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**Department of Energy**
Oak Ridge Operations
Weldon Spring Site
Remedial Action Project Office
7295 Highway 94 South
St. Charles, Missouri 63304

NOV 18 2002

Mr. Dan Wall
Project Manager
Superfund Division
U.S. EPA
Region VII
901 N. 5th Street
Kansas City, Kansas 66101

Dear Mr. Wall:

DOE PREFERRED ACTION FOR THE GROUNDWATER OPERABLE UNIT

Enclosed is the subject document transmitted to you electronically on November 15, 2002, as committed to in the meeting among DOE, EPA and MDNR on October 21, 2002. This serves as the basis to renew discussions and find a mutual path forward for groundwater at the Weldon Spring former Chemical Plant area. We look forward to your review and consolidation of this information with a similar submittal from MDNR. If we can provide any additional detail or clarification, please do not hesitate to contact me.

Sincerely,

Pamela Thompson
Project Manager
Weldon Spring Site
Remedial Action Project

Enclosure:
As stated

cc w/enclosure:
David Geiser, DOE
Ray Plieness, DOE

**DOE'S PREFERRED ACTION FOR THE GROUNDWATER OPERABLE UNIT AT THE WELDON SPRING SITE CHEMICAL PLANT AREA**

(Prepared for the November 15, 2002 Deliverable to the EPA)

The U.S. Department of Energy (DOE) is proposing the following action to address groundwater contamination at the Weldon Spring Site Chemical Plant Area: Monitored Natural Attenuation (MNA) supported by performance monitoring, with implementation of institutional controls (ICs) and identification of contingency activities.

**Background.** The contaminants of concern (COCs) identified in groundwater at the Chemical Plant area are uranium, nitrate, TCE, and nitroaromatic compounds (2,4-DNT, 2,6-DNT, TNT, and TNB). Chemical-specific ARARs have been identified for uranium, nitrate, TCE, and 2,4-DNT. Contour maps showing the locations of monitoring wells with contaminant concentrations exceeding these chemical-specific ARARs are attached as Figures 1 to 4. Risk-based concentrations were calculated for the remaining nitroaromatic compounds to provide a means of evaluating site conditions for these compounds. Figures 5 to 7 present locations of monitoring wells where current contaminant concentrations exceed the estimated risk-based concentrations for 2,6-DNT, TNT, and TNB.

For the Supplemental FS (DOE 1999), calculations were performed to estimate predictive times (the number of years) when natural attenuation processes would likely reduce site contaminant concentrations to levels equal to or below the chemical-specific ARARs and risk-based concentrations. These calculations have been revised to incorporate recent hydrogeologic information obtained from the field study completed in 2001 (MK-Ferguson 2002) and to incorporate more representative values for several of the input parameters. The following input parameters were revised: (1) hydraulic conductivity – used the upper 95% limit of the arithmetic mean of the hydraulic conductivities within a given plume contour. This approach was taken to account for high permeability regions associated with paleochannel features at the site; (2) hydraulic gradient – used a revised value to account for the variability along the groundwater flow path; (3) effective porosity – used a lower value than that used in the Supplemental FS to be more representative of site conditions; (4) contaminant concentrations – used current concentrations averaged over the plume area; and (5) distribution coefficients (Kds) - more representative Kds were incorporated. The Kds used in the Supplemental FS calculations were those identified for soil matrices and may not be as representative for the aquifer matrix being evaluated as those used in the revised calculations. Table 1 presents a summary of the input parameters and the results obtained from the revised calculations.

**Description of the Preferred Action.** The DOE's preferred action takes credit for the natural attenuation processes of dilution and dispersion that are occurring at the site (biodegradation is not occurring based on data evaluated for the site). In addition, it recognizes the need to implement performance monitoring to evaluate attainment of established performance goals. These goals could include the need to verify that plumes are stable and not expanding to areas previously not contaminated; to verify if contaminant concentrations indicate stable or decreasing conditions; and that site conditions continue to be protective of human health. Institutional controls would be implemented to ensure that groundwater is not used for drinking at a frequency and volume similar to that for residential consumption. Activities that could be implemented as contingency measures would also be identified as part of this preferred action. This approach identifies contingency procedures that can be implemented, as necessary. The following range of contingency activities that provides increasingly more aggressive options are being considered:

- Reevaluation of data;
- resampling;
- increasing the sampling frequency;
- revising institutional controls;
- reevaluating the remedy by evaluating passive to active options; and
- conducting time-critical or emergency corrective actions.

Table 2 identifies characteristics of a site where selecting MNA as a remedial action may be suitable as given in EPA's guidance for MNA. Chemical Plant area groundwater conditions or characteristics that are suitable for MNA are also presented for comparison. Table 3 provides an analysis of the preferred action against the nine criteria given in the NCP for evaluating the feasibility of alternatives.

**TABLE 1 MNA Predictive Clean-up Times Using the Flushing Model Presented in the Supplemental FS[a]**

| Contaminant | Contour | Wells Included | Kd[b] (mL/g) | R | K[c] (UL 95) (cm/s) | Actual GW Velocity (ft/yr) | L (ft) | Δh | Initial Conc. (avg.) | ARAR[d] | Time (yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Uranium | Contour 1 | 3030 | 0.4 | 5.5 | 0.0012 | 103.3 | 1050 | .0125 | 54 | 20 pCi/L | 56 |
| | Contour 2 | 3025 | 0.4 | 5.5 | 0.003 | 258.7 | 460 | 0.0125 | 29 | 20 pCi/L | 4 |
| TCE | Contour 1 | 4006, 4001, 3030, 3025, 4037, 3039, 3034, 2037, 2038, 4029, 3035, 4031, 3036, 3029, 3028, 4028, 3033, 4027, 4032, MWS 21, 4038, 3032 | 0.3 | 4.4 | .00411 | 141.7 | 1300 | .005 | 61 | 5 μg/L | 101 |
| Nitrate | Contour 1 Area 1 | 4036, 3037, 4006, 4001, 3030, 3031, 3027, 3026, 3039, 3025, 4027, 3038, 3034, 2037, 2038, 4029, 3035, 3032, 3028, 3029, 3036, 4031, 4028, 3033, 4038, 4032 | 0 | 1 | .00315 | 130.4 | 2750 | .006 | 198 | 10 mg/L | 63 |
| | Area 2 | 4013, 2001, 2005, 4011, 2021, 2002, 2047, 2003, 3003, 3023 | 0 | 1 | .00173 | 238.7 | 2350 | .02 | 173 | 10 mg/L | 28 |
| 2,4-DNT | Contour 1 | 3038, 2037, 4029, 3035, 3029, 3028, 4028, 3033, 4032, MWS 21, 4033, 4006, 4001, 3030, 3039, 3034, 2038 | 0.09 | 2.0 | .001 | 55.2 | 1600 | .008 | .43 | 0.11 μg/L | 79 |
| | Contour 2 | 3003, 3023 | 0.09 | 2.0 | .0003 | 25.9 | 600 | .0125 | .12 | 0.11 μg/L | 4 |
| | Contour 3 | 2047, 2046 | 0.09 | 2.0 | .00104 | 43.0 | 400 | .006 | .18 | 0.11 μg/L | 9 |
| | Contour 4 | 2052, 2006, 2053, 2054, 2013, 2012, 2049, 2050, 2033, 4030, 2014 | 0.09 | 2.0 | .00352 | 267.1 | 1400 | 0.011 | 114 | 0.11 μg/L | 73 |

TABLE 1 (cont.)

| Contaminant | Contour | Wells Included | Kd[b] (mL/g) | R | K[c] (UL 95) (cm/s) | Actual GW Velocity (ft/yr) | L (ft) | $\Delta h$ | Initial Conc. (avg.) | RBC[d] | Time (yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,6-DNT | Contour 1 | 4036, 4006, MWS-4, 4001, 3030, 3039, 3034, 4037, 3038, 4031, 4029, 3029, 3028, 4028, 3033, 3036, 4027, 4032 | 0.2 | 3.3 | .0012 | 98.2 | 1700 | .0119 | .34 | 0.13 µg/L | 55 |
| | Contour 2 | 2002, 2003, 3003, 3023 | 0.2 | 3.3 | .00019 | 21.9 | 1050 | .0167 | .41 | 0.13 µg/L | 182 |
| | Contour 3 | 2005 | 0.2 | 3.3 | .000021 | 1.8 | 400 | .0125 | .27 | 0.13 µg/L | 536 |
| | Contour 4 | 2047, 2046 | 0.2 | 3.3 | .00104 | 89.7 | 500 | .0125 | .81 | 0.13 µg/L | 34 |
| | Contour 5 | 4015, 2045, 2052, 2051, 2006, 2053, 2049, 2012, 4030, 4039, 2050, 2013, 2033, 2054, 2014 | 0.2 | 3.3 | .00341 | 555.1 | 2300 | .0236 | 66 | 0.13 µg/L | 85 |
| 2,4,6-TNT | Contour 1 | 4037 | 0.04 | 1.5 | .0017 | 199.3 | 800 | .017 | 4.5 | 2.8 µg/L | 3 |
| | Contour 2 | 2046 | 0.04 | 1.5 | .0014 | 482.8 | 400 | .05 | 4.2 | 2.8 µg/L | 0.6 |
| | Contour 3 | 2053, 2049, 2012 | 0.04 | 1.5 | .00396 | 341.4 | 350 | .0125 | 75 | 2.8 µg/L | 5 |
| 1,3,5-TNB | Contour 1 | 4013 | 0.16 | 2.7 | .00006 | 10.4 | 200 | 0.025 | 24 | 1.8 µg/L | 135 |
| | Contour 2 | 2046 | 0.16 | 2.7 | .0014 | 280 | 400 | 0.029 | 2.6 | 1.8 µg/L | 1 |
| | Contour 3 | 4015, 2052, 2006, 2053, 2013, 2033, 2014, 2050, 2012, 2049, 4030 | 0.16 | 2.7 | .0026 | 179.3 | 2400 | .010 | 20 | 1.8 µg/L | 87 |

[a] The following input parameters were also used in the calculations in addition to those shown in this table – bulk density at 1.7 g/cc and effective porosity at 0.15; see Figures 1 to 7 for locations of contours.

