

# EXELON GENERATION COMPANY, LLC (EGC) ESP APPLICATION OF ALTERNATIVE SITE COMPARISON PROCESS

## Introduction

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Exelon Generation Company, L.L.C. (EGC) has submitted, as part of its Early Site Permit Application Environmental Report (ESP ER), a site-by-site comparison of alternative sites to “determine if there are any alternative sites that are environmentally preferable to the proposed site.” (NUREG 1555, Section 9.3.) This process is described in two parts. First, the process developed by EGC is described. Section II of this review outlines EGC’s application of the process in its ESP Environmental Report.

The alternative site comparison process for the ESP is developed from several layers of information. This comparison process is based on the guidance outlined in NUREG-1555:

The review involves a two-part *sequential* test for obvious superiority. The first stage of the test determines whether there are environmentally preferred sites among the candidate sites. The second stage of the test considers economics, technology, and institutional factors among the environmentally preferred sites to see if any is obviously superior. If there is no environmentally preferred or obviously superior site, the proposed site prevails; if an obviously superior site is found, the reviewer must identify this site and consult with the Environmental Project Manager (EPM). (Emphasis added.)

# Section I: Alternative Process Review

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The process to determine whether there are environmentally preferable sites is presented in three steps. The remaining part of the process determines whether there is an obviously superior alternative to the proposed site.

The alternative site comparison process is illustrated in Attachment 1.

## **Stage 1: Determine Whether There Are Any Environmentally Preferable Alternatives.**

### **Step 1: Identify the Alternatives**

According to NUREG-1555, if the proposed site is co-located with an existing nuclear facility, other nuclear facilities within the Region of Interest (ROI) should be compared:

...there will be *special cases in which the proposed site was not selected on the basis of a systematic site-selection process*. Examples include plants proposed to be constructed on the site of an existing nuclear power plant previously found acceptable on the basis of a NEPA review and/or demonstrated to be environmentally satisfactory on the basis of operating experience, and sites assigned or allocated to an applicant by a State government from a list of State-approved power-plant sites. For such cases, the reviewer should analyze the applicant's site-selection process only as it applies to candidate sites other than the proposed site, *and the site-comparison process may be restricted to a site-by-site comparison of these candidates with the proposed site*. As a corollary, all nuclear power plant sites within the identified region of interest having an operating nuclear power plant or a construction permit issued by the NRC should be compared with the applicant's proposed site. (Emphasis added.)

The degree of analysis performed in the comparison process should employ the analytical rigor consistent with guidance in Regulatory Guide 4.2: "The applicant is not expected to conduct detailed environmental studies at alternative sites; only preliminary reconnaissance-type evaluations need to be conducted."

### **Step 2a: Sites Without Existing Nuclear Facilities**

The first prong of Step 2 compares undeveloped sites (those without an existing nuclear facility). *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NUREG-1437) summarizes the environmental impacts (in the context of license renewal):

"The environmental impacts of constructing [a nuclear plant] are expected to be equivalent to the impacts of building any large energy facility. Impacts could be moderated somewhat if the plant were built at a current nuclear plant site rather than at a

greenfield site because the prevailing land use would be compatible at the former site. ***Thus, building a plant on a greenfield site would produce more severe impacts.***” (Emphasis added.)

Advanced LWRs require perhaps 200 to 400 ha (500 to 1,000 acres) excluding transmission lines, which could add hundreds to thousands of ha depending upon the distance of the plant from connecting transmission lines or load centers. Destruction of wildlife habitat would occur, and threatened and endangered species would require special consideration to avoid adverse impacts. Erosion, sedimentation, fugitive dust, aesthetic intrusions, and disturbance to cultural artifacts would tend to be proportional to the amount of land disturbed, but site-specific considerations can enter the picture. Socioeconomic impacts from building a large, complex technology would be substantial. With a relatively large but currently unquantified peak construction work force, employment and local spending would benefit. Public services could be adversely affected if those services were operating at capacity previous to plant construction or if a relatively undeveloped remote community were impacted by a large number of immigrating, temporary workers.

It is anticipated that the impacts analyzed and presented in NUREG 1437 would be similar on an undeveloped greenfield or brownfield site examined in the context of an Early Site Permit application alternative site analysis. These greenfield and brownfield sites are then compared with the proposed site. However, they are not environmentally preferred to the proposed site or alternative sites with an existing nuclear facility. Therefore, no further review of the greenfield or brownfields for environmental preferability is performed.

### ***Step 2b: Alternative sites with existing nuclear sites***

The second prong of Step 2 compares sites with an existing nuclear facility to determine if the sites meet the minimum land requirements specified in the Plant Parameter Envelope (PPE), set forth in the ESP application. If additional land is required, the impact is similar to the impact found for undeveloped sites.

The first data review considers whether there is enough land to co-locate a nuclear power plant at the existing facility. Land requirements for new nuclear plants are summarized in NUREG-1437. As noted above, land requirements range from 500 to 1,000 ac. If the applicant must acquire additional property, the applicant should review the impacts of acquiring new land contiguous to the existing facility and placing the PPE footprint on the new land. The acquisition of additional *contiguous* land is preferred because the applicant may then explore the possibility of using certain existing infrastructure as well as existing information about the operating facility. The potentially large impacts from acquiring land that does not have existing infrastructure may affect the environmental preferability of the site.

The alternative site with an existing facility but with insufficient land is deemed “not environmentally preferable” to the proposed site and is excluded from further analysis.

### **Step 3: Compare Remaining Alternative Sites with Proposed EGC ESP Site**

For alternative sites where there exists a nuclear facility and where contiguous land for the proposed new nuclear facility is reasonably available, is in a form and location proximately located to the existing infrastructure, the environmental impacts to this site are compared against the impacts for the proposed site for environmental preferability. The alternate sites are reviewed against the candidate site criteria identified in Section 9.3 III of NUREG-1555. Using the candidate site criteria, each site is compared against the proposed site. If the reconnaissance-type evaluation of the sites does not appear to be environmentally preferable, they are not further considered.

#### **Additional Evaluation Factors**

Where the remaining alternative site impacts appear to be environmentally comparable to the proposed site (using the criteria from Section 9.3 III), additional factors are applied. The NUREG-1555, Section 9.3 provides:

When one or more environmentally preferable alternative sites are identified, the scope of this review should be extended, using benefit-cost techniques and other procedures to determine if any environmentally preferable site can be shown to be obviously superior to the applicant's proposed site.

#### **Apply Additional Evaluation Criteria**

Any alternative sites that appear comparable are compared against the proposed site through application of the socioeconomic criteria outlined in NUREG-1555, Table 9.3-2. Using the "site-by-site" comparison analysis in NUREG-1555, remaining alternate sites are compared to the proposed EGC ESP Site. NUREG-1555 provides:

An "environmentally preferred" alternative site is a site for which the environmental impacts are sufficiently less than for the proposed site so that environmental preference for the alternative site can be established.

#### **Stage Two: Apply "Obviously Superior" Analysis**

If an alternative site is deemed environmentally preferable to the proposed site, NUREG-1555 explains the procedure for obvious superiority:

When such a determination is made, the reviewer should conduct a benefit-cost balance and comparison of the estimated costs (environmental, economic, and time) of completing construction of the proposed plant at the proposed site and at the environmentally preferable site or sites. The reviewer should use the results of this benefit-cost balance to determine if any environmentally preferable site can be shown to be obviously superior to the applicant's proposed site.

## Section II: EGC ESP Process Application

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The following section applies the ESP Alternative Site Comparison Process described in Section I and summarizes, in an illustrative manner, the alternative site analysis presented in the EGC ESP Environmental Report, Section 9.3.

