

Revised
Evaluation of Water-Supply Well Locations
And Potential Sinkhole Areas
Near the Proposed Vanceboro Quarry

Prepared for:

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Enclosures:

DVD of Reconnaissance Photos

1.0 Introduction

Martin Marietta Aggregates, Inc. (MMA) is planning a new marine limestone quarry operation located on the border between Beaufort and Craven Counties, near Vanceboro, North Carolina (Figure 1). Groundwater Management Associates, Inc. (GMA) was contracted to perform a hydrogeologic evaluation of the Castle Hayne Aquifer in the vicinity of the Vanceboro Quarry. The focus of GMA's evaluation was to determine the volume of water to be withdrawn, and to define the size and magnitude of the drawdown resulting from groundwater withdrawals needed to support operation of the open-pit mine. GMA's evaluation has included drilling of production and observation wells, aquifer testing, and developing a complex 3-dimensional groundwater flow model. GMA's initial study findings were presented in a report dated April 2, 2008 (GMA, 2008). The North Carolina Division of Water Resources reviewed GMA's report and requested supplemental studies of deeper aquifer zones and additional groundwater flow modeling. GMA has performed the additional studies and has presented the updated modeling results to the NCDWR.

Based upon testing and modeling results, GMA predicts that the initial operation of the quarry will require a withdrawal of approximately 11.5 million gallons per day (MGD) to dewater 1/3rd of the proposed quarry area. It is believed that the 11.5 MGD is a good prediction of actual conditions as it is estimated that only 1/3rd of the pit area will be exposed at any one time as the pit expands. This condition is based upon the fact that overburden removed from an active slot will be cast back into an adjacent quarried-out slot. For modeling purposes, a maximum rate of 17 MGD was predicted, assuming that the entire pit was being dewatered at one time. The quarry withdrawals will result in a roughly circular cone of depression in the Castle Hayne Aquifer centered on the quarry. GMA produced a map illustrating the cone of depression where drawdown is predicted to exceed 5 feet (Figure 2). This area, herein referred to as "the study area" is considered to be the area of significant drawdown within which MMA would closely monitor groundwater conditions and evaluate the potential for adverse impacts to surrounding groundwater users. The study area is an asymmetrical oval that extends approximately 6 miles west and 7 miles east of the center of the proposed quarry.

This report presents the results of a reconnaissance survey by GMA of the study area presented in Figure 2. The focus of the study is to identify existing groundwater users within the study area. In addition GMA performed a cursory evaluation of the potential evidence for existing Karst features that may occur in the area. Karst is a term describing the land surface of an area underlain by limestone or dolomite that has been chemically weathered and is characterized by sinkholes, caves, and underground drainage. Understanding the location of existing Karst features could provide evidence of potential sinkholes that could develop in response to depressurization of the groundwater system from mine dewatering.

2.0 Scope of Work

GMA performed a reconnaissance well survey to identify the location of water-supply wells and possible Karst features within the study area. The survey involved the following:

1. Review of aerial photographs and topographic maps of the study area. This task was intended to identify land use within the study area and to discern where developed properties exist. This review was also used to identify areas of natural closed topographic depressions that have the potential to represent existing Karst features.
2. Field reconnaissance by vehicle to search for developed properties that may have water-supply and/or irrigation wells. This process also included compiling a photographic record of developed properties with evidence of wells.
3. Field inspection of natural closed topographic depressions that potentially represent Karst features, and
4. Review of county tax maps for all developed properties identified within the study area that appear to have water-supply wells.

The results of GMA's evaluation are presented in the following sections.

3.0 Well Search

GMA evaluated the study area (Figure 2) using aerial photographs and tax maps to determine where developed property exists. The area within a 3-mile radius of the center of the proposed mine is undeveloped timber land and open agricultural land. Sparsely populated/developed property occurs between 3 and 4 miles from the center of the proposed mine. The higher population areas occur more than 4 miles from the mine center, and these areas are predominantly along Highway 33 to the northeast of the proposed mine and along Highway 17 to the west and southwest of the proposed mine. Figure 3 illustrates perimeter areas where developed properties occur within the area of significant predicted drawdown.

Upon identifying areas of developed property from review of aerial photographs, GMA performed a field reconnaissance to search for water-supply wells that may occur. The reconnaissance involved a visual inspection of properties bordering all public roads within the area depicted in Figure 3. In addition, GMA travelled all roads (public and private) within 3 miles of the proposed mine to evaluate land use and search for wells. This proximal area is predominantly timber farms owned by Weyerhaeuser. With the exception of the production well installed by GMA at the proposed mine site, and a shallow well point at a hunting camp located on the site (See Pictures 215 to 217) no water-supply wells were identified within a 3-mile radius of the center of the mine. On the perimeter of the search area, GMA identified **195** developed properties that appear to operate water-supply wells (Figure 4). At developed properties where GMA identified evidence of water-supply wells, GMA collected GPS coordinates at the road frontage of the property. When evident from the mailbox, GMA also recorded the mailing address of each of the developed properties. Some of these properties are also served by public water, as evidenced by water meter boxes. In addition, GMA made note of public water

availability to some areas as evidenced by fire hydrants. A photographic record of the field reconnaissance activities was also developed. A copy of the photographs is included on a DVD with this report, along with the photo description database and a geo-referenced link to a GoogleEarth™ image file that depicts the locations on a satellite view. Details of GMA's field reconnaissance are presented in Table 1. GMA cannot attest to the completeness of the well search performed for the study area. Because access to developed areas was limited to inspection from public roadways, there likely are some wells that were not identified because they were not visible from the road. The data acquired provides a framework for developing a mitigation plan to address potential impacts to wells near the quarry, should significant impacts occur.

4.0 Potential Sinkhole Features

Identification of closed topographic depressions that may represent Karst features is very subjective. In areas where significant thicknesses of siliceous sediments overlie carbonate rocks, topographic indications of subsurface solution cavities may be lacking. In addition, alteration of the land surface through land clearing, farming, and timber production may eliminate visible evidence of Karst features. Visual inspection of aerial photographs and topographic maps is an effective first step in identifying potential areas where sinkhole development could occur.

From aerial photograph and map reviews, GMA identified 12 closed topographic depressions that have *potential* to be Karst features. The locations of these depressions are presented in Figure 5. The closest of the potential sinkhole features is located approximately 1.75 miles north-northwest of the center of the proposed mine (Feature 11). The remaining locations are approximately 4 to 6 miles away from the center of the proposed mine.

GMA attempted to visit each of the possible sinkhole features. Several of these features (e.g. Sink #8 and 9) were on private farm land that was not accessible to GMA without trespassing on private property, and thus were not inspected. GMA did observe some of the closed depressions (e.g., Sinks #5 and #11). These features were very shallow low areas. There was no evidence of active sinkhole collapse observed at these features.

The majority of the possible sinkhole features occur in areas to the south where the land elevation is five to ten feet lower than at the proposed quarry. GMA postulates that these areas have a thinner covering of siliceous sediments overlying the Castle Hayne limestone. As a result, sinkhole features may have a more prominent expression on the land surface where sediment cover is thin than in areas with a thicker cover of siliceous sediments.

5.0 Monitoring Well Network

Based upon the modeled drawdown in the Castle Hayne Aquifer predicted to occur from quarry withdrawals, it is evident that water-level monitoring should be performed to better understand the hydraulic impact of the quarry. Water-level monitoring requires a network of monitoring wells with adequate distribution to provide drawdown data within the cone of depression. GMA evaluated the location of existing monitoring wells in the area that are available to assist with groundwater monitoring. Existing monitoring wells are shown on Figure 6. The NCDENR operates five monitoring well stations (Cox Station, Wilmar Station, Wilmar Fire Tower Station, Purser Station, and Palmetto Swamp Station) that provide data from areas east, northwest, and west of the proposed quarry. In addition, PotashCorp Aurora operates four monitoring wells (T28, T29, T30, and T31) in areas northwest, north, and northeast of the proposed quarry. Details of well construction for the PotashCorp Aurora wells are presented in Table 2. PotashCorp has agreed to share water level data and make these wells accessible for future monitoring by MMA.

Based upon the location of existing monitoring wells (Figure 6), there is a need for new monitoring wells to aid in water-level monitoring in areas southwest, south, and southeast of the proposed quarry. Therefore, GMA recommends that three new monitoring wells be constructed at locations shown on Figure 6. For reference, Figure 6 also depicts the locations of private wells identified by GMA's well search, in addition to the locations of Castle Hayne Aquifer Capacity Use Area withdrawal sources within, and proximal to, the study area. The proposed new monitoring wells should be open to the upper limestone unit of the Castle Hayne Aquifer and should be constructed as illustrated in Figure 7.