[b] Sources for Kds presented in this table: for uranium (EPA 2000); for nitrate (Strenge, D.L., and S.R. Peterson 1989); for TCE and 2,6-DNT (DOE 1997); for 2,4-DNT, 2,4,6-TNT, and 1,3,5-TNB (Brannon, J.M. and J.C. Pennington 2002).

[c] K's presented are upper 95% limits of the arithmetic means of the hydraulic conductivities for the monitoring wells included in the contours.

[d] Chemical-specific ARARs listed are MCLs for the particular COC; RBC = risk-based concentrations calculated based on a hypothetical resident scenario.

**TABLE 2 Site Characteristics Suitable for Selecting MNA**

| Desirable Site Characteristics for MNA (as Identified in EPA Guidance) | Chemical Plant Area Groundwater Characteristics |
|---|---|
| Source removal completed. | Contaminated soil and structures have been remediated. Selecting MNA as the action for the Groundwater Operable Unit can be considered as the follow-on action to the active remedial action completed for the Chemical Plant soil and structures. |
| Physical, chemical, or biological processes that act without human intervention to reduce the mass, toxicity, mobility, volume or concentration of contaminants. | Dispersion/dilution processes are occurring to reduce contaminant concentrations with time. The contaminated shallow aquifer is recharged by infiltrating rainwater and runoff. |
| Relatively low exceedences of contaminant concentrations as compared to chemical-specific ARARs (MCLs) and risk-based concentrations. | With some exceptions, current contaminant concentrations are relatively low as indicated by plume contours. |
| Chemical-specific ARARs can be met within a reasonable timeframe. | Estimates of cleanup times for MNA indicate chemical-specific ARARs for uranium, nitrate, TCE, and 2,4-DNT can be met in approximately 100 years. |
| Groundwater is not currently used and future use is not likely. | Subject area is state-owned land and is currently used for recreational purposes. Nearby residential areas including subdivisions currently utilize county water. Future use would be prevented via the implementation of real estate agreements with property owners (i.e., MDOC, etc.) until ARARs are met. |
| Implementation of performance monitoring to gauge effectiveness and protect human health and the environment. | Triggers (e.g. when, where, and how) would be established which signal unacceptable performance of MNA at the site. |
| Need to incorporate contingency planning to support proposed action of MNA. | Contingency activities would be identified as part of the preferred action because cleanup times for meeting ARARs under MNA were based on predictive analysis. |

TABLE 3 Analysis of DOE's Preferred Action Using the Nine Criteria

| Criteria | Preferred Action |
|---|---|
| *Overall protection of human health and environment* [Addresses whether the alternative provides adequate protection of human health and the environment. Evaluation focuses on a specific alternative's ability to achieve adequate protection and describes how site risks posed by each pathway are eliminated, reduced, or controlled through natural processes, treatment, engineering, or institutional controls. This evaluation also allows for consideration of any unacceptable short-term impacts associated with each alternative. Because of its broad scope, this criterion also reflects the focus of criteria 2 through 5.] | Provides adequate protection of human health and the environment. Current land use does not include groundwater use. Future land use is likely to remain the same as current, however, institutional controls would be implemented to ensure conditions remain protective until chemical-specific ARARs are met. Monitoring data would be collected to verify that plumes have not expanded to areas previously not contaminated or to areas with potential receptors. These data would determine if concentrations are decreasing as predicted. |
| *Compliance with ARARs* [Addresses whether all applicable or relevant and appropriate state federal laws and regulations are met. Evaluation focuses on whether each alternative will meet federal and state ARARs or whether there is justification for an ARAR waiver.] | Chemical-specific ARARs for uranium, nitrate, TCE, and 2,4-DNT are expected to be met in about 100 years. This timeframe is considered reasonable based on the following factors: recreational land use projected for the long-term; complex site hydrogeology that reduces the effectiveness of other remediation technologies and increases the cleanup times; and low well yields. |
| *Long-term effectiveness and permanence* [Addresses the risk remaining at the operable units after remediation goals have been met. Evaluation focuses on the ability of alternative to maintain reliable protection of human health and the environment over time, once these goals have been met.] | The preferred action provides long-term effectiveness and permanence after ARARs are met because contaminant concentrations would be at levels equal to or lower than the MCLs for uranium, nitrate, TCE, and 2,4-DNT. In addition, since source removal has been completed, concentrations are expected to remain protective after ARARs are met. |
| *Reduction of toxicity, mobility, or volume* [Addresses the statutory preference for selecting an alternative that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances at a site. Evaluation focuses on the extent to which this is achieved by the alternative.] | While there is no active process implemented to reduce the toxicity, mobility, or volume, the predicted decrease in contaminant concentrations by natural processes would result in the reduction of the toxicity, mobility, and volume of contamination at the site. |
| *Short-term effectiveness* [Addresses the potential impacts to workers, the general public, and the environment during implementation of the alternative.] | Potential impacts are expected to be low, with less than one case of occupational injury and no occupational fatalities during construction of new wells or abandonment of old wells, as necessary. |
| *Implementability* [Addresses technical and administrative feasibility, including the availability and reliability of resources or materials required during implementation, and the need to coordinate with other agencies.] | Performance monitoring can be implemented using conventional and readily available methods. Institutional controls in the form of real estate agreements can be obtained. Approaches or methods or tools for the identified contingency activities should be available and can be readily implemented. |
| *Cost* [Addresses both capital costs and annual O&M costs, as well as the combined net present worth of the alternative.] | For monitoring, capital costs are estimated to be about \$120K. Annual O & M costs are estimated to be about \$50K. The total cost of this preferred action is about \$4.5 M with a present worth of about \$780K. |
| *State acceptance* [Addresses the statutory requirements for substantial and meaningful state involvement. This criterion will be addressed in the responsiveness summary and ROD that will be prepared following the public comment period.] | MDNR has shown a favorable response to MNA since no ARAR waivers would be invoked. |
| *Community acceptance* [Assesses the community's apparent preference for, or concerns about, the alternative being considered. This criterion will be addressed in the responsiveness summary and the ROD that will be pared following the pubic comment period.] | A public comment period that includes a public meeting will be held in order to allow the public to review the preferred/proposed action and voice any concerns or preferences they may have. |

## REFERENCES


Brannon, J.M. and J.C. Pennington, 2002, *Environmental Fate and Transport Process Descriptors for Explosives*, ERCD/EL TR-02-10, prepared for U.S. Army Corps of Engineers, Washington, DC, May.

DOE, 1997, *Remedial Investigation for the Groundwater Operable Units at the Chemical Plant Area and the Ordnance Works Area, Weldon Spring, Missouri*, DOE/OR/21548-571, Prepared by Argonne National Laboratory, Argonne, Illinois for the Department of Energy, Weldon Spring Remedial Action Project, Weldon Spring, Missouri, July. (see p. 5-10 for TCE and p. D-9 for 2,6-DNT)

DOE, 1999, *Supplemental Feasibility Study for Remedial Action for the Groundwater Operable Unit at the Chemical Plant Area of the Weldon Spring Site, Weldon Spring, Missouri*, DOE/OR/21548-783, Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri, June.

EPA, 2000, *Soil Screening Guidance for Radionuclides: User's Guide*, EPA/540-R-00-007, Office of Solid Waste and Emergency Response, Washington, DC, October.

MK-Ferguson and and Jacobs Engineering Group, 2002, *Completion Report for the Additional Groundwater Field Studies in Support of the Groundwater Operable Unit. Rev. 0*, DOE/OR-21548-920, July.

Strenge, D.L., and S.R. Peterson, 1989, *Chemical Data Bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1*, PNL-7145, Pacific Northwest Laboratory, Richland, Washington.

