MOL.19980526.0257

CRWMS/M&O

Non-Q Design Analysis Cover Sheet

Complete only applicable items.

(1.) QA: N/A

Page: 1 Of: 45

2. DESIGN ANALYSIS TITLE			
Repository Surface Design Site Layout (Rev) 2/27/98 Analysis			
3. DOCUMENT IDENTIFIER (Including Rev. No.)		4. REV. NO.	5. TOTAL PAGES
BCB000000-~~0200-01717~~-00007 Rev 02 (01717-0200 Rev 2/27/98)		02	45
6. TOTAL ATTACHMENTS	7. ATTACHMENT NUMBERS - NO. OF PAGES IN EACH		8. SYSTEM ELEMENT
4	I-8, II-4, III-4, IV-1		

	Print Name	Signature	Date
9. Originator	Hector R. Montalvo		2/27/98
10. Checker	Michael S. Ruben		2/27/98
11. Lead Design Engineer	Hector R. Montalvo		2/27/98
12. Department Manager	Steven J. Meyers		2-27-98

13. Remarks

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2. DESIGN ANALYSIS TITLE	
Repository Surface Design Site Layout Analysis	
3. DOCUMENT IDENTIFIER (Including Rev. No.)	
BCB000000-01717-0200-00007 REV 02	
4. Revision No.	5. Description of Revision
00	Initial Issue
01	Revised to incorporate editorial changes throughout.
02	Revised to incorporate latest conceptual design information.

CONTENTS

FIGURES

TABLES

1. PURPOSE

The purpose of this analysis is to establish the arrangement of the Repository surface facilities and features near the North Portal. The analysis updates and expands the North Portal area site layout concept presented in the ACD (Reference 5.5), including changes to reflect the resizing of the Waste Handling Building (WHB), Waste Treatment Building (WTB), Carrier Preparation Building (CPB), and site parking areas; the addition of the Carrier Washdown Buildings (CWBs); the elimination of the Cask Maintenance Facility (CMF); and the development of a concept for site grading and flood control.

The analysis also establishes the layout of the surface features (e.g., roads and utilities) that connect all the repository surface areas (North Portal Operations Area, South Portal Development Operations Area, Emplacement Shaft Surface Operations Area, and Development Shaft Surface Operations Area) and locates an area for a potential lag storage facility. Details of South Portal and shaft layouts will be covered in separate design analyses.

The objective of this analysis is to provide a suitable level of design for the Viability Assessment (VA).

The analysis was revised to incorporate additional material developed since the issuance of Revision 01. This material includes safeguards and security input, utility system input (size and location of fire water tanks and pump houses, potable water and sanitary sewage rates, size of wastewater evaporation pond, size and location of the utility building, size of the bulk fuel storage tank, and size and location of other exterior process equipment), main electrical substation information, redundancy of water supply and storage for the fire support system, and additional information on the storm water retention pond.

2. QUALITY ASSURANCE

An activity evaluation, *Site-Wide Systems and Facilities Design, Non-Q*, (Reference 5.27) has been performed in accordance with QAP-2-0, *Conduct of Activities*, and has determined that this analysis is not subject to the requirements of the *Quality Assurance Requirements and Description* (QARD) (Reference 5.3). In addition, review of the classification of permanent items described in *Classification of the Preliminary MGDS Repository Design* (Reference 5.38), prepared in accordance with QAP 2-3, *Classification of Permanent Items*, has been performed and indicates that for SDD SU01 there are no "Q" items. Therefore, items addressed in this analysis are to be considered "non-Q" items and, as specified in NLP-3-18, this analysis is documented as not being subject to QA controls.

3. METHOD

A purpose and scope were established for the layout analysis. Requirements that were specific to the repository surface facilities were identified and criteria were developed based on those requirements. Parameters and assumptions relative to the repository surface facilities were

determined. Other site layout constraints, such as existing facilities, site topography, fault avoidance, and flood control, were identified. The location, space requirements, and adjacency requirements were also defined.

4. DESIGN INPUTS

4.1 DESIGN PARAMETERS

The information shown as (TBV) identifies unqualified data . Consequently, the use of any data from this analysis for input into documents supporting procurement, fabrication, or construction is required to be controlled and tracked as TBV or TBD in accordance with NLP-3-15 or other appropriate procedures.

The values shown below are being used instead of older values for faulting and meteorology referenced in the CDA (Reference 5.6) *Reference Information Base* (RIB) values (Reference 5.15), CDA TDS 004.

4.1.1 Not used.

4.1.2 The coefficient of runoff, C, for the tributary area to the flood control channels is 1 (Reference 5.13).

4.1.3 The rainfall, P (24-hour) in inches, for the 25-year, 50-year, 100-year storm is 2.1, 2.3, and 2.6 respectively (Reference 5.13).

4.1.4 The design basis for the 100-year, the 500-year, and the probable maximum flood (PMF) will be based on the Probable Maximum Flood Boundaries identified in Tables 2.6.2-1 and 2.6.2-2 of the *Technical Basis Report for Surface Characteristics, Preclosure, Hydrology, and Erosion* (Reference 5.14), CDA TDS 008 (Reference 5.6). The North Portal site is adjacent to Midway Valley Wash. The maximum depth of water in this wash was estimated to be 9-12 feet during a PMF with a 2-times bulking factor. The preconstruction PMF for the North Portal Repository surface facilities is shown in Figure 6 of Attachment I. These data were extracted from the *Technical Basis Report for Surface Characteristics, Preclosure, Hydrology, and Erosion* (Reference 5.14) (TBV).

4.1.5 The WHB, WTB, and the CPB are designed to withstand the PMF because flooding of these facilities could lead to a release of radioactive contamination to the accessible environment based on the ACD, Section 7.2.1.2 (Reference 5.5) (TBV). All other facilities will be designed to withstand the 100-year flood, based on common industrial design practice. Flooding of the waste parking areas will not result in a release, as the waste casks without impact limiters will be on higher ground during the PMF.

4.1.6 The topographical survey data and surface morphology is as described in Section 1.11 of the RIB (Reference 5.15), based on the CDA, TDS-002 (Reference 5.6) which is as shown

in Figures 2 and 4 in Attachment I (TBV). The North Portal location existing pad site is relatively flat (i.e., about 2% slope) and located between Drillhole Wash and Exile Hill. The North Portal entrance is the portal currently used for the ESF.

4.1.7 The existing H-Road does not conform to the American Association of State Highway Transportation Officials (AASHTO) standards since the geometry does not meet the safety requirements for a maximum speed of 55 miles per hour. Also, the surface treatment does not meet the strength requirements for State of Nevada Department of Transportation (NDOT) highway loading.

4.2 CRITERIA

The following design criteria, which are applicable to this analysis, were developed to respond to requirements found in the *Repository Design Requirements Document (*RDRD*)* (Reference 5.1). The RDRD requirements were restated in terms of what portion of each is addressed within the analysis.

4.2.1 The repository surface facilities shall be designed so that the effects of anticipated natural phenomena and environmental conditions will not interfere with necessary safety functions (RDRD 3.2.6.1.A, RDRD 3.2.6.1.B).

4.2.2 The facility-use categories are: high-hazard facilities - facilities within the Radiologically Controlled Area (RCA); low-hazard facilities - facilities within the balance of plant (BOP) (RDRD 3.2.6.1).

4.2.3 The RCA shall be protected from the PMF, while the BOP area will be protected from the 100-year flood, by locating floor elevations above the base flood level (RDRD 3.2.6.1.F, RDRD 3.2.6.1.G.1, RDRD 3.2.6.1.G.2).

4.2.4 New buildings and transportation facilities are located to conform with the following conditions and restrictions as stated in the NRC Regulations Guidance and supplemented by DOE 6430.1A (Code 4.4.1). NRC's repository licensing requirements, 10 CFR 60, require establishing design criteria for the repository. The project has identified 488 NRC regulatory guides and DOE 6430.1A as potentially useful for establishing those criteria.

- Site grading shall minimize disturbances of the natural terrain (RDRD 3.7.2.B.1)(RDRD 3.7.2.B.2)
- Operation and service functional relationship shall be considered (RDRD 3.7.2.B.4)
- Natural topographic and geologic conditions shall be considered (RDRD 3.7.2.B.1)
- Availability of existing utility systems shall be considered (RDRD 3.7.3.8.A)
- Availability of existing road systems shall be considered (RDRD 3.7.3.6.C)

- Adequacy for parking, future expansion and other land use requirements shall be considered (RDRD 9.7.2.B.3)
- Security and safeguard requirements shall be observed (RDRD 3.7.2.D)
- Site Surveys shall be conducted in accordance with specified standards (RDRD 3.7.2.A)
- Adverse environmental impacts shall be mitigated (RDRD 3.7.2.E).
- Construction and operations of Repository segments shall comply with State of Nevada and local permits (RDRD 3.7.2.G).
- A topsoil storage area shall be provided (RDRD 3.7.2.B.1).
- Bridges shall be built over topographical depressions so that roads and railroads do not block drainage channels (RDRD 3.7.3.6.H) (RDRD 3.7.3.6.I).
- The American Railway Engineering Association (AREA) Manual for Railway Engineering will be used for determining grades, curves, turnouts and clearances (Code 4.4.5)(RDRD 3.7.3.6.E)(RDRD 3.7.3.6.G)
- Geometric design of all road, streets, access drives, and parking areas shall comply with AASHTO GDHS-84 (Code 4.4.4). (RDRD 3.3.1.B)(RDRD 3.7.3.6.D)
- NOAA Atlas 2 will be used to determine precipitation frequency data (Code 4.4.3) (RDRD 3.7.2.F).
- The method for estimating runoff from soil and cover data shall comply with SCS National Engineering Handbook, Section 4, Hydrology. (Code 4.4.3)(RDRD 3.7.2.F)
- Unit hydrographs will be used to derive flood estimates. (RDRD 3.7.2.F)
- Flood routing methods will be used to derive design flood rates at channels and buried storm drainage systems. (RDRD 3.7.2.F)
- Temporary and permanent security fencing will be provided. (RDRD 3.7.2.D)(RDRD 3.7.2.D.2)
- Erosion shall be controlled by bank stabilization or retaining walls (RDRD 3.3.11.9).

4.2.5 The site layout will accommodate emergency access and site evacuation. (RDRD 3.7.2.C3.)

4.2.6 Facilities will be provided to treat and package on-site generated waste for on-site disposal

or off-site transportation. (RDRD 3.7.3.9.B)

4.2.7 Waste handling facilities will be provided to receive, stage, package, emplace and retrieve high-level radioactive waste (HLW) and spent nuclear fuel (SNF) waste materials. (RDRD 3.7.4.1A.1, A.2, A.3, and B)

4.2.8 Transportation facilities (e.g., roads, rail lines and parking) will be provided to accommodate radwaste or other material shipments by rail and truck to the RCA. Transportation facilities (e.g., roads and truck service) will be provided to the BOP. (RDRD 3.7.3.6.F, RDRD 3.7.4.1.B).

4.2.9 Fuel storage tanks will comply with Federal, State of Nevada, and local requirements (RDRD 3.7.4.3.E).

4.2.10 Facilities will be provided to support the following repository operations: training; medical support; records management; maintenance; physical security; personnel support (e.g., offices, parking, food service, change rooms, protective equipment, records storage, and restrooms); decontamination; equipment maintenance, testing, and storage; health physics; and visitors' support (RDRD 3.7.4.4.A, C, D, F.1, F.2, F.4, G, I.2, I.3, K, M, N, O).

4.2.11 Repository surface facilities used to house flammable liquids will be no closer than 100 feet from the opening of the portal (RDRD 3.3.6.3.D).

4.2.12 Emergency response facilities and equipment will be provided. (RDRD 3.7.4.4.I).

4.2.13 The North Portal Area is relatively flat (e.g., about a 2 percent slope)(RDRD 3.7.2.B.2)

4.2.14 The distances between the WHB, CPB, and Security Station are dictated by the spacing required for the rail branches, or "frogs," and the desire to keep the CPB out of the PMF. (RDRD 3.2.6.1F)

4.2.15 Not used.

4.2.16 The WTB was located next to the WTB to facilitate and minimize the movement of personnel and materials between these related facilities. (RDRD 3.3.1A)

4.2.17 The BOP area is located southeasterly and adjacent to RCA. This BOP location was selected to promote radiological safety by considering the prevailing wind directions. (RDRD 3.3.1A)

4.3 ASSUMPTIONS

This section provides a list of the surface facility, utility, transportation, and site condition assumptions made to perform this analysis, along with the basis for each assumption.

4.3.1 Surface Facility Assumptions

This section provides the assumptions related to the new and existing surface facilities that impact the Repository Surface Facilities layout including: the nuclear facilities (WHB and WTB), the Transporter Maintenance Building (TMB), the Carrier Preparation Building (CPB), the Carrier Washdown Building (CWB), the BOP facilities (warehouse, shops, administration, mock-up, utility, fire/medical, service station, security stations), existing facilities (potable water, non-potable water, sanitary sewer, and electrical power), the Visitor's Center, waste carrier parking, and new utilities (backup power and cooling tower) (TBV).

4.3.1.1 The size and configuration of the WHB will be as shown in Table 7-2 and Figure 7 of Attachment I, based on a design analysis (Reference 5.39)(TBV). (Used in Section 7.2.)

4.3.1.2 A WTB will be provided at the repository, based on the CDA, Key 024 (Reference 5.6). The size and configuration of the WTB will be as shown in Table 7-2 and Figure 7 of Attachment I, based on a design analysis (Reference 5.39)(TBV). (Used in Section 7.2.)

4.3.1.3 A CMF will not be required at the repository. The requirement has been withdrawn. The rationale for this action is based on making the Regional Service Contractors responsible for cask fleet maintenance (TBV).(Used in Section 7.2.)

4.3.1.4 Updated building numbers have been assigned as indicated on Figure 7 of Attachment I and are based upon Figure 7.2.1-3 of the ACD (Reference 5.5)(TBV).(Used in Section 7.2.)

4.3.1.5 Not used.

4.3.1.6 The size and arrangement of the BOP and the TMB will be as shown in Table 7-2 and on Figure 7 in Attachment I, based on the ACD, Table 7.2.7-2 (Reference 5.5)(TBV). The size and configuration of the CPB will be as shown in Figure 7 of Attachment I, based on a design analysis (Reference 5.39)(TBV). (Used in Section 7.2.)

4.3.1.7 The size and location of the existing Exploratory Studies Facility (ESF) North Portal Facilities will be as described in Section 7.1, based on the *Site Facilities Interface Final Report* (Reference 5.4). Only the following ESF facilities will be existing when repository construction begins: water supply and distribution system, sanitary sewer collection system, power supply and distribution system, change house, shop building, wastewater pond, air compressors, modular office complex, and switchgear building, all listed in Table 7-1 (TBV). (Used in Section 7.1)

4.3.1.8 The size and location of the South Portal development facilities and Repository muck piles will be as shown on Figure 4 of Attachment I, based on the ACD, Figure 7.2.1-2 (Reference 5.5). The South Portal facilities are used to conduct underground development operations (e.g., excavation and construction) after start-up of the repository. The number of workers who will work in this area is based on the *ROSLR Operations Staffing Letter*

Report (Reference 5.24): shift one - 224, shift two - 183, and shift three - 57 FTEs (TBV). (Used in Sections 7.6.2 and 7.6.5.)

4.3.1.9 The size and location of the emplacement and development shafts support areas are as shown in Figure 4 in Attachment I, based on the ACD, Figures 7.4-1 and 7.5-1 (Reference 5.5) (TBV). (Used in Sections 7.6.3 and 7.6.4).

4.3.1.10 Parking areas for rail carriers and legal weight truck carriers are required to provide buffer staging between the waste receipt gate and the CPB and between the CPB and the WHB (TBV). (Used in Attachment III and throughout Section 7.) The combined parking areas will be sized to accommodate all of the following (TBV):

- 2 days of carrier receipts for normal carrier management based on the need to provide a small quantity of parking in order to avoid moving carriers multiple times during normal operations.
- 2 weeks of repository shipments (prime movers and carriers) to ensure that en route shipments can be staged if the repository cannot process casks
- 5 site prime movers (SPMs) based on two SPMs in each main parking area and one spare SPM.
- 8 empty rail or legal weight truck carriers waiting for casks and dual purpose canisters (DPCs) that are being unloaded in the WHB (based on the maximum number of casks and empty DPCs that could be in the waste transfer lines)

4.3.1.11 The carrier peak annual receipt and shipment rates are shown below based on CDA Keys 001, 002, and 003 (Reference 5.6). (Used in Attachment III and throughout Section 7.)

- 581 loaded rail casks and 581 empty rail casks (See Tables B-1 and G-0 for year 2026)
- 411 empty DPC overpacks on rail carriers and 411 overpacked empty DPCs on rail carriers (see Table 5-11)
- 531 new empty disposal containers (DCs) on rail carriers and 531 DC rail carriers (see Table 5-11)
- 239 loaded truck casks and 239 empty truck casks (see Table B-3)

4.3.1.12 Rail carriers arrive at the Repository in unit trains consisting of 2 locomotives and 5 rail carriers based on the ACD, Section 11-4 (Reference 5.5) (TBV). (Used in Section 7.6.8.)

4.3.1.13 Repository design shall not preclude the possibility of constructing facilities for storage of retrieved waste packages, based on CDA Key 016 (Reference 5.6). An area will be set aside at or near the Repository to provide flexibility in the event that storage is required. The potential does exist for siting the storage facilities approximately 4500 feet northeast of the North Portal Area. See Figure 4 in Attachment I (TBV). (Used in Figure 4 of Attachment I.)

- The north end of Midway Valley has an existing elevation change of approximately a 100-foot drop over 2,000 feet, or 5 percent slope. A slope to provide positive drainage, yet provide a reasonable level area, is 1-1/2 to 2 percent. The existing site would require a cut and fill effort to make it reasonably level and maintain a positive slope for drainage (TBV). (Used in Figure 4 of Attachment I.)

- The site for storage of retrieved packages appears to be above the 100-year flood zone and the probable maximum flood zone (TBV). Additional studies will be performed to verify this assumption.

- Northeast-trending fault lines in Midway Valley have been identified and studied in a USGS milestone report, *Evaluation of the Location and Recency of Faulting Near Prospective Surface Facilities in Midway Valley, Yucca Mountain Project, Nye County, Nevada* (Reference 5.28) The report concludes that surface cracking does exist but there are no significant Quaternary faults present beneath the site where retrieved waste packages are stored. Data gathered by field measurements and observations preclude displacements of 5 cm or more over the last 100,000 years. This conclusion was for the North Portal repository surface facilities site only and not in the area of the proposed storage facilities in Midway Valley, where there are suspected faults. It is anticipated that the same conclusion will be reached for the proposed site of the interim storage facilities, but confirmation trenching must be done (TBV). (Used in Section 7.5.)

- The total area available to store the contents of the repository is 350 acres. The total needed is based on the following: 10,213 waste packages are to be emplaced (Reference 5.6), a waste package takes about the same space to store as the vertical dry storage casks described in the *Centralized Interim Storage Facility Topical Safety Analysis Report* (Reference 5.33), and 6400 vertical storage casks can be stored dry in 220 acres (Reference 5.33). (TBV) (Used in Section 7.6.9.)

4.3.1.14 The proposed repository waste handling and administrative surface facilities will be located adjacent to the North Portal, based on CDA Key 047 (Reference 5.6). (Used in Section 7.2.)

4.3.1.15 The proposed available area for the storage of muck excavated from the ramps, mains, and emplacement drifts is approximately 400 acres based on a location close to the South Portal Operations Area. This area was selected because of availability and the desire to minimize the length of the conveyor. (TBV) (Used in Section 7.6.5.)

4.3.1.16 A restricted area boundary will be established around the WHB with a radius of 5 km, based on the CDA Key 071 (Reference 5.6). (Used in Figure 1 of Attachment I.)

4.3.2 Utility Assumptions

This section provides the assumptions related to the utility systems supporting the repository operations which impact the surface facilities layout, including: water and electrical power supply and distribution, subsurface wastewater collection/evaporation, sanitary sewer system, compressed air, backup power, cooling water, heating water, and chilled water.

4.3.2.1 The existing electrical power supply is as described in the *Site Facilities Interface Final Report* (Reference 5.4), based on the *Canyon Substation Feed to North Portal Electrical Load Analysis* (Reference 5.9). Power is available to the North Portal area via a single existing 69 kV power line, which enters the North Portal Operations Area south of Alice Hill and connects to a new substation located southeasterly of the North Portal area. This power supply has a power line with a thermal rating of 20 MVA and substations (130-69 kV and 69-12.5 kV) rated at 10/12.5 MVA. It is assumed that for the increased repository electrical loads that a new transmission line and a new substation will be required. (TBV) (Used in Section 7.5). Upgrading of existing off-site electrical power is under consideration.

Power to the North Portal surface facilities will be provided from a new substation located southeasterly of the North Portal area (Reference 5.37). (TBV) (Used in Figure 4, Attachment I.)

4.3.2.2 The Repository Segment will connect with the existing Nevada Test Site (NTS) water supply system, based on the CDA (Reference 5.6) (RDRD-3.2.3.4.B) (TBV). The existing water supply system is described in the *Site Facilities Interface Final Report* (Reference 5.4), based on the *ESF Water Supply Analysis* (Reference 5.12). Raw water is supplied to the site via existing Nevada Test Site (NTS) Well J-13, which is located about 3.5 miles southeasterly of the North Portal. The existing water supply system was designed to support a plant operations population of 400 and includes: one submersible well pump, one transfer tank located near J-13, two transfer pumps, two forebay tanks, one transfer pump with a backup pump, one potable water supply tank with a chlorine injection system, and one firewater/construction water supply tank. (Used in Section 7.5.)

4.3.2.3 The North Portal repository water supply system will be expanded to accommodate redundancy requirements for firewater storage and refill of storage tanks to supply the RCA. The South Portal operations area will require a new water supply system. (TBV) (Used in Section 7.6.6.)

4.3.2.4 The existing sanitary sewer system is as described in the *Site Facilities Interface Final Report* (Reference 5.4), based on the *Sanitary Sewer Calculation* (Reference 5.11). The sanitary sewer system includes an 18,000-gallon septic tank, leach field, piping, and manholes and was designed to support a plant operations population of 400. This system will be adequate for MGDS operations (TBV). (Used in Section 7.5.)