This Section illustrates EGC's application of this process in the Early Site Permit (ESP) Environmental Report (ER).

### **Step 1: Identify the Alternatives**

According to NUREG-1555, if the proposed site is co-located with an existing nuclear facility, other nuclear facilities within the Region of Interest (ROI) should be compared:

...there will be *special cases in which the proposed site was not selected on the basis of a systematic site-selection process*. Examples include plants proposed to be constructed on the site of an existing nuclear power plant previously found acceptable on the basis of a NEPA review and/or demonstrated to be environmentally satisfactory on the basis of operating experience, and sites assigned or allocated to an applicant by a State government from a list of State-approved power-plant sites. For such cases, the reviewer should analyze the applicant's site-selection process only as it applies to candidate sites other than the proposed site, *and the site-comparison process may be restricted to a site-by-site comparison of these candidates with the proposed site*. As a corollary, all nuclear power plant sites within the identified region of interest having an operating nuclear power plant or a construction permit issued by the NRC should be compared with the applicant's proposed site. (Emphasis added.)

In keeping with the above provision from the NUREG-1555, EGC's proposed site is not selected based on a "systematic site selection process." The applicant has selected as the proposed site the EGC ESP Site described in the EGC ESP ER. Further, pursuant to the NUREG-1555, the ROI is the state of Illinois.

Regarding the degree of analysis performed in the comparison process, EGC employed analytical rigor consistent with the guidance in Regulatory Guide 4.2: "The applicant is not expected to conduct detailed environmental studies at alternative sites; only preliminary reconnaissance-type evaluations need to be conducted."

The candidate site, region of interest, and alternatives are described and reviewed in EGC ESP ER section 9.3.1.

Figure 1 of Attachment 2 describes this process.

## **Step 2: Identify Alternative Sites**

### **Step 2a: Sites Without Existing Nuclear Facilities**

The first prong of Step 2 compares undeveloped sites (those without an existing nuclear facility). Figures 2 and 3 illustrate this comparison process.

Here, NUREG-1437 provides important and relevant conclusions regarding the review on the selection and review of these alternative sites:

The environmental impacts of constructing [a nuclear plant] are expected to be equivalent to the impacts of building any large energy facility. Impacts could be moderated somewhat if the plant were built at a current nuclear plant site rather than at a greenfield site because the prevailing land use would be compatible at the former site. ***Thus, building a plant on a greenfield site would produce more severe impacts.*** (Emphasis added.)

Advanced LWRs require perhaps 200 to 400 ha (500 to 1,000 acres) excluding transmission lines, which could add hundreds to thousands of ha depending upon the distance of the plant from connecting transmission lines or load centers. Destruction of wildlife habitat would occur, and threatened and endangered species would require special consideration to avoid adverse impacts. Erosion, sedimentation, fugitive dust, aesthetic intrusions, and disturbance to cultural artifacts would tend to be proportional to the amount of land disturbed, but site-specific considerations can enter the picture. Socioeconomic impacts from building a large, complex technology would be substantial. With a relatively large but currently unquantified peak construction work force, employment and local spending would benefit. Public services could be adversely affected if those services were operating at capacity previous to plant construction or if a relatively undeveloped remote community were impacted by a large number of immigrating, temporary workers.

It is anticipated that the impacts described in NUREG-1437 would be similar on an undeveloped greenfield or brownfield. These greenfield and brownfield sites are then compared with the proposed site. However, they are not environmentally preferred to the proposed site or alternative sites with an existing nuclear facility. Therefore, no further review of the greenfield or brownfields for environmental preferability is performed.

These greenfield and brownfield sites are compared with the proposed EGC ESP Site. As the NUREG-1437 notes, the environmental impact is considered more severe. As a result, they are not environmentally preferred to the proposed site or the alternative sites with an existing nuclear facility. Therefore, no further review of the greenfield or brownfields was performed.

The assessment of these sites and their exclusion as “not environmentally preferred” to the proposed site or the alternative sites is discussed in EGC ESP ER Sections 9.3.3.1 and 9.3.3.2.

Figures 2 and 3 of Attachment 2 describes EGC’s analysis.

## **Step 2b: Sites With Existing Nuclear Facilities**

The second prong of Step 2 compares sites with existing nuclear power plants to determine if the sites meet the minimum land requirements specified in the Plant Parameter Envelope (PPE) set forth in the ESP application for the placement of the generation of the PPE. Figure 4 of Attachment 2 illustrates this process. If additional land is required, the impact is similar to the impact found for undeveloped sites.

The first data review considers whether there is enough land to co-locate a nuclear power plant at the existing facility. Land requirements for new nuclear plants are summarized in NUREG-1437. As noted above, land requirements range from 500 to 1,000 ac. If the applicant must acquire additional property, the applicant should review the impacts of acquiring new land and placing the PPE footprint on the new land. The potential impacts may affect the environmental preferability of the site.

The existing alternative site with an existing facility but with insufficient land is deemed “not environmentally preferable” to the proposed EGC ESP Site and is excluded from further analysis. For example, if a new nuclear plant were co-located at a facility like Quad Cities or Dresden, an undeveloped site would need to be acquired. Additionally, contiguous land would be preferred, so that the applicant could take advantage of the existing facilities infrastructure and existing environmental information. If additional land that is not contiguous to the site must be used, EGC determined that additional new infrastructure would be required and the impacts would be similar to those of an undeveloped site. The impacts to this undeveloped site would be large, in keeping with the conclusions of NUREG-1437. Accordingly, these sites are not considered environmentally preferable to the proposed site.

These sites are described in the EGC ESP ER, section 9.3.3.3.

## **Step 3: Compare Remaining Sites with Proposed EGC ESP Site**

For alternative sites where there exists a nuclear facility and where there is sufficient land to place the proposed PPE footprint, the environmental impacts to this site are compared against the impacts for the proposed EGC ESP Site for environmental preferability. Figures 5 and 6 of Attachment 2 illustrate this process. Sites are reviewed against the candidate site criteria identified in NUREG-1555, Section 9.3 III. If sites do not appear to be environmentally preferable, they are not further considered, as discussed in the EGC ESP ER, Sections 9.3.3.3 and 9.3.4. Additionally, failure of any site to meet any one of the seven criteria renders the site less environmentally preferable than the existing site, and no further review is conducted for that site.

## **Additional Evaluation Factors**

Where the alternative site impacts appear to be environmentally comparable to the proposed site (using the criteria from NUREG-1555, Section 9.3 III), additional socioeconomic factors are compared against the proposed EGC ESP Site, as noted in NUREG-1555, Table 9.3-2. Figure 7 of Attachment 2 illustrates the process. These include the factors described in the EGC ESP ER

Section 9.3.3.3.8 and Table 9.3-2. An additional layer of consideration (for all sites) was created from the socioeconomic factors identified in nureg-1555, Table 9.3-2.<sup>1</sup> This review identified three areas of socioeconomic importance: the possibility of transmission to demand centers and reliability of transmission, proximity of population centers (for low population/emergency planning purposes) and ease of construction, including cost.

### **Apply Additional Site Evaluation Factors**

Using the “site-by-site” comparison analysis in NUREG-1555, remaining sites are compared to the proposed EGC ESP Site. As noted in NUREG-1555: An “environmentally preferred” alternative site is a site for which the environmental impacts are sufficiently less than for the proposed site so that environmental preference for the alternative site can be established.”

Figures 8 and 9 of Attachment 2 illustrate the process. Based on the analysis in the EGC ESP ER Section 9.3.3.3.7, none of the sites is considered environmentally preferable. As a result, the last part of the sequential analysis that tests for obvious superiority was deemed not necessary and thus not performed.

