# PROJECT REPORT COVER SHEET



**PROJECT REPORT TITLE:** CHEROKEE NUCLEAR STATION FINAL FOUNDATION GEOLOGIC MAP RECORD

**PROJECT NAME:** Duke Energy William States Lee III Nuclear Station COL Project

**PROJECT NO:** 2093

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**Approved by:** Michael Gray FCL Project Manager **Date:** December 6, 2011

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## Project Report Revision Status

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| 2 | 12/06/2011 | Revised document to address administrative and editorial revisions in Subsection 5.2.4 and corrected x-coordinates in Figure 14. Subsection 5.2.5 is added to include descriptions of detailed CNS geologic evaluations for an area described as Zone 6. New reference for ENERCON HRQ-007 added. | |

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**PROJECT NAME: Duke Energy William States Lee III Nuclear Station**

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| Item | Parameter | Yes | No | N/A |
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| 1 | Purpose is clearly stated and Report satisfies the Purpose. | X | | |
| 2 | Methodology is appropriate and properly applied. | X | | |
| 3 | Assumptions are reasonable, adequately described, and based upon sound geotechnical principles and practices. | | | X |
| 4 | Input was authorized and correctly incorporated into the Report. | X | | |
| 5 | Software is properly identified and applied; and validation is referenced, or included, and acceptable. | X | | |
| 6 | Detailed Discussion is complete, accurate, and leads logically to Results and Conclusions. | X | | |
| 7 | Results and Conclusions are accurate, acceptable, and reasonable compared to Input and Assumptions. | X | | |
| 8 | References are valid for intended use. | X | | |
| 9 | Appendices are complete, accurate, and support text. | X | | |

**Comments: (use additional pages as necessary)**

**None**

**Verifier:** R.J. Cumbest

**Randy Cumbest, Ph.D. FCL**

**December 2, 2011**

**(Date)**

## List of Acronyms

| | |
|---|---|
| **ASME** | American Society of Mechanical Engineers |
| **CNS** | Cherokee Nuclear Station Project (Duke Power Company Project 81) |
| **COLA** | Combined Operating License Application |
| **FCL** | Fugro Consultants Incorporated |
| **HRQ** | Historic Records Qualification |
| **LETCo** | Law Engineering and Testing Company |
| **PSAR** | Preliminary Safety Analysis Report |
| **SB** | Service Building |
| **WLS** | William States Lee III Nuclear Station Project |

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## 1.0 INTRODUCTION

This report documents the procedures and methodologies used to develop the Cherokee Nuclear Station (CNS) final foundation map record. The CNS foundation level geologic maps maintained by the Lead Geologist and received from Duke Energy (formerly Duke Power Company) were reproduced digitally, since the CNS as-built final foundation geologic map record was not completed before project cancelation. The CNS geologic field maps used to develop the CNS geologic map record were qualified for use as inputs using a project specific record qualification procedure. This report was prepared in accordance with Fugro Consultant's Inc. (FCL) Quality Assurance Procedure (QAP) 03B (FCL, 2011), and project approved Project Planning Document (PPD) (FCL, 2010a). Products from this report include approved final foundation map records which were to be completed during the CNS project.

Construction of CNS began in the late 1970's and the three CNS units were in various stages of completion when Duke Power Company cancelled the project in 1983. At the time of abandonment, the entire CNS Unit 1 foundation and portions of several structures were complete and, as a result, CNS concrete materials and debris obscure the foundation rock in these areas. At CNS Unit 2 much of the excavation was completed to foundation level, and at CNS Unit 3 the excavation was in progress but did not reach foundation level in most areas. The concrete foundation mat of the former CNS Unit 1 and Service Building, obscures observation of the foundation level geology beneath nearly all of the proposed WLS Unit 1.

The hand drawn CNS final foundation field map panels consist of sixty-two (62) 11-inch by 17-inch gridded clearprint paper panels. Each of these map panels document important geologic information (e.g., bedrock, fault, and structural features) that are now largely obscured by CNS Unit 1 foundations (CNS Unit 1 and Service Building area), which the proposed William States Lee III (WLS) Unit 1 power station structures will overlie. Additional CNS map coverage includes the Service Building area located west of CNS Unit 1, also obscured by concrete foundations, and portions of CNS Unit 2. These map panels document geologic conditions for the majority of the proposed WLS Unit 1 foundation. Detailed geologic mapping of unexcavated areas, including a small (approximately 530 square feet) area of the western most portion of Seismic Category I WLS Unit 1 nuclear island will be completed along with excavation mapping of WLS Unit 2.

A significant element of this report and documentation is the qualification of CNS foundation level geologic maps including the index map, selected geologic zone reports and associated petrographic thin section sample descriptions. These CNS geologic records were qualified for project use using a project specific records qualification procedure including evaluation by a Quality Review Team comprised of engineering and geologic professionals.

All electronic scans of the hand drawn field maps were georectified to restore the scanned images to their original orthogonal orientation. The georectified files were then digitized to create the individual map panels. To maintain consistency with prepared CNS maps, all line work and map symbols were emulated to the CNS mapping procedure and CNS developed map products. Digitized maps were reviewed and accepted using a project approved

procedure; this important process included the former CNS Lead Geologist. Once accepted, digitized map panels were compiled into seven (7) map sheets (Sheets 1 through 6, sheet dimensions 56-inch by 36-inch and Sheet 7, sheet dimensions 30-inch by 20-inch) documenting the extent of foundation level geologic mapping at former CNS Units 1 and 2, as well as the former CNS Service Building. These map sheets were then compiled into a single plate (Plate 1, dimensions 119-inch by 99-inch) that documents the completed foundation level geologic mapping for the CNS Units 1 and 2 powerhouses and the Service Building areas at the time of project cancellation. Selected CNS geologic zone reports and petrographic thin section sample descriptions with contemporary photomicrographs are used to make geologic assessments and determinations regarding tectonic capability of faults beneath safety-related structures at CNS. The zone reports and associated thin section analyses evaluated structural features and mineral relationships, including cross cutting relationships and timing of mineral formation to constrain the timing and age of faulting at the site.

The project report is presented in seven sections as summarized below:

- Section 1.0 Introduction presents the purpose and scope including summary results.
- Section 2.0 Methodology describes in detail the procedures developed to transform the CNS 11-inch by 17-inch field maps into a qualified digital map record. The section describes the Duke Power Company CNS mapping procedure and consultant team, CNS records qualification process developed using ASME NQA-1-2004, Subpart 3.3 (ASME, 2004), digital transformation process, map panel to sheet compilation process including quality assurance steps implemented during each project phase.
- Section 3.0, Assumptions presents the assumptions developed as part of this project report.
- Section 4.0 Inputs lists the various CNS and WLS inputs. Input files and records include CNS-geologic map documents, qualified historic data zone reports and various petrographic reports, correspondence, and WLS COLA-derived boring and map records.
- Section 5.0 Evaluation describes the corroboration and comparison processes used to demonstrate that the CNS final foundation geologic maps are acceptable for use to develop a CNS compiled final foundation level geologic map. This section provides a detailed evaluation of CNS geologic mapping procedures, and foundation geology. Distribution of lithologic features were compared to WLS COLA derived geologic mapping in the defined 'area of comparison' located in the northern portion of CNS Unit 2, which are used to corroborate the CNS foundation level geologic mapping. Comparison of CNS mapped geology to WLS borehole lithology is also performed for boreholes located within CNS Unit 1 structures. WLS shear plane orientation measurements are compared to CNS shear plane orientation measurements.
- Section 6.0 Results presents the results of the CNS Final Foundation Geologic Mapping based on corroboration with WLS COLA-derived data.
- Section 7.0 References lists the references cited in the project report.
- Section 8.0 presents the tables and figures described in this report

The compiled final foundation geologic map is provided as Plate 1 (CD-ROM). Project records and other supporting information are included as Appendices A through I to this report.

### 1.1 Summary of Results

The report concludes that the CNS final foundation geologic maps, including individual map panels and compiled map sheets, are suitable for safety related purposes to support ongoing WLS COLA evaluations. Evaluation of detailed final foundation maps along with detailed CNS geologic evaluations confirm that the foundation rock underlying Cherokee Units 1 and 2 exhibits no geologic features that are interpreted as capable tectonic features.

Some uncertainty surrounds the status of the CNS project mapping procedure (Appendix A) and its relation to the QA Program in effect during CNS mapping. The CNS mapping procedure described in this report may not represent the final approved procedure used for the project. The actual procedure issued through Duke Power Company Quality Assurance Program at the time the work was performed could not be located but a draft procedure was included in the historic documentation. The CNS Lead Geologist confirms that the geologic mapping procedure was applied during CNS mapping and met the requirements of Duke Power Company Quality Assurance Procedures at the time of mapping. To address this lack of complete documentation, the CNS foundation level geologic maps were confirmed using data corroboration methods. Additional confidence is gained through the involvement of personnel directly involved in the CNS construction program including Mr. Malcolm Schaeffer. Mr. Schaeffer served as Duke Power Company's Lead Geologist during CNS construction. In this role, he was directly responsible for the development and management of the CNS geologic mapping program. His project technical knowledge and key responsible position during CNS construction enhances the standing of the source documents. Working with Mr. Schaeffer was a group of expert consultants including Professors Donald Secor (University of South Carolina), Robert Hatcher (University of Tennessee), Henry Brown (North Carolina State University), and Robert Butler (University of North Carolina) who provided interim progress reviews and consultations to the Duke Power's CNS mapping program. It is also understood that the NRC conducted periodic independent reviews of Duke Power's geologic mapping activities.

Using corroboration and comparison methods, CNS construction derived geologic data and interpretations are independently confirmed using WLS COLA derived subsurface explorations and surface mapping, geologic data, and interpretations. This evaluation agrees with previous work performed (Enercon, 2007b) and validates the CNS Final Foundation geologic maps presented in this report. The compiled maps (Sheets 1 through 7) and Plate 1 document the final foundation geology for Duke Power Company's CNS Units 1 and 2, and therefore portions of the corresponding Duke Energy WLS Unit 1 to be constructed atop the CNS Unit 1 base slab. Evaluation of petrographic reports including thin section photomicrographs confirms site geochronological events described in FSAR Subsection 2.5.1.2.5.4 and RAI Response 02.05.01-046 (Duke Letter WLG2009.05-04, dated May 21, 2009 ( Adams ML091480603). These data indicate the site has not experienced tectonic deformation since the Mesozoic, and possibly not since 219 Ma to 300 Ma (Appendix I). Results presented in

this report conclude the CNS geologic maps satisfy the requirements of Regulatory Guide 1.132, Site Investigations for Foundations of Nuclear Power Plants, Rev. 2, October 2003.

## 2.0 METHODOLOGY

This section describes procedures used to transform CNS final foundation field map panels into CNS final foundation geologic map records. Presented in this section are the geologic mapping procedures (Appendix A) developed by Duke Power (now Duke Energy) that were used during CNS construction mapping to document final foundation geology. Also described in this section are the project specific procedures developed to qualify, digitize, and review the sixty-two (62) CNS map records (Table 1) which have been compiled into seven map sheets that cover former CNS Unit 1 (proposed WLS Unit 1), portions of Unit 2, and the Service Building (Figures 1, 2 and 3). The compiled final foundation geologic map is presented as Plate 1.

### 2.1 CNS Geologic Mapping Procedure

Excavation mapping procedures were developed specifically for construction of the CNS facility (Appendix A). These procedures outlined the responsibilities and assignments of team members, major plant structures to be mapped, technical requirements of the mapping program, and instructions for more detailed investigations if deemed necessary.

Key positions of the mapping program included a Geologist (Lead Geologist), Field Engineer, Consultant, and Independent Geologic Consultant. Mr. Malcolm Schaeffer was the Lead Geologist and worked closely with the assigned Field Engineer to coordinate geologic mapping activities with the construction activities. The Lead Geologist was responsible for all the geologic mapping activities including supervision of the mapping geologists. Mapping personnel included geologists from Duke Power Company and Law Engineering and Testing Company (LETCo) as described in Section 2.3. The Independent Geologic consultant, a third-party consultant with recognized expertise in the geology of the region, provided an independent review of fault features and supporting data.

Major CNS plant structures designated for geologic mapping included the following:

- Power Block Area (Reactor Building, Auxiliary Building and Turbine Building Complex)
- Nuclear Service Water Pond Dam Foundation
- Nuclear Service Water Spillway Control Section Foundation
- Nuclear Service Water Pump Structure Foundation

The sixty-two (62) map panels produced for this report record the geology in the CNS Power Block Area only, and are representative of the final foundation surfaces of former CNS Unit 1, Service Building, and portions of CNS Unit 2 (Figure 1).

The CNS Geologic Mapping Procedure (Appendix A) describes a two phased approach for excavation mapping of CNS foundations. Phase I consisted of "Top of Rock" Mapping at a 1:240 scale (1"=20'). Phase I included mapping of surfaces excavated with earth moving equipment only. Once hard rock was encountered, compressed air and water was used to clean the surface of loose material, the project grid coordinates were painted by a survey crew onto the foundation rock surface, and geology was mapped. According to the procedure, project grid coordinates were to be marked every 20-feet during Phase I mapping; however, during the mapping program it was determined that a 5-foot spacing between marked grid coordinates would be used. The CNS mapping described in this report is not based on the CNS Phase I (Top of Rock) mapping procedure.

Phase II (Figure 2) mapping consists of Final Excavation (Foundation) Mapping at 1:120 scale (1"=10'). As done in Phase I, prior to Phase II mapping the excavated surface (final grade) was cleaned and prepped including marking the project grid in 5-foot intervals (Figure 4). In addition to mapping general lithology, Phase II also included mapping and recording structural measurements of the following features:

- Contacts
- Foliations
- Joints
- Shears

The process described in the Geologic Mapping Procedure, state that approximately two measurements (e.g., geologic structure and associated data) of the above mentioned structures be recorded for every 10 square feet.

Section III of the Geologic Mapping Procedures describes methods for more detailed investigations for documenting fault features. Regional and site specific fault features were originally discovered and documented at Catawba Nuclear Station, located in the same geomorphic province, and during CNS PSAR investigations. When potential non-similar features were discovered during CNS Phase I excavation mapping, fault features were evaluated to determine similarities with those previously documented. Where similarity could be established and documented, excavation activities continued. Fault features (fault zones) that could not be determined initially as similar (non-similar), were subject to further investigation which included smaller scale (1"=5') mapping. Potential non-similar features required reports which consisted of the following:

- Description of feature
- Geologic history
- Summary and conclusions
- Report of findings by the Independent Geologic Consultant

Fault zones were documented as discovered and given a numeric designation; e.g. Zone 1, Zone 2, etc. These detailed evaluations determined that all documented fault zones were confirmed as similar.

## 2.2 Project Coordinate System

Layout of the CNS geologic mapping was keyed to a project specific plant coordinate grid system. The project grid origin is located at the centroid of the CNS Unit 2 reactor building (Figures 1 and 6); established as grid coordinates 100+00x and 100+00y. CNS plant coordinates are measured in feet and increase from west to east, x direction, and from south to north, y direction. During the CNS mapping program coordinates were marked at 5 foot intervals (100+00x to 100+05x). These coordinates were transcribed in the outer margins of the field Map Panels in 10 foot increments (100+00x to 100+10x). Coverage area of geologic maps of former CNS Units 1 and 2, and the Service Building, are between 93+00x/93+50y and 103+00x/102+50y, and between 91+50x/96+50y and 93+50x/97+50y, respectively (Plate 1).

## 2.3 CNS Final Foundation Geologic Mapping

Geologic mapping of CNS excavations was performed between 1977 and 1983 under the supervision of Duke Power Company's Lead Geologist Mr. Schaeffer. Mapping geologists, from both Duke Power Company and LETCo, included the field geologists listed below:

- Kenneth Bramblett (Duke Power Company)
- John Diehl (LETCo)
- Kip Hodges (Duke Power Company)
- Bruce Jernigan (LETCo)
- Daniel McLemore (LETCo)
- Baylus Morgan (Duke Power Company)
- Thomas Nichols (LETCo)
- Betsy Smith (LETCo)
- Allen Wolfe (LETCo)

The Lead Geologist was responsible for performing a detailed review of all mapping including individual foundation map panels, and releasing approved mapped areas to the Field Engineer.

Primary lithologic units mapped in CNS Unit 1 and 2 foundation excavation areas include Felsic and Mafic Gneiss. For the purpose of uniformity amongst different mappers at different locations, the classification of Felsic and Mafic Gneiss was used to cover multiple rock types with highly variable mineralogy and fabric. These rock types and their petrographic descriptions derived from PSAR evaluations are listed in Table 2C-2, Rock Classification,

Mineral Composition and Textural Aspects of Rock Samples from Cherokee and York Counties, South Carolina (Duke Power, 1974) (Appendix B). Other mapped geologic units include quartz veins and quartz bodies, and very minor amounts of calcite-epidote pods and aplite veins. Additional lithologic units mapped under the Service Building, located just west of CNS Unit 1 (Figure 1), foundation include: Felsic Schist, Intermediate Gneiss, and Quartzite. Additional features recorded on the field map panels included geologic structures, structural measurements, and joint mineral infilling. Detailed descriptions of these lithologic units, structures, and mineral infillings are discussed in Section 5, Evaluation.

## 2.4 Field Maps and Documentation

All final foundation geologic mapping was recorded on 11-inch by 17-inch gridded clearprint paper panels, described as field map panels (Appendix C). Each panel was referenced to the CNS plant grid coordinates which were located and marked by surveyors on the foundation surface and transcribed onto the outer margins of the graph paper, in both the X and Y coordinate directions (Figure 4). This resulted in a 10-inch by 15-inch area, of graph paper, to record lithology, structures, structural measurements, and mineral infilling. Geologic mapping of the prepared final foundation surface (Phase II) was hand drawn at 1:120 scale (1” = 10’), making a field map panel a 15,000 square foot representation of the CNS site. Some areas are only partially recorded on the map panels due to their location along the edge of an excavation (CNS Unit 1) or project cancellation (CNS Unit 2).

A total of sixty (60) field map panels were created for former CNS Units 1 and 2 (Figure 3) (Appendix C). Due to project cancellation, foundation excavation of CNS Unit 2 was never complete, and much of the associated field map panels were only partially complete. During excavation of the Service Building, two potentially non-similar fault zones (zones 15 and 16) were discovered. Final foundation geologic mapping of the Service Building was not a requirement of the PSAR or Geologic Mapping Procedures. However, to better characterize and understand these two zones, it was decided to perform Phase II level mapping of the Service Building foundation surface. Two field map panels, SB1 and SB2, (Appendix C) were produced for this investigation and are included as part of this project report. After the project was cancelled, the field map panels were maintained by the Lead Geologist and during WLS COLA investigations were transferred to the Duke Energy Document Management Center located at the Duke Energy McGuire Nuclear Station.

## 2.5 Duke Power Company Consultant Team

Duke Power Company personnel performed much of the original CNS work. The quality standards used during the CNS project were determined to conform to acceptable standards. The unpublished CNS maps that were used as inputs for this Project Report were confirmed as original project documents. A team of consultant expert geologists including Professors Robert Hatcher, University of Tennessee, Donald Secor, University of South Carolina, Robert Butler, University of North Carolina, and Henry Brown, North Carolina State University, provided interim progress reviews and consultations throughout the CNS construction program. Malcolm Schaeffer directed and assisted Charles E. Weaver to perform Scanning Electron

Microscope analyses of rock samples off-site. Professors Hatcher and Secor served as Duke Power's Independent Geologic Consultant, and Professors Butler and Brown served as consultants to Duke Power's Lead Geologist. It is also understood that the NRC conducted periodic independent reviews of Duke Power's geologic mapping activities. These NRC interactions are documented in historic correspondence presented in HRQ-FCL-003 (Appendix H).

## 2.6 CNS Records Qualification

### 2.6.1 Historic Records Qualification

The primary objective of the historic records qualification (HRQ) process was to confirm that records intended for use in supporting the Lee COLA meet the standard of reasonable assurance and are of a quality appropriate to satisfy 10CFR50 Appendix B requirements.

The goal of the qualification procedure was to determine whether the historic data were of sufficient quality to be used to support safety related evaluations for the Lee Nuclear Station COL application. T he qualification process is based on ASME NQA-1 (2004) and a description of the qualification procedure used is described below.

Map documents developed during CNS construction required detailed review and qualification before being used for safety related activities for the WLS COLA evaluations. The qualification of all sixty-two (62) field map panels (Table 1) was conducted by a panel of engineering and geologic professionals who comprised the Quality Review Team.

### 2.6.2 Records Qualification Procedure

**The project approved procedure allowed for qualification to be established though one or more of the following three methods:**

- Data Corroboration – Used in order to determine if subject matter data comparisons can be shown to substantiate or confirm parameter values. This method may include comparisons of the data to other sources of qualified data. Corroboration is acceptable for use if either sufficient corroborating data are available to permit statistical comparison with the unqualified data, or inferences can be clearly identified, justified, and documented between the corroborating data and the unqualified data.

- Confirmatory Testing – Used when tests can be designed and performed to establish the quality of existing or indeterminate data. Confirmatory testing may also be used when previous test results are not verifiable as a result of questionable testing methodology or a lack of applicable documentation. C onfirmatory test results should demonstrate direct correlation to previous test results, if feasible. Confirmatory testing is acceptable for use if similar tests are prescribed and if test result correlations or extrapolations are applicable.

- Peer Review – Used to independently evaluate data to determine if the employed methodology is acceptable, confidence is warranted in the data acquisition or developmental results, or the data have been used in a similar range of applications. Use of the peer review method should include an evaluation of the data acquisition and development approach, including test plans, to determine 1) the acceptability of the uncertainties associated with the employed data acquisition or development methodology, 2) the adequacy and appropriateness of the interpretations derived from the data, and 3) the extent to which the uncertainties affect the interpretations, conclusions and overall validity of the data. The quality review team will consist of personnel familiar with current industry practices for obtaining the type of documentation being verified and with its use in nuclear safety related evaluations and calculations. To the extent possible, personnel cognizant of the actual construction practices and procedures for the Cherokee plant will participate.

The qualification methodologies summarized above are in accordance with ASME NQA-1 (2004). Methods used in evaluations described in this report, Section 5.2, i ncluded data corroboration, peer review and confirmatory testing.

The qualification process was documented by the quality review team lead. The quality review team lead prepared and assembled the following records for approval by Duke Energy: Approved Data Verification Planning Form and a Data Verification Summary Form (Appendices E and H) that was signed by all quality review team members, copies of the data records that were the subject of the qualification evaluation, copies of pertinent records concerning any available procedures or documentation of data acquisition or development methodology or prior reviews of data, copies of the documentation used for corroboration, confirmatory testing records, and reference list (if applicable for other background information used). The quality review team members are listed below:

- James Cassidy (Duke Energy)
- Jerry Standridge (Duke Energy)
- John McConaghy (Duke Energy)
- Juan Vizcaya (ENERCON Service Inc.)
- Malcolm Schaeffer (HDR|DTA)
- Michael Gray (FCL, Team Lead)
- Adam Wade (FCL)
- Robert Turner (FCL)

2.6.3 Quality Review of CNS Final Foundation Map Records

All sixty-two (62) field map panels and the hand drawn index map created by the CNS Lead Geologist were reviewed using the project approved procedure. The Historic Records Qualification (HRQ) process for the hand drawn index map and sixty (60) CNS Unit 1 and 2

final foundation field maps, described in HRQ-FWLA-001 (FCL, 2010b), and the two (2) Service Building final foundation field map panels described in HRQ-FWLA-002 (FCL, 2010c) was performed by the project quality review team, in accordance with the project approved procedures listed below. In addition, select geologic zone reports, petrographic descriptions and historic NRC correspondence as described in HRQ-FCL-003 (FCL, 2011b) and contemporary photomicrographs of CNS-era thin section samples as described in HRQ-FCL-004 (FCL, 2011c) were qualified using the approved procedures listed below. The quality review team determined that CNS foundation map documents evaluated as part of HRQ-FWLA-001, HRQ-FWLA-002, HRQ-FCL-003 and HRQ-FCL-004 were acceptable inputs for nuclear safety related activities. These Cherokee-era documents were acceptable for use as inputs for completing the final foundation records for Units 1 and 2, which would therefore apply also to the portions of Lee Nuclear Station Unit 1 supported by the Cherokee Unit 1 foundation. Cherokee field map panels are used as inputs to complete the mapping activities that were begun during the Cherokee era, and to produce final foundation map records.