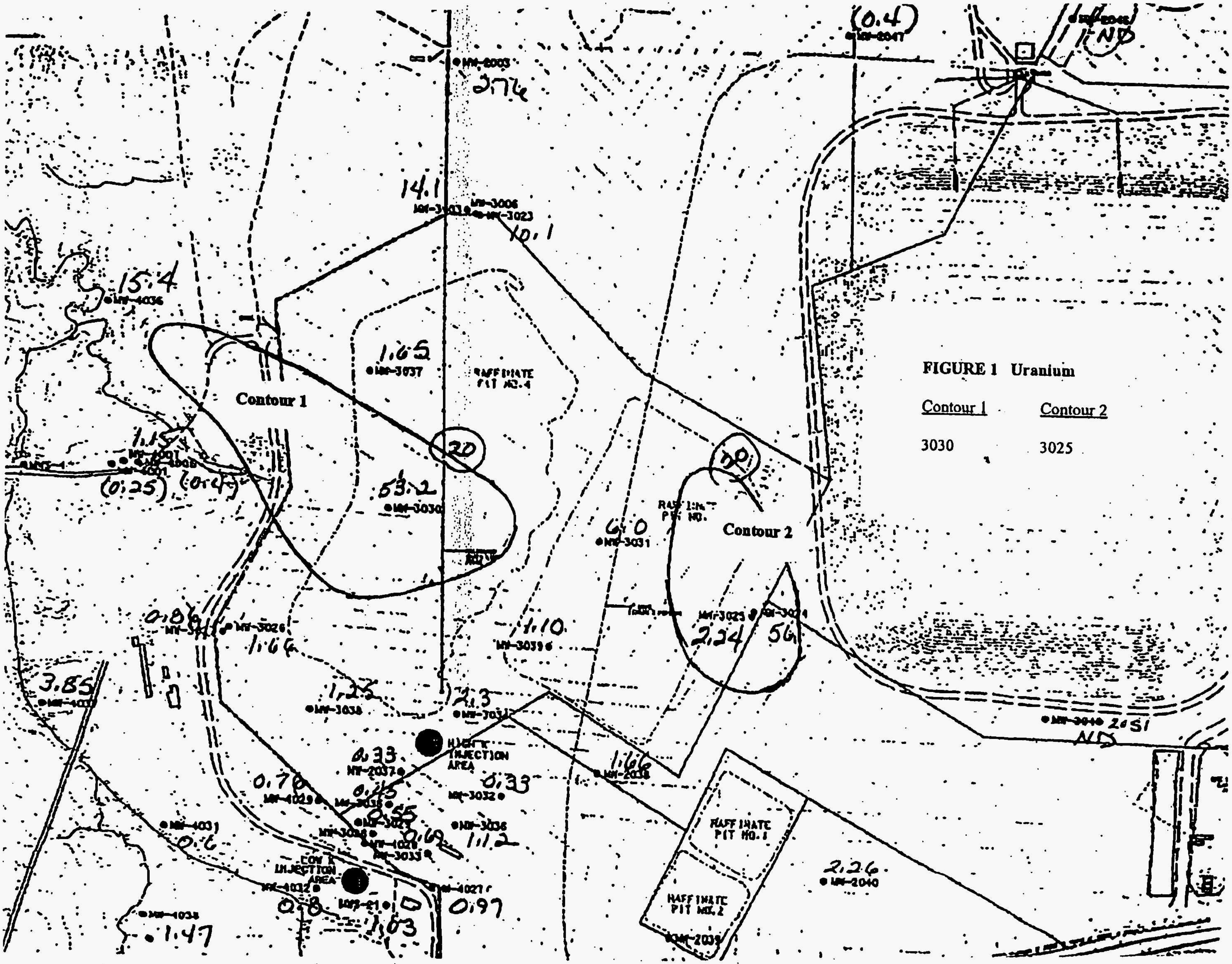



FIGURE 1 Uranium

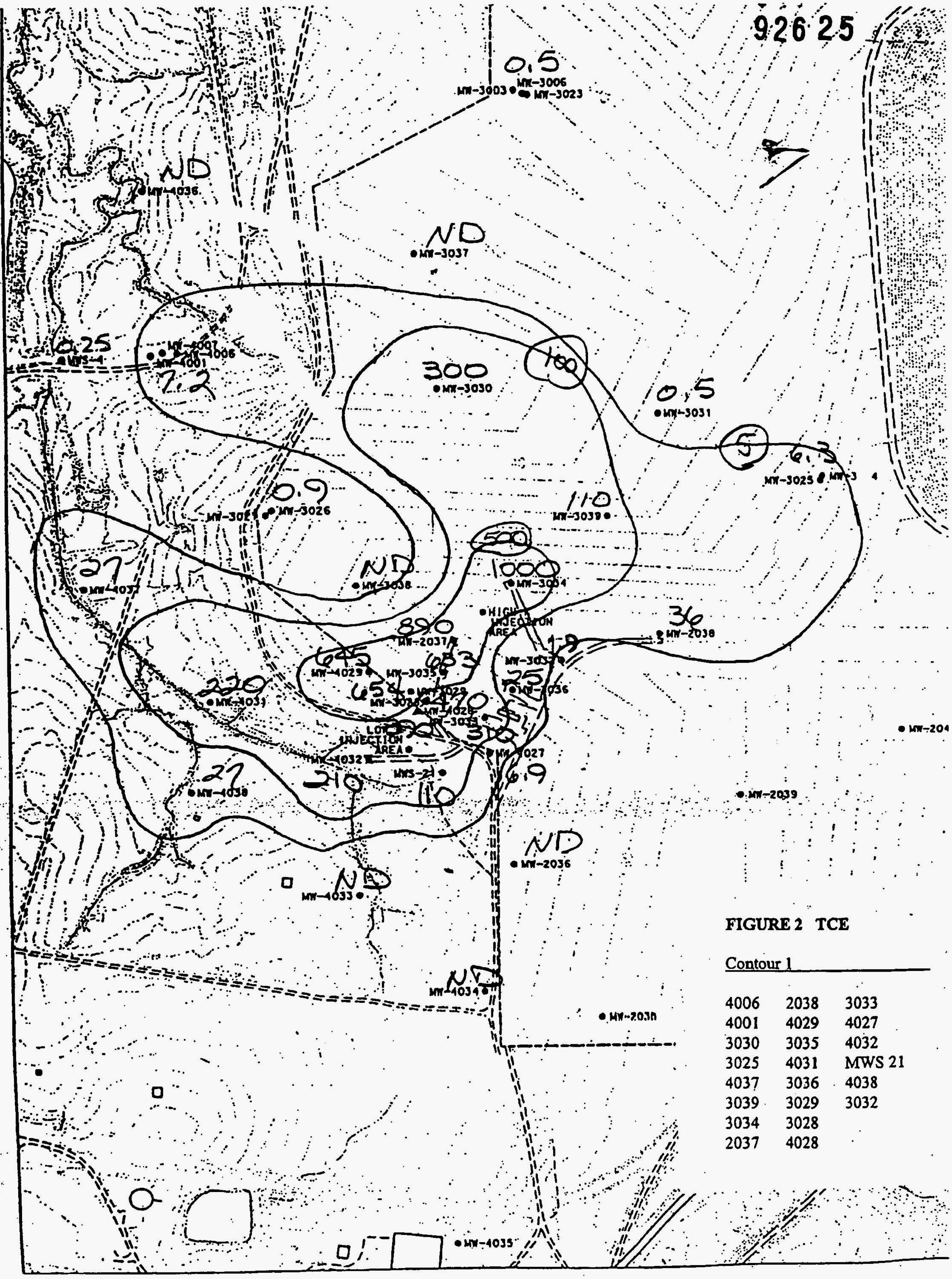



FIGURE 2 TCE

Contour 1

| | | |
|---|---|---|
| 4006 | 2038 | 3033 |
| 4001 | 4029 | 4027 |
| 3030 | 3035 | 4032 |
| 3025 | 4031 | MWS 21 |
| 4037 | 3036 | 4038 |
| 3039 | 3029 | 3032 |
| 3034 | 3028 | |
| 2037 | 4028 | |

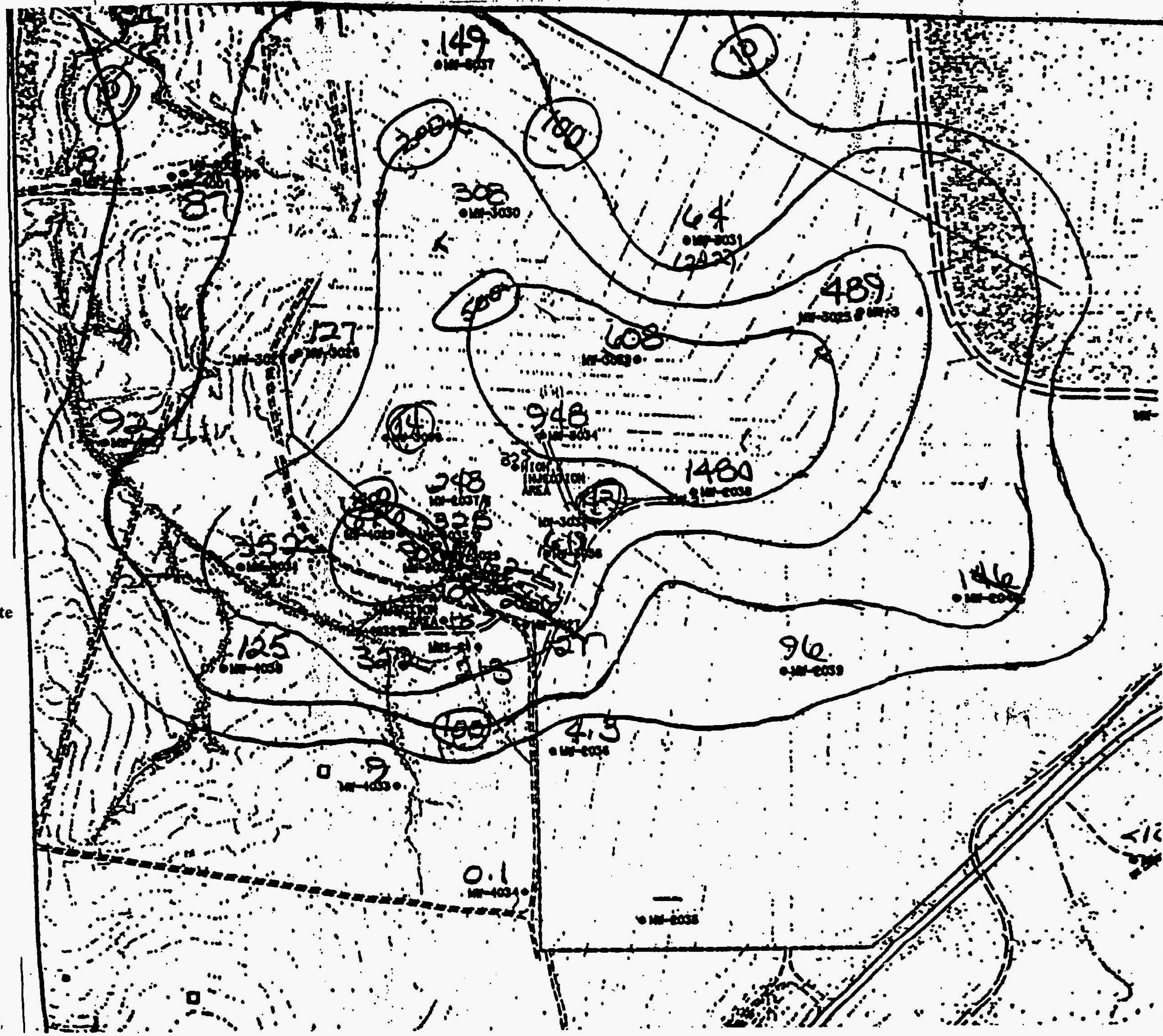



FIGURE 3A Nitrate

| Contour-1 | Area 1 |
| --- | --- |
| 4036 | 2038 |
| 3037 | 4029 |
| 4006 | 3035 |
| 4001 | 3032 |
| 3030 | 3028 |
| 3031 | 3029 |
| 3027 | 3036 |
| 3039 | 4031 |
| 3025 | 4028 |
| 4027 | 3033 |
| 3038 | 4038 |
| 3034 | 4032 |
| 2037 | |