### **Step 4: Apply “Obviously Superior” Analysis**

Because none of the sites is environmentally preferable to the proposed site, the applicant concluded that none of the sites were obviously superior, and did not perform this part of the analysis. Figure 10 of Attachment 2 describes this process. However, the applicant did not perform this process since it considered that none of the alternatives sites were environmentally preferable.

### **Conclusion**

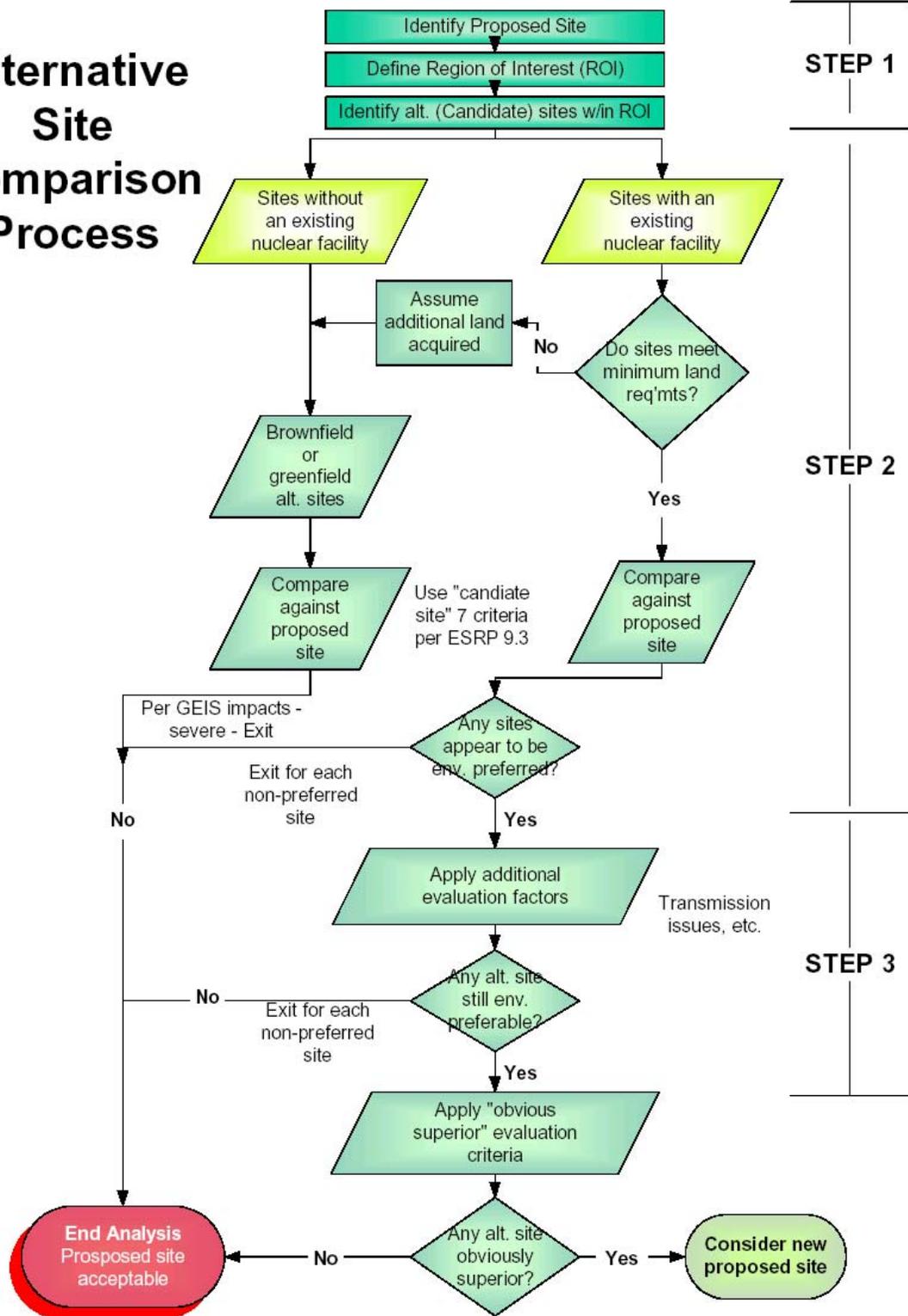
As a result, the proposed EGC ESP Site is acceptable under NUREG-1555. The review is concluded in section 9.3.4 of the EGC ESP ER.

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<sup>1</sup> In the EGC ESP ER (Table 9.3-2), EGC applied these alternative evaluation factors to each alternative site for the purposes of comparing environmental preferability in terms of socioeconomic impacts. However, as noted in the ESP ER (Section 9.3.3.3.7), the final comparison was between three remaining sites and the proposed site.

