SCIENTECH

October 5, 2005

L-9

Marjorie McLaughlin
U.S. Nuclear Regulatory Commission
Division of Nuclear Materials Safety
475 Allendale Road
King of Prussia, PA 19406

Subject: Amendment to license SMA-1018 04001455

Dear Ms. McLaughlin:

On behalf of the Whittaker Corporation, Scientech, LLC is requesting that U.S. Nuclear Regulatory Commission Material License SMA-1018 be amended to include the Final Status Survey Plan (FSSP) for Section 2 of the Whittaker Corporation Waste and Slag Storage Area, Reynolds Industrial Park, Transfer, Pennsylvania (Scientech Document No. 82A9564). The FSSP was transmitted to you previously under a separate cover letter. We appreciate your attention in this matter.

Regards,

Kevin E. Taylor, PE, CHP
Whittaker License RSO

FULL COST RECOVERY ACTION

TAC NO. U01654

137796
NMSS/RGNI MATERIALS-002

FINAL STATUS SURVEY PLAN (FSSP)

SECTION 2 OF THE WHITTAKER CORPORATION WASTE AND SLAG STORAGE AREA REYNOLDS INDUSTRIAL PARK TRANSFER, PENNSYLVANIA

U. S. NUCLEAR REGULATORY COMMISSION RADIOACTIVE MATERIALS LICENSE NO. SMA-1018

Prepared by:

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August 2005

CONTROLLED COPY No. 743

Project Application	***Prepared By***	***Date***
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APPROVALS:

Title	***Signature***	***Date***
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Corporate Radiation Safety Officer	Kenneth M. Kasper, CIH, CHP	8/26/05
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REVISION LOG

Revision Number	Affected Pages	CRA Number	Approval

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ABBREVIATIONS/ACRONYMS

2x2 NaI	2-inch by 2-inch sodium iodide detector
CRSO	Corporate Radiation Safety Officer
cpm	counts per minute
COE	U.S. Army Corps of Engineers
DCGL	Derived Concentration Guideline Level
DP	Decommissioning Plan
DQO	Data quality objective
dpm	disintegrations per minute
ISOCS	*In Situ* Object Counting System
FSS	Final status survey
FSSP	Final Status Survey Plan
GPS	Global Positioning Satellite
LLRW	Low-level radioactive waste
MARSSIM	Multi Agency Radiation Site Survey and Investigation Manual, NUREG-1575
MDC	Minimum Detectable Concentration
MDCR	Minimum Detectable Count Rate
mrem	Millirem
NRC	U.S. Nuclear Regulatory Commission
pCi/g	Picocuries per gram
QAPP	Quality Assurance Program Plan
SADA	Spatial Analysis and Decision Assistance
ScanMDC	Scanning minimum detectable concentrations
Scientech	Scientech, LLC
Whittaker	Whittaker Corporation
WRS	Wilcoxon Rank Sum

1.0 INTRODUCTION

This Final Status Survey Plan (FSSP) was prepared to support the termination of U.S. Nuclear Regulatory Commission (NRC) radioactive materials license number SMA-1018. The license covers radioactive materials in the form of waste slag located at the Whittaker Corporation (Whittaker) site located at 99 Crestview Dr., Transfer, Pennsylvania. This FSSP describes the methods that Scientech, LLC (Scientech), as Whittaker's decommissioning contractor, will perform to demonstrate that residual contamination in what is referred to in this and other documents as Section 2, meets the NRC-approved derived concentration guideline levels (DCGL). The DCGLs were approved by the NRC as the site release criteria in the August 2005 license renewal (NRC 2005). The overall decommissioning approach is described in the site Decommissioning Plan (DP) (Scientech 2005a).

The Section 2 final status survey (FSS) will incorporate a variety of on-site radiological survey and analysis techniques as well as off-site laboratory analysis of soil samples. On-site techniques will include walk-over gamma radiation surveys, *in situ* gamma spectroscopy measurements, and gamma spectroscopy analysis of soil samples. An off-site laboratory will be used to analyze a percentage of the soil samples for quality assurance purposes.

Scientech used the guidance provided in NRC Guidance (NUREG)-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)" (NRC 2000) in designing survey and sampling efforts described in this FSSP to demonstrate compliance with the DCGLs.

While the methods and procedures described in this FSSP should be followed as written, this FSSP is not intended to be the sole tool in guiding the FSS. There are many instances when the project manager or site supervisor will reference existing Scientech procedures or contact the Scientech project Health Physicist for direction. Scientech procedures should be followed when modifications to this plan are necessary.

The FSSs for Sections 1, 3, and 4 of the Whittaker site will be described in future documents. The FSS of these areas may include a combination of walkover surveys, surface and subsurface soil/slag sampling, *in situ* gamma spectroscopy, and down-hole gamma measurements.

1.1 SITE DESCRIPTION

The Whittaker site is located in the northeast corner of the Reynolds Industrial Park in northeast Pymatuning Township, approximately 3.5 miles south of the borough of Greenville, Pennsylvania, at approximately 41° 21' 30" north latitude and 80° 24' 00" west longitude. The site is an irregularly shaped parcel of land with a total area of approximately 5.8 acres located between the Greenville Metals Plant and the Shenango River. A complete site description can be found in the project DP (Scientech 2005).

The site is divided into four distinct sections, Sections 1 through 4. Section 1 is the southern-most section that contains a large slag pile. Section 2 is the central section of the site that once contained most of the higher-activity slag in piles on the ground surface as well as buried within the slag pile. Section 3 is the northern-most section of the site. The western half of the section contains a concrete pad used to stage slag prior to shipping it off-site. The eastern half of section is not covered by concrete and contains

small amounts of buried slag and other debris. Section 4 is a narrow strip that connects Section 1 with Section 2. It is expected that Section 4 contains only non-radioactive slag material.

1.2 SUMMARY OF SITE REMEDIATION ACTIVITES

The Whittaker site remediation project began in July 2004 with the mobilization of the Scientech project crew. Some of the initial site activities included setting up field office trailers, clearing and grubbing, and mechanically screening a large pile of slag originally located on the concrete pad in Section 3 to separate the soil from the slag. Early site operations also included the removal of several tons of scrap metal and debris that was scattered about the site. Scrap and debris material that could not be surveyed and free released for disposal or recycling was shipped as low level radioactive waste (LLRW) to RACE, LLC in Tennessee. Regulatory Guide 1.86 release limits were used to free-release other remaining scrap metal and debris to the extent possible and cost effective.

Much of the surface piles of slag located in Section 2 were relocated to the pad in Section 3 late in 2004. This cleared the way for a detailed characterization into the slag pile in Section 2 to provide better estimates on the slag and soil volumes in Section 2. The project demobilized following the characterization effort in December 2004.

In March 2005, the Scientech project crew remobilized to the Whittaker site and began full-scale excavation operations in Section 2. Excavated material was fed into a mechanical screener to separate the slag and other debris from the soil and sand mixed in with the slag. This resulted in stockpiles of suspected clean soil (less than the release criteria) and stock piles of slag of various activities.

2.0 APPLYING THE RELEASE CRITERIA

The NRC has approved the site DCGLs as provided in Table 2-1. The DCGLs are radionuclide concentrations in soils and slag in picocuries per gram (pCi/g). The DCGLs were developed and presented to the NRC in Scientech Document No. 82A9534, "Dose Assessment in Support of Establishing Derived Concentration Guideline Levels for the Whittaker Decommissioning Site," (Scientech 2004) and they are also presented in the DP. The DCGLs were developed based on an industrial exposure scenario.