4.3.2.5 The North Portal repository sanitary sewer system will be similar in configuration to the existing sewer system, based on the need to provide a system of similar capacity and function. The system will be modified as required. An independent sanitary sewer system, similar to the existing North Portal sanitary sewer system, will be provided for users at the South Portal based on the total plant population (TBV). (Used in Section 7.6.6.)

4.3.2.6 Electric power will be provided from the South Portal area to the Development Shaft Operations Area and from the North Portal area to the Emplacement Shaft Operations Area based on the ACD, Sections 7.5.3D and 7.4.3, respectively (Reference 5.5). (TBV) (Used in Section 7.6.6.)

4.3.2.7 The existing subsurface wastewater collection/evaporation system is as described in the *Site Facilities Interface Final Report* (Reference 5.4), based on the *Subsurface Wastewater Calculation* (Reference 5.10). The subsurface wastewater facility includes a wastewater pond that is double lined with polyvinyl chloride, a leak detection subsystem, and a wastewater line connecting the subsurface facility with the wastewater pond (TBV). (Used in Figure 4 of Attachment I.)

4.3.2.8 The North Portal repository subsurface wastewater collection/evaporation system will be similar in configuration to the existing wastewater system, based on the need to provide a system of similar capacity and function. The system will be upgraded and expanded as necessary . The South Portal wastewater system will be as described in the ACD (Reference 5.5). This will be adequate for MGDS operations (TBV). (Used in Figure 4 of Attachment I.)

4.3.2.9 Utilities such as compressed air, backup electrical power, cooling water, heating water, and chilled water systems will be developed as needed at each of the four repository surface areas because providing utilities from a single central area is cost prohibitive due to the distances between surface areas (i.e., 1.5 to 2 miles) (TBV). (Used in Figure 4 of Attachment I.)

4.3.2.10 The North Portal area utilizes centralized compressed air backup power, cooling water, heating water, and chilled water systems to serve users in the North Portal facilities and subsurface emplacement area (TBV). Similar utilities will be used at the South Portal operations area. Centralization of utilities is normally considered where two or more adjacent buildings are to be served based on DOE 6430.1A, Section 1550-2.1.1. (Code 4.4.1) (Used in Section 7.6.1.)

4.3.3 Transportation Assumptions

This section provides the assumptions related to truck and rail transportation to the repository and between repository surface areas that impact the surface facilities layout.

4.3.3.1 Waste will be shipped to the North Portal area for emplacement by rail and legal weight trucks, based on CDA Document, Key 001 (Reference 5.6) (TBV). (Used in Section 7.5.)

4.3.3.2 Only legal weight truck access is required for the South Portal and access shafts areas, based on the ACD (Reference 5.5) (TBV).(Used in Figure 4 of Attachment I.)

4.3.3.3 Roads are required at the perimeter of the areas to provide for maintenance and security based on Section 0283-4, Patrol Roads and Walkways, DOE Order 6430.1A (Code 4.4.1) (TBV). (Used in Figure 7 of Attachment I.)

4.3.3.4 The minimum turning radius for the transporter rail lines is 20 meters, based on the *Repository Subsurface Layout Configuration Analysis* (Reference 5.17)(TBV). The minimum turning radius for the commercial rail lines is 360 feet based on AREA (Code 4.4.5). (Used in Figure 7 of Attachment I.)

4.3.3.5 Rail and legal truck access to the North Portal area will be from the southeast through the valley south of Alice Hill as shown in Figure 4 of Attachment I (TBV). This access route is based on and is consistent with the *Nevada Potential Repository Preliminary Strategy* Study 2 (Reference 5.8), the *Nevada Potential Repository Preliminary Assessment of the Caliente-Chalk Mountain Rail Corridor* (Reference 5.22), and *the Nevada Potential Repository Preliminary Assessment of the Caliente-Chalk Mountain Heavy-Haul Truck Route* (Reference 5.23). (Used in Figure 4 of Attachment I.)

4.3.4 Site Condition Assumptions

This section provides the assumptions related to the site conditions that impact the surface facilities layout, including: site topography, soil conditions, fault data, weather conditions and wind conditions.

4.3.4.1 The existing west portion of the ESF pad, which will be used for the RCA, was constructed with five feet of controlled fill on undisturbed ground. The east side of the pad is generally constructed of five feet of controlled fill underlain by a varying depth of uncontrolled fill. The controlled fill was material placed in twelve inch lifts and compacted with five passes of a vibratory roller in the controlled zone. No rock over 12 inches in size was placed in the lower uncontrolled fill. The maximum thickness of the controlled fill was 10 feet in the southeast area of the pad. Additional compacted fill and stabilization of existing fill will be required to complete the BOP pad (TBV). This assumption is based on drawings and specifications used to construct the existing North Portal pad. (Used in Figure 3 of Attachment I.)

4.3.4.2 The site characteristics for fault displacement, fault location , and fault attitudes shall be as described in Section 1.2.3 of the RIB (Reference 5.15)(TBV). The earthquake fault locations in the area of the North Portal pad are shown in Figure 6 in Attachment I.

Faults in this area run north-south. Two concealed faults, including the Bowridge Fault, which is a Type 1 (active) fault, are located west of Exile Hill. One concealed, Type 1 fault, the Paintbrush Fault, is located west of Alice Hill. The other faults are not shown because their locations and existence have not been verified. The fault locations were extracted from Reference 5.21. (Used in Figure 6 of Attachment I.)

4.3.4.3 The prevailing wind data are based on the CDA TDS-007 (Reference 5.6). The North Portal area experiences diurnal wind reversals with wind from the south during the day and winds from the north during the night. Wind direction also changes seasonally with wind from the south during the summer and wind from the north during the winter. The wind rose for the North Portal is shown in Figure 6 of Attachment I. These data were extracted from the *Meteorological Monitoring Program Summary Report* (Reference 5.18). The data are consistent with, but more specific than, the data identified in CDA TDS-004 (Reference 5.6). This CDA is based on historical weather data gathered from 1962 to 1978 at a location 26 miles northeasterly of Yucca Mountain. (Used in Figure 6 of Attachment I.)

4.3.4.4 The Rational Method is acceptable for storm water drainage areas of less than one square mile. This method is used to calculate the flow of the North Portal Pad watershed due to a PMF (Code 4.4.1). (Used in Section 7.4.2.)

4.3.4.5 The rainfall intensity, I, for the probable maximum local storm is 28 inches per hour, which is the number in the reference (Reference 5.13). (TBV) (Used in Section 7.4.3.)

4.3.5 QA Classifications Assumption

It is assumed that the QA classifications identified in Section 2, Quality Assurance, have been correctly assigned. This is based on the work performed in *Classification of the Preliminary MGDS Repository Design* (Reference 5.38), which carries a TBV for these classifications. (TBV)

4.4 CODES AND STANDARDS

The following codes and standard apply to this design analysis.

4.4.1 DOE Order 6430.1A, *General Design Criteria*, April 6, 1989

4.4.2 NOAA Atlas 2, *Precipitation Frequency Atlas of the Western United States*, Volume VII, Nevada, 1973.

4.4.3 U. S. Department of Agriculture, Soil Conservation Service, *Urban Hydrology for Small Watersheds,* Technical Release 55 (TR55), June 1986.

4.4.4 American Association of State Highway and Transportation Officials (AASHTO), *A Policy on Geometric Design of Highways and Streets*, 1984.

4.4.5 *Manual for Railway Engineering*, American Railway Engineering Association (AREA), 1996.

4.4.6 *Road Design Division, Design Manual, Parts 1 & 2*, State of Nevada Department of Transportation (NDOT), 1986.

4.4.7 *Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineering* (ASCE), Manuals and Reports on Engineering Practice, No. 37.

4.4.8 *Standard for Water Tanks for Private Fire Protection*, National Fire Protection Association (NFPA), NFPA 22, 1996 Edition.

5. REFERENCES

5.1 *Repository Design Requirements Document* (RDRD), Yucca Mountain Site Characterization Project, YMP/CM-0023, REV 0, ICN 1.

5.2 Not used.

5.3 *Quality Assurance Requirements and Description* (QARD), U. S. Department of Energy, DOE/RW-0333P, REV 7.

5.4 *Site Facilities Interface Final Report*, M&O Document Identifier (DI): BCB000000-01717-4600-00003, REV 00.

5.5 *Mined Geological Disposal System (*MGDS*), Advanced Conceptual Design Report* (ACD), DI:B00000000-01717-5705-00027, REV 00.

5.6 *Controlled Design Assumptions Document* (CDA),DI: B00000000-01717-4600-00032, REV 04, ICN 3.

5.7 M&O Drawing, *Probable Maximum Flood* (PMF) *Flood Plain*, YMP-025-I-CIVL-PL117, Rev 0.

5.8 *Nevada Potential Repository Preliminary Transportation Strategy Study* 2, B00000000-01717-4600-00050, REV 01.

5.9 *Canyon Substation Feed to North Portal Analysis*, BAB000000-01717-0200-00144, REV 00.

5.10 *Surface Wastewater Calculation*, B00000000-01717-0200-00076, REV 00.

5.11 *Sanitary Sewer Calculation*, B00000000-01717-0200-00077, REV 01.

5.12 *Water Supply Analysis*, B00000000-01717-0200-00074, REV 01.

5.13 *Storm Water Drainage*, B00000000-01717-0200-00056, REV 00.

5.14 *Technical Basis Report for Surface Characteristics, Preclosure, Hydrology, and Erosion*, U.S. Department of Energy, YMP/TBR-001, REV 0.

5.15 *Yucca Mountain Site Characterization Project Reference Information Base* (RIB), *Faulting: Faulting Characteristics*, Rev 3, MO9104RIB00021.003.

5.16 Interoffice correspondence, S. J. Meyers to H. R. Montalvo, *Site Layout Input for Nuclear Facilities,* M&O Document Identifier LV.SD.SJM.9/97-045, Civilian Radioactive Waste Management System, September 9, 1997. (Batch # MOY-970923-02)

5.17 *Repository Subsurface Layout Configuration Analysis*, BCA000000-01717-0200-00008, REV 00.

5.18 *Meteorological Monitoring Program, Summary Report*, January 1994 through December 1994, Yucca Mountain Site Characterization Project, BA0000000-01717-5700-00001.

5.19 M&O Drawing, Civil Abbreviations, BAB000000-01717-2100-20005, REV 02.

5.20 M&O Drawing, Civil General Notes, Legend & Symbols, BAB000000-01717-2100-20006, REV 02.

5.21 Scott, R. B. and J. Bonk, *Preliminary Geologic Map of Yucca Mountain with Geologic Sections*, Nye County, Nevada, U.S. Geological Survey Open-File Report 84-494, 1984.

5.22 *Nevada Potential Repository Preliminary Assessment of the Caliente-Chalk Mountain Rail Corridor*, B00000000-01717-4600-00077, REV 00.

5.23 *Hydrometeorological Report No. 49*, U.S. Department of Commerce, Reprinted 1984.

5.24 Repository Operations Staffing Letter Report (ROSLR), CRWMS M&O Letter Report LF.SD.SJM.1/96.098. (MOL.19970415-0380)

5.25 *Site Characterization Plan Conceptual Design Report* (SCP-CDR), SAND84-2641, 1987.

5.26 Not used.

5.27 Activity Evaluation, *Site-Wide Systems and Facilities Design* (Work Package 12461016M1) Non-Q, CRWMS M&O, Las Vegas, Nevada, February 06, 1998.

5.28 *Evaluation of the Location and Recency of Faulting Near Prospective Surface Facilities in*

Midway Valley, Yucca Mountain Project, Nye County, Nevada, September 1994.

5.29 *Nevada Test Site Probable Maximum Flood Study*, part of *Flood Potential and Debris Hazard Study, Yucca Mountain Site*, for DOE OCRWM, U. S. Bureau of Reclamation, Denver, Colorado, 1986.

5.30 *Nevada Test Site Probable Maximum Flood Study*, part of *Flood Potential and Debris Hazard Study, Yucca Mountain Site*, for DOE OCRWM, U. S. Bureau of Reclamation, Denver, Colorado, 1991.

5.31 *Nevada Test Site Flood Inundation Study*, part of *Flood Potential and Debris Hazard Study, Yucca Mountain Site*, for DOE OCRWM, U.S. Bureau of Reclamation, Denver, Colorado, 1992.

5.32 *Flood Potential of Forty Mile Wash and Its Principal Southwestern Tributaries, Nevada Test Site, Southern Nevada*, by Squires and Young, Report 83-4001, USGS, 1984.

5.33 *Central Interim Storage Facility Topical Safety Analysis Report*, May 1997.

5.34 *ESF Layout* Calculation, BABEAD000-01717-0200-00003, Rev 04.

5.35 Interoffice correspondence, S. J. Meyers to H. R. Montalvo, *Safeguards & Security Input for the Site Layout Analysis*, M&O Document Identifier L.V.SD.SJM.1/98.004, Civilian Radioactive Waste Management System, January 19, 1998.

5.36 Interoffice correspondence, S. J. Meyers to H. R. Montalvo, *Utility System Input for the Site Layout Analysis*, M&O Document Identifier L.V.SD.SJM.1/98-006, Civilian Radioactive Waste Management System, January 16, 1998.

5.37 Interoffice correspondence, S. J. Meyers to H. R. Montalvo, *Main Electrical Substation Information for Site Analysis*, L.V.SD.SJM.1/98-012, Civilian Radioactive Waste Management System, January 29, 1998.

5.38 *Classification of the Preliminary MGDS Repository Design*, B00000000-01717-0200-00134, Rev. 00.

5.39 Surface Nuclear Facilities Space Program Analysis, BCBD00000-01717-0200-00012, Rev 01

6. USE OF COMPUTER SOFTWARE

No design or scientific software was used for this analysis.

7. DESIGN ANALYSIS

This section discusses the site condition before repository construction, the North Portal repository surface facilities, the concept of site operations, the North Portal Area flood control, the North Portal site layout, and the repository site layout.

7.1 SITE CONDITION BEFORE REPOSITORY CONSTRUCTION

This section describes the existing and planned Exploratory Surface Facility (ESF) North Portal surface facilities that could impact the repository surface facilities layout. The facilities are shown on Figure 3 of Attachment I, and are described in Table 7-1. Table 7-1 includes a site plan building number, facility name, a list of the functional areas, type of construction, principle facility dimensions, and gross floor space (Reference 5.4).

In general, the ESF facilities are designed as non-qualified, non-permanent, non-nuclear facilities with a 25-year maintainable life. It is expected that these facilities could be used for non-nuclear operations at the repository. These facilities could likely comply with the repository surface facility maintainable design life needs. Extending the life would require periodic replacement of limited life components (e.g., heating, ventilating, and air conditioning (HVAC) equipment, computer equipment, structural steel siding, etc.) and routine facility maintenance. The ESF power and water supply systems are non-qualified single source designs. If the repository requires more reliable utility systems, additional equipment may be required and the ESF systems may need to be qualified/upgraded.

Table 7-1. Existing ESF Surface Facilities at the North Portal

Site Plan Building Number	Facility Name	Functional Areas	Type of Construction	Principal Dimensions (ft)	Floor Space* (ft^2)
5010	Switchgear Building with Transformer	Electrical switchgear, IDCS control room, mechanical room, office, restrooms, external transformer	Single-story, pre-fabricated steel frame with insulated metal siding with concrete pad for transformer	140 x 60	8,400
	On Pad Substation	Transformer, switchgear	Concrete pad	60 x 80	4,800
-	Standby Generators	Standby generators, above ground fuel storage	Concrete pad	100 x 30	3,000
-	Power Line	Power line	Aboveground	-	-
5008	Change House	Locker rooms, showers, restrooms, first aid, safety/fire control, garage, bullpen and training area	Single-story, pre-fabricated steel frame with insulated metal siding	110 x 127	13,970
-	Sanitary Sewer	Septic tank, leach field, sewer line	-	200 x 175	35,000
-	Water Supply	Well pump, booster pumps, raw water tank, firewater and potable water supply tanks, chlorine injection water lines	Pumps are in pre-fabricated steel building, tanks are on concrete support ring	-	-
-	Air Compressors	Air plant (compressors, cooler receiver, condensate tank and filter)	Concrete pad	100 x 55	5,500
-	Modular Office Complex	Modular office buildings, trailers with pads, parking, portable power system	All structures are pre-fabricated for temporary construction use	1 @ 60x60 1 @ 24x60 1 @168x60 13@ 12x60	24,500

* Floor space is gross unless noted.

7.2 NORTH PORTAL REPOSITORY SURFACE FACILITIES

This section describes the planned North Portal repository surface facilities. The repository facilities, which are identified by site building number, are shown on Figure 7 of Attachment I. The figure also shows some existing and planned ESF facilities that will be available for repository use. The site plan references were kept the same as the facility numbers used in the SCP-CDR (Reference 5.25) to facilitate comparison. Facilities that were added or were not numbered in the SCP-CDR were assigned a site plan reference with an "N" prefix.

Effluent monitors and meteorological monitoring stations are located throughout the site but are not shown on the site plan.

Surface facility changes/additions include:

- The BOP facilities layout was revised to provide better security protection (Reference 5.35) and a more efficient arrangement.

- The BOP has been divided into two distinct security areas with access controlled through Security Station 1 (220-3A). The easterly portion will provide a delivery area for off-site vendors and deliveries to the Central Warehouse (220-7), Central Shops (220-4A), and Motor Pool and Facility Service Station (220-4B) and can be accessed with an NTS Site Badge. The westerly portion contains the more sensitive facilities, such as the Administration Building (220-5A), Medical Center (220-1B), Fire Station (220-2), and Mock-up Building (220-6), and can be accessed only by those personnel with a CRWMS project picture badge. These two security areas will be separated by a chain link fence (Reference 5.35).

- The Central Warehouse (220-7), Central Shops (220-4A), and Motor Pool and Facility Service Station (220-4B) have been moved away from the RCA security fence and entry portal BOP/RCA Security Station (220-3B) to minimize the possibility of an adversary using either the tools or fuel to carry out an attack. By not having tools/fuel (e.g., explosives) immediately available to an adversary, the attack scenario is made more difficult in that tools/fuel must either be brought in or, at least, made harder to obtain.. As discussed in the preceding paragraph, the Central Warehouse(220-7) has been moved so that uncleared visitors do not need to access security areas in order to make deliveries (Reference 5.35).

- The Medical Center (220-1B) and Fire Station (220-2) have been moved to the westerly area to minimize travel distance from the RCA for emergencies. This move also eliminates a straight roadway leading to the Security Station 2 (220-3B), which would allow a vehicle to gain a great deal of speed and crash through the RCA fence or Security Station 2 (220-3B), gain access to the RCA, and start an explosive or terrorist attack. The Administration Building (220-5A) is also placed within this higher security zone to provide additional protection to sensitive areas such as the security administration/weapons storage area and the computer facility (Reference 5.35).

- The Security Station (220-3B) has been moved to eliminate congestion in the area adjacent to the Transporter Maintenance Building (220-4C).
- Facilities are provided inside the RCA and the BOP areas for water supply, redundant fire water storage tanks, electrical equipment, sewer systems, process utilities (chilled water, compressed air, etc.), access roads and rail lines, as needed.
- The Utility Building (N221-2) remained in its present location to take advantage of shorter chilled water and cooling water runs.

The North Portal facilities are described in Table 7-2, which includes a site plan building number, facility name, a list of the primary functional areas and support areas, type of construction, principal facility dimensions, and the gross floor space (unless noted).