**Attachment 1**  
**Alternative Site Comparison Process**

# Alternative Site Comparison Process



**Attachment 2**  
**Application of Alternatives Comparison Process**  
**Flowchart**

# STEP 1: Identify the Alternatives

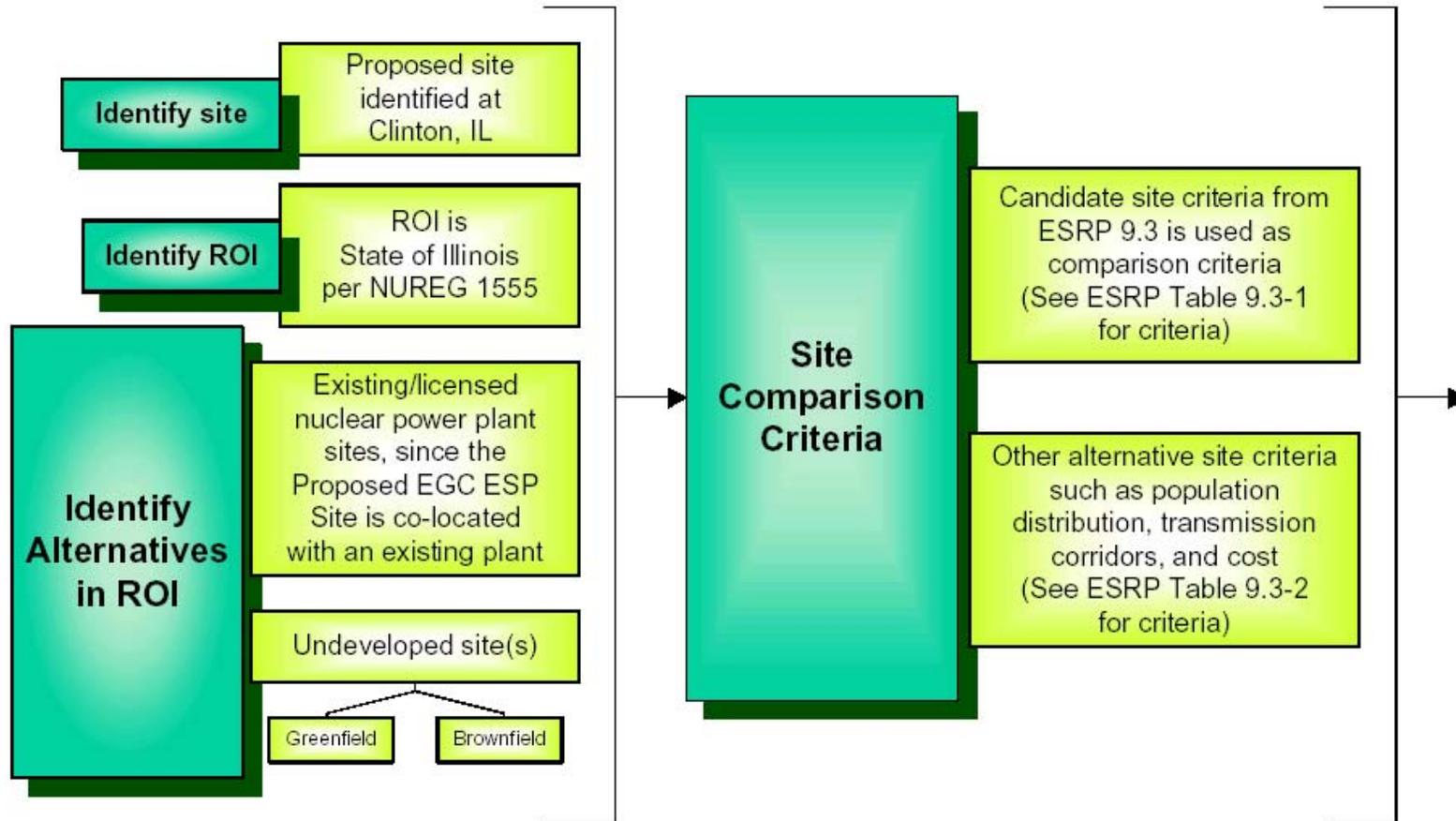


FIGURE 1

## STEP 2a: Sites Without Existing Nuclear Facility

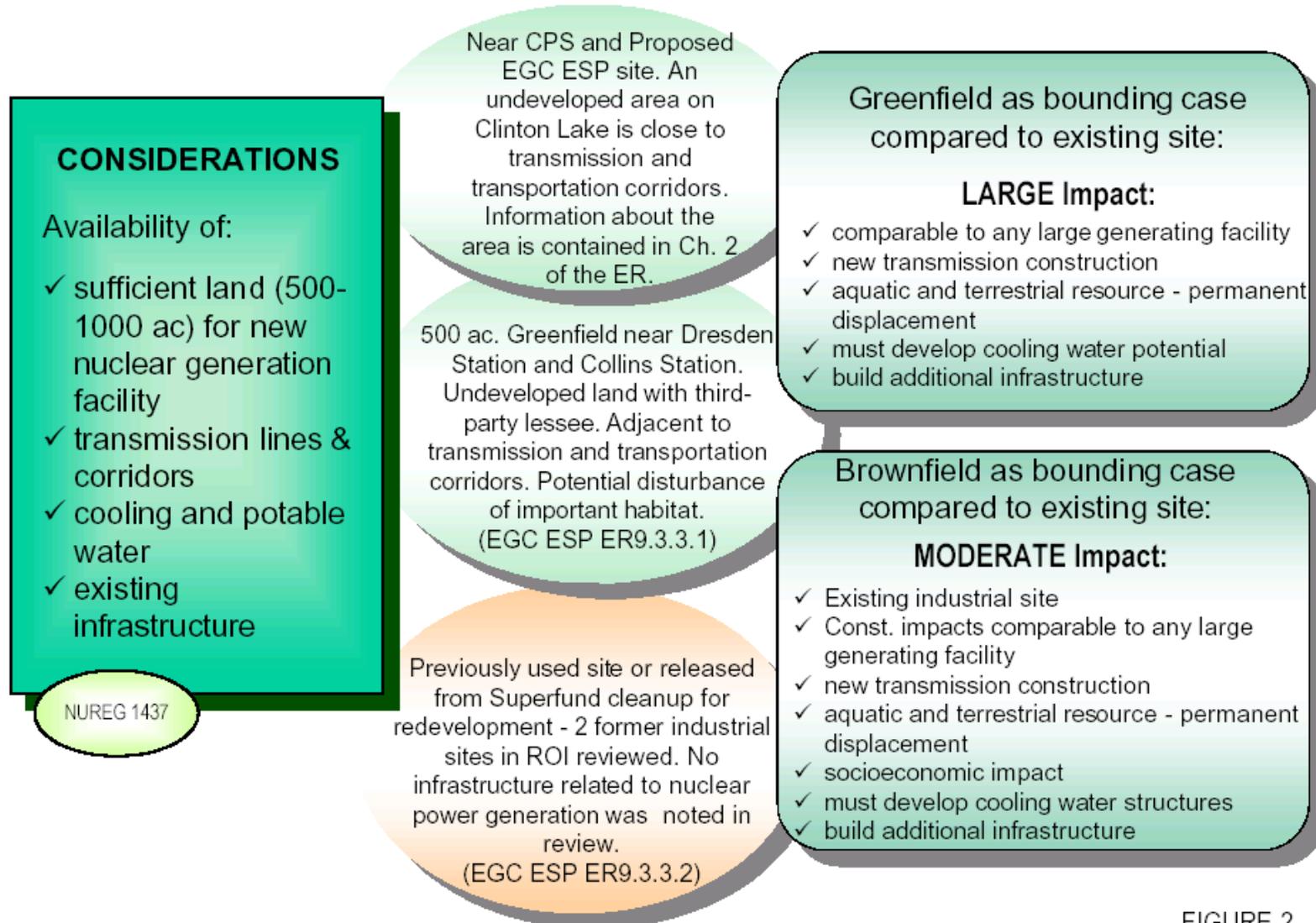


FIGURE 2

## STEP 2a (continued): Sites Without Existing Nuclear Facility

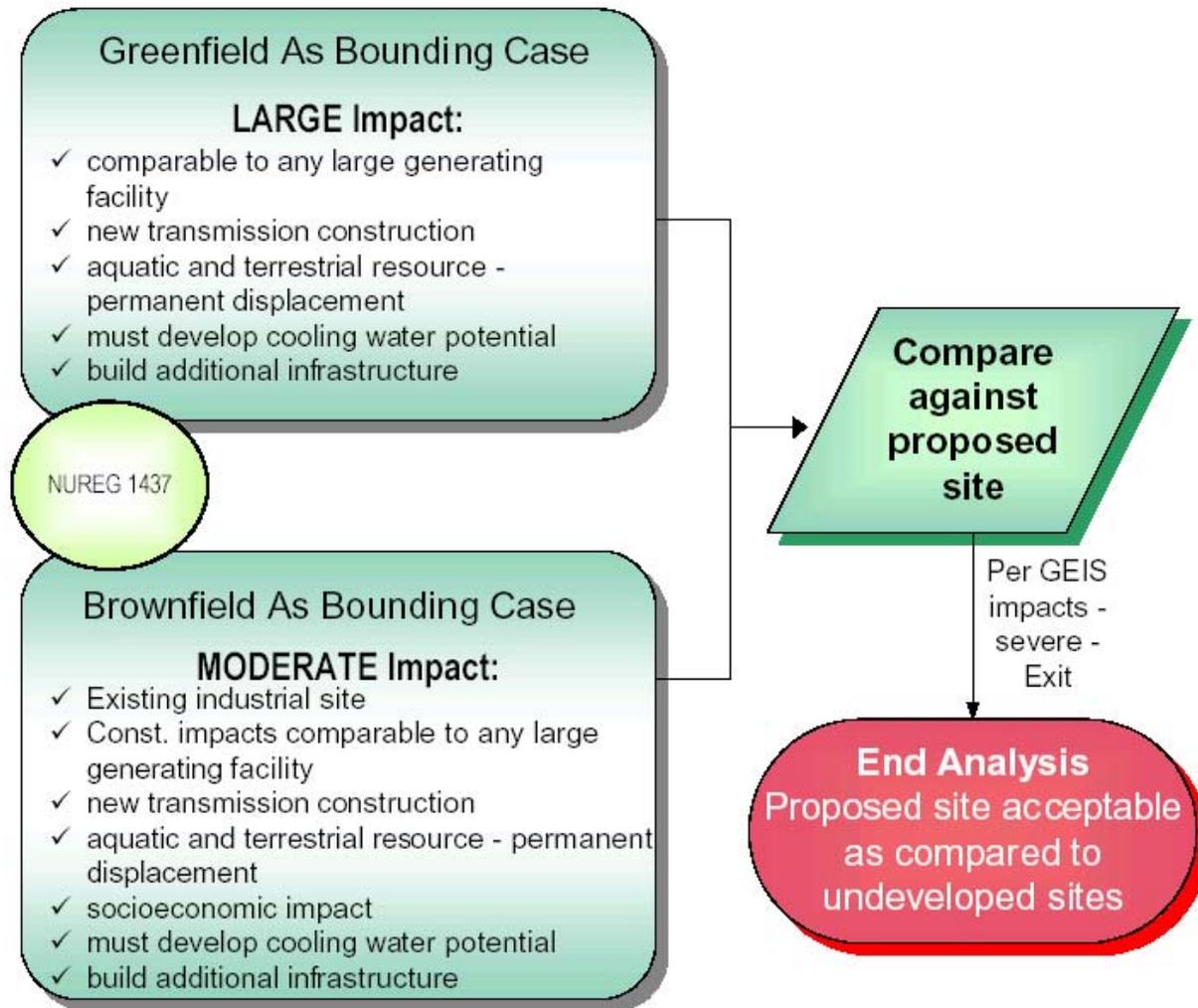


FIGURE 3