HRQ documentation is summarized below and with completed qualification documents included as Appendices E and H.

- HRQ-FWLA-001 - Cherokee Nuclear Station Final Foundation Geologic Maps and Index Map
    - Sixty (60) 11-inch by 17-inch hand drawn foundation level geologic maps at 1:120 scale (1”=10’) located at former CNS Units 1 and 2
    - One Index Map of all sixty foundation geologic maps and wall maps hand drawn over an earthwork and drainage map.

- HRQ-FWLA-002 – Cherokee Nuclear Station Service Building Final Foundation Geologic Maps
    - Two (2) 11-inch by 17-inch hand drawn foundation level geologic maps at 1:120 scale (1”=10’) located at former CNS Service Building

- HRQ-FCL-003 – CNS Geologic Zone Reports, Petrographic Descriptions and C.E. Weaver Report and Historic NRC Correspondence
    - CNS Geologic Reports on Zones 1-5 and 7-10
    - CNS Petrographic Descriptions for Zone 5 Samples CS4-1 to C-18-1
    - CNS Petrographic Descriptions for Zone 10 Samples C-31 to C44
    - CNS Petrographic Descriptions for Zone 14 Samples C-45 to C-49
    - Fine-Grained Material Report prepared by C.E. Weaver
    - Historic correspondence, including memoranda, between Duke Power representatives and the NRC

- HRQ-FCL-004 – CNS Petrographic Thin Section Sample Photomicrographs
    - Twelve (12) contemporary photomicrographs of CNS-era petrographic thin section samples.

### 2.7 Development of Digital CNS Final Foundation Maps

This section describes the process used to develop the digital map of the CNS hand drawn map panels that will serve as the final foundation level geologic map record documented during CNS construction. Each hand drawn final foundation geologic map panel (field map) was individually digitized using a three step process, which included georectification, digital drafting, and review. Additionally, the former CNS Lead Geologist conducted a site visit with digitized map panels and map sheets to confirm map features were portrayed accurately as they are observed at the former CNS plant.

#### 2.7.1 Georectification

Georectification is the process of registering an image relative to spatial coordinates. In this case, each field map panel was digitally restored to its original orthogonal configuration using GIS. The purpose of the georectification process was to eliminate/reduce distortions in field map panel scans. Distortions of the field map panels occur from weathering associated with the age of the mapping paper, as well as folding and stretching of the paper during scanning of the field map panels. Commercial software used in the georectification process include those described below:

- ArcGIS Desktop, Version 9.3.1
- ArcGIS 3D Analyst, Version 9.3.1
- ArcGIS Spatial Analyst Version 9.3.1

These commercial software tools are validated and approved for project use (WLA, 2009).

Steps used to transform CNS hand drawn field map panels to georectified (Appendix D) and digitized (Appendix F) map panels are described below and illustrated in Figure 7.

- Step 1: Locate original hand-drawn 11-inch by 17-inch clear print paper (field) map panel on CNS Index Map.
- Step 2: Create a high resolution (600 dpi) color scan of the field map panel (.tif file).
- Step 3: Define a coordinate (grid) system in geographic space, using ArcMap of the ArcGIS Desktop computer program, and referencing control points from grid locations on the .tif file image, to corresponding points in the defined geospace grid. For CNS Geologic Map Panels this coordinate system consisted of the original dimensions (11-inch by 17-inch) of the clear print paper. This process restores the map to its original orthogonal orientation, eliminating or substantially reducing map distortions, which results in improved map accuracy at the drafting (step 5) and compilation stages. Residual positional differences, or root mean square (RMS) error, are recorded to document the adjustment fit between the defined grid and the rectified image grid (Table 2). Maximum, minimum and mean values of the RMS error are 0.00103 ft, 0.00005 ft, and 0.00032 ft, respectively.
- Step 4: Transfer georectified .tif file for digitization.
- Step 5: Digitize the georectified map panel.

2.7.2 Digital Drafting

Inventory of the CNS final foundation geologic map panels lacked a complete legend to mapped features. Prior to the digitization of map panels, the explanation of mapped elements was created through review of CNS project documents including, the Lead Geologist's field notebook, Duke Power interim drafted CNS final foundation as-built maps and Nuclear Service Water Pond Dam and appurtenant structures record maps. Map legends for this project report are based on these three sources and are approved by the CNS Lead Geologist. Several previously unidentified lithologic units and mineral symbols were observed during digitization. These are properly identified during the review and approval process and are described in Table 3. Digitization of CNS Final Foundation Map Records was done using georectified scanned images of original hand drawn field map panels as described in the previous section. All information recorded on each field map panel was digitized including the plant coordinates, geologic and structural features, structural measurements, and joint mineral infilling symbols. In addition to the plant coordinates, digitized at the outer margins, an additional grid reference system common to all map panels was devised. This grid is labeled a through j on the horizontal axis and 1 through 15 on the vertical axis. This grid aided during the review process, discussed in Section 2.7.3 to identify map features by their grid cell location i.e. grid cell a-1 or j-9.

Each digitized map panel (Appendix F) is compiled into a map sheet (Appendix G). At the time of cancellation of the CNS mapping program, field map panels were in the process of being drafted and compiled. According to the CNS index map, twenty (20) compiled maps would cover CNS Units 1 through 3. For this report sixty-one (61) of the sixty-two (62) map panels have been compiled into seven (7) geologic map sheets (Appendix G). Map panel 46 records geology at the southern end of former CNS Unit 2, that was later remapped on map panel 54 during additional excavation. Map panel 46 has been digitized, and is included in Appendix F, but is not part of the compiled map sheets, since the recorded geology is superceded by map panel 54. Similarly, map panel 21, an inset map located within map panel 20, records geology in the northern area of CNS Unit 1 that was further excavated after initial foundation mapping. The compilation of these two map panels have been joined, with the geology of map panel 21 shown within the inset area of map panel 20. Former CNS Unit 1, Unit 2, and Service Building are comprised of Sheets 1 through 3, Sheets 4 though 6, and Sheet 7, respectively (Figure 3).

2.7.3 Quality Assurance Review and Approval

The project approved process was applied to each map panel and the seven compiled map sheets. The three tiers of the approved process consisted of FCL geologist preparers Adam Wade and Rob Turner, FCL geologist reviewer and Project Manager Michael Gray, and FCL consultant geologist approver Malcolm Schaeffer (HDR|DTA), who also served as former Duke Power Company Lead Geologist.

This same project approved process is also applied to derivative map products, including Map Sheets 1 through 7 (Appendix G) and the compiled map (Plate 1). The acceptor's (CNS Lead Geologist) role also includes important interpretation and resolutions of map features in order

to properly align map panels across the map sheet. This approach is commonly applied to final map records developed as part of data integration. Initials and dates of review, from reviewing personnel, are located on the bottom of each digitized map panel and map sheet.

2.7.4 Issues and Resolutions

During the drafting process, several features where observed as omitted, illegible, or undefined. These features include:

- Omitted or illegible structural measurements
- Omitted or incorrect structural symbols
- Multiple joint mineral infilling symbols for the same mineral type
- Unidentified lithologic units and mineral symbols
- Unidentified line work (extent of mapping, change in elevation, foliations)
- Undefined symbols and text (field notes)

The above mentioned features are a result of omission and errors which occurred during the mapping program, undocumented lithologic units, and poor quality scans of field map panels caused by the age and weathering of some original panels. These errors are common during field mapping, especially with multiple mapping personnel, and would have been corrected during the drafting phase of the CNS Final Foundation Geologic Mapping. During the review process these features were cataloged by map panel and grid cell location in the Issue and Resolution Log (Table 3). A few examples of these features will be discussed in this section; a complete listing of these issues and corresponding resolutions are summarized in Table 3. None of the errors observed in the digitizing and review process changed and/or altered any of the geologic interpretations.

Omitted or illegible structural measurements were verified by all personnel in the review process as unidentifiable. In the place of a structural measurement (e.g., strike/dip value) the letter “X” was used, and the structural symbol was drafted as observed on the field panel. The method was determined appropriate as the symbol provides the sense of the orientation of the structural feature in question. Examples include:

- Panel 20 CK10_01A
- Panel 22 CK10_02B

Omitted or incorrect structural symbols are believed to be omissions during mapping. These errors were only discovered in a few instances and only on four map panels, listed below:

- Panel 40 CK10_05B
- Panel 61 CK10_09B
- Panel 75 CK10_12C
- Panel 63 CK10_10 A

Omitted structural values are quite limited in number and no identified instances that could result in alternate field interpretations are identified.

Unidentified lithologic units and mineral symbols are the result of missing or incomplete mapping legend prior to completion of mapping documents attributed to CNS project cancellation. In all cases, the CNS Lead Geologist, was able to identify each lithologic unit and mineral symbol. Only two lithologic units, Calcite/Epidote pods and Aplite, were found on the field map panels that were not identified, from a legend, prior to the beginning of the digitization process. Examples include:

- Panel 36 CK10_04B
- Panel 48 CK10_07F

Examples of unidentified line work include the limits or extent of mapped areas, changes in elevation, and shear foliations. Examples include:

- Panel 42 CK10_06A
- Panel 62 CK10_10B

The limits, or extent of mapped areas, were delineated on the field map panels using two different symbol types; change in elevation symbols and dashed lines. Generally, change in elevation symbols were used in former CNS Unit 1 and dashed lines in Unit 2. To preserve uniformity across the site a dashed line was chosen to delineate the extent of mapped areas.

All features which required clarification and/or verification were resolved during the Review and Approval process. Digitized final foundation geologic maps accurately present all data originally recorded in the field. The product maps presented in this report represent the intentions of the original mapping program.

#### 2.7.5 Confirmation of CNS Map Features

Project personnel Michael Gray, Randy Cumbest and Malcolm Schaeffer (CNS Lead Geologist) conducted a site visit to compare and confirm map features found on CNS map documents as observed at selected areas within mapped areas in the former CNS Unit 2 excavation. The exposed foundation level rock was compared with digitized map panels and map sheets. Examples of these confirmed features include:

- Contact between mafic gneiss and felsic gneiss observed Panel 52 CK10-07D (Figure 8)
- Calcite and epidote infilled joints observed in panel Panel 63 CK10-10A (Figure 9)
- Quartz veins and quartz bodies observed in Panel 72 CK10-11A (Figure 10)

All features were confirmed by the former CNS Lead Geologist as accurate based on observed foundation rock outcrops at former CNS Unit 2.

## 3.0 ASSUMPTIONS

No assumptions were made for this report.

## 4.0 INPUTS

Inputs to this project report include Duke Energy provided CNS documents and WLS COLA investigation derived records listed below:

Duke Energy provided CNS documents presented in Appendix E:

- Index Map for CNS Final Foundation Map Panels illustrating locations and field map panel designator for each field map panel, which includes Service Building map panels.
- Hand drawn map panels, scans of original 11-inch by 17-inch gridded clearprint paper maps .
  - Sixty (60) hand drawn final foundation level geologic field maps for CNS Units 1 and 2
- Hand drawn map panels, scans of original 11-inch by 17-inch gridded clearprint paper maps.
  - Two (2) hand drawn final foundation level geologic field map documents of the former CNS Service Building.
- Mapping Procedure and Addendum.
  - Geologic Mapping Procedure
  - Addendum Letter.

Duke Energy provided CNS documents presented in Appendix H:

- CNS Geologic Reports on Zones 1-5 and 7-10
- CNS Petrographic Descriptions for Zone 5 Samples CS4-1 to C-18-1
- CNS Petrographic Descriptions for Zone 10 Samples C-31 to C44
- CNS Petrographic Descriptions for Zone 14 Samples C-45 to C-49
- Fine-Grained Material Report prepared by C.E. Weaver
- Historic correspondence, including memoranda, between Duke Power representatives and the NRC
- Twelve (12) contemporary photomicrographs of CNS-era petrographic thin section samples.

WLS COLA Investigation Derived Records:

- One (1) geologic map, produced during WLS COLA investigations, used to compare with CNS geologic maps for the northern portion of former CNS Unit 2 ( Enercon 2007).
- Boring log descriptions from thirteen (13) vertical boreholes advanced as part of the WLS COLA investigation in WLS Unit 1 ( former CNS Unit 1) (MACTEC 2007). Boring log descriptions from nine (9) post demolition boreholes advanced following demolition of the CNS Unit 1 reactor building (Enercon 2009).

## 5.0 EVALUATION

Evaluation of the CNS geologic maps was performed to verify the validity of the CNS documents digitized for this project. This evaluation consists mainly of a comparison between geologic interpretations, concluded from CNS (PSAR and Construction Observations) and WLS (COLA) field studies. Interpretations were compared by defining an area of comparison, the northern portion of former CNS Unit 2, where both CNS and WLS geologic mapping coincide. Elements evaluated as part of this comparison include:

- Mapping Techniques – Procedures used and conditions of site at time of mapping,
- Foundation Lithology – Rock classifications, infilled joint descriptions, petrographic analyses, and borehole data,
- Distribution of Geologic Features – Assessment of mafic intrusions recorded on geologic maps.
- Structural Orientation Measurements

These elements allow for direct evaluation, within the area of comparison, of foundation level geology as a means to corroborate geologic features documented during CNS construction. Evaluation of these work products reveals identical geologic interpretations. Similar and dissimilar features observed during this comparison are described below.

### 5.1 Area of Comparison

Both CNS and WLS maps cover portions of the proposed William States Lee Nuclear Power Station. Configuration of the CNS facility consisted of three reactor units; Units 1 though 3. CNS Units 1 and 3 correlate to WLS Units 1 and 2, respectively (Figure 1). At the time of CNS project cancellation, mapping of Unit 1 was complete with the concrete foundation in place, and excavation mapping of CNS Unit 2 was in progress. CNS Unit 2 mapping was nearly complete with all of the northern portion and parts of the southern portion mapped (Figure 2). The most complete CNS Unit 2 mapping, an approximately 119,000 square foot area in the northern most portion of the power block area, was recorded on nine map panels listed below:

- Map Panel 46 (CK10-06E) provided by Duke Power from folder CK10-06
- Map Panel 59 (CK10-09C) provided by Duke Power from folder CK10-09
- Map Panel 60 (CK10-09A) provided by Duke Power from folder CK10-09
- Map Panel 61 (CK10-09B) provided by Duke Power from folder CK10-09
- Map Panel 62 (CK10-10B) provided by Duke Power from folder CK10-10
- Map Panel 63 (CK10-10A) provided by Duke Power from folder CK10-10
- Map Panel 65 (CK10-10C) provided by Duke Power from folder CK10-10
- Map Panel 77 (CK10-13A) provided by Duke Power from folder CK10-13
- Map Panel 79 (CK10-14A) provided by Duke Power from folder CK10-14

These nine map panels comprise Sheet 4 (Appendix F) of the compiled final foundation geologic map. CNS Unit 1 and Service Building Foundation level geology is currently obscured by their concrete foundations. Therefore, the exposed foundation level rock within

former CNS Unit 2, which was also mapped during the WLS COLA site investigation (Figure 11), provides the only location to confirm and validate the CNS Final Foundation maps.

## 5.2 Observations Based on Comparison to COLA Evaluations

Three kinds of information are gathered during geologic field studies; (1) direct observation and measurement, (2) interpretive, and (3) age relations (Compton, 1985). The interpretive nature of geologic studies is of significance pertaining to this comparative study. Depending on the state of geologic theory, as well as experience and perception of the geologist, information collected may differ (Compton, 1985). Based on this principle, a side by side geologic map comparison is based on evaluation of mapping interpretations. Map elements evaluated as part of this comparison include mapping techniques, lithology and petrography, shear plane orientation measurements, and distribution of documented geologic features found on geologic maps.

### 5.2.1 Mapping Techniques

In order to understand both similar and dissimilar mapped features, it is important to first describe the objectives of each program as well as procedures and techniques used to create both CNS and WLS maps. Both procedures are summarized below.

**Mapping Procedures**

Mapping of CNS excavated foundation level geology was performed during the late 1970's until project cancellation in 1983. The CNS Final Foundation mapping program was designed to record geologic conditions at a fine scale and provide further investigations of "non-similar" features. CNS Geologic Mapping Procedures required the following for final foundation maps:

- 1:120 scale (1" = 10'),
- Surveyed grid points marked on the foundation surface for reference aid to geologic mappers,
- Two recorded structural measurements for every 10 square feet.

Field mapping, within the area of comparison, was recorded on nine (9) 11-inch x 17-inch sheets of graph paper (map panels) with plant coordinates transcribed on the margins (Appendix C). CNS Mapping Procedures (Appendix A) are described and summarized in Section 2.0.

WLS mapping, performed in support of COLA investigations (Enercon, 2007b), utilized more general Geologic Mapping Procedures in accordance with Regulatory Guide 1.132. The purpose of COLA mapping efforts was to evaluate and confirm previous geologic deformation history established during CNS PSAR investigations and construction observations. These procedures required the following:

- 1:600 scale (1" = 50'),

- Structural measurements were recorded as deemed necessary by the Mapping Geologist.

Surveyed plant grid points were limited, and performed only to confirm the plant coordinate system, not as a reference aid for geologic mapping. Field mapping was recorded on a single 32-inch x 36-inch sheet of vellum paper, using an aerial photo with topographic lines, as well as both plant and state-plane coordinates, as a base map.

**Mapping Conditions and Coverage**

In order to produce CNS maps, final foundation surfaces were cleaned using water and/or compressed air, and groundwater was actively pumped from pits and sumps to maintain a visible dry surface. Sometime after CNS project cancellation, efforts to maintain groundwater levels below foundation grade ceased. As a result, groundwater, rainfall, and erosion of the surrounding saprolite led to filling the excavation with water and sediments (Figure 12).

Prior to WLS mapping, ponded water had filled the excavated area of comparison (Figure 12) requiring significant pumping and cleaning efforts (Figure 13). These efforts were only applied to portions of the mapped area. Fine scale detailed mapping similar to CNS Final Foundation mapping was not deemed necessary for the WLS COLA investigation. In depth detailed mapping of the WLS site will take place during site construction. For this reason, WLS mapping was performed while some of the excavation floor was still covered with water, sediment, and crushed rock, which was used in creating ramps and pathways to make the site more traversable (Figure 13).

Both CNS and WLS mapping campaigns used project specific Geologic Mapping Procedures. Although these procedures differed in scale of mapping, density of recorded structural measurements, and e fforts to provide clean visible surfaces; both methods provided geologists with adequate instructions and ability to perform geologic investigations at their respective level of detail.

5.2.2 Foundation Lithology

Illustrated in both CNS and WLS geologic maps is a large plutonic body with several mafic intrusions. Previous work (Enercon, 2007b) summarized this leucocratic pluton as having intruded at a fairly high level in the crust, which cooled rapidly and ranged in composition from granodiorite to tonalite (quartz diorite). The pluton, composed of mostly light colored minerals, was later intruded by darker colored intermediate and more mafic magmas (dikes). Complex ductile deformation occurred both pre- and post-dike injection resulting in mineralogical alteration, or metamorphism of the pluton.

This section analyses and compares rock classification and descriptions made in creating each geologic map.

**CNS Rock Classification**

Initial classification of rocks underlying the site is described in the Cherokee PSAR, Section 3 A ppendix 2C Volume IV (Duke Power, 1974). Duke geologists utilized a classification system generally based on rock mineralogy, texture and fabric resulting in two primary rock types, (1) felsic gneiss and (2) mafic gneiss. Each of these classifications encompassed multiple rock types that are based on petrographic analysis.

Felsic Gneiss

CNS "felsic gneiss" includes metamorphic rocks (volcanic and sedimentary) and metamorphosed plutonic rocks of felsic composition, were identified in the field based on colors, grayish yellow when weathered to light gray or bluish gray when fresh (Duke Power, 1974). Texture of the felsic gneiss ranges from semi-schistose to equigranular. Petrographic analysis indicates that felsic gneiss includes an assemblage of upper greenschist facies metamorphic rocks, foliated and non-foliated, including felsic gneiss, plagioclase-biotite gneiss, mica gneiss, quartz-calcite gneiss, feldspar-biotite-actinolite gneiss, quartz-muscovite gneiss and meta-granodiorite.

Mafic Gneiss

"Mafic gneiss" includes various medium to dark gray mafic gneisses and mafic schists. Rocks characterized as mafic gneiss were rarely observed in natural outcrop during PSAR investigations but were commonly observed occurring as interlayers in rock core. Petrographic examination revealed actinolite-biotite gneiss, biotite gneiss and other rocks within the "mafic gneiss" assemblage.

The lithologies discussed above describe rock types mapped within CNS Units 1 and 2, and Service Building excavations. Additional rock lithologies within the felsic and mafic gneiss rock groups are found at the NSW dam foundation. Descriptions within this report pertain to rock litlologies documented with CNS Units 1 and 2 and Service Building excavations

**WLS COLA Rock Classification**

WLS geologists initially identified two primary rock types within the excavated area of comparison, (1) early leucocratic series rocks (felsic), and (2) late intrusive series rocks (mafic). Using petrographic analyses, excavated lithologic classifications were grouped into two categories: (1) meta-granodiorite/meta-quartz diorite (felsic), and (2) meta-diorite/ amphibolite (mafic) (Enercon, 2007b).

Meta-granodiorite/Meta-quartz Diorite

Rocks classified as meta-granodiorite/meta-quartz diorite are equigranular, with fine- to medium-grained clots of biotite and, in some cases, hornblende, in a fine- to medium-grained, lighter colored matrix of light blue quartz, plagioclase and variable but typically small amounts of potassium feldspar.

Meta-diorite/ Amphibolite

Rocks classified as meta-diorite/amphibolite are darker colored and occur as dikes. The dikes generally are fined grained and have variably developed fabric that is best developed near its margins.

**Fracture Infilling Mineral Assemblages**

CNS Final Foundation maps describe detailed geologic features including fractures and joints, some of which are filled with mineral assemblages (Figure 9). Although individual joints and fractures were not mapped as part of the WLS geologic mapping, these features and their infilling mineral assemblages were noted and described (Enercon, 2007b). Fracture infilling minerals recorded in both mapping efforts are listed in Table 4.

**Petrographic Analyses**

Petrographic analyses performed as part of the PSAR and COLA indicate that rock classifications based on petrography sometimes differ from the original outcrop field classifications. For example, some rock samples classified as “mafic gneiss” in the PSAR are compositionally more closely related to “felsic gneiss.” Analyses of samples obtained from da rker colored dikes have very similar compositions in terms of their felsic mineralogy (i.e., quartz, plagioclase, and potassium feldspar) as the early leucocratic series and the significant differences in compositions are in modal abundances of dark colored minerals (biotite and amphibole) to yield the darker appearance. These would be mapped as “mafic gneiss” or meta-diorite in the field. A comparison of CNS versus WLA rock classifications is present in Table 5.

**Comparison of CNS Foundation Level Geology to WLS COLA Borings**

One means of verifying the validity of CNS excavation mapping against WLS lithologic interpretations is comparing CNS geologic maps to the WLS borehole log data. The locations of thirteen WLS borings in Unit 1 area, which is obscured by its concrete foundation, were plotted on CNS Final Foundation geologic maps. The lithology of the first rock encountered in the borings was compared to the lithologies presented on t he CNS maps and the results are presented in Figure 14.

