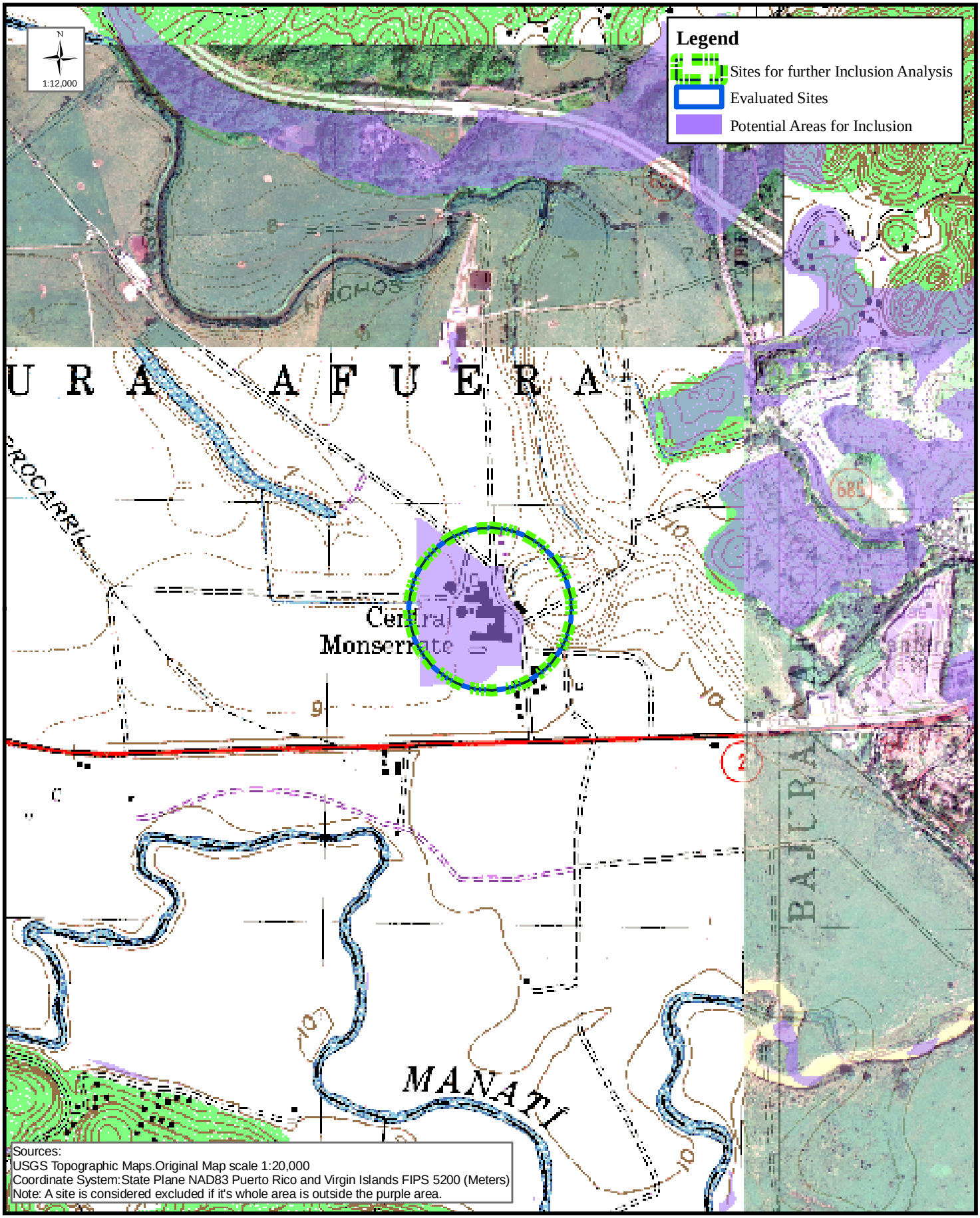

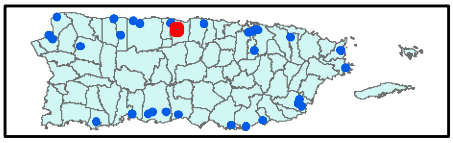

CSA Group

Old Monserrate Sugar Mill

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

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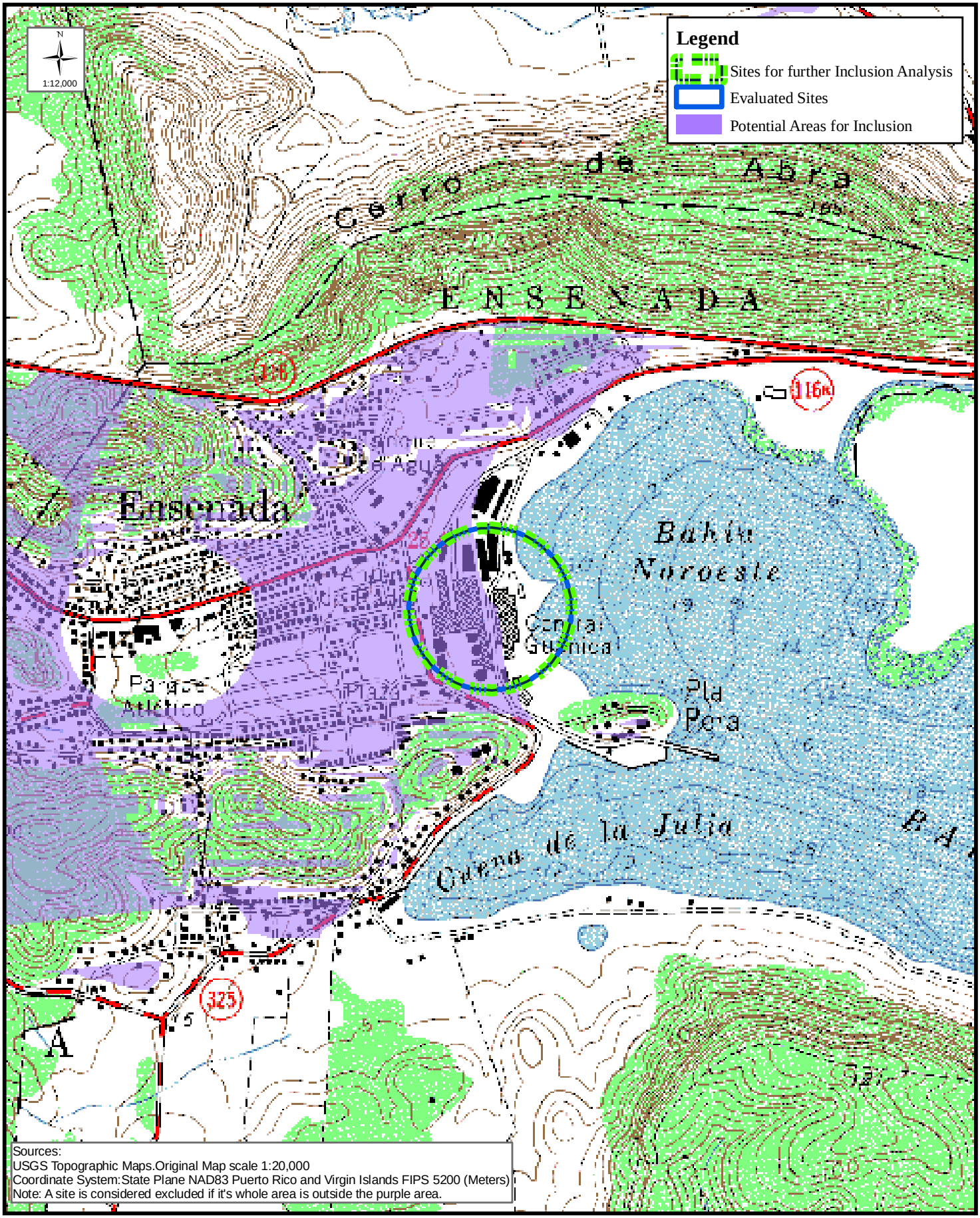

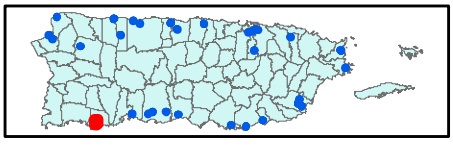

CSA Group

Old Guanica Sugar Mill

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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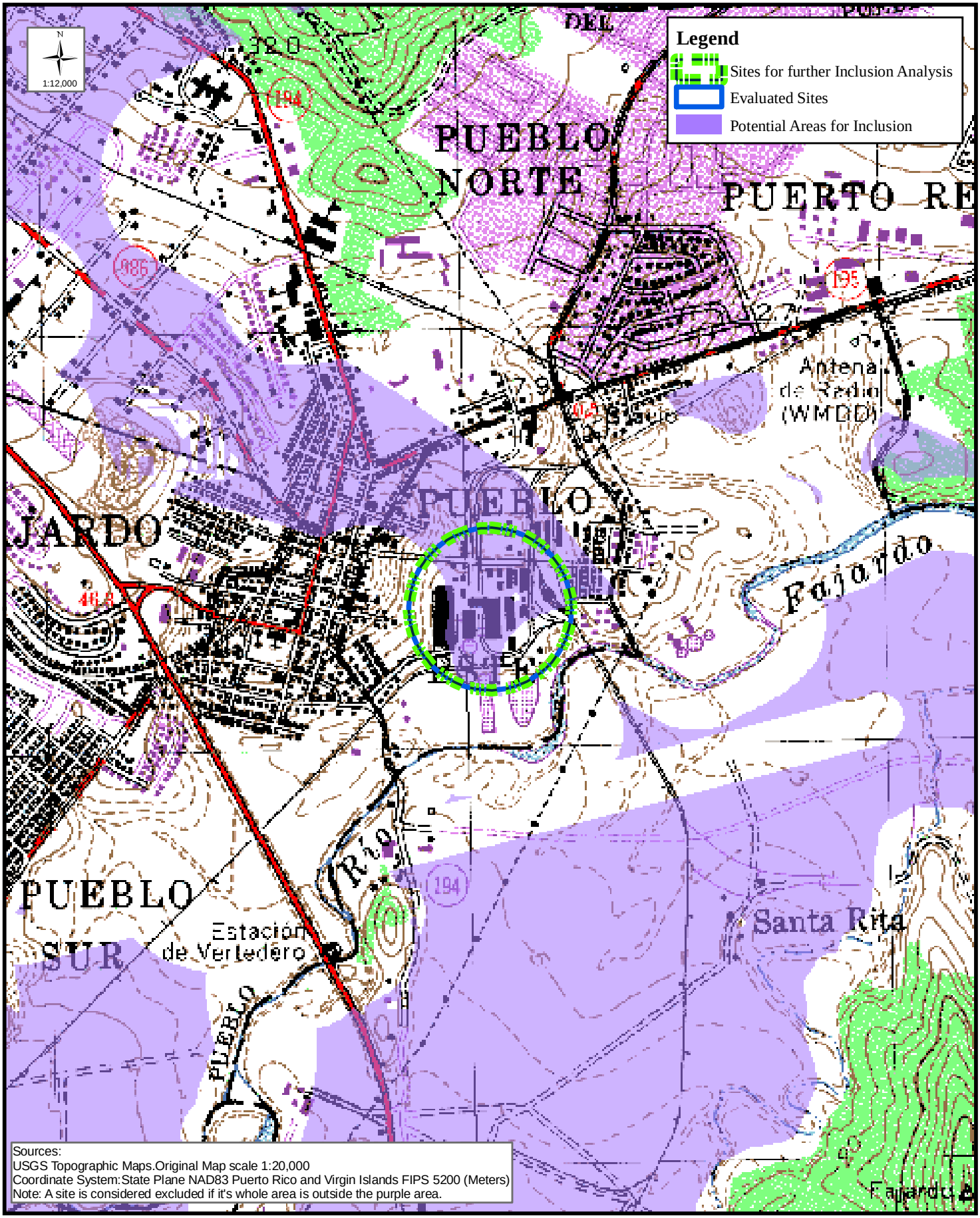