EGC ESP APPLICATION OF ALTERNATIVE SITE COMPARISON PROCESS

## STEP 2b: Sites With Existing Nuclear Facility

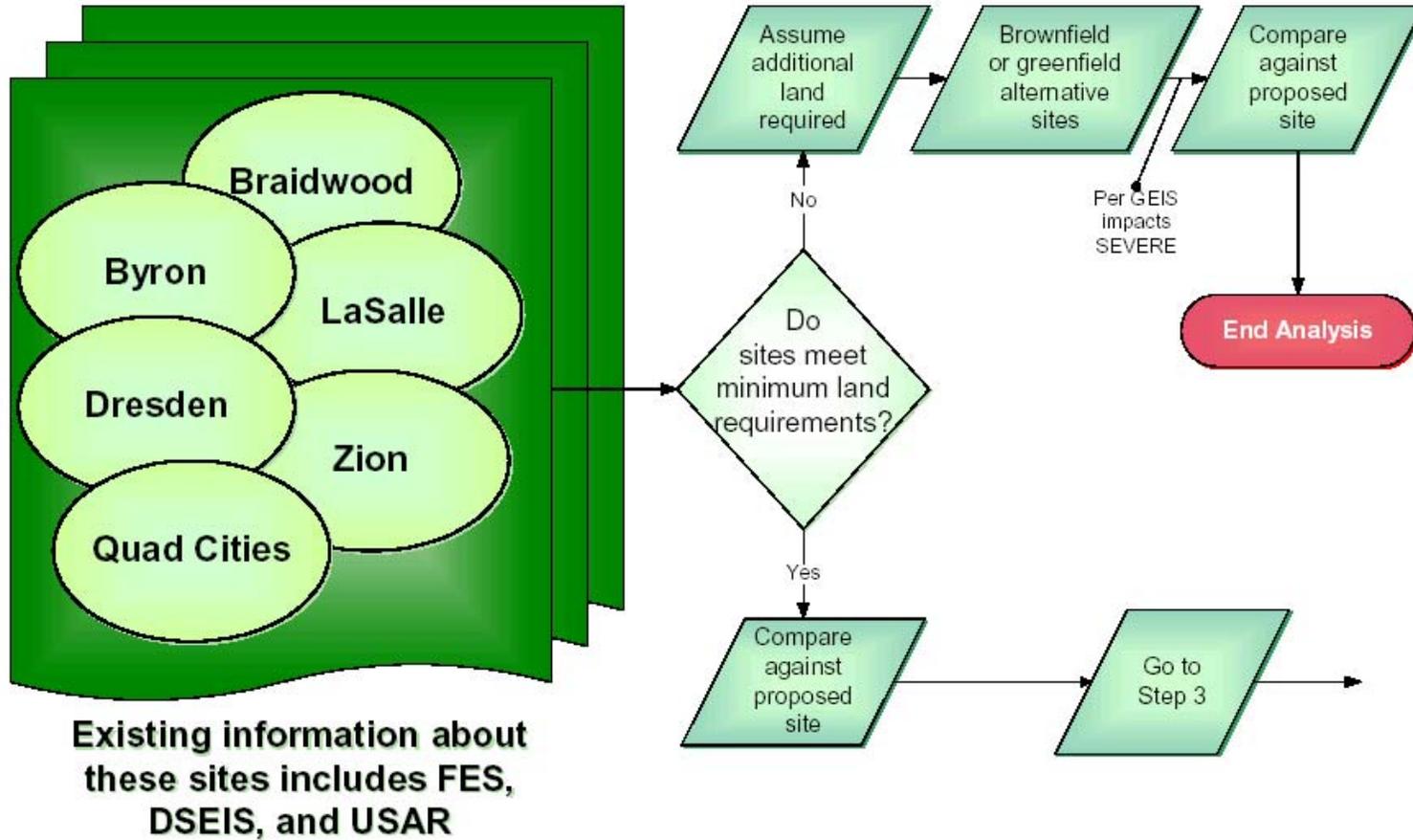


FIGURE 4

EGC ESP APPLICATION OF ALTERNATIVE SITE COMPARISON PROCESS

# STEP 3: Compare Existing Site Alternatives

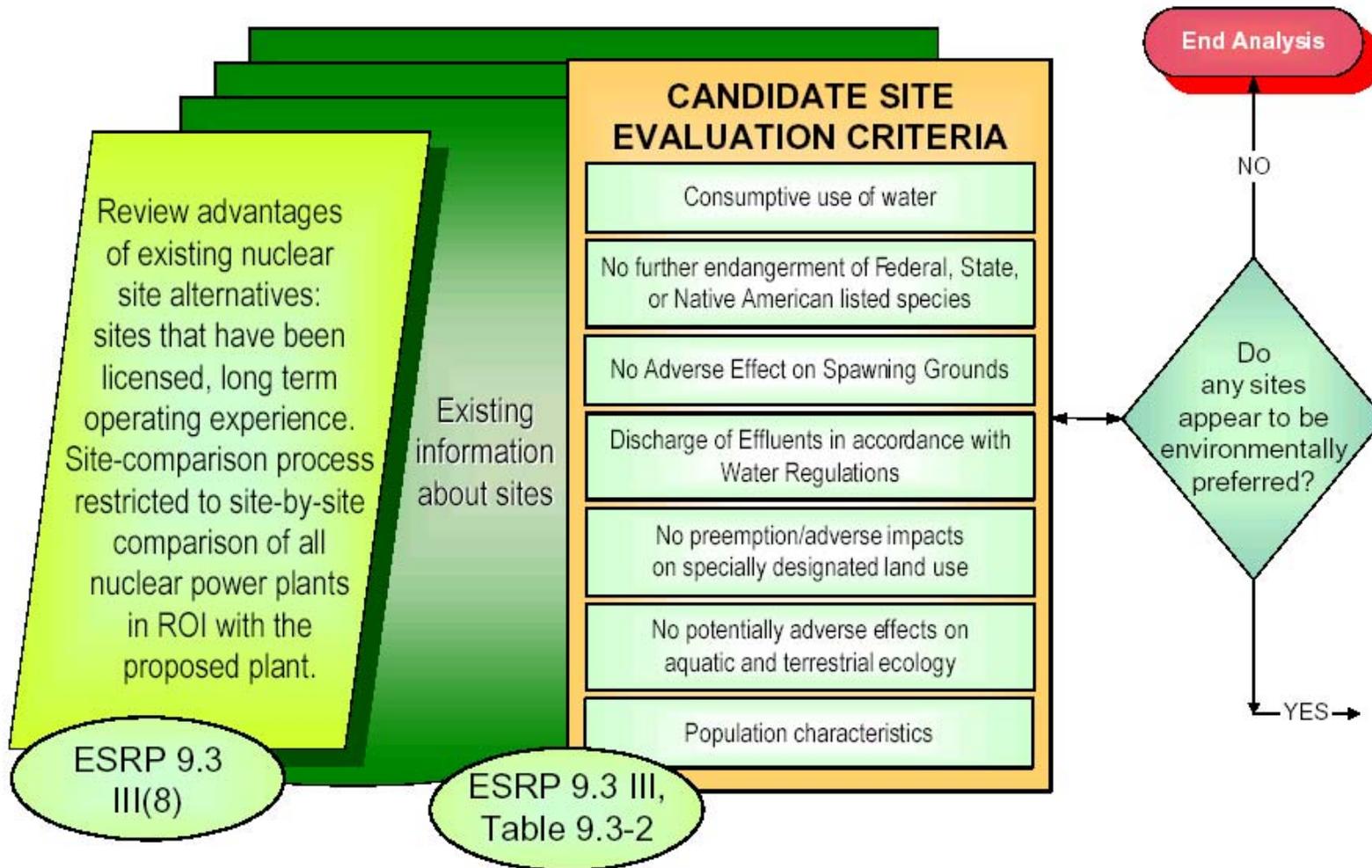


FIGURE 5

## STEP 3 (continued): Compare Existing Site Alternatives

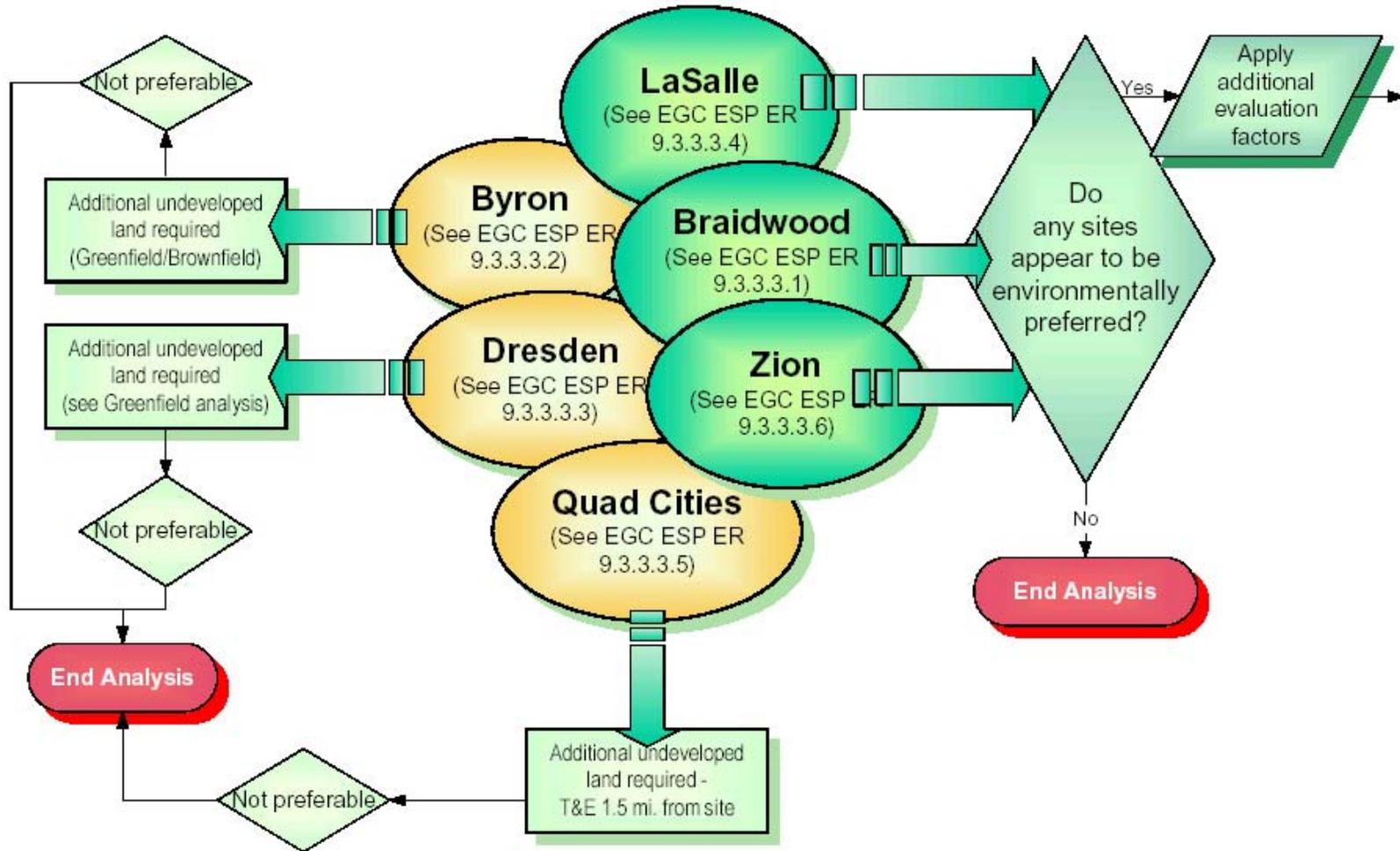


FIGURE 6

EGC ESP APPLICATION OF ALTERNATIVE SITE COMPARISON PROCESS

# STEP 3 (continued): Review Additional Evaluation Factors★

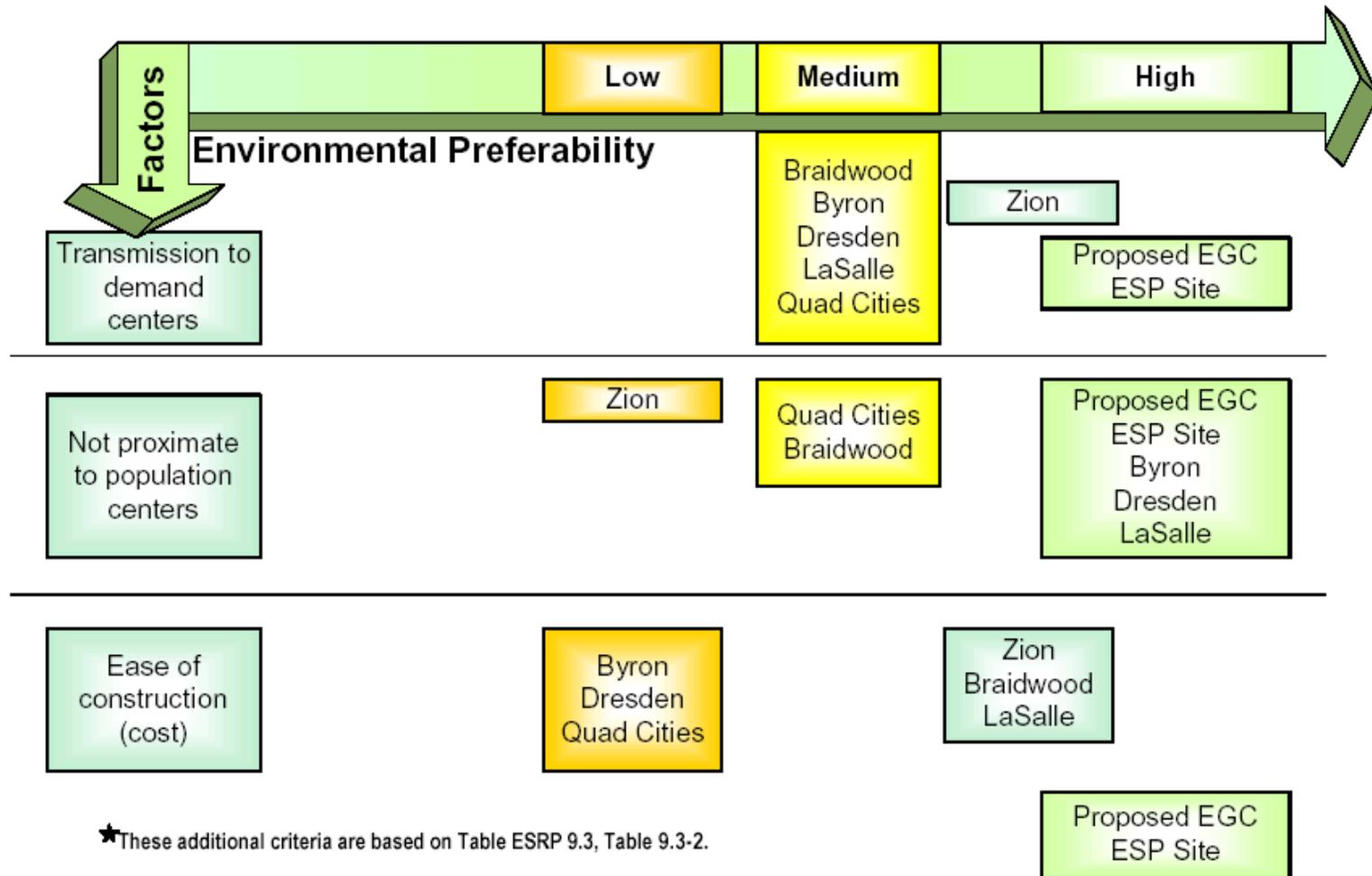


