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The Remediation of Abandoned Iron Ore Mine Subsidence in Rockaway Township, New Jersey

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Principal Author Gary Gartenberg, P.E., P.P.

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Submitted By Mr. Steve Levinson, M.S., HO,
Director of Health and Welfare
Rockaway Township
Sixty-Five Mt. Hope Road
Rockaway, New Jersey 07866-1699.

Report Production By:
Gary Gartenberg, P.E., P.P.
Gartenberg, Associates, L.L.C.
P.O. Box 243
Convent Station, New Jersey 07961.

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Abstract

This report represents the fourth Semi-Annual Technical Progress Report issued in connection with the subsidence remediation projects undertaken by Rockaway Township in Morris County, New Jersey. This report provides a summary of the major project work accomplished during this reporting period and contemplated for the subsequent reporting period. This report is issued as part of the project reporting provisions set forth in the Cooperators Agreement between the United States Government - Department of Energy, and Rockaway Township.

The purpose of the Cooperators Agreement is for the Department of Energy to provide technical and financial assistance in a coordinated effort with Rockaway Township to develop and implement a multi-phased plan to remediate ground stability problems associated with abandoned mining activity. Primarily during the 1800's, extensive iron ore mining and prospecting was undertaken in Rockaway Township, part of the Dover District Mining region in Morris County. The abandoned mining activity has resulted in public safety hazards associated with ground collapse and surface subsidence features evolving in both developed and undeveloped areas within Rockaway Township.

During this reporting period the Engineering Design for remediation of the surface safety hazards associated with the White Meadow Mine was completed. Construction Plans and Technical Specifications were completed and competitive bids were solicited by the Township for completion of the work.

The electrical resistivity survey analysis and report was completed for the Green Pond Mines site at the Township Compost Storage Facility. The geophysical survey results confirmed evidence of abandoned mining activity at the Green Pond Mine site which was previously identified.

During this reporting period, the time frame of the Cooperative Agreement between the Township and the Department of Energy was extended. An additional site of subsidence within the Township related to abandoned mining activity at Mount Hope Road was selected by Rockaway Township to be considered for remediation and inclusion under the Cooperative Agreement.

Summary

Construction Plans and Technical Specifications, the basis for a Bid Package, were completed for remediation of the White Meadow Mine site in Rockaway Township. During this reporting period, bids to conduct the work were solicited in accordance with competitive public bidding practices.

After receipt of the Bids and prior to the Township approving the acceptance of a bidder, the agreement was terminated between the Township and the Property Owner of the 189 White Meadow Road property with regard to certain cost sharing issues. These issues were not connected to the Cooperative Agreement between Rockaway Township and the United States Department of Energy. As a result of the agreement failure, initiation of construction work at the site was temporarily suspended and the bids were nullified. After reconsideration of the project elements, the Property Owner requested that the agreement and cost sharing arrangements with the Township be re-instituted.

The aforementioned work was accomplished under Phase II, Remediation Design and the initial portion of Phase III, Shaft Remediation of the Scope of Work of the Overall Project Plan.

With regard to the Green Pond Mines Project and a report was completed with regard to the electrical resistivity geophysical survey data which was previously collected at the compost facility site. A number of anomalous areas were delineated through the interpretation of the survey field data combined with the existing topography, historical data related to overburden back-filling and rock dumps of the mining areas.

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Results and Discussion

The following information provides the results of the major issues, work items and areas of investigation considered during the reporting period of this Technical Progress Report.

General Project Communications and Fundamentals

During this semi annual reporting period various communications and coordination occurred as was necessary during this portion of the project. These include meetings and correspondence in connection with awarding of the construction contract for remediation of the White Meadow Mine, related work in connection with the public bidding process, and addressing issues with the termination of the agreement with the Property Owner.

During this reporting period the completion date of the Cooperative Agreement between Rockaway Township and the Department of Energy was extended to allow additional time for the execution of the Scope of Work. Contact with the Department of Energy occurred during this period relative to Rockaway Township adding an additional site to be addressed within the original overall program budget amount previously approved.