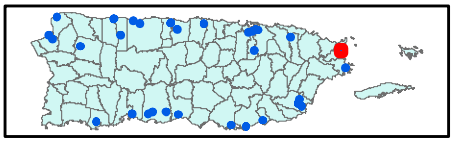

CSA Group

Old Fajardo Sugar Mill

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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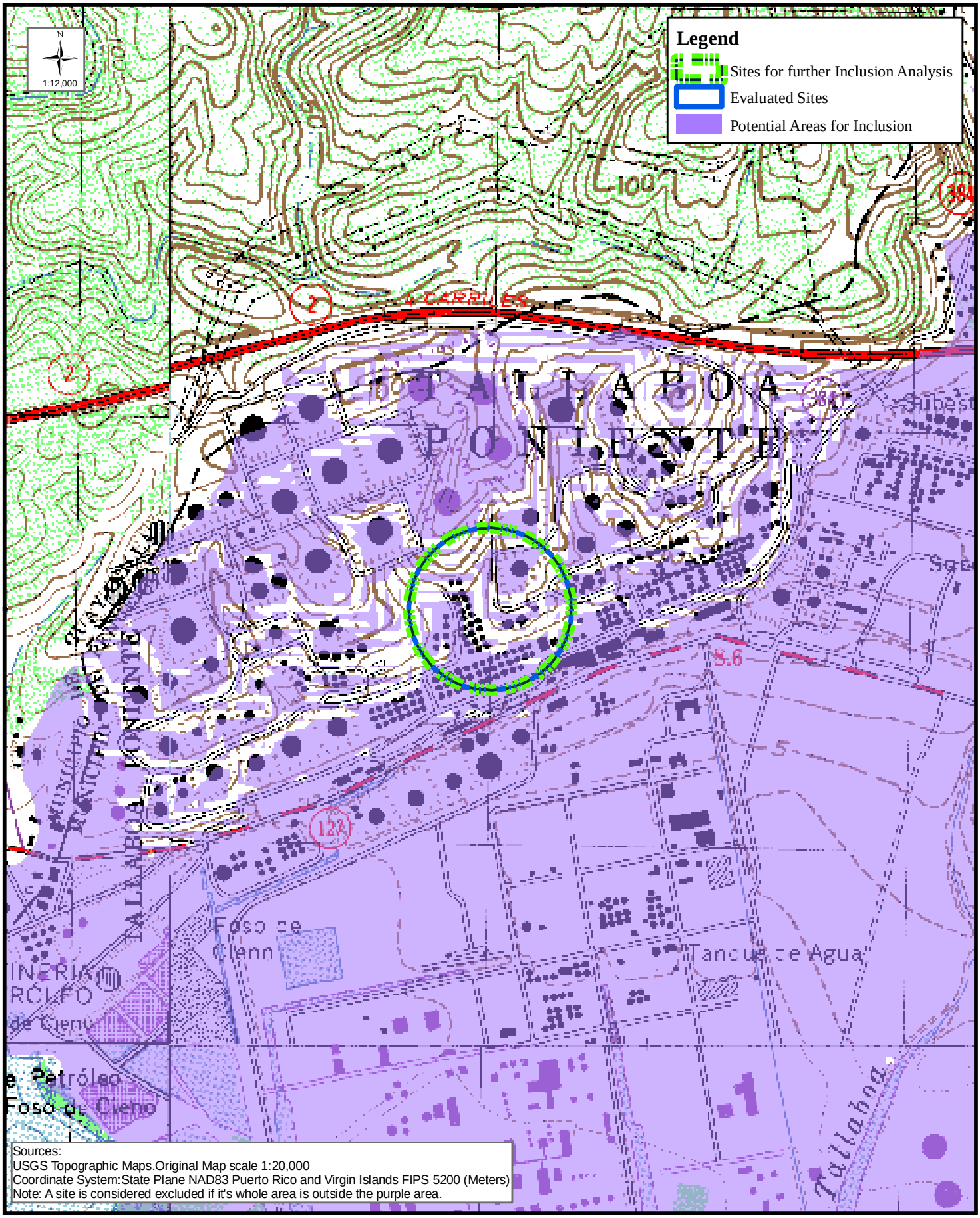

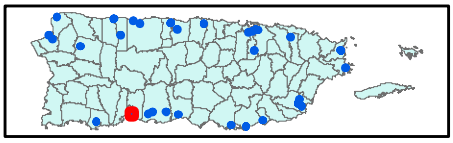

CSA Group

Old Commonwealth Oil Refining Co.

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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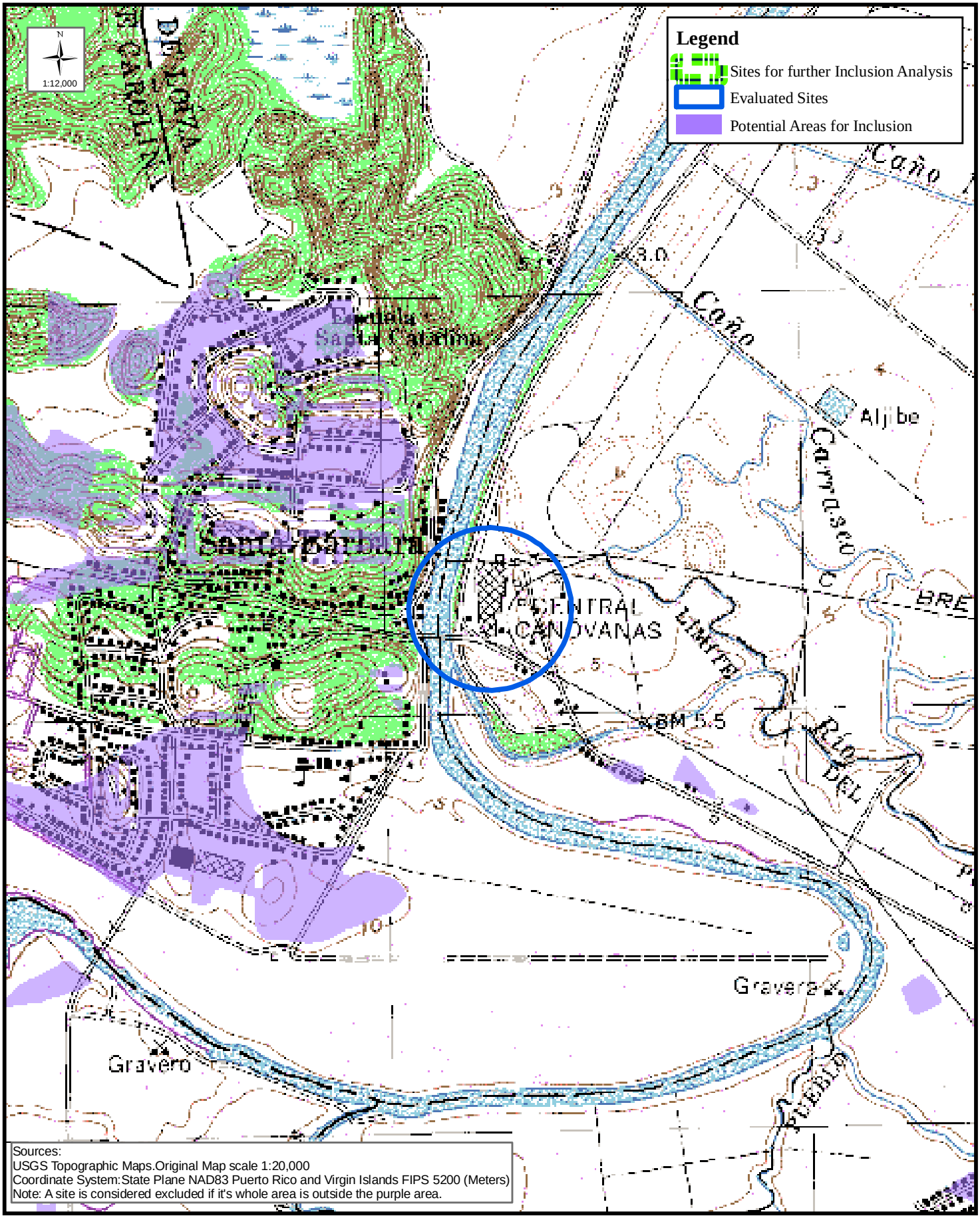