Except for boring B-1010, the CNS lithologies agree with the WLS bedrock nomenclature as presented in Figure 14. The first rock observed in boring B-1010 is identified as meta-granodiorite (felsic gneiss); where as the foundation map identifies the rock as mafic gneiss. Two possible explanations for this difference: (1) following CNS foundation mapping it is possible that subsequent excavations removed additional rock characterized as mafic gneiss, or (2) the bedrock was intermediate between mafic and felsic lithologies and could be interpreted as either rock type. Physical inspection of the recovered core in B-1010 indicates that the rock is intermediate and thus can be characterized as either felsic gneiss or mafic gneiss. A nearby outcrop exposure of similar intermediate rock is considered mafic gneiss. The difference in rock classification of this intermediate rock is not significant to the comparison described in this section. Both CNS and WLS rock classifications describe the foundation level rock types as felsic plutonic rocks and mafic intrusive rocks, which have undergone deformation and metamorphism. Differences in

rock nomenclature are attributed to different mapping schemes between CNS excavation mapping and WLS COLA mapping. Comparison of petrographic analyses, as well as CNS map and WLS boring log lithologies, correlate the CNS Felsic Gneiss and Mafic Gneiss to WLS Meta-granodiorite/Meta-quartz Diorite, and Meta-diorite/Amphibolite, respectively.

5.2.3 Distribution of Geologic Features

Previous work (Enercon, 2007b) compared Duke Power's interim drafted map, of the area of comparison to the WLS map. The comparison for this report was done using reviewed digitized and compiled CNS map panels, Sheet 4 (Figure 15).

Both CNS and WLS foundation level geology maps illustrate two principal geologic units described in the previous section. The primary rock type is composed of mostly felsic crystalline assemblages (Felsic Gneiss, Meta-granodiorite/Meta-quartz Diorite) and has been intruded by dikes composed of more mafic minerals (Mafic Gneiss, Meta-diorite/Amphibolite). These mafic dikes, are distinct lithologic bodies, and therefore serve as the basis of comparison for distribution of geologic features. In general, position and lateral thickness of mafic dikes agree well between both CNS and WLS geologic maps, particularly in the northern portion of the area of comparison. Survey points, located along the margins of the mafic dikes, confirm the similarity of these features. Dissimilar features identified and documented in this comparison include (1) position of mafic dikes and (2) absent mafic dikes.

**Assessment of Mafic Intrusions**

Both maps depict mafic intrusions with north-south to northeast southwest orientations (Figure 15). Points of contact between mafic dikes and the intruded felsic rock were surveyed in the field, during WLS mapping, to verify the locations. Good correlation is observed when the WLS survey points and map are overlain onto the CNS map. In the northern portion of the mapped area mafic dike positions are nearly coincident, with differences of up to 5 – 10 feet observed along mafic contacts in the southern area of comparison; depicted as feature A in Figure 16. Dissimilarities in positions of geologic units are quite common in field mapping and is usually the result of different mappers and/or different scales, both of which are true in this comparison. Additionally, CNS and WLS mappers used different methods to locate lithologic units, as described in Section 5.2.1. This dissimilarity is not considered significant to geologic interpretations and associated map comparisons described herein. Dissimilar features between CNS and WLS geologic maps are attributed to differences in mapping techniques and site conditions at the time of mapping. As described in section 5.2.1, CNS mapping required 1:120 scale (1 in = 10 ft), aided by a surveyed 5-foot grid reference system. WLS mapping recorded a more generalized geologic map at 1:600 scale (1 in = 50 ft), without the aid of a visible surveyed grid reference system. Coarser scale and lack of surveyed reference points resulted in minor positional dissimilarities in a few areas between the two maps. These minor differences are not considered significant to geologic interpretations and associated map comparisons.

Illustrated as Feature B in Figure 16, two mafic dikes mapped on the CNS geologic map are absent from the WLS map. The two dikes are located at north-eastern and south-western limits of the WLS geologic map. In both cases there are gaps, or areas not mapped, adjacent to the absent feature. The absent mafic units are result of lack of clear visible mapping surface. As described in Section 5.2.1, and illustrated in unmapped areas found in Figure 11, foundation level surfaces were obscured in many areas during WLS mapping. Although geologic units are absent from the WLS map, compared to the CNS map, these features are considered small with respect to the overall mapped area and other mapped mafic dikes. Absent mafic dikes, from the WLS geologic map, are the result of a less visible foundation surface. Both absent mafic dikes are adjacent to and/or in between areas not mapped. These unmapped areas were obscured by water, sediment, crushed rock, heavy equipment or combination thereof. Due to these obscurities, and the more generalized approach of the WLS map, the two mafic dikes were not mapped during the COLA investigation. However, the absent dikes are considered small and do not affect geologic interpretations.

5.2.4 Shear Plane Orientation Measurements

The bedrock exposed during CNS and WLS investigations contain numerous shears. The structural orientation of many of these shears were measured and recorded during CNS and WLS geologic mapping activities. These are compared to confirm the validity of structural orientations presented on the digitized final foundation maps provided in this report.

**CNS Foundation Mapping Shear Orientation Measurements**

Structural attitude orientations of hundreds of exposed shears were collected during CNS-era final foundation mapping activities. 418 of these measurements have been compiled from the digitized final foundation map panels. These data are presented in Table 6 and were used to develop lower-hemisphere equal area stereonet plots of the poles to the shear planes (Figures 17 and 18).

The orientation data cluster in three broad zones. The first includes a grouping of poles in the northwest quadrant of the stereonet, indicating shallowly to steeply dipping northeast oriented shear planes that dip towards the southeast. The second grouping is clustered in the southeast quadrant of the stereonet and indicates a series of northeast-oriented, northwest dipping shear planes. The last grouping is located in the northeast quadrant; these show a set of northwest oriented shear planes that dip moderately towards the southwest. Concentration plots of the data show that the majority of the shear planes are oriented northeast-southwest and dip towards either towards the northwest or southeast (Figures 17 and 18).

**CNS Zone Mapping Shear Orientation Measurements**

Several "shear-breccia" zones were investigated during field studies performed during CNS-era investigation and construction activities. These are documented in a series of Geologic Zone Reports. Compilation of these reports included mapping at smaller scales and collecting additional structural orientation data from exposed shears. Shear orientation

data from Geologic Zone Reports 6 and 11 through 16 were compiled and are presented in Table 7.

These 155 data are shown plotted on a lower-hemisphere equal area stereonet plot in Figure 19. The bulk of the points (located in the northwest and southwest quadrants of the stereonet) indicate a set of steeply dipping northwest to northeast oriented shear planes. A second cluster, located in the northeast quadrant of the stereonet is indicative of a set of shear planes that are northwest oriented and dip moderately towards the southwest.

**WLS Confirmatory Mapping Shear Orientation Measurements**

During geologic mapping of the WLS site in 2006 of open exposures in the former Duke Cherokee nuclear site Units 2 and 3 excavations, additional shear plane orientation data was collected. The 30 data points are presented within Table 8 and plotted on a lower-hemisphere equal area stereonet in Figure 20.

The bulk of the data collected during WLS mapping indicates a set of northeast trending shear planes that dip moderately to steeply towards the southeast. There are three measurements located in the northeast quadrant of the plot that suggest northwest trending shear planes that dip moderately towards the southwest.

**Shear Orientation Measurement Comparison**

Comparing shear orientation measurements obtained during CNS-era mapping with those obtained during WLS mapping reveals good agreement between the datasets. This section compares both localized structural data (CNS Unit 2 area) and non-localized data (CNS Units 1, 2 and 3).

Figure 21 presents data collected from CNS Unit 2 area final foundation mapping with WLS data collected from the same area. From this figure we can observe that:

- The WLS pole-to-plane data compare very well with the CNS data in the northwest quadrant of the stereonet. Both datasets indicate northeast striking, southeast dipping shear planes.
- The WLS pole-to-plane data fall within and correspond to the cluster of CNS data located in the northeast quadrant, indicating northwest striking, southwest dipping shear planes.

Figure 22 presents all data from both CNS and WLS mapping plotted together. From this figure it is observed that:

- For any of the three pole-to-plane datasets, the highest concentration of poles is in the northwest quadrant of the stereonet, indicating a higher percentage of northeast striking, southeast dipping shear planes.
- The Zone and WLS mapping pole-to-plane data fall within the bounds of the data collected during final foundation mapping.

5.2.5 CNS Fault Features, Zone 6

During CNS construction activities, a fault zone (designated as Zone 6 (ENERCON, 2007a)) was discovered within the excavation for the Unit 1 Reactor and Auxiliary Buildings. This fault constitutes the largest fault evaluated during CNS construction and was designated as a possible ‘nonsimilar’ feature based on field observation of orientation (northwest strike with low southwest dips), the occurrence of possible gouge material within portions of the zone, and initial thin section study of the zone which could not establish specific textural relationships of the zones to low birefringent minerals. Additional thin-section study confirmed the low birefringent mineral as potassium feldspar mineralization that occurred after the latest phase of deformation (FCL, 2011b).

Additional geologic evaluations performed at Zone 6 included detailed mapping at 1” = 20’ and 1” = 5’, thin section preparation and study, excavation of a test pit, and two angle borings.

The main trace of the fault zone is approximately 415 feet long. Along the main trace, the strike of the fault is highly variable ranging from nearly east-west to nearly north. Broadly, the feature strikes towards the northwest and portions of the zone have low dips.

Brittle and ductile deformation is observed both at a macroscopic and a microscopic level. Macroscopically, the fault is seen to offset fractures and mafic bodies, especially within the southern portion, but the northern exposure of the zone shows mafic rocks that have been stretched out and deformed along the shear planes. Thin section samples prepared from the sheared material reveal schistose textures with quartz and feldspar augens, older biotite with brittle kinks and younger, undeformed white mica (ENERCON, 2007a).

Based primarily on the microscopic evidence observed in thin sections, the CNS geologic zone report concluded that the latest deformation on this fault occurred during the later stages of greenschist metamorphism or hydrothermal activity. The report states that the pressure and temperature conditions needed for the formation of these mineral assemblages must have existed prior to 170 Ma (i.e., middle Mesozoic) and that the fault cannot be considered to be a “capable fault” as defined by 10 CFR Part 100 (ENERCON, 2007a).

WLS investigation of this feature included analysis of the CNS-era maps and re-examination of CNS thin sections and age dates to confirm the geochronologic history of this fault zone. WLS investigations concur with CNS interpretations, WLS evaluations are described in Appendix I of this report.

## 5.3 Conclusions

Both CNS and WLS maps portray identical geologic interpretations. Dissimilarities found during this comparison are considered minor and within the level expected considering the different mapping personnel, techniques and excavation conditions. This comparison agrees with previous work performed (Enercon, 2007b) and validates the CNS Final Foundation geologic maps presented in this report (Appendix F and G). Evaluation of CNS and WLS

geologic interpretations included comparison of mapping techniques, rock types and petrography, shear plane structural orientations, and distribution of geologic features found on geologic maps. Both CNS and WLS geologic maps were produced using site specific mapping procedures at differing scales and level of detail, specific to the project objectives. Both CNS and WLS geologic maps indicate foundation level geology consists of a large metamorphosed plutonic body, composed primarily of metamorphosed felsic crystalline assemblages intruded by smaller metamorphosed mafic dikes. CNS and WLS shear plane structural orientation data agree well. Minor dissimilarities in mapped geologic features have been described and accounted for and do not conflict with any geologic interpretations.

## 6.0 RESULTS

This project report documents the final foundation level geology of former CNS Reactor Units 1 (majority of WLS Unit 1) and 2, including the adjacent Service Building, as recorded during CNS construction. Those sixty-two (62) map panels, prepared by the CNS Lead Geologist during CNS construction, were maintained by the Lead Geologist and Duke Energy after project cancellation. The in-process map documents have undergone records qualification, georectification, digitization, and compilation. The resulting compiled maps (Sheets 1 through 7) and Plate 1 document the final foundation geology for Duke Power's CNS Units 1 and 2, and adjacent Service Building. These products complete the mapping records that were not completed during CNS construction.

Using a project approved procedure, map records were confirmed using data corroboration methods. Further confidence in the suitability of these records is gained through the involvement of personnel directly involved in CNS construction and documentation of geologic features and associated evaluations. The quality standards used during the CNS mapping activities are determined to conform to acceptable standards. The unpublished CNS final foundation geologic maps that are used as inputs for this project report are confirmed as original project documents. It is also understood that the NRC conducted periodic independent reviews of Duke Power's geologic mapping activities. The CNS final foundation map records developed as part of this project report are suitable for use in WLS COLA evaluations.

Evaluation of the CNS derived (PSAR and Construction Observations) geologic information and WLS (COLA) field studies was performed to verify the validity of the CNS derived documents digitized for this project. Two distinct project areas were evaluated as part of the comparison between CNS and WLS geologic datasets. The two areas of evaluation include 1) the northern portion of former CNS Unit 2, where both CNS and WLS geologic mapping coincide, and 2) CNS Unit 1 where CNS foundation level geologic mapping is compared to first encountered rock documented in thirteen WLS COLA borings. Geologic elements evaluated as part of these comparisons include mapping techniques, rock lithology, distribution of geologic features, including lithologic contacts, and fracture mineral infilling. The results of these comparisons demonstrate good agreement between CNS and WLS data. Therefore, the map records developed as part of this project report provide documentation of the as-built geologic conditions for proposed WLS Unit 1, currently obscured by the foundation mat of former CNS Unit 1 and portions of the adjacent Service Building.

Due to the differing structure footprints between CNS and WLS facilities, additional geologic mapping of the prepared excavation remains to be performed beneath localized areas, previously unexcavated, adjacent to CNS Unit 1. These areas include a small area of the westernmost portion of Seismic Category I Lee Unit 1 nuclear island (approximately 530 square feet). Detailed mapping of the foundation level geology for Lee Unit 2 Foundation support zone will also be required as excavation and mapping in this area (CNS Unit 3) was not completed prior to CNS project cancellation. These areas will be excavated and prepared to expose suitable foundation rock and then mapped in accordance with FSAR Table 2.5.4-219 as part of pre-construction activities associated with the Lee Nuclear Station.

The detailed final foundation maps along with qualified detailed CNS geologic evaluations confirm that the foundation rock underlying Cherokee Units 1 and 2 exhibits no geologic features that are interpreted as capable tectonic features. There is no information suggesting the potential for tectonic or non-tectonic surface deformation within the foundation rock underlying Lee Unit 1 and Cherokee Unit 2 described in this report.

Evaluation of petrographic reports including thin section photomicrographs confirms site geochronological events described in FSAR Subsection 2.5.1.2.5.4 and RAI Response 02.05.01-046 (Duke Letter WLG2009.05-04, dated May 21, 2009 ( Adams ML091480603). These data indicate the site has not experienced tectonic deformation since the Mesozoic, and possibly not since 219 Ma to 300 Ma. Detailed discussions of site geochronology are presented in Appendix I of this report.

Results presented in this report conclude the CNS geologic maps satisfy the requirements of Regulatory Guide 1.132, Site Investigations for Foundations of Nuclear Power Plants, Rev. 2, October 2003.

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## 8.0 TABLES AND FIGURES

**Table 1: List of CNS Final Foundation Geologic Map Records (Sheet 1 of 2)**

| Sheet Number | Duke Map Panel Scans | | | | Duke Map Panel Rescans | | | Digitized Map Panels | |
|---|---|---|---|---|---|---|---|---|---|
| | Folder Name | File Name/Map Panel Number | Date Received | Map Panel Designation | File Name/Map Panel Number | Date Received | Reason for Rescan | GIS Geo Referenced Map Panel Scan File Name | Digitized Map Panel File Name |
| 1 | CK10-01 | 20.TIF | March 23 2007 | CK10-01A | | | | Panel_20_CK10_01A_GR.TIF | 2093.Panel 20_CK10-01A Rev 0.PDF |
| 1 | | 21.TIF | March 23 2007 | CK10-01A | | | | Panel_21_CK10_01A_GR.TIF | 2093.Panel 21 CK10-01A Rev 0.PDF |
| 1 | CK10-02 | 22.TIF | March 23 2007 | CK10-02B | | | | Panel_22_CK10_02B_GR.TIF | 2093.Panel 22_CK10-02B Rev 0.PDF |
| 1 | | 23.TIF | March 23 2007 | CK10-01B | | | | Panel_23_CK10_01B_GR.TIF | 2093.Panel 23_CK10-01B Rev 0.PDF |
| 2 | | 24.TIF | March 23 2007 | CK10-02D | | | | Panel_24_CK10_02D_GR.TIF | 2093.Panel 24_CK10-02D Rev 0.PDF |
| 1 | | 25.TIF | March 23 2007 | CK10-02A | | | | Panel_25_CK10_02A_GR.TIF | 2093.Panel 25_CK10-02A Rev 0.PDF |
| 2 | | 26.TIF | March 23 2007 | CK10-02F | | | | Panel_26_CK10_02F_GR.TIF | 2093.Panel 26_CK10-02F Rev 0.PDF |
| 1 | | 27.TIF | March 23 2007 | CK10-02E | | | | Panel_27_CK10_02E_GR.TIF | 2093.Panel 27_CK10-02E Rev 0.PDF |
| 2 | | 28.TIF | March 23 2007 | CK10-020 | | | | Panel_28_CK10_020_GR.TIF | 2093.Panel 28_CK10_02C Rev 0.PDF |
| 2 | CK10-03 | 29.TIF | March 23 2007 | CK10-03A | | | | Panel_29_CK10_03A_GR.TIF | 2093.Panel 29_CK10-03A Rev 0.PDF |
| 2 | | 30.TIF | March 23 2007 | CK10-03B | | | | Panel_30_CK10_03B_GR.TIF | 2093.Panel 30_CK10-03B Rev 0.PDF |
| 2 | | 31.TIF | March 23 2007 | CK10-03C | | | | Panel_31_CK10_03C_GR.TIF | 2093.Panel 31_CK10-03C Rev 0.PDF |
| 3 | | 32.TIF | March 23 2007 | CK10-03D | | | | Panel_32_CK10_03D_GR.TIF | 2093.Panel 32_CK10-03D Rev 0.PDF |
| 3 | | 33.TIF | March 23 2007 | CK10-03E | | | | Panel_33_CK10_03E_GR.TIF | 2093.Panel 33_CK10-03E Rev 0.PDF |
| 3 | | 34.TIF | March 23 2007 | CK10-03F | | | | Panel_34_CK10_03F_GR.TIF | 2093.Panel 34_CK10-03F Rev 0.PDF |
| 3 | CK10-04 | 35.TIF | March 23 2007 | CK10-04A | | | | Panel_35_CK10_04A_GR.TIF | 2093.Panel 35_CK10-04A Rev 0.PDF |
| 3 | | 36.TIF | March 23 2007 | CK10-04B | | | | Panel_36_CK10_04B_GR.TIF | 2093.Panel 36_CK10_04B Rev 0.PDF |
| 3 | | 37.TIF | March 23 2007 | CK10-04C | | | | Panel_37_CK10_04C_GR.TIF | 2093.Panel 37 CK10-04C Rev 0.PDF |
| 3 | | 38.TIF | March 23 2007 | CK10-04D | | | | Panel_38_CK10_04D_GR.TIF | 2093.Panel 38_CK10-04D Rev 0.PDF |
| 1 | CK10-05 | 39.TIF | March 23 2007 | CK10-05A | | | | Panel_39_CK10_05A_GR.TIF | 2093.Panel 39_CK10-05A Rev 0.PDF |
| 1 | | 40.TIF | March 23 2007 | CK10-05B | | | | Panel_40_CK10_05B_GR.TIF | 2093.Panel 40_CK10-05B Rev 0.PDF |
| 1 | | 41.TIF | March 23 2007 | CK10-05C | | | | Panel_41_CK10_05C_GR.TIF | 2093.Panel 41_CK10-05C Rev 0.PDF |
| 1 | CK10-06 | 42.TIF | March 23 2007 | CK10-06A | | | | Panel_42_CK10_06A_GR.TIF | 2093.Panel 42 CK10-06A Rev 0.PDF |
| 1 | | 43.TIF | March 23 2007 | CK10-06B | | | | Panel_43_CK10_06B_GR.TIF | 2093.Panel 43 CK10-06B Rev 0.PDF |
| 2 | | 44.TIF | March 23 2007 | CK10-06C | | | | Panel_44_CK10_06C_GR.TIF | 2093.Panel 44_CK10-06C Rev 0.PDF |
| 2 | | 45.TIF | March 23 2007 | CK10-06D | | | | Panel_45_CK10_06D_GR.TIF | 2093.Panel 45_CK10-06D Rev 0.PDF |
| 4 | | 46.TIF | March 23 2007 | CK10-06E | | | | Panel_46_CK10_06E_GR.TIF | 2093.Panel 46 CK10-06E Rev 0.PDF |
| 5 | | 47.TIF | March 23 2007 | CK10-06F | | | | Panel_47_CK10_06F_GR.TIF | 2093.Panel 47 CK10-06F Rev 0.PDF |
| 6 | CK10-07 | 48.TIF | March 23 2007 | CK10-07F | | | | Panel_48_CK10_07F_GR.TIF | 2093.Panel 48_CK10-07F Rev 0.PDF |
| 2 | | 49.TIF | March 23 2007 | CK10-07A | 49 CK10-07A.JPEG | June 4 2010 | Original File corrupted (5/19/10) | Panel_49_CK10_07A_GR.TIF | 2093.Panel 49_CK10-07A Rev 0.PDF |
| 2 | | 50.TIF | March 23 2007 | CK10-07B | | | | Panel_50_CK10_07B_GR.TIF | 2093.Panel 50_CK10-07B Rev 0.PDF |
| 3 | | 51.TIF | March 23 2007 | CK10-07C | | | | Panel_51_CK10_07C_GR.TIF | 2093.Panel 51_CK10-07C Rev 0.PDF |
| 3 | | 52.TIF | March 23 2007 | CK10-07D | 52 CK10-07D.JPEG | June 4 2010 | Poor quality of original scan (5/24/10) | Panel_52_CK10_07D_GR.TIF | 2093.Panel 52_CK10-07D Rev 0.PDF |
| 5 | | 53.TIF | March 23 2007 | CK10-07E | | | | Panel_53_CK10_07E_GR.TIF | 2093.Panel 53_CK10-07E Rev 0.PDF |
| 6 | | 54.TIF | March 23 2007 | CK10-07F | | | | Panel_54_CK10_07F_GR.TIF | 2093.Panel 54 CK10-07F Rev 0.PDF |