White Meadow Mine - Remediation

During this progress reporting period, Construction Plans and Technical Specifications were completed forming the Bid Package to solicit competitive bids for the proposed remedial work. Bids were solicited in accordance with state legislated requirements for public funded projects.

The remediation of the subsidence at the White Meadow Mine site anticipates in general terms, excavating the existing pit, benching of the rock ledge at the head wall and foot wall, placement of a concrete safety plug, back-filling, and clean up and site restoration.

The basic remediation consists of installation of a three part concrete safety plug between the head wall and foot wall traversing the rear yard area. The longitudinal dimension of the safety plug will be approximately fifty five (55') feet. The intended location of the concrete safety plug and other pertinent site elements can be seen in the Construction Site Plan in the Appendix, Page A-11.

The design anticipates excavating down approximately thirteen (13') feet. The head wall and foot wall will be benched to allow a "T" shaped cross section of the plug. Vertically, approximately four (4') feet of the concrete will be at an elevation above the base of the rock bench, with three (3') feet of the plug below the elevation of the bench. The width of area which was previously mined varies from seven to ten (7' to 10') feet between the foot wall and head walls.

Six (6") inch construction joints will be installed dividing the length of the safety plug into three independent sections along the longitudinal axis. Should shifting of subsurface subsidence occur, this three piece design will allow some independent movement of the individual sections. Page A-12 in the Appendix shows a typical cross section extending through the existing and proposed excavated area at the site showing the concrete safety plug typical detail.

Placement of the safety plug will include the installation of steel reinforcement bar installed from the top of the concrete toward the surface. The surface markers will then allow for subsequent monitoring of the sub surface concrete plug. Additionally, a twelve (12") diameter observation casing will be installed approximately three (3') feet below grade through the center of the safety plug allowing future access to this area for additional subsurface gravity or hydraulic placement of fill, or video observations.

The small size and extreme vertical profile of the existing driveway providing access from White Meadow Road to the mine area at the rear yard of the site, combined with low clearance of overhead utilities at the intersection of the driveway and White Meadow Road, places severe limitations of the size of construction equipment which can safely negotiate the driveway to the rear yard area. Consequently, the Contractor conducting the work will most likely need to place the concrete for the safety plug by pumping from White Meadow Road. Also, removal of surplus material will require smaller than normal equipment to transport the material to hauling equipment.

At the conclusion of the work, the excavated area will be back filled and the original grade re-established and driveway pavement restored as noted on the Construction Site Plan, Appendix Page A-11.

White Meadow Mine - Project Status

At the conclusion of this reporting period the project had been temporarily suspended waiting a renewed agreement with the property owner and the Township. The project has previously been advertised and bidders were solicited from the public for construction of the remedial project. After bids were received and a contractor was selected, the Property Owner withdrew, voiding the cost sharing agreement with the Township concerning the Township's financial portion of the work.

After some discussions and negotiations, the Property Owner agreed to continue in the cost sharing program with the Township for the unmatched portion of the construction. As a result, a new agreement is being developed for approval by the Township and agreed to by the Property Owner. Due to the lapse in time the original bid was then voided. The Project will need to be re-advertised publicly and bids solicited.

Green Pond Mines - Geophysics

During this reporting period, analysis of the geophysical survey data was completed from the Green Pond Mines site was completed. Ten northwest-southeast resistivity survey

lines were conducted on one hundred (100') foot centers. This general area was subject to substantial mining activity in the past. As is noted after review of historical documentation and visual observation of the topographic features and cultural features which exist today at the Green Pond Mines site.

The geophysical survey conducted at this area located three separate apparent ore bodies within the survey area. A number of anomalies were located which appear to be the result of overburden back filling and rock dumps in mine depleted areas.

Previous published historical data by Sims¹ suggests that there are no vertical mine shafts in the area in question. The vertical anomalies detected appear to be indicative of overburden fill surficial mines which are also noted by Sims in his 1958 publication or shafts to deep mines. Considering historical site data of the depth of the anomalies, the anomalous conditions appear to represent depleted surface mines. However the potential exists for deep shaft mining which has occurred elsewhere in the Dover Mining District.