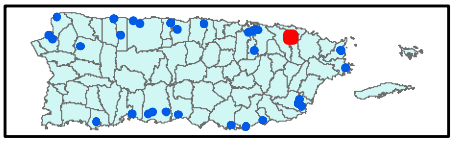

CSA Group

Old Canovanas Sugar Mill

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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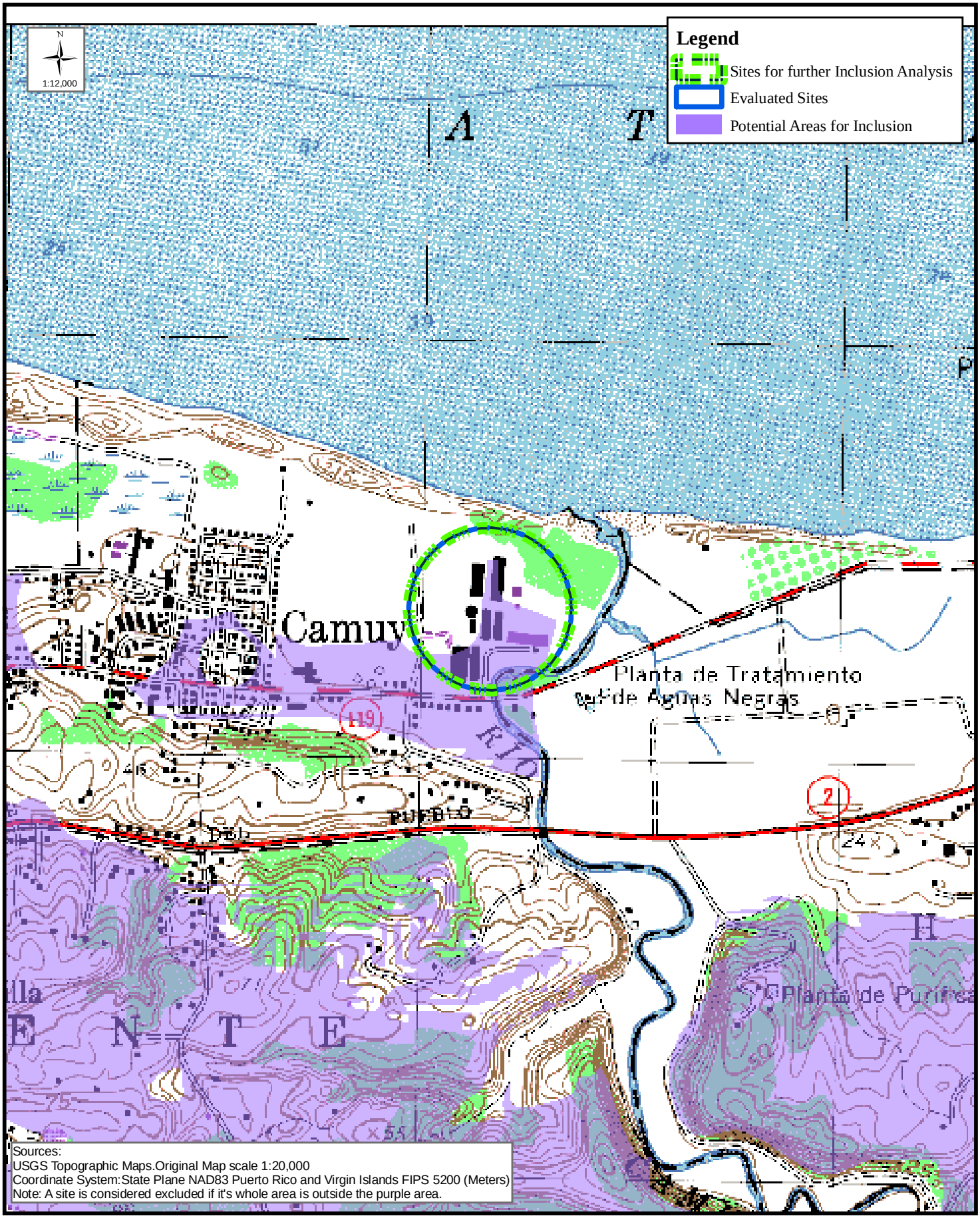

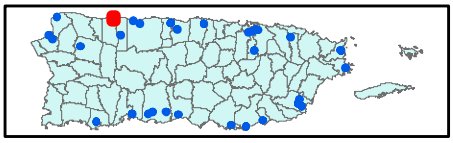

CSA Group

Old Camuy Sugar Mill

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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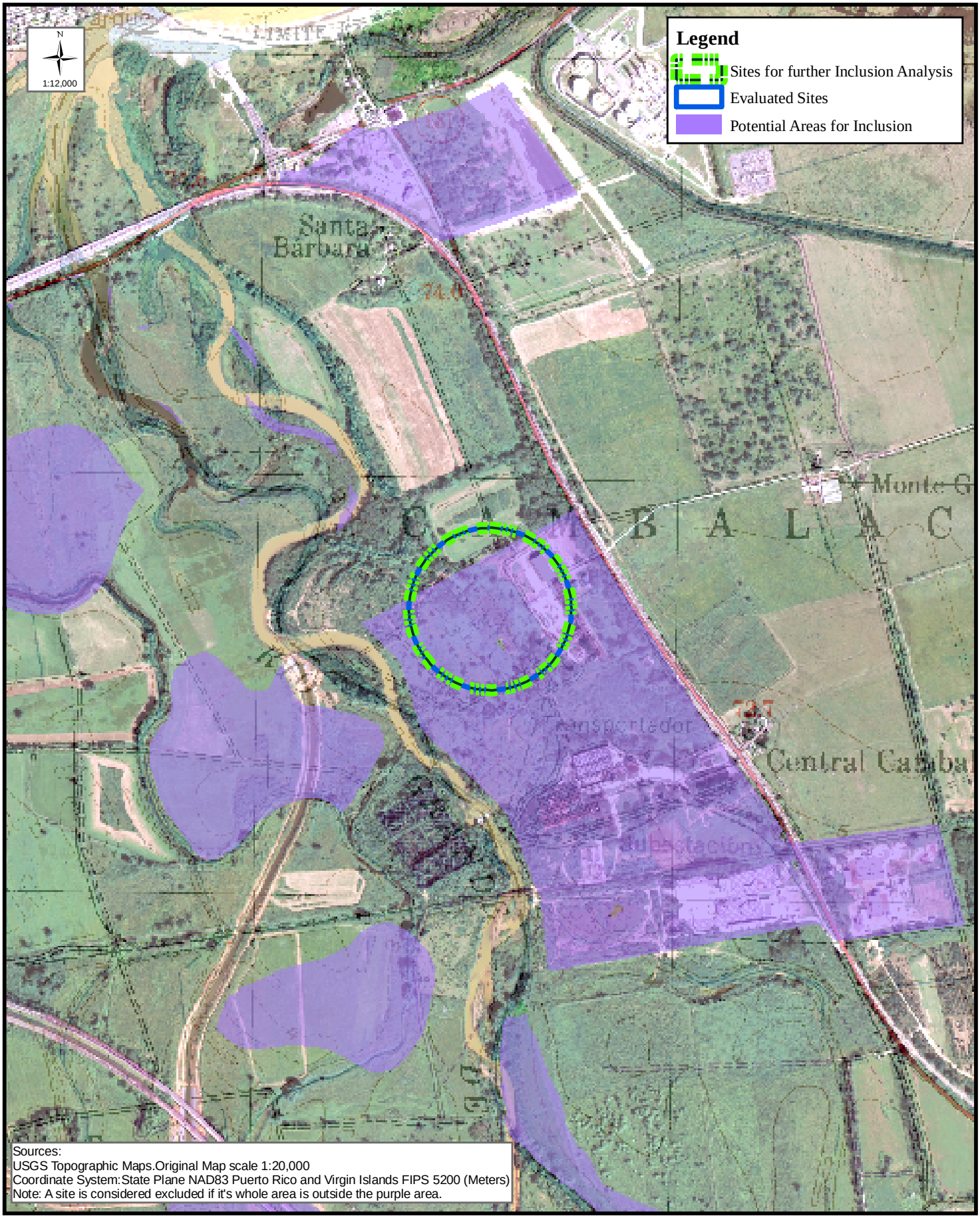

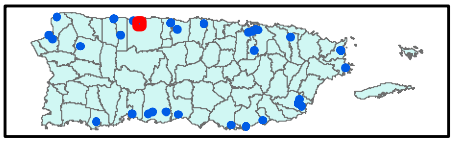

CSA Group

Old Cambalache Sugar Mill and Vicinity

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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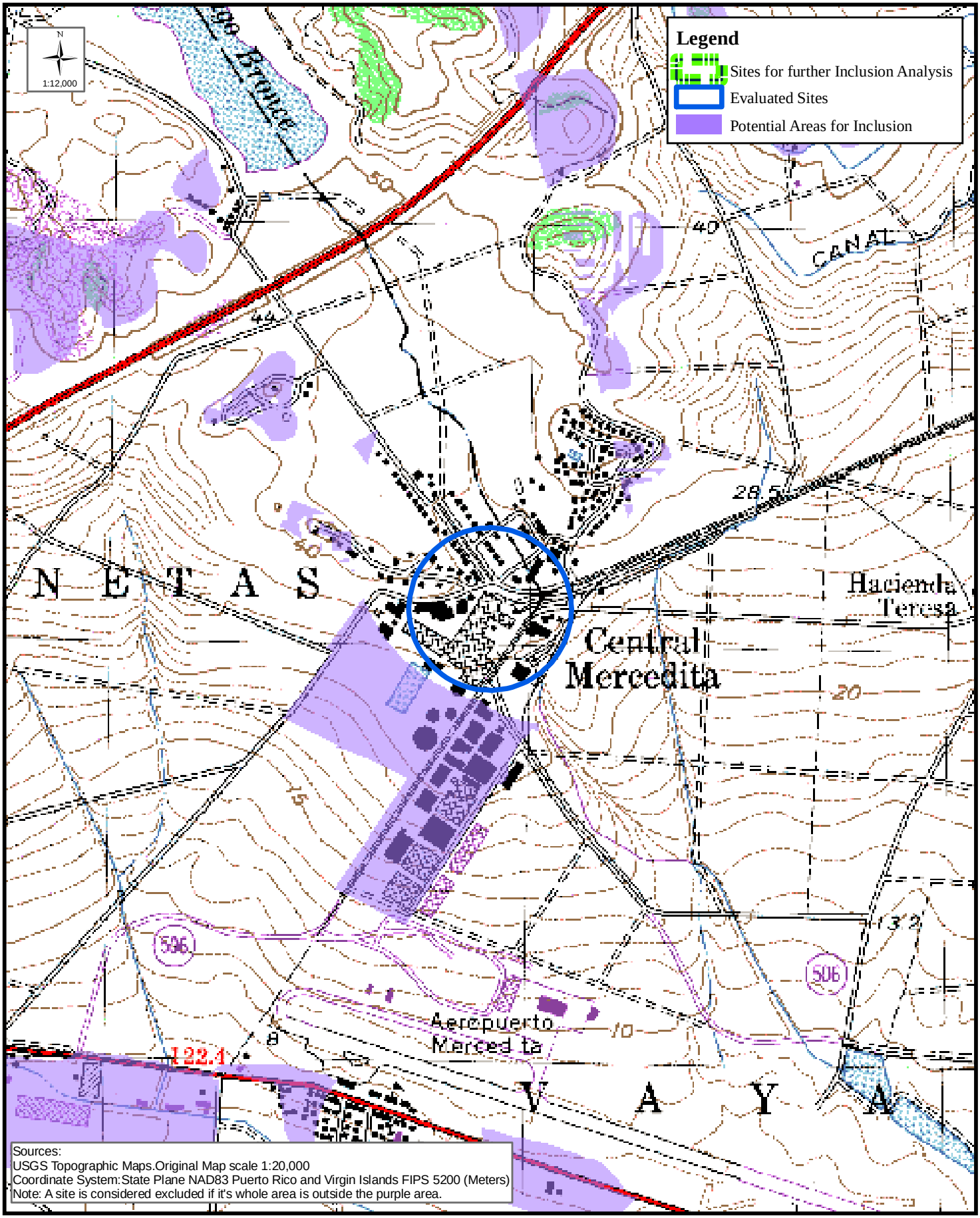