**Table 1: List of CNS Final Foundation Geologic Map Records (Sheet 2 of 2)**

| Sheet Number | Duke Map Panel Scans | | | | Duke Map Panel Rescans | | | Digitized Map Panels | |
|---|---|---|---|---|---|---|---|---|---|
| | Folder Name | File Name/Map Panel Number | Date Received | Map Panel Designation | File Name/Map Panel Number | Date Received | Reason for Rescan | GIS Geo Referenced Map Panel Scan File Name | Digitized Map Panel File Name |
| 6 | CK10-08 | 55.TIF | March 23 2007 | CK10-08C | | | | Panel_55_CK10_08C_GR.TIF | 2093.Panel 55 CK10_08C Rev 0.PDF |
| 3 | | 56.TIF | March 23 2007 | CK10-08A | | | | Panel_56_CK10_08A_GR.TIF | 2093.Panel 56_CK10-08A Rev 0.PDF |
| 3 | | 57.TIF | March 23 2007 | CK10-08B | | | | Panel_57_CK10_08B_GR.TIF | 2093.Panel 57_CK10-08A Rev 0.PDF |
| 3 | | 58.TIF | March 23 2007 | CK10-08D | | | | Panel_58_CK10_08D_GR.TIF | 2093.Panel 58_CK10-08B Rev 0.PDF |
| 4 | CK10-09 | 59.TIF | March 23 2007 | CK10-09C | | | | Panel_59_CK10_09C_GR.TIF | 2093.Panel 59 CK10-09C Rev 0.PDF |
| 4 | | 60.TIF | March 23 2007 | CK10-09A | | | | Panel_60_CK10_09A_GR.TIF | 2093.Panel 60 CK10-09A Rev 0.PDF |
| 4 | | 61.TIF | March 23 2007 | CK10-09B | | | | Panel_61_CK10_09B_GR.TIF | 2093.Panel 61_CK10-09B Rev 0.PDF |
| 4 | CK10-10 | 62.TIF | March 23 2007 | CK10-10B | 62 CK10-10B.JPEG | June 4 2010 | Poor quality of original scan (5/24/10) | Panel_62_CK10_10B_GR.TIF | 2093.Panel 62_CK10-10B Rev 0.PDF |
| 4 | | 63.TIF | March 23 2007 | CK10-10A | | | | Panel_63_CK10_10A_GR.TIF | 2093.Panel 63_CK10-10A Rev 0.PDF |
| 5 | | 64.TIF | March 23 2007 | CK10-10D | | | | Panel_64_CK10_10D_GR.TIF | 2093.Panel 64_CK10-10D Rev 0.PDF |
| 4 | | 65.TIF | March 23 2007 | CK10-10C | | | | Panel_65_CK10_10C_GR.TIF | 2093.Panel 65_CK10-10C Rev 0.PDF |
| 5 | | 66.TIF | March 23 2007 | CK10-10F | | | | Panel_66_CK10_10F_GR.TIF | 2093.Panel 66_CK10-10F Rev 0.PDF |
| 5 | | 67.TIF | March 23 2007 | CK10-10E | | | | Panel_67_CK10_10E_GR.TIF | 2093.Panel 67_CK10-10E Rev 0.PDF |
| 6 | CK10-11 | 68.TIF | March 23 2007 | CK10-11E | | | | Panel_68_CK10_11E_GR.TIF | 2093.Panel 68 CK10-11E Rev 0.PDF |
| 6 | | 69.TIF | March 23 2007 | CK10-11F | 69 CK10-11F.JPEG | June 4 2010 | Poor quality of original scan (5/21/10) | Panel_69_CK10_11F_GR.TIF | 2093.Panel 69 CK10-11F Rev 0.PDF |
| 5 | | 70.TIF | March 23 2007 | CK10-11B | | | | Panel_70_CK10_11B_GR.TIF | 2093.Panel 70_CK10-11B Rev 0.PDF |
| 5 | | 71.TIF | March 23 2007 | CK10-11C | | | | Panel_71_CK10_11C_GR.TIF | 2093.Panel 71_CK10-11C Rev 0.PDF |
| 5 | | 72.TIF | March 23 2007 | CK10-11A | | | | Panel_72_CK10_11A_GR.TIF | 2093.Panel 72_CK10-11A Rev 0.PDF |
| 6 | | 73.TIF | March 23 2007 | CK10-11D | 73 CK10-11D.JPEG | June 4 2010 | Poor quality of original scan (5/24/10) | Panel_73_CK10_11D_GR.TIF | 2093.Panel 73 CK10-11D Rev 0.PDF |
| 6 | CK10-12 | 74.TIF | March 23 2007 | CK10-12B | | | | Panel_74_CK10_12B_GR.TIF | 2093.Panel 74_CK10-12B Rev 0.PDF |
| 6 | | 75.TIF | March 23 2007 | CK10-12C | | | | Panel_75_CK10_12C_GR.TIF | 2093.Panel 75_CK10-12C Rev 0.PDF |
| 6 | | 76.TIF | March 23 2007 | CK10-12A | | | | Panel_76_CK10_12A_GR.TIF | 2093.Panel 76_CK10-12A Rev 0.PDF |
| 4 | CK10-13 | 77.TIF | March 23 2007 | CK10-13A | | | | Panel_77_CK10_13A_GR.TIF | 2093.Panel 77 CK10-13A Rev 0.PDF |
| 5 | CK10-14 | 78.TIF | March 23 2007 | CK10-14B | | | | Panel_78_CK10_14B_GR.TIF | 2093.Panel78_CK10-14B Rev 0.PDF |
| 4 | | 79.TIF | March 23 2007 | CK10-14A | | | | Panel_79_CK10_14A_GR.TIF | 2093.Panel 79 CK10-14A Rev 0.PDF |
| 7 | N/A | 122_20101012.JPEG | October 12, 2006 | SB1 | | | | Panel_122_20101012_GR.TIF | 2093.Panel SB1 Rev 0.PDF |
| 7 | | 123_20101012.JPEG | October 12, 2006 | SB2 | | | | Panel_123_20101012_GR.TIF | 2093.Panel SB2 Rev 0.PDF |

Table 2: Summary of GIS Georectification Results (Sheet 1 of 3)

| File Name/Map Panel Number | Date Received | Map Panel Designation | GIS Rectified File Name | Date Completed | Completed by | Reviewed by | Number of Points | Total RMS Error (feet) |
|---|---|---|---|---|---|---|---|---|
| 20.TIF | March 23 2007 | CK10-01A | GR_20_Scan.TIF | 5/18/2010 | M. Ticci | D. Slayter | 12 | 0.00036 |
| 21.TIF | March 23 2007 | CK10-01A | GR_21_Scan.TIF | 5/25/2010 | M. Ticci | D. Slayter | 9 | 0.00019 |
| 22.TIF | March 23 2007 | CK10-02B | GR_22_Scan.TIF | 5/25/2010 | M. Ticci | D. Slayter | 14 | 0.00053 |
| 23.TIF | March 23 2007 | CK10-01B | GR_23_Scan.TIF | 5/25/2010 | M. Ticci | D. Slayter | 9 | 0.00005 |
| 24.TIF | March 23 2007 | CK10-02D | GR_24_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 12 | 0.00025 |
| 25.TIF | March 23 2007 | CK10-02A | GR_25_Scan.TIF | 5/25/2010 | M. Ticci | D. Slayter | 11 | 0.00016 |
| 26.TIF | March 23 2007 | CK10-02F | GR_26_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 11 | 0.00025 |
| 27.TIF | March 23 2007 | CK10-02E | GR_27_Scan.TIF | 5/25/2010 | M. Ticci | D. Slayter | 8 | 0.00023 |
| 28.TIF | March 23 2007 | CK10-020 | GR_28_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 12 | 0.00057 |
| 29.TIF | March 23 2007 | CK10-03A | GR_29_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 12 | 0.00038 |
| 30.TIF | March 23 2007 | CK10-03B | GR_30_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 12 | 0.00022 |
| 31.TIF | March 23 2007 | CK10-03C | GR_31_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 12 | 0.00033 |
| 32.TIF | March 23 2007 | CK10-03D | GR_32_Scan.TIF | 5/19/2010 | M. Ticci | D. Slayter | 12 | 0.00017 |
| 33.TIF | March 23 2007 | CK10-03E | GR_33_Scan.TIF | 5/12/2010 | M. Ticci | D. Slayter | 12 | 0.00038 |
| 34.TIF | March 23 2007 | CK10-03F | GR_34_Scan.TIF | 5/12/2010 | M. Ticci | D. Slayter | 12 | 0.00031 |
| 35.TIF | March 23 2007 | CK10-04A | GR_35_Scan.TIF | 5/18/2010 | M. Ticci | D. Slayter | 12 | 0.00040 |
| 36.TIF | March 23 2007 | CK10-04B | GR_36_Scan.TIF | 5/18/2010 | M. Ticci | D. Slayter | 12 | 0.00082 |
| 37.TIF | March 23 2007 | CK10-04C | GR_37_Scan.TIF | 5/19/2010 | M. Ticci | D. Slayter | 9 | 0.00015 |
| 38.TIF | March 23 2007 | CK10-04D | GR_38_Scan.TIF | 5/18/2010 | M. Ticci | D. Slayter | 11 | 0.00019 |
| 39.TIF | March 23 2007 | CK10-05A | GR_39_Scan.TIF | 5/25/2010 | M. Ticci | D. Slayter | 11 | 0.00057 |
| 40.TIF | March 23 2007 | CK10-05B | GR_40_Scan.TIF | 5/25/2010 | M. Ticci | D. Slayter | 15 | 0.00049 |
| 41.TIF | March 23 2007 | CK10-05C | GR_41_Scan.TIF | 5/25/2010 | M. Ticci | D. Slayter | 11 | 0.00013 |
| 42.TIF | March 23 2007 | CK10-06A | GR_42_Scan.TIF | 5/25/2010 | M. Ticci | D. Slayter | 14 | 0.00068 |
| 43.TIF | March 23 2007 | CK10-06B | GR_43_Scan.TIF | 5/25/2010 | M. Ticci | D. Slayter | 12 | 0.00028 |
| 44.TIF | March 23 2007 | CK10-06C | GR_44_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 12 | 0.00022 |
| 45.TIF | March 23 2007 | CK10-06D | GR_45_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 12 | 0.00035 |
| 46.TIF | March 23 2007 | CK10-06E | GR_46_Scan.TIF | 5/26/2010 | M. Ticci | D. Slayter | 13 | 0.00048 |

Table 2: Summary of GIS Georectification Results (Sheet 2 of 3)

| File Name/Map Panel Number | Date Received | Map Panel Designation | GIS Rectified File Name | Date Completed | Completed by | Reviewed by | Number of Points | Total RMS Error (feet) |
|---|---|---|---|---|---|---|---|---|
| 47.TIF | March 23 2007 | CK10-06F | GR_47_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 12 | 0.00020 |
| 48.TIF | March 23 2007 | CK10-07F | GR_48_Scan.TIF | 5/20/2010 | M. Ticci | D. Slayter | 16 | 0.00039 |
| 49 CK10-07A.jpg | June 4 2010 | CK10-07A | GR_49_Scan.TIF | 6/10/2010 | M. Ticci | D. Slayter | 12 | 0.00019 |
| 50.TIF | March 23 2007 | CK10-07B | GR_50_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 12 | 0.00034 |
| 51.TIF | March 23 2007 | CK10-07C | GR_51_Scan.TIF | 5/12/2010 | M. Ticci | D. Slayter | 12 | 0.00103 |
| 52 CK10-07D.jpg | June 4 2010 | CK10-07D | GR_52_Scan.TIF | 6/10/2010 | M. Ticci | D. Slayter | 12 | 0.00030 |
| 53.TIF | March 23 2007 | CK10-07E | GR_53_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 17 | 0.00063 |
| 54.TIF | March 23 2007 | CK10-07F | GR_54_Scan.TIF | 5/20/2010 | M. Ticci | D. Slayter | 12 | 0.00040 |
| 55.TIF | March 23 2007 | CK10-08C | GR_55_Scan.TIF | 5/20/2010 | M. Ticci | D. Slayter | 12 | 0.00010 |
| 56.TIF | March 23 2007 | CK10-08A | GR_56_Scan.TIF | 5/18/2010 | M. Ticci | D. Slayter | 14 | 0.00049 |
| 57.TIF | March 23 2007 | CK10-08B | GR_57_Scan.TIF | 5/19/2010 | M. Ticci | D. Slayter | 10 | 0.00006 |
| 58.TIF | March 23 2007 | CK10-08D | GR_58_Scan.TIF | 5/19/2010 | M. Ticci | D. Slayter | 12 | 0.00021 |
| 59.TIF | March 23 2007 | CK10-09C | GR_59_Scan.TIF | 5/26/2010 | M. Ticci | D. Slayter | 13 | 0.00026 |
| 60.TIF | March 23 2007 | CK10-09A | GR_60_Scan.TIF | 5/26/2010 | M. Ticci | D. Slayter | 11 | 0.00025 |
| 61.TIF | March 23 2007 | CK10-09B | GR_61_Scan.TIF | 5/26/2010 | M. Ticci | D. Slayter | 11 | 0.00021 |
| 62 CK10-10B.jpg | June 4 2010 | CK10-10B | GR_62_Scan.TIF | 6/10/2010 | M. Ticci | D. Slayter | 18 | 0.00037 |
| 63.TIF | March 23 2007 | CK10-10A | GR_63_Scan.TIF | 5/26/2010 | M. Ticci | D. Slayter | 15 | 0.00032 |
| 64.TIF | March 23 2007 | CK10-10D | GR_64_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 12 | 0.00028 |
| 65.TIF | March 23 2007 | CK10-10C | GR_65_Scan.TIF | 5/26/2010 | M. Ticci | D. Slayter | 13 | 0.00038 |
| 66.TIF | March 23 2007 | CK10-10F | GR_66_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 12 | 0.00026 |
| 67.TIF | March 23 2007 | CK10-10E | GR_67_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 11 | 0.00025 |
| 68.TIF | March 23 2007 | CK10-11E | GR_68_Scan.TIF | 5/20/2010 | M. Ticci | D. Slayter | 12 | 0.00017 |
| 69 CK10-11F.jpg | June 4 2010 | CK10-11F | GR_69_Scan.TIF | 6/10/2010 | M. Ticci | D. Slayter | 13 | 0.00032 |
| 70.TIF | March 23 2007 | CK10-11B | GR_70_Scan.TIF | 5/21/2010 | M. Ticci | D. Slayter | 12 | 0.00016 |
| 71.TIF | March 23 2007 | CK10-11C | GR_71_Scan.TIF | 5/25/2010 | M. Ticci | D. Slayter | 8 | 0.00013 |
| 72.TIF | March 23 2007 | CK10-11A | GR_72_Scan.TIF | 5/25/2010 | M. Ticci | D. Slayter | 12 | 0.00030 |
| 73 CK10-11D.jpg | June 4 2010 | CK10-11D | GR_73_Scan.TIF | 6/10/2010 | M. Ticci | D. Slayter | 12 | 0.00021 |
| 74.TIF | March 23 2007 | CK10-12B | GR_74_Scan.TIF | 5/20/2010 | M. Ticci | D. Slayter | 15 | 0.00016 |
| 75.TIF | March 23 2007 | CK10-12C | GR_75_Scan.TIF | 5/20/2010 | M. Ticci | D. Slayter | 12 | 0.00039 |

**Table 2: Summary of GIS Georectification Results (Sheet 3 of 3)**

| File Name/Map Panel Number | Date Received | Map Panel Designation | GIS Rectified File Name | Date Completed | Completed by | Reviewed by | Number of Points | Total RMS Error (feet) |
|---|---|---|---|---|---|---|---|---|
| 76.TIF | March 23 2007 | CK10-12A | GR_76_Scan.TIF | 5/20/2010 | M. Ticci | D. Slayter | 15 | 0.00033 |
| 77.TIF | March 23 2007 | CK10-13A | GR_77_Scan.TIF | 5/26/2010 | M. Ticci | D. Slayter | 14 | 0.00028 |
| 78.TIF | March 23 2007 | CK10-14B | GR_78_Scan.TIF | 5/25/2010 | M. Ticci | D. Slayter | 9 | 0.00025 |
| 79.TIF | March 23 2007 | CK10-14A | GR_79_Scan.TIF | 5/26/2010 | M. Ticci | D. Slayter | 16 | 0.00032 |
| 122_20101012.jpg | October 12 2010 | SB1 | GR_122_20101012_Scan.TIF | 11/16/2010 | M. Ticci | D. Slayter | 16 | 0.00033 |
| 123_20101012.jpg | October 12 2010 | SB2 | GR_123_20101012_Scan.TIF | 11/16/2010 | M. Ticci | D. Slayter | 14 | 0.00030 |
| | | | | | | | RMS max | 0.00103 |
| | | | | | | | RMS min | 0.00005 |
| | | | | | | | RMS mean | 0.00032 |

**Table 3 CNS Final Foundation Map Panel Issue and Resolution Log (Sheet 1 of 13)**

| Sheet Number | Panel Number | Issue | Grid Cell Location of Issue | Proposed Resolution of Issue | How Resolved |
|---|---|---|---|---|---|
| 1 | Panel_20_CK10_01A | Two undefined arrow symbols | b-11 | Remove symbol | Remove symbol |
| | | Missing dip measurement on joint | d-9 | Remove symbol | Use X for missing measurements |
| | | Shear plane symbol on quartz vein | d-13 | Confirm shear with M.S. | Leave as is |
| | | Missing dip measurement on joint | e-11 | Remove symbol | Use X for missing measurements |
| | | Illegible dip measurement on joint | g-8 | Review original map | Dip = 65 |
| | | Unknown symbol | g-10 | Remove symbol | Remove symbol |
| | | Missing dip measurement on joint | j-8 | Remove symbol | Use X for missing measurements |
| 1 | Panel_21_CK10_01A | No Discrepancy Found | | | |
| 1 | Panel_22_CK10_02B | Unknown symbol | d-1 | Remove symbol | Remove symbol |
| | | Illegible strike and dip measurement on joint | d-8 | Remove symbol | Add N80W/49 based on review of original |
| | | Missing trend measurement on lineation | d-11 | Remove symbol | Use X for missing measurements |
| | | Unknown symbol | d-14 | Confirm with M.S. | Change in elev. symbol |
| | | Undefined circle with X symbol (?) | e-3 | Confirm with M.S. | Remove symbol |
| | | Unknown symbol | e-14 | Confirm with M.S. | Change in elev. symbol |
| | | Unknown symbol | f-1 | Confirm with M.S. | Remove symbol |
| | | Unknown symbol | f-2 | Confirm with M.S. | Remove symbol |
| | | Unknown symbol | g-10 | Confirm with M.S. | Change in elev. symbol |
| 1 | Panel_23_CK10_01B | Illegible dip measurement on joint | i-12 | Review original map/ Remove | Dip = 88 |

Table 3 CNS Final Foundation Map Panel Issue and Resolution Log (Sheet 2 of 13)

| Sheet Number | Panel Number | Issue | Grid Cell Location of Issue | Proposed Resolution of Issue | How Resolved |
|---|---|---|---|---|---|
| 2 | Panel_24_CK10_02D | Missing strike measurement on joint | h-5 | Remove symbol | Use X for missing measurements |
| | | Mapper's note:"5-8" (?) text | g-6 | Confirm with M.S/Remove | Remove text |
| | | Missing strike and dip measurements on joint | e-14 | Remove symbol | N2E/61 based on review of field map original |
| | | Mapper's Initials (?) | b-5 | Confirm with M.S./Remove | Remove text |
| 1 | Panel_25_CK10_02A | Unnecessary dip direction text found on joints | c-10 | Remove dip direction text | Remove dip direction text |
| | | | c-12 | Remove dip direction text | Remove dip direction text |
| | | | c-13 | Remove dip direction text | Remove dip direction text |
| | | | h-12 | Remove dip direction text | Remove dip direction text |
| | | | h-14 | Remove dip direction text | Remove dip direction text |
| | | Undefined dashed lines | e-15 | M.S. to confirm | Remove dashed lines |
| 2 | Panel_26_CK10_02F | No Discrepancy Found | | | |
| 1 | Panel_27_CK10_02E | Illegible strike and dip measurement on joint | j-15 | Review original map | N13W/15 based on review of original |
| | | Aplite (?) dike | j-15 | Add aplite to legend | M.S. confirmed red line is not aplite. Possible error made in field, Remove line |
| 2 | Panel_28_CK10_020 | Unknown text | b-2 | Review original map | Zeolite (shown as P) |
| | | Undefined “+” symbol for dip measurement | c-5 | Remove symbol | Remove symbol from dip measurement and use X |
| | | “N08W” strike measurement | c-5 | Remove “0” from 08 | Remove "0" from "08" |
| | | Unnecessary “NE” text for dip direction | d-3 | Remove dip direction | Remove dip direction text |
| | | Unknown triangle (?) symbols | i-5 | Confirm with M.S./Remove | Elevation change symbol |
| 2 | Panel_29_CK10_03A | No Discrepancy Found | | | |

**Table 3 CNS Final Foundation Map Panel Issue and Resolution Log (Sheet 3 of 13)**

| Sheet Number | Panel Number | Issue | Grid Cell Location of Issue | Proposed Resolution of Issue | How Resolved |
|---|---|---|---|---|---|
| 2 | Panel_30_CK10_03B | Missing strike measurement on joint | a-1 | Remove symbol | Use X for missing measurements |
| | | Missing dip measurement on joint | a-1 | Remove symbol | Use X for missing measurements |
| | | Missing strike measurement on joint | a-2 | Remove symbol | Use X for missing measurements |
| | | Missing dip measurement on joint | a-5 | Remove symbol | Dip = 78 based on review of original |
| | | Missing dip measurement on joint | b-1 | Remove symbol | N-S/81 based on review of original |
| | | Vertical joint symbol used for non-vertical joint | d-9 | Revise joint symbol | Revise joint symbol with northwest dip |
| | | Missing dip measurement on joint | f-1 | Remove symbol | Use X for missing measurements |
| 2 | Panel_31_CK10_03C | Illegible strike and dip measurement on joint | i-11 | Review original map | Use X for missing measurements |
| | | Illegible dip measurement on joint | d-4 | Review original map | Dip = 32 based on review of original |
| 3 | Panel_32_CK10_03D | Possible erased shear | i-11 | Draw line as a shear | Remove entire length of shear as indicated by M.S. |
| 3 | Panel_33_CK10_03E | Undefined purple lines | c-9 | Draw lines as shears | Draw lines as shears/M.S confirmed shears |
| | | Undefined “V” joint mineral infilling symbol | d-14 | Confirm with M.S. | Vertical joint, revise map symbol |
| 3 | Panel_34_CK10_03F | Missing strike and dip measurements on 2 joints | b-14 | Remove symbols | Use X for missing measurements |
| 3 | Panel_35_CK10_04A | Missing trend measurement on lineation | e-1 | Remove symbol | Use X for missing measurements |
| | | Undefined highlighted area | h-11 | Confirm with M.S. | Remove highlighted area |

**Table 3 CNS Final Foundation Map Panel Issue and Resolution Log (Sheet 4 of 13)**

| Sheet Number | Panel Number | Issue | Grid Cell Location of Issue | Proposed Resolution of Issue | How Resolved |
|---|---|---|---|---|---|
| 3 | Panel_36_CK10_04B | Undefined red units | j-3 | Draw units as aplite dikes | Add Aplite to legend |
| | | | g-4 | Draw units as aplite dikes | Add Aplite to legend |
| | | | g-5 | Draw units as aplite dikes | Add Aplite to legend |
| | | | h-4 | Draw units as aplite dikes | Add Aplite to legend |
| | | Missing trend measurement on lineation | b-9 | Remove lineation | Use X for missing measurements |
| | | Undefined black units | h-15 | Add calcite/epidote pods to legend | Add calcite/epidote pods to legend |
| 3 | Panel_37_CK10_04C | No Discrepancy Found | | | |
| 3 | Panel_38_CK10_04D | N31W measurement on east striking joint | h-5. | Change west measurement to east | Change west measurement to east/Confirmed by M.S. |
| 1 | Panel_39_CK10_05A | Undefined "v" symbol dip measurement on joint | c-8 | Confirm with M.S. | vertical joint, revise map symbol |
| | | Unknown symbol | c-9 | Spring Symbol/Add symbol to legend | Add symbol to legend |
| | | | c-10 | Spring Symbol/Add symbol to legend | Add symbol to legend |
| | | Undefined "P?" symbol | c-10 | Confirm with M.S. | P = Prehnite |
| | | Undefined triangle symbols | c-12 | Confirm with M.S. | Change in elev. symbol |
| | | N72W measurement on east facing joint | f-9 | Revise to N72E | Revise to N72E |
| | | N11W measurement on east facing joint | f-10 | Revise to N11E | Revise to N11E |
| | | N8W measurement on east facing joint | f-11 | Revise to N8E | Revise to N8E |
| | | Undefined "v" symbol dip measurement on joint | g-7 | Confirm with M.S. | vertical joint, revise map symbol |
| | | Unknown symbol | g-8 | Confirm with M.S. | Remove symbol |
| | | N4W measurement on east striking shear plane | h-13 | Revise to N4E | Leave as is |

