

WSRC-RP-2001-00673

**Site Selection for Concrete Batch Plant to
Support Plutonium Disposition
Facilities at the Savannah River Site**

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TABLE OF CONTENTS

EXECUTIVE SUMMARY
1.0 INTRODUCTION
 1.1 Synopsis of Site Selection Process
2.0 FACILITY DESCRIPTION
3.0 SITE SELECTION FOR F-AREA BATCH PLANT
 3.1 Exclusion Criteria
 3.2 Candidate site Locations
 3.2.1 Site 1
 3.2.2 Site 2
 3.2.3 Site 3
 3.2.4 Site 4
 3.2.5 Site 5
 3.3 Rationale for Scoring Criteria
 3.3.1 Proximity to PDCF and MFFF
 3.3.2 Accessibility
 3.3.3 Electricity
 3.3.4 Water
 3.3.5 Monitoring Well Displacement and Water Discharge (GW basin impact)
 3.3.6 Air quality and Fugitive dust
 3.3.7 Human Health
 3.3.8 Road Improvement
 3.3.9 Archaeology
 3.3.10 Proximity to UTR
 3.3.11 Emergency Ingress/Egress
 3.3.12 Potential for Future Missions
 3.4 Scoring of Candidate Sites
 3.5 Sensitivity analysis
4.0 CONCLUSIONS
5.0 REFERENCES

LIST OF FIGURES

Figure 1. Location of F-Area Within Savannah River Site..... p. 3
Figure 2. Locations of Candidate Batch Plant Sites in Vicinity of F-Area p. 5
Figure 3. Candidate Sites in Relation to Surface Drainage, Topography, and Depth
to Water Table..... p. 7

LIST OF TABLES

Table 1. Criteria scores for the proposed batch plant sites..... p. 10

EXECUTIVE SUMMARY

The purpose of this site selection exercise was to identify, assess, and rank candidate sites for an onsite concrete batch plant to support construction of the proposed plutonium disposition facilities (PDF) at Savannah River Site (SRS) in the vicinity of F-Area. The site is to be sized for concrete production to support the MOX Fuel Fabrication Facility and the Pit Disassembly & Conversion Facility being constructed concurrently. In May 2001 NNSA directed WSRC to complete this site selection effort, but to stop work on plans to prepare the selected site. A decision on the need for building a concrete batch plant on the SRS to service the PDF has been delayed until execution strategy for constructing the facilities is finalized. A panel of nine members developed five exclusion criteria and initially selected five candidate sites. Fourteen ranking criteria were established and sites were scored for each criterion. Site 1 was not evaluated because it was discovered that it was crossed by power lines that would prohibit development. In order of highest to lowest score, the sites ranked as Site 3, Site 5, Site 4, and Site 2. It was concluded that Site 3 was the preferred site with Site 5 as an acceptable alternate. However, it is noted that all four sites appear to be acceptable for construction and operation of a batch plant.

As this site selection study was being completed, the NNSA initiated a revision of the execution strategy for construction the PDFs. Should the final execution strategy for the PDFs alter the assumptions under which this siting study was conducted, then the siting recommendations should be revisited and revised accordingly.

1.0 INTRODUCTION

The purpose of this site selection exercise was to identify, assess, and rank candidate sites for an onsite concrete batch plant to support construction of the proposed plutonium disposition facilities (PDF) at Savannah River Site (SRS). The geographic area of study was limited to a three-mile radius of the planned PDF complex in F-Area (Figure 1). Protection of the human environment, proximity to the PDF construction sites, and ease of batch plant access (receipt of raw materials and delivery of finished product) were prime considerations in identifying candidate plant sites.

1.1 Synopsis of Site Selection Process

The site selection method utilized a simple decision-making process based on Nominal Group, Delphi and Decision Analysis techniques (Howard and Matheson, 1968; Wike, 1995). A panel of subject matter experts knowledgeable in the areas of facility engineering, regulatory compliance, and the environmental sciences implemented this process.

A listing of panel members and participants and their organizational affiliations is as follows:

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M. J. Cercy	PE&CD/Engineering
M. R. Lewis	PE&CD/SGS
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Following the identification of potential locations within the vicinity of F Area, the panel determined the most suitable candidate sites for project implementation. These candidate sites were numerically ranked using a system of mutually agreed upon scoring criteria that were weighted according to their relative importance. The siting evaluation reported in this document is based upon existing information available at the time of the study effort.