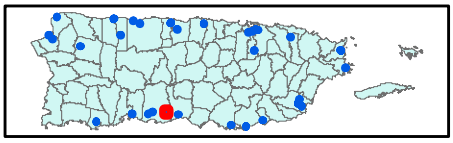

CSA Group

Mercedita Sugar Mill

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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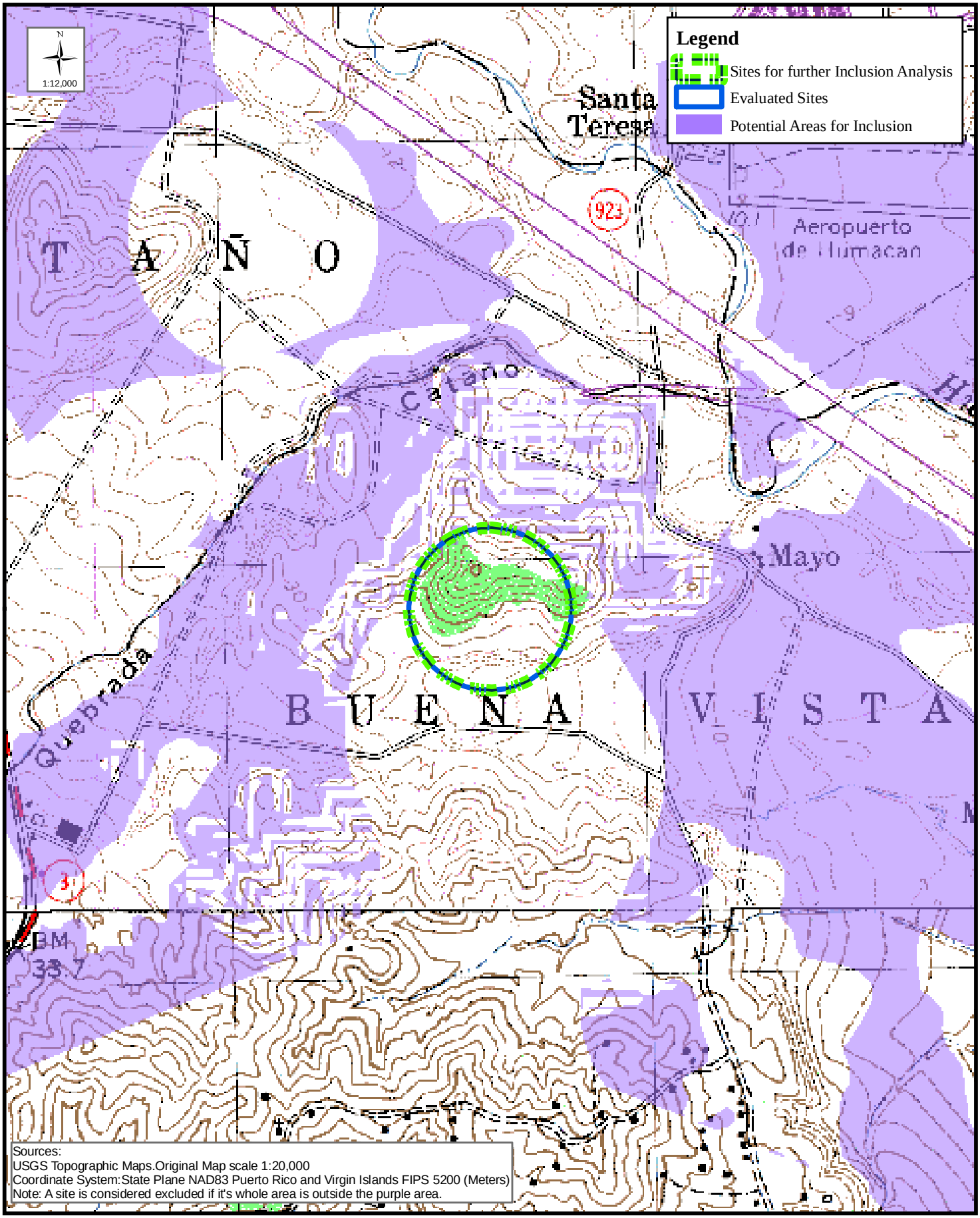

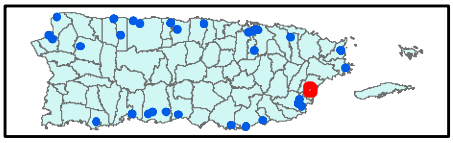

CSA Group

Humacao Landfill

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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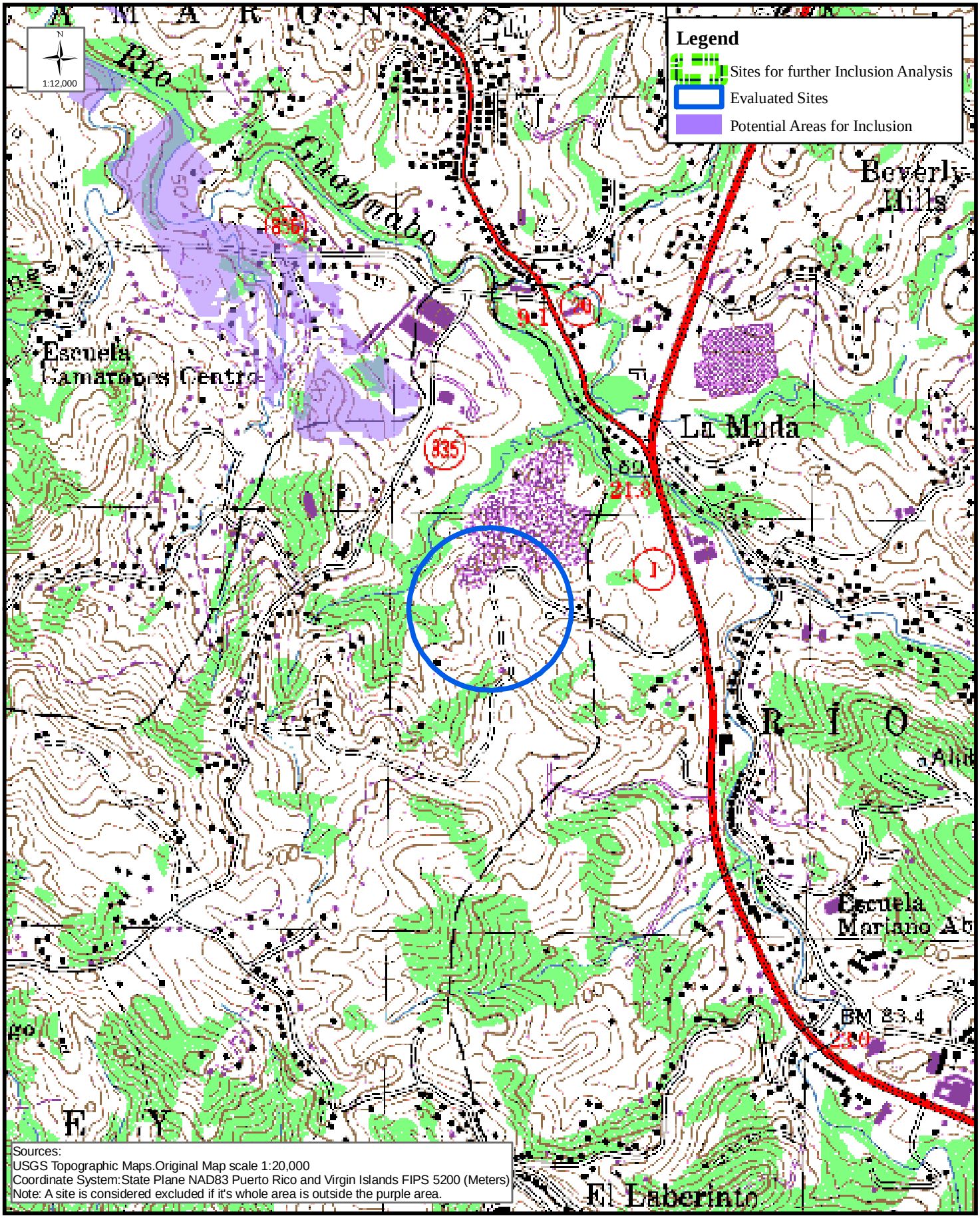

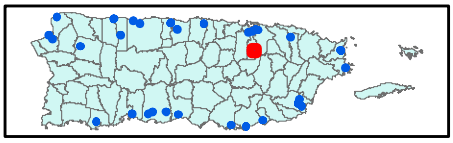

CSA Group

Guaynabo Landfill

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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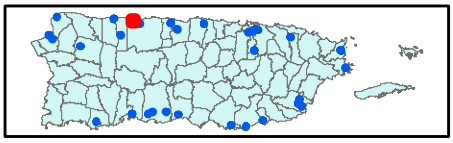
Legend

- Sites for further Inclusion Analysis
- Evaluated Sites
- Potential Areas for Inclusion

Sources:
USGS Topographic Maps.Original Map scale 1:20,000
Coordinate System:State Plane NAD83 Puerto Rico and Virgin Islands FIPS 5200 (Meters)
Note: A site is considered excluded if it's whole area is outside the purple area.