6.0 Conclusions

GMA has performed an investigation of groundwater usage and potential sinkhole features within an approximate 6-mile radius of the proposed Vanceboro Quarry. Based upon the results of this investigation, GMA concludes the following:

- The proposed Vanceboro Quarry is located in a remote, undeveloped area that is dominated by timber production and farming.
- With the exception of a hunting camp with a shallow well on the proposed quarry site, there are no developed properties, and no water-supply wells, located within a 3-mile radius of the center of the proposed mine.
- Most developed properties within the study area occur greater than 4 miles from the quarry center, and these properties are concentrated along Highway 33 to the northeast and along Highway 17 to the west and southwest.
- GMA identified 195 properties on the perimeter of the study area that appear to have water-supply wells. Some of these same properties are, or could be, served by public water, as evidenced by meter boxes and hydrants.
- GMA identified 12 closed depressions that have a potential to represent Karst features. Many of the depressions occur on private land that was not accessible to GMA for field

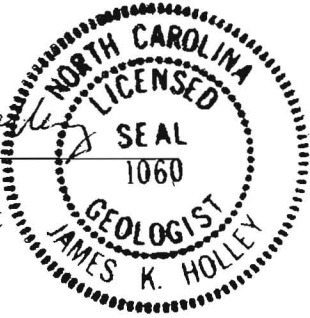
inspection. The features that were inspected by GMA did not appear to represent active sinkholes. Most of the depressions were located more than 4 miles from the center of the proposed quarry.

- GMA recommends that three new monitoring wells be constructed to provide expanded water-level monitoring capabilities for areas southwest, south, and southeast of the Vanceboro Quarry site. The new monitoring wells should be open to the upper limestone of the Castle Hayne Aquifer.

7.0 Report Certification

This report was prepared by Groundwater Management Associates, Inc., a professional corporation licensed to practice geology in the State of North Carolina.

James K. Holley
James K. Holley, P.G.
Senior Hydrogeologist

A circular professional seal for James K. Holley. The outer ring contains the text "NORTH CAROLINA" at the top and "JAMES K. HOLLEY" at the bottom. The inner ring contains "LICENSED" at the top and "GEOLOGIST" at the bottom. In the center, it says "SEAL" and "1060".

Richard K. Spruill
Richard K. Spruill, Ph.D., P.G.
Principal Hydrogeologist

Table 1. Database of Well Search Results

| Map ID | Latitude (°N) | Longitude (°W) | Possible Well Location | Fire Hydrant | Water Meter Box | Address | Notes | Photo # |
|--------|---------------|----------------|------------------------|--------------|-----------------|--|---|---------|
| 1 | 35.39573 | 76.99568 | Yes | x | | ??? Clay Button School Road | | 1, 2 |
| 2 | 35.4033 | 76.9977 | Yes | | | 586 Clay Button School Road | | 3 |
| 3 | 35.40592 | 76.99249 | Yes | | | Cotton Patch Road | Across the Street from 586 Clay Button School Road | 4 |
| 4 | | | | | | | | 5 |
| 5 | 35.40771 | 76.97795 | Yes | | | Cotton Patch Road | | 6 |
| 6 | 35.40637 | 76.97275 | Yes | | | 1600 Cotton Patch Road | | |
| 7 | 35.40602 | 76.97134 | Yes | | | 1637 Cotton patch Road | | |
| 8 | 35.40682 | 76.97432 | Yes | | | 1571 Cotton Patch Road | No Meter Visible - No Well House Visible | |
| 9 | 35.40695 | 76.97503 | Yes | | | 1377 Cotton Patch Road | Well House Between 1571 & 1377 Cotton Patch Rd. | 7 |
| 10 | 35.41146 | 77.00182 | Yes | | | 1240 Clay Button School Road | | 8 |
| 11 | | | | x | | NW Corner of Clay Button School Road & Rowe Avenue | No Lat/Long | |
| 12 | 35.41497 | 77.00343 | Yes | | | | | 9 |
| 13 | 35.41534 | 77.00356 | Yes | | | 1566 Clay Button School Road | | 10 |
| 14 | 35.41589 | 77.00367 | Yes | | | | | |
| 15 | 35.41801 | 77.00449 | Yes | | | 1748 Clay Button School Road | | 11 |
| 16 | 35.41898 | 77.00466 | Yes | | | 1734 Clay Button School Road | | 12 |
| 17 | 35.41939 | 77.00477 | Yes | | | 1768 Clay Button School Road | | 13 |
| 18 | 35.42089 | 77.00521 | Yes | | | 1876 Clay Button School Road | No Picture - Someone in Driveway (See #26) | |
| 19 | 35.4218 | 77.00509 | Yes | | | 2006, 1950, etc. Clay Button School Road | Group of Homes/Trailers with Wells ?? | 14 |
| 20 | 35.42299 | 77.00501 | Yes | | | 2052 (?) Clay Button School Road | | 15 |
| 21 | 35.42403 | 77.00497 | Yes | | | 2108 & 2096 Clay Button School Road | Group of Homes/Trailers with Wells ?? | |
| 22 | 35.42431 | 77.00493 | Yes | | x | 2126 Clay Button School Road | | 16 |
| 23 | 35.42598 | 77.00481 | Yes | | | 2266 Clay Button School Road | | 17 |
| 24 | 35.42563 | 77.00475 | Yes | | | 2240 Clay Button School Road | | 18 |
| 25 | 35.42714 | 77.00492 | Yes | x | | Intersection of Clay Button School Road & Ephesus Church | | 19 |
| 26 | 35.42089 | 77.00521 | Yes | | | 1876 Clay Button School Road | Returned to take Picture (See #18) | 20 |
| 27 | | | | | | | Returned to take Picture (See #11) | 21 |
| 28 | 35.40613 | 77.00174 | Yes | | | 544 Rowe Avenue | Do see Meter Boxes and Blue Pipeline Flags along Rowe Avenue | 22 |
| 29 | 35.40601 | 77.00473 | Yes | | | 305 Rowe Avenue | | 23 |
| 30 | 35.40606 | 77.01034 | Yes | x | | North Corner of Highway 33 & Rowe Avenue | | 24 |
| 31 | 35.40663 | 77.01138 | Yes | | | 9329 Rowe Avenue | | |
| 32 | 35.40681 | 77.01171 | Yes | | | ??? | | 25 |
| 33 | 35.39754 | 76.99857 | Yes | | | 10299 Hwy 33 | | 26 |
| 34 | 35.39766 | 76.99887 | Yes | | | 10247 Hwy 33 | | 27 |
| 35 | 35.39826 | 76.99965 | Yes | | | 10187 Hwy 33 | | 28 |
| 36 | 35.39963 | 77.0017 | Yes | | | ??? | | 29 |
| 37 | 35.40349 | 77.00684 | Yes | | | 9646 Hwy 33 | | 30 |
| 38 | 35.39485 | 76.9953 | Yes | | | 10542 Hwy 33 | | 31 |
| 39 | 35.39467 | 76.99518 | Yes | | | 10550 Hwy 33 | | 32 |
| 40 | 35.39267 | 76.99394 | Yes | | | ??? | | |
| 41 | 35.39029 | 76.99237 | Yes | | | 10896 Hwy 33 | Beaufort County Water Supply Transfer Station? | 33, 34 |
| 42 | 35.38952 | 76.99184 | Yes | x | | Intersection of Sawyer & Hwy 33 | | 36 |
| 43 | 35.38837 | 76.99059 | Yes | | | 11101 Hwy 33 | | 37 |
| 44 | 35.38178 | 76.9886 | Yes | | | Near 11540 Hwy 33 | | 38 |
| 45 | 35.37739 | 76.98139 | Yes | | | 12025 Hwy 33 | | 39 |
| 46 | 35.37695 | 76.98039 | Yes | | | ??? | | 40 |
| 47 | 35.37573 | 76.97742 | Yes | | | 12304 Hwy 33 | | 41 |
| 48 | 35.37535 | 76.97576 | Yes | x | x | 20 Tripp Road (?) | Picture from Hwy 33 side (Also, Hydrant @ Tripp & Hwy 33) | 42, 43 |
| 49 | 35.37343 | 76.96839 | Yes | | | 12837 Hwy 33 | | 44 |
| 50 | 35.37317 | 76.96691 | Yes | | | | Behind Hosanna Church | 45 |
| 51 | 35.37271 | 76.96554 | Yes | | | 13017 Hwy 33 | | 46 |
| 52 | 35.37168 | 76.9613 | Yes | | | 13302 or 13317 Hwy 33 | | 47 |
| 53 | 35.37054 | 76.95686 | Yes | x | | 13529 Hwy 33 | Warren Chapel Church - Also, Hydrant near Hwy 33 & Herring Run Rd. | 48, 49 |
| 54 | 35.36578 | 76.94021 | Yes | | | 14559 & 14563 Hwy 33 | Two Homes with One Well House (?) | 50 |
| 55 | 35.36952 | 76.9479 | Yes | | | 14050 Hwy 33 | | 51 |
| 56 | 35.36977 | 76.94923 | Yes | | | | Blounts Creek Fire Department | 52 |
| 57 | 35.37143 | 76.95061 | Yes | | | ??? | | 53 |
| 58 | 35.37743 | 76.94894 | Yes | | | Core Point Road | Next Door to 635 Core Point Road | 54 |
| 59 | 35.37843 | 76.94807 | Yes | | | 735 Core Point Road | | 55 |
| 60 | 35.37936 | 76.94717 | Yes | | | 799 Core Point Road | | 56 |
| 61 | 35.37938 | 76.94675 | Yes | | | 839 Core Point Road | | 57 |
| 62 | 35.37985 | 76.94656 | Yes | | | 855 Core Point Road | | 58 |
| 63 | 35.38157 | 76.94487 | Yes | | | 1180 Core Point Road | | 59 |
| 64 | 35.37474 | 76.95772 | Yes | | | 300 Herring Run Road | | 60 |
| 65 | 35.37973 | 76.9615 | Yes | | | 710 & 760 Herring Run Road | 2 Well houses Visible | 61 |
| 66 | 35.38019 | 76.96299 | Yes | | | 780 Herring Run Road | | 62 |
| 67 | 35.38848 | 76.96309 | Yes | | | 1480 Herring Run Road | | 63 |
| 68 | 35.39154 | 76.96036 | Yes | | | 1739 Herring Run Road | | 64 |
| 69 | 35.39227 | 76.96017 | Yes | | | 1821 Herring Run Road | | 65 |
| 70 | 35.39437 | 76.95937 | Yes | | | 1850 Herring Run Road | | 66 |
| 71 | 35.39499 | 76.95888 | Yes | x | | Intersection of Tolers Avenue & Herring Run Road | Near Church | 67 |
| 72 | 35.36444 | 76.97527 | Yes | | | 742 Tripp Road | | 68 |
| 73 | 35.36324 | 76.97533 | Yes | | | ??? | Trailer | 69 |
| 74 | | | Yes | | | | Probable Wells on Norman Road Between Tripp & Flat Swamp - Scetchy Area | |
| 75 | 35.35541 | 76.96234 | Yes | | | 1821 Tripp Road | No Picture | |
| 76 | 35.35524 | 76.96217 | Yes | | x | 1852 Tripp Road | St. Cindy Holines Church | 70 |
| 77 | 35.35482 | 76.96184 | Yes | | x | 1894 Tripp Road | | 71 |
| 78 | | | Yes | | x | 1946 Tripp Road | No Lat/Long | |
| 79 | | | Yes | | x | 1988 Tripp Road | No Lat/Long | |
| 80 | 35.3535 | 76.96078 | Yes | | | 2021 (?) Tripp Road | | 72 |
| 81 | 35.35228 | 76.95979 | Yes | | | 1312 Flat Swamp Road | | 73 |
| 82 | | | | x | | Hydrant @ Tripp Road & Flat Swamp Road | | 74 |
| 83 | 35.35142 | 76.95935 | Yes | | | ??? | | 75 |
| 84 | 35.35895 | 76.95681 | Yes | | | ??? | | 76 |
| 85 | 35.35698 | 76.95628 | Yes | | | 820 Flat Swamp Road | | 77 |
| 86 | 35.35915 | 76.9562 | Yes | | | ??? | | 78 |
| 87 | 35.3624 | 76.95392 | Yes | | x | 515 Flat Swamp Road | | 79 |
| 88 | 35.36312 | 76.95389 | Yes | | x | ??? | | 80 |
| 89 | 35.3682 | 76.95229 | Yes | | | 103 or 703 Flat Swamp Road | | 81 |

