PRELIMINARY ENGINEERING DESIGN STUDY &

COMPREHENSIVE NUTRIENT MANAGEMENT PLAN (CNMP)

covering the feedlot facility & waste management system.

Prepared for:
T-T Ranch
Grace City ND 58445

2500 hd
500 cows
2000 Feeders
June 9 2009

Sponsors:
United States Department of Agriculture
Natural Resources Conservation Service
(NRCS)

PREPARED BY:
K_2S ENGINEERING INC.

K_2S Engineering Inc.

4209 94TH Ave Se
Ypsilanti, North Dakota 58497
Phone: (701) 489-3322
Cell: (701) 320-6493
Email: k2s@daktel.com

June 3, 2009

Jeff Topp
1255 82nd Ave NE
Grace City ND 58445

Re: T-T Ranch Ag Waste System (AWS) Preliminary Design & CNMP

Jeff,

Enclosed is a copy of the preliminary design (or possible layout), Operation & Maintenance Plan, cost estimate, and CNMP for your operation. The design is consistent with NDDH (Dept. Of Health) guidelines.

I looked at trying to use as much of the existing facility as possible, but managing the stormwater efficiently was an issue, therefore, I looked at a relocation scenario. This scenario has several feet of bunk-line and a centralized working area. This scenario could also be expanded to the south of the working area. Overall this option accommodates expansion and should be quite efficient. A working facility with chutes, holding pens, etc. is shown, but I will depend on you to provide the preferred layout for the working facility.
I have laid out a scenario that should work, keeping in mind that this is a preliminary design and that design revisions can and may be made during the final design contract.

Fence-line feeding with concrete pads & curbs is included in this design.

The scenario that is laid out does have several advantages:

1. Avoiding "blue-line" stream and wetlands
2. Accommodates expansion
3. Fence-line feeding is feasible
4. NDDH Permitable system
5. Fair wind protection
6. Good location with regards to nearby residences

disadvantages:

1. Does not utilize existing facilities
2. Pond maintenance
3. Routing lot runoff water
4. Snow removal on access road

The cost estimate includes an estimate of the earthwork, concrete, water lines, fencing, seeding, site preparation, and other items listed.

The next step will be for:
1) NRCS to rank your project for EQIP
2)and either approve or disapprove you for cost-share

If approved then we may enter into a contract to make design revisions and complete a final design. If not approved you may seek other cost-share programs, such as 319 through the local Soil Conservation District or ND Stockmen's and then enter into a contract to complete the final design.

Call me if you have any questions

Shane Kjellberg P.E.

cc: Eddy Co. NRCS, Scott Ressler NDSA

Table of Contents:

I. FEASABILITY SUMMARY

I-A. General Information

This preliminary engineering design study will focus on the facility layout, associated waste management system, pen configurations, runoff containment measures and comprehensive nutrient management items that will allow this facility to be permitted through the North Dakota Department of Health (NDDH), Environmental Protection Agency (EPA) and any possible county and township ordinances. The information and design presented are not final and will need the approval of all governing agencies. These agencies may require additional measures to be included in the design to comply with their rules and regulations.

The T-T Ranch farm is a crop raising, cow/calf beef operation located near Grace City, North Dakota. Crops are raised on approximately 12,000 acres. 1,500 acres are rented for pasture. Crops are primarily grain corn, soybeans, wheat, barley, and alfalfa. Harvested crops are marketed and used for animal feedstock. The planned open lots cover approximately 20 acres and are planned to be used 6 to 12 months per year. Current cow numbers are 300-500 head and up to 2,000 feeders depending on markets and available feed. Calves are typically backgrounded. Jeff would like to develop his feedlot to improve efficiency and be compliant with environmental rules. Potential total head would be 2,500.

Open Lots:

A majority of the existing feeding areas (feedlot) will be abandon from confined feeding as shown on the design. This is only a preliminary layout, but represents a viable option.
Open lots will be used primarily for cows and backgrounding calves and possibly finishing calves.
The contained open lots have adequate space for >500 head based on ~500 square feet/head.
Designed bunk space is adequate for ~ 1,300 cows, based on 24"/head or 1,733 feeders, based on 18"/head.

The ***potential*** environmental concern and a ***possible*** violation of existing NDDH regulations, is that feedlot runoff is leaving the feedlot via drainages and overland flow entering ***possible*** "waters of the state"and impacting water quality. Note: The governing agencies (e.g. NDDH) make the determination whether a potential violation is valid.

Drainage:

Existing drainage patterns are primarily from the south to north and then southeasterly into a tributary of the James River. Refer to USGS Topgraphic Map in section IV-A-2.

Soils/groundwater:

Through a cursory site inspection, on-site test pits, and soil survey review, the soils appear to be suitable for the proposed construction activities. The test pits indicate that the soils are poorly graded sands (SP) on the north end of feedlot and lean clays (CL) on the south end. The water table/saturated soils are indicated on test pit log. A clay liner will likely be required since the pond will not have 4' of CL with no water table below planned pond bottom (but the NDDH will make the final decision on the clay liner). Existing slopes range from 0-5% for this site. *On-site clay has been tested and will meet state requirements for a clay liner.*

Local Weather/climate:

The local weather can vary from extremely warm dry summers to very cold winters. This area has an annual rainfall of approximately 17.5" and 25yr-24hr rainfall event of 3.8". Snowfall averages around 40"/year. Frost penetration for this area can be substantial varying from depths of 36" to 72".

Feed supply:

A high quality feed supply is important for maximizing weight gains, fetal development, animal health, and minimizing waste. Jeff grows, stores, and feeds a majority of the " home grown" feed with other specialties/supplement feeds purchased. Feed storage facilities will remain intact.

Water supply:

Jeff plans on continuing to use the existing well for the cattle. It is strongly recommended that this well pump tested to insure that it meets the planned watering needs. ***This should be done before final design and construction of the facilities to insure that there is adequate water at the site. Existing well is ~20' deep and is used for both livestock and human consumption.***

Marketing:

This operation consists mainly of cow/calf pairs and feeders. Jeff does his own marketing. Renovating the existing facility and installing practices will improve overall efficiency and help offset costs associated with waste containment and management.

I-B. Goals, Options, Recommendations, and Comments/Issues

Project Goals:

1) To improve the water quality of the nearby water bodies in a manner that would be both beneficial environmentally and cost effective for the producer and fiscal sponsor (s).
2) To renovate the existing facility to accommodate up to 500 cow/calf pairs and up to 2,000 feeders, improve feeding efficiency, and improve cattle health and flow.

Project Options:

1. Renovation of the existing operation. This option may be feasible, but could be expensive and difficult to manage.
2. Quit feeding cattle. This would be a significant loss to the producer's main income and way of life.
3. Relocate entire facility. This is what the design reflects and may be more effecient.

Items that would need to be addressed to implement option one would be as follows:

(1) contain runoff from open lot areas and manage stormwater as per regulations and guidelines,
(2) be cognizant of neighboring properties and do not increase runoff to these areas
(3) divert some clean water around and away from operation (-to minimize containment area/volumes),
(4) lay out new bunklines for improved feeding (-minimize feeding time, allow all cattle to eat at once, etc.),
(5) address local zoning if required.

Implementing this plan will potentially provide significant environmental benefits. When manure laden runoff enters nearby water bodies/streams/wetlands, it has the potential to degrade water quality with its excess nutrients (nitrates, phosphorous), suspended solids (eroded soil particles and manure), and pathogens (*e.g.* Crypto-Sporidium, Giardia, E. Coli). The system designed would eliminate the potential of these pollutants entering nearby water bodies/streams/wetlands and improve the water quality of the nearby water bodies/streams/wetlands.

Facility and stormwater d[illegible] and recommendations:

Recommendations and design are based on past experience, literature from the NRCS Ag. Waste Field Manual, Midwest Plan Service Handbooks, several other related handbooks and literature, industry standards, regulating agencies design guidelines, and input from managers of livestock facilities. Since each site varies (as well as management styles) the individuals involved have to realize that you have to deal with what each site gives you and you cannot always apply the best/preferred practice.

An appropriately designed facility and management plan should provide ample space (~300-500sqft/hd), dry lots (3-5% lot slope or mounds), enough bunk-space for planned cattle numbers (18-24"/head), wind protection, ample bedding and regular lot cleaning (minimum 1 time/week), good quality feed and supplements, ample feed, well planned & constructed fences with planned gating for smooth cattle flows, and daily cattle inspections to name a few. These aforementioned items when implemented will maximize efficiencies, promote high cattle performance and maximize profits.

Water Supply System:

It is important to have ample quantity, good access to, ample space, and good quality water to maximize cattle performance, weight gains, and promote good herd health.

The existing well ***may*** need to be modified to provide water for additional cattle or meet/maintain existing cattle watering demands. It is recommended that a 2" pipeline is connected into the supply line (or new well) and then trenched to the tank locations shown on drawings.

Larger pipelines are recommended since they have higher flow rates than smaller pipelines and create fewer issues (flows) when tying into the line for additional future waterers. Since the majority of the cost is involved in trenching, using a larger pipe vs. a smaller pipe is relatively inexpensive.

Pertinent data for a new well is listed below:

Supply Location: house basement or above ground pumphouse.

Materials: fittings for waterers, pressure tanks, valves, fittings, gauges, ***water meter***, and other necessary equipment and tools.

Estimated Daily water Use for 500 pregnant cows, +2,000 feeders:

(gpm = gallons per minute; gpd = gallons per day)

500 x 15 gpd/hd = ~7,500 gallons;

2,000 x 10gpd/hd = ~20,000 gallons; Total = 27,500 gallons (~10 million gallons/year)

Estimated demand for 2,500 head; 27,500 gallons over an 8 hr window = ~58 gpm minimum at the furthest waterer or large capacity stock water tanks

-with headloss's the pump will need more than 58 gpm output

This is a recommendation -if a higher output is preferred by manager then design accordingly.

Plumbing shall be in accordance with North Dakota State Well Code and rural water authority.

Large stock-water tanks (500-1000 gallons) within lots are recommended if well output/flow is low.

In conclusion the existing well (or rural water tap) will need to be pump tested and then designed accordingly.

Note: A water use permit would be required since the system will consume more than 12.5 ac-ft (~4 million gallons) of water per year. Application would be with the ND State Water Commission and can take up to 1 year.

Electrical Power Demands:

Power demands will be mainly for the waterers, service receptacles, and light poles. Number, sizes and location of lights, waterers and other planned electrical devices needs to be determined, so that a licenced electrician can properly size wires and make necessary modifications to the existing electrical system to insure that it conforms to all electrical codes. Concrete waterer pads (and any pads with an electrical device) need to be grounded as shown in drawings to control "stray" voltage.

Stormwater Managemer d associated practices:
Stormwater management rules and regulations generally require that soil erosion is controlled to acceptable limits, polluted water is contained and treated, ditches, pipes, and other structures are designed to handle certain type of storm event. The rules and regulations also have set standards for types of practices (e.g. minimum top width of a dike). Many of the practices shown in the plans and specifications reflect these standards and design criteria set by regulating agencies.

Heavy use roads and pads :
The concrete design has been derived from different experiences and design information, primarily American Concrete Institute (ACI) and Portland Cement Assc. (PCA) and older SCS details and literature. Heavy use roads and pads are recommenced, since they will improve the efficiency of the system. Heavy use protection can be costly and is usually not required for permit certification, therefor the owner should research his alternatives and discuss them with the engineer. We typically require 9" of gravel underlain with a woven geotextile which helps keep fine material from migrating upward into gravel and also helps distribute the wheel load over a greater surface area. Maintenance of gravel roads is necessary (i.e. grading and maintaining design thickness), and the idea of the geotextile is to minimize this maintenance.

Fencing:
Four strand barbed wire is specified but most producers put up sucker rod, panels or guard rail with railroad ties or drill stem at 10' CC, which exceeds the barbed wire specification. Woven wire around the ponds is required (liability-helps keep kids, young livestock out).

Critical Area Seeding:
Seeding, fertilizing and mulching is required to conform with storm water pollution prevention plans (SWPPP). Mulching provides a cover that reduces erosion and helps with seed germination. NDDH rules and regulations require this seeding with mulching, or that an erosion control type blanket is used and done so in a timely matter, therefore the plans and specifications reflect this.

Nutrient Management Plan:
The Nutrient Management Plan (NMP) is develop to conform with rules of the regulating agencies and/or the standards set by cost-share agencies. The nutrient management plan makes recommendations on the locations, timing, rates and methods of applying manure wastes.

Feed Management Plan:
No recommendations on feed management are made for the following reasons:

1. Soil phosphorous levels are not high on nearby fields, so phosphorus levels can be kept in check.
2. The amount of feedstock (containing phosphorus) imported on to this farm/system is negligible.

Mortality Management Plan:
Mortality management plan makes recommendations on the locations, timing, rates and methods of disposing of dead animals.

Plans and Specifications

Plans and specifications are written to conform with rules of the regulating agencies and/or the standards set by cost-share agencies as well as conforming with local zoning ordinances. Deviating from the plans and specification without written approval of the engineer, and regulating agencies and sponsors will have the following effects;

1) the engineer will ***not*** be able to certify the project as completed as per plans and specifications,
2) certification is required for permit approval and cost-share approval. Therefore, it is imperative that the owner/project manager read the plans and specifications prior to final design approval and have questions addressed prior to approval.

I-C. Design and Construction stages

Design Stages (brief summary)

1. Initial Site Visit -meeting with owner, farm inventory
2. Topographic Survey and geological investigations
3. Preliminary design -that would be this packet.
4. Meeting review preliminary design w/ owner/manager
5. Final Design -revised preliminary design, owner approval, permitting agency submittal and approval
6. Final design revisions -if needed
7. Construction management -staking, field inspections, quality assurance inspection, material testing to insure standards are met.
8. Final Approval -after construction is complete the engineer inspects the system, performs an as-built survey and composes a report for certification. This report is submitted to governing agencies as required.

Construction stages

1. This project is not part of a future expansion or phase, therefore one construction stage is assumed for this project. The project manager or owner will likely coordinate the bid solicitations and construction activities in accordance with the plans and specifications. The project manager can also employ an entity to manage the project for him/her.

II. PRELIMINARY PLANS & SPECIFICATIONS

II-A. ENGINEER'S APPROVAL

Engineer's approval:

I, Shane K Kjellberg, hereby certify that these Plans and Specifications were prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of North Dakota.

To the best of my professional knowledge, judgement, and belief, these construction drawings and specifications meet Natural Resource Conservation Service (NRCS) standards and guide specifications.

Signature_____Date:_____

ND License #4444
MN License #43321
SD License #8051

USDA NRCS TSP CODE: TSP-03-2174

II-B. BID SECTION

INVITATION FOR BIDS

, 2010

Attention:

Concrete Contractors
Excavating Contractors
Backhoe/trenching Contractors

During the summer of 2010, We are planning to renovate our existing operation and implement an ag waste system, which is located ~3 miles north of Grace City, ND. The design includes dikes, diversions, concrete work and other structural practices. Attached you will find a bid packet that includes bid sheet with instructions, drawings and specifications.

I am asking all recipients of the attached bid package to review the material for any contractor applicable bid item(s). All bids (**completed on enclosed bid sheet**) must be returned to the _____. (_____), in a sealed envelope, no later than _____ ***day, _____, 20010 @ .m. CST*** . All bids will be considered, but the owner reserves the right to refuse or reject any or all bids.

Please review the attached information throughly, and if you have any questions, do not hesitate to contact one of the following individuals:

Jeff Topp
Grace City ND
701-674-3119

Shane Kjellberg P.E.
Ypsilanti ND
701-489-3322

It is encouraged that all bidding participants make an on-site visit and get all questions addressed **prior** to bidding. Feel free to contact one of the above mentioned individuals for an appointment.

Thank you for your time.

Sincerely,

T-T Ranch

BID DEADLI... day, , 2010 @ a.m. CST

K_2S Engineering Inc. -- Bid Sheet

Section I: Project Information

Name: T-T Ranch Project Description: Ag Waste System

Project Location: 1255 82 Ave NE Grace City ND 58445

Attached Plans: Sheets 1- 14 , Dated: May , 2009
Special Provisions: Yes☐ No☒ No. _____

Attached Specifications: 2, 3, 6, 7, 8, 10, 11, 21, 23, 26, 32, 34, 44, 45, 92, 95, 522, 531, 532, 533, 534, 536, 539, 547, 548, 551, 591, 592,

Performance Time: The actual performance dates will be entered on the contract at the time of award.

Section II: Bidder Instructions:

[1] **Bids must be submitted on this form**, complete bid section on reverse.

[2] Mail all bids to the location denoted in the "Bid Opening" box below.

[3] All Bid Items shall be submitted as a sealed bid(s) and shall be **received no later** than deadline shown on top of this page.

[4] Note: Contractors are not required to bid on all bid items. Contractors may bid only on items in which they have expertise (e.g. Seeding or earthfill).

[5] Alternate Bids are not permitted. Where permitted, only one alternate bid may be submitted by each bidder. Any alternate bid must include a complete site specific design which can be reviewed and approved by the engineer.

[6] All bids must remain valid for 60 days.

[7] A contract shall be awarded based on the determination of the Lowest Responsible Bid.

[8] The Landowner and/or Producer, in consultation with the fiscal sponsor and engineer, may reject any or all bids for just cause, and waive informalities or minor irregularities in bids received.

[9] The award will be based upon the total price as corrected for errors. When unit prices are requested, the unit price shall be multiplied by the estimated number of units. In the event of an error on a submitted bid sheet, the price will be corrected to agree with submitted unit price. Total price will be corrected to be sum of corrected items.

[10] The contractor should examine the plans and specifications carefully as well as doing an on site examination of construction site prior to completing bid. No extras will be allowed because of a contractor's misunderstanding of the amount of work involved or lack of knowledge of existing conditions.

[11] **Estimated quantities for drainfill, gravel, rock, concrete & geotextile are based on "neat-line" calculations. No quantities for settlement, compaction, overfills, or over excavations have been figured into these estimated quantities. Estimated quantities for earthfill includes 32% for compaction. The contractor is responsible for computing his/her own estimated quantities and is responsible for computing the drainfill, gravel, rock, concrete, & geotextile material needed for loss due to compaction, overfills and overlaps. Estimated quantities are based on in place compacted fill to the depths and dimensions shown on drawings.**

Bid Opening	
Date:	**day, , 2010**
Time:	**a.m. CST**
Location:	

Inquiries:
All inquiries and correspondence concerning this solicitation should be submitted in writing to Jeff Topp at 701-674-3119

BID SCHEDULE

The following bid is submitted in response to th ation for bids on the project described on this for.... ...e price is based on my knowledge of the plans and specifications identified below. The following bid has been independently arrived at without collusion with any other bidder, competitor or potential competitor. This bid will remain valid for a period of 60 days after the date given below. I am willing to sign a contract with the landowner/sponsor and will provide referrals, proof of insurance, etc. if requested by the landowner/sponsor. If there are any special provisions which I will require to be added, they are attached to this bid.