CSA Group

Granado Rum Destillery

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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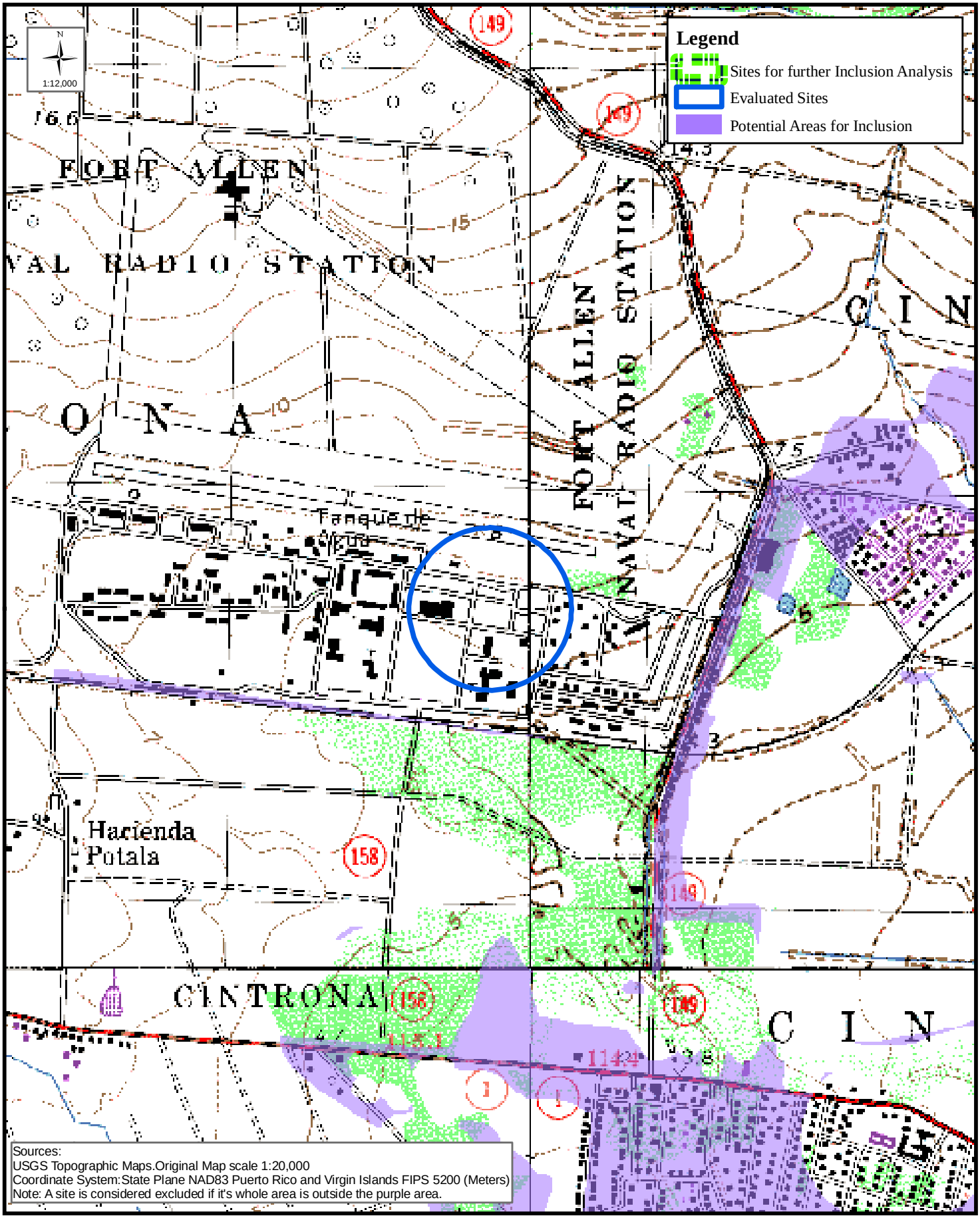

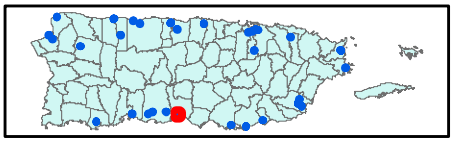

CSA Group

Fort Allen US naval Base

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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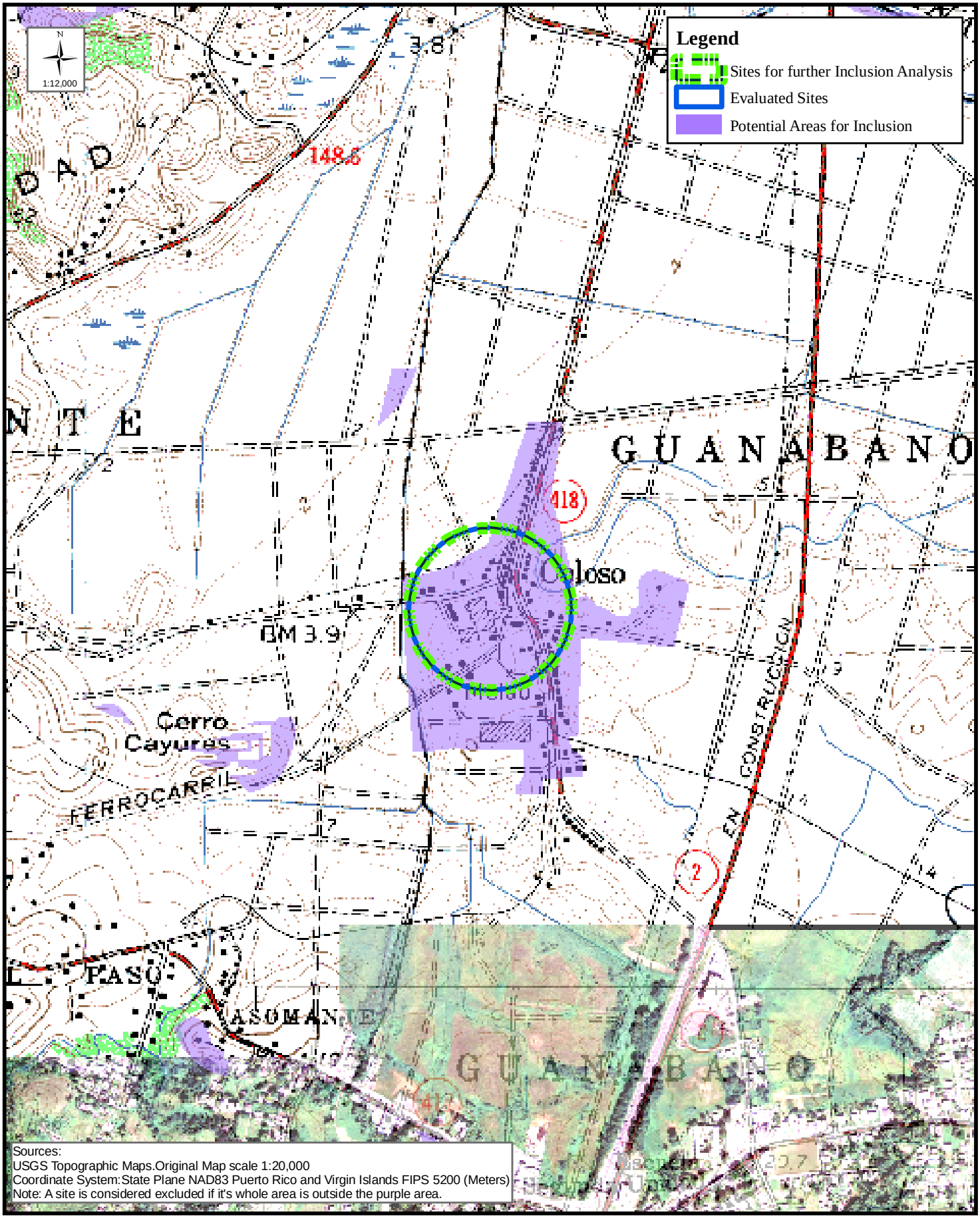

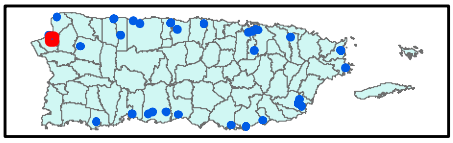

CSA Group

Coloso Sugar Mill and Vicinity

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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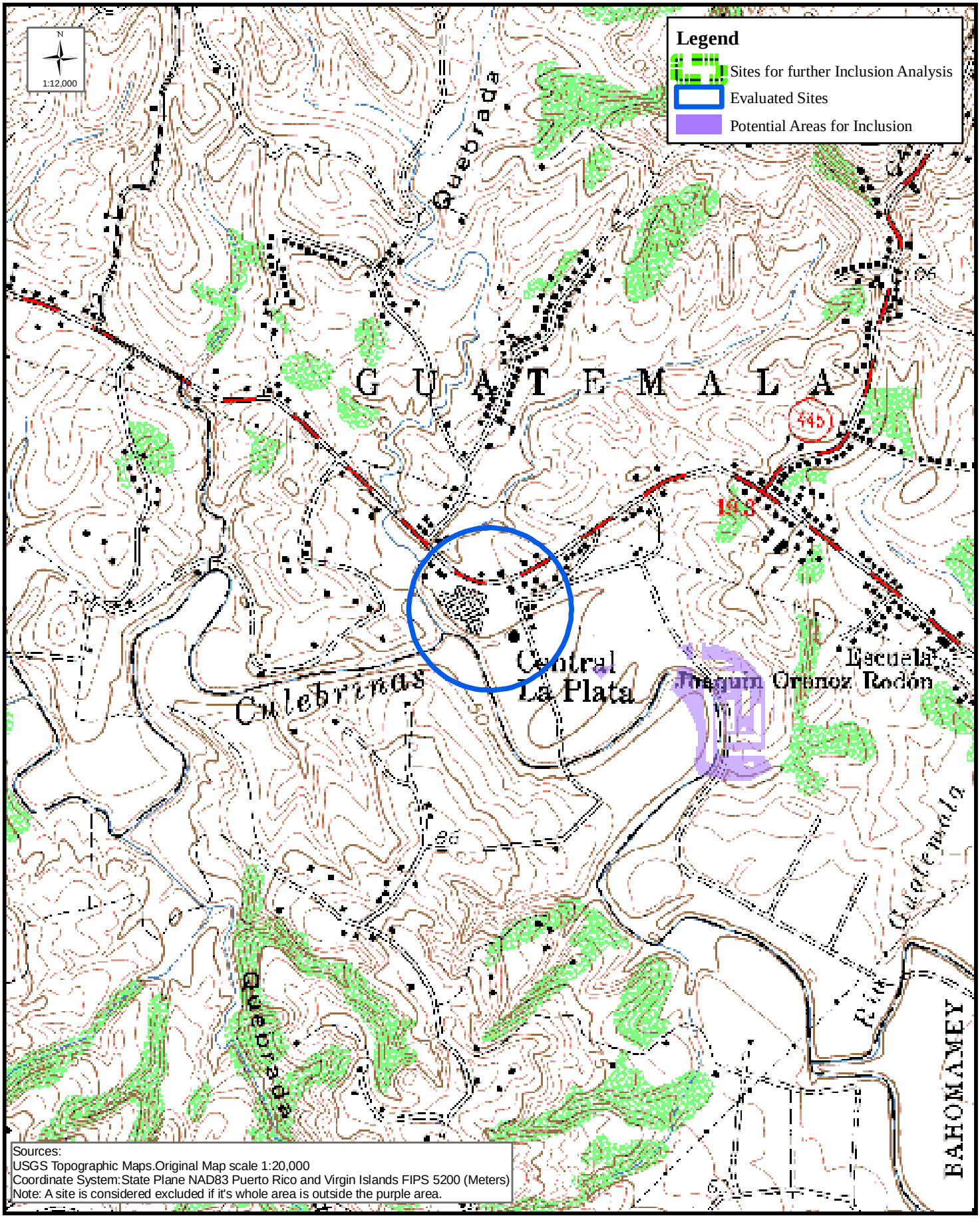