Table 1. Database of Well Search Results (continued)

| Map ID | Latitude (°N) | Longitude (°W) | Possible Well Location | Fire Hydrant | Water Meter Box | Address | Notes | Photo # |
|--------|---------------|----------------|------------------------|--------------|-----------------|---|---|------------|
| 90 | 35.35025 | 76.95489 | Yes | | | 1468 Flat Swamp Road | Two Well Houses (?) | 82, 83 |
| 91 | 35.34899 | 76.95924 | Yes | | | ??? Flat Swamp Road | | 84 |
| 92 | 35.34585 | 76.95659 | Yes | | | ??? Flat Swamp Road | Church | 85 |
| 93 | 35.3413 | 76.95084 | Yes | | | ??? Tuten Road | | 86 |
| 94 | 35.34103 | 76.95026 | Yes | | x | ??? Tuten Road | In Garden | 87 |
| 95 | 35.34007 | 76.94837 | Yes | | | ??? Tuten Road | | 88 |
| 96 | 35.33951 | 76.9472 | Yes | | | ??? Tuten Road | | 89 |
| 97 | 35.33696 | 76.94213 | Yes | | | ??? Tuten Road | Abandon House ?? | 90 |
| 98 | - | - | - | - | - | ??? Little Egypt Road | Equal Liberty Church - No Sign of Public/County Water | 91 |
| 99 | 35.31931 | 76.94727 | Yes | | | ??? Little Egypt Road | Trailer and Large Farm | 92, 93, 94 |
| 100 | 35.32275 | 76.95599 | Yes | | | ??? Core Point Road | Two Well Houses (?) | 95, 96 |
| 101 | 35.32411 | 76.95561 | Yes | | | 3511 Core Point Road | | 97 |
| 102 | 35.32478 | 76.95541 | Yes | | | 3455 Core Point Road | | 98 |
| 103 | 35.32549 | 76.95502 | Yes | | | 3403 Core Point Road | | 99 |
| 104 | 35.32597 | 76.95485 | Yes | | | 3359 Core point Road | | 100 |
| 105 | 35.32692 | 76.95403 | Yes | | | 3273 Core point Road | | 101 |
| 106 | 35.33035 | 76.95279 | Yes | | | ??? Core Point Road | | 102 |
| 107 | 35.3307 | 76.95287 | Yes | | | ??? Core Point Road | Two Well Houses - East Side and West Side of the Road | 103, 104 |
| 108 | 35.33238 | 76.95334 | Yes | | | ??? Core Point Road | West Side of Road | 105 |
| 109 | 35.3326 | 76.9535 | Yes | | | ??? Core Point Road | East Side of the Road | 106 |
| 110 | 35.33453 | 76.9547 | Yes | | | 2716 Core Point Road | | 107 |
| 111 | 35.27817 | 76.97194 | Yes | | | 1690 (?) Core Point Road | Large Farm w/ House | 108 |
| 112 | 35.27605 | 76.97359 | Yes | | | ??? Core Point Road | | 109 |
| 113 | 35.27467 | 76.97523 | Yes | | | ??? Core Point Road | | 110 |
| 114 | 35.27431 | 76.9761 | Yes | | | ??? Core Point Road | | 111 |
| 115 | 35.27424 | 76.97659 | Yes | | | ??? Core Point Road | | 112, 113 |
| 116 | 35.27413 | 76.97704 | Yes | | | 1500 Core Point Road | | 114 |
| 117 | 35.27354 | 76.9792 | Yes | | | ??? Core Point Road | | 115 |
| 118 | 35.27301 | 76.98088 | Yes | | | 1425 or 1420 Core Point Road | | 116 |
| 119 | 35.27243 | 76.98168 | Yes | | xx | 1402 (?) Core Point Road | Two Meters in Drive | 117, 118 |
| 120 | 35.27105 | 76.98409 | Yes | | | ??? Core Point Road | Well Houses on East (1 Picture) and West Side of the Road | 119, 120 |
| 121 | 35.26808 | 76.98849 | Yes | | | 3945 Hill Neck Road | | 121 |
| 122 | 35.26213 | 77.00073 | Yes | | | 3515 Hill Neck Road | | 122 |
| 123 | 35.26048 | 77.00244 | Yes | | | ??? Hill Neck Road | | 123 |
| 124 | 35.25883 | 77.00386 | Yes | | | 3350 or 3354 Hill Neck Road | | 124 |
| 125 | - | - | No | - | - | SR 1624 and/or 1625 | No building in the area (Katie Pl. Whitford Rd., and Guinea Mill Rd.) | |
| 126 | 35.25341 | 77.07948 | Yes | | | 102 Hudnell Road | | 125, 126 |
| 127 | 35.25469 | 77.07787 | Yes | | | ??? Hudnell Road | Do See Some Meter Boxes on Hudnell Road | 127 |
| 128 | 35.2598 | 77.07565 | Yes | | | ??? Hudnell Road | East Side of the Road | 128 |
| 129 | 35.2632 | 77.07455 | Yes | | | ??? Hudnell Road | | 129 |
| 130 | 35.26376 | 77.07436 | Yes | | | 550 Hudnell Road | | 130 |
| 131 | 35.26534 | 77.07521 | Yes | | | 555 Hudnell Road | | 132 |
| 132 | 35.26832 | 77.10492 | Yes | | | ??? Backwoods Road | No sign of County Water on Backwoods Road | 133 |
| 133 | 35.27293 | 77.1014 | Yes | | | 725 Backwoods Road | | 134 |
| 134 | 35.27399 | 77.10138 | Yes | | | 695 Backwoods Road | | 135 |
| 135 | 35.27513 | 77.10186 | Yes | | | 645 Backwoods Road | | 136 |
| 136 | 35.28131 | 77.10204 | Yes | | | ??? Backwoods Road | East Side of the Road | 137, 138 |
| 137 | 35.286 | 77.11206 | Yes | | | 235 Brown Farm Road | Brown Farm Road (SR1633) | 139 |
| 138 | 35.30934 | 77.13287 | Yes | | | Alligator Road | Alligator Rd. (SR1637) - Large Tree Farm on Prop. | 140, 141 |
| 139 | 35.32112 | 77.14008 | Yes | | x | 527 Maul Swamp Road | | 142 |
| 140 | 35.32174 | 77.13865 | Yes | | x | 565 Maul Swamp Road | | 143 |
| 141 | 35.32214 | 77.13725 | Yes | | | 615 Maul Swamp Road | | 144 |
| 142 | 35.32302 | 77.13535 | Yes | | | 660 Maul Swamp Road | Also, Well at trailer across street from address?? | 145, 146 |
| 143 | 35.32326 | 77.13483 | Yes | | | 674 Maul Swamp Road | | 147 |
| 144 | 35.3244 | 77.13265 | Yes | | | 785 (?) Maul Swamp Road | | 148 |
| 145 | 35.32456 | 77.13234 | Yes | | | 785 (?) Maul Swamp Road | | 149 |
| 146 | 35.3279 | 77.12812 | Yes | | x | 945 Maul Swamp Road | | 150 |
| 147 | 35.32852 | 77.12704 | Yes | | | 965 Maul Swamp Road | | 151 |
| 148 | 35.3308 | 77.11619 | Yes | | | ??? Maul Swamp Road | No sign of County/Public Water on Maul Samp Rd. East of Lewis Rd. | 152 |
| 149 | 35.3334 | 77.10843 | Yes | | | ??? Maul Swamp Road | Large Hog Farm | 153 |
| 150 | 35.33729 | 77.09868 | Yes | | | 1880 Maul Swamp Road | | 154 |
| 151 | 35.3377 | 77.0979 | Yes | | | 1898 Maul Swamp Road | | 155 |
| 152 | 35.33879 | 77.09558 | Yes | | | 1898 Maul Swamp Road | Same Address on Several Homes on Maul Swamp (1898) | 156 |