TABLE 2-1
WHITTAKER SITE DCGLS

	Thorium-232+D	Uranium-238+D	Uranium-238
DCGL (pCi/g)	7.0	9.7	166.5
Peak Dose (mrem/yr)	24.9	24.9	6.30

The thorium-232+D DCGL applies to thorium-232 in equilibrium with its decay daughters. Since it takes about 30 years for thorium-232 to reach secular equilibrium with its decay daughters and the age of the slag is at least 30 years, thorium-232 is in equilibrium with its decay daughters at the Whittaker site. This condition is also supported by laboratory data.

The uranium-238+D DCGL applies to uranium-238 in equilibrium with its decay daughters. While data indicates that this level of equilibrium is not predictable in higher-activity slag materials, data also indicates that as the activity level of the material decreases and approaches background levels, the uranium-238 and daughter concentrations approach equilibrium. Therefore, for very low-activity material that may be present on-site following remediation, equilibrium is assumed. This is a conservative assumption because radium-226 and its decay daughters provide most of the dose impact of the uranium-238 decay chain. In an equilibrium state, radium-226, as a long-lived daughter in the uranium-238 decay chain, can be quantified to demonstrate compliance with the uranium-238+D DCGL.

The uranium-238 DCGL applies to uranium-238 and its initial short-lived daughters only (no long-lived decay daughters present). The DCGL is equal to the "source material" concentration and the peak dose of the uranium-238 at this level is low. Analysis of slag samples indicates that uranium-238 is present, on average, at 25% of the thorium-232 concentration. As such, the uranium-238 DCGL will never be approached as long as the thorium-232+D DCGL is not exceeded.

The DCGLs in Table 2-1 must be applied at the same time. As such, the unity rule will be used when evaluating compliance with the DCGLs. Analytical data on slag samples indicate that the uranium-238+D (and radium-226) concentrations are typically about 25% of the thorium-232+D concentrations. Applying the unity rule as shown below, assuming that residual materials will have this same makeup, the DCGL for thorium-232+D becomes 5.9 pCi/g.

$$\left(\frac{5.9pCi/g}{7.0pCi/g}\right)_{thorium-232+D} + \left(\frac{1.5pCi/g}{9.7pCi/g}\right)_{uranium-238+D} + \left(\frac{1.5pCi/g}{166.5pCi/g}\right)_{uranium-238} = 1$$

2.1 SURVEYS AND SAMPLING

Section 2 of the Whittaker site will be divided into 5 Class 1 survey units and 1 Class 2 survey unit. The classification is based on the potential for radioactive materials or contamination to be present in the survey unit following remediation according to MARSSIM protocols.

Survey units designated as Class 1 survey units, those most likely to contain residual contamination above the release criteria, will be no greater than 2,000 m^2 in area. Each of these survey units will receive, at a minimum, a 100% walkover survey and discrete sampling. Each survey unit will have 9 sample points. The number of samples was determined using the MARSSIM protocols. The sample locations were determined using a random-start grid pattern. The calculations for determining the number of samples is provided in Appendix A.

Survey units designated as Class 2 survey units, those less likely to contain residual contamination above the release criteria, will be no greater than 10,000 m^2 in area. Each of these survey units will receive a 10% walkover survey and discrete sampling. The Class 2 survey unit will also have 9 sample points as developed in the previous paragraph. The number of samples was determined using the MARSSIM protocols. The sample locations were determined using a random-start grid pattern.

Area exposure rates will be taken at one meter above ground surfaces at the location of each sample point using an exposure rate meter. The purpose of the measurements will be to provide a comparison of the post-decontamination exposure levels to the general site background.

2.2 INSTRUMENTS AND DETECTION LIMITS

The FSS will consist of walkover surveys, *in situ* gamma spectroscopy surveys, and soil sampling with on-site analysis. The instruments proposed for use during the FSS and their applications are provided in Table 2-2. If necessary, Scientech may substitute comparable instruments should those provided in Table 2-2 not be available.

All instruments will be calibrated using NIST-traceable standards according to Scientech's "Calibration and Maintenance of Survey Instruments Procedure" (Scientech 2005b). Instruments will be checked daily to insure they are operating properly and instrument control logs/charts will be maintained. The daily checks will include a background measurement and a source check. Instrument records, including dates of use, efficiencies, calibration due dates and source traceability will be maintained in accordance with established Scientech procedures.

The formulas for the minimum detectable count rate (MDCR) and ScanMDC are provided in Table 2-3. Field measurements indicate that the expected background count rate for a 2x2 NaI detector will be about 8,360 cpm with a standard deviation of 1,174 cpm. Using the equation in Table 2-3 and substituting the true background standard deviation in counts per second (19.6) for $\sqrt{b_i}$, the MDCR is 2,295 net cpm or 10,655 gross cpm. This MDCR corresponds to 2.7 pCi/g thorium-232+D based on the

conversion factors of 830 cpm per μR/h and 1.0 μR/hr per pCi/g from NUREG-1507. This ScanMDC is well below the 7.0 pCi/g DCGL. MicroShield modeling indicates that these conditions hold true when the detector is positioned about 3 inches from the ground surface.

TABLE 2-2
FSS INSTRUMENTS

Application	Primary Instrument
• Walkover surveys and fixed-point measurements	Ludlum 2221 or Ludlum 2360 scaler/rate meters with Ludlum 44-10 2x2 NaI detectors (optional GPS data/position logging system).
• Soil analysis (500 ml samples) • *In situ* measurements	Canberra HPGe with gamma spectroscopy analysis software and ISOCS software.
• Exposure rates	Ludlum Model 19 microR meter.

TABLE 2-3
ScanMDC CALCULATION EQUATIONS

Factor	Equation	Variables
MDCR (cpm)	$MDCR = \frac{d'\sqrt{b_i} \times (60/i)}{\sqrt{0.5}}$ $b_i = b(i/60)$	b = Background count rate (cpm) i = observation interval = 1 second d' = detectability value = 1.38 0.5 = surveyor efficiency
ScanMDC (pCi/g)	$ScanMDC = MDCR\left(\frac{\mu R/hr}{830cpm}\right)\left(\frac{1.0pCi/g}{1.0\mu R/hr}\right)$	Conversion factors from Table 6.7 of NUREG-1507.

2.3 DAILY INSTRUMENT AND BACKGROUND MEASUREMENTS

Daily instrument checks will be made according to Scientech's "General Radiological Survey and Air Sampling Procedure" (Scientech 2003). These measurements will be made in non-impacted areas using radioactive check sources. These measurements will be recorded for the purpose of assuring that instruments are operating properly. An instrument control log will be used for each instrument to keep track of background counts and response checks. The acceptable response range is determined *apriori* according to Scientech procedures (Scientech 2002b).

Daily background measurements will also be made according to Scientech procedures (Scientech 2002b). These measurements will be made in non-impacted areas. Single background measurements used to estimate the mean background will be made for a minimum of 10 minutes for scaling instruments (scalers).