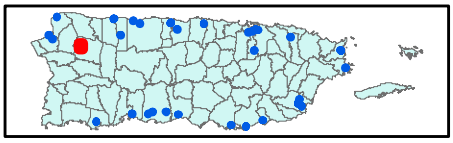

CSA Group

Central La Plata, San Sebastian

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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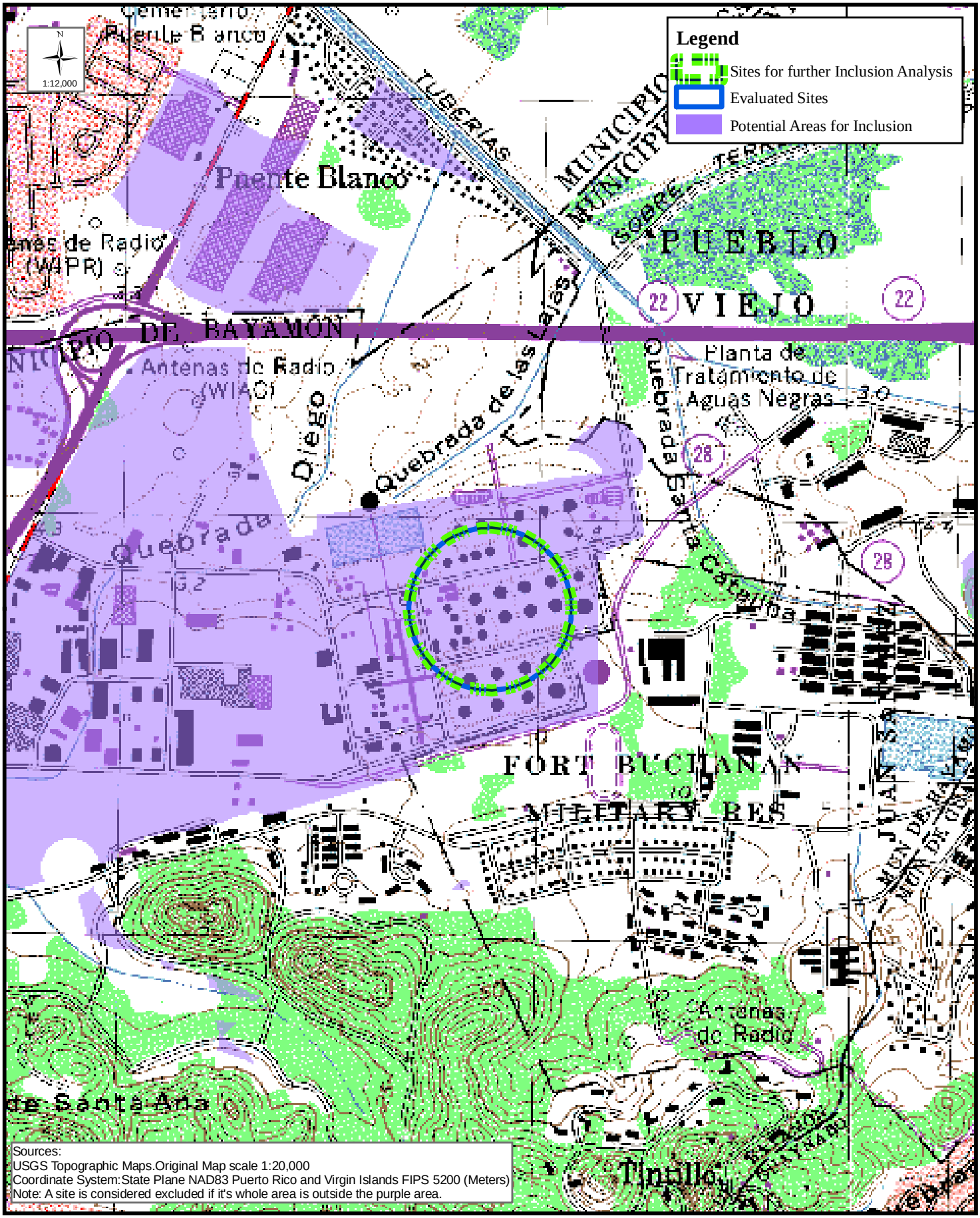

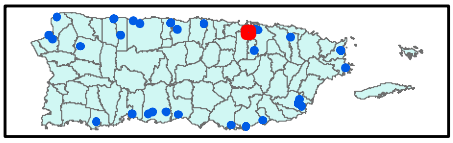

CSA Group

Caribbean Oil

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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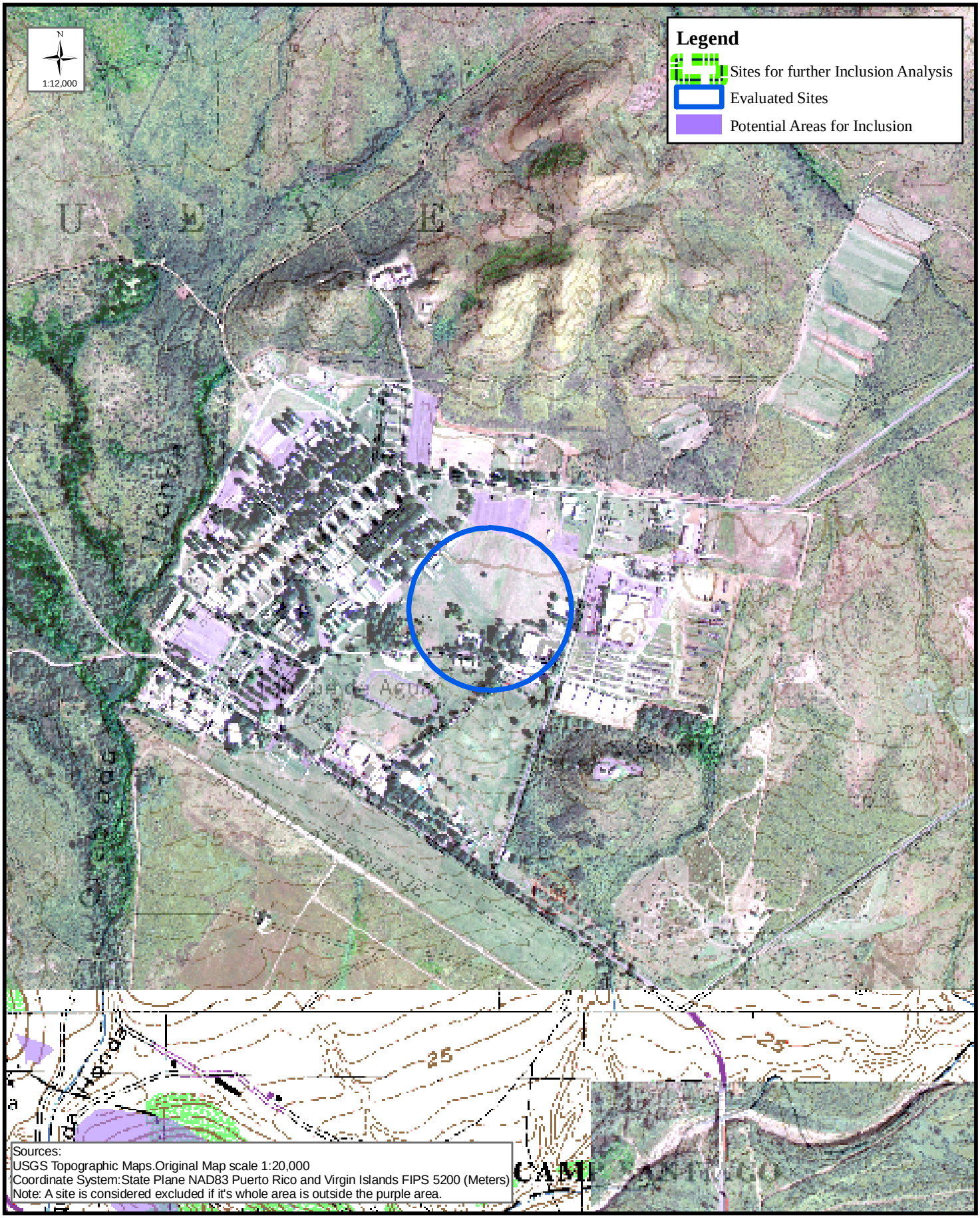