| 153 | 35.33185 | 77.12579 | Yes | | | 130 Lewis Road | No sign of Public Water on Lewis between Maul Swamp and Gray Rd. | 157, 158 |
| 154 | 35.34749 | 77.12524 | Yes | | | Near 760 Lewis Road | No Address Found | 159, 160 |
| 155 | 35.351 | 77.1293 | Yes | | | 755 Gray Road | | 161 |
| 156 | 35.35065 | 77.13295 | Yes | | | 645 Gray Road | | 162, 163 |
| 157 | 35.35047 | 77.13523 | Yes | | | 565 Gray Road | No sign of Public Water on Gray between Hwy 17 and Lewis Rd. | 164 |
| 158 | 35.35229 | 77.12548 | Yes | | | ??? Gray Road | | 165 |
| 159 | 35.35344 | 77.12492 | Yes | | | ??? Gray Road | | 166, 167 |
| 160 | 35.36661 | 77.10584 | Yes | | | ??? Gray Road | Large Hog (?) Farm | 168 |
| 161 | 35.40486 | 77.08133 | Yes | x | | Near 2687 Haw Branch Road | | 169 |
| 162 | 35.408 | 77.07935 | Yes | | | 2452 Haw Branch Road | | 170 |
| 163 | 35.41913 | 77.07952 | Yes | | x | ??? Haw Branch Road | | 171 |
| 164 | 35.41954 | 77.07958 | Yes | | | 1664 Haw Branch Road | | 172 |
| 165 | 35.42057 | 77.07954 | Yes | | | 1623 Haw Branch Road | | 173 |
| 166 | 35.38742 | 77.11241 | Yes | | | ??? Haw Branch Road | Set of Trailors | 174 |
| 167 | 35.38742 | 77.11214 | Yes | | | ??? Haw Branch Road | Large Farm (Hog?) | 175, 176 |
| 168 | 35.3925 | 77.12252 | Yes | x | | Intersection of Chandler Road and CC Road | | 177 |
| 169 | 35.3925 | 77.12252 | Yes | | | ??? Chandler Road | | 178 |
| 170 | 35.40366 | 77.12731 | Yes | | | 1872 Chandler Road | | 179 |
| 171 | 35.40274 | 77.1265 | Yes | | | 1900 Chandler Road | | 180 |
| 172 | 35.40258 | 77.12619 | Yes | | | ??? Chandler Road | | 181 |
| 173 | 35.40169 | 77.12536 | Yes | | | 2038 Chandler Road | | 182 |
| 174 | 35.40109 | 77.12486 | Yes | | | 2113 Chandler Road | | 183 |
| 175 | 35.40084 | 77.12447 | Yes | | | 2112 Chandler Road | | 184 |
| 176 | 35.40034 | 77.12453 | Yes | | x | ??? Chandler Road | | 185 |
| 177 | 35.39841 | 77.12405 | Yes | | | 2290 Chandler Road | | 186 |

Table 1. Database of Well Search Results (continued)

| Map ID | Latitude (°N) | Longitude (°W) | Possible Well Location | Fire Hydrant | Water Meter Box | Address | Notes | Photo # |
|-------------|---------------|----------------|------------------------|--------------|-----------------|------------------------------------|---|---------------|
| 178 | 35.39814 | 77.12397 | Yes | | x | 2327 Chandler Road | | 187 |
| 179 | 35.39715 | 77.12366 | Yes | | | 2360 Chandler Road | | 188 |
| 180 | 35.39311 | 77.12305 | Yes | | | 1611(?) Chandler Road | Crossroads Baptist Church | 189 |
| 181 | 35.39311 | 77.12305 | Yes | | | ??? CC Road | | 190 |
| 182 | 35.39251 | 77.12412 | Yes | | | 1096 CC Road | | 191 |
| 183 | 35.39264 | 77.12717 | Yes | | | 959 CC Road | | |
| 184 | 35.39264 | 77.12717 | Yes | | | 933 CC Road | | 192 |
| 185 | 35.39258 | 77.12751 | Yes | | | 921 CC Road | | 193 |
| 186 | 35.39273 | 77.13031 | Yes | | | ??? CC Road | | 194 |
| 187 | 35.39386 | 77.13634 | Yes | | | 375 CC Road | | 195 |
| 188 | 35.39402 | 77.13696 | Yes | | | 356 CC Road | | 196 |
| 189 | 35.39412 | 77.13728 | Yes | | x | 351 CC Road | | 197 |
| 190 | 35.39443 | 77.13889 | Yes | | | 247 CC Road | | 198 |
| 191 | 35.39452 | 77.1394 | Yes | | | 211 CC Road | | 199 |
| 192 | 35.39475 | 77.14032 | Yes | | | 175 CC Road | | 200 |
| 193 | 35.39515 | 77.14325 | Yes | x | | Intersection of Hwy 17 and CC Road | | 201 |
| 194 | 35.39009 | 77.12352 | Yes | | | 2897 (?) Chandler Road | | 202 |
| 195 | 35.38978 | 77.12354 | Yes | | | 2921 Chandler Road | | 203 |
| 196 | 35.38957 | 77.12354 | Yes | | | ??? Chandler Road | | 204 |
| 197 | 35.38912 | 77.1238 | Yes | | | 2978 Chandler Road | | 205 |
| 198 | 35.38698 | 77.1253 | Yes | | | 3123 Chandler Road | | 206 |
| 199 | 35.3865 | 77.12563 | Yes | | | 3161 Chandler Road | Purser Road (Craven Co.) and Chandler Road (Beaufort Co.) - Same Road | 207 |
| 200 | 35.37829 | 77.13181 | Yes | | | 800 Purser Road | | 208 |
| 201 | 35.37489 | 77.13478 | Yes | | | 680 Purser Road | | 209 |
| 202 | 35.37416 | 77.1354 | Yes | x | | ??? Purser/Chandler | 3 Monitoring Wels (NCDENR?) | 210 |
| 203 | 35.37355 | 77.13628 | Yes | | | 3510 Irene Road | | 211, 212 |
| 204 | 35.36832 | 77.14269 | Yes | | | 295 Chandler Road | | 213 |
| August 2008 | | | | | | | | |
| 205 | 35.385899 | 76.992411 | Yes | | | CCC #1 Rd. (CC Road) | Property with at Least 3 Mobile Homes | |
| 206 | 35.384917 | 76.989139 | Yes | | | Hwy 33 | Near CCC#1 Road (CC Road) | |
| 207 | 35.370111 | 76.974944 | Yes | | | Tripp Road | Farm House with Well | |
| 208 | 35.360694 | 76.974694 | Yes | x | | Norman Road | Farm House with Well - Fire Hydrant & Public Water Noted | |
| 209 | 35.359028 | 76.976028 | Yes | | | Norman Road | Mobile Home on the East Side of Norman Road | |
| 210 | 35.356111 | 76.977667 | Yes | | | Norman Road | Near Railroad Tracks | |
| 211 | 35.353917 | 76.978583 | Yes | | | Norman Road | At Least 7 Homes at Norman Road Dead End - Water Valve Noted | |
| 212 | 35.360389 | 76.969417 | Yes | | | Tripp Road | Rundown (Abandoned?) House | |
| 213 | 35.358417 | 76.965222 | Yes | | | Tripp Road | New Home | |
| 214 | 35.347194 | 76.965056 | Yes | | | Moore Road | 5 Wells on Moore Road | |
| 215 | 35.338361 | 76.963444 | Yes | | | Over The Swamp Road | Triumph Missionary Church - At Least 8 Wells on Over The Swamp Road | |
| MMA1 | | | | | | | | |
| | 35.352277 | 77.031248 | Yes | | | Hunting Camp | Hunting Trailer across from MMA Production Well | 215, 216, 217 |
| | 35.35.2777 | 77.030938 | Yes | | | On-Site Wells | Production Well MMA1 & Observation wells | 214 |