Table 3 CNS Final Foundation Map Panel Issue and Resolution Log (Sheet 5 of 13)

| Sheet Number | Panel Number | Issue | Grid Cell Location of Issue | Proposed Resolution of Issue | How Resolved |
|---|---|---|---|---|---|
| 1 | Panel_40_CK10_05B | Unknown symbol | a-6 | Confirm with M.S. | Remove symbol |
| | | Unknown symbol | a-13 | Confirm with M.S. | Remove symbol |
| | | Unknown symbol | a-14 | Confirm with M.S. | Remove symbol |
| | | Unknown symbol | b-5 | Confirm with M.S. | Remove symbol |
| | | “Stop Here” text | b-5 | Confirm with M.S. | Remove text |
| | | “N33W 40SW” text on quartz with no structural symbol | c-2 | Confirm with M.S. | Remove text |
| | | Unknown symbol | c-3 | Confirm with M.S. | Remove symbol |
| | | Unknown symbol | c-5 | Confirm with M.S. | Remove symbol |
| | | Unknown symbol | d-5 | Confirm with M.S. | Remove symbol |
| | | Mapper's note: “NO!” text | d-7 | Confirm with M.S. | Remove text |
| | | Unknown symbol | d-9 | Confirm with M.S. | Remove symbol |
| | | Undefined “S-S-S” text | d-11 | Confirm with M.S. | S=Sulfides |
| | | Mapper's note “STOP” text | e-3 | Confirm with M.S. | Remove text |
| | | Unknown symbol | e-15 | Confirm with M.S. | Remove symbol |
| | | Unknown symbol | f-3 | Confirm with M.S. | Remove symbol |
| | | Missing structural symbol | j-6 | Confirm shear and “v” with M.S. | Vertical shear symbol |
| 1 | Panel_41_CK10_05C | Undefined “BF” text | c-15 | Confirm with M.S. | BF=Biotite Feldspar |
| 1 | Panel_42_CK10_06A | Undefined dashed lines | a-4 | Confirm with M.S. | Removed dashed lines |
| | | | b-2 | Confirm with M.S. | Removed dashed lines |
| | | | b-7 | Confirm with M.S. | Removed dashed lines |
| | | | c-11 | Confirm with M.S. | Removed dashed lines |
| | | | j-7 | Confirm with M.S. | Removed dashed lines |
| | | Undefined "fg" text | a-7 | Confirm with M.S. | Remove text |
| | | | a-8 | Confirm with M.S. | Remove text |
| | | | a-9 | Confirm with M.S. | Remove text |
| | | | a-10 | Confirm with M.S. | Remove text |
| | | | i-14 | Confirm with M.S. | Remove text |

**Table 3 CNS Final Foundation Map Panel Issue and Resolution Log (Sheet 6 of 13)**

| Sheet Number | Panel Number | Issue | Grid Cell Location of Issue | Proposed Resolution of Issue | How Resolved |
|---|---|---|---|---|---|
| 1 | Panel_43_CK10_06B | No Discrepancy Found | | | |
| 2 | Panel_44_CK10_06C | Unnecessary "SE" dip direction text | b-1 | Remove dip direction text | Remove dip direction text |
| | | Undefined "MAL" text | d-11 | Confirm with M.S. | Mineral description - Mica Allanite Laumontite (MAL) |
| | | Joint orientations | e-8 | Review original map | Strike=N15E, Dip=61 |
| | | Missing strike and dip measurements on shear plane | g-7 | Remove symbol | Use X for missing measurements |
| | | Undefined "Fold" text | g-14 | Confirm with M.S. | Remove text |
| | | Incorrect "Chle" text for chlorite | i-13 | Confirm with M.S. | Replace "Chle" with "C" for Chlorite |
| 2 | Panel_45_CK10_06D | Unknown text | a-12 | Confirm with M.S. | Mineral description -Mica Allanite Pyrite (MAPy)(?) |
| | | | c-11 | Confirm with M.S. | Mineral description - Mica Allanite Laumontite (MAL) |
| | | Undefined dashed lines | d-13 | Add lines to legend | Shear foliations |
| | | | d-14 | Add lines to legend | Shear foliations |
| | | | e-12 | Add lines to legend | Shear foliations |
| | | Incorrect line work for shear | i-3 | Confirm with M.S joint/vein extents | Remove shear as indicated on field map panel |
| | | Unknown symbols | i-14 | Confirm with M.S. | Borehole location - remove/irrelevant symbol |
| | | | i-15 | Confirm with M.S. | Borehole location - remove/irrelevant symbol |
| | | Undefined "Joint Face" text | g-15 | Confirm with M.S. | Remove text |
| 4 | Panel_46_CK10_06E | Map checker's note: "Do not put on" text | b-6 | Remove text | Remove text |
| | | Missing strike and dip measurements on joint | c-12 | Use X for missing measurements | Use X for missing measurements |

Table 3 CNS Final Foundation Map Panel Issue and Resolution Log (Sheet 7 of 13)

| Sheet Number | Panel Number | Issue | Grid Cell Location of Issue | Proposed Resolution of Issue | How Resolved |
|---|---|---|---|---|---|
| 5 | Panel_47_CK10_06F | Missing strike measurement on joint | b-3 | Use X for missing measurements | Use X for missing measurements |
| | | Map checker's note "Do not draw" text | b-6 | M.S. to confirm feature as accurate | Remove text |
| | | | b-7 | M.S. to confirm feature as accurate | Remove text |
| | | "N81W" measurement on east striking joint | d-3 | Change to N81E (?) | Strike = N18E |
| | | Illegible strike measurement on joint | g-8 | Use X for missing measurements | Use X for missing measurements |
| | | Illegible/missing dip measurement on joint | j-8 | Use X for missing measurements | Use X for missing measurements |
| 6 | Panel_48_CK10_07F | Undefined "AP" text (Possible Aplite dike or Allanite Prehnite mineralization ?) | g-9 | M.S to confirm Aplite dike or Allanite Prehnite mineralization | Draw as Aplite dike |
| | | Possible aplite dikes? | g-9 | Draw shear as Aplite dike? | Draw as Aplite dike |
| 2 | Panel_49_CK10_07A | Unknown text | d-8 | Confirm with M.S. | Mineral description - Mica Allanite Pyrite (MAP) |
| | | Unknown rectangle with X symbol | b-12 | Confirm with M.S. | Possible concrete pad - remove from map |
| | | | d-12 | Confirm with M.S. | Possible concrete pad - remove from map |
| | | | f-13 | Confirm with M.S. | Possible concrete pad - remove from map |
| | | | f-14 | Confirm with M.S. | Possible concrete pad - remove from map |
| | | | g-5 | Confirm with M.S. | Possible concrete pad - remove from map |
| | | | h-2 | Confirm with M.S. | Possible concrete pad - remove from map |

Table 3 CNS Final Foundation Map Panel Issue and Resolution Log (Sheet 8 of 13)

| Sheet Number | Panel Number | Issue | Grid Cell Location of Issue | Proposed Resolution of Issue | How Resolved |
|---|---|---|---|---|---|
| 2 | Panel_49_CK10_07A | Unknown rectangle with X symbol | h-12 | Confirm with M.S. | Possible concrete pad - remove from map |
| | | | i-6 | Confirm with M.S. | Possible concrete pad - remove from map |
| | | Illegible strike and measurement on joint | g-11 | Confirm with M.S. | N4W/27 based on review of original |
| | | Contact lines of mafic gneiss obscured by possible concrete pad symbol | h-2 | Confirm with M.S. | Connect contact lines |
| | | Two possibly erased shears ? | i-12 | Confirm with M.S. | Remove shears |
| 2 | Panel_50_CK10_07B | Missing strike measurement on vertical joint | h-5 | Remove symbol | Use X for missing measurements |
| 3 | Panel_51_CK10_07C | Undefined dark green unit | f-15 | Draw unit as calcite/epidote pod | Draw unit as calcite/epidote pod/Confirmed by M.S. |
| 3 | Panel_52_CK10_07D | Illegible dip measurement joint | h-5 | Remove symbol | Dip = 46 based on review of original |
| | | | i-15 | Remove symbol | Dip = 62 based on review of original |
| 5 | Panel_53_CK10_07E | No Discrepancy Found | | | |
| 6 | Panel_54_CK10_07F | Illegible dip measurement on joint | e-10 | Use X for missing measurements | Dip = 26 based on review |
| 6 | Panel_55_CK10_08C | No Discrepancy Found | | | |
| 3 | Panel_56_CK10_08A | Undefined "S" symbol | d-8. | Update legend with "Sulfide" | Update legend with "Sulfide" |
| | | Incorrect line work for shear | c-13 | Confirm with M.S./Review Original | Revised as joint per M.S |
| | | | c-14 | Confirm with M.S./Review Original | Revised as joint per M.S |
| | | | d-11 | Confirm with M.S./Review Original | Revised as joint per M.S |

Table 3 CNS Final Foundation Map Panel Issue and Resolution Log (Sheet 9 of 13)

| Sheet Number | Panel Number | Issue | Grid Cell Location of Issue | Proposed Resolution of Issue | How Resolved |
|---|---|---|---|---|---|
| 3 | Panel_56_CK10_08A | Incorrect line work for shear | d-13 | Confirm with M.S./Review Original | Revised as joint per M.S |
| | | | e-10 | Confirm with M.S./Review Original | Revised as joint per M.S |
| | | | h-13 | Confirm with M.S./Review Original | Revised as joint per M.S |
| | | | i-13 | Confirm with M.S./Review Original | Revised as joint per M.S |
| | | | i-14 | Confirm with M.S./Review Original | Revised as joint per M.S |
| 3 | Panel_57_CK10_08B | No Discrepancy Found | | | |
| 3 | Panel_58_CK10_08D | No Discrepancy Found | | | |
| 4 | Panel_59_CK10_09C | Missing strike and dip measurements on shear plane | h-3 | Use X for missing measurements | Use X for missing measurements |
| | | | h-4 | Use X for missing measurements | Use X for missing measurements |
| | | | i-7 | Use X for missing measurements | Use X for missing measurements |
| | | Missing strike and dip measurements on joint | h-5 | Use X for missing measurements | Use X for missing measurements |
| | | Unknown geologic unit (Ca pod?) | j-5 | Draw as Ca/E pod | Draw as Ca/E pod |
| | | Mapper's note: "?" symbol | i-6 | M.S. to confirm | Remove "?" |
| 4 | Panel_60_CK10_09A | Undefined thick black lines? (Ca/E pods?) | g-7 | Draw as Ca/E pods | These are quartz veins unless secondary mineralization noted, then pegmatites. |
| 4 | Panel_61_CK10_09B | Structural measurements with no structural symbol | c-8 | Draw shear plane symbol | Draw shear plane symbol |
| | | Mapper's note: “A-19” text | g-14 | Remove Text | Remove Text |
| | | Map checker's note: “do not put on” text | h-6 | Remove Text | Remove text |

Table 3 CNS Final Foundation Map Panel Issue and Resolution Log (Sheet 10 of 13)

| Sheet Number | Panel Number | Issue | Grid Cell Location of Issue | Proposed Resolution of Issue | How Resolved |
|---|---|---|---|---|---|
| 4 | Panel_61_CK10_09B | Undefined Reddish orange line work | h-12 | Draw as shear | Draw as aplite dikes |
| | | | j-14 | Draw as shear | Draw as shear |
| | | | j-15 | Draw as shear | Draw as shear |
| | | Missing dip measurement from contact symbol | j-15 | Use X for missing measurements | Use X for missing measurements |
| | | Calcite/Epidote pods difficult to discern from quartz veins | entire map panel | M.S. to confirm Ca/Ep pods | M.S confirmed all Ca/E pods and quartz veins from original field map |
| 4 | Panel_62_CK10_10B | Illegible or missing strike and dip measurements | i-1 | Use X for missing measurements | 59 dip |
| | | | j-1 | Use X for missing measurements | N15W |
| | | | i-3 | Use X for missing measurements | 55 dip |
| | | | g-6 | Use X for missing measurements | N5E |
| | | | b-6 | Use X for missing measurements | N88W |
| | | | a-7 | Use X for missing measurements | N11W |
| | | | h-7 | Use X for missing measurements | Use X for missing measurements |
| | | | a-8 | Use X for missing measurements | Use X for missing measurements |
| | | | b-8 | Use X for missing measurements | N88E |
| | | | f-8 | Use X for missing measurements | N10W |
| | | | c-12 | Use X for missing measurements | 65 dip |
| | | Calcite/Epidote pods ? (Drawn in red on drafted panel) | entire map panel | M.S to confirm Ca/E pods | Ca/E pods confirmed |

**Table 3 CNS Final Foundation Map Panel Issue and Resolution Log (Sheet 11 of 13)**

| Sheet Number | Panel Number | Issue | Grid Cell Location of Issue | Proposed Resolution of Issue | How Resolved |
|---|---|---|---|---|---|
| 4 | Panel_62_CK10_10B | Undefined dashed lines | e-3 through gj-4 | M.S to confirm | Draw as change in elevation symbol. Use aerial photo to confirm symbol orientation. |
| 4 | Panel_63_CK10_10A | Vertical dip measurement with non-vertical joint symbol | f-9 | Use vertical symbol | Use vertical symbol |
| | | Contact symbol used on shear plane measurement (?) | g-9 | Use shear plane symbol | Use shear plane symbol |
| | | Contact symbol used on shear plane measurement (?) | h-6 | Use shear plane symbol | Use shear plane symbol |
| 5 | Panel_64_CK10_10D | Illegible text (Ca?) | e-6 | Insert text "Ca" for Calcite | Insert text "Ca" for Calcite |
| | | Illegible dip measurement on joint | b-15 | Use X for missing measurements | dip = 65 based on review |
| 4 | Panel_65_CK10_10C | Missing dip measurement on joint | e-15 | Use X for missing measurements | Use X for missing measurements |
| | | Calcite/Epidote pods? | a-14 | M.S to confirm Ca/E pods | Draw as Ca/E pod |
| | | | d-14 | M.S to confirm Ca/E pods | Draw as Ca/E pod |
| | | | e-10 | M.S to confirm Ca/E pods | Draw as Ca/E pod |
| | | | e-11 | M.S to confirm Ca/E pods | Draw as Ca/E pod |
| | | | e-14 | M.S to confirm Ca/E pods | Draw as Ca/E pod |
| | | | f-2 | M.S to confirm Ca/E pods | Draw as Ca/E pod |
| | | | f-3 | M.S to confirm Ca/E pods | Draw as Ca/E pod |
| | | | g-11 | M.S to confirm Ca/E pods | Draw as Ca/E pod |
| | | | j-5 | M.S to confirm Ca/E pods | Draw as Ca/E pod |
| | | | j-15 | M.S to confirm Ca/E pods | Draw as quartz veins |
| | | Mafic gneiss within square shaped quartz veins? | f-9 | M.S to confirm | Quartz veins only no mafic gneiss |
| | | Undefined "fg" text | c-5 | M.S to confirm | Remove Text |

Table 3 CNS Final Foundation Map Panel Issue and Resolution Log (Sheet 12 of 13)

| Sheet Number | Panel Number | Issue | Grid Cell Location of Issue | Proposed Resolution of Issue | How Resolved |
|---|---|---|---|---|---|
| 5 | Panel_66_CK10_10F | Missing strike and dip measurement on joint | b-4 | Use X for missing measurements | Use X for missing measurements |
| 5 | Panel_67_CK10_10E | Calcite/Epidote pods? | d-4 | Draw as Calcite/Epidote pod | Draw as Calcite/Epidote pod |
| | | | c-5 | Draw as Calcite/Epidote pod | Draw as Calcite/Epidote pod |
| | | Apex direction of change in elevation symbols difficult to discern | entire map panel | M.S. to confirm interpretation | Leave as is |
| 6 | Panel_68_CK10_11E | No Discrepancy Found | | | |
| 6 | Panel_69_CK10_11F | Illegible strike measurement on joint | a-4 | Use X for missing measurements | Use X for missing measurements |
| | | | a-5 | Use X for missing measurements | Use X for missing measurements |
| | | Illegible strike and dip measurement on joint | a-7 | Use X for missing measurements | Use X for missing measurements |
| | | | a-11 | Use X for missing measurements | Use X for missing measurements |
| | | | a-12 | Use X for missing measurements | Use X for missing measurements |
| | | Illegible strike and dip measurement on shear plane | c-13 | Use X for missing measurements | Use X for missing measurements |
| 5 | Panel_70_CK10_11B | No Discrepancy Found | | | |
| 5 | Panel_71_CK10_11C | No Discrepancy Found | | | |
| 5 | Panel_72_CK10_11A | Undefined “AP” text (Possible Allanite Prehnite mineralization?) | e-8 | M.S. to confirm "AP" text | AP = Aplite. Draw joint as Aplite Dike |
| 6 | Panel_73_CK10_11D | Illegible strike measurement on joint | a-2 | Use X for missing measurements | Use X for missing measurements |
| | | Illegible dip measurement on joint | a-9 | Use X for missing measurements | Use X for missing measurements |
| | | | a-11 | Use X for missing measurements | Use X for missing measurements |

**Table 3 CNS Final Foundation Map Panel Issue and Resolution Log (Sheet 13 of 13)**

| Sheet Number | Panel Number | Issue | Grid Cell Location of Issue | Proposed Resolution of Issue | How Resolved |
|---|---|---|---|---|---|
| 6 | Panel_73_CK10_11D | Illegible strike measurement on joint | a-13 | Use X for missing measurements | Use X for missing measurements |
| 6 | Panel_74_CK10_12B | No Discrepancy Found | | | |
| 6 | Panel_75_CK10_12C | Missing structural symbol on shear or joint | a-10 | M.S to confirm/add shear symbol | Leave as is |
| 6 | Panel_76_CK10_12A | Illegible strike measurement on joint | d-8 | Use X for missing measurements | Use X for missing measurements |
| 4 | Panel_77_CK10_13A | No Discrepancy Found | | | |
| 5 | Panel_78_CK10_14B | Missing strike measurement | b-1 | Use X for missing measurements | Use X for missing measurements |
| 4 | Panel_79_CK10_14A | Possible erased shear | a-14 | M.S to confirm | Remove shear |
| | | | | Total Number of Issues | 210 |
| | | | | Number of Unresolved Issues | 0 |

## Table 4 CNS and WLS Mineral Infilling (Sheet 1 of 1)

| CNS Final Foundation Mapping Mineral Infilling Observations | WLS COLA Mapping Mineral Infilling Observations |
|---|---|
| Allanite | Biotite |
| Biotite | Calcite |
| Calcite | Opaques |
| Chlorite | Potassium Feldspar |
| Epidote | Quartz |
| Feldspar | Sericite (Muscovite) |
| Iron Oxide | |
| Laumontite | |
| Manganese Oxide | |
| Mica | |
| Prehnite (zeolite) | |
| Pyrite | |
| Quartz | |
| Sulfides | |