Name: T-T Ranch Project: Ag Waste System

To Be Completed By K2S Engineering				*To Be Completed By Bidder*	
Bid Item	**Construction Specification**	**Estimated Quantity**	**Units**	**Unit Price**	**Price**
1. Structure Removal	3	1	job		
2. Clearing & Grubbing-manure	2	1	Acres		
3. Plastic Pipe -waterline (trenching length)	45	4,887	Feet		
4. Plastic Pipe -electrical waterers & light poles	45	1	job		
5. Corrugated PE Tubing -18" PE pipe	44	120	Feet		
6. Corrugated Metal Pipe- 18" pipe, ends & fittings	51	60	Feet		
7. Excavation - topsoil stripping	21	14,860	Cu. yds.		
8. Excavation -pond, structures & diversion ditches	21	70,923	Cu. yds.		
9. Top-soiling	26	14,860	Cu. yds.		
10. Earthfill -gravel fill for access roads (compacted in-place)	23	3,336	Cu. yds.		
11. Earthfill - Drainfill under concrete (compacted in-place)	23	484	Cu. yds.		
12. Geotextile (for gravel -woven) (overlaps **not** included)	95	13,343	Sq. yds.		
13. Concrete -12' wide heavy use pads & waterers	32	575	Cu. yds.		
13. Concrete -curbs (2,600')	32	86	Cu. yds.		
13. Concrete -solid separator	32	45	Cu. yds.		
13. Concrete -headwalls	32	6	Cu. yds.		
14. Fencing -woven (pond)	92	4,108	Feet		
14. Fencing -4-strand barbed	92	1,000	Feet		
14. Fencing -feedlot	92	11,747	Feet		
14. Fencing -windbreak	92	0	Feet		
15. Seeding & Mulching	6	8	Acres		
16. Clay Liner	825	13,019	Cu. yds.		
				Total Price	**$**

Company Name: _____ **Signature** _____

Address: _____ **Title** _____ **Date** _____

_____ **Phone** _____ **Fax** _____

Construction Management Plan

Project: **T-T Ranch Ag. Waste System**

Staking by engineering firm: The basic staking shall be performed by K_2S Engineering Inc. or their designated representative. Basic staking will involve slope and/or offset staking at approximately 100 foot intervals and at points-of-intersections. Benchmarks shown on drawings will also be marked for contractor use. Note: any staking that is damaged and/or removed due to the contractor's own carelessness shall be re-staked at the contractor's expense. Staking removed due to general construction operations shall be re-staked by the engineering firm.

Staking by contractor: Contractor shall have the ability and equipment to transfer elevations and use offset or slope stakes to locate points (e.g. centerline channels or roads, pond corners, etc).

Required inspection by engineer or designated representative:

1. Installation of silt fences or other erosion control measures if required by ND Health Department storm water permit. **Inspector must check to see the location placement and securing of silt fence is done properly.**

2. Clearing, grubbing, and stripping per specifications by contractor. **Inspector must check to see that necessary clearing, grubbing and stripping is performed.**

3. Excavation and earth-fills for roads, channels, dikes and ponds as per specifications. **Inspector must check earth-fill moisture content as required by specifications**. **Inspector must check grades and elevations prior to seeding and placement of subsequent fills/structures. Inspector must assure proper fill (e.g. gradations for gravel fill) and compaction in areas required.**

4. Installation of clay liner. **Contractor shall provide engineer with testing results as per specifications. Inspector must check to see that proper materials, grades, dimensions, and elevations are attained.**

5. Installation of pipes, electrical, and waterlines as per specifications. **Inspector must check pipe size and materials, pipe depths, elevations, connections, and backfilling. Material certification will be required.**

6. Installation of heavy use concrete pads, and access roads. **Inspector must check to see that proper grades, dimensions, and elevations are attained. Material certification will be required for all materials. (e.g. batch tickets and gradations). Inspector shall prepare tests cylinders as directed by Engineer to assure strength requirements are met.**

7. Installation of geotextile. **Inspector must check to see that proper materials, grades, dimensions, and elevations are attained.**

8. Seed and mulch all disturbed areas. **Seed and fertilizer slips will be required for certification.**

Contractor shall give engineer a minimum of 48 hours notice prior to completing or installing any bid item to allow scheduling for inspections. An on-site pre-construction meeting will be scheduled to review construction staking and project items.

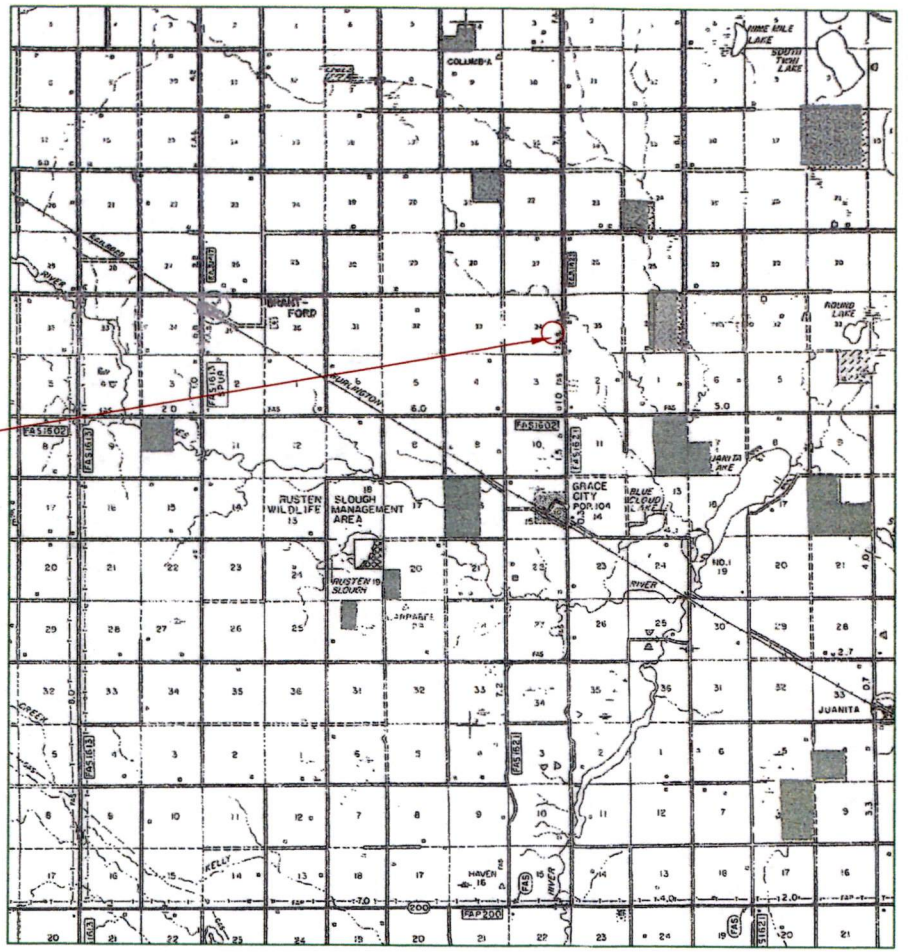
ayment schedule shall be between project owner/manager and contractor(s). It is recommended that final payments 're made when engineer has approved work as completed to design specifications.

roject owner/manager:	Jeff Topp
ontracting Officer (CO):	Jeff Topp
Contracting Officer Technical Representative (COTR):	K_2S Engineering Inc.
ost-share Representative(s):	USDA NRCS

II-C. DRAWINGS

USDA NRCS EQIP
T-T Ranch
AG WASTE SYSTEM

CONTENTS



I HAVE REVIEWED THE DRAWINGS AND SPECIFICATIONS FOR THIS PROJECT. THE PROJECT HAS BEEN EXPLAINED TO ME FULLY AND I AGREE WITH ALL TECHNICAL ASPECTS OF THE PROJECT.

LANDOWNER'S/PRODUCER'S
SIGNATURE: _____ DATE: _____

IT'S THE LAW
CALL BEFORE YOU DIG
STOP
1-800-795-0555
GIVE AT LEAST TWO FULL WORKING DAYS NOTICE!

CONSTRUCTION NOTES

ALL WORK SHALL BE ACCOMPLISHED ACCORDING TO THE PLANS AND SPECIFICATIONS OF THE PROJECT. ANY CHANGES SHALL BE WITH PRIOR WRITTEN APPROVAL BY THE PROJECT APPROVER.

AT LEAST TWO FULL WORKING DAYS PRIOR TO EXCAVATION, THE CONTRACTOR SHALL NOTIFY THE NORTH DAKOTA ONE-CALL AT 1-800-795-0555 AND ANY OTHER LOCAL UTILITIES THAT MAY BE IN THE AREA.

THE CONTRACTOR SHALL GIVE THE PROJECT COORDINATOR AND THE LANDOWNER/OPERATOR A MINIMUM OF TWO FULL WORKING DAYS NOTICE PRIOR TO CONSTRUCTION.

ALL CONSTRUCTION PRACTICES SHALL BE IN ACCORDANCE WITH O.S.H.A. STANDARDS AND REGULATIONS PART 1910 AND 1926. ALL EXCAVATIONS SHALL BE SLOPED, SHORED, OR SHIELDED ACCORDING TO O.S.H.A. PART 1926.

THE CONTRACTOR SHALL COMPLY WITH ALL LOCAL, STATE, AND FEDERAL REGULATIONS (E.G. CULTURAL RESOURCES)

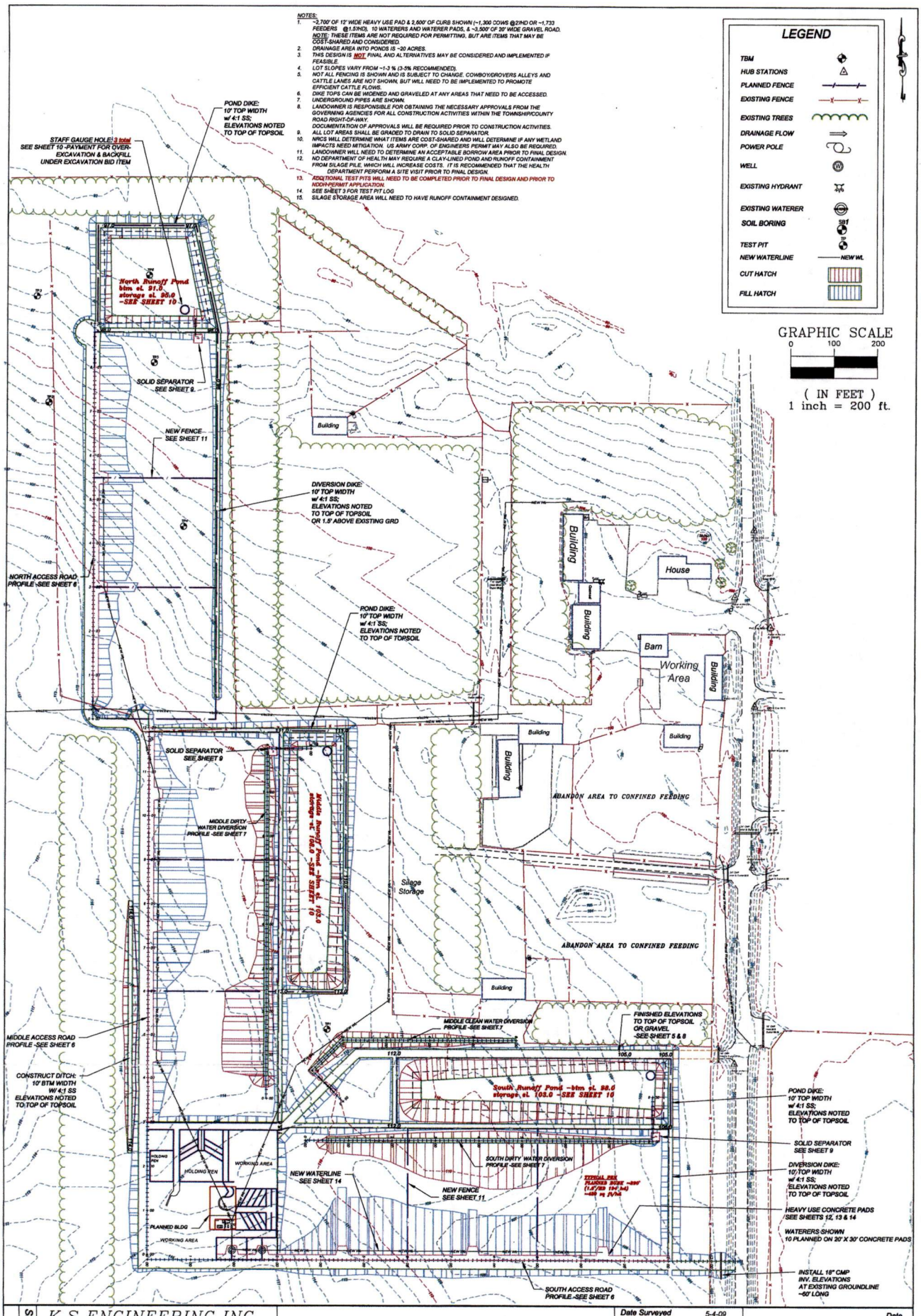
Approved By .....
Title .....
Date

Date Surveyed 5-4-09
Date Drawn 5-09
Designed by skk
Drawn by skk
Date Checked
Checked by
File: coversheet.dwg

USAD NRCS EQIP
T-T Ranch
Ag Waste System
Cover sheet

K2S ENGINEERING INC.
4209 94TH AVE SE
YPSILANTI, ND 58497
Phone 701-469-3322

Sheet No.
1 of 14



Sheet No. 2 of 14

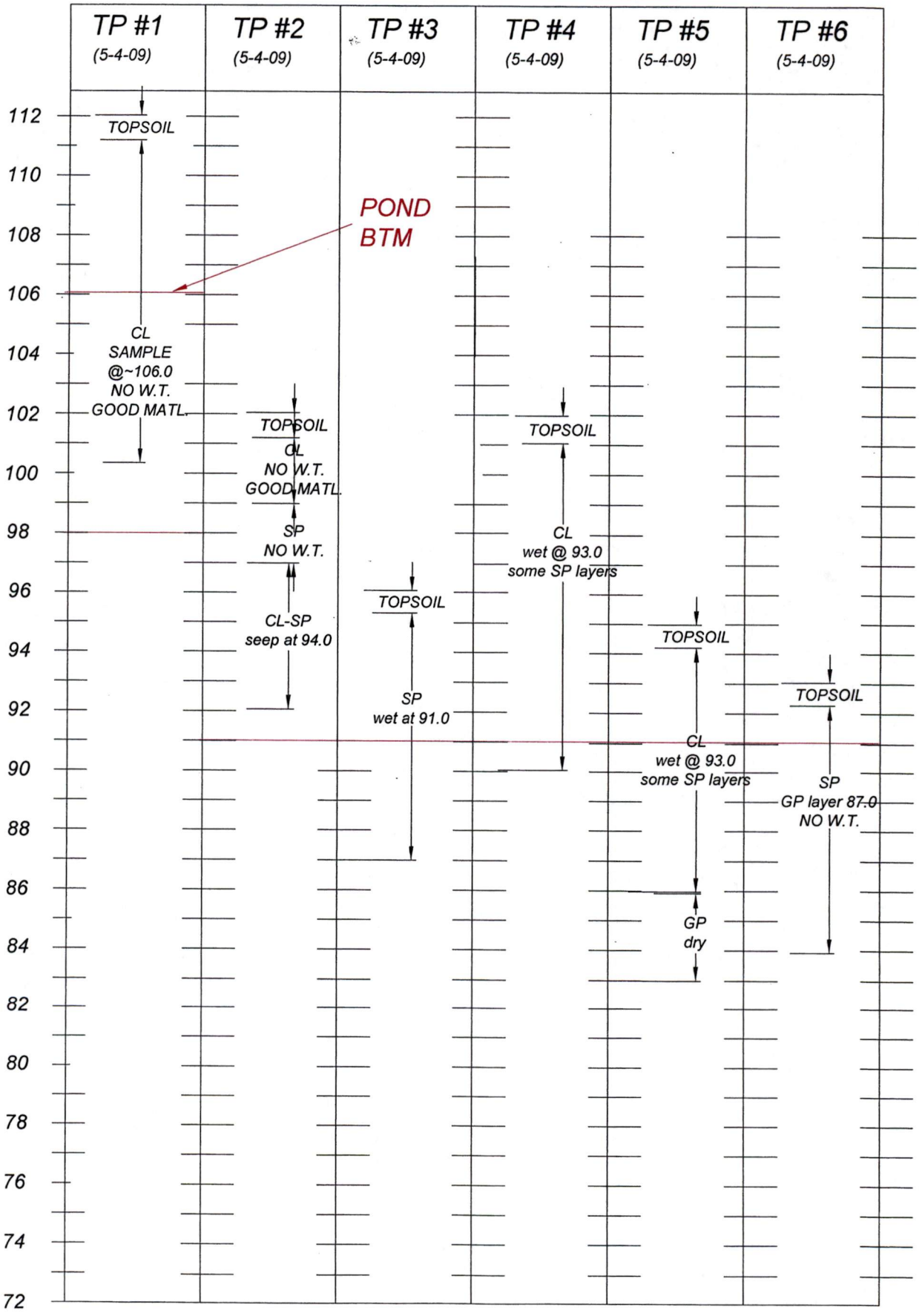
K_2S ENGINEERING INC.
4209 94TH AVE SE
YPSILANTI, ND 58497
Phone 701-489-3322

USDA NRCS EQIP
T-T Ranch
Ag Waste System
Plan View

Date Surveyed	5-4-09
Date Drawn	5-09
Designed by	skk
Drawn By	skk
Date Checked	
Checked by	
File:	prelim2009.dwg

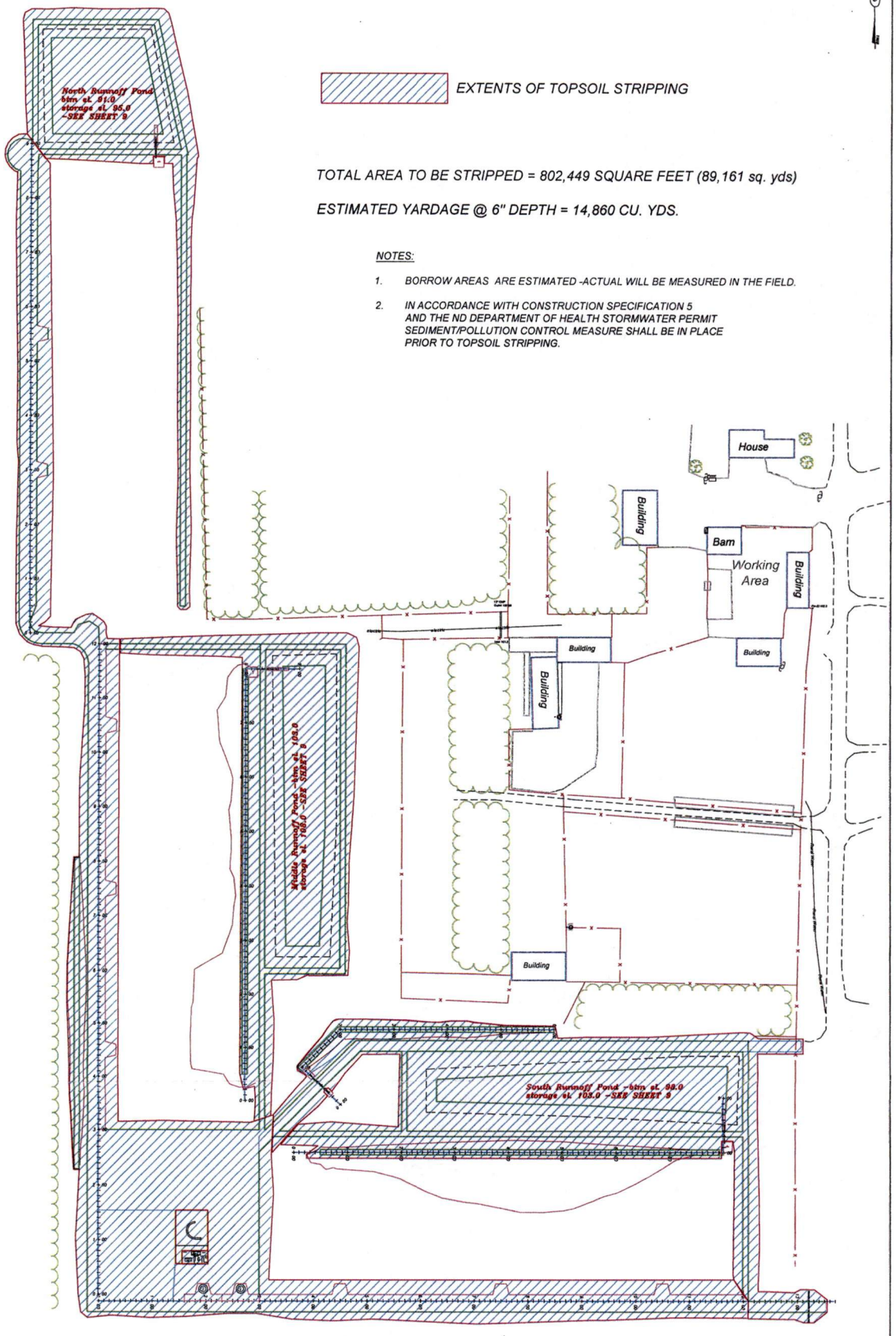
Date
Approved By .....
Title .....