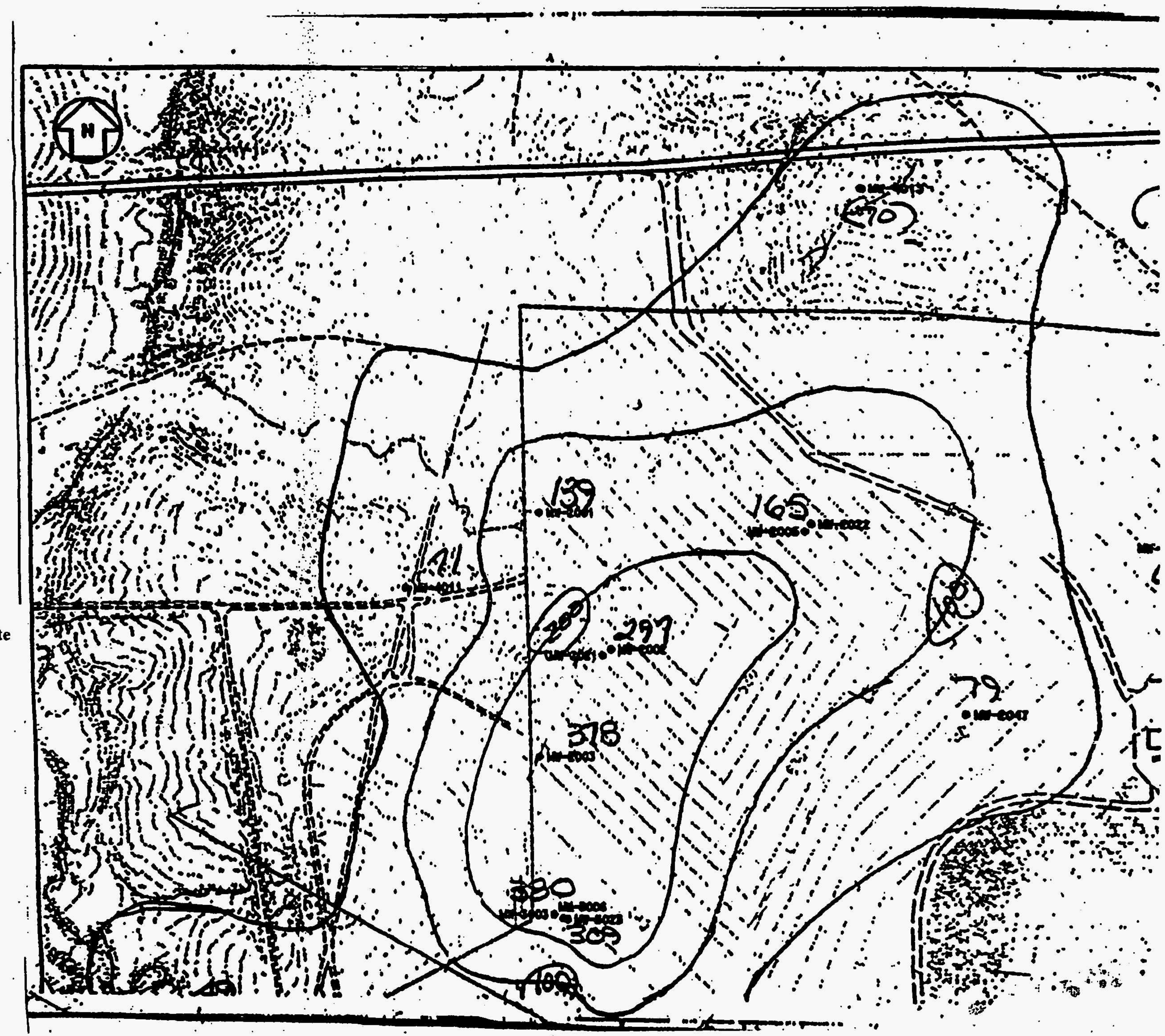



FIGURE 3B Nitrate

Contour-1 Area 2

4013
2001
2005
2022
4011
2021
2002
2047
2003
3003
3023

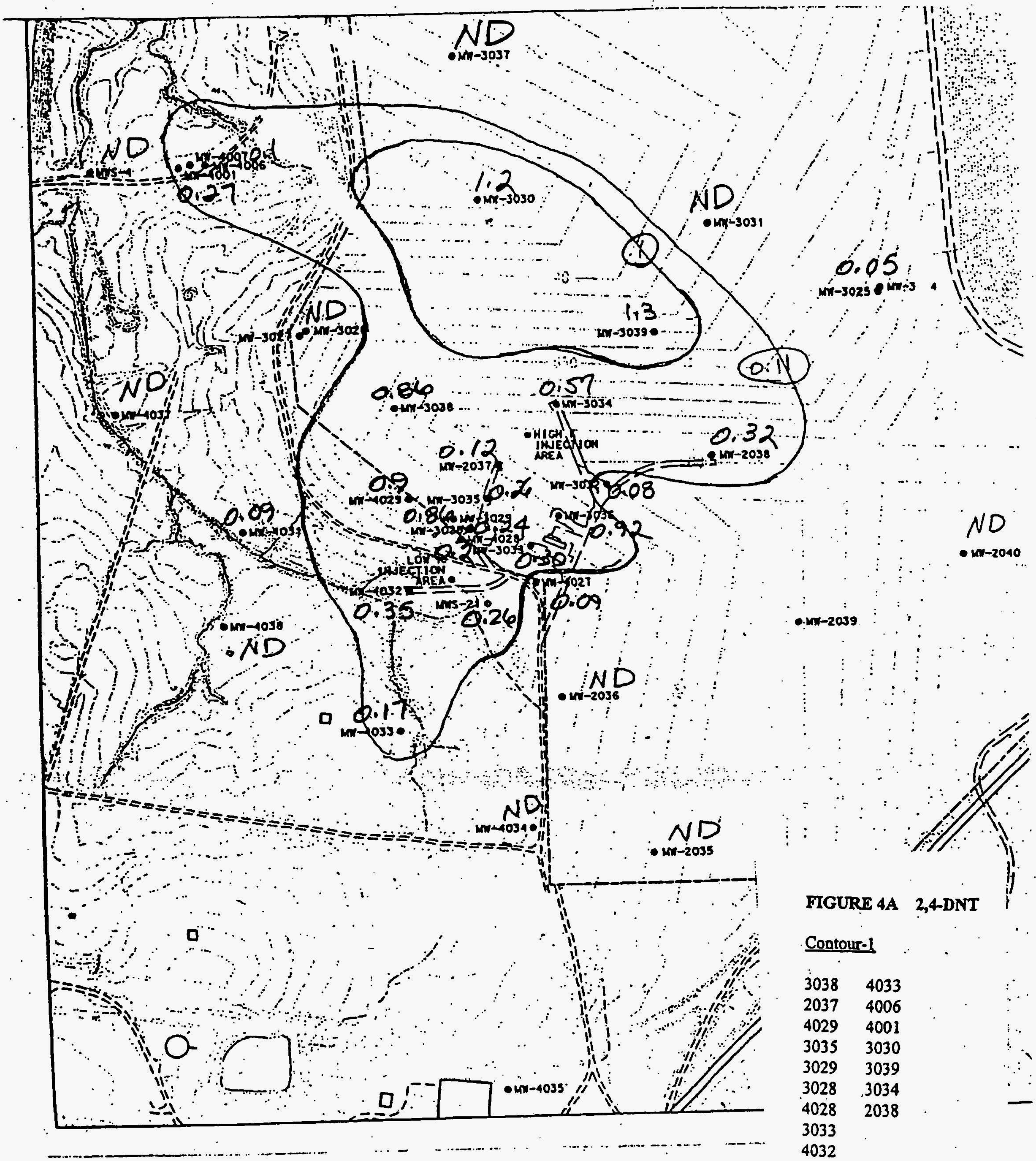
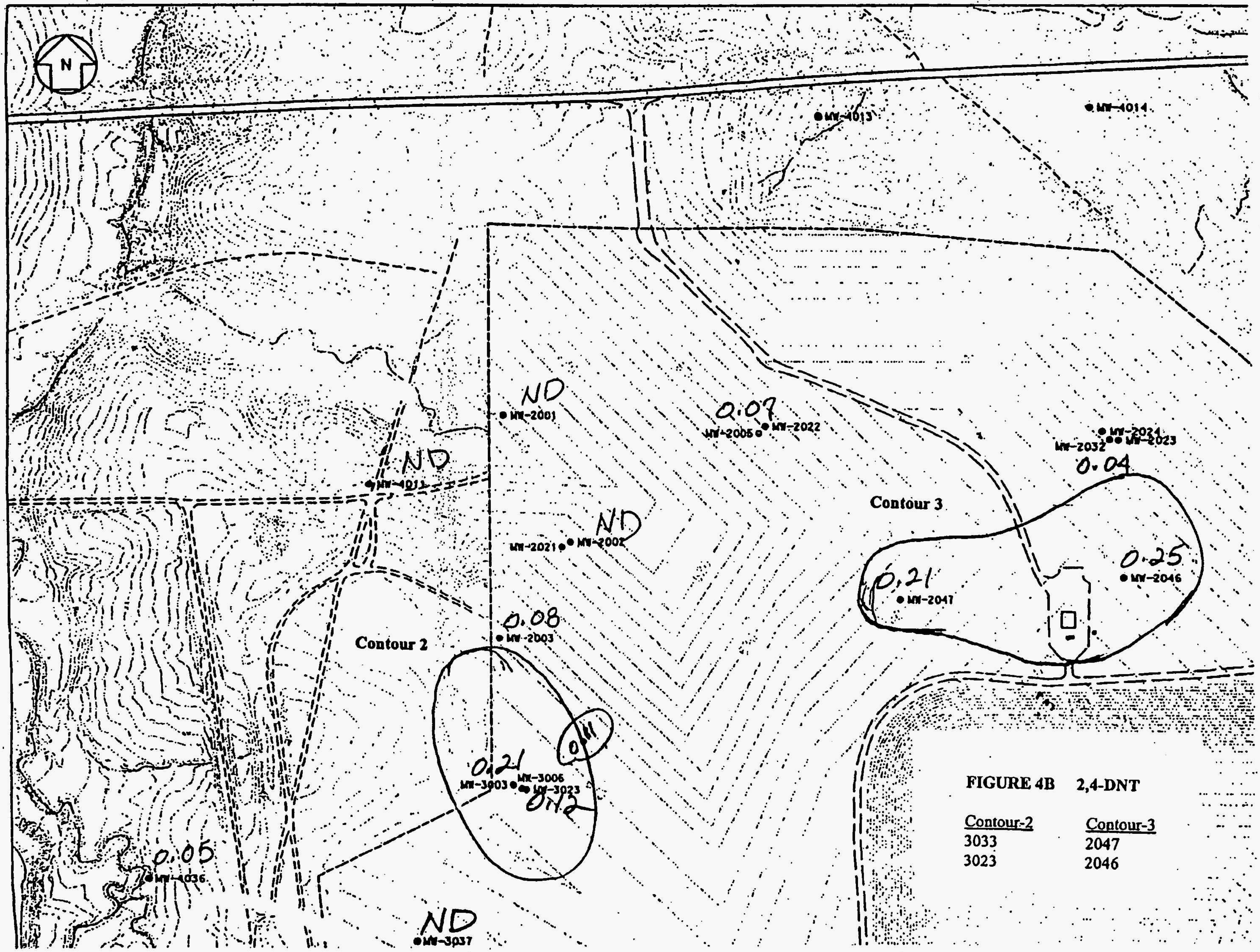