The collapsed area adjacent to the road and compost area, which is currently fenced at the area in question at the compost facility, appears to terminate at a depth of approximately forty (40') feet in a northern trend. Based upon review of published historical documentation, the topography of the collapsed area and the geological trends, this appears to be the result of subsidence and washout of overburden fill.

Mt. Hope Road Subsidence

A recent subsidence area increased in size adjacent to Mt. Hope Road between Mt. Hope Pond and Mt. Hope Road. The Township has elected to include this subsidence location in the Overall Project due to its close proximity to the traveled roadway and the adjacent recreation area and the associated hazards to vehicles or pedestrians occasioning this area.

The area in question is located in general between the Elizabeth shaft and the Brown shaft, along the general north forty five (N45E°) degrees east geologic trend through this mining district. This area is approximately one half (1/2) mile southwest from the general location of the New Leonard shaft. This is the principle operating shaft of the Mt. Hope Mine which was the most prolific magnetite producer in the Dover Mining District. The Mount Hope mine is though to be the oldest operating iron mine in the United States with a production history dating back to at least 1710, and possible 1665 based on historical data.

Considering the proximity of the subsidence adjacent to Mt. Hope Road, and its location adjacent to the Rockaway Township water recreation area at Mt. Hope Pond, the

¹ Sims, P.K., Geology and Magnetite Deposits of Dover District, Morris County, New Jersey, 1958 U.S. Geological Survey Professional Paper 287, Figure 44

Township has elected to include remediation of this subsidence area within the overall budgetary constraints of the grant with the Department of Energy.

The location of the subsidence is shown in the Appendix, Page A-13. The subsidence surface feature is approximately twenty five (25') feet in diameter, conical shaped with an axis length of approximately fifteen (15') feet at the center. An Outline Specifications with a Scope of Work has been developed to provide immediate temporary relief to this location. This includes clearing and cleaning of the existing subsidence area and adjacent work areas including the subsidence cone which contains large organic debris and small trees, limited excavation would be then conducted including a small bench at the perimeter of the cone with cleaning and scraping of the walls of the existing subsidence cone. The area would be back filled with shot rock approximately two (2') feet in diameter with mix sizes. Near the upper portion of the excavation, a concrete matrix would be introduced of approximately twelve (12 cy) cubic yards to the back filled area. The area would then be back filled to the surface.

Subsequent Reporting Period Activity Plan

During the subsequent reporting period it is anticipated that Phase III, Shaft Remediation, will be undertaken at the White Meadow Mine site. It is anticipated that an agreement will be reached shortly with the Township and the Property Owner, allowing the Project to be re-bid and completed in the near term.

Field investigations will continue at the Green Pond Mine site to correlate the results of the geophysical data with the abandoned mining features and topography which exist today. Depending on the outcome of other subsidence projects within this grant in Rockaway Township, a defined Scope of Work for remediation at this area will be finalized. Subsequent design and plans will then be developed for remedial work at the compost facility site.

Work to eliminate the immediate safety hazard associated with the subsidence adjacent to Mt. Hope Road is anticipated to be conducted during the subsequent reporting period. This work should provide immediate term relief addressing the safety concerns at this location.

Conclusions

The geophysical results obtained at the Green Pond Mines site from analysis of the electrical resistivity survey indicates the presence of substantial mining activity at this area. This information assists in the task of delineating the subsurface features inferred from the existing abandoned mining activity site features which remain today, and available information set forth in the historical literature.

Initial review of the available documentation at the Mount Hope Road location indicates the subsidence is related to abandoned mining activity. This site is located adjacent to mining features, and is midway between the general location of the Brown shaft and Elizabeth shafts.