LOG OF TEST PITS



Sheet No. 3 of 14	K_2S ENGINEERING INC. 4209 94TH AVE SE YPSILANTI, ND 58497 Phone 701-489-3322	USDA NRCS EQIP T-T Ranch Ag Waste System Test Pit Log	Date Surveyed 5-4-09 Date Drawn 5-09 Designed by skk Drawn By skk Date Checked Checked by File: prelim2009.dwg	Date Approved By ..... Title ..... 3 OF 14

EXTENTS OF TOPSOIL STRIPPING
PLAN VIEW
1" = 180'



TOTAL AREA TO BE STRIPPED = 802,449 SQUARE FEET (89,161 sq. yds)

ESTIMATED YARDAGE @ 6" DEPTH = 14,860 CU. YDS.

NOTES:

1. BORROW AREAS ARE ESTIMATED -ACTUAL WILL BE MEASURED IN THE FIELD.
2. IN ACCORDANCE WITH CONSTRUCTION SPECIFICATION 5 AND THE ND DEPARTMENT OF HEALTH STORMWATER PERMIT SEDIMENT/POLLUTION CONTROL MEASURE SHALL BE IN PLACE PRIOR TO TOPSOIL STRIPPING.

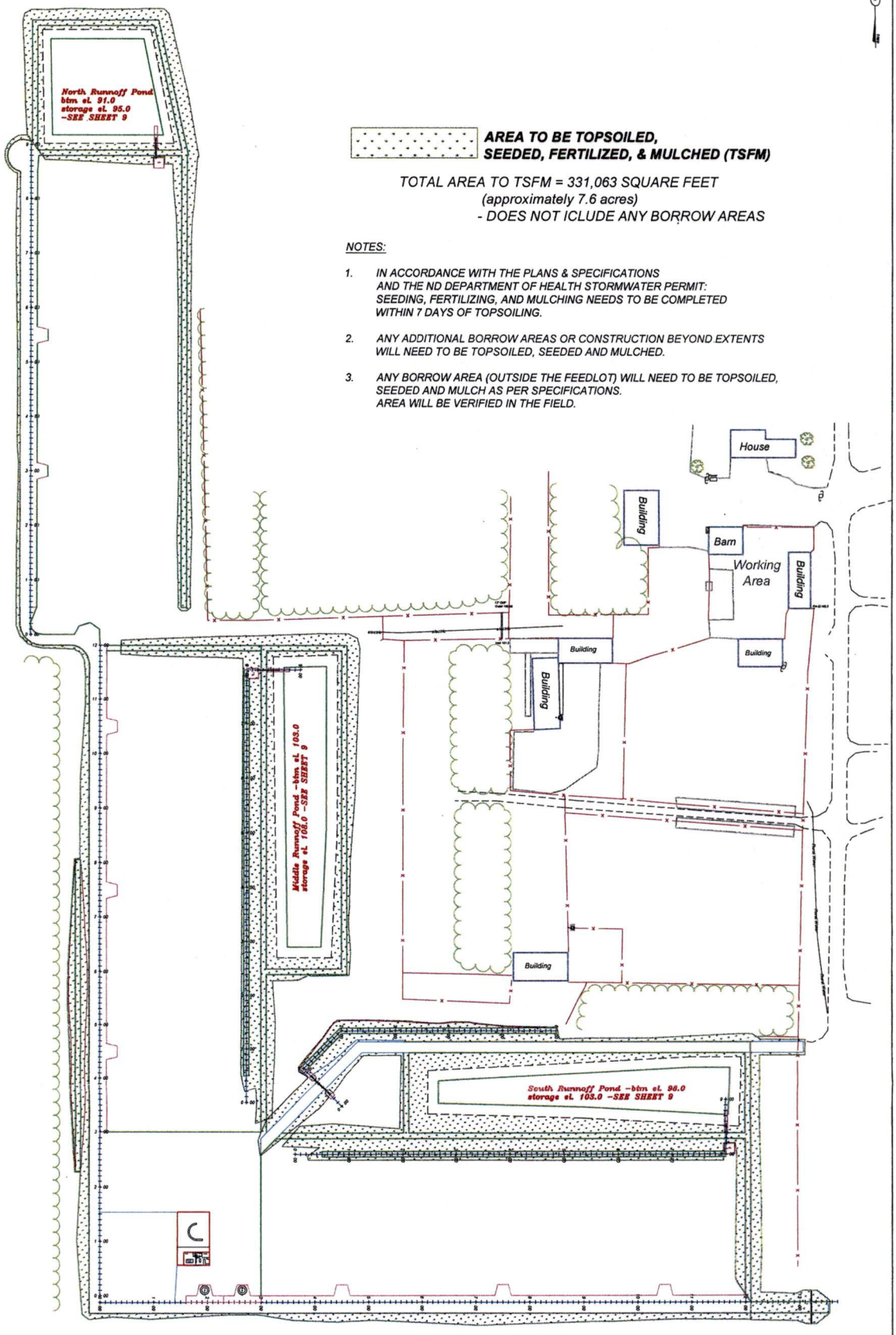
K_2S ENGINEERING INC.
4209 94TH AVE SE
YPSILANTI, ND 58497
Phone 701-489-3322

USDA NRCS EQIP
T-T Ranch
Ag Waste System
Topsoil Stripping

Date Surveyed	5-4-09
Date Drawn	5-09
Designed by	skk
Drawn By	skk
Date Checked	
Checked by	
File:	prelim2009.dwg

Approved By .....
Title .....
Date

AREAS TO BE TOPSOILED, FERTILIZED, SEEDED & MULCHED (TSFM)
PLAN VIEW
1" = 180'



AREA TO BE TOPSOILED, SEEDED, FERTILIZED, & MULCHED (TSFM)

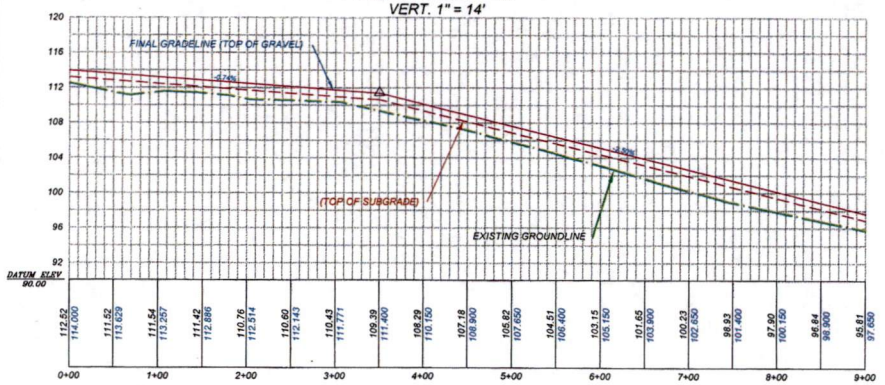
TOTAL AREA TO TSFM = 331,063 SQUARE FEET
(approximately 7.6 acres)
- DOES NOT ICLUDE ANY BORROW AREAS

NOTES:

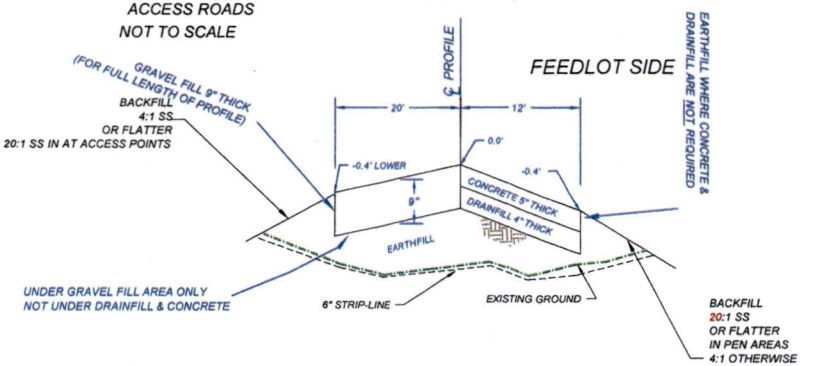
1. IN ACCORDANCE WITH THE PLANS & SPECIFICATIONS AND THE ND DEPARTMENT OF HEALTH STORMWATER PERMIT: SEEDING, FERTILIZING, AND MULCHING NEEDS TO BE COMPLETED WITHIN 7 DAYS OF TOPSOILING.
2. ANY ADDITIONAL BORROW AREAS OR CONSTRUCTION BEYOND EXTENTS WILL NEED TO BE TOPSOILED, SEEDED AND MULCHED.
3. ANY BORROW AREA (OUTSIDE THE FEEDLOT) WILL NEED TO BE TOPSOILED, SEEDED AND MULCH AS PER SPECIFICATIONS. AREA WILL BE VERIFIED IN THE FIELD.

Sheet No.				
5 of 14	K_2S ENGINEERING INC. 4209 94TH AVE SE YPSILANTI, ND 58497 Phone 701-489-3322	USDA NRCS EQIP T-T Ranch Ag Waste System Topsoiling	Date Surveyed 5-4-09 Date Drawn 5-09 Designed by skk Drawn By skk Date Checked Checked by File: prelim2009.dwg	Date Approved By ..... Title .....

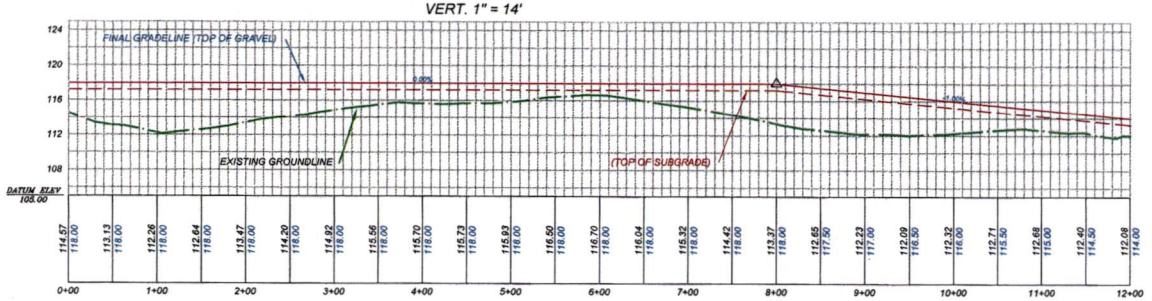
NORTH ACCESS ROAD PROFILE
SCALE: HORZ. 1" = 140'
VERT. 1" = 14'



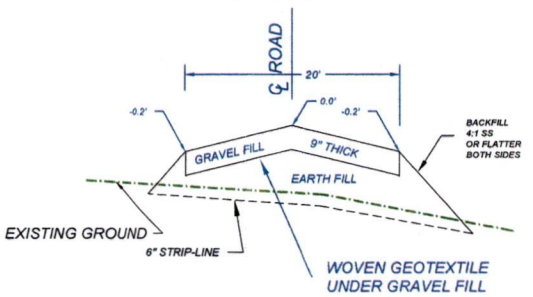
TYPICAL X-SECTION
ACCESS ROADS
NOT TO SCALE



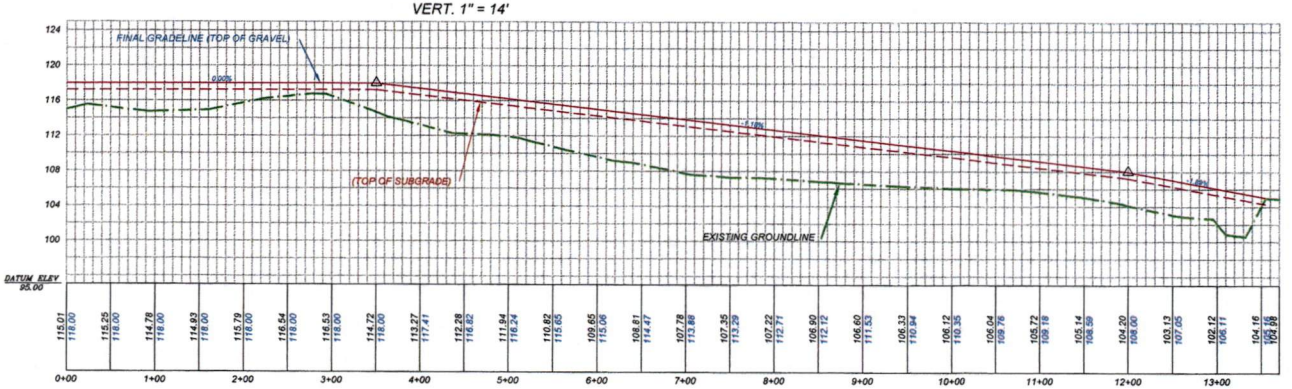
MIDDLE ACCESS ROAD PROFILE
SCALE: HORZ. 1" = 140'
VERT. 1" = 14'



TYPICAL X-SECTION
20' WIDE ROAD
NOT TO SCALE



SOUTH ACCESS ROAD PROFILE
SCALE: HORZ. 1" = 140'
VERT. 1" = 14'



Date
Approved By .....
Title .....

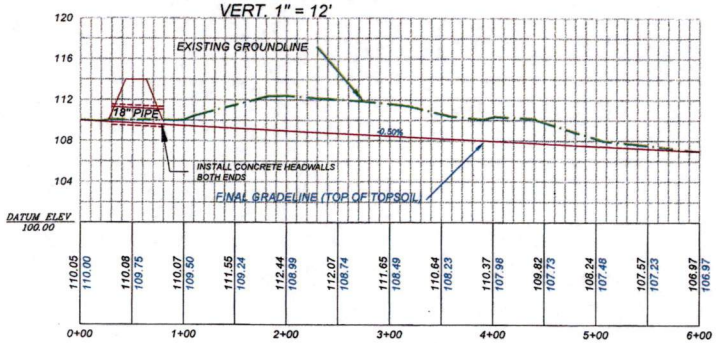
Date Surveyed 5-4-09
Date Drawn 5-09
Designed by SkK
Drawn By SkK
Date Checked
Checked by
File: prelim2009.dwg

USDA NRCS EQIP
T-T Ranch
Ag Waste System
Profiles & Details

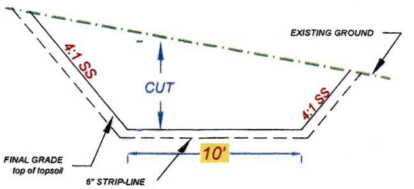
K2S ENGINEERING INC.
4209 94TH AVE SE
YPSILANTI, ND 58497
Phone 701-489-3322

Sheet No.
6 of 14

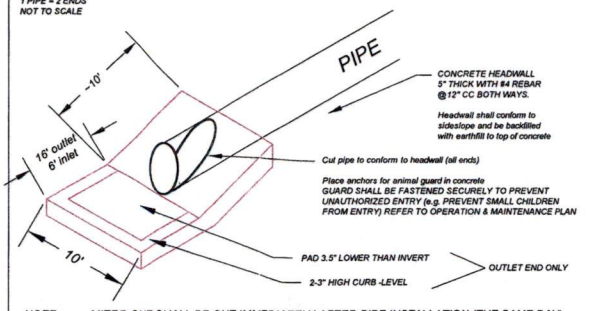
MIDDLE CLEAN WATER DIVERSION PROFILE
SCALE: HORZ. 1" = 120'
VERT. 1" = 12'



TYPICAL X-SECTION
CLEAN WATER DIVERSION DITCH
NOT TO SCALE



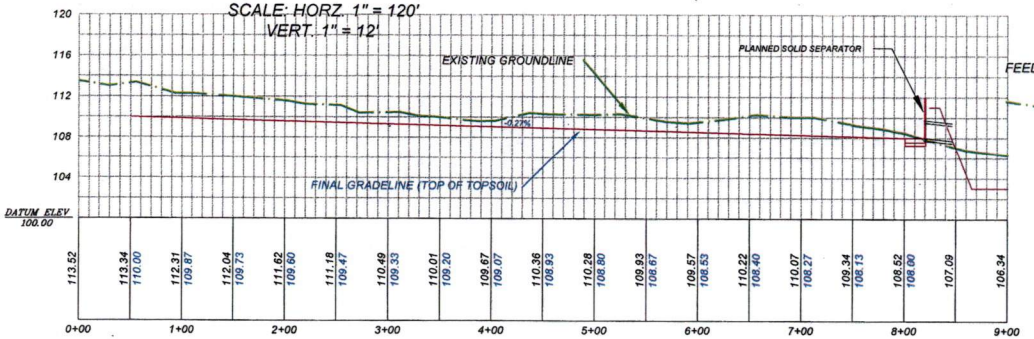
HEADWALL DETAIL
BOTH ENDS OF 18" PE PIPE
1 PIPE = 2 ENDS
NOT TO SCALE



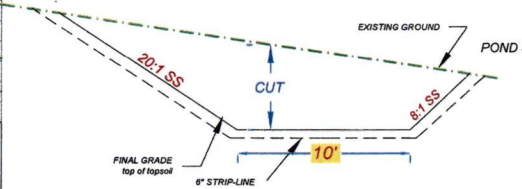
NOTE: MITER CUT SHALL BE CUT IMMEDIATELY AFTER PIPE INSTALLATION (THE SAME DAY) AND HEADWALL SHALL BE CONSTRUCTED WITHIN 5 DAYS OF PIPE INSTALLATION TO PREVENT PIPE FROM FLOATING/LIFTING UP AND DAMAGING FILL AREAS.