FACILITY DESCRIPTION

The proposed onsite concrete batch plant is required to support the concrete construction needs of the plutonium disposition facilities (PDF) at SRS. These planned facilities include the:

- Mixed Oxide Fuel Fabrication Facility (MFFF)
- Pit Disassembly and Conversion Facility (PDCF)
- Plutonium Immobilization Plant (PIP)

The batch plant will be a stationary central type mixing facility with a peak output of at least 320 cubic yards per hour. Capacity of the plant is based on meeting the peak needs of MFFF and PDCF concurrently. The plant site, which will encompass approximately ten acres, will include batching equipment, aggregate bins and conveyor system, storage and truck maintenance facilities, material stockpiles, and a wash out basin (10 to 15 ft. deep). There will be no permitted effluent discharge to the environment. Batch plant operations will result in the generation of fugitive dust due to truck traffic and the offloading and handling of aggregate and other source materials. Infrastructure requirements include road access, electrical power, potable water, and sanitary sewer. The number of concrete trucks needed to meet the peak demand is dependent on the types of pours and the travel time from the batch plant to the facility. For this evaluation, it was assumed that 20-30 trucks would be required. Candidate sites for the batch plant must be located within a three mile radius of the PDF complex in F-Area to minimize travel time.

DESCRIPTION OF SITE SELECTION PROCESS

Development and Application of Site Exclusion Criteria

An initial step in the site selection process is the development and application of exclusion criteria to identify areas that should not be considered for siting purposes. The application of these criteria prevented locating candidate sites in areas which could potentially result in significant environmental impacts, threaten human health, delay project implementation or increase facility costs, present physical hazards, or result in unacceptable regulatory risks. The exclusion criteria used in this siting exercise are identified below.

The proposed F-Area batch plant will not be located in an area where it would:

- encroach upon or adversely impact wetlands, high quality surface streams, waterbodies, or other high value ecological resources (e.g., SREL ecological setasides, pristine habitats);
- adversely impact any known or proposed threatened or endangered species or their critical habitat;
- be within a 100-year floodplain;
- be on a 'high risk' waste site.
- outside a three mile radius of the proposed PDF facilities to limit travel time and number of vehicles for product delivery.

The application of exclusion criteria eliminates sites that are unacceptable for the intended purpose. The detailed evaluation of candidate sites that follows provides a rank order of preference among sites that meet requirements specified by the project.

Identification of Candidate Site Locations

A total of five candidate plant locations (Sites 1-5) were initially identified within the study area (Figure 2). During the field investigation phase, the presence of high voltage power lines running through the center of Site 1 was identified as a significant liability due to the costs of utility relocation, and this site was subsequently disqualified from further consideration.

Site 2 is located immediately adjacent to the southwestern perimeter of F-Area, north of Road C and east of the F-Area entrance road. Most of the site is heavily forested, with a cleared laydown area along its northern edge. Topographically, the site is flat. Depth to the water table is 75 to 85 feet. Surface drainage is to the west toward Upper Three Runs (Figure 3). There are no known waste sites in the immediate vicinity of Site 2.

Site 3 is located on a heavily wooded tract immediately south of Road C and west of Burma Rd. This site is located farthest from the MFFF and PDCF construction zones. Topographically, the site is flat, with depth to water table being approximately 80 feet. This site is located on a topographic divide, so surface drainage is both west toward Upper Three Runs and east toward Fourmile Branch (Figure 3). There are no known waste sites in the immediate vicinity of Site 3.

Site 4 is located southeast of F-Area on a tract bounded by Road C on the south and Road E on the west and north. Most of the site is heavily forested. Topographically, this site possesses moderate relief. Depth to the water table is approximately 40-60 feet. Surface drainage is to the south toward Fourmile Branch (Figure 3). There are no known waste sites in the immediate vicinity of Site 4.

Site 5 is located immediately adjacent to the northeastern perimeter of F-Area and is the closest to the MFFF and PDCF construction zones. Surface cover ranges from cleared to lightly forested. Topographically, the site is relatively flat and elevated slightly from the surrounding terrain. Depth to the water table is 90 to 100 feet, with surface drainage north toward Upper Three Runs (Figure 3). Waste sites in the immediate vicinity of Site 5 include the inactive F-Area retention basin and the active F-Area Ash Basin. Sites 2 and 4 are the next closest (equidistant) sites to the PDCF construction zone after Site 5. A well cluster for monitoring groundwater from the Mixed Waste Management Facility is located in the center of Site 5.