2.4 REFERENCE AREA MEASUREMENTS

The MARSSIM approach to the release of a survey unit relies on the ability of the survey and sampling effort to demonstrate that the contaminant concentrations in the survey unit are not statistically greater that the concentrations in a background reference area by more than the DCGLs. The Wilcoxon Rank Sum (WRS) test is the preferred statistical test because the site contaminants are also present naturally in background. Because there area several types of survey units to be considered (soil, wetlands, river bed, etc.), there need to be as many corresponding reference areas to provide an accurate measurement of the applicable background. The reference areas sample/data sets will likely include the following:

- Native soil sampling
- Wetland soil sampling
- River sediment sampling

Reference areas should be selected at off-site locations with similar characteristics to the on-site locations. Samples and surveys should be conducted using the same techniques as applied to the survey units. The number of reference area samples will be determined using MARSSIM protocols. Nine samples will be required from each soil/sediment background reference area (see Appendix A).

3.0 DATA QUALITY OBJECTIVES

The Data Quality Objective (DQO) process provides systematic procedures for defining the criteria that the FSS survey design should satisfy. The following DQOs are quantitative and qualitative statements derived from the output of the DQO process. More information on data quality and the DQO process is provided in the site-specific Quality Assurance Program Plan (QAPP).

- The null hypothesis (H_0) is defined as: The residual activity in the survey unit exceeds the release criteria.
- The upper bound of the gray region is originally defined as the DCGL and the lower bound of the gray region is defined as one-half of the DCGL but can be adjusted for an acceptable relative shift.
- The Type I and Type II decision error probabilities for determining the number of samples per survey unit for comparison tests are both 5%.
- For on-site and off-site *ex situ* soil sample analysis, minimum detectable concentrations (MDC) will be less than 50% of the DCGLs.
- The minimum detectable concentrations for walk-over surveys (ScanMDC) using a 2-inch by 2-inch sodium iodide (2x2 NaI) detector will be less than or not greater than 150% of the DCGL.
- Survey measurements will be documented and controlled as described in Section 8.0 and appropriate Scientech procedures.
- Locations for soil sampling and *in situ* measurements in Class 1 and Class 2 survey units will be established using a systematic, random start pattern.
- Data quality will be assessed through a combination of on-site analysis of duplicate samples, replicate on-site analyses, and replicate off-site analyses.

DQOs may be adjusted during the course of the project. The project health physicist and CRSO must approve of variations from the DQOs stated above.

4.0 SURVEY AND SAMPLING IN SECTION 2

During the excavation of the slag, soil, and sand mixture, the native soils below the Section 2 slag piles were exposed. In this area, a MARSSIM-type survey will be conducted on the native soils that once lay beneath the slag pile. These surveys are described below in Sections 4.1 and 4.2.

The number of sample points and their locations in Section 2 survey units were determined using the Spatial Analysis and Decision Assistance (SADA) software (Version 4.0). SADA is funded by the United States Environmental Protection Agency and the NRC. It was developed by the Institute for Environmental Modeling at the University of Tennessee, Knoxville.

4.1 SURVEY AND SAMPLING IN SLAG PILE AREA

Scientech will use a MARSSIM-based survey to release the underlying native soils of Section 2. Because Section 2 contained a majority of the radioactive slag at the Whittaker site, the entire section was excavated in a systematic grid-by-grid method, the slag was separated from the soil using a mechanical screen, and the slag and soil were stockpiled separately in Section 3. As a result, all of the underlying soils in Section 2 are exposed.

A small part of Section 2, north of the main slag pile, did not contain significant volumes of slag and was not excavated.

The excavated areas of Section 2 are designated as a Class 1 area based on MARSSIM recommendations. MARSSIM recommends that exterior Class 1 survey units be limited to 2,000 square meters (m^2), or about 0.5 acres. As such, the excavated areas were divided into four separate Class 1 survey units.

Using the established 30-foot by 30-foot grid system and grid nomenclature used to direct the site excavation, the survey units are defined as follows. The alpha-numeric designation is the identification number of the 30-foot by 30-foot grid section as shown in the figures provided in Appendix A.

- Section 2-West, Survey Unit 1 (S2 SU1):
    - B-2, B-3, B-4, B-5
    - C-2, C-3, C-4, C-5
    - D-2, D-3, D-4, D-5
    - E-2, E-3, E-4, E-5
    - F-1, F-2, F-3, F-4, F-5

- Section 2-East, Survey Unit 2 (S2 SU2):
    - B-6, B-7, B-8, B-9
    - C-6, C-7, C-8
    - D-6, D-7, D-8
    - E-6, E-7
    - F-6
    - Eastern slope to chain-link fence

- Section 2-South, Survey Unit 3 (S2 SU3):
    - G-1, G-2, G-3, G-4, G-5, G6
    - H-1, H-2, H-3, H-4, H-5
    - I-2, I-3, I-4
    - Eastern slope to chain-link and barbed-wire fences
    - Southern slope to silt fence

- Section 2-North, Survey Unit 4 (S2 SU4):
    - A-5, A-6, A-7, A-8, A-9
    - AA-5, AA-6, AA-7, AA-8, AA-9
    - BB-6, BB-7, BB-8, BB-9
    - Eastern slope to wetlands beyond silt fence
    - North to Section 3 concrete pad

With the underlying soils exposed, Scientech will perform a 100% walk-over survey using 2x2 NaI detectors and collect soil samples at predetermined locations. The soil sample maps for the Section 2 survey units are provided in Appendix B. The random-start sampling pattern and figure were generated by the SADA program. The Section 2-North survey unit (S2 SU4) includes some grid sections that were not excavated because there was no evidence of significant volumes of buried slag in these areas. Samples and surveys in these areas, including the slopes, will be performed on the surface soils.

Soil samples will be collected in 1 gallon zipper bags using stainless steel scoops or trowels. Sampling tools will be cleaned between uses using a non-hazardous detergent such as 409™ or Simple Green™. For on-site analysis, the samples will be dried and then transferred to 500 ml polyethylene Marinelli containers. The sample containers will be sealed with electrical tape and labeled with the sample identification number, sample mass, the time and date the sample was collected, and the initials of the sampling technician. The sample mass should be within 10% of the mass of the calibration standard. If the sample mass falls outside the 10% variance range, the project Health Physicist should be contacted for guidance.

Samples that will be sent off-site will be containerized, labeled, and packaged according to the off-site laboratory's requirements.

It is expected that a GPS system coupled to a 2x2 NaI detector will be used to survey the area and log the gamma count rate data and the position. If the GPS system is not available, qualified health physics technicians will use 2x2 NaI detectors and manually record count rate data. The same grid system used to direct the excavations will be used to identify survey sections. For each grid, the average and maximum gross gamma count rates measured during the survey will be recorded on a survey form.

Scientech may also collect *in situ* gamma spectroscopy measurements at the soil sampling points using the HPGe detector to determine isotopic contents. These measurements will be made at the direction of the project Health Physicist.

4.2 LOWLAND AND RIVERBED AREAS

The area east of Sections 1, 2, 3 and 4 is a lowland area that lies within the designated floodway of the Shenango River. This area adjacent to Section 2 is very narrow as the slag pile was closest to the river in this area. The area adjacent to Section 3 is a particularly swampy wetland area. The area to the east of Section 1 is quite wide as the river turns toward the southeast south of Section 2. The area east of Section 4 contains wetlands and two creeks fed by storm drains. The creeks are separated by an elevated wooded area.

In 1998, Scientech conducted a survey of areas between the site perimeter fence, adjacent to Sections 1 and 2, and the Shenango River. These activities were reported in Scientech Document No. 82A9139, "Final Report for Removing Migrated Slag Material From Whittaker Corporation's Greenville, PA Site." This report describes the survey that was conducted along the fence to the east of Section 2 and to the east and south of Section 1. During the survey, two pieces of radioactive slag were identified, one of which was just beyond the river bank. These pieces of slag were moved to within the perimeter fence. When the water level was low, a section of the river adjacent to Section 2 was scanned and no radioactive materials were identified.