ESTIMATED CONCRETE VOLUME FOR 1 **INLET** HEADWALLS ~2 CU. YDS ("NEAT LINE")
ESTIMATED CONCRETE VOLUME FOR 1 **OUTLET** HEADWALLS ~4 CU. YDS ("NEAT LINE")

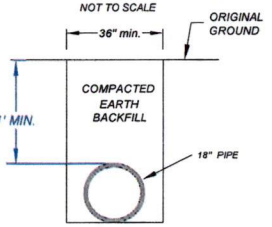
MIDDLE DIRTY WATER DIVERSION PROFILE
SCALE: HORZ. 1" = 120'
VERT. 1" = 12'



TYPICAL X-SECTION
MIDDLE DIRTY WATER DIVERSION DITCH
NOT TO SCALE

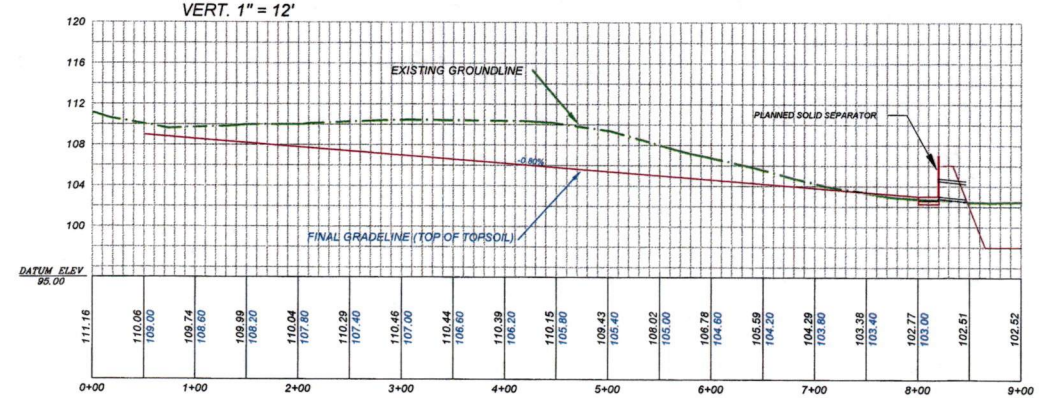


TYPICAL 18" PIPE X-SECTION
NOT TO SCALE

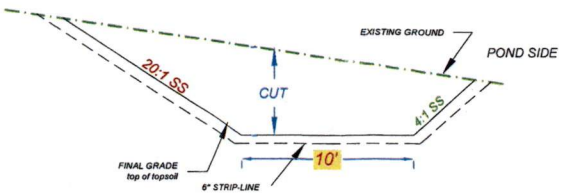


NOTE: EARTH BACKFILL SHALL CONSIST OF ACCEPTABLE MATERIAL FROM EXCAVATION.

SOUTH DIRTY WATER DIVERSION PROFILE
SCALE: HORZ. 1" = 120'
VERT. 1" = 12'



TYPICAL X-SECTION
SOUTH DIRTY WATER DIVERSION DITCH
NOT TO SCALE



Date
Approved By .....
Title .....

Date Surveyed 5-4-09
Date Drawn 5-09
Designed by SMK
Drawn By SMK
Date Checked
Checked by
File: prelim2009.dwg

USDA NRCS EQIP
T-T Ranch
Ag Waste System
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K2S ENGINEERING INC.
4209 94TH AVE SE
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Sheet No.
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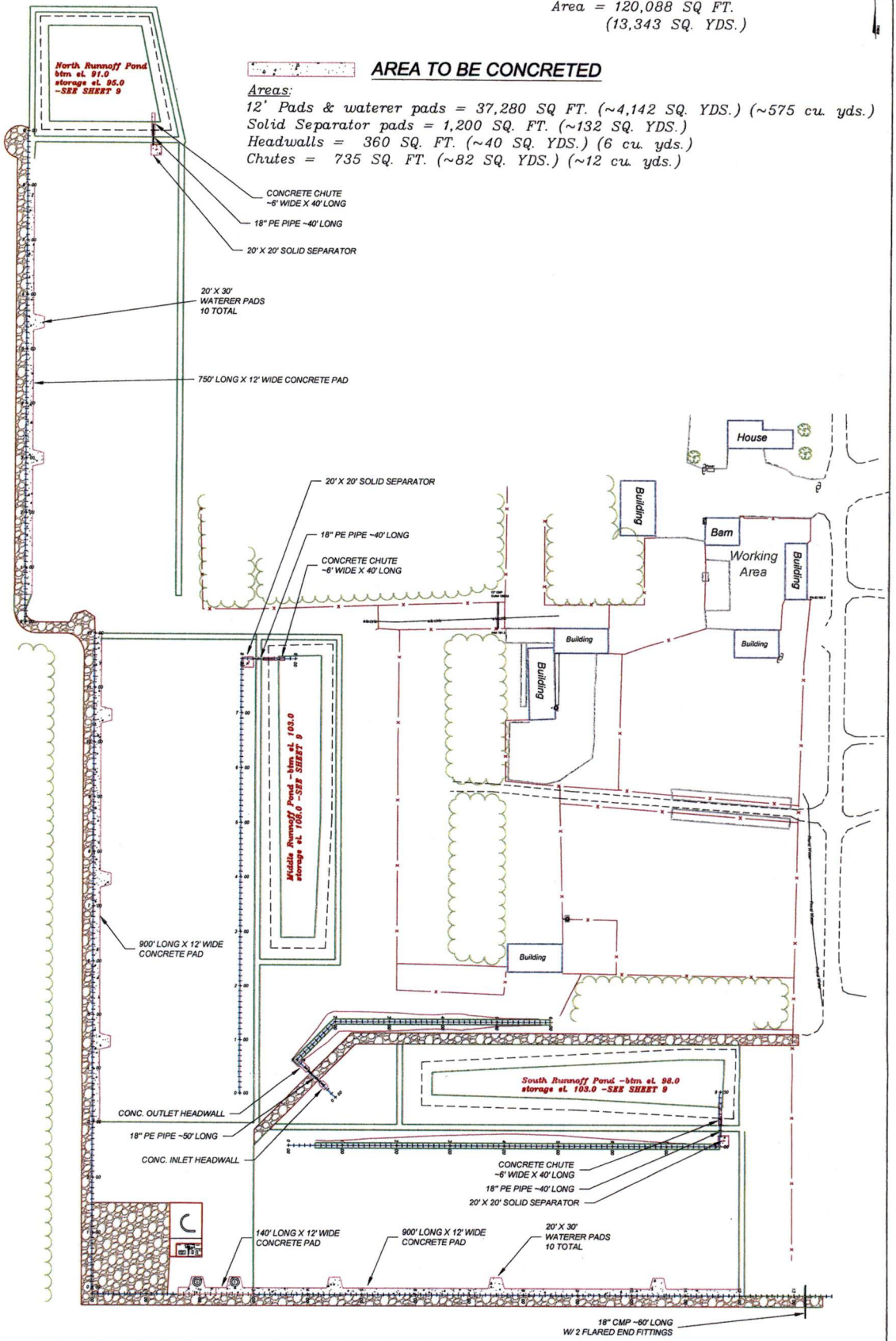
AREAS TO BE GRAVELED, CONCRETED
PLAN VIEW
1" = 180'

AREA TO BE GRAVELED
-9" THICK UNDERLAIN W/ GEOTEXTILE

Area = 120,088 SQ FT.
(13,343 SQ. YDS.)

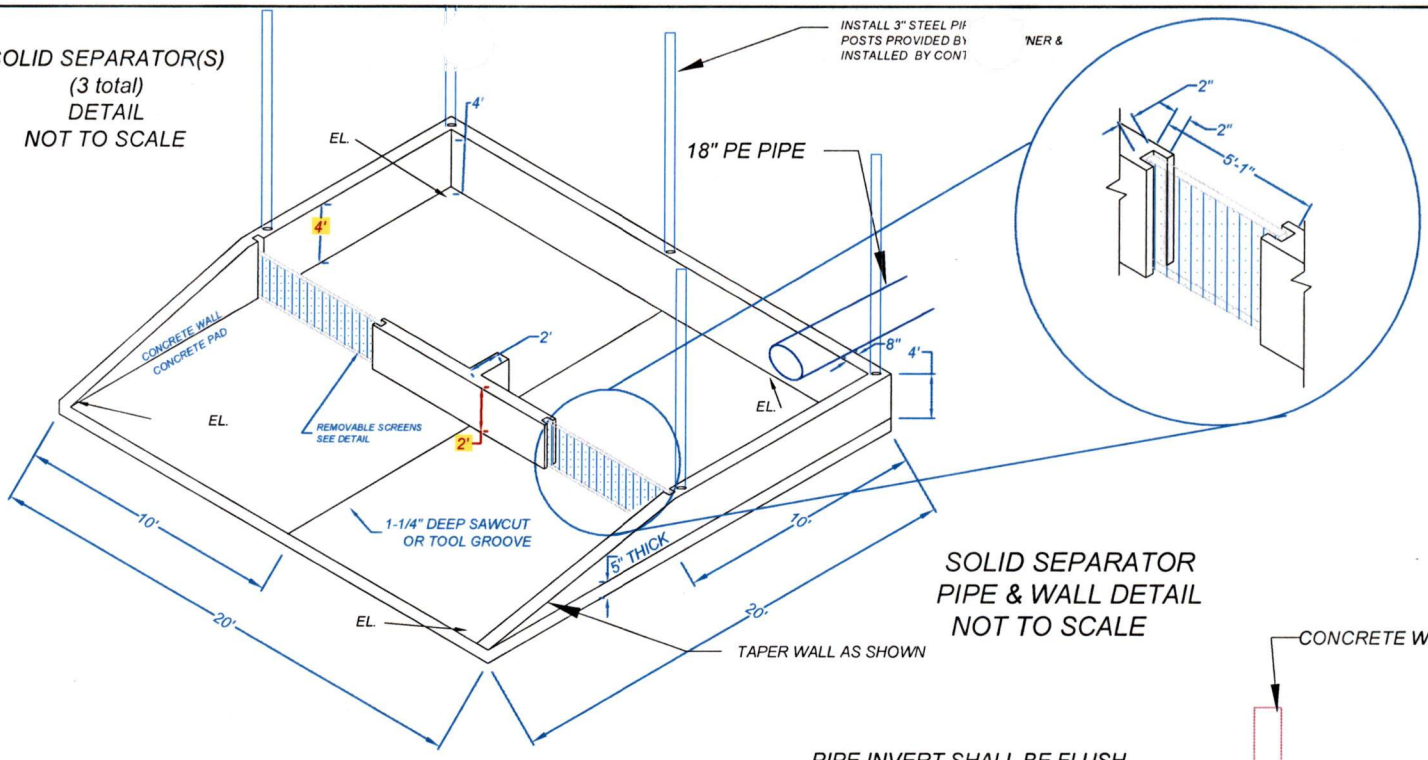
AREA TO BE CONCRETED

Areas:
12' Pads & waterer pads = 37,280 SQ FT. (~4,142 SQ. YDS.) (~575 cu. yds.)
Solid Separator pads = 1,200 SQ. FT. (~132 SQ. YDS.)
Headwalls = 360 SQ. FT. (~40 SQ. YDS.) (6 cu. yds.)
Chutes = 735 SQ. FT. (~82 SQ. YDS.) (~12 cu. yds.)



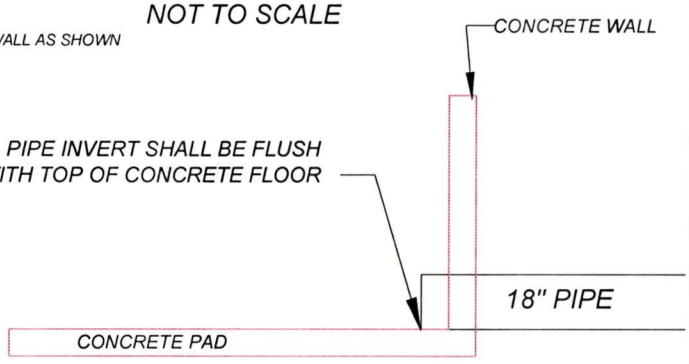
Sheet No.				
8 of 14	K_2S ENGINEERING INC. 4209 94TH AVE SE YPSILANTI, ND 58497 Phone 701-489-3322	USDA NRCS EQIP T-T Ranch Ag Waste System Concrete & Gravel Areas	Date Surveyed 5-4-09 Date Drawn 5-09 Designed by skk Drawn By skk Date Checked Checked by File: prelim2009.dwg	Date Approved By ..... Title .....

SOLID SEPARATOR(S)
(3 total)
DETAIL
NOT TO SCALE



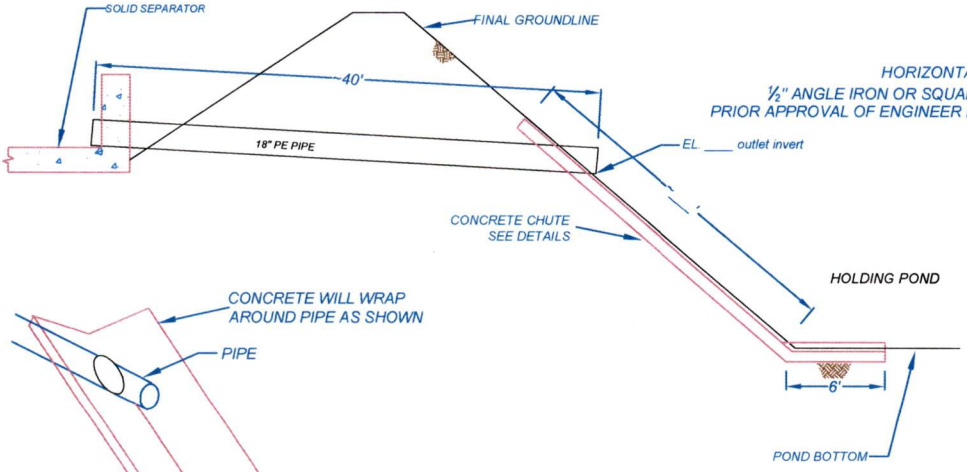
SOLID SEPARATOR PIPE & WALL DETAIL
NOT TO SCALE

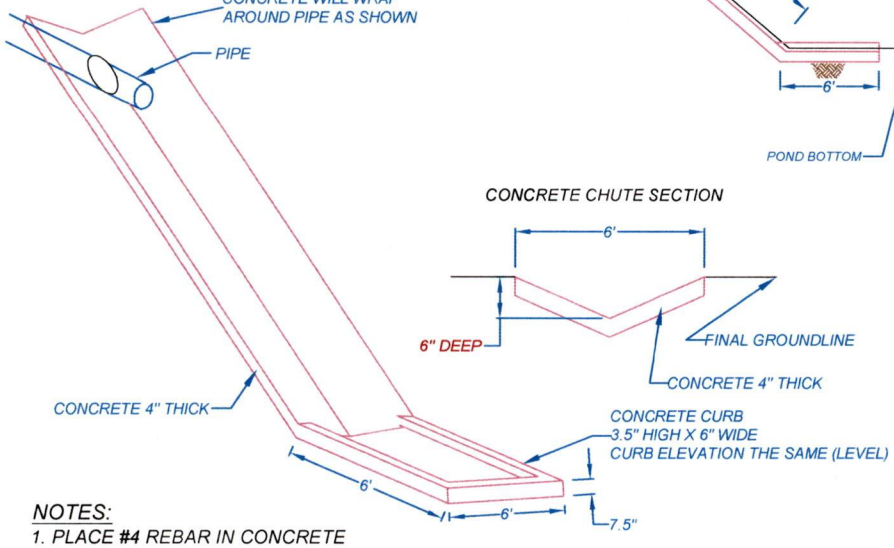
NOTE: SEE SHEET 12 FOR SOLID SEPARATOR WALL DETAILS



NOTE: SEE SHEET 6 FOR 18" PIPE TYPICAL X-SECTION

PIPE & CONCRETE GUTTER DETAIL
NOT TO SCALE

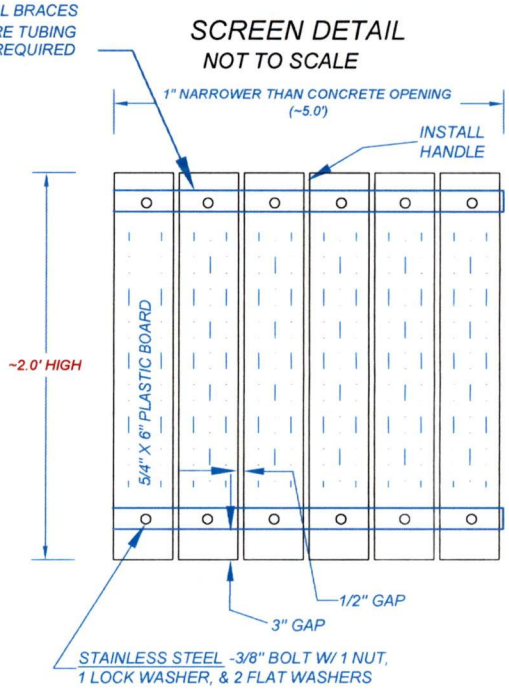




CONCRETE CHUTE SECTION

NOTES:
1. PLACE #4 REBAR IN CONCRETE AT 12" CC, BOTH WAYS.

SCREEN DETAIL
NOT TO SCALE



NOTE: PLASTIC BOARDS SHALL HAVE UV INHIBITORS AND BE RESISTANT TO WEATHER AND WEAR.

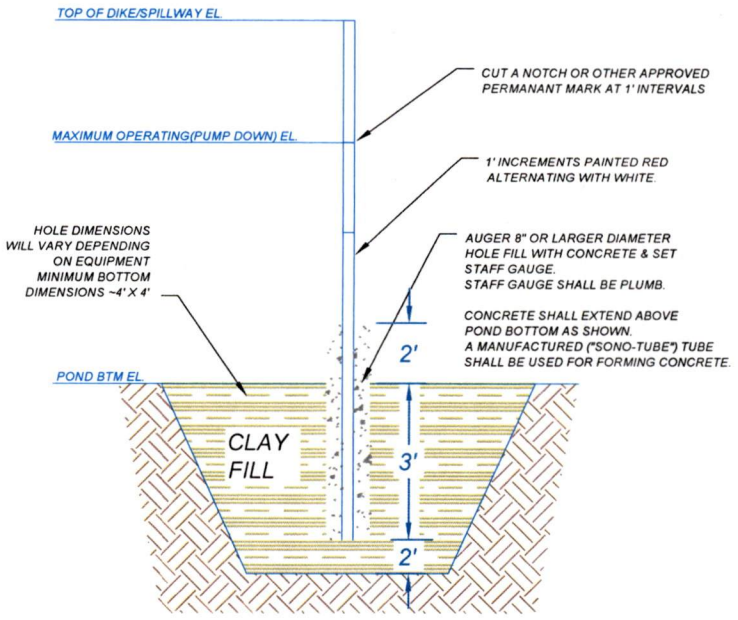
NOTE: HORIZONTAL BRACES SHALL BE ½" ANGLE IRON OR APPROVED EQUAL TO KEEP SCREENS FROM BOWING AND BREAKING UNDER PRESSURE.

NOTES:

1. STAFF GAUGE SHALL BE MADE OF A MATERIAL (E.G. 4" X 4" TREATED POST OR LARGER) THAT IS UV RAY RESISTANT, NON-CORROSIVE IN A MANURE ENVIRONMENT, AND IS STRUCTURALLY SOUND.
   STRUCTURALLY SOUND MEANS THAT THE GAUGE WILL WITHSTAND ASSUMED WIND AND MANURE FORCES. STRESS POINTS (I.E. POND BOTTOM INTERFACE) SHOULD BE REINFORCED TO DECREASE THE LIKELIHOOD OF FAILURE.
2. STAFF GAUGE IS NOT DESIGNED TO WITHSTAND COLLISIONS WITH MOVING EQUIPMENT (PAYLOADERS, SKID STEERS, ETC.).
3. IF THE POND LEVEL IS WITHIN 1.5' OF PUMPDOWN MARK/ELEVATION IN THE FALL (POST HARVEST) OR IN THE SPRING (PRE-SEEDING) IT WOULD BE ADVISED TO PUMP DOWN POND AND APPLY RUNOFF WATER TO FIELDS. THIS WILL PREVENT SEVERAL POTENTIUAL ISSUES (E.G. ODORS, DIKES OVERTOPPING AND ERODING, WATER BACKING INTO PIPES AND LOTS) OF POND OVERFILLING.