Table 2. Well Construction Data and Water Levels for PotashCorp Monitoring Wells

| Well | Well Depth (ft) | TOC Elevation | DTW (ft) 7/31/07 | GW Elev. (ft) 7/31/07 | DTW (ft) 8/6/07 | GW Elev. (ft) 8/6/07 |
|------|-----------------|---------------|------------------|-----------------------|-----------------|----------------------|
| S-28 | 239 | 38.93 | 32.00 | 6.93 | 32.06 | 6.78 |
| S-29 | 155.8 | 37.32 | 23.18 | 14.14 | 23.10 | 14.22 |
| S-30 | 84.5 | 40.45 | 10.88 | 29.57 | 11.25 | 29.20 |
| S-31 | 217.6 | 39.51 | 19.47 | 20.04 | 19.39 | 20.12 |

TOC – Top of Casing of the well

DTW – Depth to Water

GW Elev. – Groundwater Elevation above Mean Sea Level

Top of casing elevations provided by PotashCorp

Well depths are below land surface as measured by GMA using a water level probe on 7/31/07

GMA does not have additional data on construction of the PotashCorp wells. Details of well construction could be requested from PotashCorp.

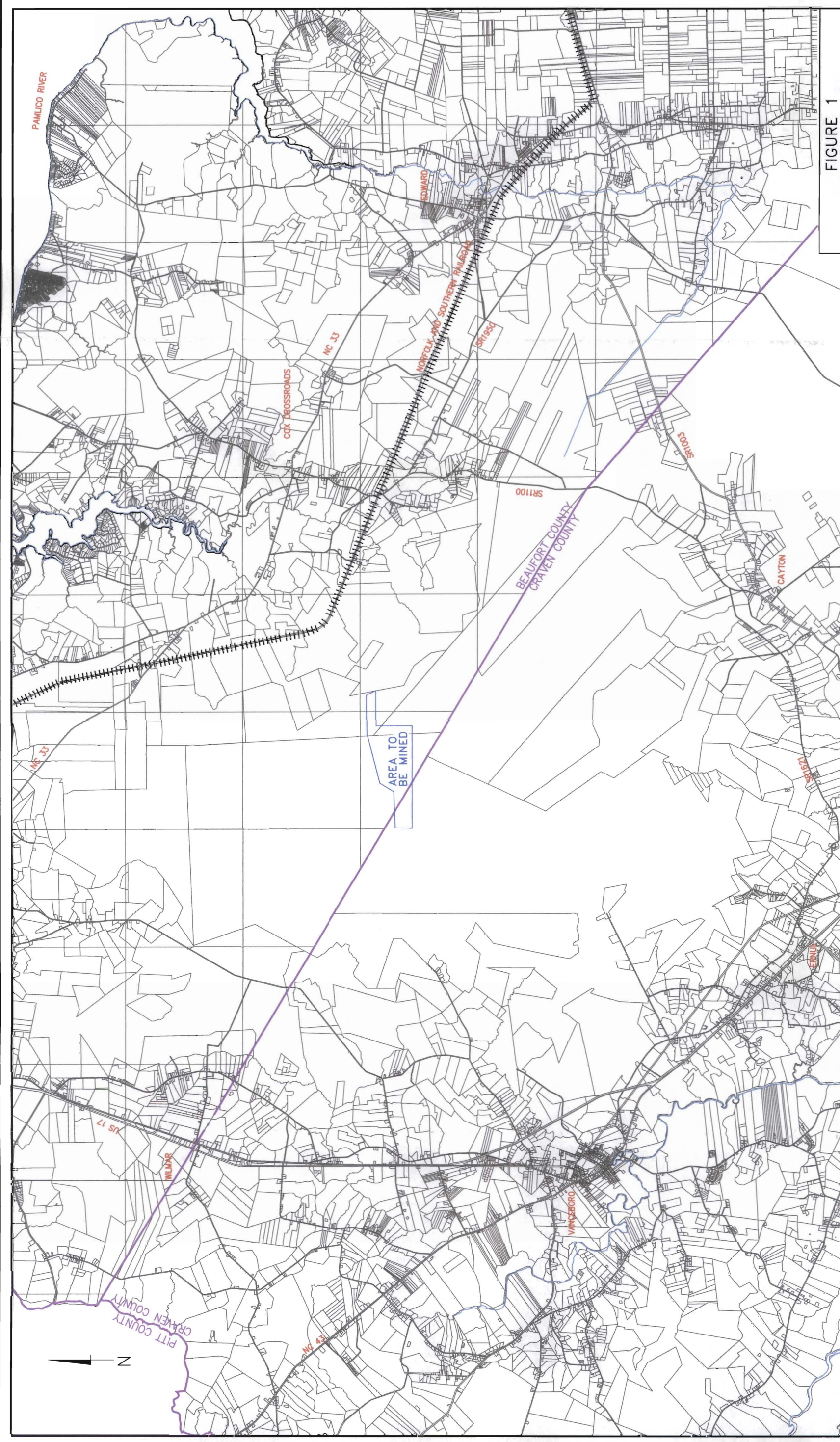
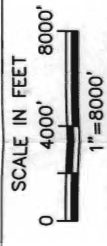