In August 1999, an "island" of radioactive slag was identified in the river. This "island," which was about 5 feet in diameter and about 12 feet east of fence post #198 (3 feet from the river's bank) was identified because the river was much lower than normal. The water in the area is typically 10 to 12 inches deep. The pile consisted of mostly large pieces of slag (20 to 30 pounds) and some small fragments.

In September 1999, the slag "island" was removed from the river bed by hand and the pieces of slag were placed inside the fence through a new gate that was installed to support the removal activities. Several other pieces of radioactive slag were also identified and excavated (by hand) near the river outside the fence between posts #198 and #200. A sediment sample was collected from the below the slag pile in August before it was removed and a second sample was taken after the slag pile was removed. While the results of the sample analysis showed contaminant concentrations slightly above background levels, the concentrations were well below the current release criteria. Additional surveys conducted north and south of the pile indicated no additional radioactive materials outside the fence.

4.2.1 Lowland Class 1 Survey Unit

Because the lowland area adjacent to Section 2 used to contain radioactive materials as described in Section 4.2, this area will be designated as a Class 1 survey unit. Appendix B contains a figure showing the survey unit (S2 SU5) which includes the river bank east of the perimeter fence to about 10 feet into the riverbed. The survey unit extends from fence post #185 north to fence post #213.

This survey unit will receive a 100% walkover survey using 2x2 NaI detectors. For scanning and direct measurements conducted in the riverbed, the detector will be placed in a water-tight housing and the surveys will be conducted as close to the bottom of the river as possible. Background measurements will be made using the same detector setup in the river upstream of the Class 1 survey unit. If the river is low enough in some areas, the protective housing should not be used. Scientech will work with the Pennsylvania Department of Conservation and Natural Resources at the Pymatuning State Park dam and the COE as necessary to limit the flow of the river during the survey and sampling effort.

An unbiased, triangular grid pattern was established to identify sampling locations (see S2 SU5 in Appendix B). Samples will be collected from either the surface soils or the river bottom sediments. The samples will be dried as necessary and analyzed using the on-site gamma spectroscopy system.

4.2.2 Lowland Class 2 Survey Units

The lowland area south of the Section 2 slag pile area will include a Class 2 survey unit (S2 SU6). S2 SU6 is located south of S2 SU5 and S2 SU3 (see figures in Appendix B) and is bound on the south by the northern creek (including creek sediments) and on the east by the river.

The Class 2 survey unit will receive a walkover survey of 10% to 50% of the area. Due to the soggy conditions of the wetland in these survey units, the surveys should be conducted during a dry period if possible. If necessary, a water-tight casing should be used to protect the 2x2 NaI detectors from the water. More than 10% of this area was surveyed in 2005 using GPS data logging instruments; however, more surveys will be necessary.

The SADA program was used to develop the MARSSIM-based random-start triangular sampling pattern in S2 SU6. The samples will be dried as necessary and analyzed using the on-site gamma spectroscopy system.

5.0 DATA MANAGEMENT

The project manager or designee will have the responsibility of on-site data management. The project manager or designee will be responsible for relaying all walkover survey and fixed-point measurements and exposure/dose rate measurements to the project Health Physicist on a regular basis. Contact information for the project health physicist is provided below in Table 5-1.

TABLE 5-1
PROJECT HEALTH PHYSICIST CONTACT INFORMATION

Project Health Physicist	Kevin Taylor
Office Phone	(864) 235-3695
Mobile Phone	(864) 414-3831
E-mail	ktaylor@scientech.com
Fax	(864) 235-8405

It is important to record all information specific to the survey on the appropriate survey form or survey map. The detector and probe identification information, the survey date, and the name of the survey technician should be recorded.

5.1 WALKOVER SURVEY DATA

If the GPS system is used to log the gamma count rates in gross cpm along with the position of the detector, the survey data will be downloaded by the survey technician and stored on a computer hard drive and a removable storage devise (diskette, CD, USB drive, etc.). Survey maps will be produced from the electronic data.

If a GPS system is not used for logging a walkover survey, the data from surveys will be recorded as follows:

- The number of walkover sections will be equal to the number of fixed measurement data points in the survey unit.
- Each survey section within a survey unit should be approximately the same size.
- For each survey section, the average and maximum count rates will be recorded in gross cpm on a survey sheet.
- A survey map will show each scanning section.

5.2 *IN-SITU* MEASURMENT DATA

At each soil sampling point, an *in situ* gamma measurement will be made. Using a 2x2 NaI detector, the gamma count rate (in cpm) should be recorded on a survey form or on the survey/sampling map.

To supplement the gross gamma measurements, Scientech's *in-situ* Object Counting System (ISOCS) may be used to perform *in-situ* gamma analysis of the soil at the sampling locations. Analysis reports will be managed as described in Section 5.4

5.3 EXPOSURE RATE MEASUREMENTS

Area exposure rates will taken at one meter above ground surface at each soil sample or survey point location using an exposure rate meter. Exposure rates will be reported in units of microroentgen per hour (μR/hr) and should be recorded on a survey form or on the survey/sampling map.

5.4 GAMMA SPECTROSCOPY ANALYSIS REPORTS

As a minimum, each gamma spectroscopy report will include the specific sample/location information (identification number, mass, location, etc.), the peak locate report, peak area correction report, the efficiency report, the nuclide identification report, and the minimum detectable activity report. The combined report should be printed immediately after spectrum analysis. An electronic file of the spectrum should be saved onto the computer hard drive. Spectra files should be backed up to a removable media device at least once per day.

ISOCS geometry reports will also be printed and filed. All calibration records will also be printed and filed. All geometry, source certificate, isotope library, analysis sequence files, and other support files should be backed up whenever created or updated.

6.0 QUALITY ASSURANCE

Scientech will employ several different measures to ensure that the data generated in support of this FSS Plan is of high quality. In addition to the instrument calibration and control measures described in Sections 2.2 and 2.3, Scientech will use a multi-peak standard to perform calibrations of the ISOCS. A percentage of soil samples will also be sent to an off-site laboratory for additional gamma spectroscopy analysis, and replicate measurements will be made to evaluate the precision of the analytical methods.

6.1 ISOCS CALIBRATIONS

The ISOCS system requires both gamma energy and efficiency calibrations. A radioactive standard with multiple photo-peaks (energy lines) will be used to perform the initial energy calibration. An energy re-calibration will be performed each day that the system is used as either a tool for field-laboratory soil sample analysis or for *in situ* soil analysis.

ISOCS geometry templates will be used to perform the efficiency calibrations of the ISCOS system. For field laboratory analysis of soil samples, a standard 500 ml Marinelli sample container geometry will be used. For *in situ* soil analysis, a circular plane geometry will be used. The project Health Physicist will approve the use of all geometry templates.

6.2 OFF-SITE LABORATORY ANALYSIS

No less than 5% of the on-site samples will be sent to an off-site laboratory for gamma spectroscopy analysis. The MDC for the off-site analysis will be less than 50% of the DCGLs. The off-site analysis results will be compared to the on-site analysis results to evaluate the accuracy of the on-site analysis methods.