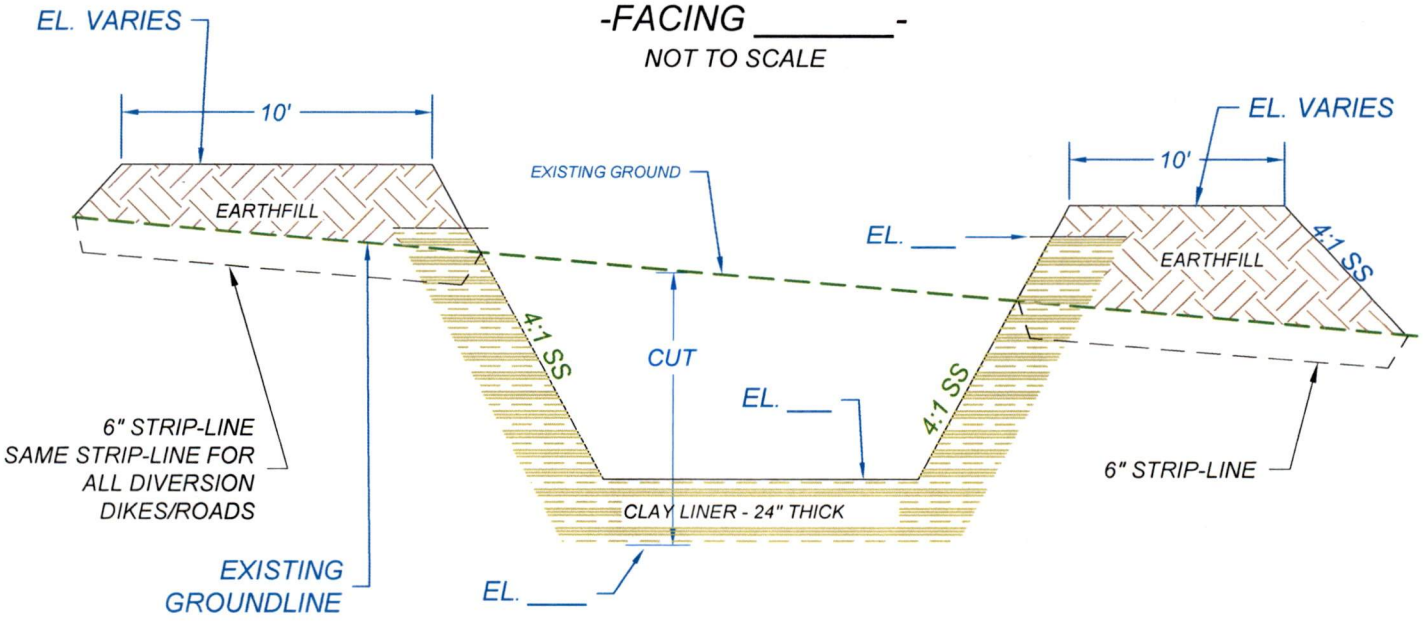
HOLDING POND - STAFF GAUGE DETAIL

NOT TO SCALE



HOLDING POND - TYPICAL SECTION -FACING _____-

NOT TO SCALE



K_2S ENGINEERING INC.
4209 94TH AVE SE
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USDA NRCS EQIP
T-T Ranch
Ag Waste System
Details

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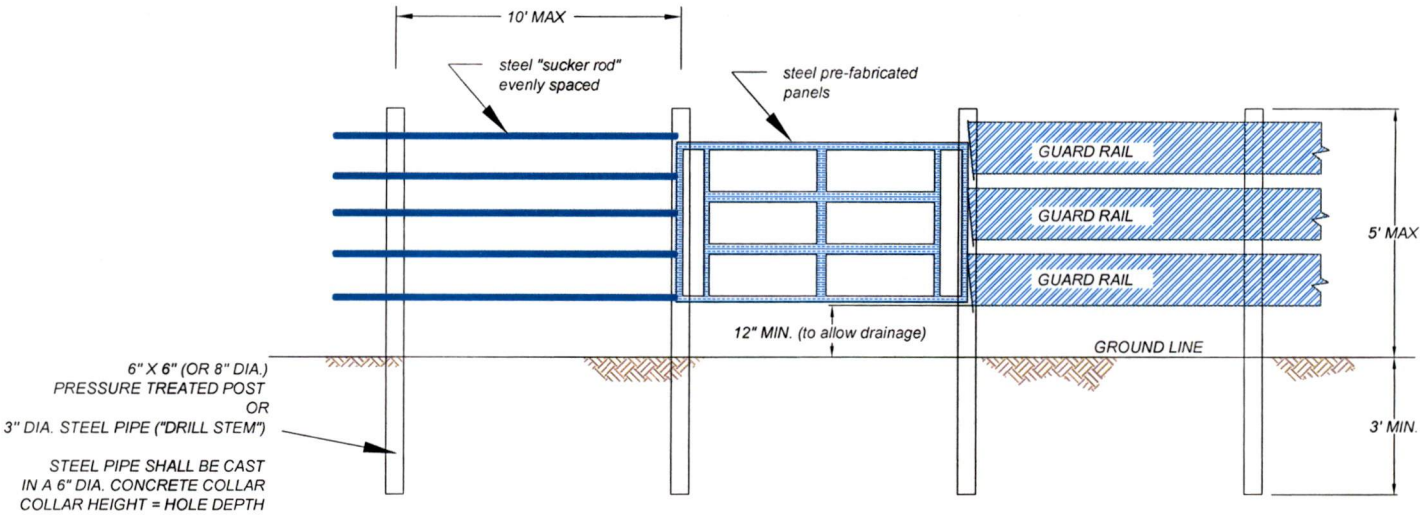
Title .....

ALTERNATE FEEDLOT FE 'G
"NON-TENSION" TYF
3 POSSIBLE TYPES SHOWN
NOT TO SCALE

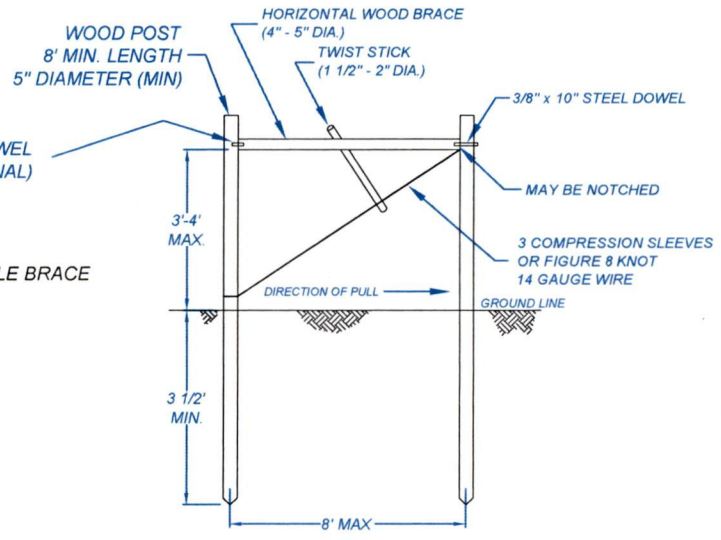


NOTES:
1. FENCE PANELS, RAILS, RODS SHALL BE SECURELY FASTENED TO POSTS, WHEREAS THEY WILL SUPPORT UP TO 500 POUND DEAD LOAD (e.g. LARGE PERSON(S) CLIMBING OVER).
2. ALL SET POSTS SHALL BE ALIGNED, LEVELED, AND PLUMB.
3. FASTENERS OR FENCING SHALL BE DESIGNED TO ACCOUNT FOR EXPANSION AND CONTRACTION FORCES.
4. ALL FENCING AND FASTENING MATERIALS SHALL BE LIKE MATERIALS AND NON-CORROSIVE TO OUTDOOR FEEDLOT TYPE ENVIRONMENTS.
5. THIS DRAWING REPRESENTS 3 POSSIBLE TYPES OF FEEDLOT FENCING. THE PRODUCER CAN PRESENT (AND ENCOURAGED TO) AN ALTERNATIVE DESIGN TO THE ENGINEER FOR APPROVAL (PRIOR TO FENCE CONSTRUCTION).
6. FEEDLINE FENCING (NECK RAILS) DESIGNS SHALL BE BY PRODUCER WITH PRIOR APPROVAL OF ENGINEER.

ESTIMATED LENGTH OF FEEDLOT FENCE ~_____' (INCLUDES BUNKLINE)

ESTIMATED LENGTH OF BARBED FENCE ~__'
ESTIMATED LENGTH OF WOVEN WIRE FENCE ~_____'

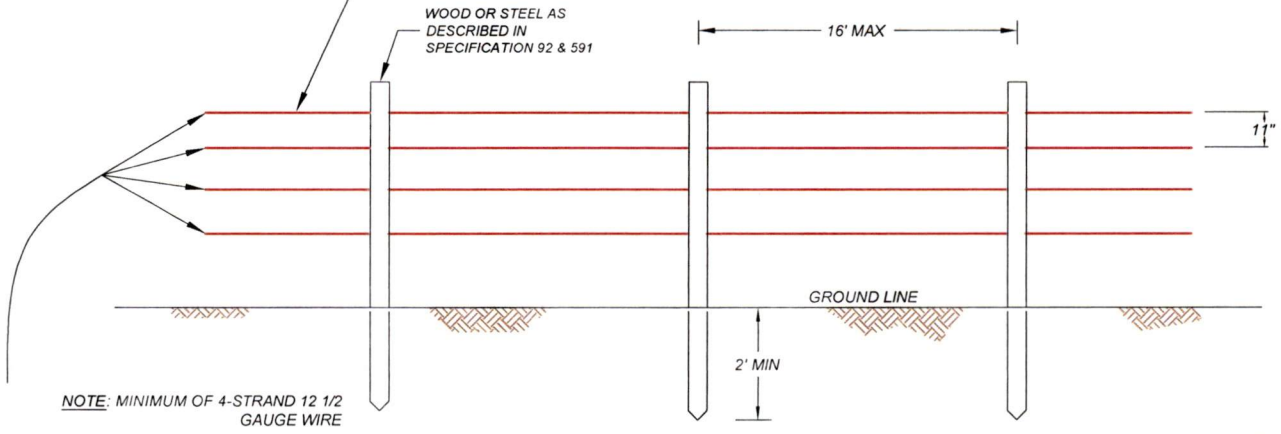
SINGLE BRACE ASSEMBLY (a.k.a. end panels)
NOT TO SCALE



NOTE: CORNER BRACE = 2 X SINGLE BRACE

NOTE: USE 48" HIGH WOVEN WIRE W/ 1 STRAND OF BARBED ON TOP AROUND POND(S)

LINE POST & WIRE SPACING FOR 12 1/2 GAUGE BARBED OR WOVEN WIRE FENCE
NOT TO SCALE



NOTE: MINIMUM OF 4-STRAND 12 1/2 GAUGE WIRE

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USDA NRCS EQIP
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Checked by	
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Date
Approved By .....
Title .....

HEAVY USE CONCRETE PAD(S
PLAN VIEW
SCALE 1" = 80'

NOT SHOWN AS
PART OF PRELIM.

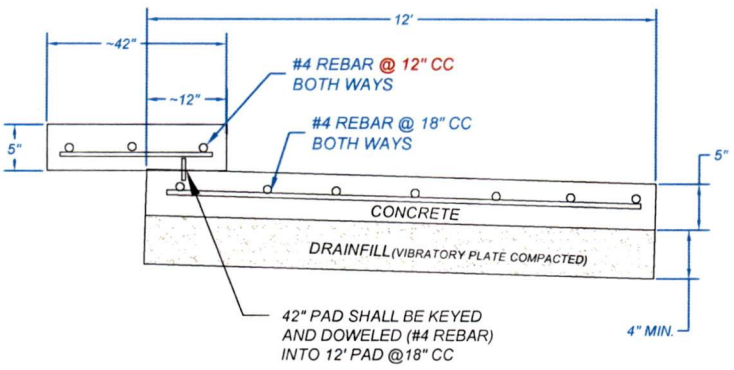
NOTES:

1. ALL PAD EDGES SHALL BE CHAMFERED OR EDGED WITH AN EDGING TOOL.
2. PADS SHALL BE SCREEDED, FLOATED, AND FINISHED TO PROVIDE A UNIFORM AND FLAT FINISH.
3. WATER SHALL NOT BE ADDED TO SURFACE OF CONCRETE.
4. UNIFORM APPLICATION OF CURING COMPOUND SHALL BE APPLIED WITHIN 5 MINUTES AFTER FINISHING.
5. CURING COMPOUND SHALL COMPLETELY COVER CONCRETE SURFACE.
6. SEE SHEET 11 FOR PAD DETAILS.
7. CONTRACTOR IS REPANSIBLE FOR INSTALATION OF POSTS IN CONCRETE (LANDOWNER WILL PROVIDE POSTS).

Sheet No.				
12 of 14	K_2S ENGINEERING INC. 4209 94TH AVE SE YPSILANTI, ND 58497 Phone 701-489-3322	USDA NRCS EQIP T-T Ranch Ag Waste System Details	Date Surveyed 5-4-09 Date Drawn 5-09 Designed by skk Drawn By skk Date Checked Checked by File: prelim2009.dwg	Date Approved By ..... Title ..... 12 OF 14

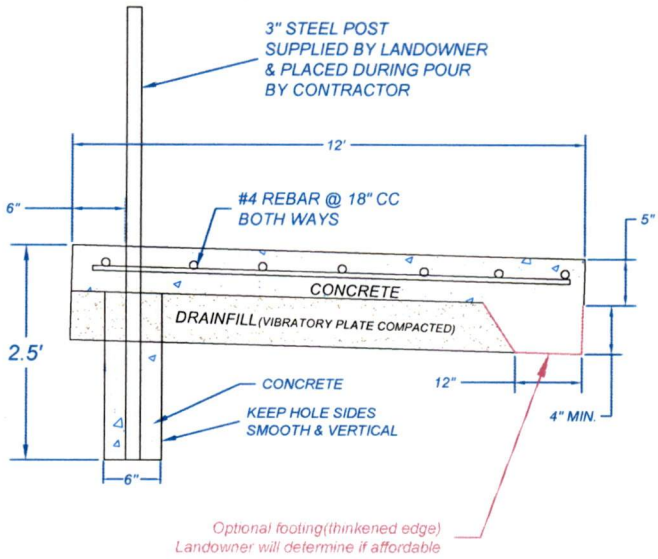
CONCRETE PAD & 42" WIDE BUNK PAD DETAIL ALTERNATIVE PAD -NO QUANTITIES INCLUDED FOR 42" PAD IN DESIGN

NOT TO SCALE



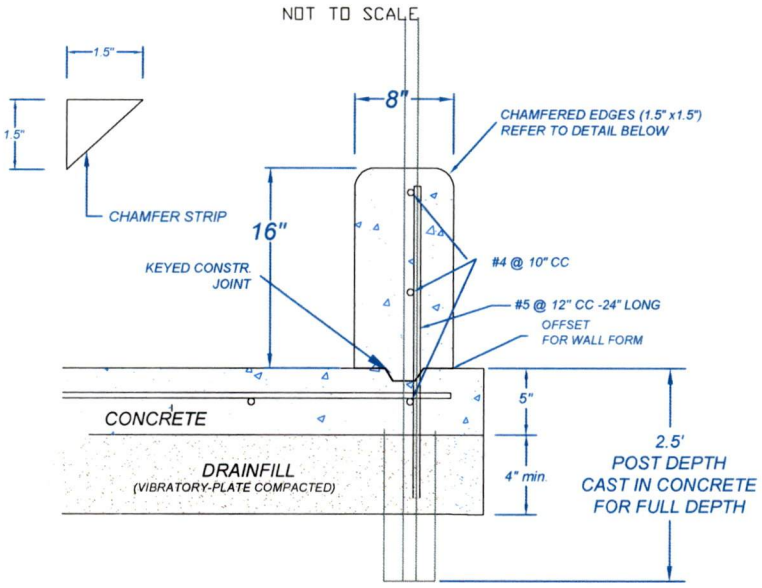
CONCRETE PAD & POST DETAIL -curb not shown-

NOT TO SCALE



CONCRETE CURB, PAD & POST DETAIL

NOT TO SCALE

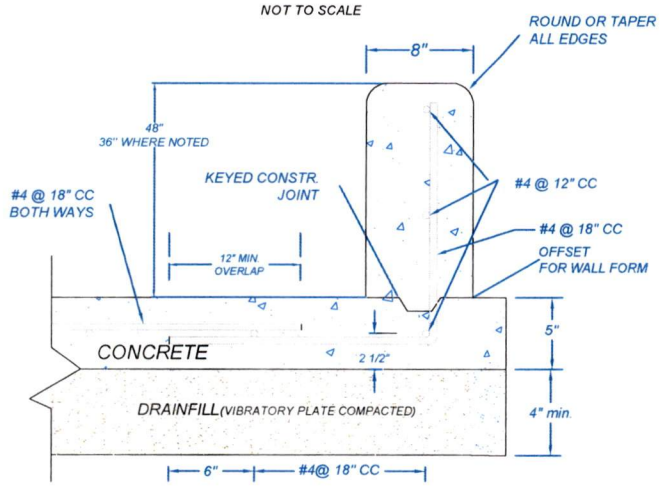


NOTE: CURB MAY BE POURED AT THE SAME TIME AS PAD AS DETAILED OR THE CURB MAY BE POURED SEPARATELY WITH THE FOLLOWING CONDITIONS & AS DETAILED BELOW:

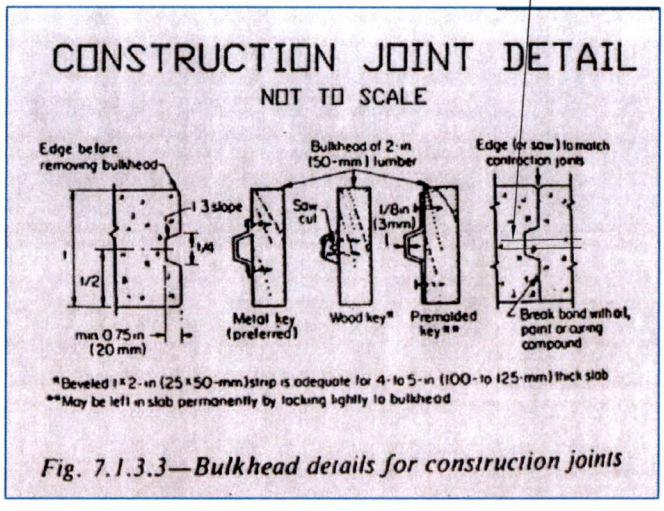
1. #5 24" LONG REBAR DOWELS SHALL BE PLACE VERTICALLY IN CENTER OF CURB AT 12" CC.
2. A CONTINUOUS KEYWAY SHALL BE FORMED INTO PAD WHERE CURB WILL BE.
3. NO CURING COMPOUND SHALL BE PLACE ON PAD AREA WHERE CURB WILL BE PLACED. NO CURING COMPOUND SHALL BE PLACED ON REBAR.
4. CURBS SHALL BE CHAMFERED AS SHOWN.
5. POSTS SHALL BE PLACED DURING PAD POUR. POST HOLE SHALL BE AUGURED AND POSTS SHALL BE PLACED AS DETAILED IN "CONCRETE PAD & POST DETAIL WITHOUT CURB"
6. POSTS SHALL BE STRAIGHT, TRUE & PLUMB.