Table 7-2. Repository Surface Facilities at the North Portal

Site Plan Building Number	Facility Name	Areas	Type of Construction	Principal Dimensions (ft)	Floor Space* (ft^2)
Radiologically Controlled Area Facilities					
210	Airlock Building (AB)	Airlock for loaded shielded transporter with trolley locomotive front and rear. The building is divided into two sections. The section closer to the North Portal has louvers to allow for air intake to the tunnel.	Single story structural steel frame with insulated metal siding and roof.	50 x 150	7,500
211	Waste Handling Building (WHB)	Carrier bay, assembly transfer lines (pool area, assembly cell, DC load/decon cell), canister transfer lines (cask prep & decon, canister transfer) , DC welding and storage cell, WP decon/transfer cell, WP transporter dock, WP remediation cell, airlocks, equipment transfer corridors, empty DC preparation area, operating galleries, access corridors, crane and welder maintenance bays, mechanical equipment rooms, waste handling control room, change rooms, laboratories, health physics, area, offices, and rest rooms	High-bay, structural-steel-frame receiving and shipping area; multilevel, reinforced-concrete hot cells; a steel frame, insulated-siding personnel annex	536 x 540	380,000 (net of structure)

Table 7-2. Repository Surface Facilities at the North Portal, continued

Site Plan Building Number	Facility Name	Areas	Type of Construction	Principal Dimensions (ft)	Floor Space* (ft^2)
215-1	Waste Treatment Building (WTB)	Liquid radioactive waste treatment area, waste solidification area, solid radioactive waste treatment area and loading and unloading area, mixed waste storage, mechanical equipment rooms, control room, laundry, health physics area, change rooms, offices and rest rooms	Two-story high bay; structural-steel frame. Insulated metal siding and roof	200 x 260	65,400 (net of structure)
215-2	Carrier Preparation Building (CPB)	Staging/cask preparation area (i.e.,personnel barrier retraction, impact limiter removal/installation, and radiological inspection), office, and restrooms	Single-story structural steel frame with insulated metal siding and roof with high bay	120 x 160	19,600 (net of structure)
215-3	Carrier Washdown Building (CWB)	Water Washdown Station	Single-story structural steel frame with insulated metal siding and roof.	28 x 75	2,100
220-4C	Transporter Maintenance Building (TMB)	Transporter storage, parts storage, minor maintenance service bays, wash/decon area, hazardous waste staging, health physics area, lockers, showers, and offices	Single-story structural steel frame with insulated metal siding and roof	60 x 120	7200
N120-1A	Loaded Rail Carrier Parking	Waste transportation rail car parking (75 rail cars)	Rail yard asphalt		
N120-1B	Loaded Truck Carrier Parking	Waste transportation trailer parking (15 trailers)	Asphalt		
-	Empty Carrier Parking	Waste transportation and DPC carrier parking (8 carriers)	Rail yard asphalt		
5008	Change House	Locker rooms, showers, restrooms, first aid, safety/fire control, garage, bullpen and training area	Single-story, pre-fabricated steel frame with insulated metal siding	110 x 127	13,970
5010	Switchgear Building with Transformer	Electrical switchgear, IDCS control room, mechanical room, office, restrooms, external transformer	Single-story, pre-fabricated steel frame with insulated metal siding with concrete pad for transformer	140 x 60	8,400
Balance of Plant Area Facilities					
220-3A	Security Station 1 (Main BOP portal)	Waiting room, badge distribution, communications center, records storage, security administration, offices, lockers and showers	Two-story, architectural-steel frame with insulated metal siding	50 x 80	8,000

Table 7-2. Repository Surface Facilities at the North Portal, continued

Site Plan Building Number	Facility Name	Areas	Type of Construction	Principal Dimensions (ft)	Floor Space* (ft^2)
220-3B	Security Station 2 (RCA/BOP portal)	Security check station, health physics offices	Single-story, architectural-steel frame with insulated metal siding	65 x 80	3,000
220-3C	Security Station 3 (RCA truck/rail portal)	Storage for contamination equipment, security check station, health physics offices	Single-story, architectural-steel frame with insulated metal siding	40 x 70	2,800
220-5A	Admin. Building	Offices, laboratories, training rooms, and mechanical areas	Two-story, architectural-steel frame with insulated metal siding	100 x 220	44,000
220-5B	Food Service Facility	Kitchen, lunchroom, serving area, food/supplies storage, and rest rooms	Single-story, architectural-steel frame with insulated metal siding	60 x 180	11,000
220-5C	Training Auditorium	Auditorium	Single-story, architectural-steel frame with insulated metal siding	25 x 40 50 seat capacity	1,000
220-1B	Medical Center	Examination rooms, X-ray, medical labs, waiting room, ambulance garage, mechanical rooms, and offices	Single-story, architectural-steel frame with insulated metal siding	40 x 175	8,200
220-2	Fire Station	Apparatus room, communications room, equipment storage, firemen's quarters, offices, lunchroom, lockers and showers	Single-story, architectural-steel frame with insulated metal siding	85 x 100	7,600
220-22	Computer Center	Computer room, mechanical equipment areas, offices, and central monitoring center	Single-story, reinforced-concrete structure	60 x 65	4,000
220-7	Central Warehouse	Storage space, receiving an shipping dock, offices, lunchroom, lockers and showers	Single-story, (clear height 23 feet) architectural-steel frame with insulated metal siding	200 x 285	57,000
220-4A	Central Shops	Craft shops (electrical, mechanical, plumbing, welding, automotive, machining), central covered work area (not included in floor area), offices, lunchroom, first aid, lockers	Single-story, architectural-steel frame with insulated metal siding	200 x 285	57,000
220-4B	Motor Pool and Facility Service Station	Dispatch office, carwash, fuel storage, light maintenance, parking (heavy maintenance is off-site)	Single-story, architectural-steel frame with insulated metal siding	30 x 40	1,200
220-6	Mockup Building	High-bay mockup room, classrooms, and offices	Single-story, architectural-steel frame with insulated metal siding	72 x 120	8,640

Table 7-2. Repository Surface Facilities at the North Portal, continued

Site Plan Building Number	Facility Name	Areas	Type of Construction	Principal Dimensions (ft)	Floor Space* (ft^2)
N221-2	Utility Building	Water chillers, water boilers, cooling tower water make-up treatment, plant and instrument air compression.	Single-story, architectural-steel frame with insulated metal siding.	100 x 220	22,000
Site Service Facilities					
N120-1C	General Parking	Car parking lots, bus loading areas, bus parking lot	Asphalt	250 x 250	62,500
N120-1E	Cooling Tower	Cooling tower, cells, pump basin			
N221-3	Visitor Center	Theater, meeting rooms, reception area, food service, offices, restrooms		150 x 150	14,300
	Fire Storage Tanks and Pump Houses	Two 250,000-gallon tanks, 33-foot diameter, two pumphouses, each with two 2000 GPM pumps	Steel tanks and single-story, architectural-steel frame with insulated siding buildings		
	Wastewater Pond	Wastewater pond, waste water pipe	Pond is polyvinyl Chloride (PVC) lined	500 x500	
	Bulk Fuel Storage Tank	One 250,000-gallon tank	Steel tank inside an earthen bermed area		
	Exterior Process Equipment	Two 20-foot diameter water tanks, one 12-foot diameter water tank, one 12-foot diameter x 50-foot long horizontal fuel tank, one liquid nitrogen dewar, and two 12-foot x 40-foot tube trailers			
	Storm Water Retention Pond	Storm water pond, storm water sewer piping	Pond is unlined	1130 x 1130	

* Floor space is gross unless noted.

7.3 CONCEPT OF SITE OPERATIONS

This section describes the concept for the repository site operations, including waste handling operations, empty cask operations, empty dual-purpose canister (DPC) operations, empty disposal container (DC) operations, site-generated waste management operations, general supply operations, and personnel transportation operations. Material movements are illustrated in Figure 7-1 and have been updated from the ACD, Figure 7.2.1-4 (Reference 5.5). The numbers in parentheses after the facility names are the site map references, which can be identified on Figure 7 of Attachment I and have been updated from the ACD, Figure 7.2.1-3 (Reference 5.5). This information was used to provide a site layout that minimizes travel distances (See Criterion 4.2.4).

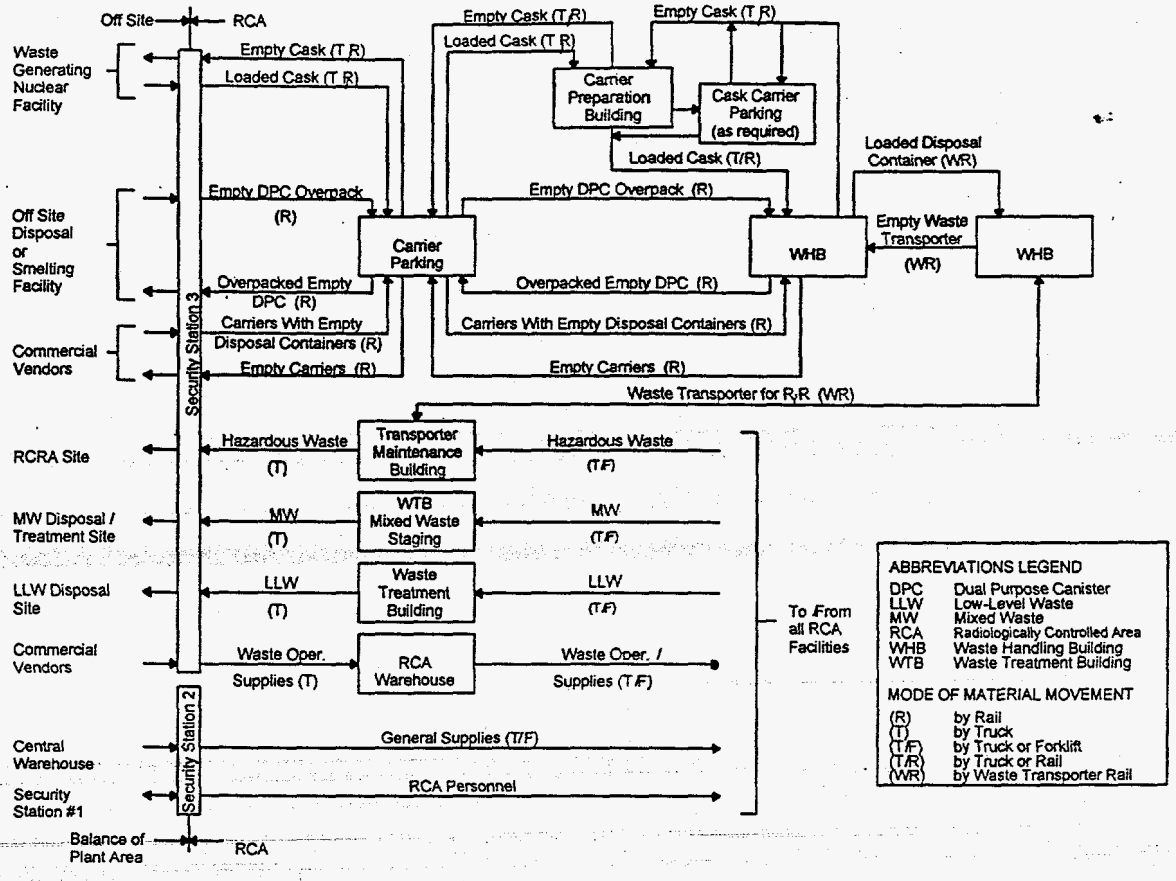


Figure 7-1 Material Movement

7.3.1 Waste Handling Operations

A waste or cask shipment is delivered by an off-site prime mover (OPM) (e.g., diesel locomotive or truck tractor) through Security Station 3 (220-3C) to one of the parking areas within the RCA (N120-1A or N120-1B) (See Criteria 4.2.7 and 4.2.8 and Assumptions 4.3.1.10 and 4.3.1.11). The OPM then waits within the RCA for a return shipment. Materials are inspected as they pass through the security station.

A cask carrier is moved from the RCA parking areas with a site prime mover (SPM) to the CPB (215-2), where the personnel barriers and impact limiters are removed, and the casks are inspected for radiological contamination. If contamination is determined, appropriate decontamination procedures will be effected. The SPM is a track-mobile vehicle with the capability to drive on roads or rail. Road access into the CPB will be via at-grade rail crossings. (See Assumption 4.3.1.5). If the WHB is not ready to receive a cask, the SPM will move the cask carrier to a staging parking area. The SPM moves the cask carrier to the carrier bay of the WHB if the WHB is ready to receive a cask. The carrier is then moved into the carrier bay of the WHB (211), where the cask is removed from the carrier. After the cask is removed from the carrier, the empty carrier may remain in the

WHB or be moved to one of the staging parking areas until the empty cask is available for removal from the WHB.

Within the WHB, the waste is removed from the transporter cask and packaged into a DC. The DC containing the waste is loaded into a shielded transporter. The transporter is moved from the WHB with one trolley locomotive. Outside the WHB, a second trolley locomotive is connected to the free end of the transporter and the DC with waste is hauled to the underground emplacement drifts through the North Portal.

7.3.2 Empty Cask Operations

An empty cask is loaded onto a carrier in the WHB carrier bay. The loaded carrier is hauled to the CPB with an SPM to reinstall the impact limiters and personnel barrier, then to one of the parking areas in the RCA. An OPM hauls the cask carrier containing the empty cask through Security Station 3 to return the cask to an off-site nuclear waste generating facility. Rail shipments will be configured into unit trains prior to leaving the RCA. (See Criterion 4.2.8 and Assumptions 4.3.1.10 and 4.3.1.11.) A Carrier Washdown Building (215-3) has been provided as an option.

7.3.3 Empty DPC Operations

A portion of the commercial SNF is received in DPCs, each of which is packed inside of a shielded transportation cask. After WHB operations removes the SNF from the DPC, the empty DPC is overpacked and shipped off-site to a commercial waste facility for disposal or metal recovery. The site operations associated with the empty overpack and the DPC are described in the following paragraphs.

An empty DPC overpack is delivered by train to the repository from the off-site disposal or smelting facility. (See Assumptions 4.3.1.10 and 4.3.1.11). The overpack is hauled through Security Station 3 (220-3C) by the OPM to one of the parking areas within the RCA (N120-1A or N120-1B). The OPM then waits within the RCA for a return shipment. Materials are inspected for contraband as they pass through the security station and inspected for contamination in the parking area. If the overpack failed the radiological inspection, appropriate decontamination procedures will be effected (See Assumption 4.3.1.5).

When the WHB is ready to receive a DPC overpack, the SPM moves the overpack carrier into the carrier bay of the WHB (211), where the overpack is removed from the carrier and transferred to the Assembly Transfer System to receive an empty DPC. If necessary, the carrier may be staged in the parking area prior to entering the CWB and moving into the WHB.

An empty DPC is overpacked and loaded onto a carrier in the WHB. The loaded carrier is hauled to the RCA parking area with the SPM. An OPM hauls the carrier containing the empty DPC through Security Station 3 to an off-site facility for disposal or smelting.

7.3.4 Empty DC Operations

An empty DC is delivered to the repository by unit train from the DC fabricator. See Assumption 4.3.1.10. The DC is hauled through Security Station 3 (220-3C) by the OPM to the one of the parking areas within the RCA (N120-1A or N120-1B). The OPM then waits within the RCA to return the empty rail cars. Materials are inspected as they pass through the security station.

When the WHB is ready to receive an empty DC, the SPM moves the DC carrier into the empty DC preparation area of the WHB (211), where the DC is removed from the carrier and prepared for waste loading. If necessary, the carrier may be staged in the rail parking area prior to entering the WHB.

The empty carrier is returned to the RCA parking area. The empty carriers are reconfigured into a unit train within the RCA to be hauled from the repository by the OPM.

7.3.5 Site-Generated Waste Management Operations

Secondary wastes (i.e., low-level waste (LLW), hazardous, and mixed wastes) are generated throughout the operating areas in the RCA facilities. Solid and packaged liquid (e.g., bottled) wastes are accumulated at the point of generation in drums or boxes (See Criterion 4.2.6). The following material shipments are conducted with a truck or forklift to support secondary waste operations

- Mixed waste drums are transferred to the WTB (215-1) where the material is packaged for storage, then transferred to the mixed waste storage area within the WTB.
- LLW drums are transferred to the WTB where the material is treated and packaged for storage. The packaged LLW is then transferred from the RCA through Security Station 3 for disposal.
- Hazardous waste drums are transferred to the TMB (220-4C), where the bulk of the hazardous waste is generated. Here this material is packaged and shipped to an off-site Resources Conservation Recovery Act (RCRA) licensed treatment/disposal site via Security Station 3.
- Empty waste drums and boxes are stored in the WTB and provided to the other RCA areas as needed.
- Liquid LLW from decontamination operations in the WHB is piped to waste treatment equipment in the WTB area. This LLW waste is concentrated, packaged and shipped off site with the other LLW.

7.3.6 General Supply Operations

General supplies for the North Portal area will be brought by truck into the BOP area through Security Station 1 (220-3A) and stored in the Central Warehouse (220-7) (See Criterion 4.2.10). These materials will be transferred by truck as needed to other BOP facilities, to smaller warehouse areas within the major RCA facilities through Security Station 2 (220-3B)(See Criterion 4.2.10), or to satellite warehouse areas at the South Portal Operations Area, the Development Shaft area, or Emplacement Shaft area.

7.3.7 North Portal Operation Area Personnel Transportation

Site personnel will arrive at the site in busses or personal vehicles, which will be parked outside the BOP area. Personnel will walk to their work place from an unloading area. All personnel working in the North Portal area will enter the BOP area through Security Station 1 (220-3A). Personnel working in the RCA will also pass through Security Station 2 (220-3B). (See Criterion 4.2.10.)

7.4 STORM WATER DRAINAGE AND FLOOD CONTROL

The following design analysis investigates the flood potential of the existing North Portal pad and the RCA due to a PMF and that of the BOP area due to a storm of 100-year frequency and will recommend methods for prevention of flooding of facilities and protection of pad slopes from erosion during flooding. Flooding of the South Portal Development Operations Area has been discussed in the *ESF Layout Calculation* (Reference 5.34).

7.4.1 PMF Flood Plain Determination

The information on PMFs is taken from *Nevada Test Site Probable Maximum Flood Study* (Reference 5.29), a computational study performed specifically for the Yucca Mountain Project by the U.S. Bureau of Reclamation (USBR) for the U.S. Geological Survey (USGS). The study uses PMF hydrographs computed with the USBR flood hydrology computer program, FGRAPH. The study contains PMF calculations for two events - a local storm of 6-hour duration (i.e., a thunderstorm) and a general storm. Information presented is for the locations in the vicinity of the proposed repository site for which these calculations were made. These locations include three areas of interest: Boundary Ridge, Midway Valley, and Drillhole-Coyote. Of particular importance and relevancy to the Repository Surface Site is the Midway Valley Area because of its proximity to the RCA and BOP facilities.

PMF calculations for clear water flows by Bullard in the *Nevada Test Site Probable Maximum Flood Study* (Reference 5.29) were made with probable maximum precipitation (PMP) index values determined from *Hydrometeorological Report No. 49* (HMR 49) of the National Weather Service (Reference 5.23) . HMR 49 represents the current standard of practice for Federal agencies involved in preparing PMF studies in the Colorado River and Great Basin drainages; American National Standard Institute (ANSI) standards reference this document for nuclear plant and facility design. Because all of the basins included in Reference 5.29 are small and close together, a central location

(N 36 deg 52 min 30 sec, W 116 deg 26 min 48 sec) was used to determine the PMP values. PMP values for thunderstorm events, which were determined from HMR 49 for this study, were thought to be large enough to encompass more recent exceptional thunderstorms. The values determined are limited by present-day knowledge of the future climatic changes (Reference 5.29).

In all cases, the local thunderstorm PMF values appear larger and more critical than those of the general thunderstorm; therefore, Bullard suggests using local thunderstorm values for design purposes. The hydrographs developed in the study represent clear water flows. Potential sediment and debris loads can represent a substantial portion of the PMF or lesser flows; however, these loads were not addressed.

An update to this study by Bullard, *Nevada Test Site Probable Maximum Flood Study* (Reference 5.30) was completed. This was done because quality assurance procedures for software documentation were not in place at the time the original study was conducted. This update provides PMF values for Midway Valley Wash in the area east of the Exile Hill, Drill Hole Wash, Coyote Wash, and three small washes located approximately 1.5 miles southwest of Exile Hill. PMP values were obtained for a local storm event using HMR 49 in the same way as in the original report. A unit hydrograph for each basin was developed using USBR's rainfall runoff model. A second update to this study, *Nevada Test Site Flood Inundation Study* (Reference 5.31), was conducted to study water surface profiles for the PMF flows. PMF values are for clear water and double PMF values represent sediment and debris in transport during the flood event. Maximum flood inundation limits that may be expected during 100-year, 500-year, and regional maximum floods were studied in *Flood Potential of Forty Mile Wash and Its Principal Southwestern Tributaries, Nevada Test Site, Southern Nevada* (Reference 5.32). M&O Civil Drawing No. YMP-025-1-CIVL-PL117 (Reference 5.7) shows the flood plains calculated by this study and the update study by Blanton (Reference 5.31). The horizontal position of the Exile Hill Portal (North Portal) is shown to be outside the inundation area. The designed vertical position of the North Portal is also above the estimated water surface.

A later study performed in 1995, *Technical Basis Report for Surface Characteristics, Preclosure, Hydrology, and Erosion* (Reference 5.14), states that the results of the PMF study by Bullard (1991)(Reference 5.30) used the PMF methodology primarily because it complies with American National Standards Institute, Inc. requirements that PMF technology be used in the design of nuclear related facilities and secondarily because the PMF analysis predicts the worst possible case flood scenario. It further states that Bullard describes only the clear water PMF calculations and neglected the bulking factor and that later Blanton (1992) (Reference 5.31) reevaluates the PMF for different locations and includes a bulking factor of two, based on field inspections and considering the natural ground cover within the small drainage basins and steepness of the slopes.

The *Technical Basis Report for Surface Characteristics, Preclosure, Hydrology, and Erosion* , Figure 2.6.2-1 (Reference 5.14), shows the location of the bulked PMF values for Midway Valley Wash and their relationship to the North Portal pad. The horizontal position of the North Portal is again shown to be outside the inundation area. The designed and constructed vertical position of the North Portal is also above the estimated water surface.

The *Technical Basis Report for Surface Characteristics, Preclosure, Hydrology, and Erosion*, Figure 2.6.2-2 (Reference 5.14), shows a portion of the existing North Portal Pad on the flood-prone area and the inundation lines stopping at the boundary of the pad.

The pad intersects the flood levels, thereby causing the water to flow around the pad. It is recognized that the surface profiles of Midway Valley Wash will rise to account for constriction of flow caused by the pad area that is superimposed on the inundation zone. During final design, the floor elevation of the high-hazard buildings may be adjusted to reflect any changes in water profiles.

In its new configuration, shown on Figure 8 of Attachment I, the North Portal pad has been enlarged from Figure 3 of Attachment I. The RCA and the BOP area are again above the inundation zone because the top of the pad is above the water level, causing the water to flow around the pad. The northeast corner of the floor of the WHB is set approximately 1.5 feet above the maximum elevation of the flood stage that intersects the building to allow for freeboard (TBV). The remaining buildings in the RCA are set at the same floor elevation as the WHB. The pad for the BOP area is set a minimum of 3 feet below the floor elevation of the WHB to account for the dock height at the southeast corner of the building.

A railroad will be constructed on a compacted fill embankment across the Midway Valley Wash and a bridge will be provided to allow for passage of drainage water. This bridge and embankment will also cause a flow restriction.

Additional studies based on economic consideration will be performed to determine the effects of constriction from the enlargement of the pad and the embankment, and whether the bridge needs to be enlarged to allow for a higher volume of drainage water or the buildings need to be set to a higher floor elevation.

The proposed North Portal pad slopes will be protected from erosion due to flooding by building retaining walls or by implementing stream bank stabilization.

7.4.2 Existing North Portal Pad Drainage

The drainage design for the North Portal pad protects the portal from a PMF. Portal protection is accomplished by constructing two open channels around the perimeter of the pad.

The drainage basin for the pad is divided into two sub-basins. One sub-basin (approximately 11.5 acres in size) generates the runoff affecting the northernmost portion of the pad. Runoff flow from the other sub-basin (approximately 4 acres in size) affects the southernmost portion of the pad. Drainage basins are measured by scaling a 1" = 100' topographical map of the area and verifying by a field walkthrough.

The Rational Method was used to determine the peak discharge. An assumption was made that the Rational Method is acceptable for small drainage areas less than one square mile (Assumption 4.3.4.4). The formula used is:

Q = CIA, where

Q = Peak discharge in cfs
C = Runoff coefficient depending on characteristics of the drainage basin
I = Rainfall intensity in inches per hour
A = Drainage Area in acres

Because of the small drainage basins and steep slopes of these basins (close to 38%), the runoff coefficient, C, is assumed to be one. This is a conservative assumption, but, as stated, closely matches existing conditions of the drainage basins.

The rainfall intensity, I, was developed from the information provided in the *Nevada Test Site Probable Maximum Flood Study* (Reference 5.29), and was determined to be 28 inches per hour. This value was calculated using data for a local storm. Local storms in general have a greater intensity than general storms. Therefore, a more conservative estimate of peak discharge values will be achieved by using intensity of a local storm.

Peak discharge of each sub-basin was determined using the above procedure and the results indicate that the water will need to be diverted. Two channels were designed to protect the pad from estimated discharges.