6.3 DUPLICTE SAMPLES AND REPLICATE MEASUREMENTS

To evaluate the precision of the on-site analytical methods, Scientech will collect and analyze duplicate samples and perform replicate analyses on individual samples.

To prepare a duplicate sample, a sufficient volume of soil for two samples will be collected at a single sample location. Once dried, the sample volume will be divided into two separate 500 ml Marinelli samples. Each sample will be analyzed independently. A duplicate sample will be collected from at least one sample location in each of the six Section 2 survey units and each background reference area. The analytical results of the sample pairs will be compared.

Replicate analyses will be made on at least 10% of the samples collected. The replicate analysis will involve recounting a single sample to collect a second gamma spectra and performing an identical analysis on the second spectra.

7.0 REFERENCES

Scientech, LLC (Scientech). 2005a. "Decommissioning Plan, U.S. Nuclear Regulatory Commission License No. SMA-1018, Whittaker Corporation Waste and Slag Storage Area, Transfer, Pennsylvania. Document No. 82A9426, Revision 2. August, 2005.

Scientech. 2005b. "Calibration and Maintenance of Survey Instruments Procedure." Document No. 82A8034, Revision 5. July, 2005.

Nuclear Regulatory Commission 2005. Whittaker NRC License Renewal, August, 2005.

Scientech. 2004. "Dose Assessment in Support of Establishing Derived Concentration Guideline Levels for the Whittaker Decommissioning Site." Document No. 82A9534, Revision 1. August, 2004.

Scientech. 2003. "General Radiological Survey and Air Sampling Procedure." Document No. 82A8008, Revision 6. April, 2003.

NRC. 2000. "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)." (NUREG)-1575, Revision 1. August, 2000.

APPENDIX A

CALCULATIONS FOR NUMBER OF SURVEY UNIT SAMPLE POINTS

CALULATION OF THE NUMBER OF SAMPLE POINTS IN FSS SURVEY UNITS

$$N = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{3(P_r - 0.5)^2}$$

Where:

N = Number of combined samples in the survey unit and the reference area (rounded up to the nearest integer value).
Z = Z-statistic based on selected α and β error rates forum in Table 5.2 in MARSSIM.
α = Acceptable Type I (false positive) error rate.
β = Acceptable Type II (false negative) error rate.
P_r = Probability of a random measurement from the survey unit exceeding a random measurement from the reference area by less than the DCGL; P_r, found in Table 5.1 of MARSSIM, is based on the relative shift Δ/σ.

Δ is the shift which is typically defined as the DCGL minus the lower bound of the gray region (LBGR).

σ is the estimated standard deviation of data from the survey unit.

As described in Section 2.0 of the Section 2 FSSP, the DCGL for thorium-232 is 7.0 pCi/g. If we estimate that the LBGR is one-half of the DCGL, this means that Δ is 3.5 pCi/g. Assuming that the standard deviation of the thorium-232 concentration in the exposed native soils is similar to the standard deviation of previous background soil samples, σ can be estimated as 0.5 to 1.0 pCi/g. Therefore, the relative shift Δ/σ ranges from 7 to 3.5. Looking up these values in Table 5.1 of MARSSIM, P_r ranges from 0.993 to 1.0.

Typically, 5% is an acceptable error rate for both Type I and Type II errors. Therefore, α and β are both equal to 0.05 and the Z-statistics from Table 5.2 of MARSSIM is 1.645.

Substituting P_r and the Z-statistics into the above equation gives:

$$15 = \frac{(1.645 + 1.645)^2}{3(0.993 - 0.5)^2} \qquad 15 = \frac{(1.645 + 1.645^2}{3(1.0 - 0.5)^2}$$

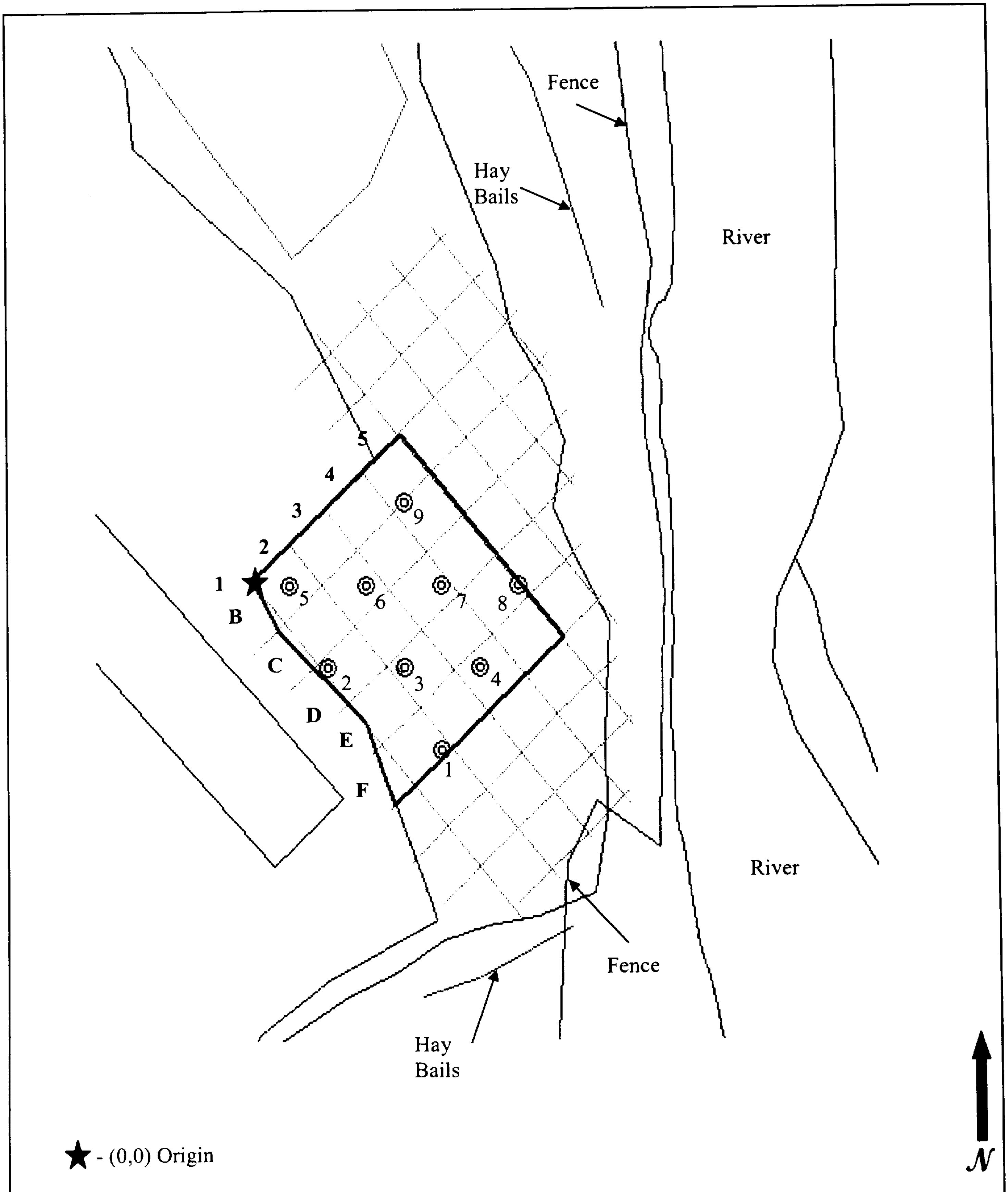
Then, according to MARSSIM protocols, the value for N is increased by 20%.