SOLID SEPARATOR WALL & FLOOR DETAIL

NOT TO SCALE



REBAR SHALL BE CONTINUOUS THRU CONSTRUCTION JOINT
NOTE: THIS JOINT WOULD BE USED; 1. IN THE EVENT THAT THE POUR FOR THE DAY ENDS OR PROBLEMS WITH CONCRETE DELIVERY, 2. BETWEEN THE WATER PAD & 12' WIDE CONCRETE PAD



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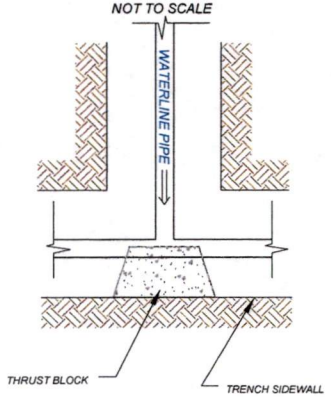
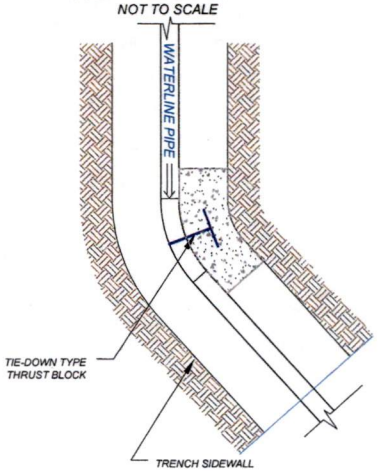
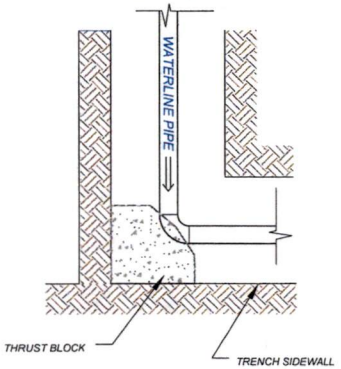
THRUST BLOCK AT TEE DETAIL
OVERHEAD VIEW
NOT TO SCALE



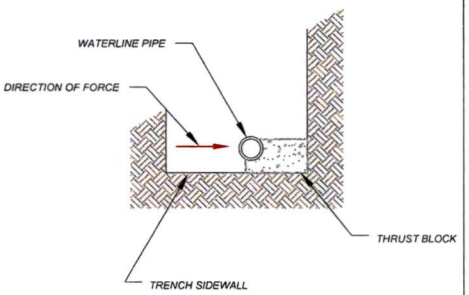
TIE-DOWN TYPE
THRUST BLOCK AT ELBOW DETAIL
OVERHEAD VIEW
NOTE : ANGLE MAY VARY
NOT TO SCALE



THRUST BLOCK AT ELBOW DETAIL
OVERHEAD VIEW
NOTE : ANGLE MAY VARY
NOT TO SCALE



THRUST BLOCK DETAIL
SIDE VIEW
NOT TO SCALE

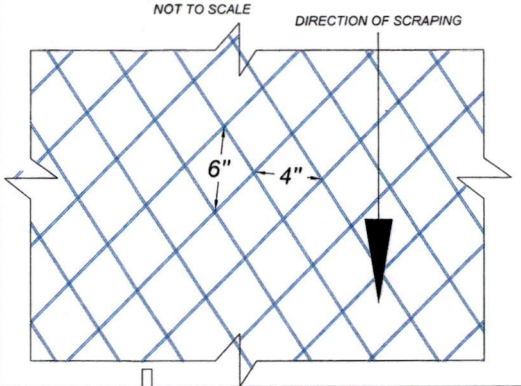


NOTES:

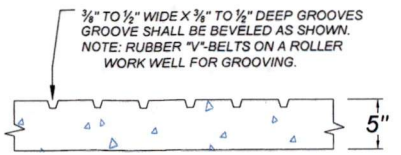
1. ALTERNATIVE THRUST BLOCKING OR PRE-MANUFACTURED THRUST BLOCKING MAY BE USED WITH PRIOR APPROVAL.
2. JOINTED OR FITTED BENDS REQUIRE THRUST BLOCKING. (E.G. PVC PIPE WITH AN ELBOW FITTING) LONG SWEEPING, NON-JOINTED BENDS USING POLYETHYLENE PIPE (BLACK PIPE) DOES NOT REQUIRE THRUST BLOCKING.
3. THRUST BLOCKS MAY BE CAST IN-PLACE WITH PRE-MIX CONCRETE (E.G. "QUICKCRETE").
4. THRUST BLOCKS SHALL CONSIST OF APPROXIMATELY 1 CUBIC FOOT (1' X 1' X 1') OF CONCRETE AND SHALL EXTEND TO TRENCH SIDE WALL AS SHOWN ABOVE.

CONCRETE FLOOR GROOVING DETAILS
FOR CATTLE TRAFFIC AREAS
NOT TO SCALE

OVERHEAD VIEW
DIAMOND PATTERN
NOT TO SCALE

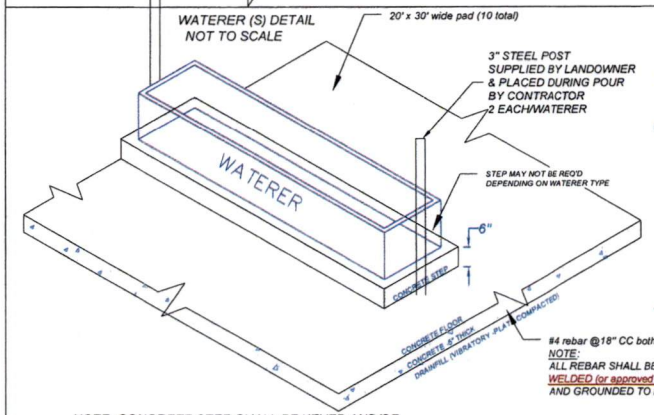


TYPICAL X-SECTION
GROOVE DIMENSIONS
NOT TO SCALE



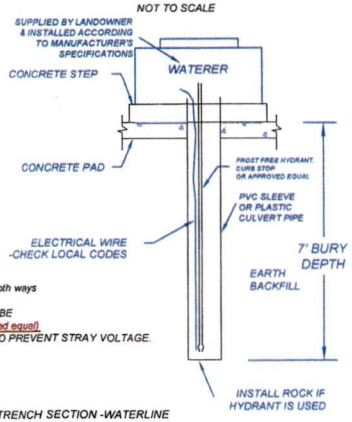
NOTE: ALTERNATE GROOVING SHALL HAVE PRIOR APPROVAL.

WATERER (S) DETAIL
NOT TO SCALE

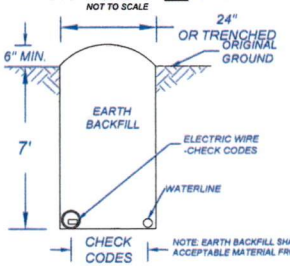


NOTE: CONCRETE STEP SHALL BE KEYED AND/OR DOWELED INTO FLOOR TO PREVENT SLIDING.

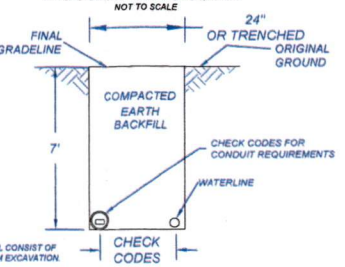
WATERER/HYDRANT DETAIL
-ELEVATION VIEW-
NOT TO SCALE



TYPICAL TRENCH SECTION -WATERLINE
WHERE COMPACTION IS NOT REQUIRED
NOT TO SCALE



TYPICAL TRENCH SECTION -WATERLINE
WHERE COMPACTION IS REQUIRED
NOT TO SCALE



NOTE: ALL TRENCHING SHALL BE IN ACCORDANCE WITH O.S.H.A RULES & REGULATIONS.

Date
Approved By .....
Title .....

Date Surveyed	5-4-09
Date Drawn	5-09
Designed by	skk
Drawn By	skk
Date Checked	
Checked by	
File: prelim2009.dwg	

USDA NRCS EQIP
T-T Ranch
Ag Waste System
Waterline Details & Concrete Finish

K2S ENGINEERING INC.
4209 94TH AVE SE
YPSILANTI, ND 58497
Phone 701-489-3322

Sheet No.
14 of 14

II-D. SPECIFICATIONS

CONSTRUCTION SPECIFICATIONS

2.	CLEARING AND GRUBBING
3.	STRUCTURE REMOVAL
5.	POLLUTION CONTROL
6.	SEEDING, SPRIGGING AND MULCHING
7.	CONSTRUCTION SURVEYS
8.	MOBILIZATION
10.	WATER FOR CONSTRUCTION
11.	REMOVAL OF WATER
21.	EXCAVATION
23.	EARTHFILL
26.	TOPSOILING
32.	STRUCTURE CONCRETE
34.	STEEL REINFORCEMENT
44.	CORRUGATED POLYETHYLENE TUBING
45.	PLASTIC PIPE
51.	CORRUGATED METAL PIPE
92.	FENCE
95.	GEOTEXTILE

Construction Specification 2—Clearing and Grubbing

1. Scope

The work consists of clearing and grubbing and disposal of trees, snags, logs, brush, stumps, shrubs, and rubbish from the designated areas.

2. Protection of existing vegetation

Trees and other vegetation designated to remain undisturbed shall be protected from damage throughout the duration of the construction period. Any damages resulting from the contractor's operations or neglect shall be repaired by the contractor.

Earthfill, stockpiling of materials, vehicular parking, and excessive foot or vehicular traffic shall not be allowed within the drip line of vegetation designated to remain in place. Vegetation damaged by any of these or similar actions shall be replaced with viable vegetation of the same species, similar condition, and like size unless otherwise approved by the contracting officer.

Any cuts, skins, scrapes, or bruises to the bark of the vegetation shall be carefully trimmed and local nursery accepted procedures used to seal damaged bark.

Any limbs or branches 0.5 inch or larger in diameter that are broken, severed, or otherwise seriously damaged during construction shall be cut off at the base of the damaged limb or branch flush with the adjacent limb or tree trunk. All roots 1-inch or larger in diameter that are cut, broken, or otherwise severed during construction operations shall have the end smoothly cut perpendicular to the root. Roots exposed during excavation or other operations shall be covered with moist earth or backfilled as soon as possible to prevent the roots from drying out.

3. Marking

The limits of the area(s) to be cleared and grubbed will be marked by stakes, flags, tree markings, or other suitable methods. Trees to be left standing and uninjured will be designated by special markings placed on the trunk about 6 feet above the ground surface.

4. Clearing and grubbing

All trees not marked for preservation and all snags, logs, brush, stumps, shrubs, rubbish, and similar materials shall be cleared from within the limits of the designated areas. Unless otherwise specified, all stumps, roots, and root clusters that have a diameter of 1 inch or larger shall be grubbed out to a depth of at least 2 feet below subgrade for concrete structures and 1 foot below the ground surface at embankment sites and other designated areas.

5. Disposal

All materials cleared and grubbed from the designated areas shall be disposed of at locations shown on the drawings or in a manner specified in section 7. The contractor is responsible for complying with all local rules and regulations and the payment of any and all fees that may result from disposal at locations away from the project site.

6. Measurement and payment

Method 1—For items of work for which specific units prices are established in the contract, the cleared and grubbed area is measured to the nearest 0.1 acre. Payment for clearing and grubbing is

made for the total area within the designated limits at the contract unit price. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 2—For items of work for which specific unit prices are established in the contract, the length of the cleared and grubbed area is measured to the nearest full station (100 feet) along the line designated on the drawing or identified in the specifications. Payment for clearing and grubbing is made for the total length within the designated limits at the contract unit price. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 3—For items of work for which specific unit prices are established in the contract, each tree, stump, and snag having a diameter of 4 inches or larger and each log having a diameter of 4 inches or larger and a length of 10 feet are measured before removal. The size of each tree and snag is determined by measuring its trunk at breast height above the natural ground surface. The size of each log is determined by measuring the butt and by measuring its length from butt to tip. The size of each stump is measured at the top. Diameter is determined by dividing the measured circumference by 3.14.

Payment for clearing and grubbing of each tree, stump, and snag having a diameter of 4 inches or larger and each log having a diameter of 4 inches or larger and a length of 10 feet or larger is made at the contract unit price for its size designation as determined by the following schedule:

Measured diameter (in)	Size designation (in)
4 to 8	6
8 to 12	10
12 to 24	18
24 to 36	30
36 to 60	48
Over 60	60

The sum of such payments shall constitute full compensation for clearing and grubbing (including the clearing and grubbing of smaller trees, stumps, snags, logs, brush, shrubs, and roots), applicable permits and associated fees, and rubbish removal. Such payment shall constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 4—For items of work for which specific lump sum prices are established in the contract, payment for clearing and grubbing is made at the contract lump sum price. Such payment shall constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 7.

7. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. BID ITEM 2, CLEARING AND GRUBBING

This item shall consist of the work and materials necessary to remove any trees, trash, debris, and plant and manure residues from construction areas and areas to be abandoned as described in this specification.

1. Disposal area will be as indicated on drawings. Landowner will be responsible for final disposal of materials. Topsoil will be redistributed over areas to be seeded by contractor.

2. Manure shall be applied in accordance with nutrient management plan.

3. In section 6, Measurement and payment, Method 1 shall apply.

Construction Specification 3—Structure Removal

1. Scope

The work shall consist of the removal, salvage, and disposal of structures (including fences) from the designated areas.

2. Marking

Method 1—Each structure or structure part to be removed will be marked with stakes, flags, paint, or other suitable method.

Method 2—The area boundaries from which structures must be removed will be marked using stakes, flags, paint, or other suitable method. Structures to remain undisturbed or to be salvaged will be designated by special markings.

3. Removal

Method 1—All structures designated for removal in the contract shall be removed to the specified extent and depth.

Method 2—Within the areas so marked, all visible and buried structures identified shall be removed to the specified extent and depth.

4. Salvage

Structures or structure parts that are designated to be salvaged shall be carefully removed and neatly placed in the specified or approved storage location. Salvaged structures that are capable of being disassembled shall be dismantled into individual members or sections. Such structures shall be neatly and systematically match marked with paint before disassembly. All connectors and other parts shall be marked to indicate their proper location within the structure and shall be fastened to the appropriate structural member or packed in suitable containers.

Material from fences designated to be salvaged shall be placed outside the work area on the property on which the fence was originally located. Fence wire shall be rolled into uniform rolls of suitable size and neatly piled with other salvaged materials. Posts and rails shall be neatly stacked.

5. Disposal of refuse materials

Refuse materials resulting from structure removal shall be disposed of in a manner and at locations specified in section 7 of this specification or in an acceptable manner and at locations approved by the contracting officer. Disposal by burning shall be in accordance with local rules and regulations.

6. Measurement and payment

Method 1—For items of work for which specific unit prices are established by the contract, payment for the removal of each structure unit, except fences, is made at the contract unit price. Fences removed or removed and salvaged are measured to the nearest linear foot. Payment for fence removal or removal and salvage is made at the contract unit prices for each type and size of fence.

Such payment will constitute full compensation for all labor, equipment, tools, applicable permits and associated fees for burning and disposal of refuse, and all other items necessary and incidental to the completion of the work.

Method 2—For items of work for which specific lump sum prices are established by the contract, payment for structure removal is made at the contract lump sum price.

Such payment will constitute full compensation for all labor, equipment, tools, applicable permits and associated fees for burning and disposal of refuse, and all other items necessary and incidental to the completion of the work.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed as a contract line item number in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in section 7 of this specification.

7. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. BID ITEM 1, STRUCTURE REMOVAL

This item shall consist of performing the work necessary to remove fences, hay bales/stacks, structures noted on drawings, and feeders from areas where construction activities will be performed and areas to be abandon.

1. In section 2, Marking and section 3, Removal, Method 1 shall apply for both.

2. In section 6, Measurement and payment, Method 1 shall apply.

Construction Specification 5—Pollution Control

1. Scope

The work consists of installing measures or performing work to control erosion and minimize the production of sediment and other pollutants to water and air from construction activities.

2. Material

All material furnished shall meet the requirements of the material specifications listed in section 8 of this specification.

3. Erosion and sediment control measures and works

The measures and works shall include, but are not limited to, the following:

Staging of earthwork activities—The excavation and moving of soil materials shall be scheduled to minimize the size of areas disturbed and unprotected from erosion for the shortest reasonable time.

Seeding—Seeding to protect disturbed areas shall occur as soon as reasonably possible following completion of that earthwork activity.

Mulching—Mulching to provide temporary protection of the soil surface from erosion.

Diversions—Diversions to divert water from work areas and to collect water from work areas for treatment and safe disposition. They are temporary and shall be removed and the area restored to its near original condition when the diversions are no longer required or when permanent measures are installed.

Stream crossings—Culverts or bridges where equipment must cross streams. They are temporary and shall be removed and the area restored to its near original condition when the crossings are no longer required or when permanent measures are installed.

Sediment basins—Sediment basins collect, settle, and eliminate sediment from eroding areas from impacting properties and streams below the construction site(s). These basins are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

Sediment filters—Straw bale filters or geotextile sediment fences trap sediment from areas of limited runoff. Sediment filters shall be properly anchored to prevent erosion under or around them. These filters are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

Waterways—Waterways for the safe disposal of runoff from fields, diversions, and other structures or measures. These works are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

Other—Additional protection measures as specified in section 8 of this specification or required by Federal, State, or local government.

4. Chemical pollution

The contractor shall provide watertight tanks or barrels or construct a sump sealed with plastic sheets to dispose of chemical pollutants, such as drained lubricating or transmission fluids, grease, soaps, concrete mixer washwater, or asphalt, produced as a by-product of the construction activities. At the completion of the construction work, sumps shall be removed and the area restored to its original condition as specified in section 8 of this specification. Sump removal shall be conducted without causing pollution.

Sanitary facilities, such as chemical toilets, or septic tanks shall not be located next to live streams, wells, or springs. They shall be located at a distance sufficient to prevent contamination of any water source. At the completion of construction activities, facilities shall be disposed of without causing pollution as specified in section 8 of this specification.

5. Air pollution

The burning of brush or slash and the disposal of other materials shall adhere to state and local regulations.

Fire prevention measures shall be taken to prevent the start or spreading of wildfires that may result from project activities. Firebreaks or guards shall be constructed and maintained at locations shown on the drawings.

All public access or haul roads used by the contractor during construction of the project shall be sprinkled or otherwise treated to fully suppress dust. All dust control methods shall ensure safe construction operations at all times. If chemical dust suppressants are applied, the material shall be a commercially available product specifically designed for dust suppression and the application shall follow manufacturer's requirements and recommendations. A copy of the product data sheet and manufacturer's recommended application procedures shall be provided to the engineer 5 working days before the first application.

6. Maintenance, removal, and restoration

All pollution control measures and temporary works shall be adequately maintained in a functional condition for the duration of the construction period. All temporary measures shall be removed and the site restored to near original condition.

7. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, each item is measured to the nearest unit applicable. Payment for each item is made at the contract unit price for that item. For water or chemical suppressant items used for dust control for which items of work are established in section 8 of this specification, measurement for payment will not include water or chemical suppressants that are used inappropriately or excessive to need. Such payment will constitute full compensation for the completion of the work.

Method 2—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds and supported by invoices presented by the contractor that reflect actual costs. If the total of all progress payments is less than the lump sum contract price for this item, the balance remaining for this item will be included in the final contract payment. Payment of the lump sum contract price will constitute full compensation for completion of the work.

Method 3—For items of work for which lump sum prices are established in the contract, payment will be prorated and provided in equal amounts on each monthly progress payment estimate. The number of months used for prorating shall be the number estimated to complete the work as outlined in the contractor's approved construction schedule. The final month's prorate amount will be provided with the final contract payment. Payment as described will constitute full compensation for completion of the work.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items, and the items to which they are made subsidiary, are identified in section 8 of this specification.

8. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. SUBSIDIARY ITEM, POLLUTION CONTROL

This item shall consist of performing the work and providing the materials necessary for conforming with this specification.