One channel is designed to start from the southwest corner of the pad and to be built around the entire western and northern side of the pad for an approximate length of 2,230 feet. The channel is to be located 15 to 30 feet away from the top of the cut on the west side of the pad. This was determined to be the most suitable location considering the topography of the area, ease of construction, and the fact that blasting will be required for excavation into the rock in this area. A 15 to 30 foot distance will provide enough room for blasting and construction crews working on the pad, and at the same time will protect the east side of the proposed channel from vibrations due to blasting. All the channel cross-sections will be trapezoidal in shape. The side slopes will be at 2 horizontal to 1 vertical. Channel slope varies greatly and was used to minimize excavation and construction costs, while providing sufficient capacity to carry the runoff flow. For the first 350 feet, the channel's bottom width is designed to be 10 feet wide and the channel depth to be 2.5 feet deep including one foot of freeboard. Channel slope in this portion is steep, and high velocities are anticipated. However, the channel is not expected to be full in this portion, which would help keep the velocities in check. From station 3 + 50 to station 4 + 50, the channel will transition into a 20 foot wide bottom and 2.5 feet deep channel. Increasing the bottom width of the channel here would reduce flow velocity further. Channel dimensions stay the same, with channel slope being the only variable, from station 3 + 50 to 22 + 30.

The second channel is designed to start from the southwest corner of the pad and to be built around the southern side of the pad for a length of approximately 820 feet. The channel is designed to be located a safe distance away from the edge of the pad and to protect the toe of the fill on the lower half of the southern side of the pad from erosion. All the channel cross-sections will be of a trapezoidal shape. The side slope will be 2 horizontal to 1 vertical. Bottom width will be 10 feet

and channel depth is calculated to be 1.5 feet. Both channels require the use of a rip rap apron for their entire length, except were there is excavation in rock.

Both channels have been constructed as part of the Exploratory Surface Facilities. No modifications will be required to adapt these channels for protection of the Repository North Portal Surface Facilities from the PMF.

7.4.3 Radiologically Controlled Pad Drainage

The drainage design for the RCA will protect this pad from a PMF. Pad protection will be accomplished by providing an underground storm drainage collection system to contain the runoff from this area and prevent spillage over the fill slopes and the BOP area. A retention pond will be provided to prevent storm water pollution.

The drainage basin for the RCA is approximately 38 acres, as shown in Attachment II. The drainage basin area was estimated using measurements taken by scaling a 1"=100' topographic map of the area.

The Rational Method was used to determine the peak discharge. The formula used is:

$Q = CIA$ where

Q = Peak discharge in cfs
C = Runoff coefficient depending on characteristics of the drainage basin

I = Rainfall intensity in inches per hour
A = Drainage Area in acres

From Paragraph 7.4.2:

C = 1.0
I = 28 inches per hour

Then: $Q = 1 \times 28 \times 38 = 1064$ cfs

The underground storm drainage system and retention pond will be sized for this flow. The retention pond will be designed for a duration of one hour.

7.4.4 Balance of Plant Pad Drainage

The drainage design for the BOP area will protect this pad from the 100-year storm (Code 4.1.4). Pad protection will be accomplished by providing an underground storm drainage collection system to contain the runoff from this area and prevent spillage over the fill slopes.

The drainage basin for the BOP area is approximately 37.5 acres, as shown in Attachment II. The drainage basin area was estimated using measurements taken by scaling a 1"=100' topographic map of the area. A retention pond will be provided to prevent storm water pollution.

Technical Release 55 (TR-55) (Code 4.4.3), (DOE 6430.1A) (Code 4.4.1) procedures were used to determine the peak discharge. This method is preferred based on accuracy.

From Attachment II:

Q=144 cfs

The underground storm drain system and the retention pond will be sized for this flow. The retention pond will be sized for a duration of one hour.

7.4.5 Retention Pond

The size of the retention pond is determined by the volume of storm water runoff from the Radiological Controlled Pad generated by a storm of duration of one hour (Reference 5.13).

Volume of retention pond = 1064 cfs x 60 minutes x 60 seconds = 3,830,400 cubic feet

Using a depth of water of 3 feet, then:

Area of retention pond = 3,830,400/ 3 = 1,276,800 square feet = 29.3 acres

The pond will have a depth of 3 feet plus one foot freeboard.

7.5 NORTH PORTAL SITE LAYOUT

The site plans for the North Portal area are shown on Figures 6 and 7 in Attachment I. These site plans were updated from the ACD (Reference 5.5) to show the latest facilities configuration. Figure 6 provides an overview of the site including the relationship of the RCA and the BOP to the off-site utilities, transportation corridors, and natural features such as flood zones and late quaternary faults. This figure shows the following:

- The North Portal area is relatively flat (e.g. about 2 percent slope) and is located in Midway Valley between Midway Valley Wash and Exile Hill.

- Significant quaternary faults in the North Portal area do not lie under the waste handling facilities. Tertiary faults (not shown on either figures) exist but do not present a seismic hazard in the RCA.

- The surface facilities are currently located above the inundation zone for the PMF. The flood zone is based on CDA TDS-008 (Reference 5.6) for a regional storm in accordance with the *Technical Basis Report for Surface Characteristics, Preclosure, Hydrology, and*

Erosion (Reference 5.14).

- The existing fill underneath the existing North Portal pad will require stabilization and additional compacted fill will be required for the BOP area.

- The North Portal is located in the easterly side of Exile Hill. This portal is currently being used for underground access to the ESF.

- Rail and truck access to the area will be from the east through Midway Valley, south of Alice Hill.

- Existing electrical power to the area from south of Alice Hill via a single existing 69 kV power line with a thermal rating of 20MVA will be retained and continue to feed the existing booster pump station and any additional loads. Upgrading of existing electrical off-site power is under consideration.

- To provide adequate power to the repository, a new transmission line and a new substation will be provided.

- Raw well water is supplied to the site via existing NTS Well J-13 (Figure 1, Attachment I), which is located approximately 3.5 miles southeasterly from the North Portal. The water is pumped to a booster pump station a quarter mile south of the portal and then to potable and non-potable storage tanks at the top of Exile Hill. The water flows by gravity to the North Portal Operations Area for potable water and firewater/construction water. The existing pumps at J-13 and the existing booster pump station will be upgraded from 150 GPM to 300 GPM capacity. The existing water storage tank at J-13 will be replaced by two 100,000- gallon tanks. The piping from NTS Well J-12 which serve as backup to NTS Well J-13 will be replaced (Reference 5.36).

  To augment non-potable water requirements, an existing raw water well, known as C-Well, will be used. This well will require a new booster pump station housing two 600 GPM pumps and two 50,000-gallon forebay tanks. (Reference 5.36).

- Sanitary sewage flows by gravity from the North Portal Operations Area to a septic tank and leach field. Based on the new population requirements the existing sanitary sewer system is adequate (Reference 5.36).

Figure 6 in Attachment I identifies the relationship between the RCA and BOP, while Figure 7 in Attachment I identifies the surface facilities by site reference number (e.g., 211 for the WTB). The reference numbers are the same designations used in the ACD (Reference 5.5). This figure shows the following:

- The RCA is located adjacent to the North Portal and extends northerly to enclose Security Station 3 (220-3C). The RCA includes four discrete nuclear facilities: the WHB (211), the

WTB (215-1), the TMB (220-4C), and the CPB (215-2). The RCA also includes the parking areas for waste transportation trucks and rail cars. The RCA is secured by fencing. The distances between the WHB, CPB, and Security Station 3 are dictated by the spacing required for the rail line branches, or "frogs," and the desire to keep the CPB out of the PMF.

- The WHB is located just east of the existing change house, placing the WHB as close as possible to the portal while preserving the change house. The WTB was located next to the WHB to facilitate and minimize the movement of personnel and materials between these related facilities. The TMB is located to be accessible to the waste transporter rail lines.

- The BOP area is located southeasterly and adjacent to the RCA. This BOP location was selected to promote radiological safety by considering the prevailing wind directions, as shown by the wind rose in Figure 6 in Attachment I. The facilities within the BOP house the non-nuclear operations needed to support waste operations and site personnel.

7.6 REPOSITORY SITE LAYOUT

The repository surface facilities are located in four discrete operational areas as described below and as shown on the overall repository surface site plan in Figure 4 of Attachment I. This figure also shows the relationship of these areas to the emplacement (North) and development (South) portals, subsurface ramps and emplacement areas, emplacement and development shafts, and muck conveyor routing, muck storage area, and lag storage area.

7.6.1 North Portal Operations Area

The North Portal Operations Area is the largest and most complex surface facility area, covering approximately 80 acres and including 19 (17 new and 2 existing) structures. This area is adjacent to the North Portal, where the waste is brought underground for emplacement. The operations area includes an RCA and a BOP area. The RCA is where the SNF and civilian and defense high-level waste (DHLW) materials are received from off-site transportation and placed in disposal containers. North of this area is a potential 300 to 400 acre site shown on Figure 4 of Attachment I for lag storage.

The BOP area includes structures and systems that will support repository operations in all areas (e.g., general administration, medical center, training center, shops, motor, central warehouse and centralized utilities).

This area uses centralized utilities generated as needed because providing utilities from a single central area is cost prohibitive due to the distances between surface areas.

7.6.2 South Portal Development Operations Area

The South Portal Development Operations Area is the second largest surface facility area, covering approximately 12 acres and including 8 structures. This area is located adjacent to the South Portal to support the excavation of the underground and the operation of the development ventilation intake fans. The area functions independently and includes the basic facilities needed for personnel support, maintenance, warehousing, material staging, security, and transportation. This area will normally be staffed with support personnel based on the ACD, Section 7.3 (Reference 5.5), plus all subsurface construction personnel during the development/emplacement phase, and will be unmanned after underground excavation is completed. Most personnel will move directly from off-site to this area. General supplies will be transferred from the North Portal operations area and transported by truck to the South Portal Development Operations Area.

This area uses centralized utilities generated as needed because providing utilities from a single central area is cost prohibitive due to the distances between surface areas.

7.6.3 Emplacement Shaft Surface Operations Area

The Emplacement Shaft Surface Operations Area is a 1½ acre site that includes fans, power supply, headframe, and hoist system and is located at the opening of the north shaft. The main facility is provided to house the emplacement ventilation exhaust fans and to support the maintenance of these fans. The area is normally unmanned. Personnel and materials are dispatched as needed from the North Portal Operations Area to conduct inspections or maintenance.

This area uses centralized utilities generated as needed because providing utilities from a single central area is cost prohibitive due to the distances between surface areas.

7.6.4 Development Shaft Surface Operations Area

The Development Shaft Surface Operations Area is a 1½ acre site and includes fans, power supply, headframe, and a general purpose building and is located at the opening of the south shaft. The facility is provided to house a head frame and shaft conveyance needed for underground emergency personnel egress and inspection access. The area also includes the exhaust for the underground ventilation system and electrical equipment. This area is normally unmanned. Personnel and materials are dispatched as needed from other areas to conduct inspections and maintenance.

This area uses centralized utilities generated as needed because providing utilities from a single central area is cost prohibitive due to the distances between surface areas.

7.6.5 Repository Muck Storage Area

An area of approximately 400 acres is available for the Repository Muck Storage Area. Minimal flood protection, in the form of drainage ditches, is sufficient to protect it from any local flooding caused by the 100-year storm.

7.6.6 Utilities

Potable and non-potable water to the North Portal operations will be supplied by water storage tanks on Exile Hill. An alternate source for non-potable water will be supplied from a new pumphouse at C-Well. Potable and non-potable water will flow by gravity from the existing tanks to the North Portal area. Non-potable water will also flow by gravity from the storage tank at Exile Hill to fill or replenish the firewater storage tank located above the North Portal pad. Non-potable water will flow by pressure from the new pumphouse located at C-Well to feed the new fire storage tank located at the North Portal pad (Reference 5.36).

The firewater supply and storage system consists of two new 250,000-gallon tanks and two new fire pumphouses to conform with redundancy requirements. One of the tanks will be located above the North Portal Pad and the other tank will be located at the North Portal pad. Firewater will be supplied by gravity from the tank located above the North Portal pad to a pumphouse that will boost the pressure in case of a fire, and will also feed the fire loop distribution systems in the RCA and BOP areas. Firewater from the storage tank on the pad will be supplied by gravity to one of the pumphouses, which in turn will boost the pressure in case of a fire, and will also feed the fire loop distribution system in the RCA and the BOP. Locating one storage tank on the hill above the North Portal will take advantage of gravity flow in case the BOP is supplied without a booster. By separating the two sources, hardening of the pumphouse on the pad is not required. See Attachment IV for firewater system.

Non-potable water to the South Portal Development Operations Area will be supplied from the existing Booster Pump Station to a potable water storage tank and a non-potable firewater storage tank located on top of a hill in the vicinity of the South Portal. A chlorination system to provide potable water will be provided. Water will flow by gravity to the South Portal area.

The sanitary sewer from the South Portal Operations Area will flow by gravity to a septic tank and leach field.

Electric power to the North Portal Operations Area will be provided from a substation located southeasterly of the North Portal area to feed the North Portal Operations Area.

7.6.7 Access Roads

An access road will be provided from the North Portal Operations Area to join the Nevada Test Site (NTS) offsite road and the South portal access road.

H-Road will be extended from its terminus to join the Emplacement Shaft area.

The South Portal access road will be extended to join the access road to the top of Yucca Mountain.

The top of the Yucca Mountain access road will be improved from its intersection with the extension of the South Portal access road to the Development Shaft area.

All existing access roads will be upgraded to meet AASHTO and NDOT standards.

The access roads from the North Portal operations to the NTS off-site road will provide site emergency access and evacuation.

7.6.8 Rail

Rail access to the North Portal area will be from the northeast through Midway Valley south of Alice Hill. A railroad car storage spur will be provided before entering the security station to accommodate buffer and escort cars. Parking areas for rail carriers will be provided for buffer staging between the waste receipt gate and the CPB and between the CPB and the WHB.

7.6.9 Potential Storage Area

A potential storage area of 350 acres is available to provide the ability to retrieve and store all the waste that may be emplaced in the Repository. Waste retrieval capability must be maintained for a period of time starting when the first waste package is emplaced and extending until the start of the closure operation. The length of the retrievability period is set at 50 years in 10 CFR. The DOE has extended this period of retrievability to 100 years from the emplacement of the first waste package. The area located on Figure 4 of Attachment I.

7.6.10 Site Parking

Site parking has been provided to accommodate the minimum parking capacity for truck and rail equipment. Parking areas have been sized to provide buffer staging between the waste receipt gate and the CPB and between the CPB and WHB. Each parking area was sized as described in Attachment III.

7.6.11 Topsoil Storage Area

The existing topsoil storage area is shown on Attachment I, Figure 2. This area will be expanded to accept the additional repository volume needs.

7.6.12 Bridge Crossing

A bridge will be provided for railroad and highway crossing above the Midway Valley Wash. This bridge was located in a compacted fill embankment to allow passage of the PMF flood. The length of the bridge will be determined by future flood routing studies.

8. CONCLUSIONS

These conclusions are intended to support the VA design. Due to the unqualified/unconfirmed input data used in this analysis, the output/conclusions from this analysis cannot be used as input into

documents supporting procurement, fabrication, or construction unless they are controlled and tracked as TBV or TBD in accordance with NLP-3-15.

8.1 SITE CONDITIONS BEFORE REPOSITORY CONSTRUCTION

The design analysis in Section 7.1 presented the description of the existing ESF North Portal facilities that could impact the repository surface facilities layout. These facilities were non-nuclear, non-qualified, and generally designed for a 25-year life. These facilities could likely comply with the design life requirements of the repository surface facilities with additional upgrades and periodic replacement of limited life components such as HVAC, computer equipment, and routine facility maintenance. These facilities, as detailed in Table 7-1, include an existing switchgear building, electrical transformers on a concrete pad, change house, and underground utilities.

8.2 NORTH PORTAL REPOSITORY SURFACE FACILITIES AND OPERATIONS

The design analysis of Section 7.2 presented the repository surface facilities that are either inside the Radiologically Control Area or Balance of Plant Area. As detailed in Table 7.2, the RCA facilities include the Waste Handling Building, the Waste Treatment Building, the Carrier Preparation Building, the Transporter Maintenance Building, the Carrier Washdown Building, rail carrier and truck carrier parking, the change house, and the switchgear building.

The Balance of Plant facilities include Security Stations 1, 2, and 3; the Administration Building; the Food Service Facility; Training Auditorium; Medical Center; Fire Station; Computer Center; Central Warehouse and Shops; Motor Pool and Service Station; Mockup Building; and car/bus parking lots.

The waste handling operations inside the RCA were detailed in Section 7.3 and are diagramed in Figure 7-1. Waste handling operations include moving rail and truck carriers with loaded casks through security, and carrier preparation into the Waste Handling Building. Empty casks are moved out either by rail or truck carrier and go through carrier preparation and security before being returned to off-site nuclear waste generating facilities. Similar operations of moving SNF received in DPC overpacks by train carriers were detailed in Section 7.3.3. The delivery operations of empty disposal containers into the WHB and the return of their rail and truck carriers were detailed in Section 7.3.4. Included in site operations are the processes of generating secondary wastes (LLW, hazardous, and mixed wastes) throughout the RCA facilities and operations. Section 7.3.5 discusses the waste generation and their disposal operations. The flows of general operating supplies and personnel from the BOP into and out of the RCA were discussed in Sections 7.3.6 and 7.3.7.

8.3 FLOOD CONTROL AND STORM WATER DRAINAGE

A detailed discussion of the studies performed by the U.S Bureau of Reclamation for the U.S. Geological Survey to determine the Probable Maximum Flood for the Yucca Mountain Project was given in Section 7.4.1 Using a bulking factor of two which accounts for natural ground cover within the small drainage basins and the steepness of the surrounding slopes, the worst case possible flood

scenario was arrived at for the North Portal Pad. Although a portion of the original pad is in the flood-prone area, the flood inundation lines will stop at the boundary of the pad because the top of the pad is above the water level, causing the water to flow around the pad. Because the water surface profiles will rise to account for constriction of flow caused by the pad being superimposed on the inundation zone, the Waste Handling Building and other high hazard buildings will be set approximately 1.5 feet above the maximum elevation of the flood stage. The pad for the BOP Area was set for a minimum of 3 feet below the floor elevation of the WHB accounting for its the dock height at the southeast corner.

Two existing open channels constructed for the ESF will protect the North Portal from the PMF. One channel starts in the southwest corner of the pad and travels around the entire western and northern side of the pad for approximately 2230 feet. The second channel starts at the southwest corner of the pad and runs around the entire southern side for an approximate length of 820 feet. Both channels have been designed for peak discharge values of storm water runoff as developed by the USBR. These runoff values are for two drainage sub-basins, one located to the west and the other to the south of the portal and pad.

Storm drainage collection systems and their quantified peak discharge values were discussed for the RCA and BOP. The RCA storm water drainage area will be approximately 27.5 acres resulting in a peak PMF discharge of 770 cfs. The BOP drainage area is approximately 37.5 acres with a peak 100-year discharge of 144 cfs. The design of the underground collection systems will comply with environmental regulations for storm water discharge.

8.4 NORTH PORTAL SITE LAYOUT

An overview of the North Portal site showing the locations of buildings, utilities, transportation corridors, and natural features such as flood zones and faulting is presented in Section 7.5. The locations of the four nuclear facilities (WHB, WTB, TMB and the CPB) inside the RCA are justified and shown on Figure 7 of Attachment I. The location of the BOP area which house the non-nuclear operations support facilities is discussed in regards to radiological safety and prevailing wind directions. Brief discussions are given in the section about rail and truck access, power, water and sanitary sewerage. Site plans, updated from the ACD (Reference 5.5) and from additional information developed since Revision 1 of this document (References 5.35, 5.36, and 5.37, are shown on Figures 6 and 7 in Attachment I. The North Portal site does not have significant quaternary faults which have had 5 cm or more of displacements over the last 100,000 years.

8.5 REPOSITORY SITE LAYOUT

The four discrete operational areas of the repository surface facilities are described in Section 7.6 and shown on Figure 4 of Attachment I.

The North Portal Area is the largest and most complex area. It is approximately 80 acres in size and includes 19 structures. The RCA contains the nuclear facilities which will receive spent nuclear fuel from off-site transportation and place in disposal containers for emplacement underground. The

BOP area includes the facilities which will support all surface repository operations. A 400-acre area for the potential onsite lag storage is also shown on Figure 4 north of the North Portal Area.

The South Portal Development Operations Area is the second largest surface facility area. It is approximately 12 acres in size and includes 8 structures. It is located next to the South Portal. The facilities and personnel in this area will support the excavation of the underground tunnels and operation of the Development Ventilation Intake Fans. The area will function independently and will include basic facilities needed for personnel support maintenance, warehousing, material staging, security and transportation.

The Emplacement Shaft Surface Operations Area and the Development Shaft Surface Operations Area were discussed. The Emplacement Shaft area, located at the opening of the north shaft, will be approximately 1-½ acres in size with two structures to house the emplacement ventilation exhaust fans and their maintenance support. The Development Shaft area is also approximately 1-½ acre in size and located at the opening of the south shaft. The single facility will house the underground emergency egress and inspection access. Also located here will be exhaust fans for the underground ventilation system and electrical equipment. Both facilities will normally be unmanned with personnel dispatched from other facilities when needed. At present there are no defined fire protection requirements.

The final area discussed is the Repository Muck Storage Area for repository tunnel construction. This area will be approximately 400 acres in size for storing tunnel muck.