## Table 5 Comparison of CNS to WLS Rock Terminology (Sheet 1 of 1)

| CNS PSAR Classification | WLS COLA Classification | |
|---|---|---|
| | Field Mapping | Petrographic |
| Felsic Gneiss (includes felsic gneiss, plagioclase-biotite gneiss, mica gneiss, quartz-calcite gneiss, quartz-muscovite gneiss, meta-granodiorite and other rocks) | Early Leucocratic Series | Meta-Granodiorite to Meta-Quartz Diorite |
| Mafic Gneiss (includes actinolite-biotite gneiss, biotite gneiss and other rocks) | Late Intrusive Series | Meta-Diorite, Amphibolite |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 20 | g | 13 | CNS Unit 1 | 67 | 81S | 203 | 9 |
| 20 | h | 6 | CNS Unit 1 | 16 | 65NW | 74 | 25 |
| 20 | h | 14 | CNS Unit 1 | 10 | 90V | 260 | 0 |
| 20 | i | 8 | CNS Unit 1 | 349 | 75E | 281 | 15 |
| 20 | i | 10 | CNS Unit 1 | 13 | 52E | 257 | 38 |
| 20 | i | 13 | CNS Unit 1 | 34 | 85SE | 236 | 5 |
| 20 | j | 13 | CNS Unit 1 | 11 | 79E | 259 | 11 |
| 20 | j | 6 | CNS Unit 1 | 341 | 71E | 289 | 19 |
| 20 | j | 12 | CNS Unit 1 | 8 | 82SE | 262 | 8 |
| 20 | j | 7 | CNS Unit 1 | 337 | 69W | 113 | 21 |
| 22 | a | 11 | CNS Unit 1 | 315 | 33SW | 135 | 57 |
| 22 | a | 3 | CNS Unit 1 | 7 | 75W | 83 | 15 |
| 22 | b | 3 | CNS Unit 1 | 357 | 56E | 273 | 34 |
| 22 | b | 10 | CNS Unit 1 | 317 | 50SW | 133 | 40 |
| 22 | c | 10 | CNS Unit 1 | 305 | 85NE | 325 | 5 |
| 22 | c | 10 | CNS Unit 1 | 310 | 48SW | 140 | 42 |
| 22 | d | 5 | CNS Unit 1 | 8 | 42E | 262 | 48 |
| 22 | d | 11 | CNS Unit 1 | 330 | 65SW | 120 | 25 |
| 22 | e | 8 | CNS Unit 1 | 5 | 56E | 265 | 34 |
| 22 | e | 6 | CNS Unit 1 | 353 | 47E | 277 | 43 |
| 22 | e | 3 | CNS Unit 1 | 21 | 42NW | 69 | 48 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 22 | g | 1 | CNS Unit 1 | 30 | 64NW | 60 | 26 |
| 22 | h | 2 | CNS Unit 1 | 356 | 45W | 94 | 45 |
| 22 | h | 5 | CNS Unit 1 | 355 | 53W | 95 | 37 |
| 22 | j | 2 | CNS Unit 1 | 358 | 76E | 272 | 14 |
| 23 | i | 12 | CNS Unit 1 | 34 | 90V | 236 | 0 |
| 23 | j | 10 | CNS Unit 1 | 24 | 67SE | 246 | 23 |
| 24 | a | 14 | CNS Unit 1 | 16 | 66E | 254 | 24 |
| 24 | a | 13 | CNS Unit 1 | 17 | 82W | 73 | 8 |
| 24 | a | 8 | CNS Unit 1 | 18 | 79W | 72 | 11 |
| 24 | b | 11 | CNS Unit 1 | 22 | 72SE | 248 | 18 |
| 24 | b | 9 | CNS Unit 1 | 17 | 71W | 73 | 19 |
| 24 | h | 1 | CNS Unit 1 | 315 | 85NE | 315 | 5 |
| 24 | i | 7 | CNS Unit 1 | 9 | 83E | 261 | 7 |
| 24 | i | 13 | CNS Unit 1 | 11 | 86W | 79 | 4 |
| 24 | j | 3 | CNS Unit 1 | 313 | 39SW | 137 | 51 |
| 25 | b | 10 | CNS Unit 1 | 38 | 75SE | 232 | 15 |
| 25 | d | 11 | CNS Unit 1 | 78 | 76N | 12 | 14 |
| 25 | f | 10 | CNS Unit 1 | 70 | 77N | 20 | 13 |
| 25 | f | 13 | CNS Unit 1 | 347 | 81W | 103 | 9 |
| 25 | f | 12 | CNS Unit 1 | 333 | 69W | 117 | 21 |
| 25 | i | 7 | CNS Unit 1 | 319 | 69SW | 131 | 21 |
| 26 | h | 4 | CNS Unit 1 | 71 | 80N | 19 | 10 |
| 26 | h | 7 | CNS Unit 1 | 47 | 72SE | 223 | 18 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 26 | h | 7 | CNS Unit 1 | 350 | 65W | 100 | 25 |
| 26 | j | 6 | CNS Unit 1 | 56 | 69SE | 214 | 21 |
| 27 | j | 9 | CNS Unit 1 | 13 | 54E | 257 | 36 |
| 27 | j | 12 | CNS Unit 1 | 44 | 85SE | 226 | 5 |
| 28 | c | 4 | CNS Unit 1 | 56 | 66SE | 214 | 24 |
| 28 | e | 13 | CNS Unit 1 | 70 | 20SE | 200 | 70 |
| 28 | f | 9 | CNS Unit 1 | 19 | 19E | 251 | 71 |
| 28 | f | 1 | CNS Unit 1 | 11 | 68W | 79 | 22 |
| 29 | f | 8 | CNS Unit 1 | 355 | 81W | 95 | 9 |
| 29 | f | 12 | CNS Unit 1 | 26 | 83W | 64 | 7 |
| 29 | g | 5 | CNS Unit 1 | 19 | 83W | 71 | 7 |
| 29 | h | 4 | CNS Unit 1 | 10 | 59E | 260 | 31 |
| 29 | h | 10 | CNS Unit 1 | 23 | 86SE | 247 | 4 |
| 29 | h | 2 | CNS Unit 1 | 3 | 82W | 87 | 8 |
| 29 | h | 15 | CNS Unit 1 | 4 | 86W | 86 | 4 |
| 29 | i | 10 | CNS Unit 1 | 356 | 79E | 274 | 11 |
| 29 | i | 15 | CNS Unit 1 | 10 | 70E | 260 | 20 |
| 29 | i | 7 | CNS Unit 1 | 330 | 59E | 300 | 31 |
| 29 | i | 13 | CNS Unit 1 | 10 | 78W | 80 | 12 |
| 29 | i | 6 | CNS Unit 1 | 18 | 81W | 72 | 9 |
| 29 | j | 8 | CNS Unit 1 | 4 | 86E | 266 | 4 |
| 30 | c | 15 | CNS Unit 1 | 44 | 76SE | 226 | 14 |
| 30 | d | 14 | CNS Unit 1 | 46 | 53SE | 224 | 37 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 30 | f | 1 | CNS Unit 1 | 88 | 38NW | 2 | 52 |
| 30 | f | 12 | CNS Unit 1 | 42 | 66SE | 228 | 24 |
| 30 | g | 8 | CNS Unit 1 | 20 | 59E | 250 | 31 |
| 30 | h | 10 | CNS Unit 1 | 43 | 69SE | 227 | 21 |
| 30 | i | 3 | CNS Unit 1 | 10 | 55E | 260 | 35 |
| 30 | j | 8 | CNS Unit 1 | 45 | 64SE | 225 | 26 |
| 31 | a | 12 | CNS Unit 1 | 358 | 83E | 272 | 7 |
| 31 | a | 7 | CNS Unit 1 | 36 | 80SE | 234 | 10 |
| 31 | a | 15 | CNS Unit 1 | 45 | 27SE | 225 | 63 |
| 31 | b | 12 | CNS Unit 1 | 43 | 74SE | 227 | 16 |
| 31 | e | 9 | CNS Unit 1 | 19 | 67W | 71 | 23 |
| 31 | f | 9 | CNS Unit 1 | 9 | 72W | 81 | 18 |
| 31 | g | 10 | CNS Unit 1 | 35 | 78NW | 55 | 12 |
| 31 | i | 8 | CNS Unit 1 | 47 | 73SE | 223 | 17 |
| 32 | g | 5 | CNS Unit 1 | 8 | 56E | 262 | 34 |
| 32 | g | 3 | CNS Unit 1 | 17 | 72E | 253 | 18 |
| 32 | h | 1 | CNS Unit 1 | 0 | 82E | 270 | 8 |
| 32 | h | 2 | CNS Unit 1 | 27 | 38SE | 243 | 52 |
| 32 | i | 2 | CNS Unit 1 | 343 | 85E | 287 | 5 |
| 32 | i | 4 | CNS Unit 1 | 39 | 71SE | 231 | 19 |
| 32 | i | 1 | CNS Unit 1 | 357 | 82W | 93 | 8 |
| 32 | j | 13 | CNS Unit 1 | 13 | 64E | 257 | 26 |
| 32 | j | 3 | CNS Unit 1 | 49 | 13NW | 41 | 77 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 33 | a | 11 | CNS Unit 1 | 0 | 75E | 270 | 15 |
| 33 | b | 3 | CNS Unit 1 | 9 | 66E | 261 | 24 |
| 33 | b | 1 | CNS Unit 1 | 36 | 55SE | 234 | 35 |
| 33 | b | 8 | CNS Unit 1 | 55 | 90V | 215 | 0 |
| 33 | b | 14 | CNS Unit 1 | 356 | 42W | 94 | 48 |
| 33 | c | 1 | CNS Unit 1 | 13 | 79E | 257 | 11 |
| 33 | c | 12 | CNS Unit 1 | 6 | 60W | 84 | 30 |
| 33 | c | 11 | CNS Unit 1 | 346 | 54W | 104 | 36 |
| 33 | d | 6 | CNS Unit 1 | 25 | 80E | 245 | 10 |
| 33 | e | 5 | CNS Unit 1 | 26 | 69SE | 244 | 21 |
| 33 | e | 13 | CNS Unit 1 | 39 | 38SE | 231 | 52 |
| 33 | e | 14 | CNS Unit 1 | 41 | 77SE | 229 | 13 |
| 33 | e | 12 | CNS Unit 1 | 52 | 20SE | 218 | 70 |
| 33 | g | 4 | CNS Unit 1 | 42 | 81SE | 228 | 9 |
| 33 | h | 12 | CNS Unit 1 | 6 | 64E | 264 | 26 |
| 33 | i | 5 | CNS Unit 1 | 5 | 74E | 265 | 16 |
| 33 | i | 2 | CNS Unit 1 | 44 | 81SE | 226 | 9 |
| 33 | j | 1 | CNS Unit 1 | 5 | 83E | 265 | 7 |
| 33 | j | 15 | CNS Unit 1 | 37 | 75SE | 233 | 15 |
| 34 | g | 15 | CNS Unit 1 | 8 | 65E | 262 | 25 |
| 34 | h | 11 | CNS Unit 1 | 7 | 57E | 263 | 33 |
| 35 | d | 4 | CNS Unit 1 | 350 | 53W | 100 | 37 |
| 35 | d | 2 | CNS Unit 1 | 339 | 51W | 111 | 39 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 35 | f | 4 | CNS Unit 1 | 38 | 56SE | 232 | 34 |
| 35 | h | 8 | CNS Unit 1 | 3 | 69E | 267 | 21 |
| 35 | h | 7 | CNS Unit 1 | 12 | 47E | 258 | 43 |
| 35 | h | 2 | CNS Unit 1 | 41 | 57SE | 229 | 33 |
| 35 | j | 1 | CNS Unit 1 | 9 | 58E | 261 | 32 |
| 36 | e | 12 | CNS Unit 1 | 4 | 61E | 266 | 29 |
| 36 | e | 6 | CNS Unit 1 | 355 | 55E | 275 | 35 |
| 36 | e | 14 | CNS Unit 1 | 355 | 55E | 275 | 35 |
| 36 | e | 9 | CNS Unit 1 | 334 | 72E | 296 | 18 |
| 36 | f | 5 | CNS Unit 1 | 5 | 50E | 265 | 40 |
| 36 | g | 2 | CNS Unit 1 | 2 | 46E | 268 | 44 |
| 36 | g | 3 | CNS Unit 1 | 20 | 51SE | 250 | 39 |
| 36 | i | 15 | CNS Unit 1 | 29 | 80SE | 241 | 10 |
| 37 | j | 3 | CNS Unit 1 | 6 | 81W | 84 | 9 |
| 38 | b | 4 | CNS Unit 1 | 61 | 84NW | 29 | 6 |
| 38 | c | 3 | CNS Unit 1 | 356 | 71E | 274 | 19 |
| 38 | d | 5 | CNS Unit 1 | 10 | 65E | 260 | 25 |
| 38 | d | 5 | CNS Unit 1 | 350 | 88E | 280 | 2 |
| 38 | e | 5 | CNS Unit 1 | 49 | 83SE | 221 | 7 |
| 38 | f | 4 | CNS Unit 1 | 52 | 79SE | 218 | 11 |
| 39 | b | 9 | CNS Unit 1 | 7 | 64E | 263 | 26 |
| 39 | c | 10 | CNS Unit 1 | 36 | 55NW | 54 | 35 |
| 39 | c | 14 | CNS Unit 1 | 348 | 64W | 102 | 26 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 39 | d | 12 | CNS Unit 1 | 359 | 60E | 271 | 30 |
| 39 | d | 14 | CNS Unit 1 | 25 | 73E | 245 | 17 |
| 39 | d | 7 | CNS Unit 1 | 341 | 55W | 109 | 35 |
| 39 | e | 8 | CNS Unit 1 | 5 | 53E | 265 | 37 |
| 39 | e | 12 | CNS Unit 1 | 36 | 72W | 54 | 18 |
| 39 | g | 8 | CNS Unit 1 | 352 | 60W | 98 | 30 |
| 39 | h | 13 | CNS Unit 1 | 356 | 53E | 274 | 37 |
| 39 | h | 15 | CNS Unit 1 | 11 | 88W | 79 | 2 |
| 39 | i | 14 | CNS Unit 1 | 15 | 83W | 75 | 7 |
| 39 | j | 15 | CNS Unit 1 | 8 | 39W | 82 | 51 |
| 40 | b | 15 | CNS Unit 1 | 11 | 72W | 79 | 18 |
| 40 | b | 13 | CNS Unit 1 | 18 | 59W | 72 | 31 |
| 40 | b | 13 | CNS Unit 1 | 19 | 64W | 71 | 26 |
| 40 | b | 4 | CNS Unit 1 | 335 | 87W | 115 | 3 |
| 40 | c | 6 | CNS Unit 1 | 357 | 62W | 93 | 28 |
| 40 | c | 1 | CNS Unit 1 | 9 | 76W | 81 | 14 |
| 40 | c | 7 | CNS Unit 1 | 340 | 42W | 110 | 48 |
| 40 | d | 13 | CNS Unit 1 | 355 | 71W | 95 | 19 |
| 40 | d | 12 | CNS Unit 1 | 10 | 49W | 80 | 41 |
| 40 | d | 8 | CNS Unit 1 | 326 | 64W | 124 | 26 |
| 40 | e | 9 | CNS Unit 1 | 359 | 71E | 271 | 19 |
| 40 | f | 9 | CNS Unit 1 | 45 | 71SE | 225 | 19 |
| 40 | f | 3 | CNS Unit 1 | 57 | 82SE | 213 | 8 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 40 | f | 11 | CNS Unit 1 | 0 | 77W | 90 | 13 |
| 40 | f | 1 | CNS Unit 1 | 355 | 73W | 95 | 17 |
| 40 | f | 7 | CNS Unit 1 | 23 | 56W | 67 | 34 |
| 40 | f | 14 | CNS Unit 1 | 337 | 42W | 113 | 48 |
| 40 | g | 4 | CNS Unit 1 | 10 | 81W | 80 | 9 |
| 40 | g | 14 | CNS Unit 1 | 23 | 59W | 67 | 31 |
| 40 | h | 9 | CNS Unit 1 | 45 | 60SE | 225 | 30 |
| 40 | h | 3 | CNS Unit 1 | 67 | 72SE | 203 | 18 |
| 40 | h | 7 | CNS Unit 1 | 344 | 46W | 106 | 44 |
| 40 | i | 14 | CNS Unit 1 | 28 | 70NW | 62 | 20 |
| 40 | j | 6 | CNS Unit 1 | 28 | 90V | 242 | 0 |
| 41 | g | 14 | CNS Unit 1 | 11 | 81W | 79 | 9 |
| 42 | b | 4 | CNS Unit 1 | 353 | 66E | 277 | 24 |
| 42 | b | 8 | CNS Unit 1 | 350 | 59E | 280 | 31 |
| 42 | c | 1 | CNS Unit 1 | 10 | 55E | 260 | 35 |
| 42 | d | 2 | CNS Unit 1 | 0 | 87E | 270 | 3 |
| 42 | d | 11 | CNS Unit 1 | 0 | 78E | 270 | 12 |
| 42 | d | 10 | CNS Unit 1 | 352 | 85E | 278 | 5 |
| 42 | d | 1 | CNS Unit 1 | 16 | 72E | 254 | 18 |
| 42 | d | 5 | CNS Unit 1 | 358 | 77W | 92 | 13 |
| 42 | d | 13 | CNS Unit 1 | 9 | 62W | 81 | 28 |
| 42 | f | 11 | CNS Unit 1 | 17 | 76E | 253 | 14 |
| 42 | g | 3 | CNS Unit 1 | 351 | 77E | 279 | 13 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 42 | g | 7 | CNS Unit 1 | 350 | 76E | 280 | 14 |
| 42 | g | 9 | CNS Unit 1 | 10 | 80E | 260 | 10 |
| 42 | h | 7 | CNS Unit 1 | 11 | 85E | 259 | 5 |
| 42 | h | 5 | CNS Unit 1 | 40 | 90V | 230 | 0 |
| 42 | j | 5 | CNS Unit 1 | 18 | 75E | 252 | 15 |
| 43 | b | 1 | CNS Unit 1 | 14 | 81W | 76 | 9 |
| 43 | b | 5 | CNS Unit 1 | 22 | 67W | 68 | 23 |
| 43 | d | 10 | CNS Unit 1 | 49 | 55SE | 221 | 35 |
| 43 | d | 2 | CNS Unit 1 | 10 | 61W | 80 | 29 |
| 43 | e | 8 | CNS Unit 1 | 10 | 80E | 260 | 10 |
| 43 | e | 2 | CNS Unit 1 | 0 | 68W | 90 | 22 |
| 43 | e | 4 | CNS Unit 1 | 357 | 56W | 93 | 34 |
| 43 | e | 5 | CNS Unit 1 | 356 | 74W | 94 | 16 |
| 43 | e | 10 | CNS Unit 1 | 355 | 41W | 95 | 49 |
| 43 | h | 14 | CNS Unit 1 | 14 | 58E | 256 | 32 |
| 43 | h | 8 | CNS Unit 1 | 41 | 64SE | 229 | 26 |
| 43 | i | 14 | CNS Unit 1 | 355 | 77E | 275 | 13 |
| 43 | i | 2 | CNS Unit 1 | 34 | 67SE | 236 | 23 |
| 44 | a | 4 | CNS Unit 1 | 312 | 51SW | 138 | 39 |
| 44 | a | 5 | CNS Unit 1 | 312 | 50SW | 138 | 40 |
| 44 | a | 5 | CNS Unit 1 | 307 | 50SW | 143 | 40 |
| 44 | b | 7 | CNS Unit 1 | 9 | 73E | 261 | 17 |
| 44 | b | 1 | CNS Unit 1 | 12 | 65E | 258 | 25 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 44 | b | 5 | CNS Unit 1 | 85 | 45S | 185 | 45 |
| 44 | b | 4 | CNS Unit 1 | 272 | 36S | 178 | 54 |
| 44 | b | 5 | CNS Unit 1 | 54 | 44SE | 216 | 46 |
| 44 | b | 4 | CNS Unit 1 | 62 | 49SE | 208 | 41 |
| 44 | c | 6 | CNS Unit 1 | 0 | 74E | 270 | 16 |
| 44 | c | 5 | CNS Unit 1 | 10 | 88E | 260 | 2 |
| 44 | c | 5 | CNS Unit 1 | 306 | 54SW | 144 | 36 |
| 44 | c | 5 | CNS Unit 1 | 359 | 90V | 1 | 0 |
| 44 | c | 10 | CNS Unit 1 | 345 | 81W | 105 | 9 |
| 44 | c | 4 | CNS Unit 1 | 29 | 44W | 61 | 46 |
| 44 | d | 13 | CNS Unit 1 | 357 | 81E | 273 | 9 |
| 44 | d | 5 | CNS Unit 1 | 84 | 33S | 186 | 57 |
| 44 | d | 11 | CNS Unit 1 | 344 | 87W | 106 | 3 |
| 44 | f | 5 | CNS Unit 1 | 285 | 44SW | 165 | 46 |
| 44 | g | 14 | CNS Unit 1 | 10 | 79E | 260 | 11 |
| 44 | h | 8 | CNS Unit 1 | 42 | 42SE | 228 | 48 |
| 44 | h | 8 | CNS Unit 1 | 45 | 47SE | 225 | 43 |
| 44 | i | 8 | CNS Unit 1 | 34 | 55SE | 236 | 35 |
| 44 | i | 7 | CNS Unit 1 | 59 | 36SE | 211 | 54 |
| 44 | i | 8 | CNS Unit 1 | 327 | 45SW | 123 | 45 |
| 44 | j | 10 | CNS Unit 1 | 329 | 35SW | 121 | 55 |
| 44 | j | 9 | CNS Unit 1 | 310 | 46SW | 140 | 44 |
| 45 | a | 12 | CNS Unit 1 | 316 | 55SW | 134 | 35 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 45 | b | 13 | CNS Unit 1 | 313 | 58SW | 137 | 32 |
| 45 | f | 13 | CNS Unit 1 | 44 | 50SE | 226 | 40 |
| 45 | f | 14 | CNS Unit 1 | 50 | 47SE | 220 | 43 |
| 45 | f | 15 | CNS Unit 1 | 353 | 69W | 97 | 21 |
| 45 | g | 5 | CNS Unit 1 | 45 | 81SE | 225 | 9 |
| 45 | j | 15 | CNS Unit 1 | 287 | 69SW | 163 | 21 |
| 46 | b | 14 | CNS Unit 2 | 35 | 54SE | 235 | 36 |
| 46 | e | 13 | CNS Unit 2 | 20 | 77W | 70 | 13 |
| 46 | f | 14 | CNS Unit 2 | 42 | 72NW | 48 | 18 |
| 46 | f | 14 | CNS Unit 2 | 44 | 83NW | 46 | 7 |
| 46 | f | 15 | CNS Unit 2 | 34 | 90V | 236 | 0 |
| 46 | g | 14 | CNS Unit 2 | 37 | 74NW | 53 | 16 |
| 46 | g | 11 | CNS Unit 2 | 47 | 86SE | 223 | 4 |
| 46 | j | 9 | CNS Unit 2 | 45 | 85SE | 225 | 5 |
| 47 | b | 11 | CNS Unit 2 | 55 | 80NW | 35 | 10 |
| 47 | b | 1 | CNS Unit 2 | 24 | 90V | 246 | 0 |
| 47 | b | 14 | CNS Unit 2 | 42 | 90V | 228 | 0 |
| 47 | b | 4 | CNS Unit 2 | 3 | 40W | 87 | 50 |
| 47 | b | 7 | CNS Unit 2 | 345 | 56W | 105 | 34 |
| 47 | b | 6 | CNS Unit 2 | 337 | 45W | 113 | 45 |
| 47 | c | 3 | CNS Unit 2 | 22 | 71E | 248 | 19 |
| 47 | c | 8 | CNS Unit 2 | 88 | 64S | 182 | 26 |
| 47 | c | 6 | CNS Unit 2 | 36 | 62SE | 234 | 28 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 47 | c | 2 | CNS Unit 2 | 10 | 66W | 80 | 24 |
| 47 | c | 1 | CNS Unit 2 | 11 | 50W | 79 | 40 |
| 47 | d | 10 | CNS Unit 2 | 38 | 73NW | 52 | 17 |
| 47 | d | 1 | CNS Unit 2 | 32 | 84SE | 238 | 6 |
| 47 | d | 1 | CNS Unit 2 | 33 | 74SE | 237 | 16 |
| 47 | d | 1 | CNS Unit 2 | 9 | 74W | 81 | 16 |
| 47 | e | 1 | CNS Unit 2 | 30 | 58SE | 240 | 32 |
| 47 | e | 12 | CNS Unit 2 | 42 | 67SE | 228 | 23 |
| 47 | e | 12 | CNS Unit 2 | 12 | 67W | 78 | 23 |
| 47 | g | 6 | CNS Unit 2 | 47 | 76NW | 43 | 14 |
| 47 | g | 7 | CNS Unit 2 | 55 | 90V | 215 | 0 |
| 47 | h | 4 | CNS Unit 2 | 42 | 78SE | 228 | 12 |
| 47 | h | 2 | CNS Unit 2 | 14 | 75W | 76 | 15 |
| 47 | j | 1 | CNS Unit 2 | 10 | 55E | 260 | 35 |
| 48 | a | 7 | CNS Unit 2 | 44 | 76NW | 46 | 14 |
| 48 | a | 8 | CNS Unit 2 | 45 | 75NW | 45 | 15 |
| 48 | d | 10 | CNS Unit 2 | 43 | 81NW | 47 | 9 |
| 48 | j | 9 | CNS Unit 2 | 320 | 60SW | 130 | 30 |
| 49 | a | 14 | CNS Unit 1 | 8 | 73E | 262 | 17 |
| 49 | b | 10 | CNS Unit 1 | 355 | 72E | 275 | 18 |
| 49 | c | 9 | CNS Unit 1 | 357 | 70E | 273 | 20 |
| 49 | c | 7 | CNS Unit 1 | 5 | 75E | 265 | 15 |
| 49 | d | 9 | CNS Unit 1 | 355 | 48E | 275 | 42 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 49 | j | 8 | CNS Unit 1 | 355 | 70W | 95 | 20 |
| 50 | d | 1 | CNS Unit 1 | 15 | 77W | 75 | 13 |
| 50 | g | 2 | CNS Unit 1 | 348 | 63W | 102 | 27 |
| 50 | h | 5 | CNS Unit 1 | 328 | 62SW | 122 | 28 |
| 51 | a | 3 | CNS Unit 1 | 12 | 73E | 258 | 17 |
| 51 | c | 5 | CNS Unit 1 | 8 | 25E | 262 | 65 |
| 51 | i | 3 | CNS Unit 1 | 350 | 78E | 280 | 12 |
| 52 | g | 5 | CNS Unit 1 | 46 | 86SE | 224 | 4 |
| 52 | h | 15 | CNS Unit 1 | 352 | 57E | 278 | 33 |
| 52 | h | 11 | CNS Unit 1 | 333 | 76NE | 297 | 14 |
| 52 | h | 15 | CNS Unit 1 | 0 | 90V | 270 | 0 |
| 52 | i | 9 | CNS Unit 1 | 37 | 80SE | 233 | 10 |
| 52 | i | 13 | CNS Unit 1 | 45 | 78SE | 225 | 12 |
| 52 | i | 9 | CNS Unit 1 | 43 | 90V | 227 | 0 |
| 52 | j | 8 | CNS Unit 1 | 37 | 77NW | 53 | 13 |
| 52 | j | 15 | CNS Unit 1 | 51 | 80SE | 219 | 10 |
| 53 | a | 1 | CNS Unit 2 | 315 | 61SW | 135 | 29 |
| 53 | b | 3 | CNS Unit 2 | 335 | 77SW | 115 | 13 |
| 53 | b | 5 | CNS Unit 2 | 0 | 62W | 360 | 28 |
| 53 | b | 4 | CNS Unit 2 | 336 | 84W | 114 | 6 |
| 53 | c | 8 | CNS Unit 2 | 341 | 40W | 109 | 50 |
| 53 | c | 5 | CNS Unit 2 | 333 | 37W | 117 | 53 |
| 53 | c | 6 | CNS Unit 2 | 329 | 68W | 121 | 22 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 53 | d | 12 | CNS Unit 2 | 29 | 87NW | 61 | 3 |
| 53 | d | 11 | CNS Unit 2 | 313 | 35SW | 137 | 55 |
| 53 | e | 13 | CNS Unit 2 | 324 | 51SW | 126 | 39 |
| 53 | e | 10 | CNS Unit 2 | 322 | 75W | 128 | 15 |
| 53 | f | 11 | CNS Unit 2 | 333 | 70SW | 117 | 20 |
| 53 | f | 12 | CNS Unit 2 | 320 | 55SW | 130 | 35 |
| 53 | g | 8 | CNS Unit 2 | 11 | 87E | 259 | 3 |
| 53 | h | 2 | CNS Unit 2 | 45 | 78SE | 225 | 12 |
| 53 | i | 5 | CNS Unit 2 | 5 | 90V | 265 | 0 |
| 53 | i | 4 | CNS Unit 2 | 15 | 73NW | 75 | 17 |
| 54 | b | 12 | CNS Unit 2 | 40 | 76S | 230 | 14 |
| 54 | b | 7 | CNS Unit 2 | 35 | 81SE | 235 | 9 |
| 54 | b | 15 | CNS Unit 2 | 56 | 90V | 214 | 0 |
| 54 | d | 10 | CNS Unit 2 | 32 | 85NW | 58 | 5 |
| 54 | e | 13 | CNS Unit 2 | 49 | 80SE | 221 | 10 |
| 54 | f | 9 | CNS Unit 2 | 53 | 71SE | 217 | 19 |
| 54 | g | 14 | CNS Unit 2 | 30 | 69NW | 60 | 21 |
| 54 | i | 10 | CNS Unit 2 | 50 | 76NW | 40 | 14 |
| 54 | i | 15 | CNS Unit 2 | 47 | 79SE | 223 | 11 |
| 54 | i | 7 | CNS Unit 2 | 316 | 74W | 134 | 16 |
| 54 | i | 4 | CNS Unit 2 | 305 | 76W | 145 | 14 |
| 54 | j | 6 | CNS Unit 2 | 3 | 73E | 267 | 17 |
| 54 | j | 2 | CNS Unit 2 | 359 | 62W | 91 | 28 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 54 | j | 6 | CNS Unit 2 | 357 | 58W | 93 | 32 |
| 54 | j | 9 | CNS Unit 2 | 342 | 88W | 108 | 2 |
| 54 | j | 4 | CNS Unit 2 | 337 | 66W | 113 | 24 |
| 55 | g | 11 | CNS Unit 2 | 11 | 78E | 259 | 12 |
| 55 | h | 14 | CNS Unit 2 | 45 | 82NW | 45 | 8 |
| 56 | b | 14 | CNS Unit 1 | 28 | 87E | 242 | 3 |
| 56 | b | 11 | CNS Unit 1 | 26 | 90V | 244 | 0 |
| 56 | c | 12 | CNS Unit 1 | 335 | 75W | 115 | 15 |
| 57 | h | 1 | CNS Unit 1 | 344 | 63E | 106 | 27 |
| 57 | h | 1 | CNS Unit 1 | 355 | 84W | 95 | 6 |
| 57 | i | 3 | CNS Unit 1 | 1 | 78E | 269 | 12 |
| 57 | i | 1 | CNS Unit 1 | 56 | 87NW | 34 | 3 |
| 57 | i | 3 | CNS Unit 1 | 36 | 81SE | 234 | 9 |
| 57 | i | 3 | CNS Unit 1 | 41 | 71SE | 229 | 19 |
| 57 | j | 1 | CNS Unit 1 | 49 | 87SE | 221 | 3 |
| 59 | g | 2 | CNS Unit 2 | 274 | 50S | 176 | 40 |
| 59 | g | 10 | CNS Unit 2 | 41 | 64SE | 229 | 26 |
| 60 | i | 10 | CNS Unit 2 | 40 | 76SE | 230 | 14 |
| 60 | i | 12 | CNS Unit 2 | 352 | 90V | 278 | 0 |
| 60 | i | 12 | CNS Unit 2 | 352 | 90V | 278 | 0 |
| 60 | i | 14 | CNS Unit 2 | 11 | 89W | 79 | 1 |
| 61 | c | 8 | CNS Unit 2 | 352 | 66W | 98 | 24 |
| 61 | c | 8 | CNS Unit 2 | 12 | 80W | 78 | 10 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 62 | a | 5 | CNS Unit 2 | 50 | 90NW | 40 | 0 |
| 62 | c | 9 | CNS Unit 2 | 10 | 78W | 80 | 12 |
| 62 | g | 4 | CNS Unit 2 | 20 | 84W | 70 | 6 |
| 62 | j | 1 | CNS Unit 2 | 29 | 45SE | 241 | 45 |
| 63 | e | 5 | CNS Unit 2 | 39 | 83SE | 231 | 7 |
| 63 | e | 1 | CNS Unit 2 | 40 | 43SE | 230 | 47 |
| 63 | e | 7 | CNS Unit 2 | 40 | 54SE | 230 | 36 |
| 63 | e | 11 | CNS Unit 2 | 58 | 67SE | 212 | 23 |
| 63 | f | 9 | CNS Unit 2 | 50 | 90V | 220 | 0 |
| 63 | g | 9 | CNS Unit 2 | 50 | 50SE | 220 | 40 |
| 63 | h | 6 | CNS Unit 2 | 45 | 89SE | 225 | 1 |
| 63 | j | 5 | CNS Unit 2 | 75 | 38S | 195 | 52 |
| 64 | a | 11 | CNS Unit 2 | 31 | 77E | 239 | 13 |
| 64 | a | 15 | CNS Unit 2 | 37 | 75SE | 233 | 15 |
| 64 | e | 5 | CNS Unit 2 | 48 | 82NW | 42 | 8 |
| 64 | e | 5 | CNS Unit 2 | 55 | 85SE | 215 | 5 |
| 65 | d | 6 | CNS Unit 2 | 28 | 90V | 242 | 0 |
| 65 | d | 6 | CNS Unit 2 | 72 | 90V | 198 | 0 |
| 65 | g | 15 | CNS Unit 2 | 19 | 70W | 71 | 20 |
| 66 | c | 3 | CNS Unit 2 | 355 | 90V | 275 | 0 |
| 66 | e | 1 | CNS Unit 2 | 29 | 87W | 61 | 3 |
| 66 | h | 1 | CNS Unit 2 | 15 | 61E | 255 | 29 |
| 67 | c | 9 | CNS Unit 2 | 60 | 87SE | 210 | 3 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| 67 | f | 6 | CNS Unit 2 | 56 | 75SE | 214 | 15 |
| 68 | j | 8 | CNS Unit 2 | 13 | 76E | 257 | 14 |
| 68 | j | 11 | CNS Unit 2 | 14 | 72E | 256 | 18 |
| 69 | b | 1 | CNS Unit 2 | 9 | 81E | 261 | 9 |
| 69 | b | 4 | CNS Unit 2 | 13 | 66E | 257 | 24 |
| 69 | c | 8 | CNS Unit 2 | 17 | 73E | 253 | 17 |
| 69 | d | 12 | CNS Unit 2 | 18 | 82W | 72 | 8 |
| 72 | b | 15 | CNS Unit 2 | 56 | 79NW | 34 | 11 |
| 72 | i | 15 | CNS Unit 2 | 355 | 69E | 275 | 21 |
| 72 | i | 14 | CNS Unit 2 | 16 | 61E | 254 | 29 |
| 73 | a | 5 | CNS Unit 2 | 19 | 75E | 251 | 15 |
| 73 | a | 8 | CNS Unit 2 | 337 | 59SW | 113 | 31 |
| 73 | a | 4 | CNS Unit 2 | 326 | 64SW | 124 | 26 |
| 73 | a | 8 | CNS Unit 2 | 313 | 62SW | 137 | 28 |
| 73 | a | 12 | CNS Unit 2 | 348 | 68W | 102 | 22 |
| 73 | b | 12 | CNS Unit 2 | 330 | 63W | 120 | 27 |
| 73 | c | 1 | CNS Unit 2 | 57 | 82SE | 213 | 8 |
| 73 | d | 7 | CNS Unit 2 | 40 | 82NW | 50 | 8 |
| 73 | e | 5 | CNS Unit 2 | 62 | 67SE | 208 | 23 |
| 74 | i | 6 | CNS Unit 2 | 11 | 74E | 259 | 16 |
| 74 | j | 7 | CNS Unit 2 | 342 | 84E | 288 | 6 |
| 75 | a | 7 | CNS Unit 2 | 49 | 75NW | 41 | 15 |
| 78 | a | 2 | CNS Unit 2 | 20 | 50E | 250 | 40 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| SB1 | d | 12 | CNS Service Building | 352 | 54E | 278 | 36 |
| SB1 | d | 13 | CNS Service Building | 325 | 58W | 125 | 32 |
| SB1 | e | 7 | CNS Service Building | 11 | 64E | 259 | 26 |
| SB1 | e | 9 | CNS Service Building | 349 | 52E | 281 | 38 |
| SB1 | e | 12 | CNS Service Building | 348 | 73E | 282 | 17 |
| SB1 | e | 9 | CNS Service Building | 339 | 79E | 291 | 11 |
| SB1 | e | 7 | CNS Service Building | 337 | 90V | 293 | 0 |
| SB1 | f | 9 | CNS Service Building | 349 | 84E | 281 | 6 |
| SB1 | f | 12 | CNS Service Building | 343 | 54E | 287 | 36 |
| SB1 | g | 13 | CNS Service Building | 343 | 84E | 287 | 6 |
| SB1 | g | 12 | CNS Service Building | 336 | 84E | 294 | 6 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| SB1 | g | 9 | CNS Service Building | 353 | 90V | 277 | 0 |
| SB1 | h | 6 | CNS Service Building | 7 | 73E | 263 | 17 |
| SB1 | h | 12 | CNS Service Building | 343 | 81E | 287 | 9 |
| SB1 | i | 14 | CNS Service Building | 4 | 83E | 266 | 7 |
| SB1 | i | 8 | CNS Service Building | 5 | 73E | 265 | 17 |
| SB1 | i | 11 | CNS Service Building | 354 | 64E | 276 | 26 |
| SB1 | i | 12 | CNS Service Building | 350 | 74E | 280 | 16 |
| SB1 | i | 6 | CNS Service Building | 19 | 50E | 251 | 40 |
| SB1 | i | 6 | CNS Service Building | 20 | 56E | 250 | 34 |
| SB2 | c | 14 | CNS Service Building | 0 | 83E | 270 | 7 |
| SB2 | d | 12 | CNS Service Building | 5 | 67E | 265 | 23 |