FIGURE 7

EGC ESP APPLICATION OF ALTERNATIVE SITE COMPARISON PROCESS

## STEP 3 (continued): Compare Existing Site Alternatives to Proposed EGC ESP Site

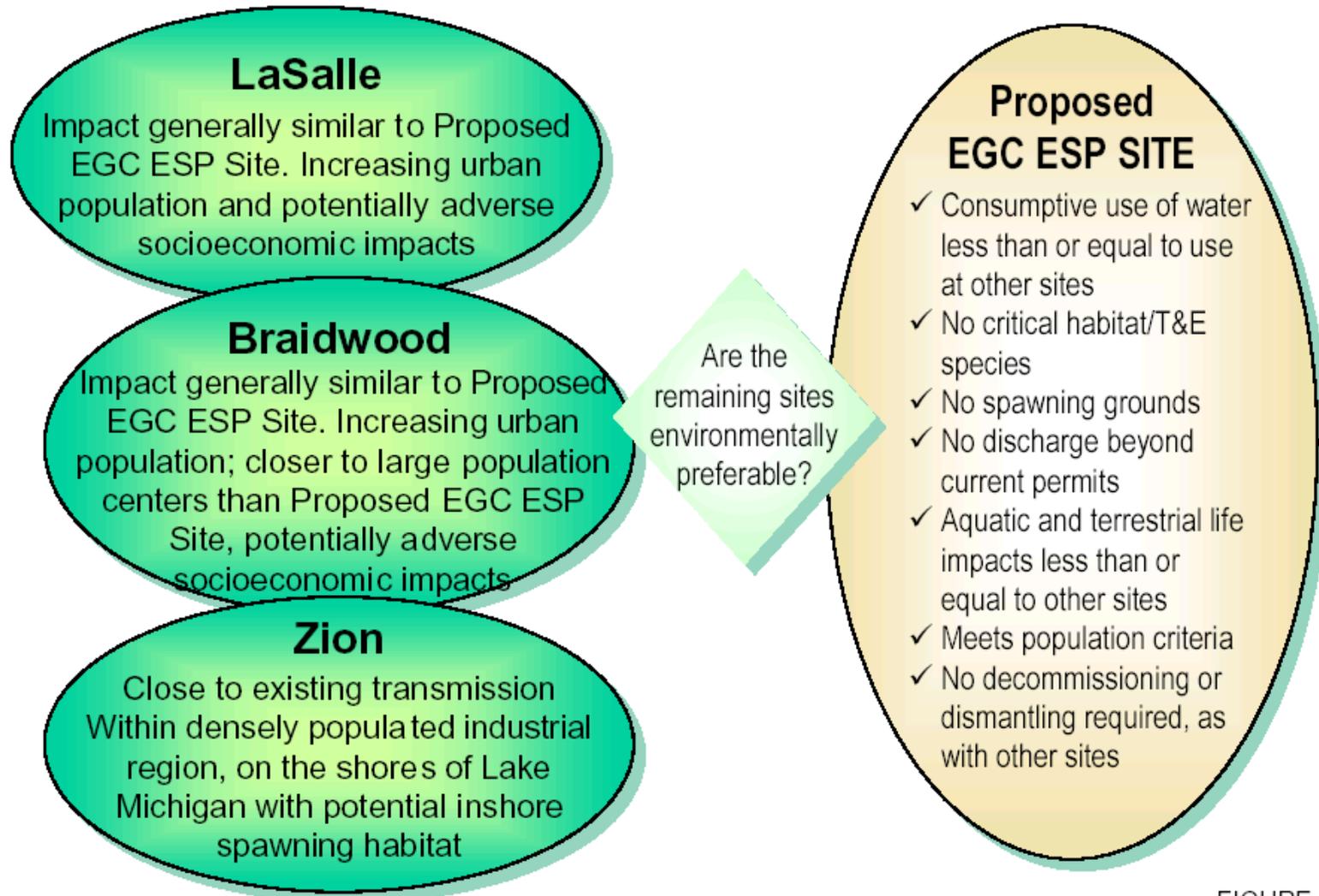


FIGURE 8

EGC ESP APPLICATION OF ALTERNATIVE SITE COMPARISON PROCESS

### STEP 3 (continued): Compare Existing Site Alternatives to Proposed EGC ESP Site

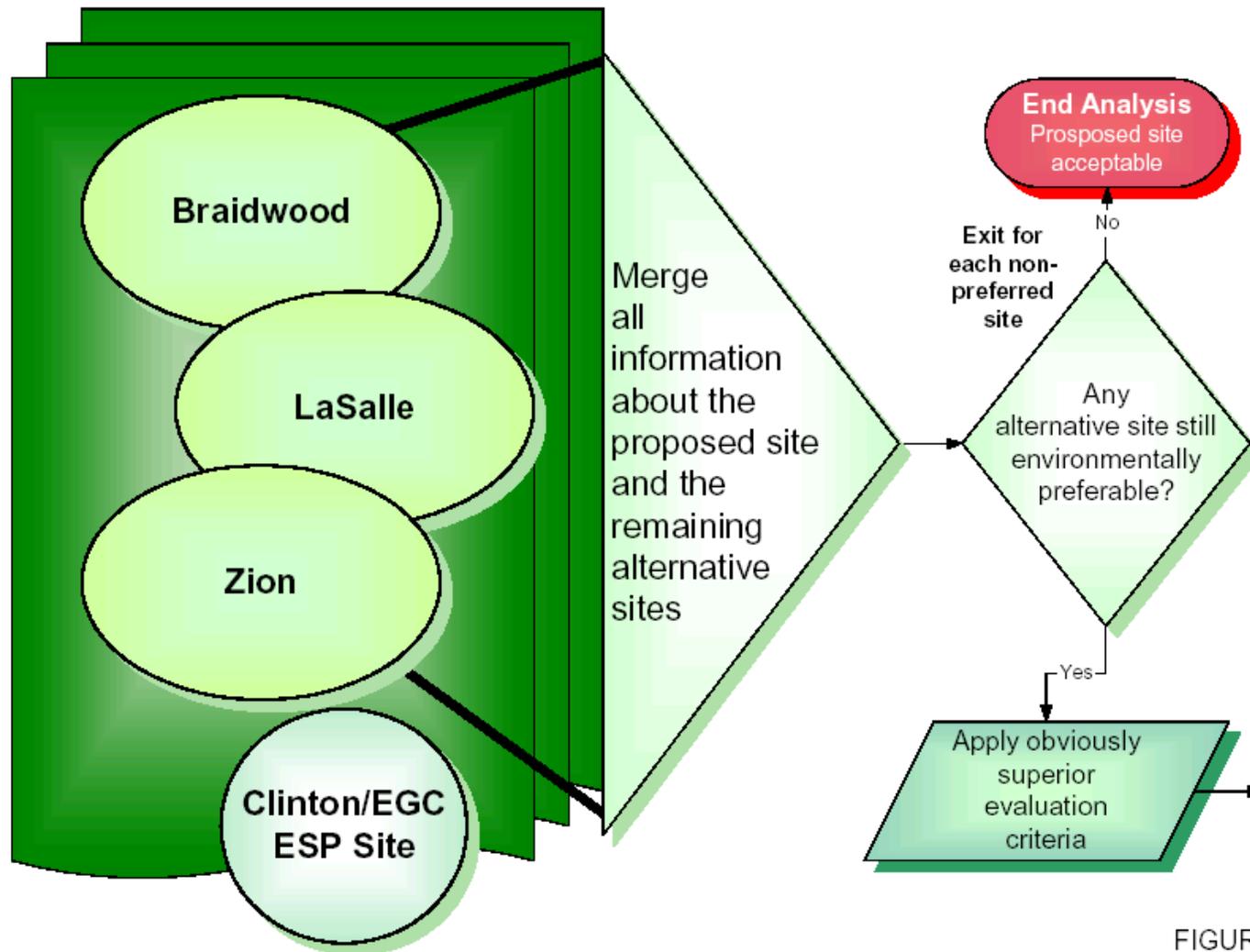


FIGURE 9

EGC ESP APPLICATION OF ALTERNATIVE SITE COMPARISON PROCESS