FIGURE 1



PROJECT 62902

DATE 9/15/2009



PROPOSED VANCEBORO QUARRY

MARTIN MARIETTA AGGREGATES
BEAUFORT COUNTY, NC

-LEGEND-

+++++ NORFOLK AND SOUTHERN RAILROAD

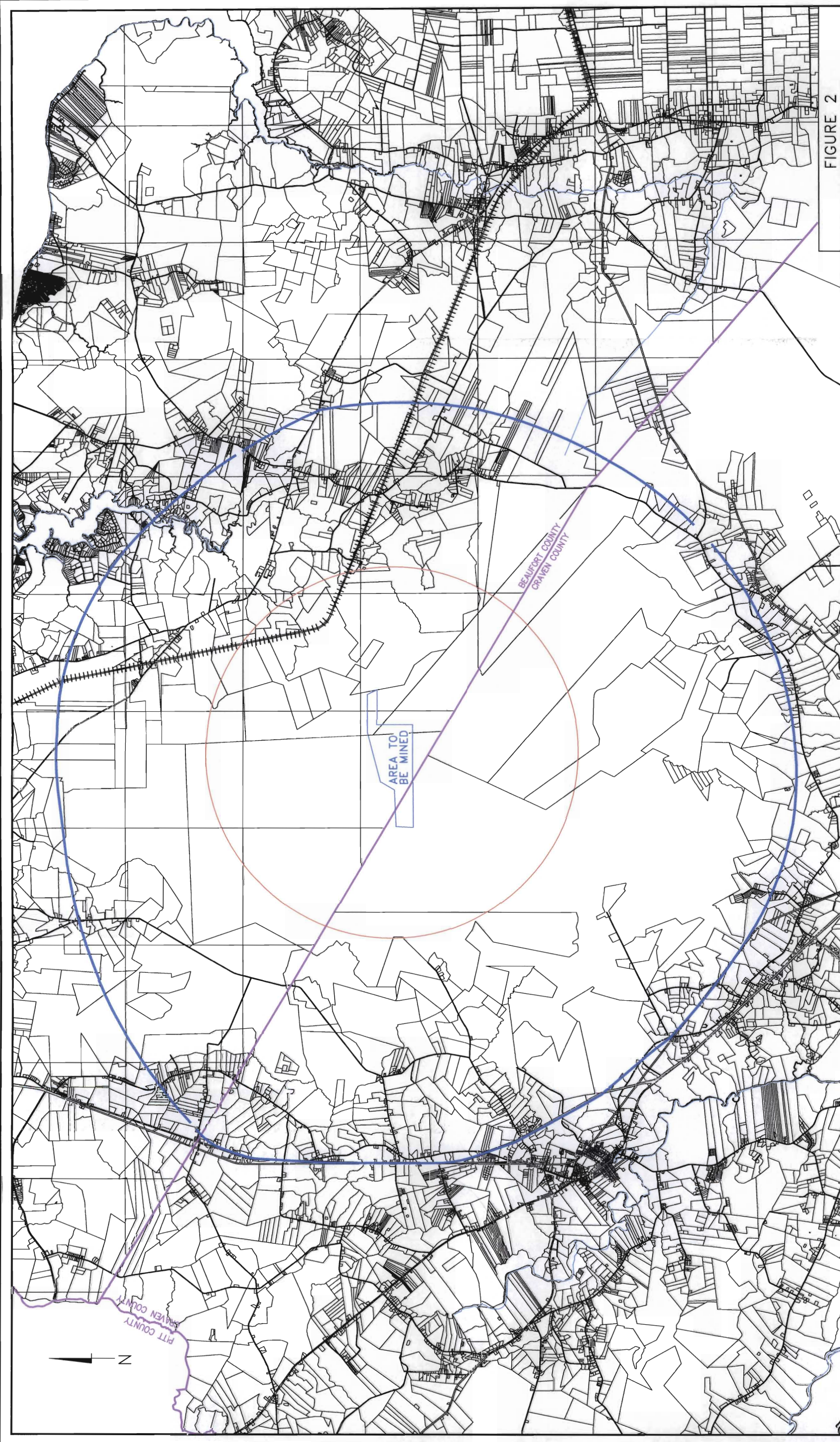
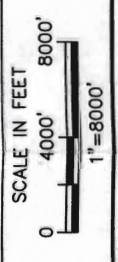


FIGURE 2



PROJECT 62902

DATE 9/15/2009



AREA OF DRAWDOWN EXCEEDING 5 FEET
AS PREDICTED BY THE MODFLOW MODEL

MARTIN MARIETTA AGGREGATES
BEAUFORT COUNTY, NC

- LEGEND-
- 3 MILE RADIUS
 - AREA OF DRAWDOWN EXCEEDING 5' AS PREDICTED BY THE MODFLOW MODEL
 - NORFOLK AND SOUTHERN RAILROAD

AREA TO
BE MINED

BEAUFORT COUNTY
CRAVEN COUNTY

PITT COUNTY
CRAVEN COUNTY



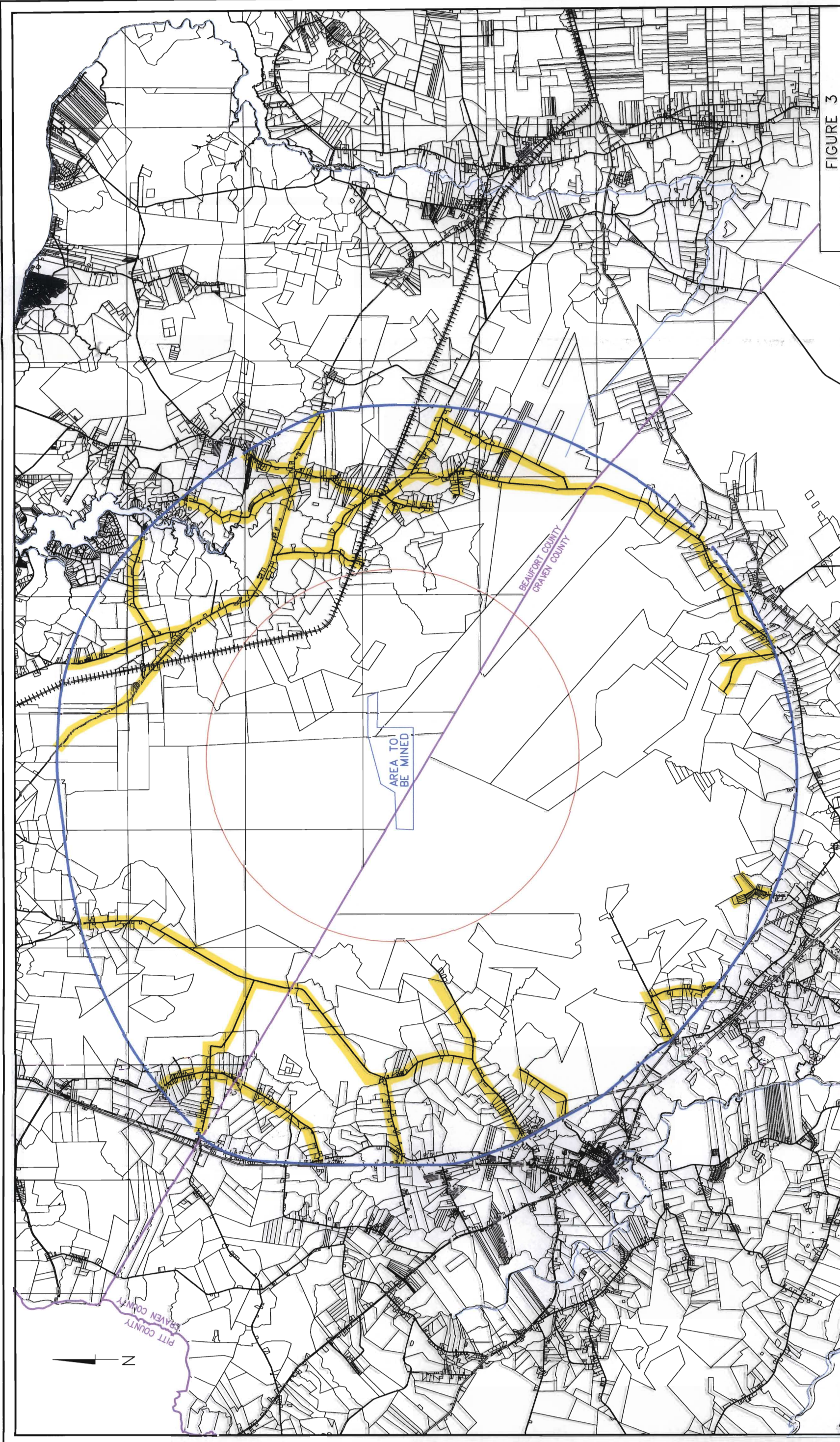
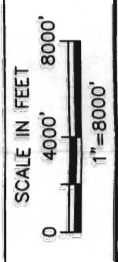


FIGURE 3



PROJECT 62902

DATE 9/15/2009



DEVELOPED PROPERTIES WITH THE STUDY AREA

MARTIN MARIETTA AGGREGATES
BEAUFORT COUNTY, NC

- LEGEND-**
- 3 MILE RADIUS
 - AREA OF DRAWDOWN EXCEEDING 5' AS PREDICTED BY THE MODFLOW MODEL
 - DEVELOPED PROPERTIES
 - NORFOLK AND SOUTHERN RAILROAD