**Table 6 – Final Foundation Map Panel Shear Orientation Measurements**

| Final Foundation Map Panel No. | Grid X | Grid Y | Location | Strike (Azimuth) | Dip/Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|---|---|---|
| SB2 | d | 14 | CNS Service Building | 13 | 67E | 257 | 23 |
| SB2 | f | 14 | CNS Service Building | 17 | 67NW | 73 | 23 |
| SB2 | g | 10 | CNS Service Building | 293 | 58SW | 157 | 32 |
| SB2 | i | 13 | CNS Service Building 2 | 351 | 57W | 99 | 33 |
| SB2 | j | 13 | CNS Service Building | 325 | 47SW | 125 | 43 |
| SB2 | j | 10 | CNS Service Building | 348 | 61W | 102 | 29 |
| SB2 | j | 13 | CNS Service Building | 342 | 71W | 108 | 19 |

Table 7 – CNS Geologic Zone Report Shear Orientation Measurements

| Zone | Location | Strike | Dip / Dip Dir | Pole Trend | Pole Plunge |
|---|---|---|---|---|---|
| 6 | CNS Unit 1 and Unit 2 | 3 | 86E | 273 | 4 |
| 6 | CNS Unit 1 and Unit 2 | 4 | 90 | 274 | 0 |
| 6 | CNS Unit 1 and Unit 2 | 4 | 62E | 274 | 28 |
| 6 | CNS Unit 1 and Unit 2 | 6 | 81SE | 276 | 9 |
| 6 | CNS Unit 1 and Unit 2 | 28 | 27S | 359 | 63 |
| 6 | CNS Unit 1 and Unit 2 | 49 | 90 | 319 | 0 |
| 6 | CNS Unit 1 and Unit 2 | 83 | 41SE | 353 | 49 |
| 6 | CNS Unit 1 and Unit 2 | 92 | 41S | 2 | 49 |
| 6 | CNS Unit 1 and Unit 2 | 92 | 22S | 2 | 68 |
| 6 | CNS Unit 1 and Unit 2 | 99 | 53SW | 9 | 37 |
| 6 | CNS Unit 1 and Unit 2 | 106 | 41SW | 16 | 49 |
| 6 | CNS Unit 1 and Unit 2 | 119 | 45SW | 29 | 45 |
| 6 | CNS Unit 1 and Unit 2 | 124 | 63SW | 34 | 27 |

Table 7 – CNS Geologic Zone Report Shear Orientation Measurements

| Zone | Location | Strike | Dip / Dip Dir | Pole Trend | Pole Plunge |
|---|---|---|---|---|---|
| 6 | CNS Unit 1 and Unit 2 | 130 | 51SW | 40 | 39 |
| 6 | CNS Unit 1 and Unit 2 | 134 | 61SW | 44 | 29 |
| 6 | CNS Unit 1 and Unit 2 | 134 | 52SW | 44 | 38 |
| 6 | CNS Unit 1 and Unit 2 | 135 | 54SW | 45 | 36 |
| 6 | CNS Unit 1 and Unit 2 | 135 | 56SW | 45 | 34 |
| 6 | CNS Unit 1 and Unit 2 | 135 | 58SW | 45 | 32 |
| 6 | CNS Unit 1 and Unit 2 | 138 | 72SW | 48 | 18 |
| 6 | CNS Unit 1 and Unit 2 | 138 | 55SW | 48 | 35 |
| 6 | CNS Unit 1 and Unit 2 | 140 | 53SW | 50 | 37 |
| 6 | CNS Unit 1 and Unit 2 | 140 | 58SW | 50 | 32 |
| 6 | CNS Unit 1 and Unit 2 | 140 | 46SW | 50 | 44 |
| 6 | CNS Unit 1 and Unit 2 | 141 | 60SW | 51 | 30 |
| 6 | CNS Unit 1 and Unit 2 | 141 | 62SW | 51 | 28 |
| 6 | CNS Unit 1 and Unit 2 | 144 | 45SW | 54 | 45 |
| 6 | CNS Unit 1 and Unit 2 | 148 | 40SW | 58 | 50 |

Table 7 – CNS Geologic Zone Report Shear Orientation Measurements

| Zone | Location | Strike | Dip / Dip Dir | Pole Trend | Pole Plunge |
|---|---|---|---|---|---|
| 6 | CNS Unit 1 and Unit 2 | 149 | 52SW | 59 | 38 |
| 6 | CNS Unit 1 and Unit 2 | 149 | 61SW | 59 | 29 |
| 6 | CNS Unit 1 and Unit 2 | 151 | 78SW | 61 | 12 |
| 6 | CNS Unit 1 and Unit 2 | 176 | 82W | 86 | 8 |
| 6 | CNS Unit 1 and Unit 2 | 176 | 90 | 86 | 0 |
| 6 | CNS Unit 1 and Unit 2 | 182 | 73W | 92 | 17 |
| 6 | CNS Unit 1 and Unit 2 | 185 | 77W | 95 | 13 |
| 6 | CNS Unit 1 and Unit 2 | 188 | 51NW | 98 | 39 |
| 6 | CNS Unit 1 and Unit 2 | 190 | 60NW | 100 | 30 |
| 6 | CNS Unit 1 and Unit 2 | 209 | 82NW | 119 | 8 |
| 6 | CNS Unit 1 and Unit 2 | 223 | 82NW | 133 | 8 |
| 6 | CNS Unit 1 and Unit 2 | 225 | 89NW | 135 | 1 |
| 6 | CNS Unit 1 and Unit 2 | 229 | 70NW | 139 | 20 |
| 6 | CNS Unit 1 and Unit 2 | 340 | 88NE | 250 | 2 |
| 6 | CNS Unit 1 and Unit 2 | 344 | 68NE | 254 | 22 |

Table 7 – CNS Geologic Zone Report Shear Orientation Measurements

| Zone | Location | Strike | Dip / Dip Dir | Pole Trend | Pole Plunge |
|---|---|---|---|---|---|
| 6 | CNS Unit 1 and Unit 2 | 345 | 80NE | 255 | 10 |
| 6 | CNS Unit 1 and Unit 2 | 350 | 65NE | 260 | 25 |
| 6 | CNS Unit 1 and Unit 2 | 353 | 71NE | 263 | 19 |
| 6 | CNS Unit 1 and Unit 2 | 354 | 82NE | 264 | 8 |
| 6 | CNS Unit 1 and Unit 2 | 354 | 47NE | 264 | 43 |
| 6 | CNS Unit 1 and Unit 2 | 356 | 90 | 266 | 0 |
| 6 | CNS Unit 1 and Unit 2 | 356 | 61E | 266 | 29 |
| 6 | CNS Unit 1 and Unit 2 | 360 | 79E | 270 | 11 |
| 6 | CNS Unit 1 and Unit 2 | 360 | 58E | 270 | 32 |
| 11 | CNS Nuclear Service Water Dam | 2 | 74E | 272 | 16 |
| 11 | CNS Nuclear Service Water Dam | 5 | 69E | 275 | 21 |
| 11 | CNS Nuclear Service Water Dam | 9 | 57SE | 279 | 33 |
| 11 | CNS Nuclear Service Water Dam | 12 | 71SE | 282 | 19 |
| 11 | CNS Nuclear Service Water Dam | 15 | 75SE | 285 | 15 |
| 11 | CNS Nuclear Service Water Dam | 15 | 59SE | 285 | 31 |

Table 7 – CNS Geologic Zone Report Shear Orientation Measurements

| Zone | Location | Strike | Dip / Dip Dir | Pole Trend | Pole Plunge |
|---|---|---|---|---|---|
| 11 | CNS Nuclear Service Water Dam | 17 | 72SE | 287 | 18 |
| 11 | CNS Nuclear Service Water Dam | 18 | 74SE | 288 | 16 |
| 11 | CNS Nuclear Service Water Dam | 19 | 69SE | 289 | 21 |
| 11 | CNS Nuclear Service Water Dam | 20 | 75SE | 290 | 15 |
| 11 | CNS Nuclear Service Water Dam | 24 | 75SE | 294 | 15 |
| 11 | CNS Nuclear Service Water Dam | 24 | 71SE | 294 | 19 |
| 11 | CNS Nuclear Service Water Dam | 24 | 68SE | 294 | 22 |
| 11 | CNS Nuclear Service Water Dam | 26 | 83SE | 305 | 28 |
| 11 | CNS Nuclear Service Water Dam | 26 | 83SE | 296 | 7 |
| 11 | CNS Nuclear Service Water Dam | 27 | 65SE | 297 | 25 |
| 11 | CNS Nuclear Service Water Dam | 30 | 71SE | 300 | 19 |
| 11 | CNS Nuclear Service Water Dam | 35 | 62SE | 308 | 29 |
| 11 | CNS Nuclear Service Water Dam | 38 | 61SE | 310 | 30 |
| 11 | CNS Nuclear Service Water Dam | 38 | 49SE | 308 | 41 |
| 11 | CNS Nuclear Service Water Dam | 39 | 66SE | 309 | 24 |

Table 7 – CNS Geologic Zone Report Shear Orientation Measurements

| Zone | Location | Strike | Dip / Dip Dir | Pole Trend | Pole Plunge |
|---|---|---|---|---|---|
| 11 | CNS Nuclear Service Water Dam | 40 | 72SE | 310 | 18 |
| 12 | CNS Nuclear Service Water Dam | 9 | 73SE | 279 | 17 |
| 12 | CNS Nuclear Service Water Dam | 9 | 66SE | 279 | 24 |
| 12 | CNS Nuclear Service Water Dam | 9 | 61SE | 279 | 29 |
| 12 | CNS Nuclear Service Water Dam | 9 | 58SE | 279 | 32 |
| 12 | CNS Nuclear Service Water Dam | 11 | 55SE | 281 | 35 |
| 12 | CNS Nuclear Service Water Dam | 15 | 70SE | 285 | 20 |
| 12 | CNS Nuclear Service Water Dam | 15 | 63SE | 285 | 27 |
| 12 | CNS Nuclear Service Water Dam | 18 | 58SE | 288 | 32 |
| 12 | CNS Nuclear Service Water Dam | 19 | 73SE | 289 | 17 |
| 12 | CNS Nuclear Service Water Dam | 26 | 48SE | 296 | 42 |
| 12 | CNS Nuclear Service Water Dam | 28 | 53SE | 298 | 37 |
| 12 | CNS Nuclear Service Water Dam | 30 | 82SE | 300 | 8 |
| 12 | CNS Nuclear Service Water Dam | 31 | 59SE | 301 | 31 |
| 12 | CNS Nuclear Service Water Dam | 35 | 62SE | 305 | 28 |

Table 7 – CNS Geologic Zone Report Shear Orientation Measurements

| Zone | Location | Strike | Dip / Dip Dir | Pole Trend | Pole Plunge |
|---|---|---|---|---|---|
| 12 | CNS Nuclear Service Water Dam | 39 | 78SE | 309 | 12 |
| 12 | CNS Nuclear Service Water Dam | 155 | 62SW | 65 | 28 |
| 13 | CNS Nuclear Service Water Dam | 11 | 69SE | 281 | 21 |
| 13 | CNS Nuclear Service Water Dam | 44 | 57SE | 314 | 33 |
| 13 | CNS Nuclear Service Water Dam | 60 | 55SE | 330 | 35 |
| 13 | CNS Nuclear Service Water Dam | 84 | 90 | 354 | 0 |
| 13 | CNS Nuclear Service Water Dam | 84 | 62SE | 354 | 28 |
| 13 | CNS Nuclear Service Water Dam | 246 | 51NW | 156 | 39 |
| 13 | CNS Nuclear Service Water Dam | 275 | 62N | 185 | 28 |
| 13 | CNS Nuclear Service Water Dam | 279 | 78NE | 189 | 12 |
| 13 | CNS Nuclear Service Water Dam | 289 | 50NE | 199 | 40 |
| 13 | CNS Nuclear Service Water Dam | 314 | 48NE | 224 | 42 |
| 13 | CNS Nuclear Service Water Dam | 316 | 55NE | 226 | 35 |
| 13 | CNS Nuclear Service Water Dam | 354 | 90 | 264 | 0 |
| 14 | CNS Unit 3 | 16 | 81NW | 106 | 9 |
| 14 | CNS Unit 3 | 17 | 84NW | 107 | 6 |

Table 7 – CNS Geologic Zone Report Shear Orientation Measurements

| Zone | Location | Strike | Dip / Dip Dir | Pole Trend | Pole Plunge |
|---|---|---|---|---|---|
| 14 | CNS Unit 3 | 17 | 86NW | 107 | 4 |
| 14 | CNS Unit 3 | 18 | 86NW | 108 | 4 |
| 14 | CNS Unit 3 | 20 | 84NW | 110 | 6 |
| 14 | CNS Unit 3 | 20 | 84SE | 290 | 6 |
| 14 | CNS Unit 3 | 21 | 81NW | 111 | 9 |
| 14 | CNS Unit 3 | 21 | 79NW | 111 | 11 |
| 14 | CNS Unit 3 | 22 | 56NW | 112 | 34 |
| 14 | CNS Unit 3 | 22 | 82NW | 112 | 8 |
| 14 | CNS Unit 3 | 27 | 87NW | 117 | 3 |
| 14 | CNS Unit 3 | 29 | 84SE | 299 | 6 |
| 14 | CNS Unit 3 | 29 | 70NW | 119 | 20 |
| 14 | CNS Unit 3 | 30 | 82SE | 300 | 8 |
| 14 | CNS Unit 3 | 30 | 80NW | 120 | 10 |
| 14 | CNS Unit 3 | 32 | 90 | 122 | 0 |
| 14 | CNS Unit 3 | 33 | 84SE | 303 | 6 |
| 14 | CNS Unit 3 | 33 | 90 | 123 | 0 |
| 14 | CNS Unit 3 | 34 | 77SE | 304 | 13 |
| 14 | CNS Unit 3 | 35 | 87NW | 125 | 3 |
| 14 | CNS Unit 3 | 38 | 76SE | 308 | 14 |
| 14 | CNS Unit 3 | 42 | 81SE | 312 | 9 |
| 14 | CNS Unit 3 | 47 | 75SE | 317 | 15 |
| 15/16 | CNS Service Building | 2 | 63E | 272 | 27 |
| 15/16 | CNS Service Building | 4 | 82E | 274 | 8 |
| 15/16 | CNS Service Building | 4 | 64E | 274 | 26 |