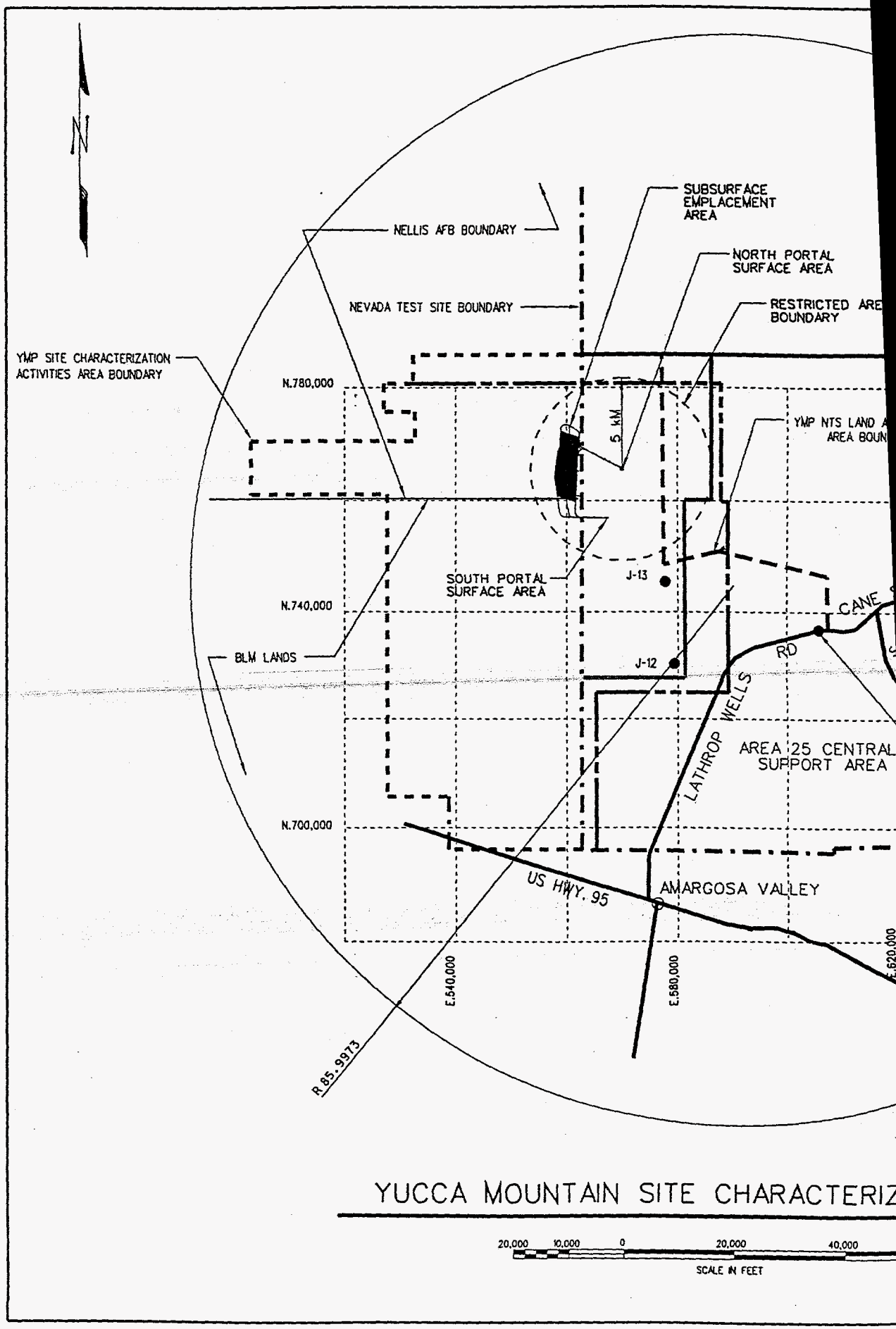
Grading for the North Portal Operations area will require recompaction and stabilization of the existing fill and the addition of compacted fill under the BOP.

Existing access roads will require upgrading since they were not constructed in accordance with AASHTO and NDOT standards.

The railroad tracks within the Midway Valley Wash will be above the PMF inundation area and constructed with compacted fill. Retaining walls or bank stabilization will be required.

9. ATTACHMENTS

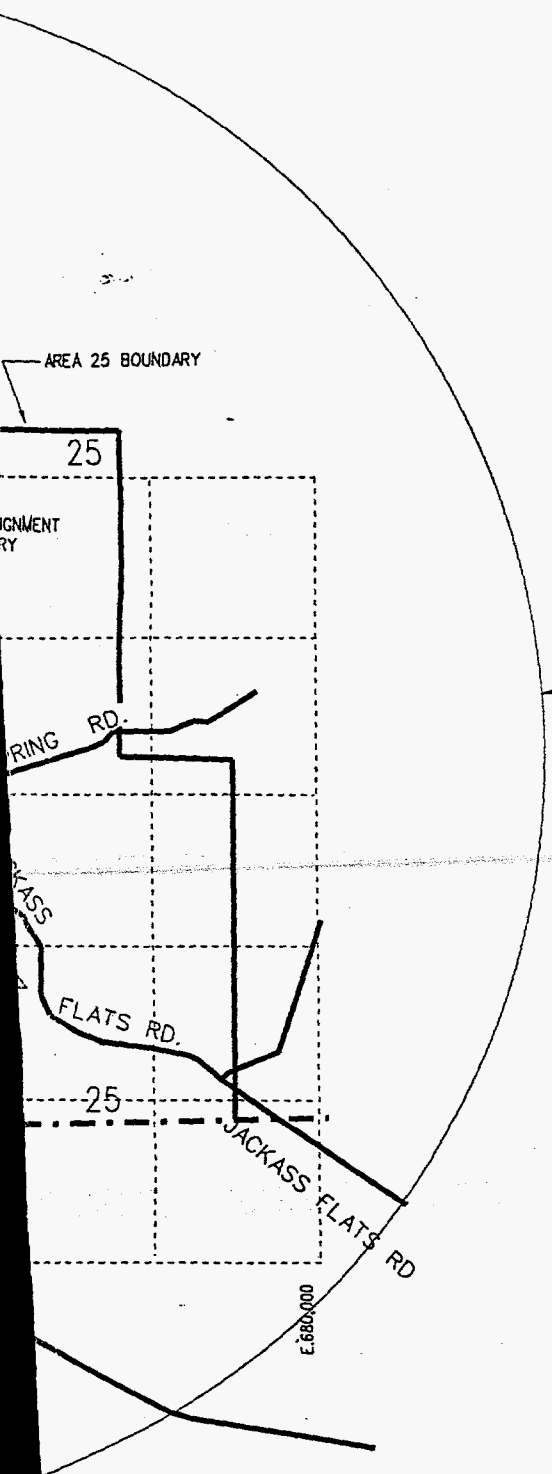
ATTACHMENT	DESCRIPTION
I	Repository Surface Design Site Layout Figures
II	Storm Water Drainage Calculations
III	Site Parking Capacity for Rail and Truck Carriers
IV	Firewater System for North Portal Operations



YUCCA MOUNTAIN SITE CHARACTERIZ

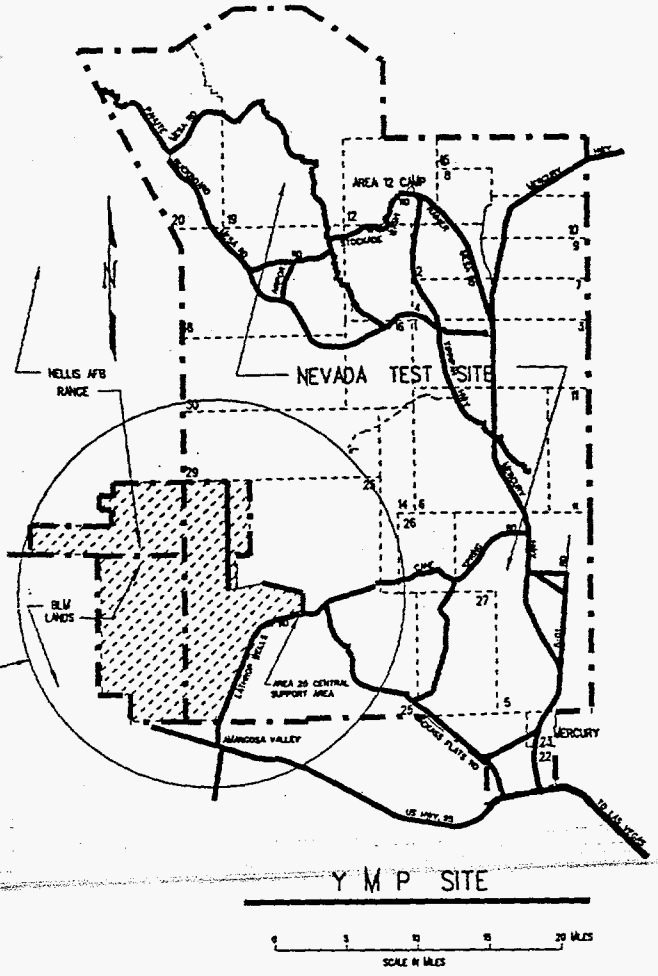
20,000 10,000 0 20,000 40,000

SCALE IN FEET



ION PROJECT

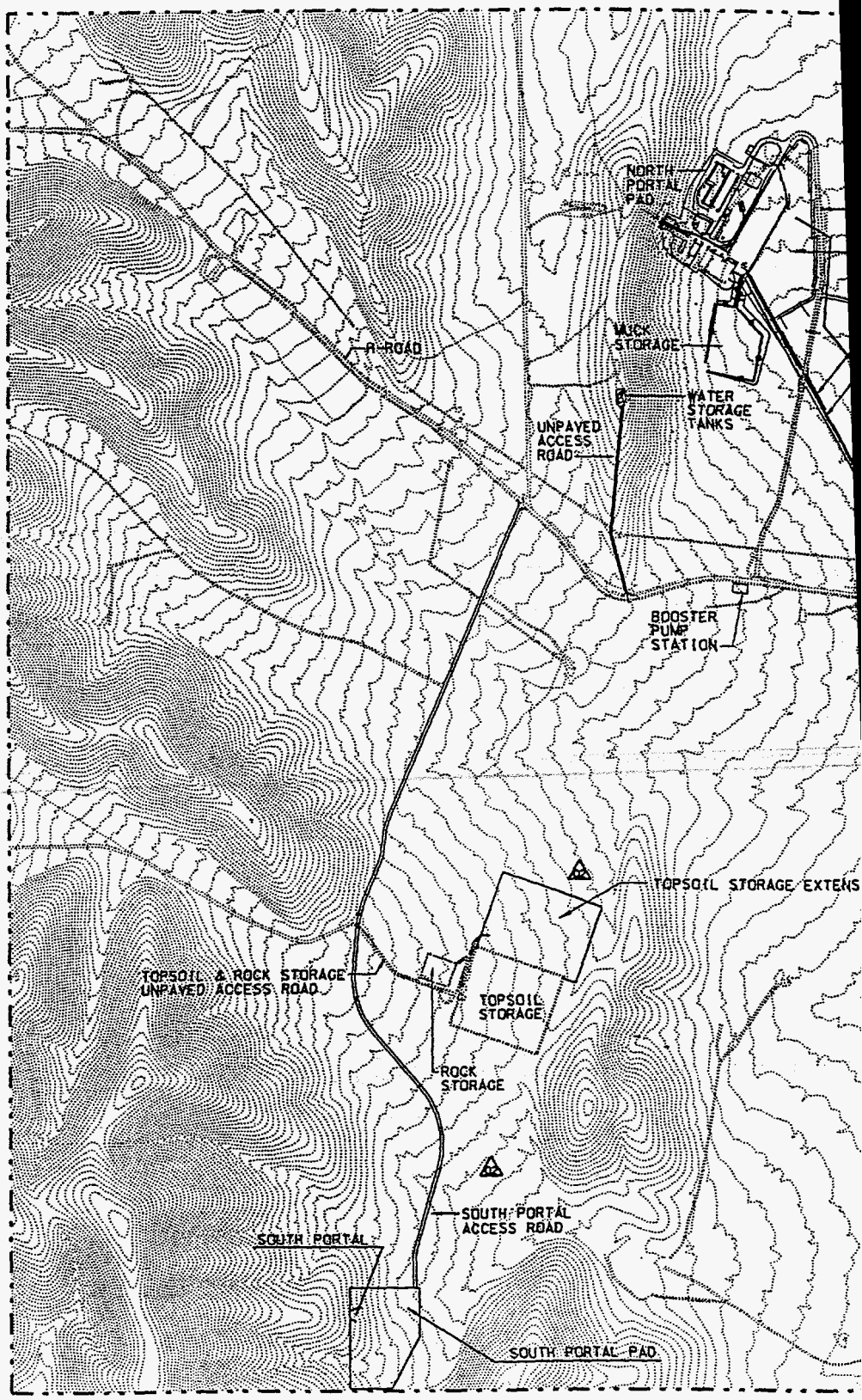
60,000

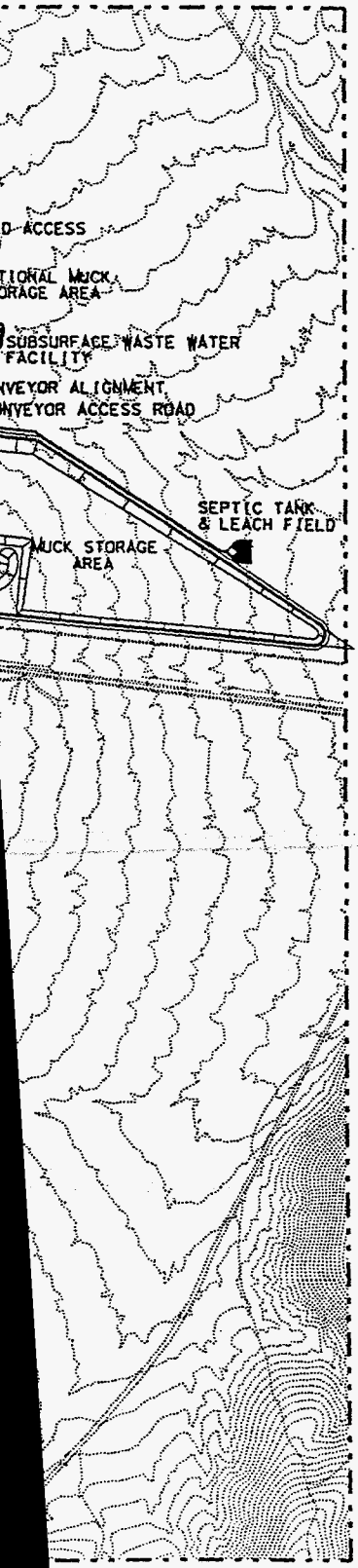


NOTES:

1. FOR PRE-REPOSITORY OVERALL SITE PLAN SEE FIGURE 2.
2. FOR PRE-REPOSITORY NORTH PORTAL SITE PLAN SEE FIGURE 3.
3. FOR REPOSITORY OVERALL SITE PLAN SEE FIGURE 4.
4. FOR REPOSITORY SHAFT ACCESS ROAD SEE FIGURE 5.
5. FOR NORTH PORTAL REPOSITORY SURFACE OVERVIEW SEE FIGURE 6.
6. FOR NORTH PORTAL REPOSITORY AREA SITE PLAN SEE FIGURE 7.
7. FOR NORTH PORTAL REPOSITORY GRADING PLAN AND SECTION SEE FIGURE 8.
8. THIS FIGURE DEPICTS PRELIMINARY DESIGN AND IS PRESENTED FOR INFORMATION ONLY. THE INFORMATION IS NOT INTENDED FOR PROCUREMENT, FABRICATION, OR CONSTRUCTION.

FIGURE 1
YMP SITE PLAN
MAP


NORTH PORTAL PAD
A-ROAD
MUCK STORAGE
WATER STORAGE TANKS
UNPAVED ACCESS ROAD
BOOSTER PUMP STATION
TOPSOIL STORAGE EXTENS
TOPSOIL & ROCK STORAGE UNPAVED ACCESS ROAD
TOPSOIL STORAGE
ROCK STORAGE
SOUTH PORTAL ACCESS ROAD
SOUTH PORTAL
SOUTH PORTAL PAD



N

NOTES:

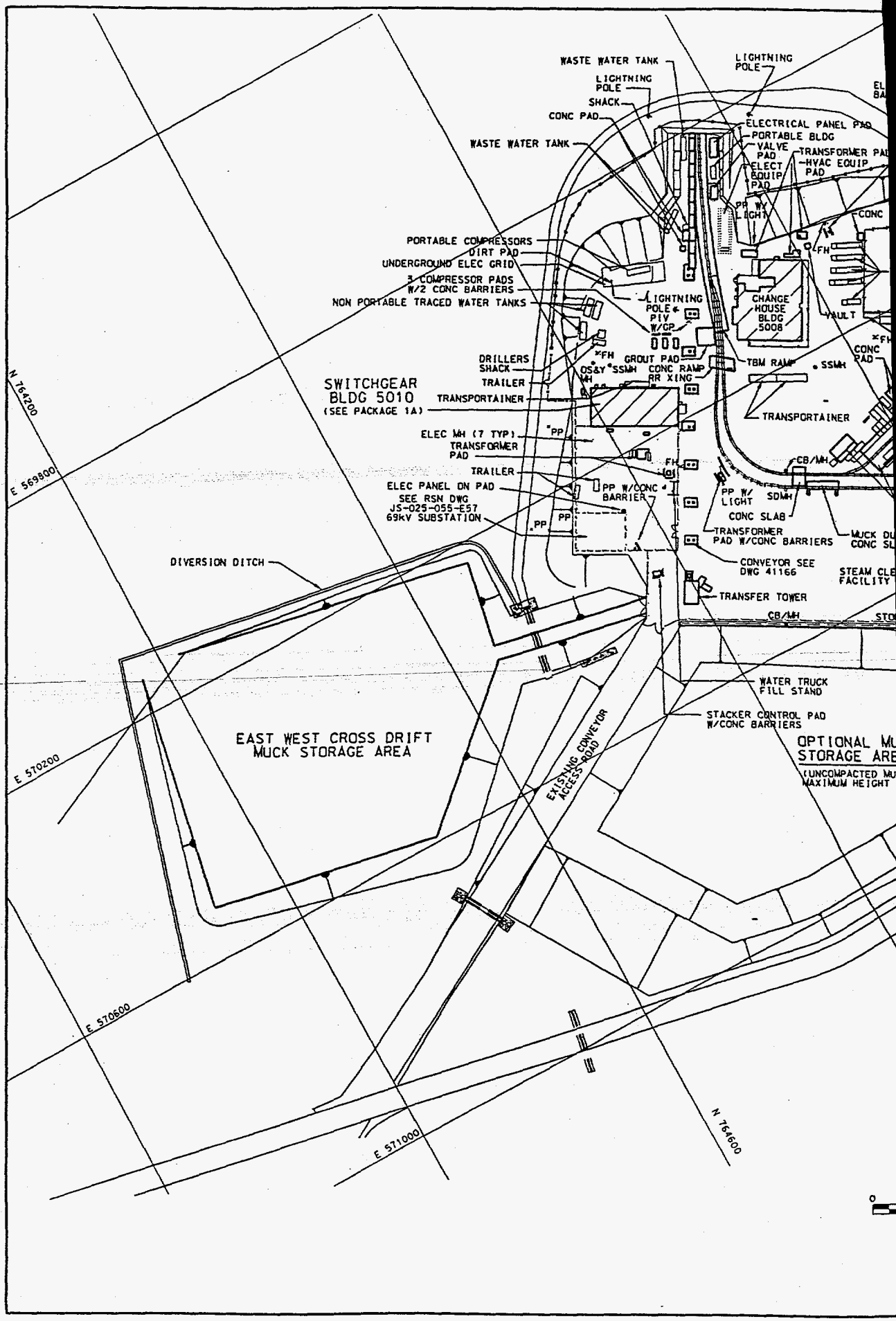
1. FOR CIVIL ABBREVIATIONS SEE DRAWING BAB000000-01717-2100-20005 REV 02 (REF 5.19).
2. FOR LEGEND AND SYMBOLS SEE DRAWING BAB000000-01717-2100-20006 REV 02 (REF 5.20).
3. FOR OTHER FIGURES SEE FIGURE 1
4. THIS FIGURE DEPICTS PRELIMINARY DESIGN AND IS PRESENTED FOR INFORMATION ONLY. THE INFORMATION IS NOT INTENDED FOR PROCUREMENT. FABRICATION. OR CONSTRUCTION.