FIGURE 4A 2,4-DNT

Contour-1

| | |
|---|---|
| 3038 | 4033 |
| 2037 | 4006 |
| 4029 | 4001 |
| 3035 | 3030 |
| 3029 | 3039 |
| 3028 | 3034 |
| 4028 | 2038 |
| 3033 | |
| 4032 | |
| MWS 21 | |


N
MW-4013
MW-4014
ND
MW-2001
0.07
MW-2005
MW-2022
MW-2024
MW-2032
MW-2023
0.04
ND
MW-4011
Contour 3
ND
MW-2021
MW-2002
0.25
MW-2046
0.21
MW-2047
0.08
MW-2003
Contour 2
0.11
0.21
MW-3003
MW-3006
MW-3023
0.12
0.05
MW-4036
ND
MW-3037
FIGURE 4B 2,4-DNT
Contour-2
3033
3023
Contour-3
2047
2046

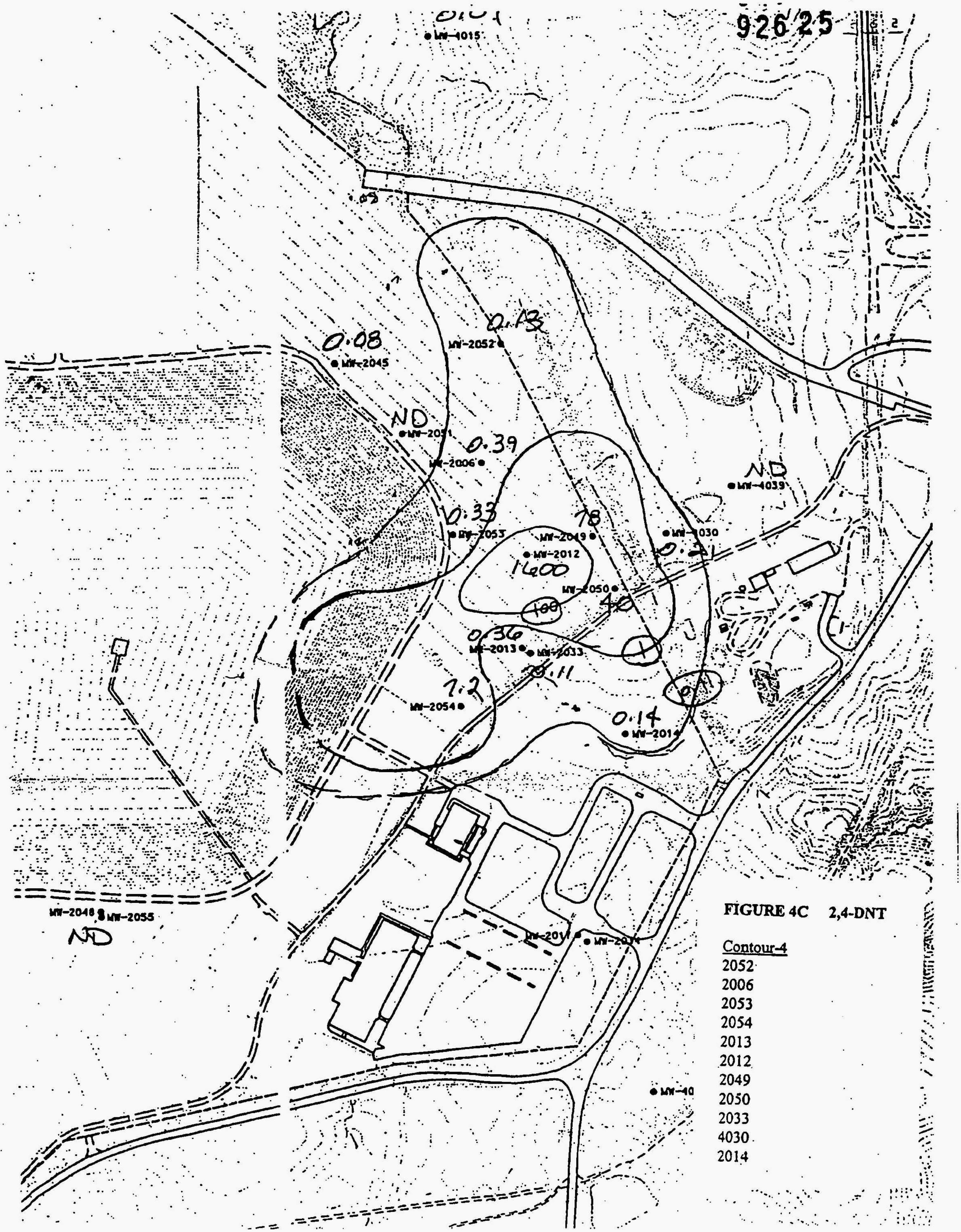



FIGURE 4C 2,4-DNT

Contour-4
2052
2006
2053
2054
2013
2012
2049
2050
2033
4030
2014

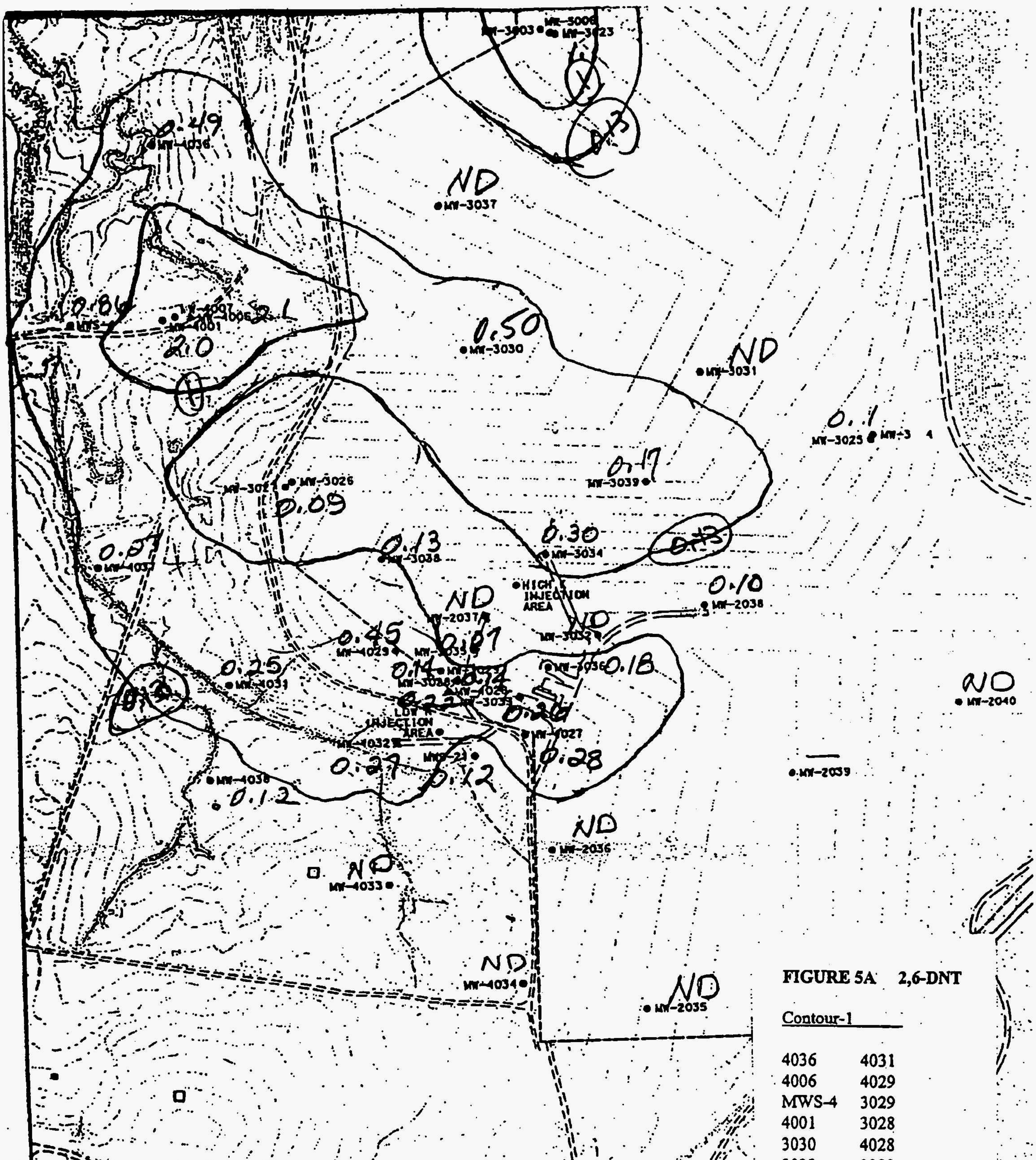



**FIGURE 5A 2,6-DNT**

Contour-1

| | |
|---|---|
| 4036 | 4031 |
| 4006 | 4029 |
| MWS-4 | 3029 |
| 4001 | 3028 |
| 3030 | 4028 |
| 3039 | 3033 |
| 3034 | 3036 |
| 4037 | 4027 |
| 3038 | 4032 |