Rationale for Scoring Criteria

Explanation for the logic and rationale applied in rating each site for the various criteria is discussed below.

Proximity to PDCF and MFFF

Distance of travel from the batch plant site to the MFFF or PDCF site. The shorter the travel distance the higher the score.

Accessibility

Ease of access to the batch plants and from the batch plants to the MFFF and PDCF sites during normal operations. Considerations are truck traffic in and out of the areas at the same time personal vehicles and construction vehicles are traveling to MFFF and PDCF. The easier the access (lower congestion) the higher the score. It is assumed very limited BP production traffic will occur during the SRS primary shift changes, and the majority of the production traffic will occur outside the shift change periods.

Site 2 – Material supply to this location will be via Road C and the F Area entrance road. Access to the PDF will be via either the F Area entrance road then

along the F Area perimeter road, or from the BP location to Road E and then on new F Area perimeter access road. Increased traffic on the F Area access road during the day shift is a traffic safety concern.

Site 3 – Material supply to this location will be via Road C and then Burma Road or 125 to Road 3 and then Burma Road. Access to the PDF facilities will be via C Road, E Road and the new F Area perimeter access road. Traffic volume on C Road and E Road is light during the non-shift change periods.

Site 4 – Material supply to this location will be via Road C and Road E. Access to the PDF facilities will be via E Road and the new F Area perimeter access road.

Site 5 – Material supply to this location will be via Road C, Road E and the new F Area perimeter access road. Access to the PDF facilities will be via the new F Area perimeter access road. For this location both the supply vehicles and concrete trucks will travel the new F Area perimeter access road. The existing rail line south of Site 5 was not considered as a supply option during this evaluation.

Electricity

Sites were evaluated based on the distance from the site boundary to an existing electricity source. Points were awarded on a scale that provided the maximum of ten points for a distance of less than 100 meters to a suitable power source and the minimum of two points for a distance of more than 2000 meters.

Water

Sites were evaluated based on the distance from the site boundary to an existing water source. Points were awarded on a scale that provided the maximum of ten points for a distance of less than 100 meters to a suitable water source and the minimum of two points for a distance of more than 2000 meters.

Monitoring Well Displacement and Water Discharge (GW basin impact)

The potential impacts to groundwater and existing or planned monitoring wells for each proposed batch plant location were compared to the geotechnical and geosciences data generated for the Plutonium Disposition facilities. Each batch plant location was scored relatively according to the maximum value assigned for the groundwater impact and monitoring well displacement parameters. Locations that had greater distances between the land surface and the water table scored higher than those with lessor distances. If existing monitoring wells were within the proposed batch plant footprint, or if a footprint was downgradient from, or within a known plume, that site was scored lower. The site rankings and a brief explanation for each are shown below (Wyatt, 2001)

Monitoring well displacement:

Site 2 – generally out of plume consideration, but will eventually be evaluated for F-Tank Farm

Site 3 - not in a defined flow path

Site 4 - downgradient from F-Area Tank Farm and upgradient from F-Area Seepage Basins

Site 5 - downgradient from Mixed Waste Management Facility, many existing wells

GW basin impact

Site 2 - close to tributary to Upper Three Runs, but still deep water table beneath basin

Site 3 - shallower water table beneath basin

Site 4 - shallowest water table of 5 sites beneath basin
Site 5 - deepest water table beneath basin, on groundwater high

Air quality and Fugitive dust

Air quality at SRS is permitted relative to the site boundary. Because all candidate sites are clustered in the vicinity of F-Area near the center of SRS, there is no significant difference in their respective distances from the site boundary. Therefore, air quality is considered a non-discriminator.

Fugitive dust generation can be expected from the proposed batch plant operations. Any impacts on F-Area facilities and personnel would be primarily a function of wind direction and frequency. The sites rank 4, 3, 5, and 2 from best to worst for fugitive dust impact and are scored accordingly (Hunter, 2001).

Human Health

The five potential site locations for the F-Area Batch Plant are very similar in proximity to the nine sites for Plutonium Disposition Facilities that were evaluated for effect to workers based on the dose evaluation for a site worker from the nearest onsite process (Lee 2000). The evaluations were based on their distance from the 291-F Canyon Stack and predominant wind direction for SRS.

The effect to workers at the potential sites 2, 3, and 4 were assigned a maximum score of seven based on their proximity to the 291-F Canyon Stack. However, the effect to workers at site 5 was assigned a score five due to an additional consideration of its close proximity to the preferred Surplus Plutonium Disposition Facility sites 1, 2M and X (Lee 2001).