N = 15 x 1.2 = 18

Therefore, the number for samples combined in the survey unit and reference area is 18, or 9 samples in each survey unit and 9 samples in each background reference area.

APPENDIX B

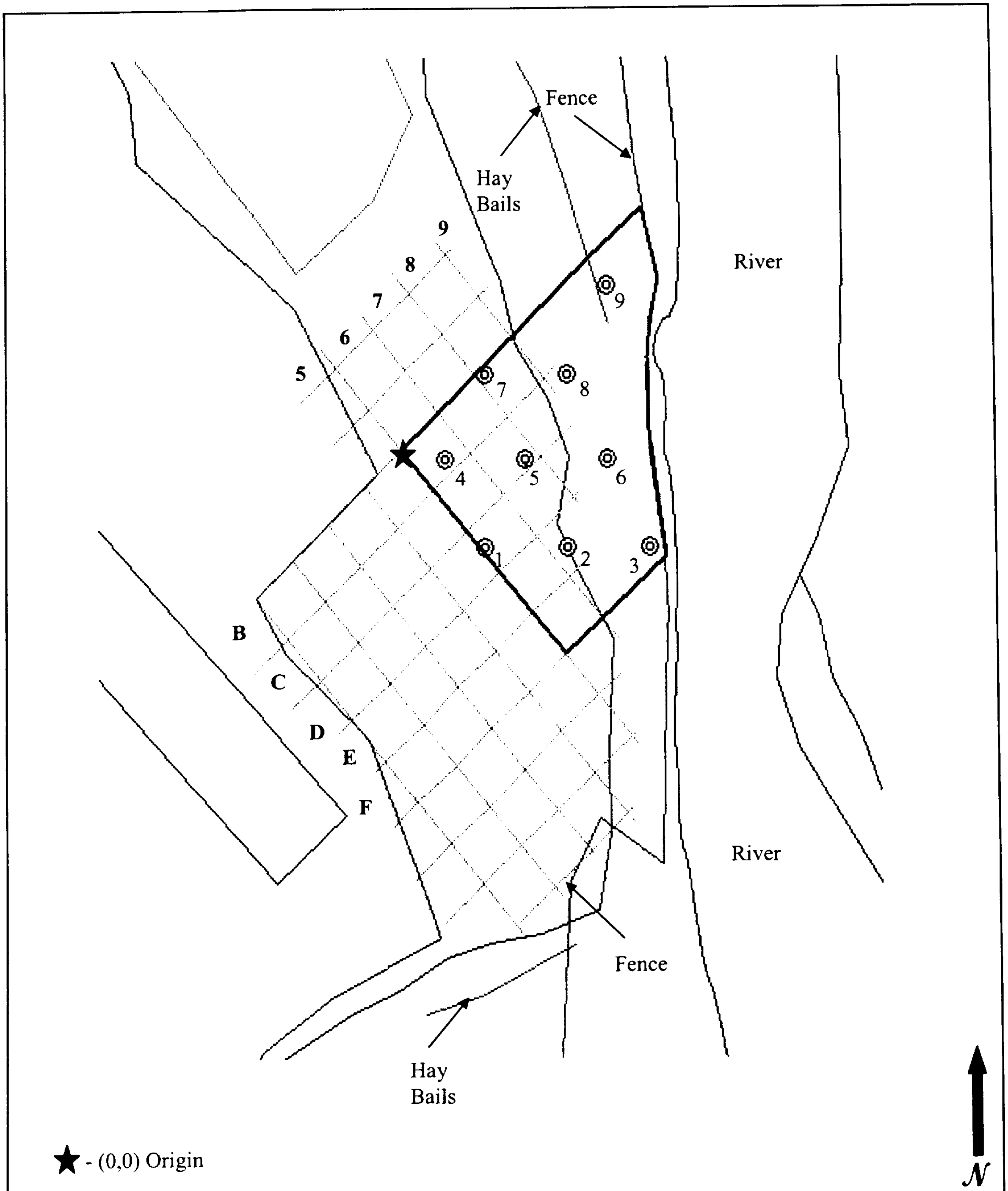
SECTION 2 SURVEY UNIT MAPS



SCIENTECH

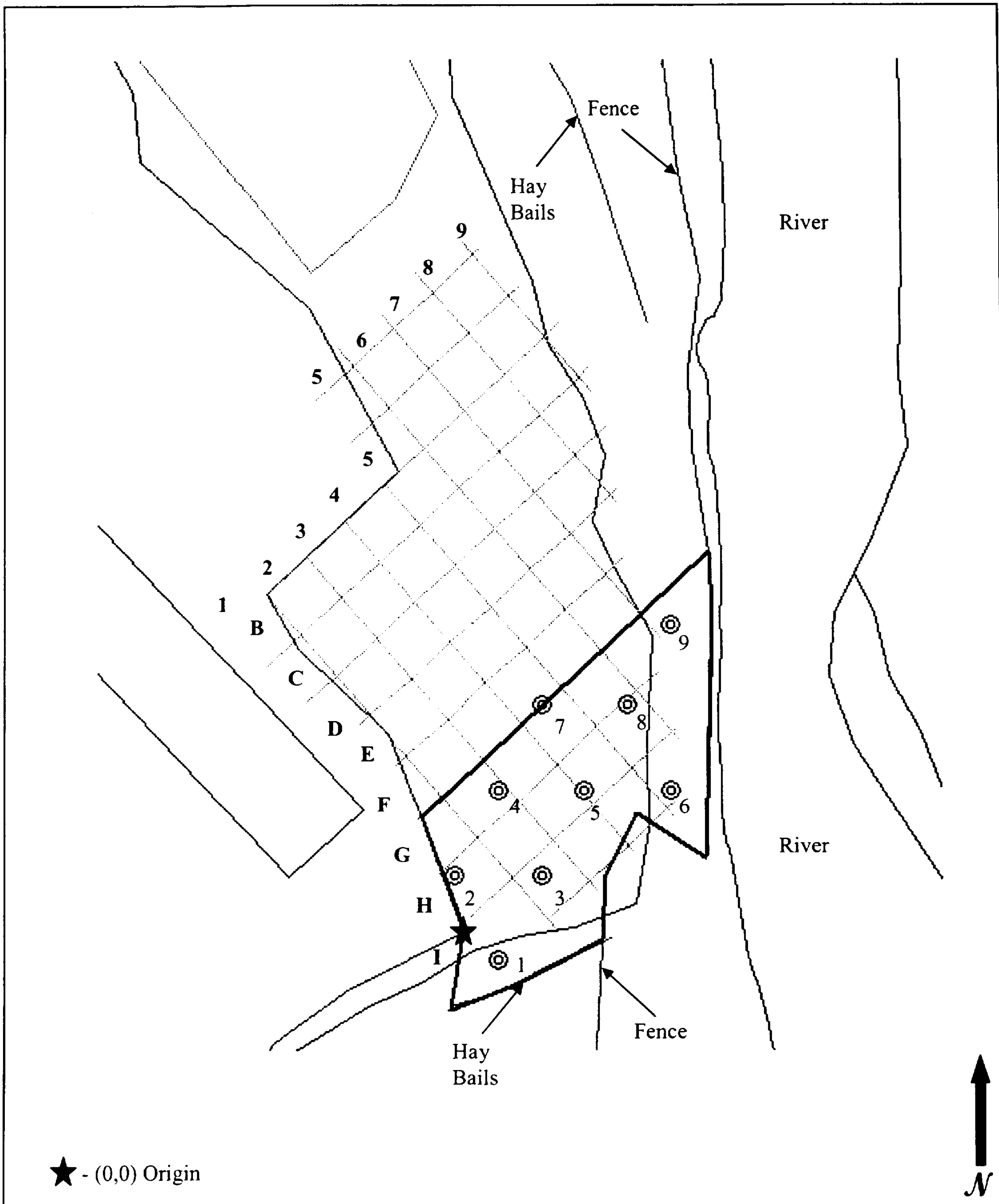
Whittaker Final Status Survey Sampling Map