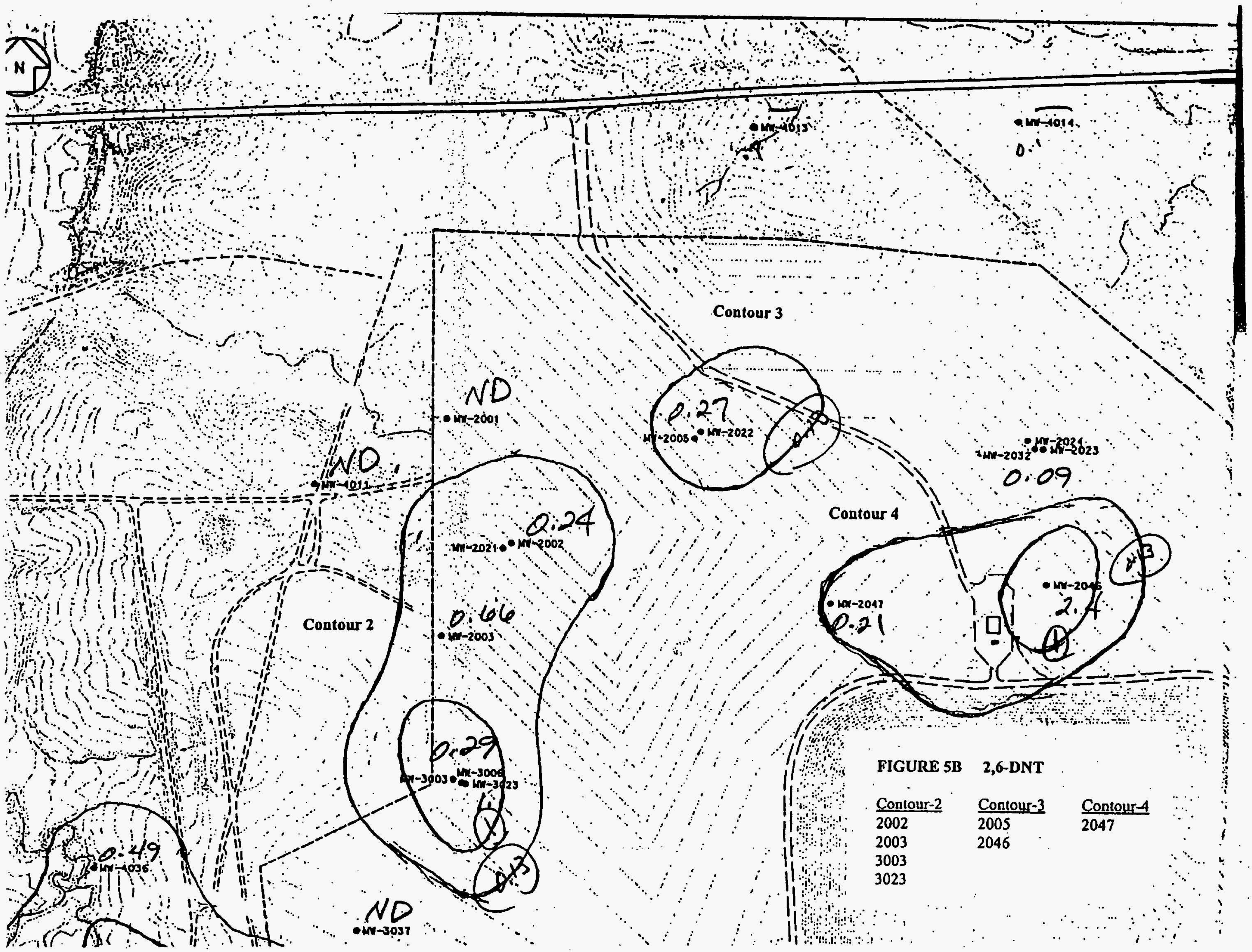



FIGURE 5B 2,6-DNT

926 25

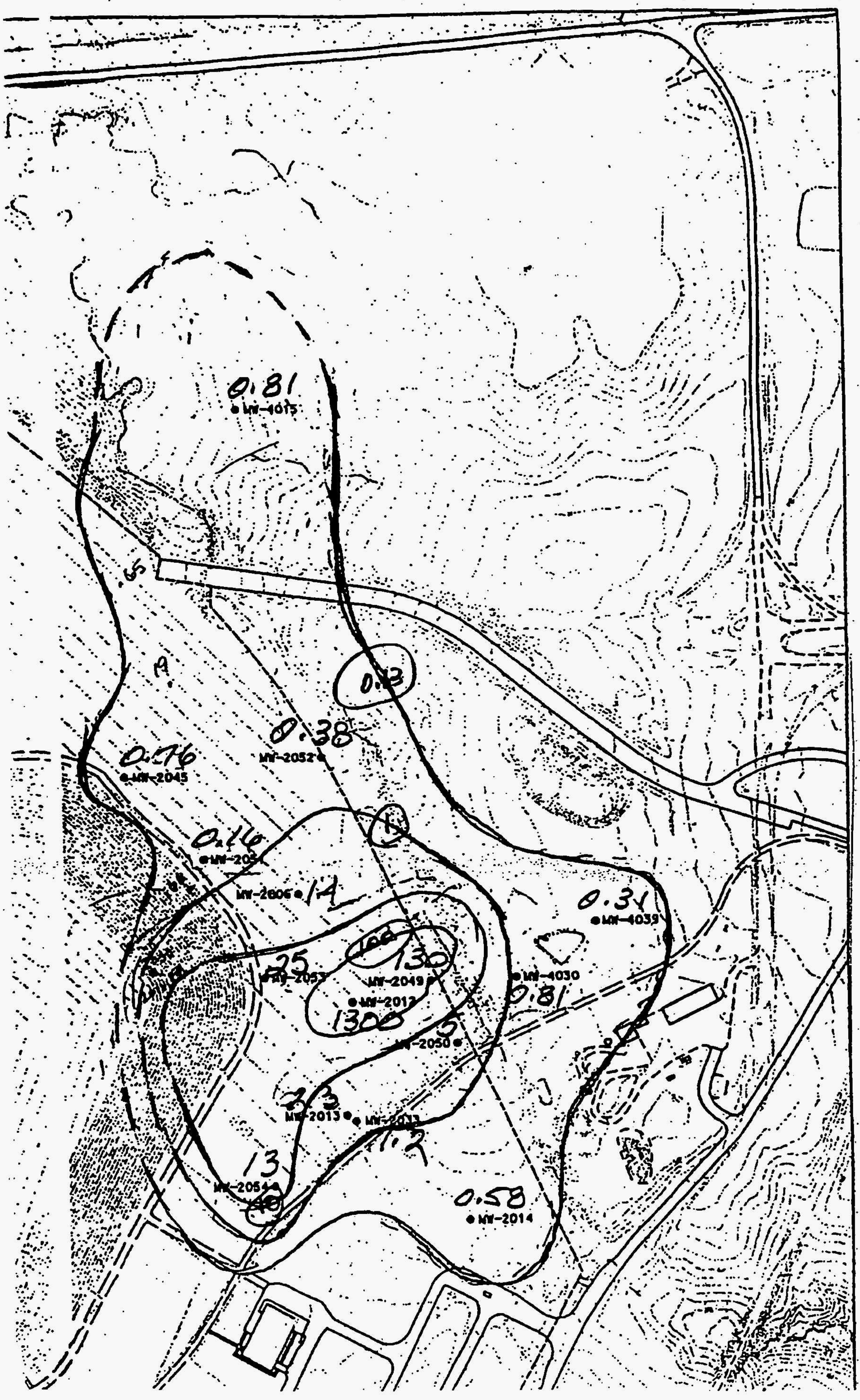



**FIGURE 5C 2,6-DNT**

Contour-5

4015
2045
2052
2051
2006
2053
2049
2012
4030
4039
2050
2013
2033
2054
2014

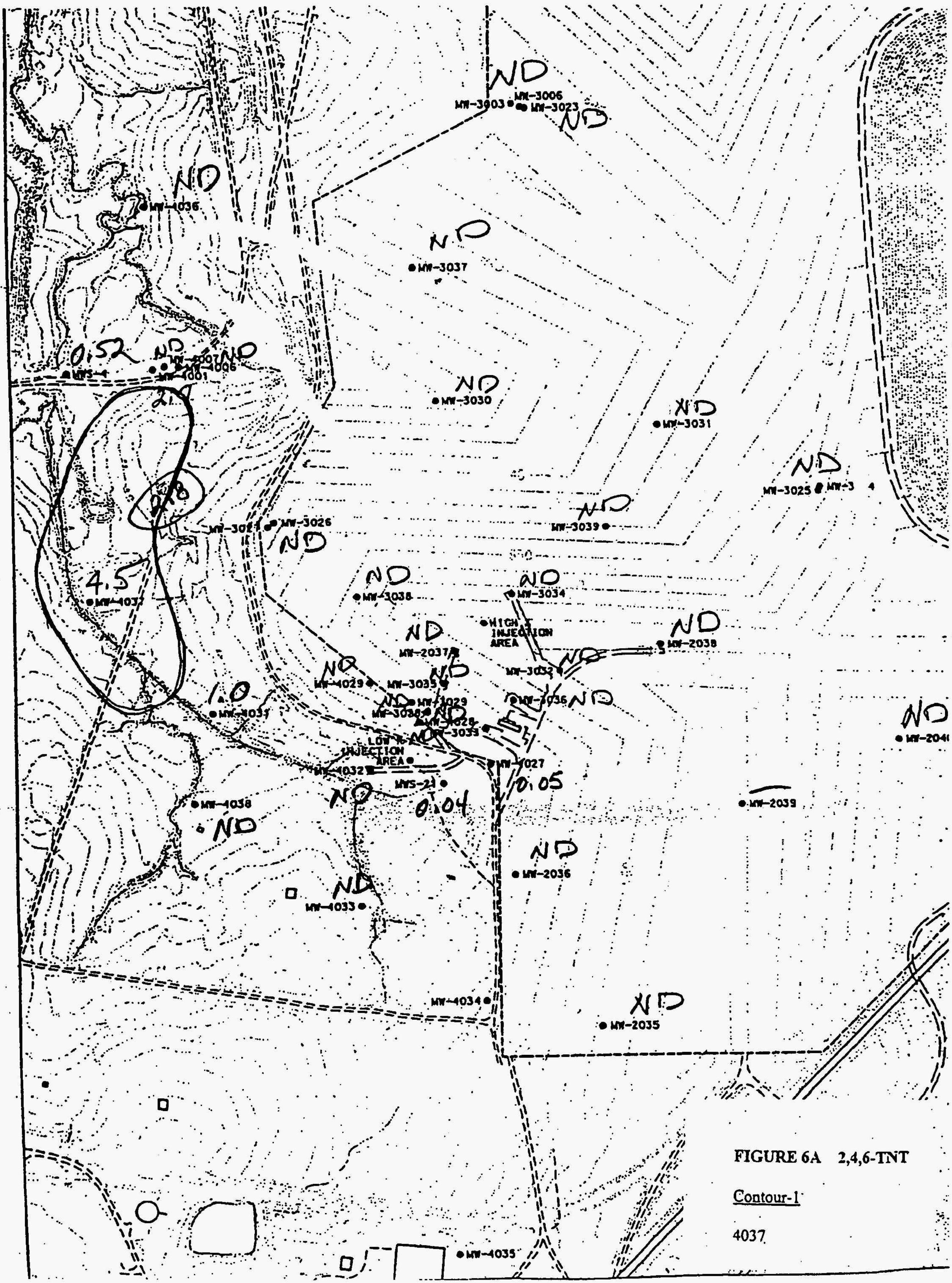