Road Improvement

Sites ratings were based on the amount in meters of road that would need to be upgraded for access to the site. Points were awarded on a scale that provided the maximum of six points for less than 100 meters of required road improvement and the minimum of two points if more than 1000 meters would be required.

Archaeology

Archaeology scores for each site were determined using the Archaeology Sensitivity Zone Maps from the Archaeological Resource Management Plan of the Savannah River Archaeological Research Program (SRARP, 1989). Sites 2 and 3 are in Sensitivity Zone 3 and therefore received a higher score than sites 4 and 5 which are in Zone 2.

Proximity to UTR

Upper Three Runs Creek is considered to be a valuable aquatic resource not only to the SRS but also to regional ecosystem biodiversity. This stream has unprecedented diversity of aquatic insects and would be vulnerable to runoff, siltation, or other unintended inputs. For this reason, distance from UTR or its tributaries is an important consideration in site selection. Sites 3 and 4 are on the divide between UTR and Fourmile Branch drainages while sites 2 and 5 are entirely within UTR watershed and therefore score lower.

Emergency Ingress/Egress

Ability to access the batch plants and to get people to safe harbors from the batch plants during emergency conditions. Considerations are traffic in and out of the batch plants at

the same time other vehicles are traveling the access roads. The easier the access (lower congestion) the higher the score.

Site 2 – Access to the site by emergency vehicles will be from the F Area entrance road. Evacuation from the site will be via the F Area entrance road or E Road (access by secondary roads near 717-12F). During evacuations BP personnel will mix with F Area personnel.

Site 3 – Access to the site by emergency vehicles will be from the C Road and Burma Road. Evacuation from the site will be via either C Road or Burma Road south to Road 3 to 125. During evacuations BP personnel will either mix with personnel on Road C or traffic at 125.

Site 4 – Access to the site by emergency vehicles will be from the Road E. Evacuation from the site will be via Road E. During evacuations BP personnel will mix with F Area and E Area personnel on Road E.

Site 5 – Access to the site by emergency vehicles will be from the Road E and the new F Area perimeter access road. Evacuation from the site will be via the new F Area perimeter access road and Road E. During evacuations BP personnel will mix with PDF personnel on the new access road, then with F Area and E Area personnel on Road E.

Potential for Future Missions

Whenever a facility is sited in a developed area such as F-Area, each site must be evaluated for suitability for future missions. Sites 3 and 4 are considered to have greater potential use for future missions than sites 2 and 5 and therefore scored higher for this criterion.

SCORING OF CANDIDATE SITES

Summary of scoring for the candidate sites is shown in Table 1. Sites 2 and 4 have similar scores and are the lowest of the four sites. Site 3 has the highest score and Site 5 is intermediate. The range of scores is 7.6 points.

Criteria	Maximum Points	Site 2	Site 3	Site 4	Site 5
Proximity to PDCF and MFFF	20	14.7	11.7	13.3	20
Accessibility	15	9.7	13.3	11.7	9.3
Electricity	10	6.7	9.3	8	9.3
Water	10	6.7	9.3	8	9.3
Monitoring well displacement	5	5	5	2	1
Water Discharge (basin)	6	5	4	3	6
Air quality	1	1	1	1	1
Human Health	7	7	7	7	5
Fugitive dust	4	2.5	3.5	4	3
Road improvement	6	5.3	5.3	5.3	4.3
Archaeology	1	1	1	0	0
Proximity to UTR	5	4.5	5	5	4.5
Emergency Ingress/Egress	8	7	7.3	7.3	5.7
Potential for future missions	2	1	2	2	1
Total	100	77.1	84.7	77.6	79.4

Table 1. Criteria scores for the proposed batch plant sites.

SENSITIVITY ANALYSIS

The primary weights representing the relative importance of ecology, human health, geoscience and engineering present the greatest potential for variability (Harris, 2001). The scores assigned within categories were considered to be of lesser variability since subject area experts determined them. They were not varied. The primary weights were simultaneously varied from 10% to 30% using the method of extreme vertices. Statistical analysis of the resulting weighted scores confirmed the robustness of the recommended site selection

Sensitivity analysis has demonstrated that Site 3 is best suited over widely varying error ranges in primary weights (Harris, 2001). Site 3 has higher scores than the other three sites up to and including a 20% perturbation in the primary weights. Site 5 is almost always better than Sites 2 and 4 up to a 10% perturbation in the primary weights. Sites 2 and 4 are the least favorably disposed for site selection.