1. Alternative erosion control measures shall have prior approval of the engineer.

2. Payment for this item will be included under the bid items for which pollution control by the contractor is required. Items that may require pollution control for construction by the contractor are, but not limited to: excavations, earthfills, plastic & metal pipes, concrete work, clay liner (if specified).
   Note: be sure to adjust price on specific bid items to account for pollution control.

Construction Specification 6—Seeding, Sprigging, and Mulching

1. Scope

The work consists of preparing the area for treatment; furnishing and placing seed, sprigs, mulch, fertilizer, inoculant, lime, and other soil amendments; and anchoring mulch in designated areas as specified.

2. Material

Seed—All seed shall conform to the current rules and regulations of the state where it is being used and shall be from the latest crop available. It shall meet or exceed the standard for purity and germination listed in section 7.

Seed shall be labeled in accordance with the state laws and the U.S. Department of Agriculture rules and regulations under the Federal Seed Act in effect on the date of invitations for bids. Bag tag figures are evidence of purity and germination. No seed will be accepted with a test date of more than 9 months before the delivery date to the site.

Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. The percent of noxious weed seed allowable shall be as defined in the current State laws relating to agricultural seeds. Each type of seed shall be delivered in separate sealed containers and fully tagged unless exception is granted in writing by the contracting officer.

Fertilizer—Unless otherwise specified, the fertilizer shall be a commercial grade fertilizer. It shall meet the standard for grade and quality specified by State law. Where fertilizer is furnished from bulk storage, the contractor shall furnish a supplier's certification of analysis and weight. When required by the contract, a representative sample of the fertilizer shall be furnished to the contracting officer for chemical analysis.

Inoculants—The inoculant for treating legume seeds shall be a pure culture of nitrogen-fixing bacteria prepared specifically for the species and shall not be used later than the date indicated on the container or as otherwise specified. A mixing medium, as recommended by the manufacturer, shall be used to bond the inoculant to the seed. Two times the amount of the inoculant recommended by the manufacturer shall be used except four times the amount shall be used when seed is applied using a hydraulic seeder. Seed shall be sown within 24 hours of treatment and shall not remain in the hydraulic seeder longer than 4 hours.

Lime and other soil amendments—Lime shall consist of standard ground agriculture limestone, or approved equivalent. Standard ground agriculture limestone is defined as ground limestone meeting current requirements of the State Department of Agriculture. Other soil amendments shall meet quality criteria and application requirements specified in section 7.

Mulch tackifiers—Asphalt emulsion tackifiers shall conform to the requirements of ASTM D 977, Specification for Emulsified Asphalt. The emulsified asphalt may be rapid setting, medium setting, or slow setting. Nonasphaltic tackifiers required because of environmental considerations shall be as specified in section 7.

Straw mulch material—Straw mulch shall consist of wheat, barley, oat or rye straw, hay, grass cut from native grasses, or other plants as specified in section 7. The mulch material shall be air-dry, reasonably light in color, and shall not be musty, moldy, caked, or otherwise of low quality. The use of mulch that contains noxious weeds is not permitted. The contractor shall provide a method satisfactory to the contracting officer for determining weight of mulch furnished.

Other mulch materials—Mulching materials, such as wood cellulose fiber mulch, mulch tackifiers, synthetic fiber mulch, netting, and mesh, are other mulching materials that may be required for specialized locations and conditions. These materials, when specified, must be accompanied by the manufacturer's recommendations for methods of application.

3. Seeding mixtures, sod, sprigs, and dates of planting

The application rate per acre for seed mixtures, sprigs, or sod and date of seeding or planting shall be as shown on the plans or as specified in section 7.

4. Seedbed preparation and treatment

Areas to be treated shall be dressed to a smooth, firm surface. On sites where equipment can operate on slopes safely, the seedbed shall be adequately loosened (4 to 6 inches deep) and smoothed. Depending on soil and moisture conditions, disking or cultipacking, or both, may be necessary to properly prepare a seedbed. Where equipment cannot operate safely, the seedbed shall be prepared by hand methods by scarifying to provide a roughened soil surface so that broadcast seed will remain in place.

If seeding is to be accomplished immediately following construction operations, seedbed preparation may not be required except on a compacted, polished, or freshly cut soil surface.

Rocks larger than 6 inches in diameter, trash, weeds, and other debris that will interfere with seeding or maintenance operations shall be removed or disposed of as specified in section 7.

Seedbed preparation shall be discontinued when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by the contracting officer's technical representative (COTR).

5. Seeding, sprigging, fertilizing, mulching, and stabilizing

All seeding or sprigging operations shall be performed in such a manner that the seed or sprigs are applied in the specified quantities uniformly in the designated areas. The method and rate of seed application shall be as specified in section 7. Unless otherwise specified, seeding or sprigging shall be accomplished within 2 days after final grading is completed and approved.

Fertilizer, lime, and other soil amendments shall be applied as specified in section 7. When specified, the fertilizer and soil amendments shall be thoroughly incorporated into the soil immediately following surface application.

The rate, amount, and kind of mulching or mesh shall be as specified in section 7. Mulches shall be applied uniformly to the designated areas. They shall be applied to areas seeded not later than 2 working days after seeding has been performed. Straw mulch material shall be stabilized within 24 hours of application using a mulch crimper or equivalent anchoring tool or by a suitable tackifier. When the mulch crimper or equivalent anchoring tool is used, it shall have straight blades and be the type manufactured expressly for and capable of firmly punching the mulch into the soil. Where the equipment can be safely operated, it shall be operated on the contour. Hand methods shall be used where equipment cannot safely operate to perform the work required.

The tackifier shall be applied uniformly over the mulch material at the specified rate, or it shall be injected into the mulch material as it is being applied. Mesh or netting stabilizing materials shall be applied smoothly, but loosely on the designated areas. The edges of these materials shall be buried or securely anchored using spikes or staples as specified in section 7.

The contractor shall maintain the mesh or netting areas until all work under the contract has been completed and accepted. Maintenance shall consist of the repair of areas damaged by water erosion, wind, fire, or other causes. Such areas shall be repaired to reestablish the intended condition and to the design lines and grades required by the contract. The areas shall be refertilized, reseeded, and remulched before the new application of the mesh or netting.

6. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, each area treated is measured as specified in section 7 and the area calculated to the nearest 0.1 acre. Payment for treatment is made at the contract unit price for the designated treatment, which will constitute full compensation for completion of the work.

When specified as an item of work, mesh or netting is measured to the nearest square yard of surface area covered and accepted. Payment is made at the contract unit price and will constitute full compensation for completion of the work.

Method 2—For items of work for which specific lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for this item is made at the contract lump sum price for the item and will constitute full compensation for the completion of the work.

Method 3—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds. Progress payments will be determined as specified in section 7. Payment of the lump sum contract price will constitute full compensation for completion of the work.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the item(s) to which they are made subsidiary are identified in section 7.

7. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. BID ITEM 15, SEEDING SPRIGGING AND MULCHING

This item shall consist of the work and materials necessary to create a smooth, firm, free draining seedbed. Backfill areas, diversion dikes, ditches, areas noted on drawings, and all other areas disturbed by construction operations are to be seeded, fertilized, and mulched as described in this specification (note: graded lot areas, gravel access roads, and concrete pads do **not** need to be seeded). ***Note: seeding and mulching shall be completed within 7 days of topsoiling.***

1. Salvaged topsoil shall be redistributed evenly over all disturbed areas designated by project engineer or his/her representative. **Payment for topsoiling shall be included under Bid Item 9, Topsoiling.**

2. Fertilizer shall be applied at a rate of 100 lbs/ac of 10-10-10.

3. Lime shall **not** be applied.

4. The soil surface shall be scarified to a depth of 2" with a disk or other suitable implement.

5. The seeding rates for the disturbed areas shall be as listed below (select one mixture and one companion crop):

Native mixture:

Certified Seed	Seed Mixture
Western Wheatgrass	50%
Slender Wheatgrass	50%

Tame Grass mixture:

Certified Seed	Seed Mixture
Smooth Bromegrass	50%
Intermediate Wheatgrass	50%

Companion Crop:

Certified Seed	Rate
Oats, Barley	10 lbs./ac
Spring Wheat	15 lbs/ac

The seeding rate for the native and tame mixture shall be 20 lb./ac (this does not include the companion crop).

If the seeding is to be completed after September 1, add 5 lb./ac. of winter wheat.

Minimum seed germination rate shall be 85%, and minimum seed purity shall be 95%. Similar growth habit varieties may be substituted. Fescue (if specified) shall have low levels of endophyte.

Inoculate trefoil (if specified) with the proper fresh culture a maximum of 24 hours prior to sowing. Use four times the recommended inoculant when hydroseeding.

6. Firm the seedbed by cultipacking or rolling.

7. Straw or hay mulch shall be applied at a rate of 2 tons/ac. Mulch must be free of undesirable weed seeds. Anchor mulch by lightly disking.

8. Items subsidiary to this Bid item are:
   Mobilization & Demobilization, Construction Specification 8

9. In section 6, Measurement and Payment, Method 1 will apply.

Construction Specification 7—Construction Surveys

1. Scope

The work consists of performing all surveys, measurements, and computations required by this specification.

2. Equipment and material

Equipment for construction surveys shall be of a quality and condition to provide the required accuracy. The equipment shall be maintained in good working order and in proper adjustment at all times. Records of repairs, calibration tests, accuracy checks, and adjustments shall be maintained and be available for inspection by the engineer. Equipment shall be checked, tested, and adjusted as necessary in conformance with manufacturer's recommendations.

Material is field notebooks, stakes, templates, platforms, equipment, spikes, steel pins, tools, and all other items necessary to perform the work specified.

3. Quality of work

All work shall follow recognized professional practice and the standards of the industry unless otherwise specified in section 9 of this specification. The work shall be performed to the accuracy and detail appropriate for the type of job. Notes, sketches, and other data shall be complete, recorded neatly, legible, reproducible and organized to facilitate ease in review and allow reproduction of copies for job documentation. Survey equipment that requires little or no manual recording of field data shall have survey information documented as outlined in section 9 of this specification.

All computations shall be mathematically correct and shall include information to identify the bid item, date, and who performed, checked, and approved the computations. Computations shall be legible, complete, and clearly document the source of all information used including assumptions and measurements collected.

If a computer program is used to perform the computations, the contractor shall provide the engineer with the software identification, vendor's name, version number, and other pertinent data before beginning survey activities. Computer generated computations shall show all input data including values assigned and assumptions made.

The elevations of permanent and temporary bench marks shall be determined and recorded to the nearest 0.01 foot. Differential leveling and transit traverses shall be of such precision that the error of vertical closure in feet shall not exceed plus or minus 0.1 times the square root of the traverse distance in miles. Linear measurements shall be accurate to within 1 foot in 5,000 feet, unless otherwise specified in section 9 of this specification. The angular error of closure for transit traverses shall not exceed 1 minute times the square root of the number of angles turned.

The minimum requirements for placing slope stakes shall be at 100-foot stations for tangents, as little as 25 feet for sharp curves, breaks in the original ground surface and at any other intermediate stations necessary to ensure accurate location for construction layout and measurement. Slope stakes and cross sections shall be perpendicular to the centerline. Significant breaks in grade shall be determined for cross sections. Distances shall be measured horizontally and recorded to the nearest 0.1 foot. Side shots for interim construction stakes may be taken with a hand level.

Unless otherwise specified in section 9 of this specification, measurements for stationing and establishing the location of structures shall be made to the nearest 0.1 foot.

Elevations for concrete work, pipes, and mechanical equipment shall be determined and recorded to the nearest 0.01 foot. Elevations for earth work shall be determined and recorded to the nearest 0.1 foot.

4. Primary control

The baselines and bench marks for primary control, necessary to establish lines and grades needed for construction, are shown on the drawings and have been located on the job site.

These baselines and bench marks shall be used as the origin of all surveys, layouts, and measurements to establish construction lines and grades. The contractor shall take all necessary precautions to prevent the loss or damage of primary control points. Any stakes or control points lost or damaged by construction activity will be reestablished by the contractor or at contractor expense.

5. Construction surveys

Before work starts that requires contractor performed surveys, the contractor shall submit in writing for the engineer's review: the name, qualifications, and experience of the individuals to be assigned to the survey tasks.

Method 1—Contractor performed surveys shall include:

- checking and any supplemental or interim staking
- performing quantity surveys, measurements, and computations for progress payment
- other surveys as described in section 9 of this specification

Method 2—Contractor performed surveys shall consist of all work necessary for:

- establishing line and grade for all work
- setting slope stakes for all work
- checking and any supplemental or interim staking
- establishing final grade stakes
- performing quantity surveys, measurements, and computations for progress payment
- other surveys as described in section 9 of this specification

Method 3—Contractor performed surveys shall consist of all work necessary for:

- establishing line and grade for all work
- setting slope stakes for all work
- checking and any supplemental or interim staking
- establishing final grade stakes
- performing quantity surveys, measurements, and computations for progress payments
- performing original (initial) and final surveys for determinations of final quantities
- other surveys as described in section 9 of this specification.

6. Staking

The construction staking required for the item shall be completed before work on any item starts. Construction staking shall be completed as follows or as otherwise specified in section 9 of this specification:

Clearing and grubbing—The boundary of the area(s) to be cleared and grubbed shall be staked or flagged at a maximum interval of 200 feet, closer if needed, to clearly mark the limits of work. When contractor staking is the basis for determining the area for final payment, all boundary stakes will be reviewed by the engineer before start of this work item.

Excavation and fill—Slope stakes shall be placed at the intersection of the specified slopes and ground line. Slope stakes and the reference stakes for slopes shall be marked with the stationing, required cut or fill, slope ratio, and horizontal distance from the centerline or other control line. The minimum requirements for placing slope stakes is outlined in section 3, Quality of work.

Structures—Centerline and offset reference line stakes for location, alignment, and elevation shall be placed for all structures.

7. Records

All survey data shall be recorded in fully identified standard hard-bound engineering survey field notebooks with consecutively numbered pages. All field notes and printed data shall include the purpose or description of the work, the date the work was performed, weather data, sketches, and the personnel who performed and checked the work. Electronically generated survey data and computations shall be bound, page numbered, and cross referenced in a bound field notebook containing the index for all survey activities. All work shall follow recognized professional practice.

The construction survey records shall be available at all times during the progress of the work for examination and use by the engineer and when requested, copies shall be made available. The original field notebooks and other records shall be provided to and become the property of the owner before final payment and acceptance of all work.

Complete documentation of computations and supporting data for progress payments shall be submitted to the engineer with each invoice for payment as specified in section 9 of the specification. When the contractor is required to conduct initial and final surveys as outlined in section 5, Construction Surveys, notes shall be provided as soon as possible after completion to the engineer for the purpose of determining final payment quantities.

8. Payment

Method 1—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds, after presentation of correct and accurate invoices by the contractor showing related costs and evidence of the charges of suppliers, subcontractors, and others for supplies furnished and work performed. Invoices for the total amount of the contract price will not be accepted until all surveys are complete and required documentation has been determined complete. If the total of such payments is less than the lump sum contract price for this item, the unpaid balance will be included in the final contract payment. Payment of the lump sum contract price will constitute full compensation for completion of all work under the bid item.

Method 2—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds with progress payment amounts determined as a percentage of the total work planned as projected from the contractor's approved construction schedule. Payment of the lump sum contract price will constitute full compensation for completion of all work under this bid item.

Payment will not be provided under this item for the purchase price of materials or equipment having a residual value.

Compensation for any item of work described in the contract, but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the item to which they are made subsidiary are identified in section 9 of this specification.

9. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. SUBSIDIARY ITEM, CONSTRUCTION SURVEYS

This item shall consist of all surveys required for the contractors' quality control; to insure that earthwork, gravel placement, pipe placement and concrete placement are to the specified elevations, line and grades shown on drawings.

1. In section 5, Construction surveys, Method 1 shall apply.

2. Initial staking provided by government or designated representative:

   a. centerline, slope and/or offset for all earthfill work, pipes, and concrete.

   b. grade hubs set for top of gravel fills (blue topping).

   c. original and final surveys for determination of adjusted quantities, if different from original design elevations and dimensions.

3. Final elevation tolerances are +/- 0.1'. Contractor shall have the equipment and ability to transfer elevations from construction stakes and blue tops.

4. A coordinate point list is provided at the end of this specification.

5. Payment for this item will be included under the bid items for which survey work by the contractor is required. Bid items that will require survey work by the contractor are, but not limited to: excavations, earthfills, plastic and metal pipes, corrugated plastic tubing, concrete work, clay liner (if specified).

Coordinate Point List:

Number	Northing	Easting	Elevation	Full Desc
1	10000.0000	10000.0000	100.00	stn1
2	10221.8358	9961.2864	98.34	stn2
3	9820.5183	9964.1757	103.50	stn3
4	9453.7135	9961.3503	103.03	stn4
5	9002.7127	9919.9671	103.92	stn5
6	10068.8206	9917.9239	101.23	stn6

Construction Specification 8—Mobilization and Demobilization

1. Scope

The work consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required under the contract. It does not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

2. Equipment and material

Mobilization shall include all activities and associated costs for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable; and other items specified in section 4 of this specification.

Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal, and site cleanup of offices, buildings, and other facilities assembled on the site specifically for this contract.

This work includes mobilization and demobilization required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted, or added items of work for which the contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.

3. Payment

No payment will be made for this item. Mobilization will be paid for under the bid item(s) that have mobilizing costs.

Construction Specification 10—Water for Construction

1. Scope

The work consists of furnishing, transporting, measuring, and applying water as specified.

2. Facilities and equipment

The contractor shall install and maintain access and haul roads and furnish, operate, and maintain all pumps, meters, piping, tanks, storage, and other facilities required to load, transport, store, distribute, and use construction water as specified.

These facilities shall be equipped with accurate, work dedicated meters; tanks of known volume; or other devices that provide a correct measurement of water supplied. Meters shall be installed at the point of delivery into water hauling equipment or application system, such as sprinkler systems or flooding systems, as specified.

3. Dust abatement and haul road maintenance

Water for dust abatement and haul road maintenance shall be applied to haul roads and other dust producing areas as needed to prevent air pollution or excessive dust (which causes impaired vision on trafficked roads and in work areas) and to maintain the roads in good condition for safe and efficient operation during periods of use. Roads that may be jointly used with the public and by the contractor's equipment shall have dust abatement provisions acceptable to the public entity that has road maintenance responsibility. Compensation for water used for dust abatement and haul road maintenance shall be as specified in section 8 of this specification.

4. Earthfill, drainfill, and rockfill

Water required for proper installation of earthfill, drainfill, and/or rockfill shall be used in the fill materials as specified in the applicable construction specification(s). Compensation for construction water used for earthfill, drainfill, and/or rockfill shall be as specified in section 8 of this specification.

5. Concrete, mortar, and grout

Water required in the mixing or curing of concrete, shotcrete, roller compacted concrete, or other portland cement mortar or grout shall meet the requirements of the applicable construction specifications and shall be used in conformance with those specifications. Payment for construction water used in these items is covered by the applicable concrete, mortar, or grout specification, or a combination of these.

6. Other construction requiring water

Water required and used for other construction activities under this contract, but not specifically covered by this specification shall be considered subsidiary to the item(s) of work that requires its use.

7. Measurement and payment

Method 1—For water items for which specific unit prices are established in the contract, the volume of water furnished and used in accordance with the specifications will be measured to the nearest 1,000 gallons.

Payment for water is made at the contract unit price. Such payment will constitute full compensation for the direct costs of water. All other costs necessary for applying water are subsidiary to the items of work they are associated.

Method 2—For water items for which specific unit prices are established in the contract, the volume of water furnished and used in accordance with the specifications will be measured to the nearest 1,000 gallons.