Appendix

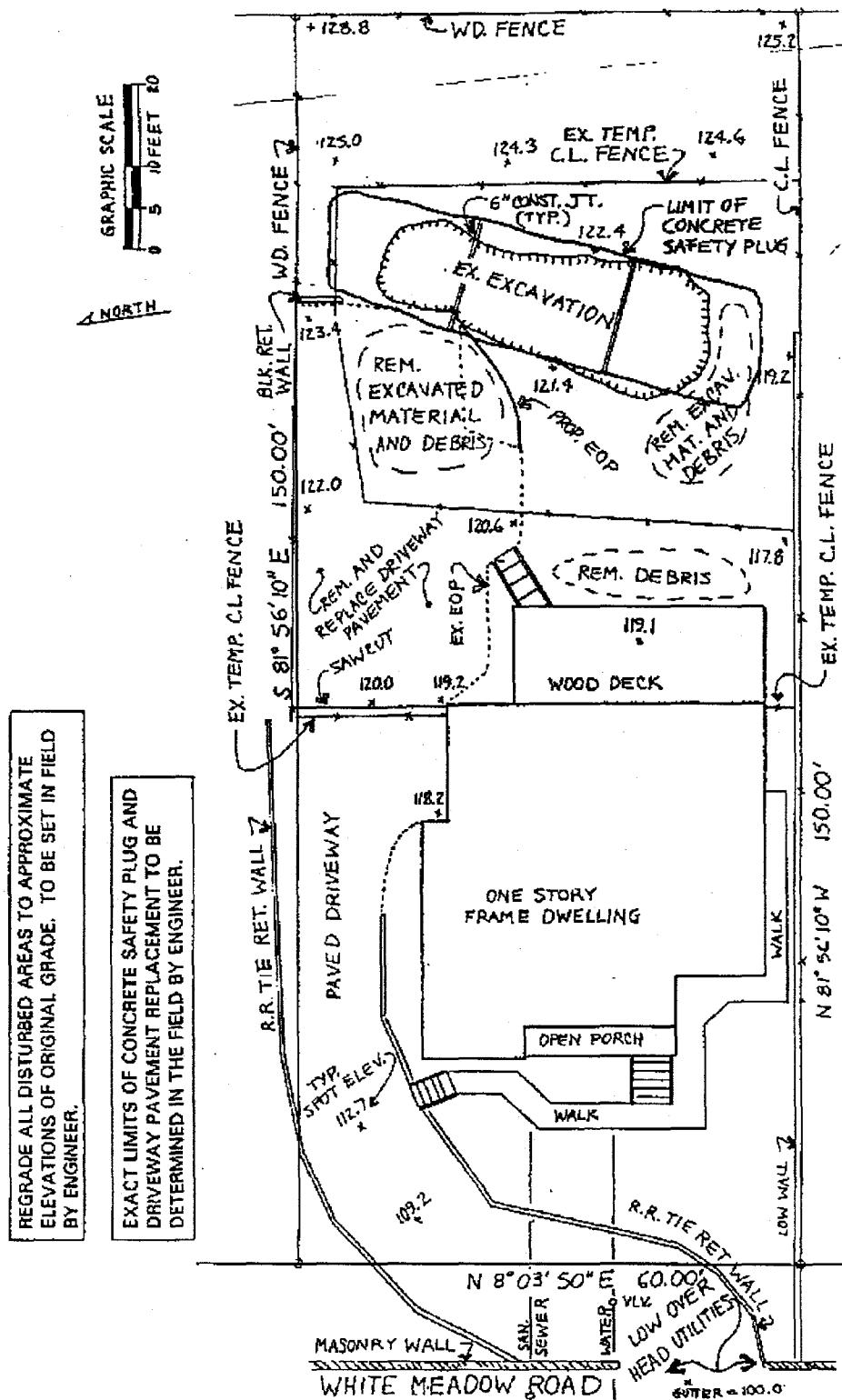
The Appendix contains the following referenced information:

Page A-11 Construction Plan (Figure MD-6), Specifications for Subsidence Remediation at 189 White Meadow Road, work product prepared by Gartenberg Associates, L.L.C., Convent Station, NJ, April 1999.

Page A-12 Figure MD-5, Specifications for Subsidence Remediation at 189 White Meadow Road, work product prepared by Gartenberg Associates, L.L.C., Convent Station, NJ, April 1999.