**Table 7 – CNS Geologic Zone Report Shear Orientation Measurements**

| Zone | Location | Strike | Dip / Dip Dir | Pole Trend | Pole Plunge |
|---|---|---|---|---|---|
| 15/16 | CNS Service Building | 5 | 75E | 275 | 15 |
| 15/16 | CNS Service Building | 6 | 71SE | 276 | 19 |
| 15/16 | CNS Service Building | 9 | 61SE | 279 | 29 |
| 15/16 | CNS Service Building | 10 | 82SE | 279 | 8 |
| 15/16 | CNS Service Building | 19 | 46SE | 289 | 44 |
| 15/16 | CNS Service Building | 20 | 52SE | 290 | 38 |
| 15/16 | CNS Service Building | 114 | 54SW | 24 | 36 |
| 15/16 | CNS Service Building | 145 | 54SW | 55 | 36 |
| 15/16 | CNS Service Building | 150 | 41SW | 60 | 49 |
| 15/16 | CNS Service Building | 155 | 43SW | 65 | 47 |
| 15/16 | CNS Service Building | 162 | 68SW | 72 | 22 |
| 15/16 | CNS Service Building | 168 | 58SW | 78 | 32 |
| 15/16 | CNS Service Building | 171 | 53SW | 81 | 37 |
| 15/16 | CNS Service Building | 218 | 63NW | 128 | 27 |
| 15/16 | CNS Service Building | 335 | 84NE | 245 | 6 |

**Table 7 – CNS Geologic Zone Report Shear Orientation Measurements**

| Zone | Location | Strike | Dip / Dip Dir | Pole Trend | Pole Plunge |
|---|---|---|---|---|---|
| 15/16 | CNS Service Building | 337 | 90 | 247 | 0 |
| 15/16 | CNS Service Building | 339 | 77NE | 249 | 13 |
| 15/16 | CNS Service Building | 341 | 52NE | 251 | 38 |
| 15/16 | CNS Service Building | 342 | 83NE | 252 | 7 |
| 15/16 | CNS Service Building | 345 | 80NE | 255 | 10 |
| 15/16 | CNS Service Building | 348 | 50NE | 258 | 40 |
| 15/16 | CNS Service Building | 348 | 73NE | 258 | 17 |
| 15/16 | CNS Service Building | 349 | 83NE | 259 | 7 |
| 15/16 | CNS Service Building | 350 | 51NE | 260 | 39 |
| 15/16 | CNS Service Building | 350 | 72NE | 260 | 18 |
| 15/16 | CNS Service Building | 353 | 90 | 263 | 0 |
| 15/16 | CNS Service Building | 354 | 60NE | 264 | 30 |

**Table 8 – WLS Geologic Mapping Shear Orientation Measurements**

| Location | Strike (Azimuth) | Dip / Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|
| CNS Unit 2 | 0 | 72E | 270 | 18 |
| CNS Unit 2 | 3 | 50E | 273 | 40 |
| CNS Unit 2 | 4 | 70E | 274 | 20 |
| CNS Unit 2 | 7 | 69SE | 277 | 21 |
| CNS Unit 2 | 7 | 69SE | 277 | 21 |
| CNS Unit 2 | 10 | 70SE | 280 | 20 |
| CNS Unit 2 | 12 | 78SE | 282 | 12 |
| CNS Unit 2 | 14 | 55SE | 284 | 35 |
| CNS Unit 2 | 14 | 64SE | 284 | 26 |
| CNS Unit 2 | 15 | 82SE | 285 | 8 |
| CNS Unit 2 | 18 | 80SE | 288 | 10 |
| CNS Unit 2 | 18 | 76SE | 288 | 14 |
| CNS Unit 2 | 20 | 80SE | 290 | 10 |
| CNS Unit 2 | 21 | 52SE | 291 | 38 |
| CNS Unit 2 | 22 | 82SE | 292 | 8 |
| CNS Unit 2 | 25 | 80SE | 295 | 10 |
| CNS Unit 2 | 25 | 46SE | 295 | 44 |
| CNS Unit 2 | 38 | 78SE | 308 | 12 |
| CNS Unit 2 | 39 | 62SE | 309 | 28 |
| CNS Unit 2 | 43 | 78SE | 313 | 12 |
| CNS Unit 2 | 50 | 42SE | 320 | 48 |
| CNS Unit 2 | 58 | 78SE | 328 | 12 |

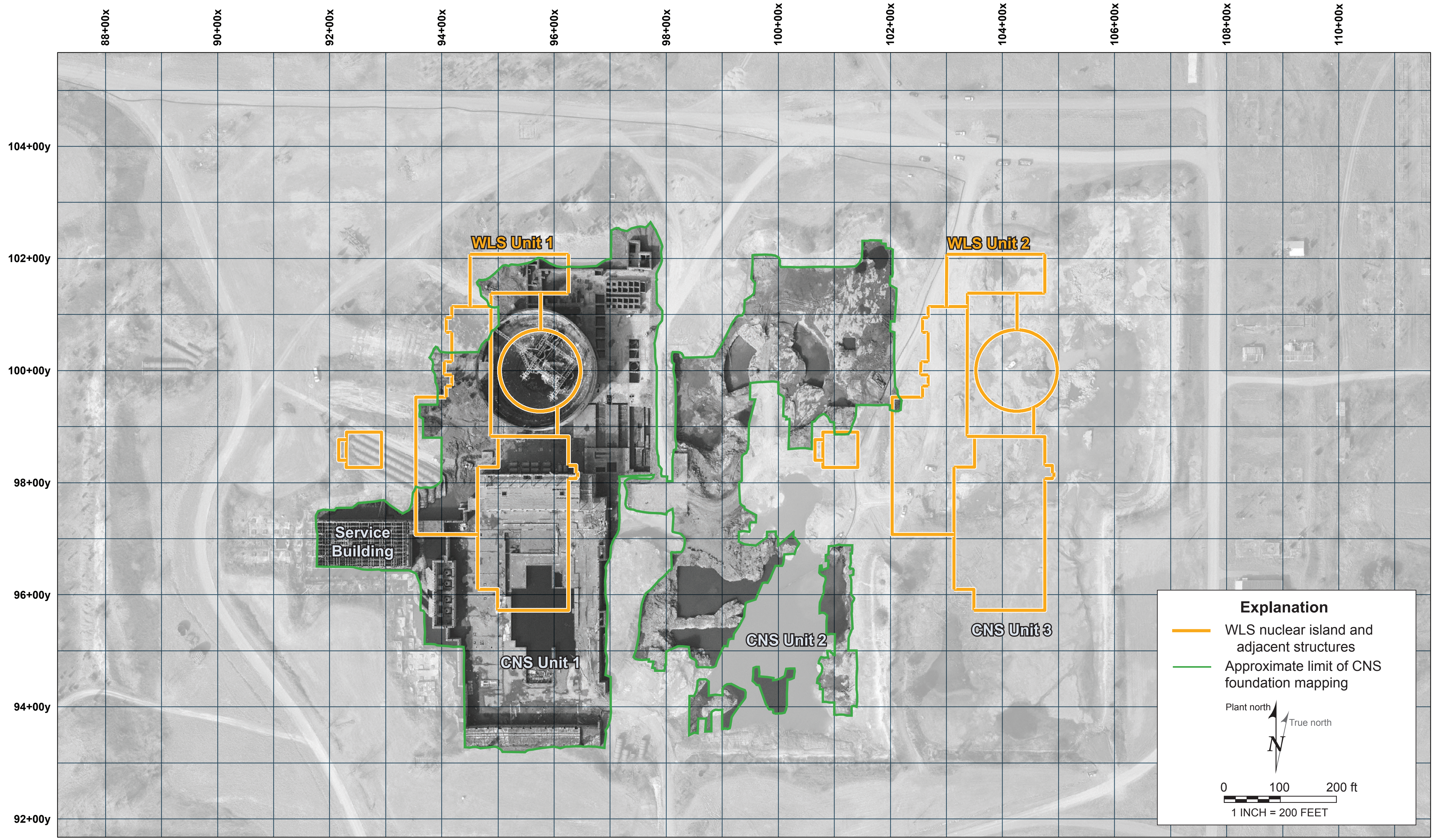
**Table 8 – WLS Geologic Mapping Shear Orientation Measurements**

| Location | Strike (Azimuth) | Dip / Dip Dir | Pole Trend (Azimuth) | Pole Plunge |
|---|---|---|---|---|
| CNS Unit 2 | 62 | 60SE | 332 | 30 |
| CNS Unit 2 | 73 | 38SE | 343 | 52 |
| CNS Unit 2 | 149 | 52SW | 59 | 38 |
| CNS Unit 2 | 155 | 60SW | 65 | 30 |
| CNS Unit 2 | 177 | 76W | 87 | 14 |
| CNS Unit 2 | 336 | 82NE | 246 | 8 |
| CNS Unit 2 | 354 | 62NE | 264 | 28 |
| CNS Unit 2 | 355 | 68NE | 265 | 22 |


WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

CNS and WLS Site Features

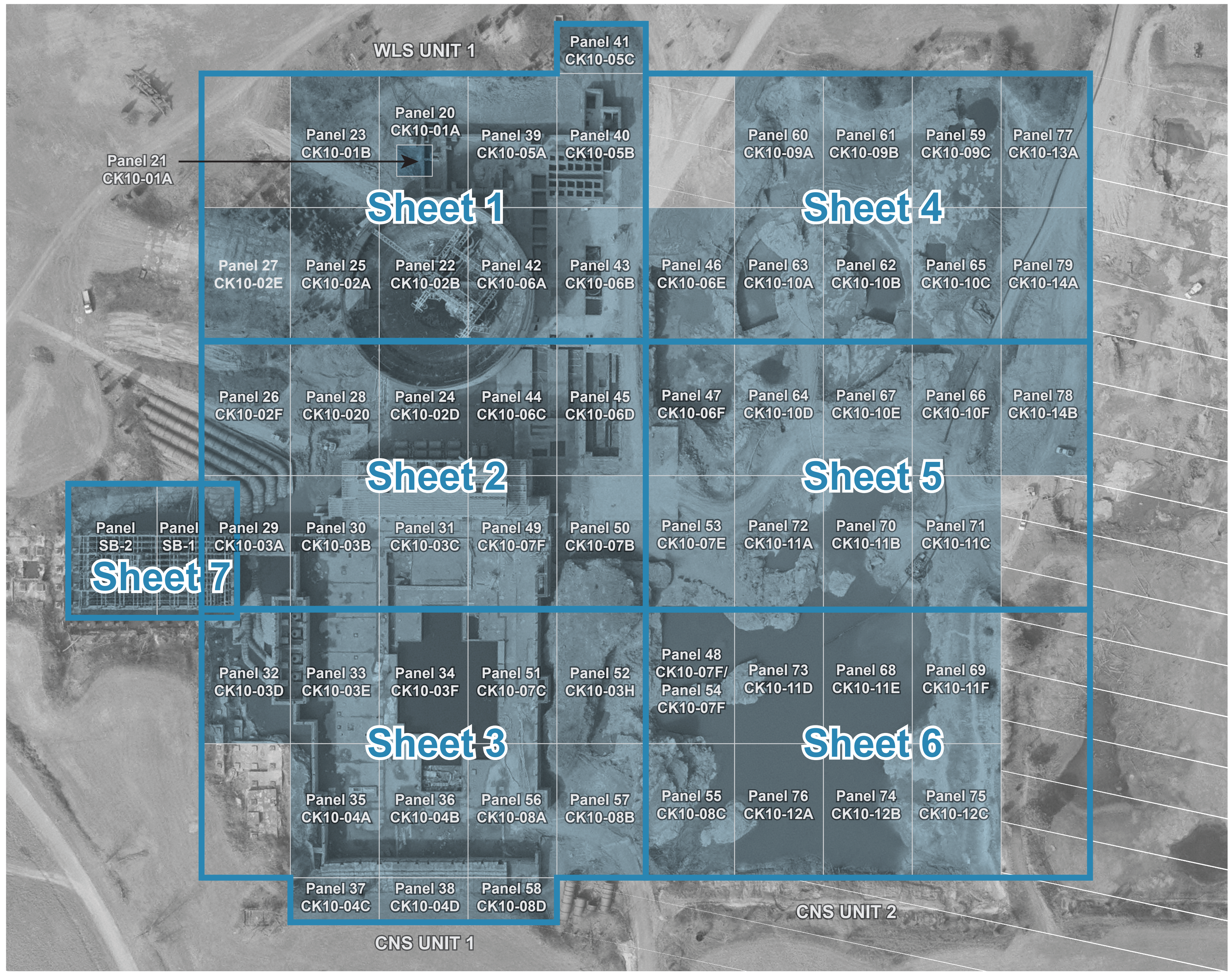
FIGURE 1

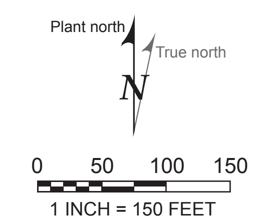



WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Extent of CNS Foundation Level Geologic Mapping

FIGURE 2

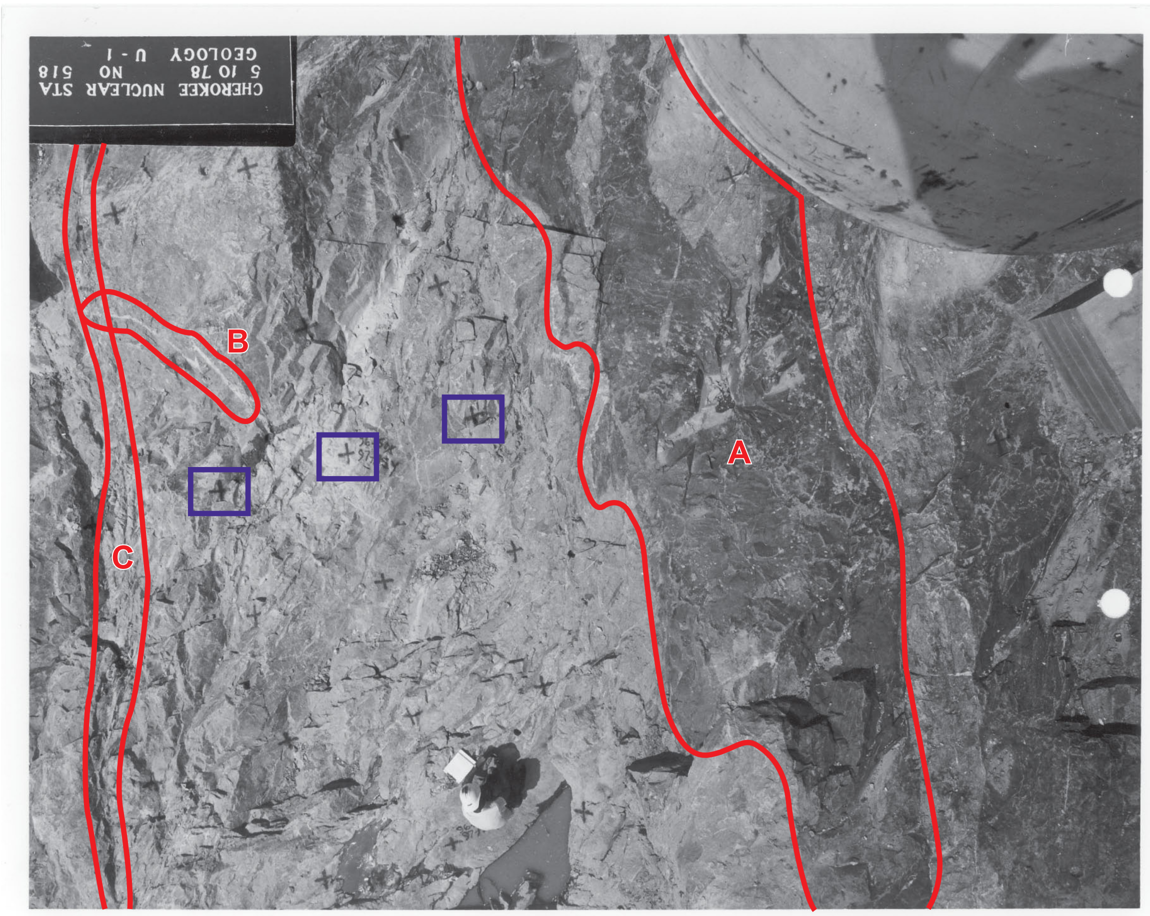


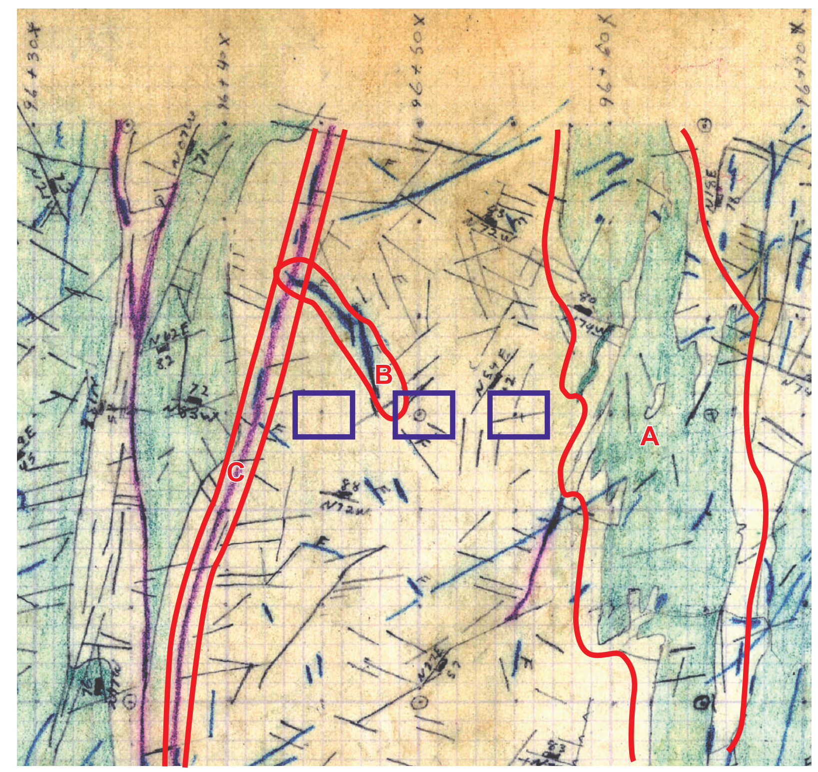

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Index of CNS Final Foundation
Geologic Map Panels and Sheets

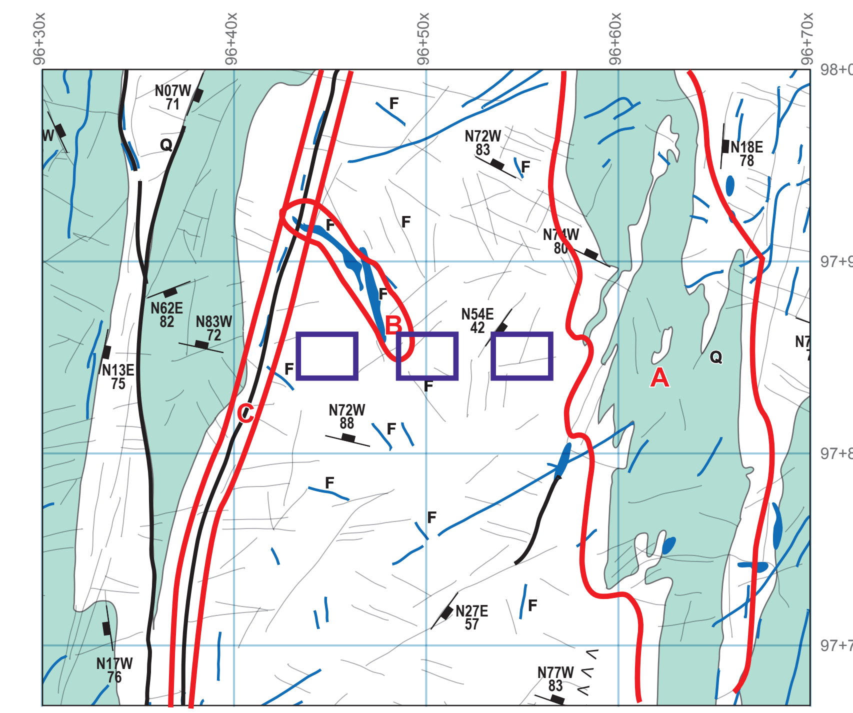
FIGURE 3




Mapping geologist performing final foundation geologic mapping in CNS Unit 1. Blue boxes denote CNS plant coordinates surveyed and marked at 5-foot spacings. Features identified in red represent mapped features illustrated on adjacent geologic maps (field and digitized). (Photo source: HRQ-016 Filename: No. 518 Unit 1 Excavation 5-10-78.pdf)




Observed features from CNS construction photograph recorded on field map panel (CK10-07A).




Observed features from CNS construction photograph recorded on digitized map panel (Panel 49_CK10_07A).

Plant north
True north
N

0 5 10 ft
1 INCH = 10 FEET

**Explanation**

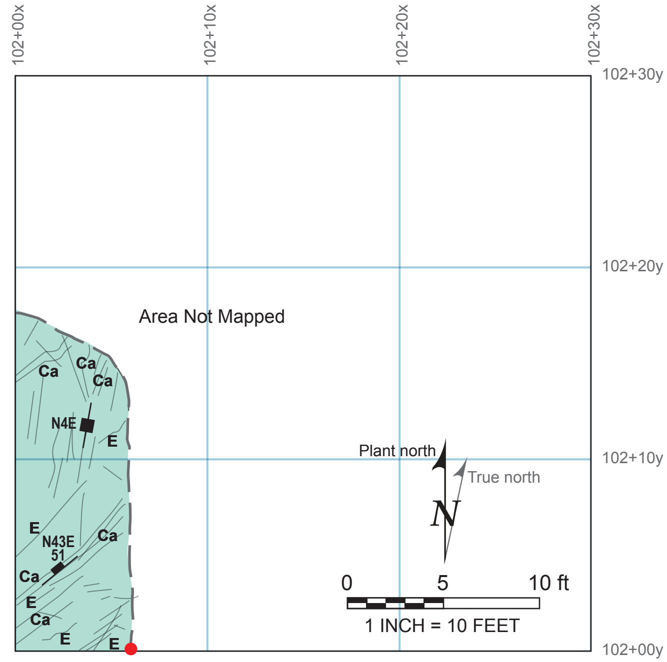
- **A** Mafic gneiss
- **B** Quartz vein
- **C** Shear
- ☐ CNS plant grid coordinates (marked on rock surface and located on field map)

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Mapped Features Observed in CNS Construction Photograph

FIGURE 4

Example CNS plant coordinates (102+00y) and elevation (545.00 ft. MSL) survey grid position painted on west-facing vertical wall.
View towards west, January 19, 2011.




Location of painted CNS plant coordinates (red dot) observed on excavation wall (Panel 77, CK10_13A).

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

CNS Plant Coordinates Observed on Excavated Wall

FIGURE 5

CNS Plant Coordinate Origin (100+00x and 100+00y) monument. Adjacent stakes trend approximately east-west. View towards northeast, January 19, 2011.

Close up of monument for CNS Plant Coordinate Origin (6-inch ruler for scale). View towards northeast, January 19, 2011.

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CNS Plant Coordinate
Original Monument

FIGURE 6