FIGURE 6A 2,4,6-TNT

Contour-1

4037

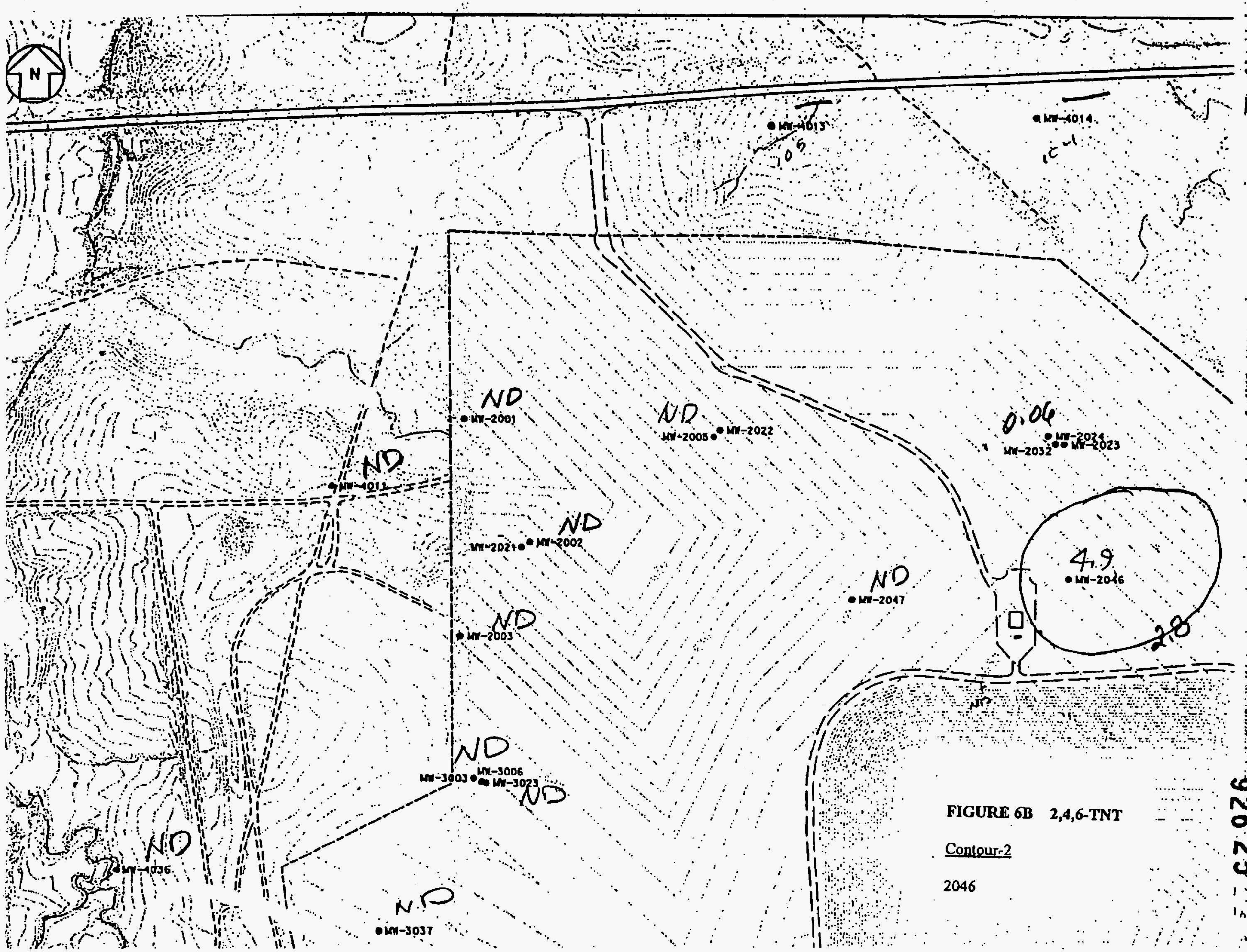



**FIGURE 6B 2,4,6-TNT**

Contour-2

2046

926 25

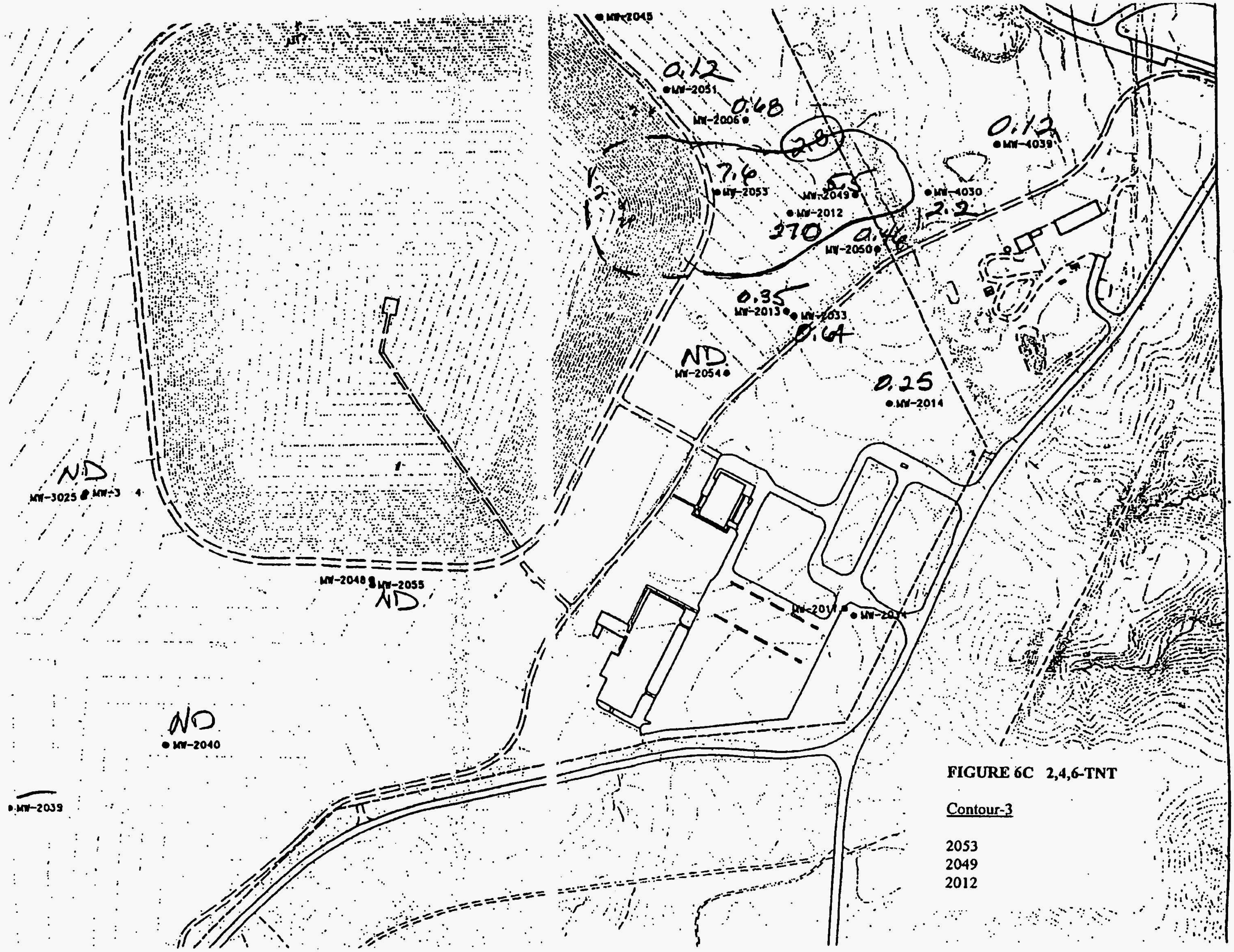



**FIGURE 6C 2,4,6-TNT**

Contour-3

2053
2049
2012