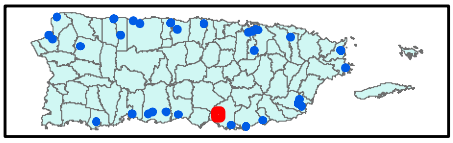

CSA Group

Camp Santiago US Reservation

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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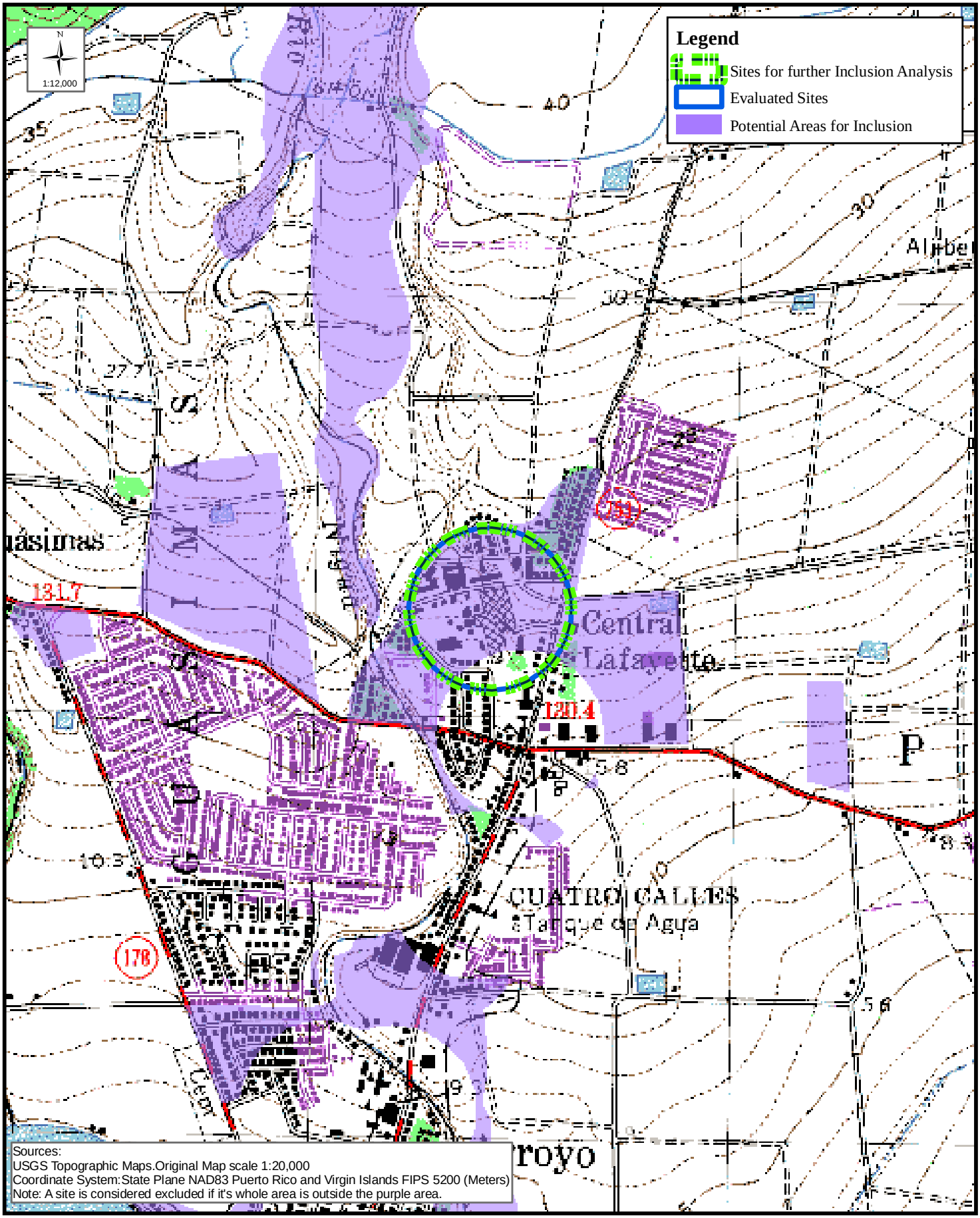

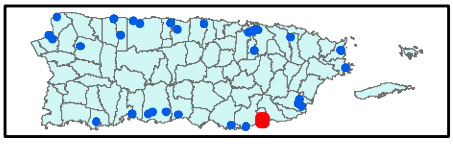

CSA Group

Arroyo Sugar Mill

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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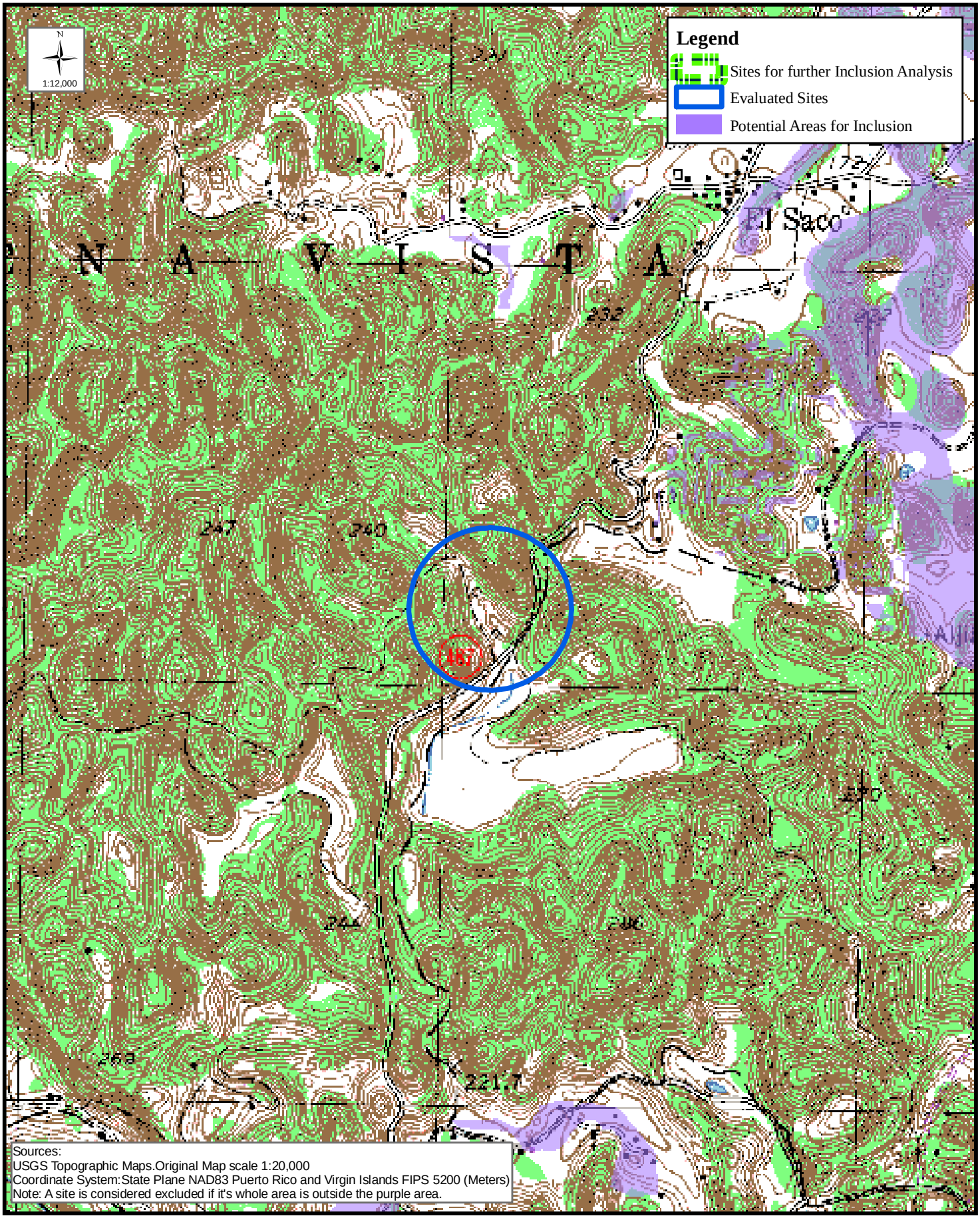

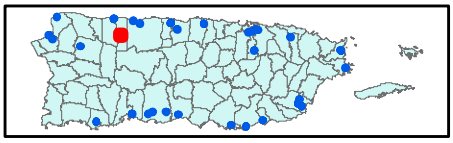

CSA Group

ALCO Site

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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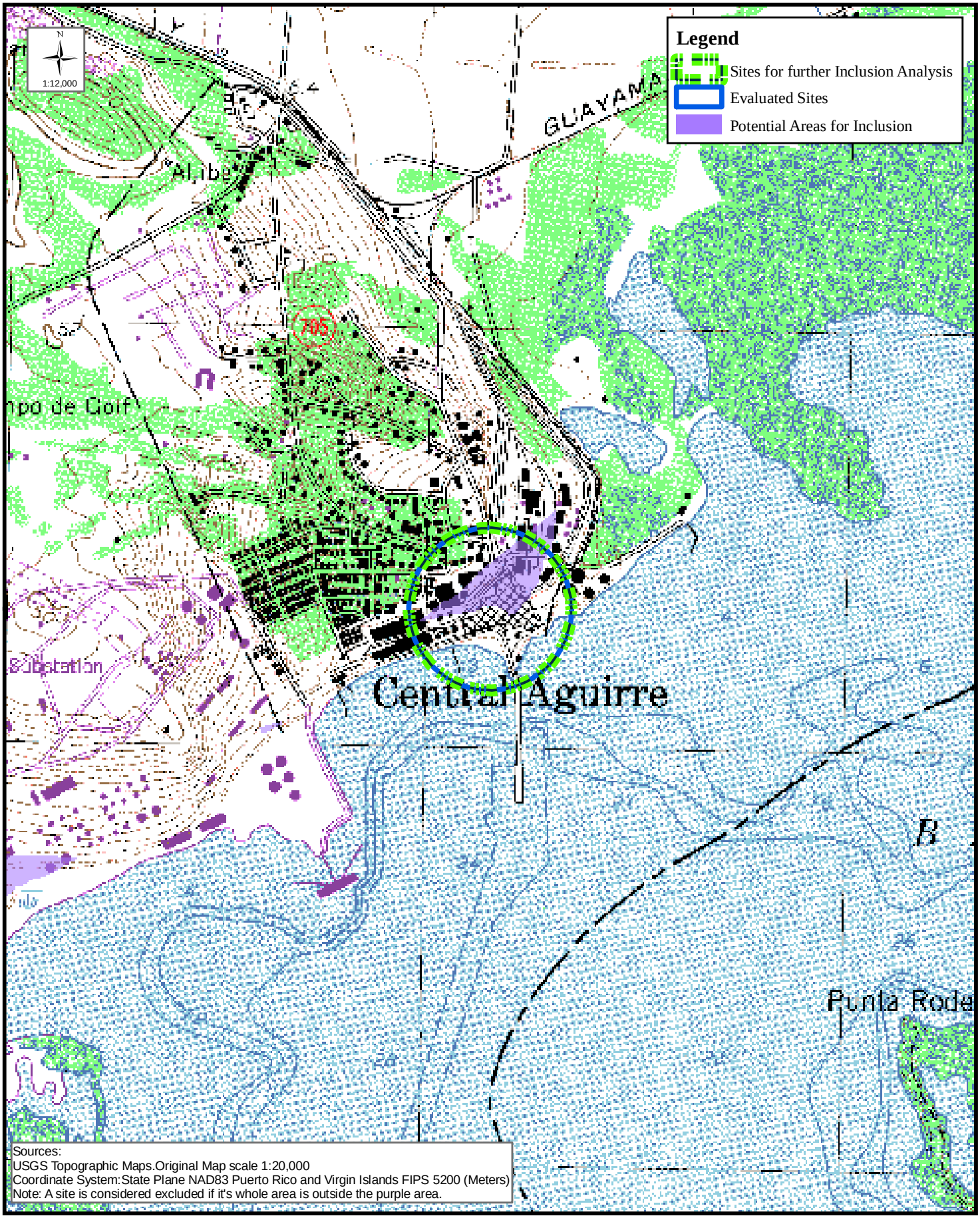