Section 2 – Survey Unit 1 (S2 SU1)



Whittaker Final Status Survey Sampling Map

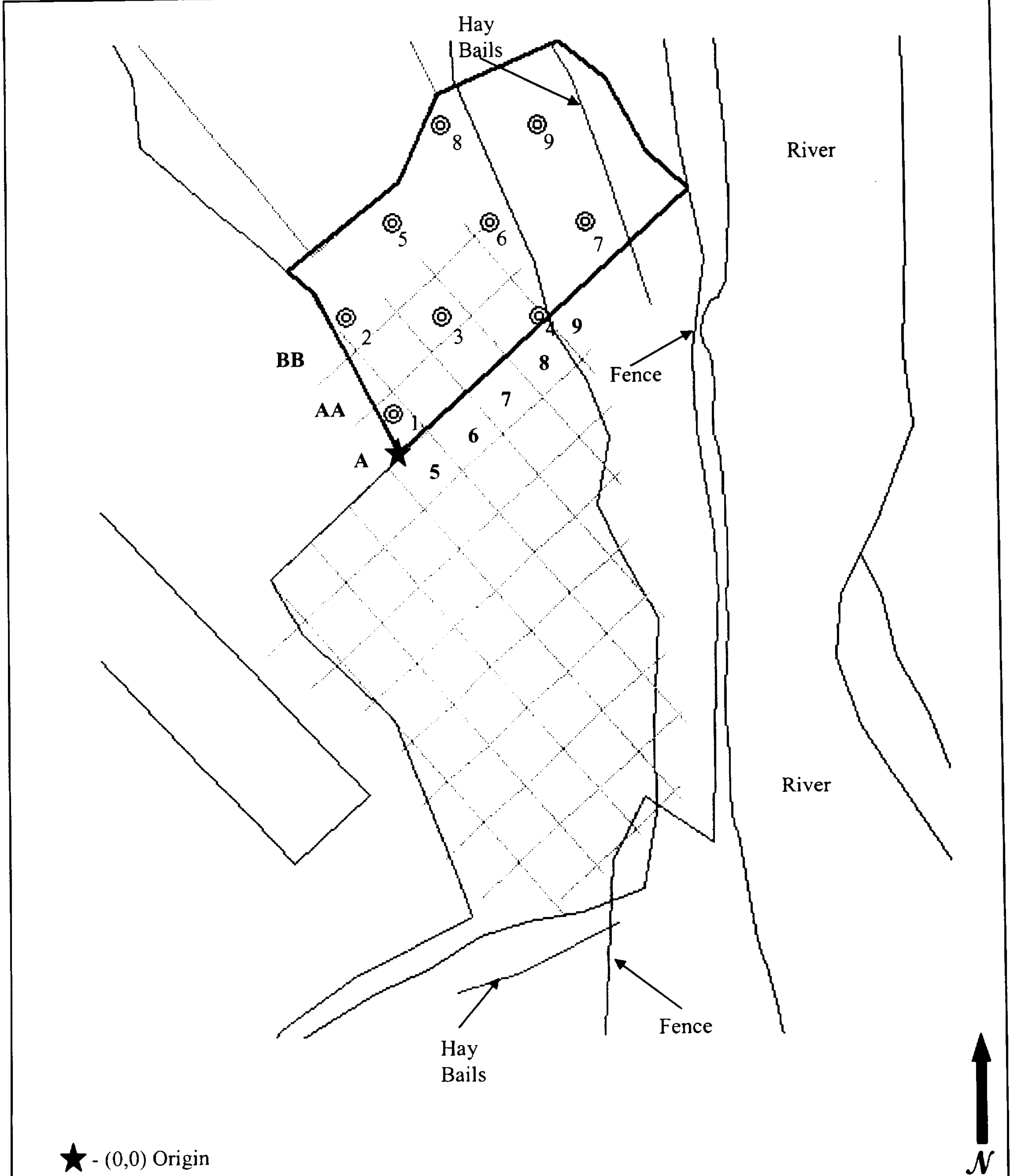
Section 2 – Survey Unit 2 (S2 SU2)



SCIENTECH

Whittaker Final Status Survey Sampling Map

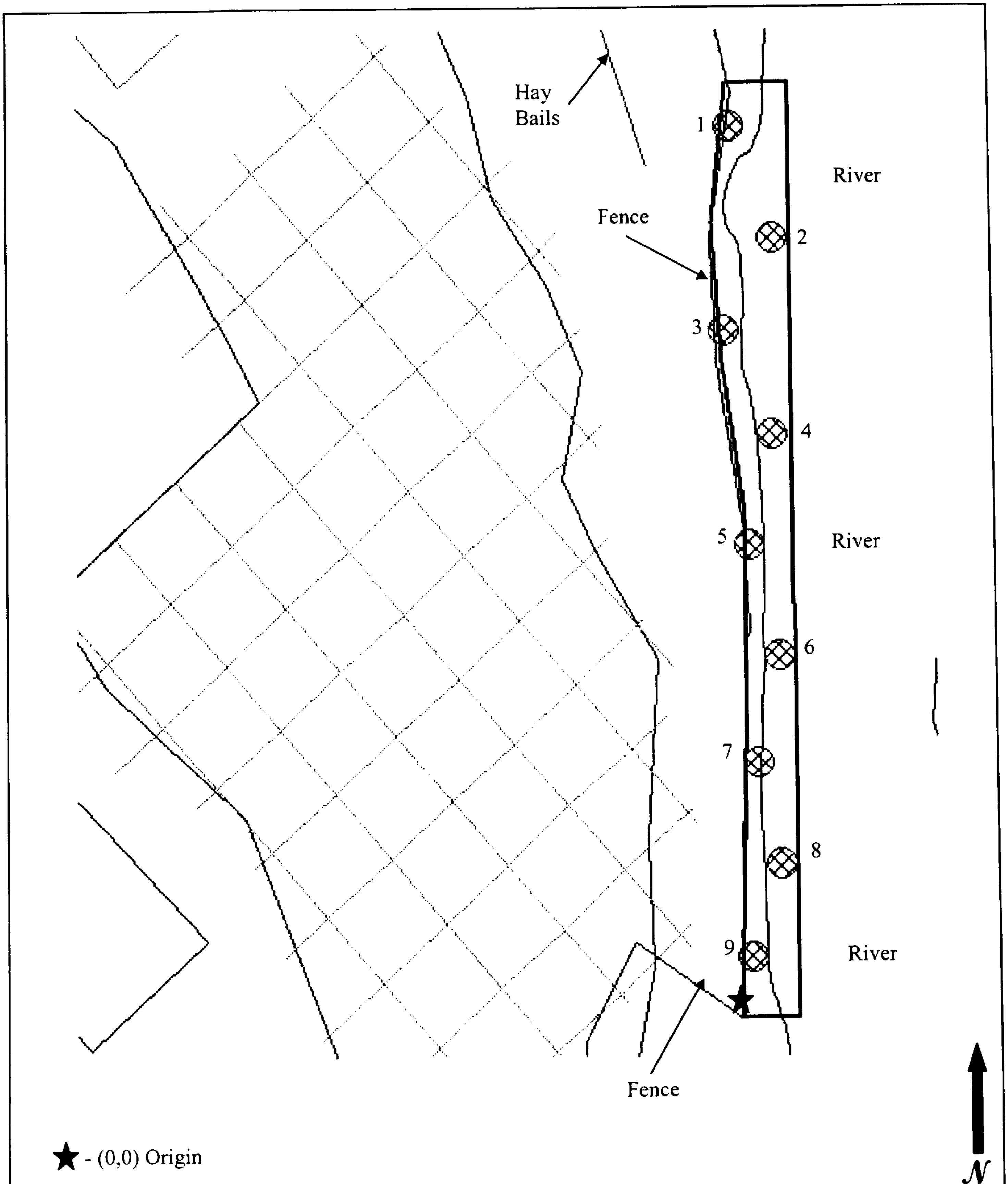
Section 2 – Survey Unit 3 (S2 SU3)