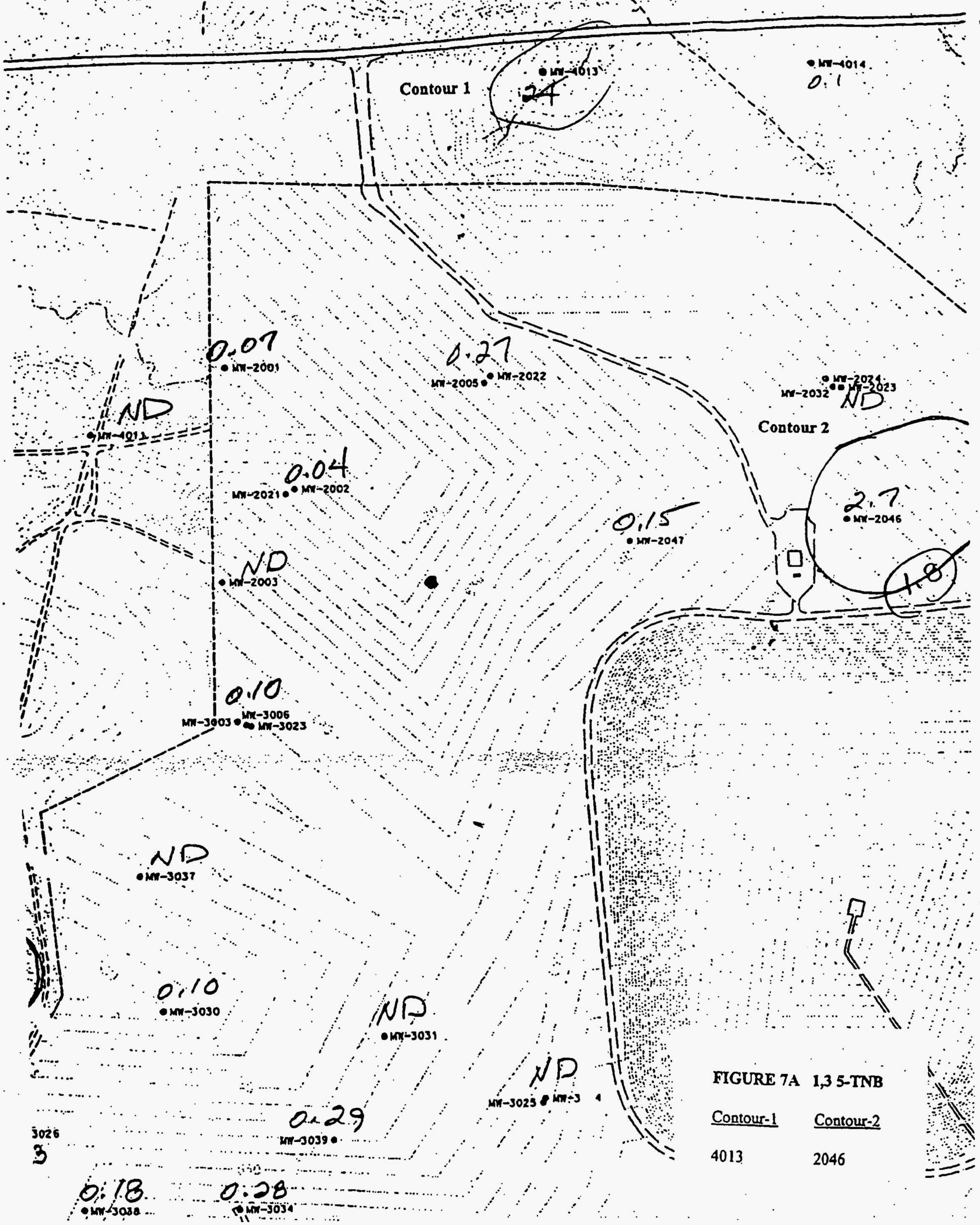



**FIGURE 7A 1,3 5-TNB**

| Contour-1 | Contour-2 |
|---|---|
| 4013 | 2046 |

92625

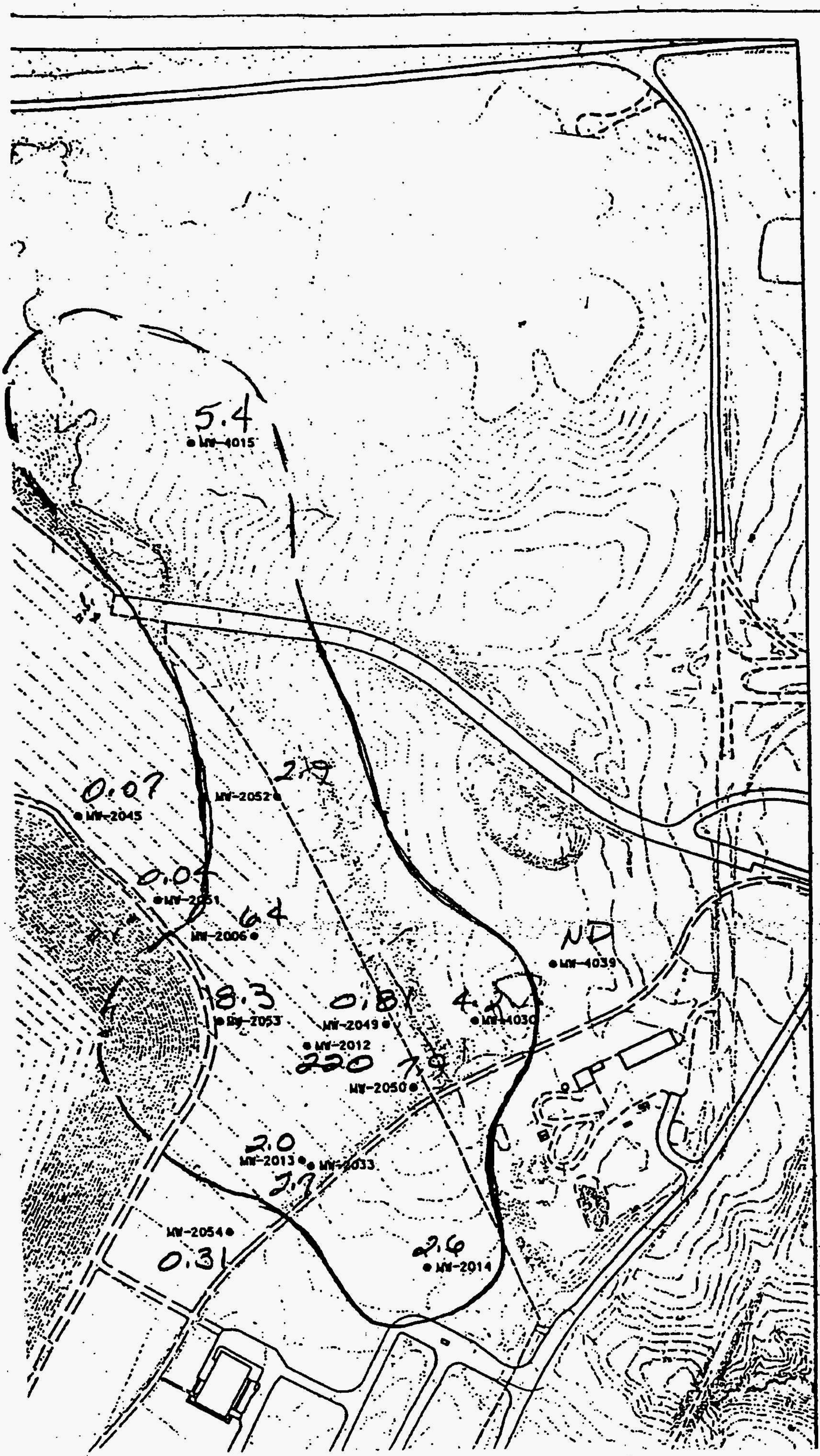



FIGURE 7B 1,3,5-TNB

Contour-3

4015
2052
2006
2053
2013
2033
2014
2050
2012
2049
4030

6W-300-303-1.11