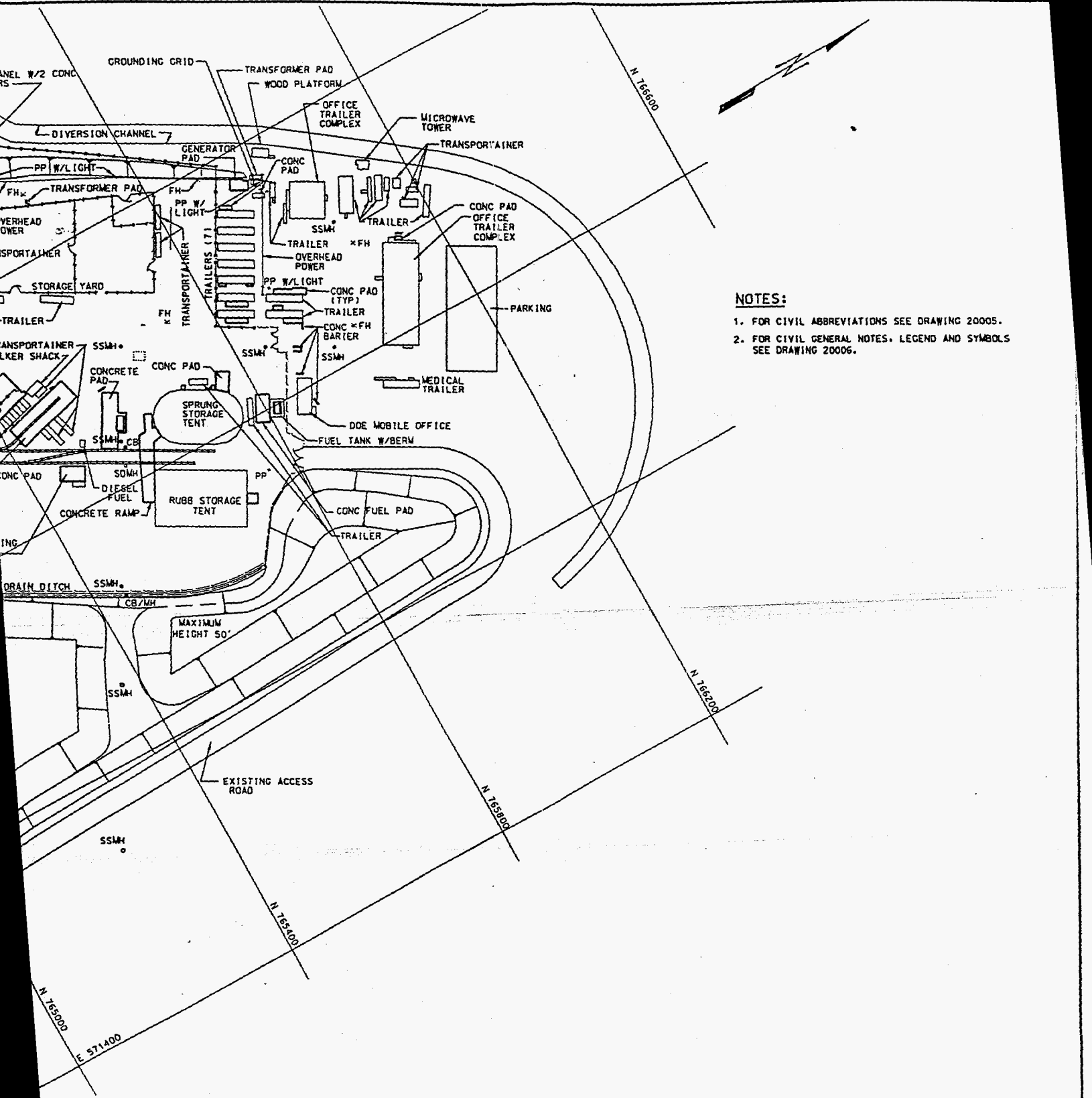
GRAPHIC SCALE

0 300 600 1200 1800 FEET

1"=600'

FIGURE 2
PRE-REPOSITORY
OVERALL SITE PLAN


WASTE WATER TANK
LIGHTNING POLE
SHACK
CONC PAD
WASTE WATER TANK
LIGHTNING POLE
ELECTRICAL PANEL PAD
PORTABLE BLDG
VALVE PAD
TRANSFORMER PAD
ELECT EQUIP PAD
HVAC EQUIP PAD
PP W/ LIGHT
CONC
PORTABLE COMPRESSORS
DIRT PAD
UNDERGROUND ELEC GRID
3 COMPRESSOR PADS W/2 CONC BARRIERS
NON PORTABLE TRACED WATER TANKS
LIGHTNING POLE PIV W/GP
CHANGE HOUSE BLDG 5008
VAULT
FH
DRILLERS SHACK
OS&Y
SSMH
GROUT PAD
CONC RAMP RR XING
TBM RAMP
SSMH
CONC PAD
SWITCHGEAR BLDG 5010
(SEE PACKAGE 1A)
TRAILER
TRANSPORTAINER
TRANSPORTAINER
ELEC MH (7 TYP)
PP
TRANSFORMER PAD
FH
CB/MH
TRAILER
ELEC PANEL ON PAD
SEE RSN DWG JS-025-055-E57 69kV SUBSTATION
PP W/CONC BARRIER
PP W/ LIGHT
SDMH
CONC SLAB
TRANSFORMER PAD W/CONC BARRIERS
MUCK DU
CONC SL
DIVERSION DITCH
CONVEYOR SEE DWG 41166
STEAM CLE
FACILITY
TRANSFER TOWER
CB/MH
STO
WATER TRUCK FILL STAND
STACKER CONTROL PAD W/CONC BARRIERS
EAST WEST CROSS DRIFT MUCK STORAGE AREA
EXISTING CONVEYOR ACCESS ROAD
OPTIONAL MU
STORAGE ARE
(UNCOMPACTED MU
MAXIMUM HEIGHT
N 764200
E 569800
E 570200
E 570600
E 571000
N 764600



NOTES:

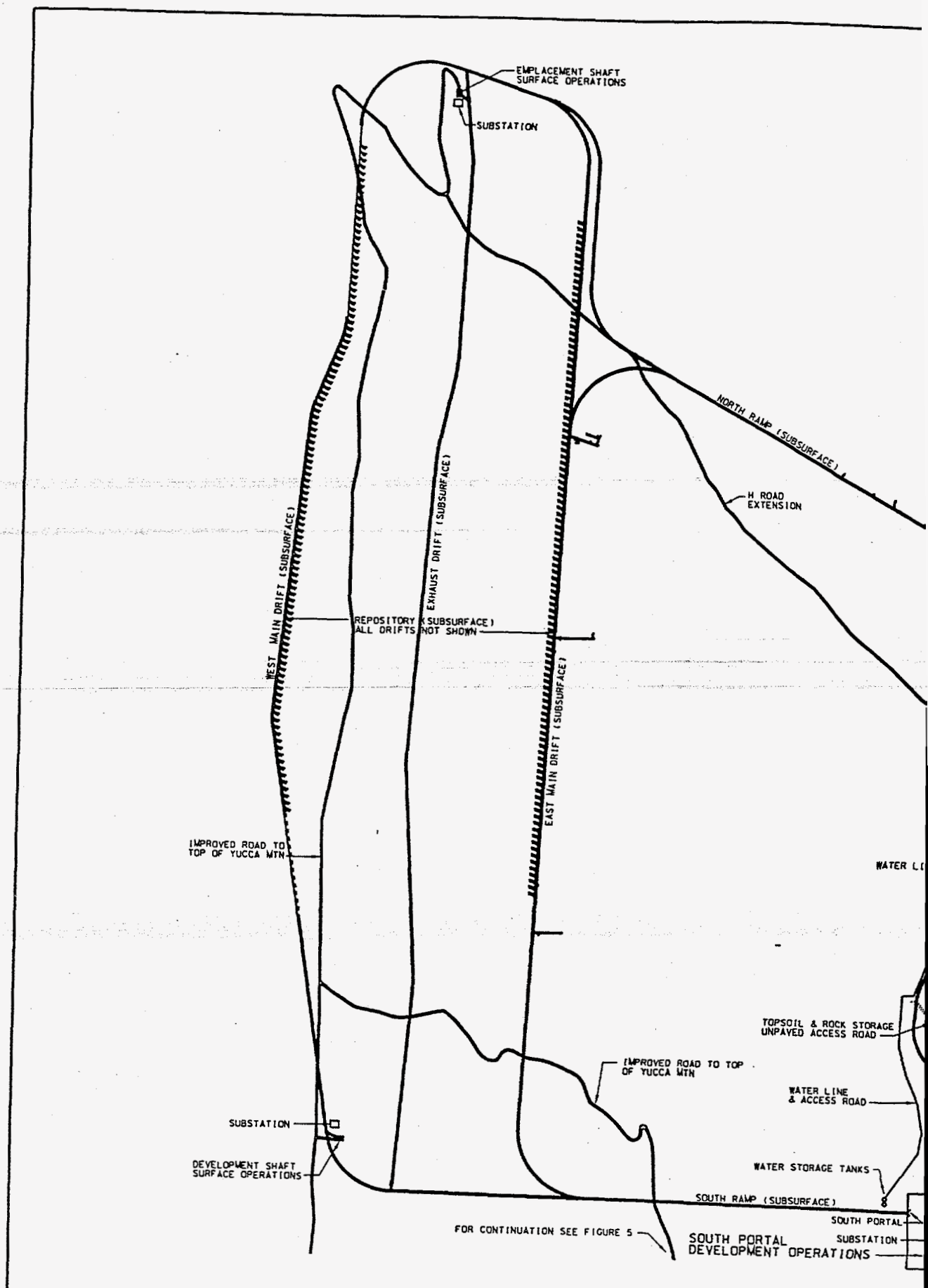
1. FOR CIVIL ABBREVIATIONS SEE DRAWING 20005.
2. FOR CIVIL GENERAL NOTES, LEGEND AND SYMBOLS SEE DRAWING 20006.

HIC SCALE

200 300 FEET

= 100'

FIGURE 3
PRE- REPOSITORY NORTH PORTAL SITE PLAN


EMPLACEMENT SHAFT SURFACE OPERATIONS
SUBSTATION
NORTH RAMP (SUBSURFACE)
H ROAD EXTENSION
WEST MAIN DRIFT (SUBSURFACE)
EXHAUST DRIFT (SUBSURFACE)
REPOSITORY (SUBSURFACE) ALL DRIFTS NOT SHOWN
EAST MAIN DRIFT (SUBSURFACE)
IMPROVED ROAD TO TOP OF YUCCA MTN
WATER LI
TOPSOIL & ROCK STORAGE UNPAVED ACCESS ROAD
IMPROVED ROAD TO TOP OF YUCCA MTN
WATER LINE & ACCESS ROAD
SUBSTATION
DEVELOPMENT SHAFT SURFACE OPERATIONS
WATER STORAGE TANKS
SOUTH RAMP (SUBSURFACE)
SOUTH PORTAL
FOR CONTINUATION SEE FIGURE 5
SOUTH PORTAL DEVELOPMENT OPERATIONS
SUBSTATION

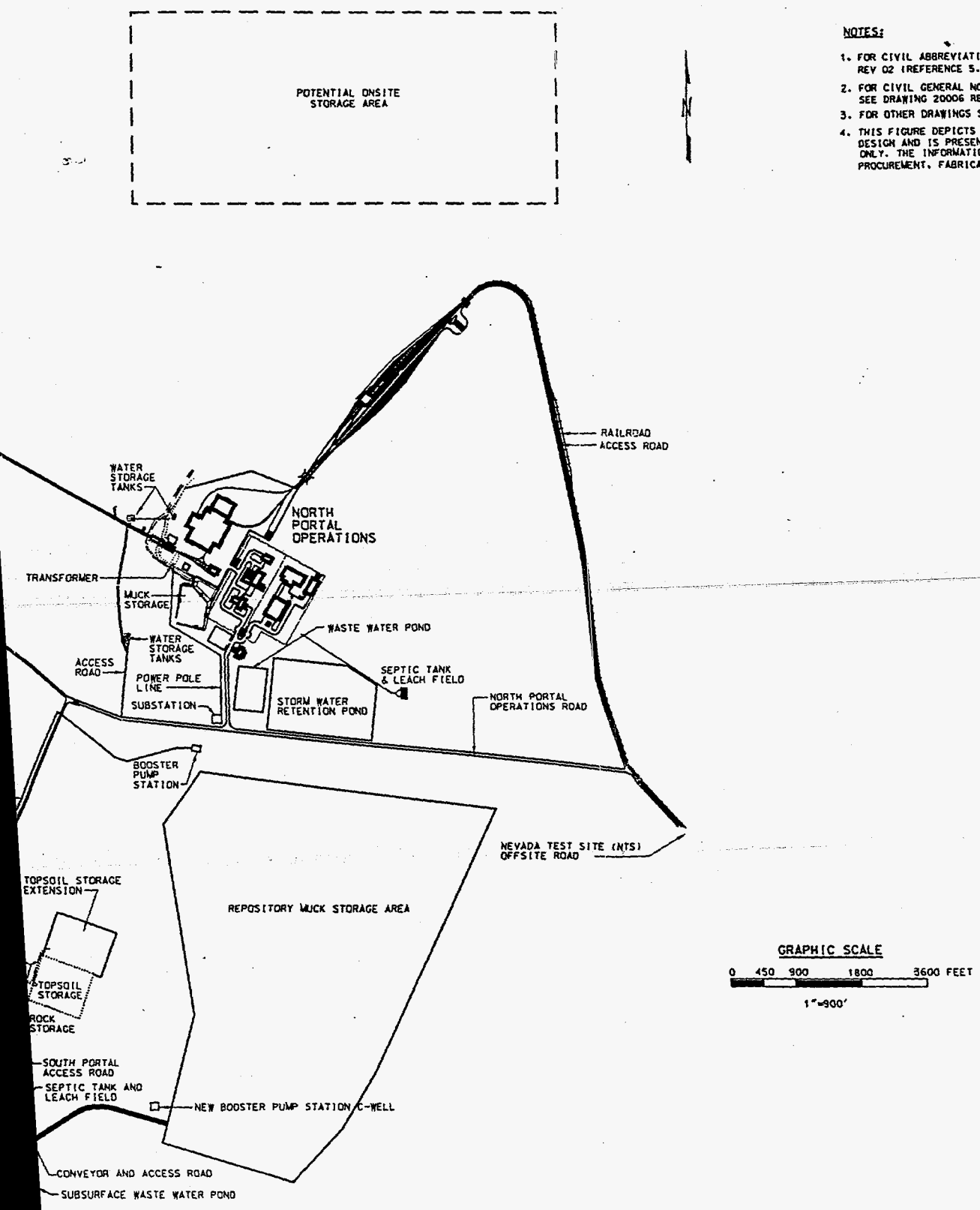
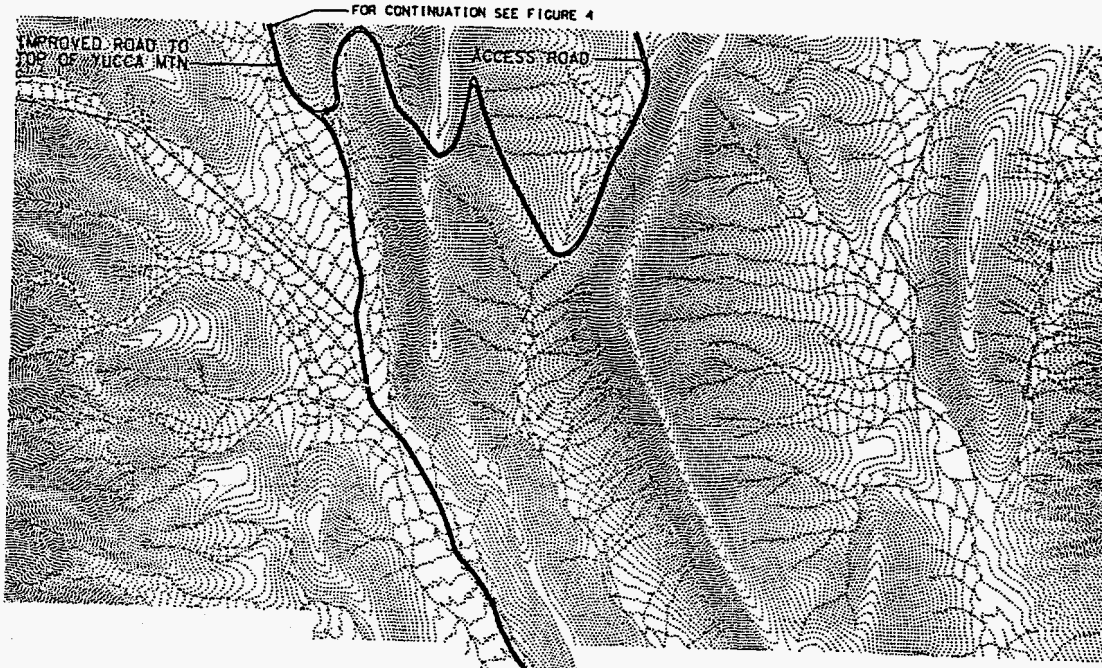
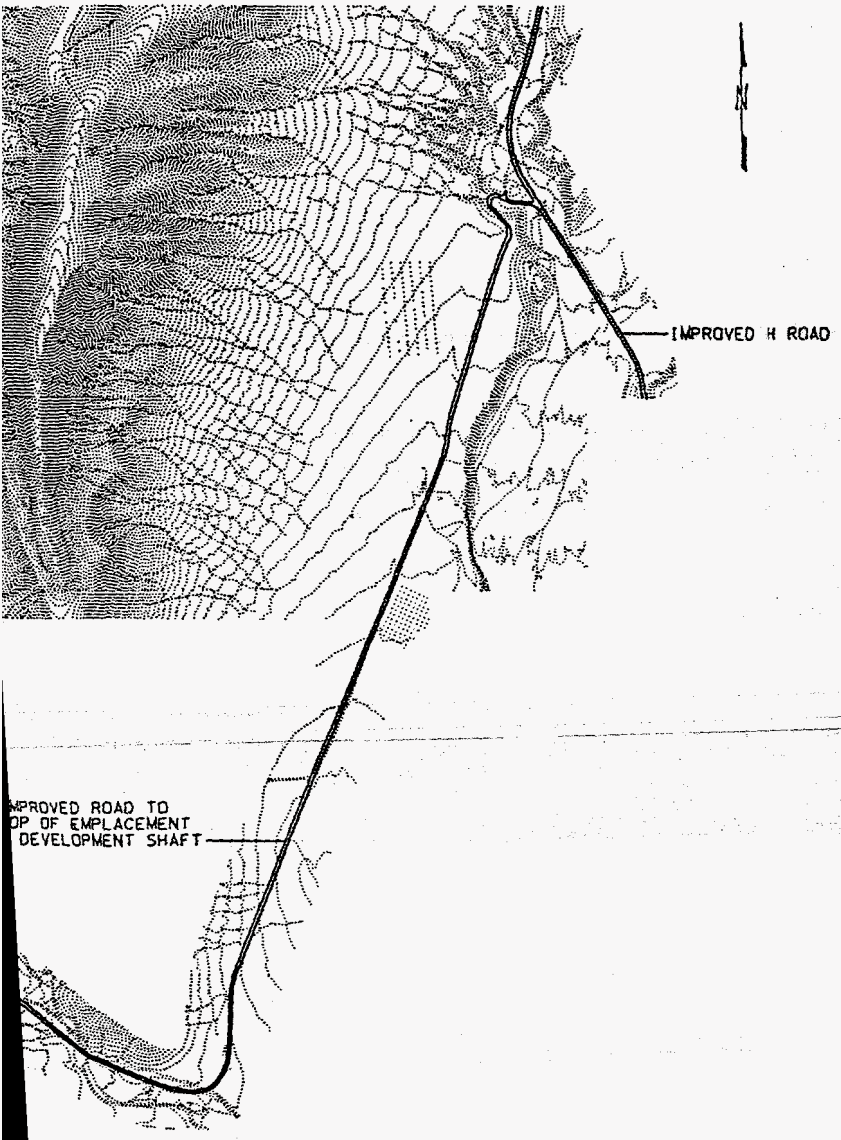


FIGURE 4
REPOSITORY
OVERALL SITE PLAN


FOR CONTINUATION SEE FIGURE 4
IMPROVED ROAD TO
TOP OF YUCCA MTN
ACCESS ROAD



NOTES:

1. FOR CIVIL ABBREVIATIONS SEE DRAWING 20005 REV 02 (REF 5.19)
2. FOR CIVIL GENERAL NOTES, LEGEND AND SYMBOLS SEE DRAWING 20006 REV 02 (REF 5.20)
3. FOR OTHER DRAWINGS SEE FIGURE 1.
4. THIS FIGURE DEPICTS PRELIMINARY DESIGN AND IS PRESENTED FOR INFORMATION ONLY. THE INFORMATION IS NOT INTENDED FOR PROCUREMENT, FABRICATION, OR CONSTRUCTION