SCIENTECH

Whittaker Final Status Survey Sampling Map

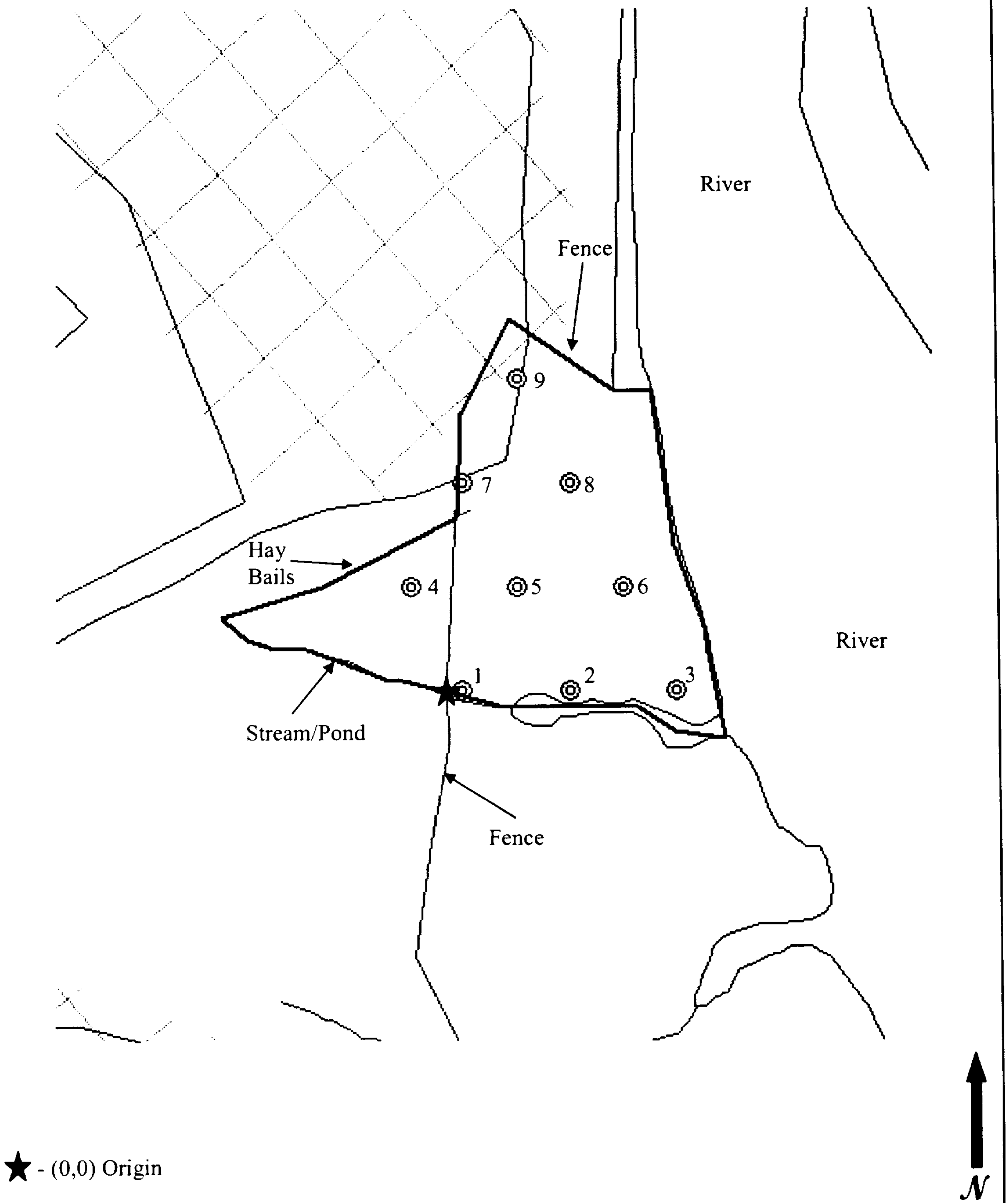
Section 2 – Survey Unit 4 (S2 SU4)



SCIENTECH

Whittaker Final Status Survey Sampling Map

Section 2 – Survey Unit 5 (S2 SU5)



SCIENTECH

Whittaker Final Status Survey Sampling Map

Section 2 – Survey Unit 6 (S2 SU6)

Sampling Points for Section 2 Survey Units

S2 SU1	ft East	ft North
Origin	0	0
1	118	-94
2	47	-49
3	94	-49
4	142	-49
5	23	-3
6	71	-3
7	118	-3
8	166	-3
9	94	42

S2 SU2	ft East	ft North
Origin	0	0
1	52	-56
2	102	-56
3	153	-56
4	26	-7
5	77	-7
6	128	-7
7	52	41
8	102	41
9	128	90

S2 SU3	ft East	ft North
Origin	0	0
1	19	-17
2	-5	31
3	44	31
4	19	78
5	68	78
6	117	78
7	44	125
8	93	125
9	117	172

S2 SU4	ft East	ft North
Origin	0	0
1	-5	21
2	-33	74
3	23	74
4	78	74
5	-5	128
6	51	128
7	106	128
8	23	181
9	78	181

S2 SU5	ft East	ft North
Origin	0	0
1	-1	313
2	14	274
3	-4	241
4	14	205
5	5	166
6	15.	127
7	7	90
8	16	54
9	5	21

S2 SU6	ft East	ft North
Origin	0	0
1	6	0
2	45	0
3	85	0
4	-14	38
5	26	38
6	65	38
7	6	75
8	45	75
9	26	113

This is to acknowledge the receipt of your letter/application dated

10/5/2005, and to inform you that the initial processing which includes an administrative review has been performed.

Amendment SMA-1018/04002455

[X] There were no administrative omissions. Your application was assigned to a technical reviewer. Please note that the technical review may identify additional omissions or require additional information.

[ ] Please provide to this office within 30 days of your receipt of this card

____.

A copy of your action has been forwarded to our License Fee & Accounts Receivable Branch, who will contact you separately if there is a fee issue involved.

Your action has been assigned **Mail Control Number** 137796.
When calling to inquire about this action, please refer to this control number.
You may call us on (610) 337-5398, or 337-5260.

NRC FORM 532 (RI)
(6-96)

Sincerely,
Licensing Assistance Team Leader