## STEP 4: Apply Obviously Superior Evaluation Criteria

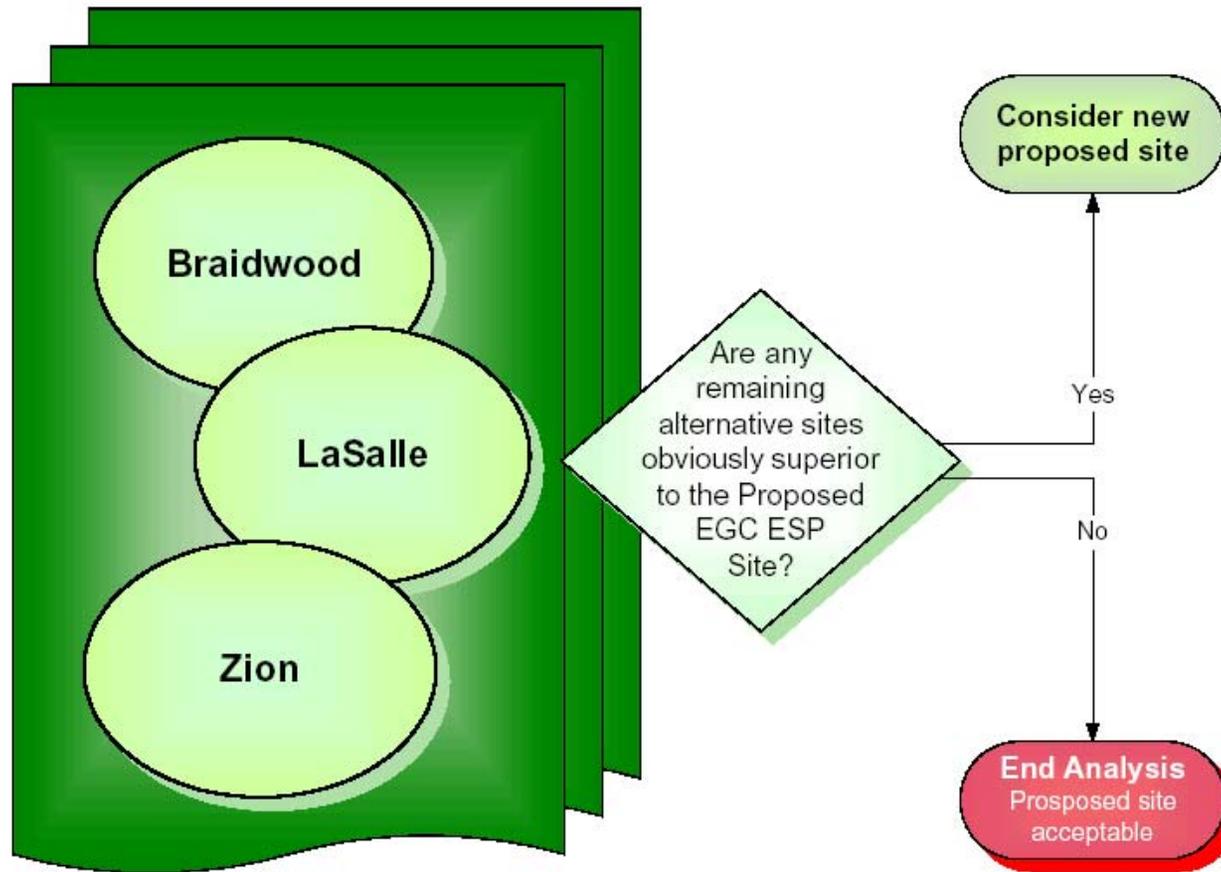


FIGURE  
10

EGC ESP APPLICATION OF ALTERNATIVE SITE COMPARISON PROCESS

# CONCLUSION

## Proposed EGC ESP Site is Preferred

- ✓ Postulated consumptive use of water at the Proposed EGC ESP Site is equal to water use at other sites
- ✓ Does not contain critical habitat or occurrence of threatened species
- ✓ Does not contain spawning grounds for threatened species
- ✓ Impact review does not postulate effluent discharge beyond the limits of existing NPDES permits or regulations for the proposed site
- ✓ Site review postulates no preemption or land use changes for construction and operation of the proposed facility
- ✓ Terrestrial and aquatic impacts at the Proposed EGC ESP Site are anticipated to be generally equal to other sites (with the exception of Quad Cities)
- ✓ Impact on population would be less than other sites
- ✓ Does not require decommissioning or dismantlement of existing facility

FIGURE  
11

EGC ESP APPLICATION OF ALTERNATIVE SITE COMPARISON PROCESS