CONCLUSIONS

Based on scoring, Site 3 would be the preferred site with Site 5 as an acceptable alternate. As demonstrated by the exclusion of Site 1 after closer examination, it should be reiterated that the remaining sites are all acceptable due to having passed all exclusion criteria. It appears that three criteria are the primary discriminators; Proximity to PDCF and MFFF, Accessibility, and Monitoring Well Displacement.

During the execution of this site selection task NNSA-NN61 approved a task change proposal (TCP PDSS-01-005) to remove preparation of the concrete batch site from the Plutonium Disposition Support Systems Project. Nevertheless, WSRC was directed to complete this site selection effort. A decision on the need for building a concrete batch plant on the SRS to service the PDF has been delayed until execution strategy for constructing the facilities is finalized. The final execution strategy may change the assumptions under which this siting study was conducted and result in a reordering of the preferences of the four sites evaluated.

If the NNSA decides to build one facility at a time, or decreases the peak rate for concrete supply, the exclusion criteria for the batch plant site to be within a three mile radius of the PDF should be reevaluated. Depending on the supply rate a commercial concrete batch plant may be a supply option.

Other factors can also affect final site selection. The first of the influencing factors is the construction execution plan for the new facilities, concurrently or staggered. Given that all four of the evaluated sites are acceptable, more detailed assessment of each site with respect to project requirements may reveal that factors resulting in low scores for an individual site (e.g. monitoring wells at Site 5) could be effectively mitigated, or their relative importance is changed because of the revised execution plan. In this case, the siting study should be revisited to incorporate the changed assumptions.

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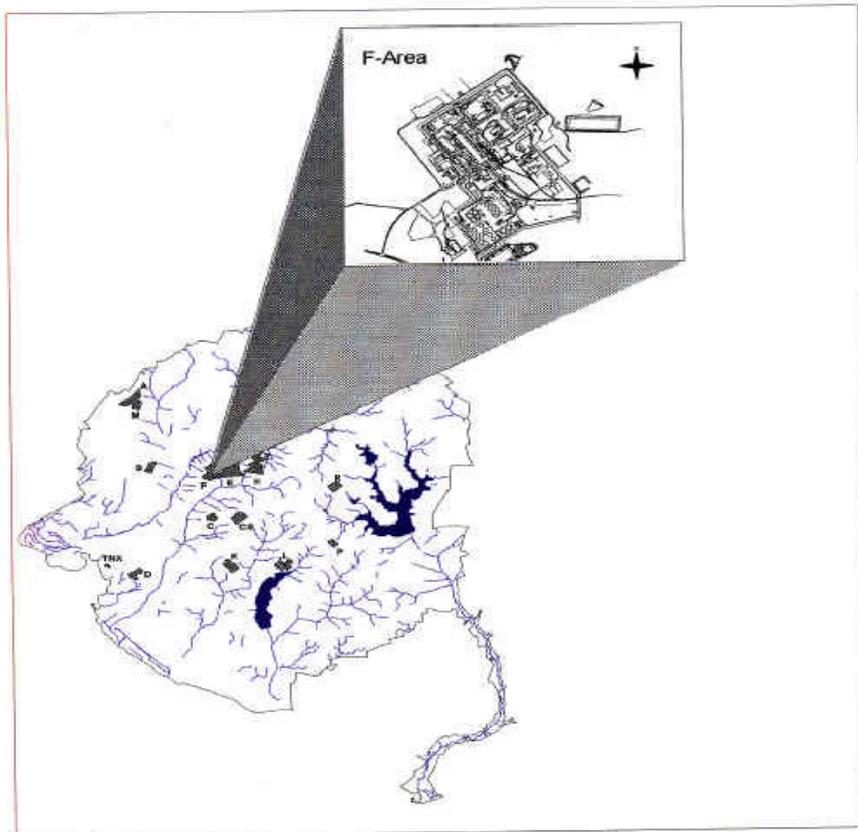


Figure 1. Location of F-Area Within Savannah River Site.