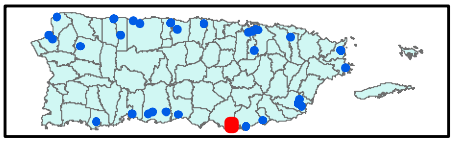

CSA Group

Aguirre Sugar Mill; Jobs Power Plant

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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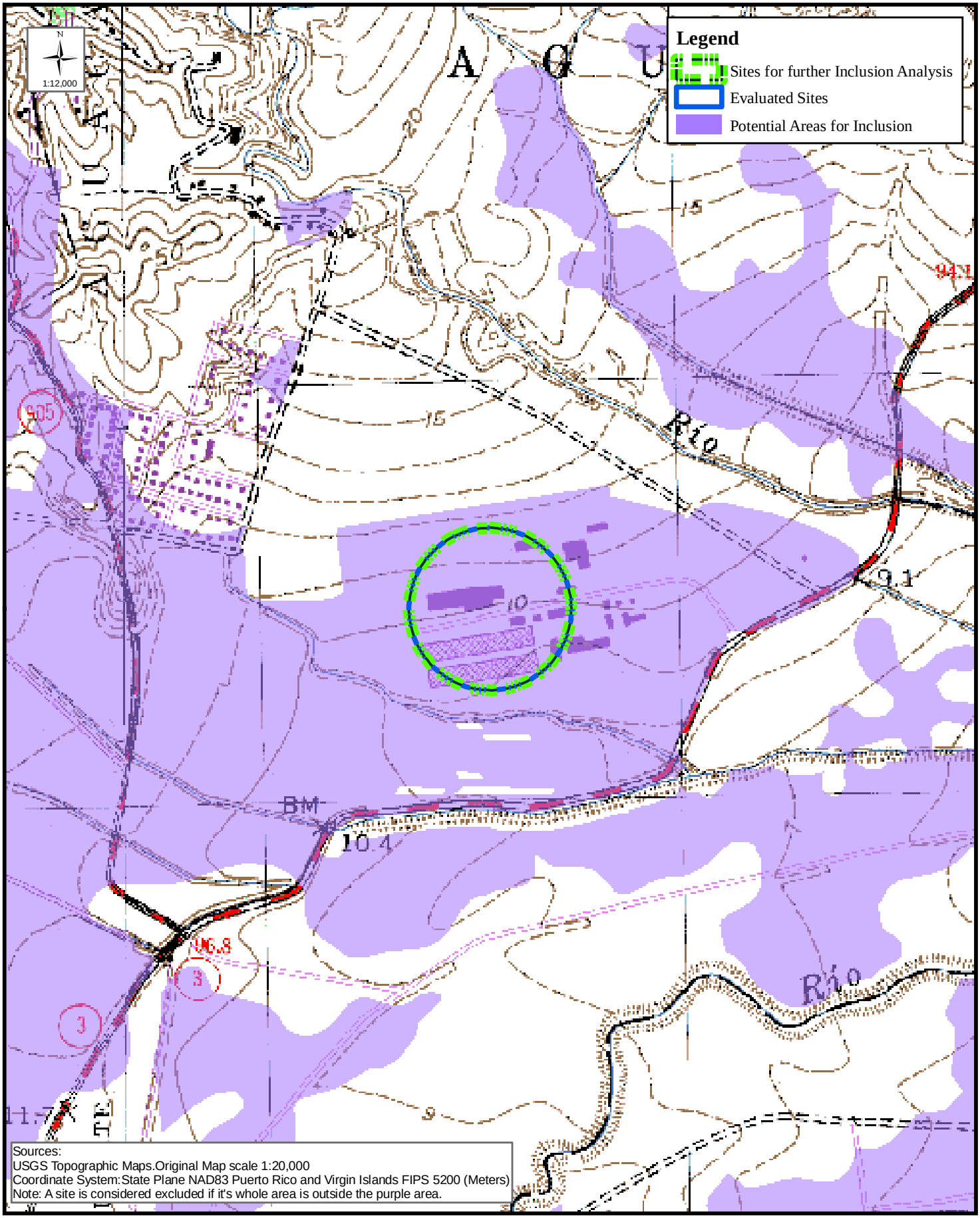

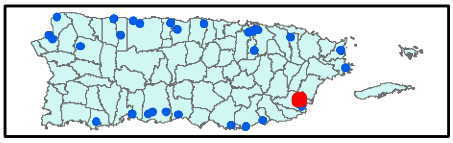

CSA Group

Abandoned Union Caribe Site

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers

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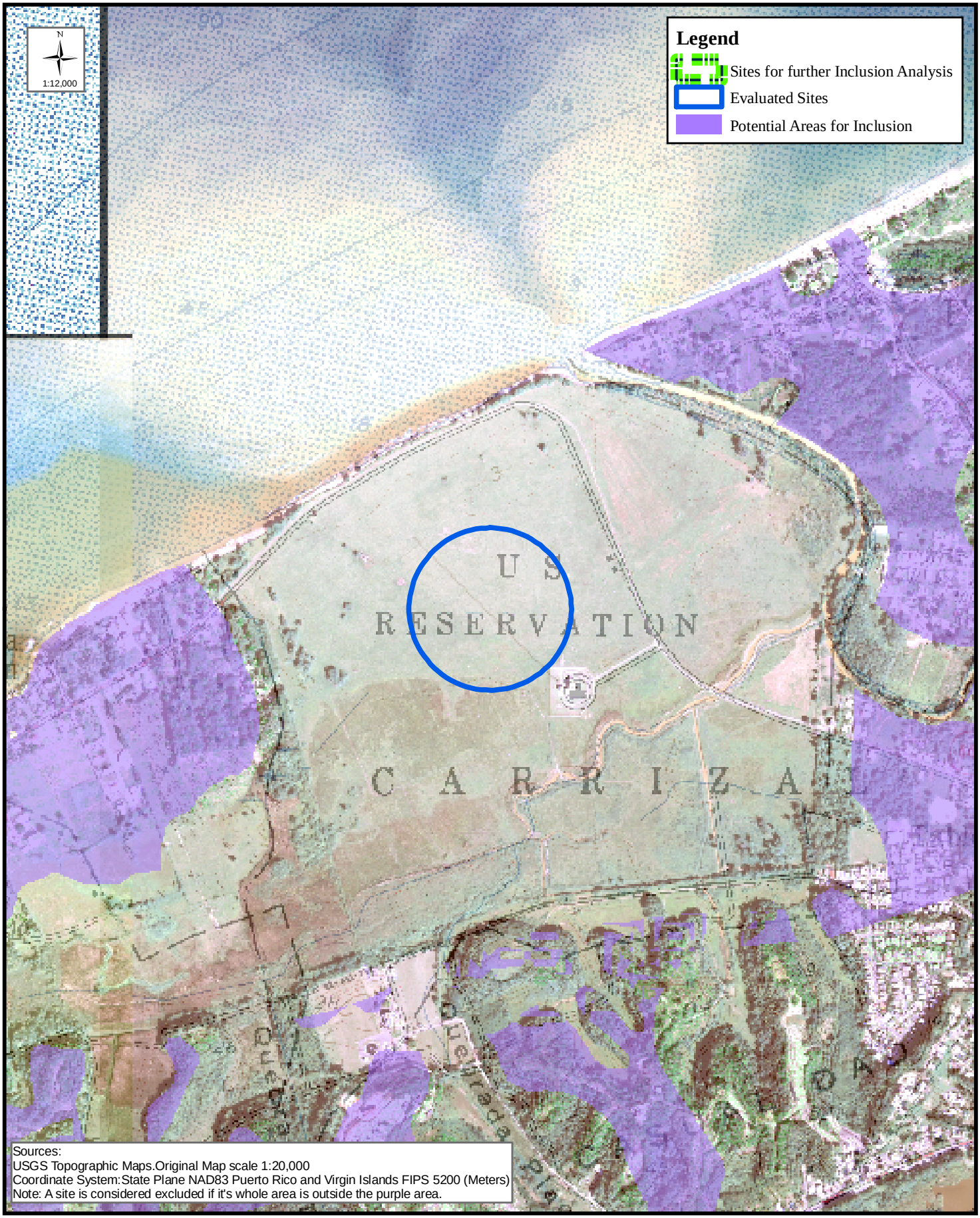
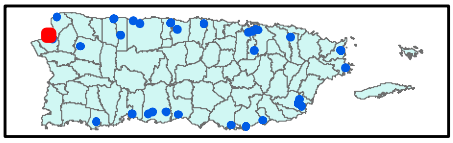


Sources:
USGS Topographic Maps.Original Map scale 1:20,000
Coordinate System:State Plane NAD83 Puerto Rico and Virgin Islands FIPS 5200 (Meters)
Note: A site is considered excluded if it's whole area is outside the purple area.



CSA Group

US Navy Reservation, Carrizal

Exclusion Analysis

Renewable Power Generation and Resources Recovery Facility

EnergyAnswers