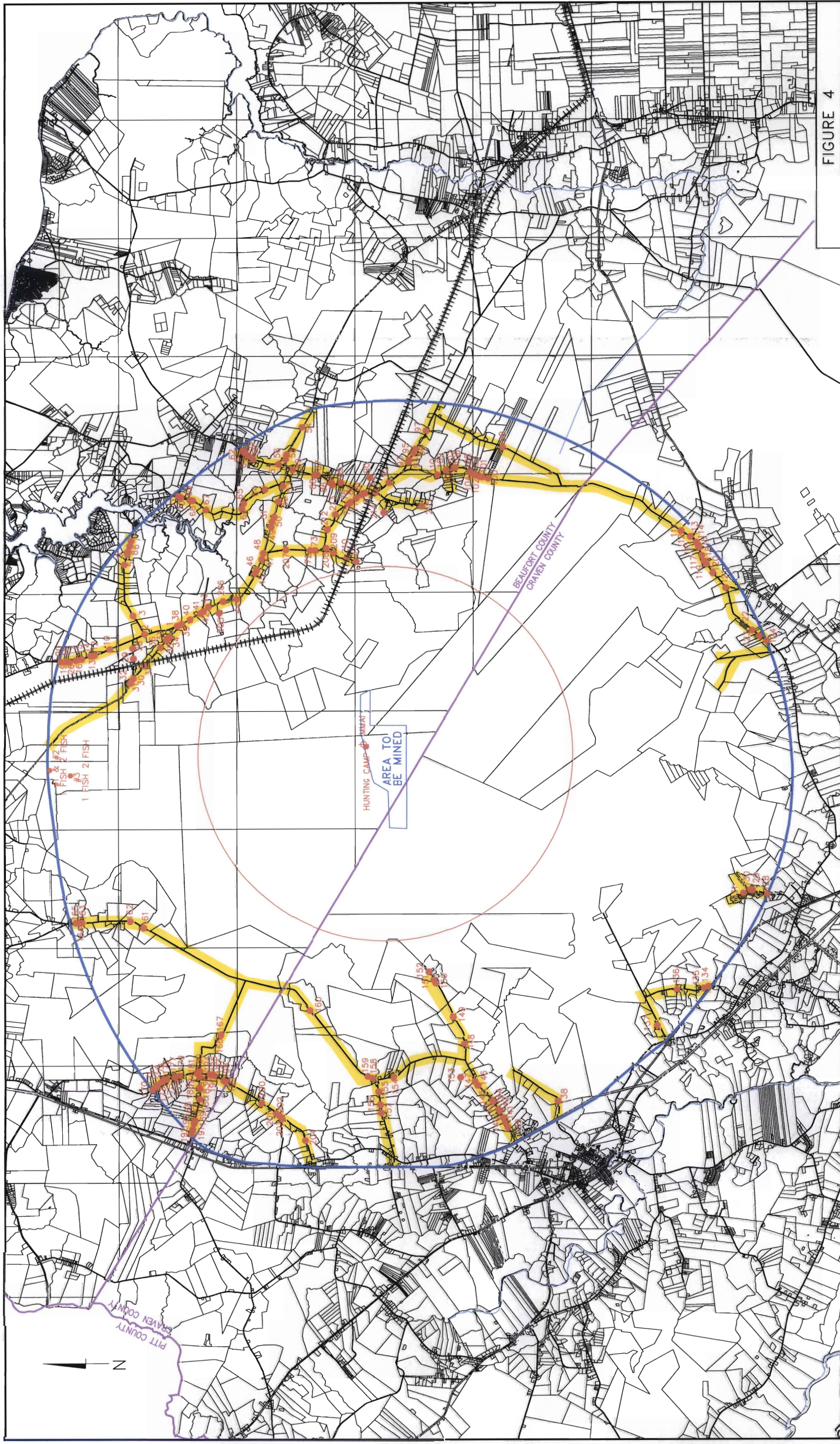


FIGURE 4

PROJECT 62902
 DATE 10/23/2009
 SCALE IN FEET
 0 4000' 8000'
 1"=8000'



WATER SUPPLY WELL LOCATIONS WITHIN THE STUDY AREA

MARTIN MARIETTA AGGREGATES
 BEAUFORT COUNTY, NC

- LEGEND-**
- RESIDENTIAL WATER-SUPPLY WELL
 - ⊕ VANCEBORO QUARRY WELL
 - 3 MILE RADIUS
 - AREA OF DRAWDOWN EXCEEDING 5' AS PREDICTED BY THE MODFLOW MODEL
 - DEVELOPED PROPERTIES
 - +++++ NORFOLK AND SOUTHERN RAILROAD

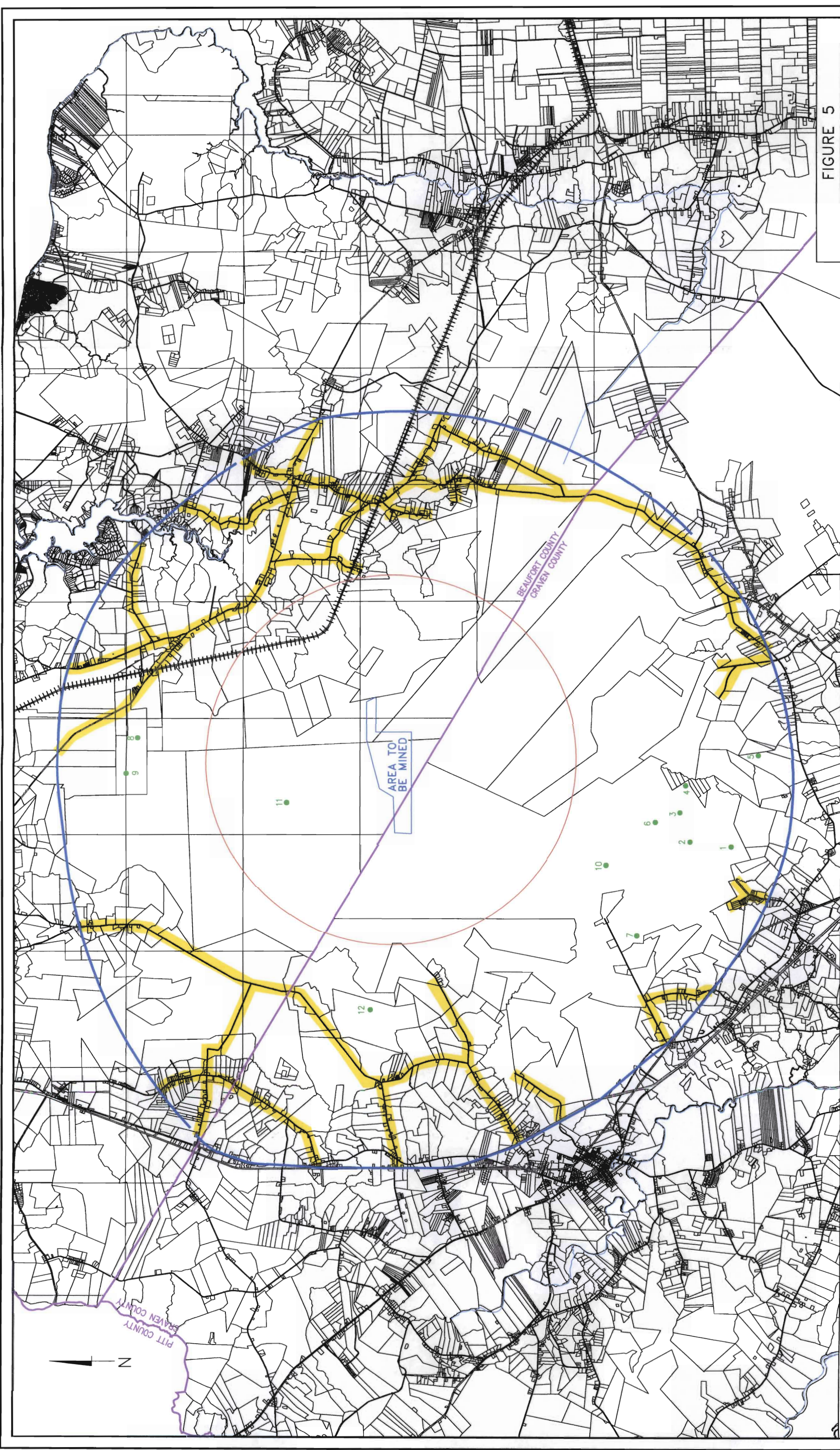


FIGURE 5



PROJECT 62902
 DATE 9/15/2009
 SCALE IN FEET
 0 4000' 8000'
 1"=8000'

POSSIBLE KARST FEATURES IDENTIFIED WITHIN STUDY AREA
 MARTIN MARIETTA AGGREGATES
 BEAUFORT COUNTY, NC

- LEGEND-
- POSSIBLE SINK HOLE STRUCTURES
 - 3 MILE RADIUS
 - AREA OF DRAWDOWN EXCEEDING 5' AS PREDICTED BY THE MODFLOW MODEL
 - DEVELOPED PROPERTIES
 - +++++ NORFOLK AND SOUTHERN RAILROAD