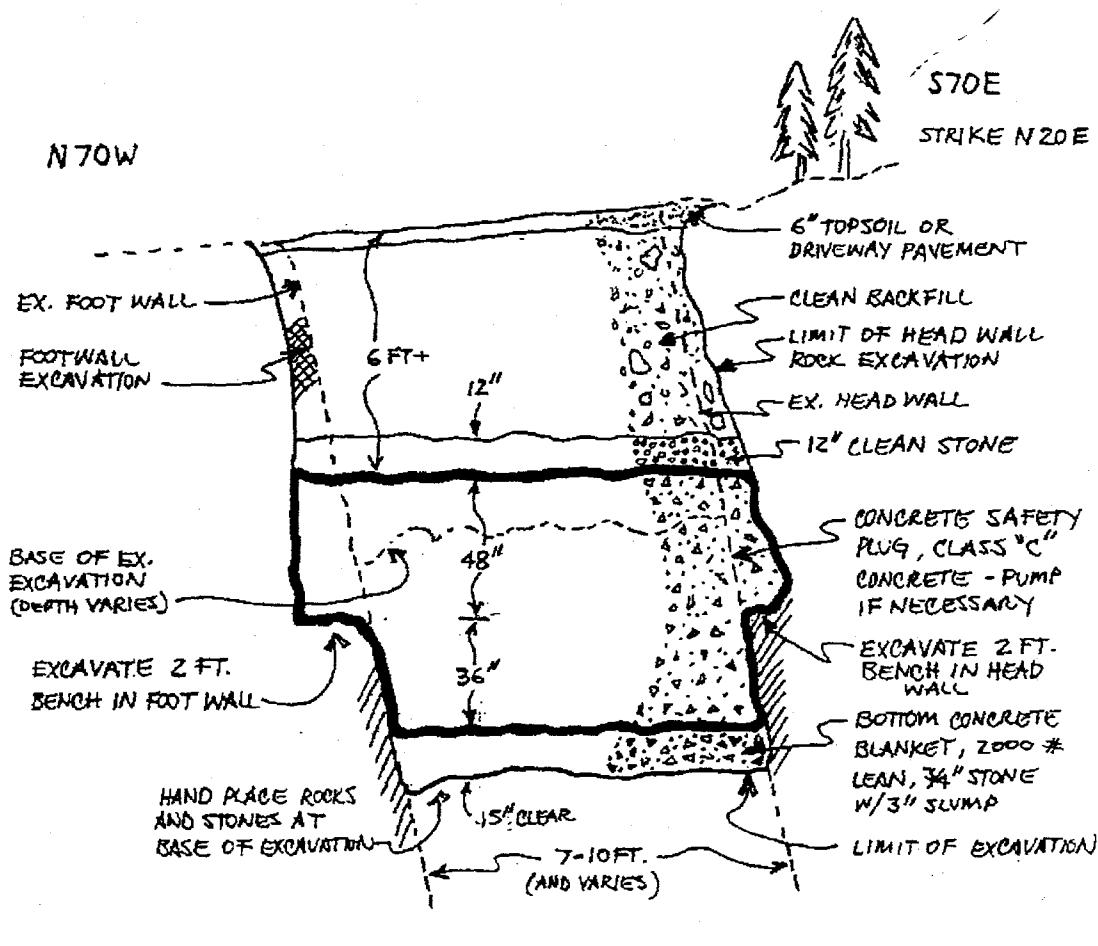
Page A-13 Sims, P.K., Geology and Magnetite Deposits of Dover District, Morris County, New Jersey, 1958 U.S. Geological Survey Professional Paper 287, Plate 1 (partial).

WHITE MEADOW MINE – CONSTRUCTION PLAN



CONSTRUCTION PLAN

WHITE MEADOW MINE – SECTION THROUGH STRIKE



**SECTION THROUGH STRIKE OF
EXISTING AND PROPOSED EXCAVATION
LIMITS AND SAFETY PLUG DETAIL**

N.T.S.

MOUNT HOPE ROAD SUBSIDENCE – LOCATION MAP