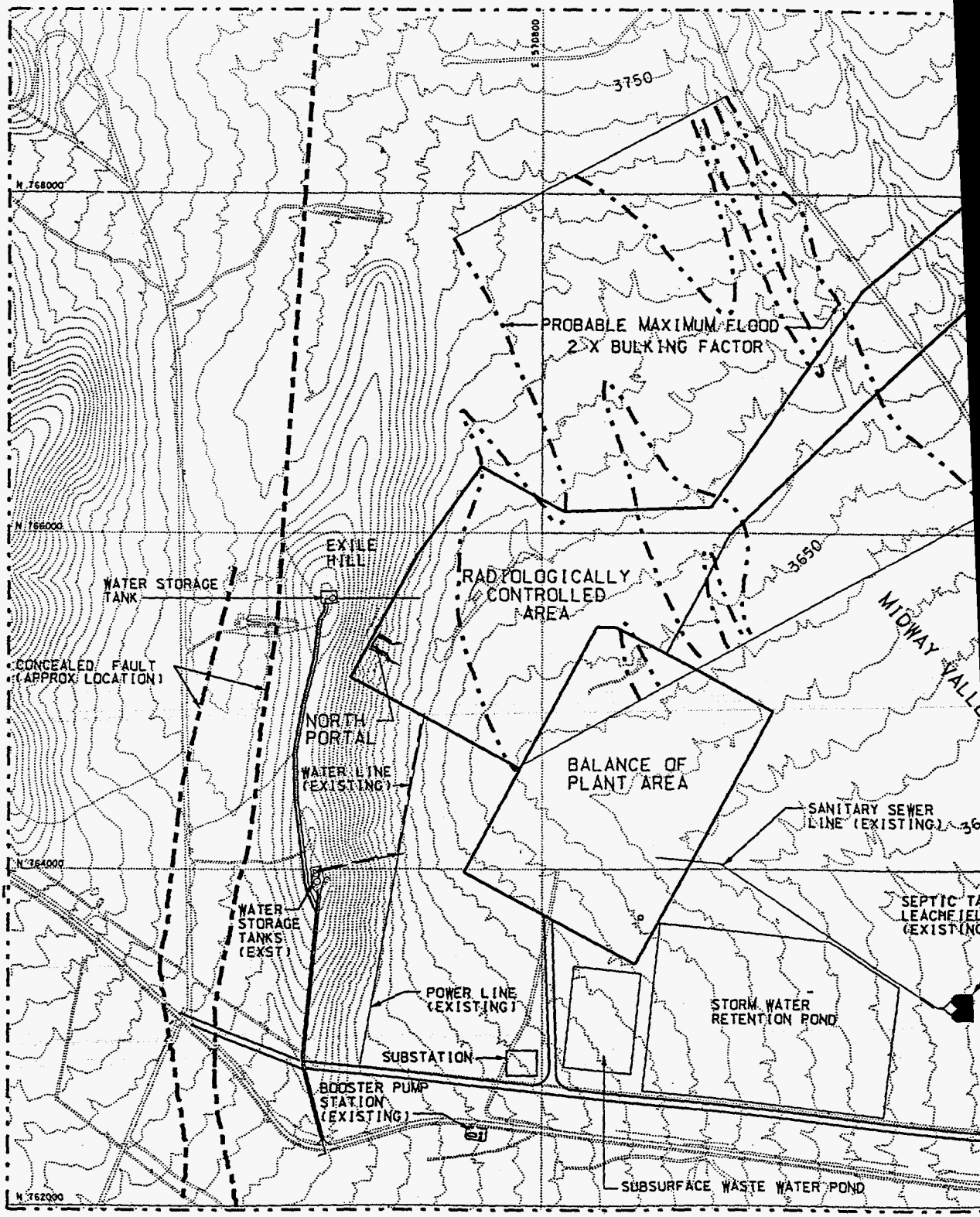
GRAPHIC SCALE

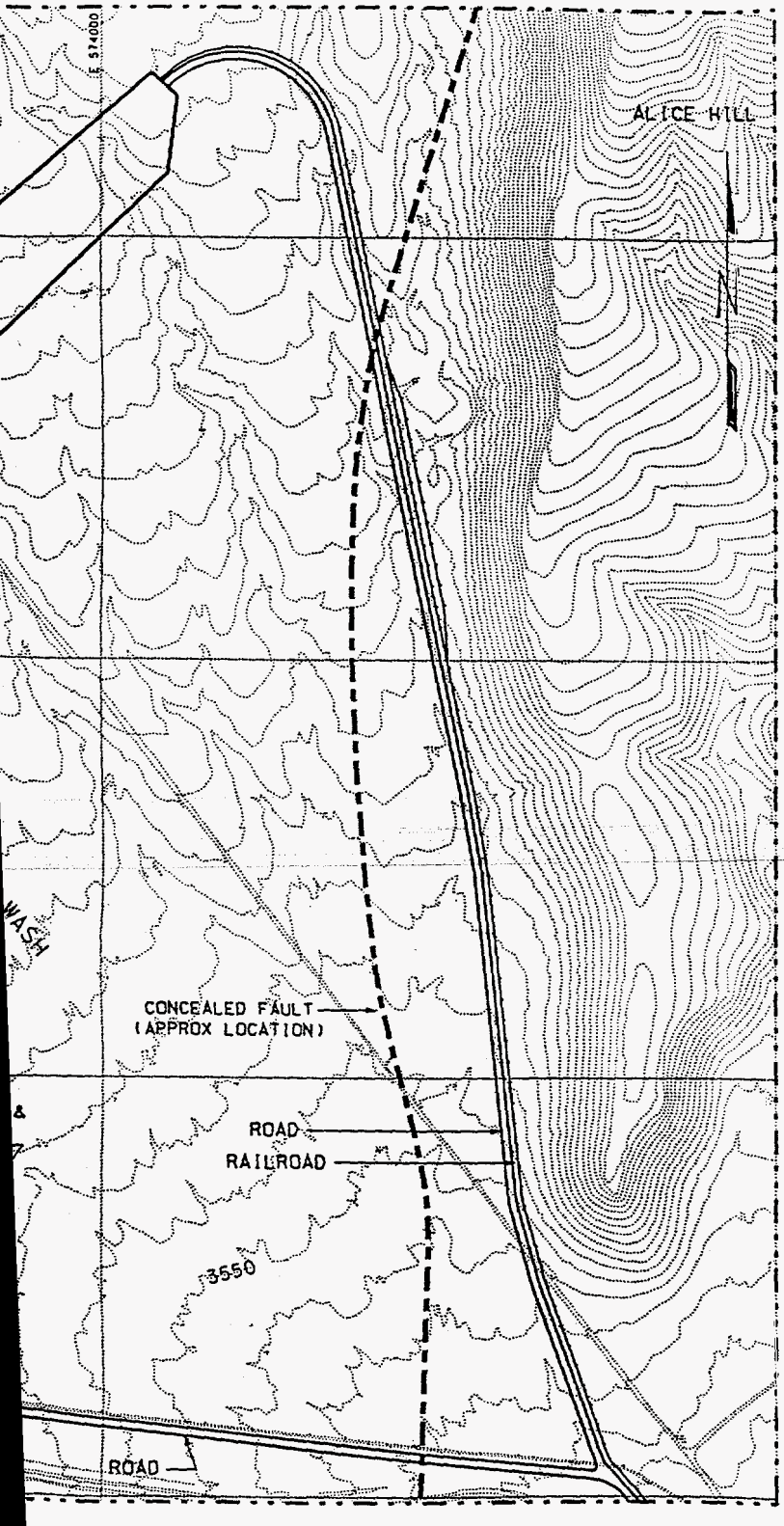
0 450 900 1800 3600 FEET

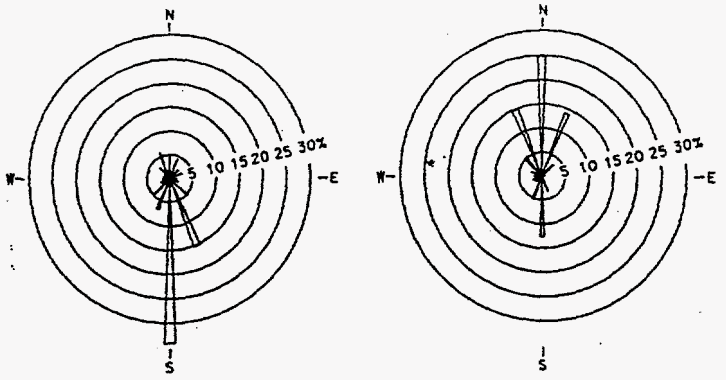
1" = 900'

FIGURE 5
REPOSITORY
SHAFT ACCESS ROAD

squert t:\eng\civil\


E 510800
3750
N 768000
PROBABLE MAXIMUM FLOOD
2 X BULKING FACTOR
N 766000
EXILE
HILL
WATER STORAGE
TANK
RADIOLOGICALLY
CONTROLLED
AREA
3650
MIDWAY VALL
CONCEALED FAULT
(APPROX LOCATION)
NORTH
PORTAL
WATER LINE
(EXISTING)
BALANCE OF
PLANT AREA
SANITARY SEWER
LINE (EXISTING)
N 764000
WATER
STORAGE
TANKS
(EXST)
SEPTIC TA
LEACHFIEL
(EXISTING
POWER LINE
(EXISTING)
STORM WATER
RETENTION POND
SUBSTATION
BOOSTER PUMP
STATION
(EXISTING)
SUBSURFACE WASTE WATER POND
N 762000





WINDROSE AT THE NORTH PORTAL SITE

NOTES:

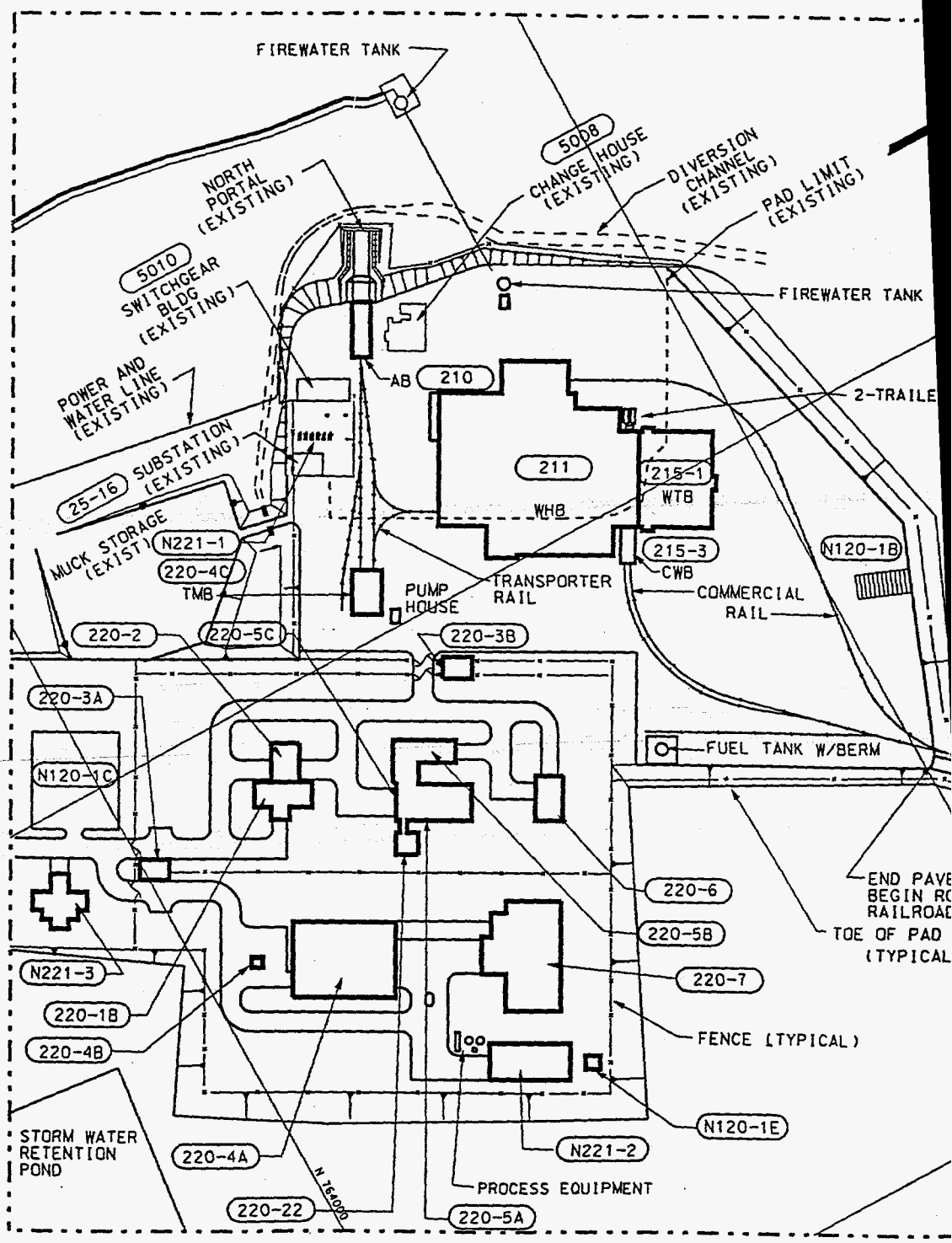
1. WIND ROSE WAS EXTRACTED FROM METEROLOLOGICAL MONITORING PROGRAM. SUMMARY REPORT. JANUARY 1994 THROUGH DECEMBER 1994. YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT. DOCUMENT IDENTIFIER BA0000000-01717-5700-00001.
2. CONCEALED FAULTS WERE EXTRACTED FROM SCOTT.R.B. AND J. BONK. PRELIMINARY GEOLOGIC MAP OF YUCCA MOUNTAIN WITH GEOLOGIC SECTIONS. NYE COUNTY. NEVADA. U.S. GEOLOGICAL SURVEY OPEN-FILE REPORT 84-494. 1984 (REF 5.21)
3. PROBABLE MAXIMUM FLOOD WAS EXTRACTED FROM TECHNICAL BASIS REPORT FOR SURFACE CHARACTERISTICS PRECLOSURE. HYDROLOGY. AND EROSION. U.S. DERARTMENT OF ENERGY. YMP/TBR-0001. REFERENCE 5.14.
4. FOR CIVIL ABBREVIATIONS SEE DRAWING BA8000000-01717-2100-20005 REV 02 (REF.5.19)
5. FOR CIVIL LEGEND AND SYMBOLS SEE DRAWING BA8000000-01717-2100-20006 REV 02 (REF.5.20)
6. FOR OTHER FIGURES SEE FIGURE 1.
7. THIS FIGURE DEPICTS PRELIMINARY DESIGN AND IS PRESENTED FOR INFORMATION ONLY. THE INFORMATION IS NOT INTENDED FOR PROCUREMENT. FABRICATION. OR CONSTRUCTION.

GRAPHIC SCALE

0 200 400 800 1200 FEET

1" = 400'

FIGURE 6
NORTH PORTAL REPOSITORY
SURFACE OVERVIEW



NOTES:

1. FOR CIVIL ABBREV
   REV 02 (REF 5.19
2. FOR CIVIL GENERA
   SEE DRAWING 2000
3. FOR OTHER FIGURE
4. THIS FIGURE DEPI
   DESIGN AND IS PR
   ONLY. THE INFORM
   PROCUREMENT. FAB

RADIOLOGICALLY CONTROLLED AREA FACILITIES

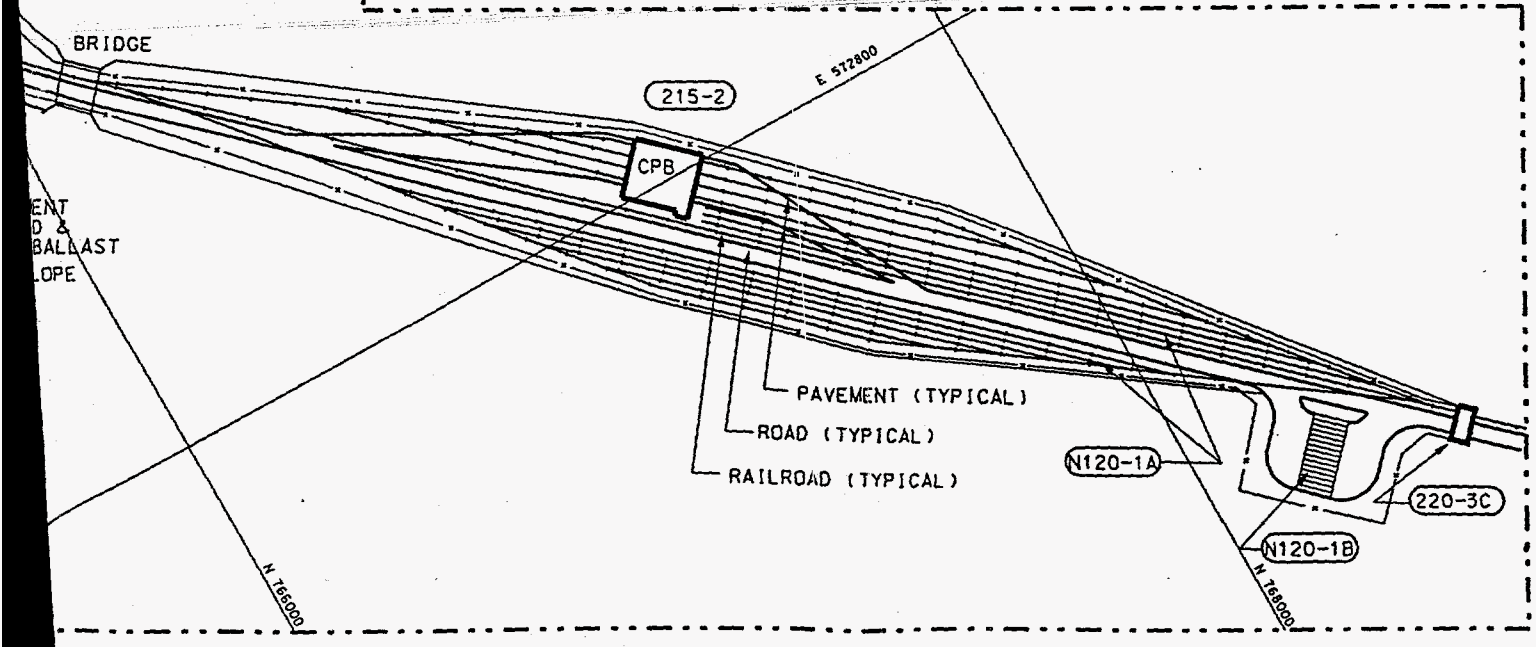
210	AIRLOCK BLDG (AB)
211	WASTE HANDLING BUILDING (WHB)
215-1	WASTE TREATMENT BUILDING (WTB)
215-2	CARRIER PREPARATION BLDG (CPB)
215-3	CARRIER WASHDOWN BLDG (CWB)
220-4C	TRANSPORTER MAINTENANCE BUILDING (TMB)
N120-1A	RAIL PARKING
N120-1B	TRUCK PARKING
N221-1	STANDBY GENERATORS
25-16	SUBSTATION (EXISTING)
5008	CHANGE HOUSE (EXISTING)
5010	SWITCHGEAR BUILDING (EXISTING)

BALANCE OF PLANT AREA FACILITIES

220-3A	SECURITY STATION 1 (MAIN BOP PORTAL)
220-3B	SECURITY STATION 2 (RCA/BOP PORTAL)
220-3C	SECURITY STATION 3 (RCA TRUCK/RAIL PORTAL)
220-5A	ADMINISTRATION BUILDING
220-5B	FOOD SERVICE FACILITY
220-5C	TRAINING AUDITORIUM
220-1B	MEDICAL CENTER
220-2	FIRE STATION
220-22	COMPUTER CENTER
220-7	CENTRAL WAREHOUSE
220-4A	CENTRAL SHOPS
220-4B	MOTOR POOL AND FACILITY SERVICE STATION
220-6	MOCKUP BUILDING
N120-1E	COOLING TOWER
N221-2	UTILITY BUILDING

SITE SERVICE FACILITIES

N120-1C GENERAL PARKING
N221-3 VISITOR CENTER

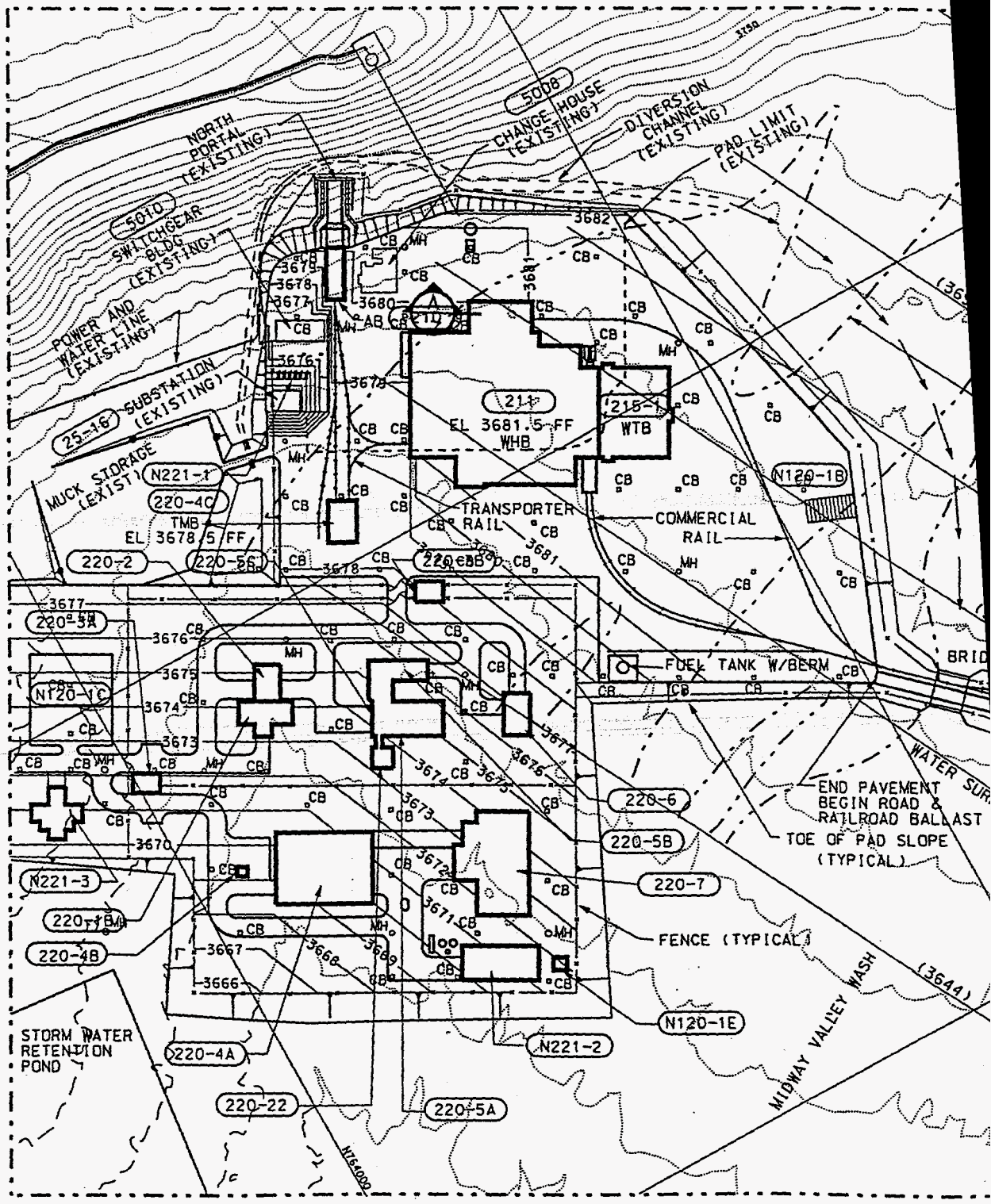


GRAPHIC SCALE
0 100 200 400 600 FEET
1" = 200'

IONS SEE DRAWING 20005

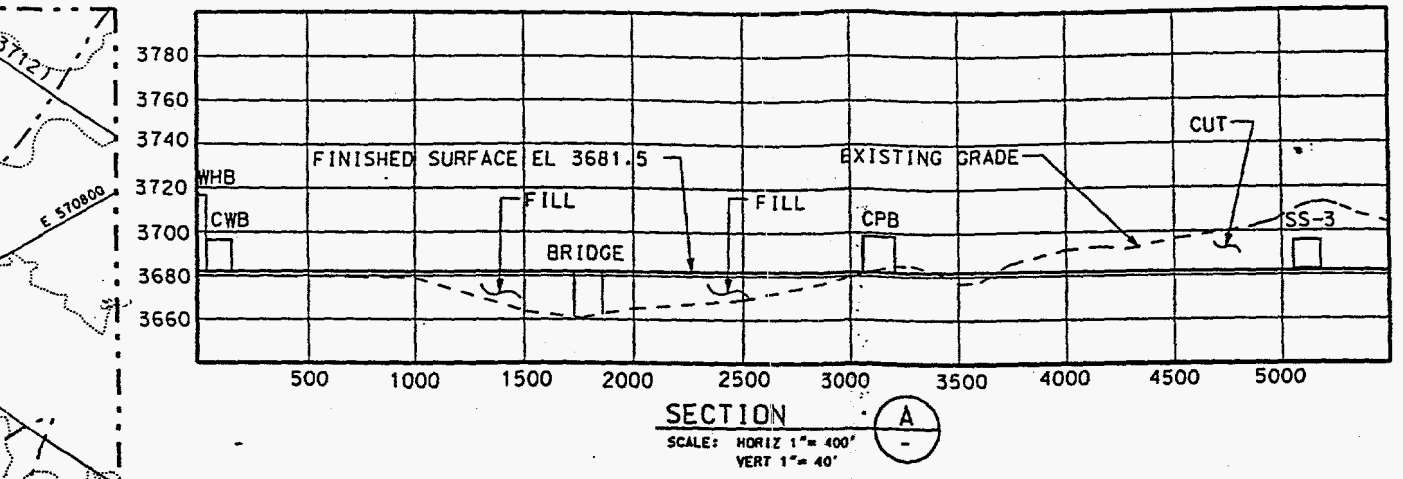
OTES. LEGEND AND SYMBOLS
V 02 (REF 5.20)
E FIGURE 1.
PRELIMINARY
TED FOR INFORMATION
N IS NOT INTENDED FOR
TION. OR CONSTRUCTION

FIGURE 7
NORTH PORTAL REPOSITORY AREA SITE PLAN



NOTES:

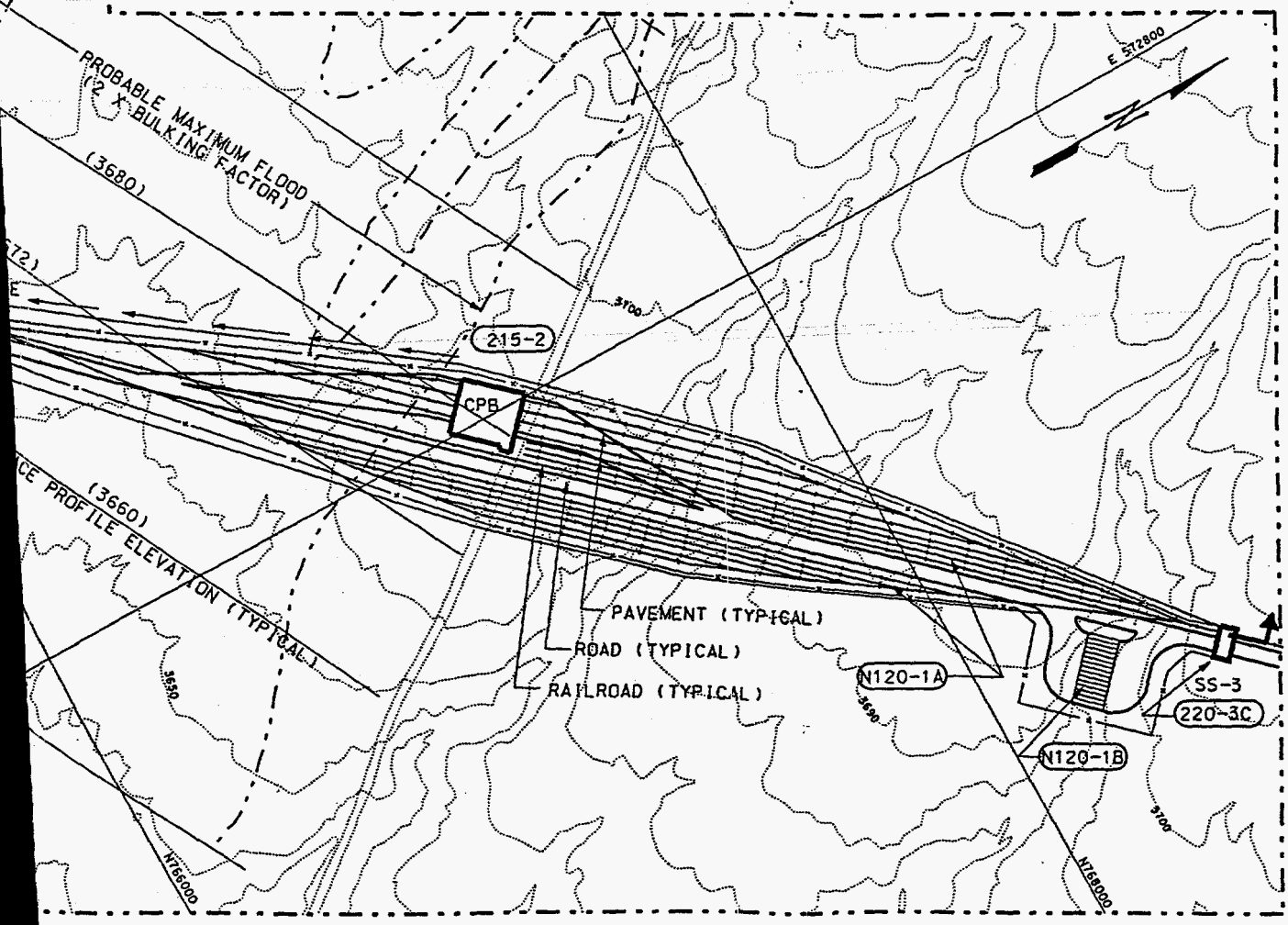
1. FOR CIVIL ABBREVIATIONS SEE DRAWING 20005 REV 02 (REF 5.19)
2. FOR CIVIL GENERAL NOTES, LEGEND AND SYMBOLS SEE DRAWING 20006 F
3. FOR OTHER FIGURES SEE FIGURE 1
4. THIS FIGURE DEPICTS PRELIMINARY DESIGN AND IS PRESENTED FOR IN THE INFORMATION IS NOT INTENDED FOR PROCUREMENT, FABRICATION OR



SECTION A

SCALE: HORIZ 1"= 400'
VERT 1"= 40'

NOTE: SECTION FOLLOWS RAIL FROM WHB THRU CWB PAST CPB TO SS-3



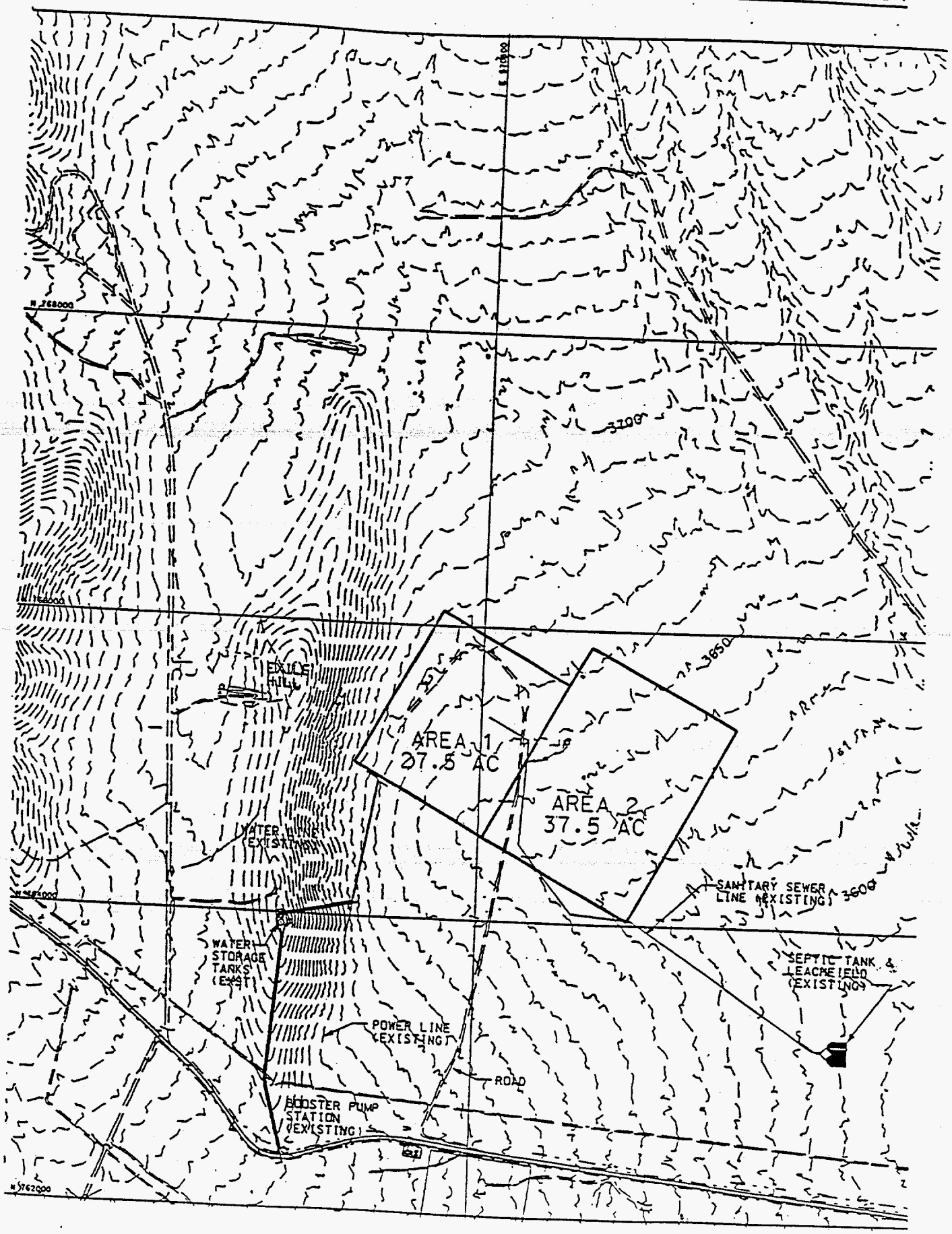
PLAN
1"=200'

GRAPHIC SCALE
0 100 200 400 600 FEET
1"=200'

02 (REF 5.20)

MATION ONLY
CUREMENT

FIGURE 8
NORTH PORTAL REPOSITORY
GRADING PLAN AND SECTION



REPOSITORY NORTH PORTAL SURFACE FACILITIES
APPROXIMATE SIZE OF THE WATER SHEDS

Title: Repository Surface Design Site Layout Analysis

Worksheet 2: Runoff curve number and runoff

Project BALANCE OF PLANT AREA By HRM Date 7/21/97

Location REPOSITORY NORTH PORTAL FACILITIES Checked MSL Date 8/29/97

Circle one: Present (Developed)

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☑ acres ☐ mi² ☐ %	Product of CN x area
GROUP D	IMPERVIOUS AREAS: PAVED PARKING LOTS, ROOFS, DRIVEWAYS, ETC.	98			37.5	3675
1/ Use only one CN source per line.		Totals =			37.5	3675

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{3675}{37.5} = 98$; Use CN = 98

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr	25	50	100
Rainfall, P (24-hour) ..... in	2.1	2.3	2.6 (REF. 4.4.2)
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	1.9	2.07	2.4

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project BALANCE OF PLANT AREA By HRM Date 7/21/97

Location REPOSITORY NORTH PORTAL FACILITIES Checked NSL Date 8/29/97

Circle one: Present (Developed)

Circle one: T_c T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID			
1. Surface description (table 3-1)		SMOOTH			
2. Manning's roughness coeff., n (table 3-1) ..		0.011			
3. Flow length, L (total L ≤ 300 ft)	ft				
4. Two-yr 24-hr rainfall, P_2	in				
5. Land slope, s	ft/ft				
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+		=
Shallow concentrated flow		Segment ID			
7. Surface description (paved or unpaved)		PAVED			
8. Flow length, L	ft	900			
9. Watercourse slope, s	ft/ft	0.02			
10. Average velocity, V (figure 3-1)	ft/s	2.5			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.10	+		= 0.10
Channel flow		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s				
18. Flow length, L	ft				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr				0.10

Worksheet 4: Graphical Peak Discharge method

Project BALANCE OF PLANT AREA By HRM Date 7/21/97

Location REPOSITORY NORTH PORTAL FACILITIES Checked MSR Date 8/29/97

Circle one: Present (Developed)

1. Data:

   Drainage area ..... A_m = 0.06 mi^2 (acres/640)

   Runoff curve number .... CN = 98 (From worksheet 2)

   Time of concentration .. T_c = 0.10 hr (From worksheet 3)

   Rainfall distribution type = II (I, IA, II, III)

   Pond and swamp areas spread throughout watershed ..... = _____ percent of A_m (____ acres or mi^2 covered)

			Storm #1	Storm #2	Storm #3	
2.	Frequency	yr	25	50	100	
3.	Rainfall, P (24-hour)	in	2.1	2.3	2.6	(REF. 4.4.2)
4.	Initial abstraction, I_a ..... (Use CN with table 4-1.)	in	0.041	0.041	0.041	
5.	Compute I_a/P		0.02	0.02	0.02	
6.	Unit peak discharge, q_u ..... (Use T_c and I_a/P with exhibit 4-II)	csm/in	1000	1000	1000	
7.	Runoff, Q ..... (From worksheet 2).	in	1.9	2.07	2.4	
8.	Pond and swamp adjustment factor, F_p .... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.0	1.0	1.0	
9.	Peak discharge, q_p ..... (Where $q_p = q_u A_m Q F_p$)	cfs	114	124	144	

SITE PARKING CAPACITY FOR RAIL AND TRUCK CARRIERS

1. PURPOSE

This attachment establishes the minimum parking capacity for truck and rail equipment within the Radiologically Controlled Area (RCA). Parking areas are sized to provide buffer staging between the waste receipt gate and the Carrier Preparation Building (CPB) and between the CPB and the Waste Handling Building (WHB). Each parking area was sized as described below based on Assumptions 4.3.1.10 and 4.3.1.11.

2. RECEIPT RAIL PARKING

Receipt rail parking is sized to accommodate two days of incoming and outgoing rail carriers, and one-half of the rail carriers and all the locomotives arriving at the repository in two weeks. The other half of the carriers are staged in the WHB Rail Parking Area based on the *Waste Quantity, Mix, and Throughput Study Report* (Reference 5.26). The calculations are based on the peak annual carrier and locomotive rates and are as follows:

A. Receipt Rail Parking
- = quantity of locomotive and rail carrier parking provided between Security Station 3 and the CPB
- = (2 days * Annual Rail Carriers Processed / 365 days/yr) + (2 weeks * (Annual Rail Carriers Received / 2 rail parking areas + Annual Rail site prime movers (SPMs) Received) / 52 weeks/yr)
- = (2 days * 3,046 carriers / 365 days/yr) + (2 weeks * (1,523 carriers / 2 rail parking areas + 609 locomotives) / 52 weeks/yr)
- = 69 rail carrier/locomotive staging locations
- = Provide 75 rail carrier/locomotive staging locations

B. Annual Rail Carriers Received
- = 581 loaded casks + 411 empty dual-purpose canister (DPC) overpacks + 531 new empty disposal containers (DCs)
- = 1,523 rail carriers received

C. Annual Rail Carriers Processed
- = 581 loaded casks + 411 empty DPC overpacks + 531 new empty DCs + 581 empty casks + 411 overpacked DPCs + 531 DC carriers
- = 3,046 rail carriers processed
- = 1,523 rail carriers shipped

D. Annual Rail SPMs Received
- = Annual Rail Carriers Received * (2 locomotives/5 carriers)
- = 1,523 rail carriers * (2 locomotives/5 carriers)
- = 609 locomotives

SITE PARKING CAPACITY FOR RAIL AND TRUCK CARRIERS

3. RECEIPT TRUCK PARKING

Receipt truck parking is sized to accommodate two days of incoming and outgoing truck carriers (i.e., trailers), half of the truck carriers and all the truck tractors arriving at the repository in two weeks, and half of the site prime movers, which are designed to haul either truck or rail carriers. The other half of the carriers received in two weeks are staged in the WHB Truck Parking Area. The calculations are based on the peak annual carrier and tractor rates and are as follows:

A. Receipt Truck Parking
   = quantity of tractor and trailer (i.e. truck carrier) parking provided between Security Station 3 and the CPB
   = (2 days * Annual Truck Carrier Processed / 365 days/yr) + (2 weeks * (Annual Truck Carriers Received / 2 truck parking areas + Annual Truck SPMs Received) / 52 weeks/yr) + (Number of SPMs staged / 2)
   = (2 days * 478 carriers / 365 days/yr) + (2 weeks * (239 carriers / 2 truck parking areas + 239 tractors) / 52 weeks/yr) + (5 SPMs / 2)
   = 19 truck, tractor/trailer staging locations
   = Provide 20 truck tractor/trailer staging locations

B. Annual Truck Carriers Received
   = 239 loaded casks

C. Annual Truck Carriers Processed
   = 239 loaded casks + 239 empty casks
   = 478 truck carriers processed

D. Annual truck SPMs Required
   = Annual Truck Carriers Received
   = 239 tractors

4. WHB RAIL PARKING

WHB rail parking is sized to accommodate two days of incoming and outgoing waste-cask rail carriers, half of the rail carriers arriving at the repository in two weeks, and the maximum number empty carriers waiting for the empty DPCs and rail casks being processed in the WHB. The calculations are based on the peak annual carrier rates and are as follows:

SITE PARKING CAPACITY FOR RAIL AND TRUCK CARRIERS

A. WHB Rail Parking
= quantity of rail carrier parking provided between the CPB and WHB
= (2 days * Annual Rail Carrier Processed / 365 days/yr) + (2 weeks * Annual Rail Carriers Received / 2 rail parking areas / 52 weeks/yr) + Empty Carriers for casks and DPCs being processed in the WHB
= (2 days * 1,162 carriers / 365 days/yr) + (2 weeks * 1,523 carriers / 2 rail parking areas) / 52 weeks/yr) + 8 empty carriers
= 44 rail carrier staging locations
= Provide 50 rail carrier staging locations

B. Annual Rail Carriers Received
= 1,523 rail carriers received

C. Annual Rail Carriers Processed (waste carriers only)
= 581 loaded casks + 581 empty casks
= 1,162 rail carriers processed

D. Empty Carriers for casks and DPCs being processed in the WHB
= 5 cask carriers [1 per transfer line] and 3 DPC carriers [1 per Assembly Transfer Line]
= 8 carriers

5. WHB TRUCK PARKING

WHB truck parking was sized to accommodate two days of incoming and outgoing waste-cask truck carriers, half of the truck carriers arriving at the repository in two weeks, and half of the on-site prime movers (OPMs). The calculations are based on the peak annual carrier and tractor rates and are as follows:

A. WHB Truck Parking
= quantity of truck carrier parking provided between the CPB and WHB
= (2 days * Annual Truck Carriers Processed / 365 days/yr) + (2 weeks * Annual Truck Carriers Received / 2 truck parking areas / 52 weeks/yr) + Empty Carriers for truck casks being processed in the WHB + (Number of OPMs staged / 2)
= (2 days * 478 carriers / 365 days/yr) + (2 weeks * (239 carriers / 2 rail parking areas) / 52 weeks/yr) + 3 empty carriers + (5 OPMs / 2)
= 13 truck carrier staging locations
= Provide 15 truck carrier staging locations

B. Annual Truck Carriers Received
= 239 truck carriers received

SITE PARKING CAPACITY FOR RAIL AND TRUCK CARRIERS

C. Annual Truck Carriers Processed (waste carriers only)
= 239 loaded casks + 239 empty casks
= 478 truck carriers processed

D. Empty Carriers for casks and DPCs being processed in the WHB
= 3 truck cask carriers [1 per Assembly Transfer Line]

6. SUMMARY

The RCA area in the North Portal Operations Area should provide parking for rail and truck equipment as shown below:

A. Receipt Rail Parking - rail sidings for locomotive and rail carrier parking between Security Station 3 and the CPB - 75 spaces

B. Receipt Truck Parking - parking spaces for truck tractors and trailers between Security Station 3 and the CPB - 20 spaces

C. WHB Rail Parking - rail sidings for rail carrier staging between the CPB and WHB - 50 spaces

D. WHB Truck Parking - parking spaces for truck tractors and trailers between the CPB and WHB - 15 spaces

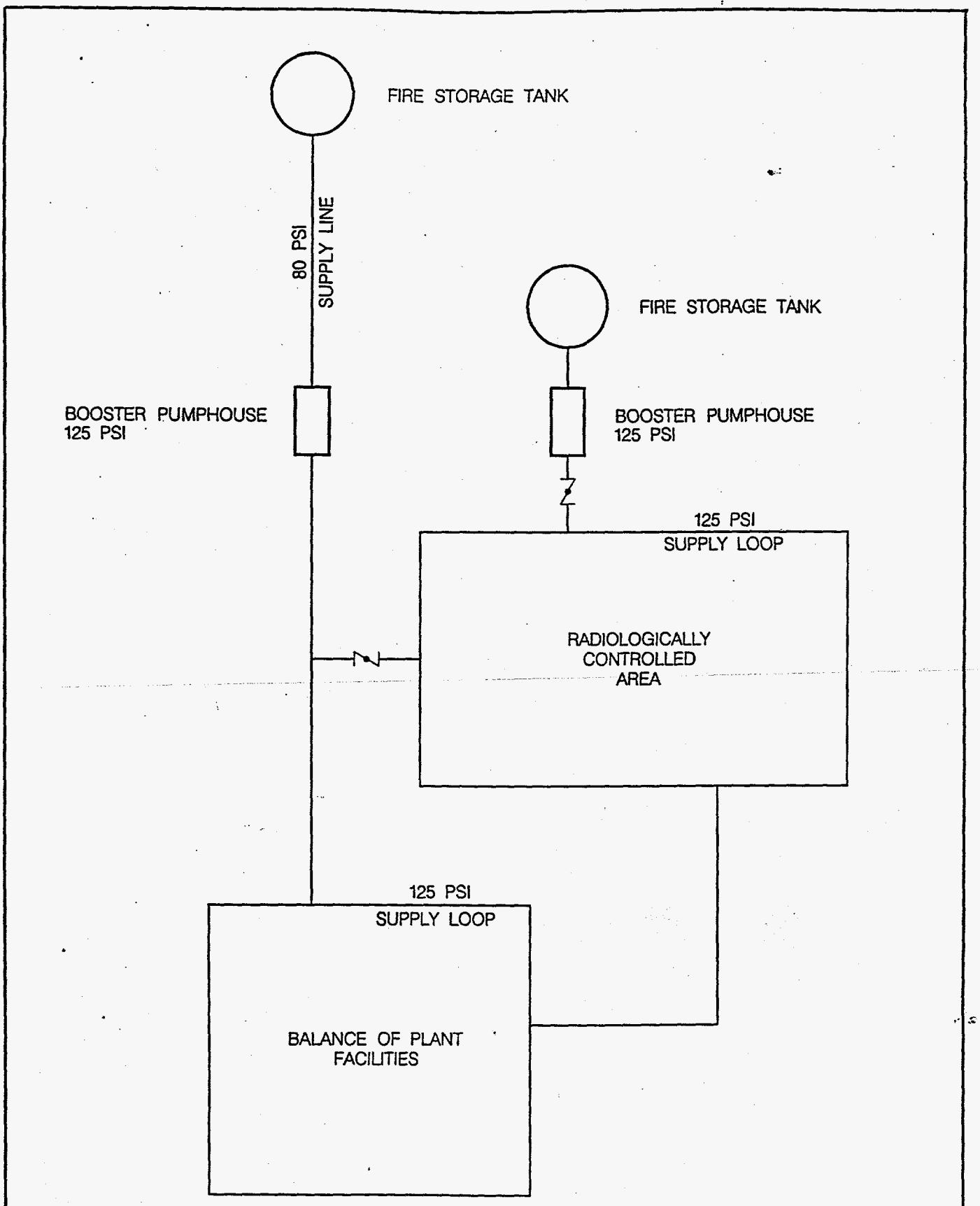


Figure 1
FIRE WATER SYSTEM FOR NORTH PORTAL OPERATIONS