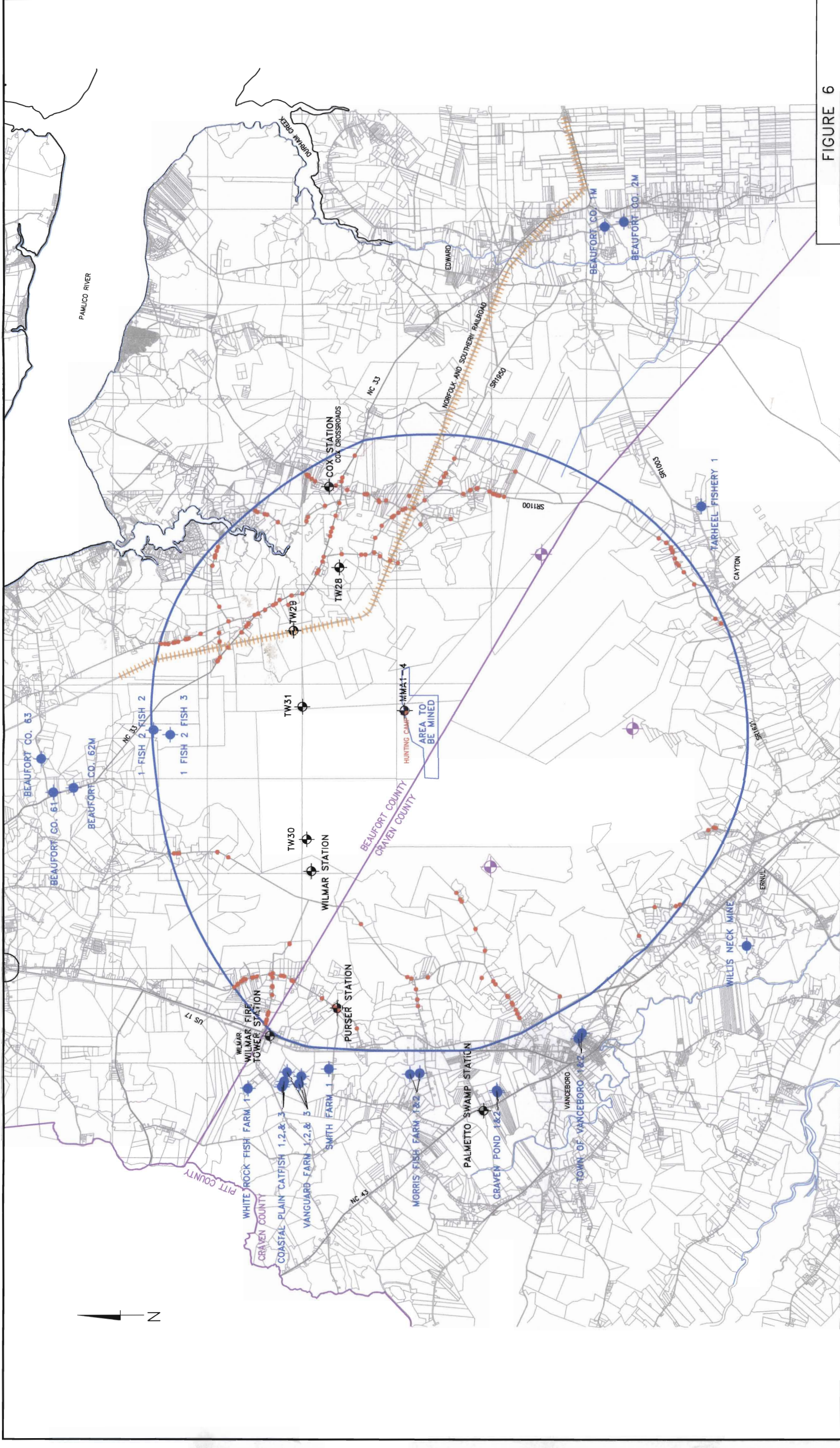
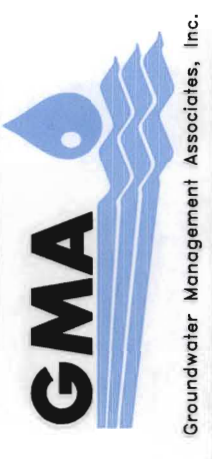


FIGURE 6

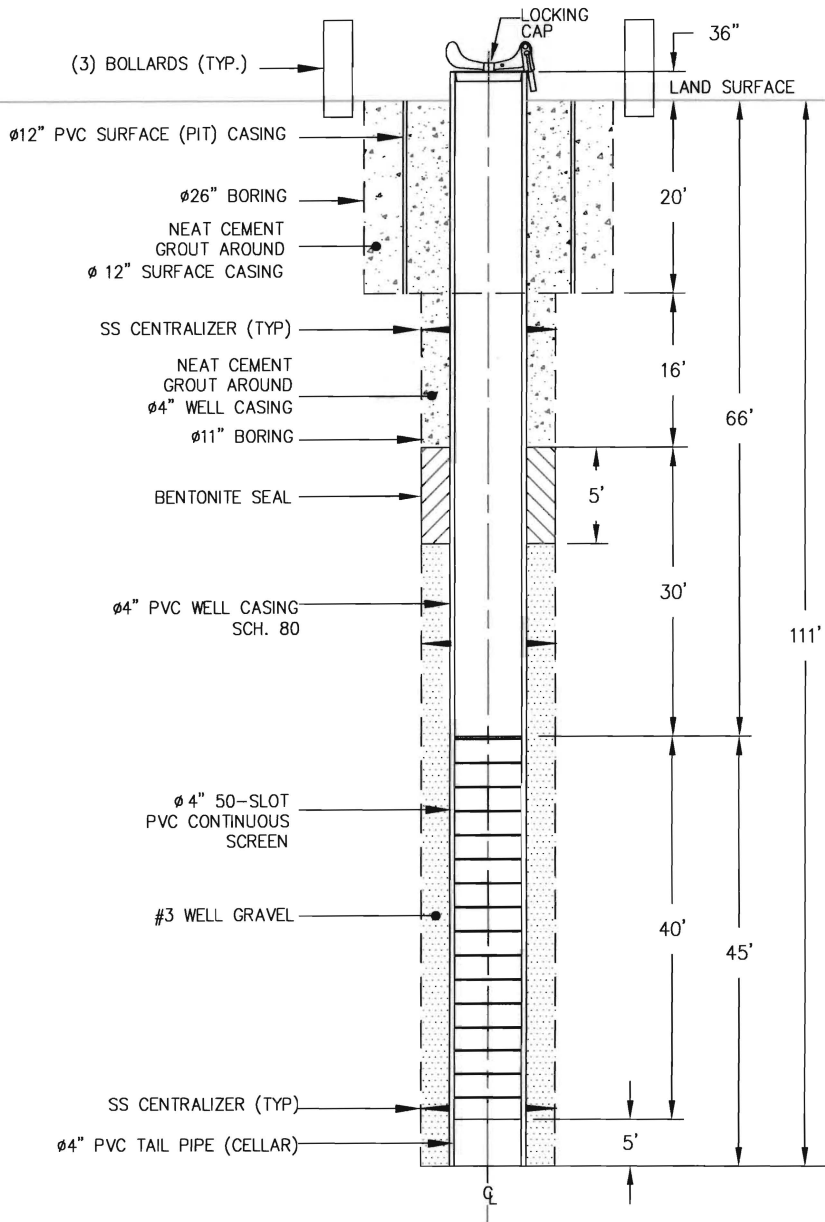


PROJECT 62902
 DATE 5/26/2010
 SCALE IN FEET
 0 5000' 10,000'
 1"=10,000'

PROPOSED VANCEBORO QUARRY MONITORING WELLS
 MARTIN MARIETTA AGGREGATES
 BEAUFORT COUNTY, NC

- LEGEND-
- EXISTING MONITORING WELL
 - CASTLE HAYNE AQUIFER CAPACITY USE AREA WATER-SUPPLY SOURCES
 - PROPOSED MONITORING WELL
 - RESIDENTIAL WATER-SUPPLY WELL

MARTIN MARIETTA AGGREGATES
 BEAUFORT AND CRAVEN COUNTIES
 PROPOSED MONITORING WELL CONSTRUCTION DETAIL
 FOR THE VANCEBORO QUARRY



NOT TO SCALE

LEGEND



File: GJR\GMA\62902
 UCHMW

MARTIN MARIETTA AGGREGATES
 VANCEBORO QUARRY

Date: 6/16/2010

Project No. 62902

BEAUFORT AND CRAVEN COUNTIES

Figure 7