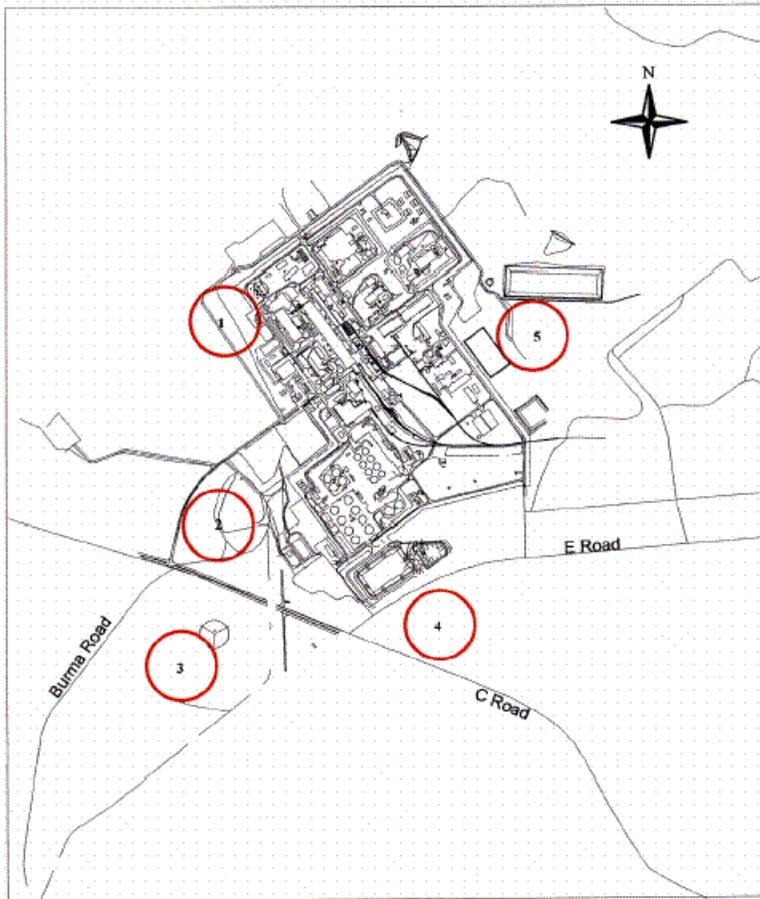


Figure 2. Locations of Candidate Batch Plant Sites in Vicinity of F-Area.

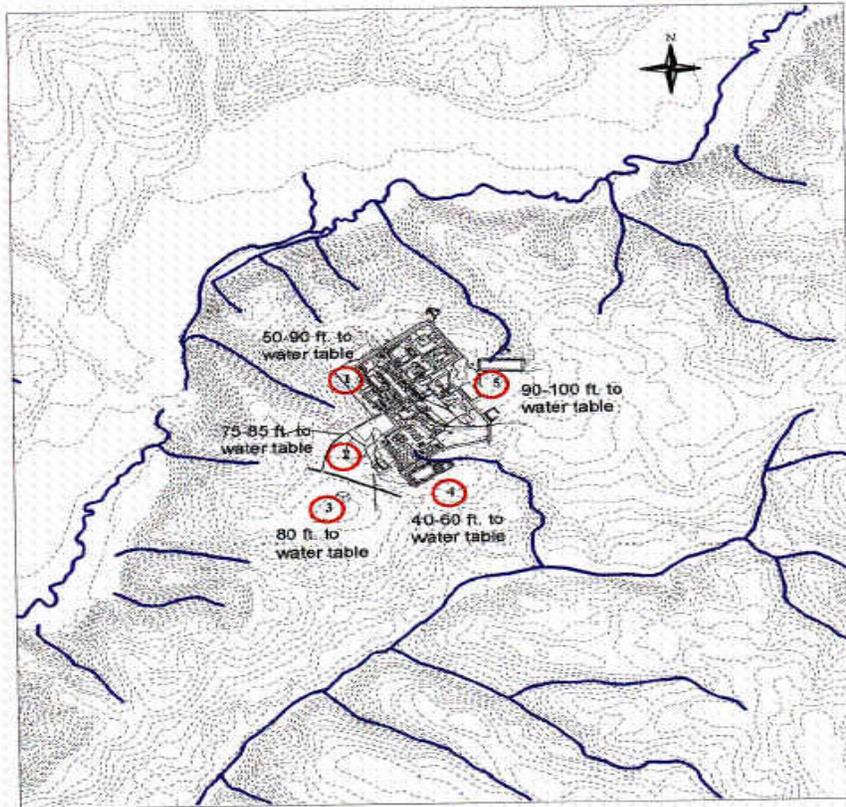


Figure 3. Candidate Sites in Relation to Surface Drainage, Topography, and Depth to Water Table.