Payment for water and the cost associated with transportation, distribution, and application is made at the contract unit price. Such payment will constitute full compensation for completion of the work.

Method 3—For water items for which specific unit prices are established in the contract, the volume of water used in accordance with the specifications will be measured to the nearest 1,000 gallons.

Payment for water is made at the contract unit price. Such payment, excluding water cost, will constitute full compensation for completion of the work.

All methods—The following provisions apply to all methods of measurement and payment:

- The measurement for payment will include all water used except as noted in sections 5, 6, and 8 of this specification. Measurement for payment will not include water that is used inappropriately or in excessive to need.
- Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 8 of this specification.

8. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. SUBSIDIARY ITEM, WATER FOR CONSTRUCTION

This item shall consist of performing the work and providing the water necessary for conforming with this specification.

1. Material and site conditions ***will likely exist where water for construction will be necessary***.

2. Payment for this item will be included under the bid items for which water for construction by the contractor is required. Items that may require water for construction by the contractor are, but not limited to: excavations, earthfills, plastic and metal pipes, corrugated plastic tubing, concrete work, clay liner (if specified).
   Note: be sure to adjust price on specific bid items to account for adding water.

Construction Specification 11—Removal of Water

1. Scope

The work consists of the removal of surface water and ground water as necessary to perform the construction required by the contract in accordance with the specifications. It shall include: (1) constructing, installing, building, and maintaining all necessary temporary water containment facilities, channels, and diversions; (2) furnishing, installing, and operating all necessary pumps, piping, and other facilities and equipment; and (3) removing all such temporary works and equipment after their intended function is no longer required.

2. Diverting surface water

The contractor shall install, maintain, and operate all cofferdams, channels, flumes, sumps, and all other temporary diversion and protective works needed to divert streamflow and other surface water through or around the construction site. Control of surface water shall be continuous during the period that damage to construction work could occur. Unless otherwise specified and/or approved, the diversion outlet shall be into the same drainageway that the water would have reached before being diverted.

The contractor shall furnish the contracting officer, in writing, a proposed plan for diverting surface water before beginning any construction activities for which a diversion is required, unless waived in section 8 of this specification. Acceptance of this plan or the waiving of the plan requirement will not relieve the contractor of the responsibilities related to this activity during the process of completing the work as specified.

3. Dewatering the construction site

Foundations, cutoff trenches, and all other parts of the construction site shall be dewatered and kept free of standing water and muddy conditions as necessary for the proper execution of the work. The contractor shall furnish, install, operate, and maintain all drains, sumps, pumps, casings, well points, and all other equipment required to properly dewater the site as specified. Dewatering systems that cause a loss of soil fines from the foundation areas will not be permitted.

The contractor shall furnish the contracting officer, in writing, a proposed plan for dewatering before commencing with any construction activity for which dewatering may be required, unless waived in section 8 of this specification. Acceptance of this plan or the waiving of the plan requirement will not relieve the contractor of the responsibilities for completing the specified work.

4. Dewatering borrow areas

The contractor shall maintain all borrow areas free of surface water or otherwise provide for timely and effective removal of surface and subsurface water that accumulates within the borrow area, unless waived in section 8 of this specification. Borrow material shall be processed as necessary to achieve proper and uniform moisture content at the time of placement.

If pumping to dewater borrow areas is included as a bid item of work in the bid schedule, each pump discharge pipe shall be equipped with a water meter. The meter shall be such that the measured quantity of water is accurate within 3 percent of the true quantity. The contractor shall provide necessary support to perform accuracy tests of the water meter when requested by the contracting officer.

5. Erosion and pollution control

Removal of water from the construction site, including the borrow areas, shall be accomplished so that erosion and the transporting of sediment and other pollutants are minimized. Dewatering activities shall be accomplished in a manner that the water table water quality is not altered. Pollution control activities shall not conflict with the requirements of Construction Specification 5, Pollution Control, if it is a part of this contract.

6. Removal of temporary works

When temporary works are no longer needed, the contractor shall remove and return the area to a condition similar to that which existed before construction. Areas where temporary works were located shall be graded for sightly appearance with no obstruction to natural surface waterflows or the proper functioning and access to the works of improvement installed. The contractor shall exercise extreme care during the removal stages to minimize the loss of soil sediment and debris that was trapped during construction.

Pipes, casings, and any other material used to dewater the site shall be removed from temporary wells. The wells shall be filled to ground level with clean gravel or other suitable material approved by the contracting officer. The contractor shall exercise extreme care to prevent pollution of the ground water by these actions.

7. Measurement and payment

Method 1—Items of work listed in the bid schedule for removal of water, diverting surface water, and dewatering construction sites and borrow areas are paid for at the contract lump sum prices. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 2—Items of work listed in the bid schedule for removal of water, diverting surface water, dewatering construction sites, and dewatering borrow areas are paid for at the contract lump sum prices. Such payment will constitute full compensation for furnishing, installing, operating, and maintaining the necessary trenches, drains, sumps, pumps, and piping and for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work. The exception is that additional payment for pumping to dewater borrow areas and the removal of water will be made as described in the following paragraph.

If pumping to dewater borrow areas is a contract bid item, payment is made at the contract unit price, which shall be the price per 1,000 gallons shown in the bid schedule. Such payment will constitute full compensation for pumping only. Compensation for equipment and preparation and for other costs associated with pumping is included in the lump sum payment for removal of water or the lump sum payment for dewatering the borrow areas. Payment is made only for pumping that is necessary to dewater borrow areas that cannot be effectively drained by gravity or that must have the water table lowered to be usable as a suitable borrow source. Pumping for other purposes will not be included for payment under this item.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the contract line item to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 8 of this specification.

8. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. SUBSIDIARY ITEM, REMOVAL OF WATER

This item shall consist of performing the work and providing the equipment necessary for conforming with this specification.

1. Material and site conditions ***will likely exist where removal of water will be necessary***.

2. A written plan for water removal will not be required.

3. Payment for this item will be included under the bid items for which removal of water by the contractor is required. Items that may require removal of water by the contractor are, but not limited to: excavation, earthfills, plastic and metal pipes, corrugated plastic tubing, concrete work, clay liner (if specified).
   Note: be sure to adjust price on specific bid items to account for removal of water.

Construction Specification 21—Excavation

1. Scope

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials.

2. Classification

Excavation is classified as common excavation, rock excavation, or unclassified excavation in accordance with the following definitions.

Common excavation is defined as the excavation of all materials that can be excavated, transported, and unloaded using heavy ripping equipment and wheel tractor-scrapers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by excavators having a rated capacity of one cubic yard or larger and equipped with attachments (shovel, bucket, backhoe, dragline, or clam shell) appropriate to the material type, character, and nature of the materials.

Rock excavation is defined as the excavation of all hard, compacted, or cemented materials that require blasting or the use of ripping and excavating equipment larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than 1 cubic yard encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material.

For the purpose of these classifications, the following definitions shall apply:

Heavy ripping equipment is a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a track type tractor having a power rating of at least 250 flywheel horsepower unless otherwise specified in section 10.

Wheel tractor-scraper is a self-loading (not elevating) and unloading scraper having a struck bowl capacity of at least 12 cubic yards.

Pusher tractor is a track type tractor having a power rating of at least 250 flywheel horsepower equipped with appropriate attachments.

Unclassified excavation is defined as the excavation of all materials encountered, including rock materials, regardless of their nature or the manner in which they are removed.

3. Blasting

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person(s) of proven experience and ability who is authorized and qualified to conduct blasting operations.

Blasting shall be done in a manner as to prevent damage to the work or unnecessary fracturing of the underlying rock materials and shall conform to any special requirements in section 10 of this specification. When specified in section 10, the contractor shall furnish the engineer, in writing, a blasting plan before blasting operations begin.

4. Use of excavated material

Method 1—To the extent they are needed, all suitable material from the specified excavations shall be used in the construction of required permanent earthfill or rockfill. The suitability of material for specific purposes is determined by the engineer. The contractor shall not waste or otherwise dispose of suitable excavated material.

Method 2—Suitable material from the specified excavations may be used in the construction of required earthfill or rockfill. The suitability of material for specific purposes is determined by the engineer.

5. Disposal of waste materials

Method 1—All surplus or unsuitable excavated materials are designated as waste and shall be disposed of at the locations shown on the drawings.

Method 2—All surplus or unsuitable excavated materials are designated as waste and shall be disposed of by the contractor at sites of his own choosing away from the site of the work. The disposal shall be in an environmentally acceptable manner that does not violate local rules and regulations.

6. Excavation limits

Excavations shall comply with OSHA Construction Industry Standards (29CFR Part 1926) Subpart P, Excavations, Trenching, and Shoring. All excavations shall be completed and maintained in a safe and stable condition throughout the total construction phase. Structure and trench excavations shall be completed to the specified elevations and to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work. Excavations outside the lines and limits shown on the drawings or specified herein required to meet safety requirements shall be the responsibility of the contractor in constructing and maintaining a safe and stable excavation.

7. Borrow excavation

When the quantities of suitable material obtained from specified excavations are insufficient to construct the specified earthfills and earth backfills, additional material shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as specified in section 10 or as approved by the engineer.

Borrow pits shall be excavated and finally dressed to blend with the existing topography and sloped to prevent ponding and to provide drainage.

8. Overexcavation

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete made of materials and mix proportions approved by the engineer. Concrete that will be exposed to the atmosphere when construction is completed shall meet the requirements of concrete selected for use under Construction Specification 31, Concrete for Major Structures, or 32, Structure Concrete, as appropriate.

Concrete that will be permanently covered shall contain not less than five bags of cement per cubic yard. The concrete shall be placed and cured as specified by the engineer.

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved, compacted earthfill. The exception to this is that if the earth is to become the subgrade for riprap, rockfill, sand or gravel bedding, or drainfill, the voids may be filled with material conforming to the specifications for the riprap, rockfill, bedding, or drainfill. Before correcting an overexcavation condition, the contractor shall review the planned corrective action with the engineer and obtain approval of the corrective measures.

9. Measurement and payment

For items of work for which specific unit prices are established in the contract, the volume of each type and class of excavation within the specified pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas or by methods outlined in section 10 of this specification. Regardless of quantities excavated, the measurement for payment is made to the specified pay limits except that excavation outside the specified lines and grades directed by the engineer to remove unsuitable material is included. Excavation required

because unsuitable conditions result from the contractor's improper construction operations, as determined by the engineer, is not included for measurement and payment.

Method 1—The pay limits shall be as designated on the drawings.

Method 2—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.

b. The lower and lateral limits shall be the neat lines and grades shown on the drawings.

Method 3—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.

b. The lower and lateral limits shall be the true surface of the completed excavation as directed by the engineer.

Method 4—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.

b. The lower limit shall be at the bottom surface of the proposed structure.

c. The lateral limits shall be 18 inches outside of the outside surface of the proposed structure or shall be vertical planes 18 inches outside of and parallel to the footings, whichever gives the larger pay quantity, except as provided in d below.

d. For trapezoidal channel linings or similar structures that are to be supported upon the sides of the excavation without intervening forms, the lateral limits shall be at the underside of the proposed lining or structure.

e. For the purposes of the definitions in b, c, and d, above, any specified bedding or drainfill directly beneath or beside the structure will be considered to be a part of the structure.

All methods—The following provisions apply to all methods of measurement and payment.

Payment for each type and class of excavation is made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work except that extra payment for backfilling overexcavation will be made in accordance with the following provisions.

Payment for backfilling overexcavation, as specified in section 8 of this specification, is made only if the excavation outside specified lines and grades is directed by the engineer to remove unsuitable material and if the unsuitable condition is not a result of the contractor's improper construction operations as determined by the engineer.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 10 of this specification.

10. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. BID ITEM 7, EXCAVATION -Topsoil Stripping

This item shall consist of the work and materials necessary to strip and stockpile topsoil. These shall be excavated to the lines, grades, elevations, and locations shown on drawings and as described in this specification. **Final elevation tolerances are +/- 0.1'. Contractor shall have the equipment and ability to transfer elevations from construction stakes and blue tops.**

1. In section 2, Classification, *Common excavation* shall apply.

2. In section 4, Use of excavated material, Method 1 shall apply.

3. In section 5, Disposal of waste materials, Method 1 shall apply.

4. All topsoil and organic materials shall be stripped from the graded site area, diversion and pond dike areas, borrow areas, and along the access road areas shown on sheet 2 of drawings and stockpiled adjacent to these areas.

5. Items subsidiary to this Bid item are:
   Clearing & Grubbing, Construction Specification 2
   Pollution Control, Construction Specification 5
   Construction Surveys, Construction Specification 7
   Mobilization & Demobilization, Construction Specification 8
   Water for Construction, Construction Specification 10
   Removal of Water, Construction Specification 11
   Earthfill -Dikes, Sub-grades, Backfills, Construction Specification 23

6. All excavations shall have a workmanlike finish (i.e. smoothed and graded with proper equipment).

7. Suitable topsoil material shall be used for topsoiling as described in **Bid Item 9, Topsoiling.**

8. Any existing waterlines or tiles uncovered and/or damaged shall be repaired and reburied to original condition or better.

9. In section 9, Measurement and payment, Method 3 shall apply.

B. <u>BID ITEM 8, EXCAVATION -pond, structures, roads, and diversion ditches</u>

This item shall consist of the work and materials necessary to; excavate the borrow area, excavate diversion ditches, **excavate staff gauge hole**, over-excavate for clay liner, and excavate structure (solid separator) areas. These areas shall be excavated to the lines, grades, elevations, and locations shown on drawings and as described in this specification. **Final elevation tolerances are +/- 0.1'. Contractor shall have the equipment and ability to transfer elevations from construction stakes and blue tops.**

1. In section 2, Classification, *Common excavation* shall apply.

2. In section 4, Use of excavated material, Method 1 shall apply.

3. In section 5, Disposal of waste materials, Method 1 shall apply.

4. All excavations shall have a workmanlike finish (i.e. smoothed and graded with proper equipment).

5. Suitable excavated material shall be used for needed fills and backfills as described in **Subsidiary Item, <u>Earthfill</u> -Dikes, sub-grades, and backfilling.**

6. Items subsidiary to this Bid item are:
   Earthfill -Dikes, Sub-grades, Backfills, Construction Specification 23;
   Pollution Control, Construction Specification 5
   Construction Surveys, Construction Specification 7;
   Mobilization & Demobilization, Construction Specification 8
   Water for Construction, Construction Specification 10;
   Removal of Water, Construction Specification 11

7. Borrow areas shall be as noted on drawings. These areas shall be regraded and be free draining after fill is borrowed. Disposal area shall be areas adjacent to existing lot areas.

8. Any existing waterlines or tiles uncovered and/or damaged shall be repaired and reburied to original condition or better.

9. ***Any sand and/or gravel areas found in the pond bottom or side-slope areas shall be over-excavated 2 feet and filled with compacted CL (clay) material from on-site excavations as directed by the engineer or his/her designated representative. Measurement and payment will be as described in No. 10 below. <u>If a clay liner is specified then disregard this statement.</u>***

10. In section 9, Measurement and payment, Method 3 shall apply.

Construction Specification 23—Earthfill

1. Scope

The work consists of the construction of earth embankments, other earthfills, and earth backfills required by the drawings and specifications.

Earthfill is composed of natural earth materials that can be placed and compacted by construction equipment operated in a conventional manner.

Earth backfill is composed of natural earth material placed and compacted in confined spaces or adjacent to structures (including pipes) by hand tamping, manually directed power tampers or vibrating plates, or their equivalent.

2. Material

All fill material shall be obtained from required excavations and designated borrow areas. The selection, blending, routing, and disposition of material in the various fills shall be subject to approval by the engineer.

Fill materials shall contain no frozen soil, sod, brush, roots, or other perishable material. Rock particles larger than the maximum size specified for each type of fill shall be removed prior to compaction of the fill.

The types of material used in the various fills shall be as listed and described in the specifications and drawings.

3. Foundation preparation

Foundations for earthfill shall be stripped to remove vegetation and other unsuitable material or shall be excavated as specified.

Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the earthfill, and the surface material of the foundation shall be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of 2 inches in depth normal to the slope and shall be at such a moisture content that the earthfill can be compacted against them to produce a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose material by hand or other effective means and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earthfill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

Foundation and abutment surfaces shall be no steeper than one horizontal to one vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earthfill conforming to the specifications for the earthfill to be placed upon the foundation.

4. Placement

Earthfill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the engineer. Earthfill shall not be placed upon a frozen surface nor shall snow, ice, or frozen material be incorporated in the earthfill matrix.

Earthfill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified in section 10 or shown on the drawings. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted.

Hand compacted earth backfill shall be placed in layers whose thickness before compaction does not exceed the maximum thickness specified for layers of earth backfill compacted by manually directed power tampers.

Earth backfill shall be placed in a manner that prevents damage to the structures and allows the structures to assume the loads from the earth backfill gradually and uniformly. The height of the earth backfill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure.

Earthfill and earth backfill in dams, levees, and other structures designed to restrain the movement of water shall be placed to meet the following additional requirements:

(a) The distribution of materials throughout each zone shall be essentially uniform, and the earthfill shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture, moisture content, or gradation from the surrounding material. Zone earthfills shall be constructed concurrently unless otherwise specified.

(b) If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.

(c) The top surface of embankments shall be maintained approximately level during construction with two exceptions: A crown or cross-slope of about 2 percent shall be maintained to ensure effective drainage, or as otherwise specified for drainfill or sectional zones.

(d) Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of streamflow during construction are specifically authorized in the contract.

(e) Embankments built at different levels as described under (c) or (d) above shall be constructed so that the slope of the bonding surfaces between embankment in place and embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all material not meeting the requirements of this specification and shall be scarified, moistened, and recompacted when the new earthfill is placed against it. This ensures a good bond with the new earthfill and obtains the specified moisture content and density at the contact of the inplace and new earthfills.

5. Control of moisture content

During placement and compaction of earthfill and earth backfill, the moisture content of the material being placed shall be maintained within the specified range.

The application of water to the earthfill material shall be accomplished at the borrow areas insofar as

practicable. Water may be applied by sprinkling the material after placement on the earthfill, if necessary. Uniform moisture distribution shall be obtained by disking.

Material that is too wet when deposited on the earthfill shall either be removed or be dried to the specified moisture content prior to compaction.

If the top surface of the preceding layer of compacted earthfill or a foundation or abutment surface in the zone of contact with the earthfill becomes too dry to permit suitable bond, it shall either be removed or scarified and moistened by sprinkling to an acceptable moisture content before placement of the next layer of earthfill.

6. Compaction

Earthfill—Earthfill shall be compacted according to the following requirements for the class of compaction specified:

> ***Class A compaction***—Each layer of earthfill shall be compacted as necessary to provide the density of the earthfill matrix not less than the minimum density specified in Section 10 or identified on the drawings. The earthfill matrix is defined as the portion of the earthfill material finer than the maximum particle size used in the compaction test method specified.
>
> ***Class B compaction***—Each layer of earthfill shall be compacted to a mass density not less than the minimum density specified.
>
> ***Class C compaction***—Each layer of earthfill shall be compacted by the specified number of passes of the type and weight of roller or other equipment specified or by an approved equivalent method. Each pass shall consist of at least one passage of the roller wheel or drum over the entire surface of the layer.

Earth backfill—Earth backfill adjacent to structures shall be compacted to a density equivalent to that of the surrounding inplace earth material or adjacent required earthfill or earth backfill. Compaction shall be accomplished by hand tamping or manually directed power tampers, plate vibrators, walk-behind, miniature, or self-propelled rollers. Unless otherwise specified heavy equipment including backhoe mounted power tampers or vibrating compactors and manually directed vibrating rollers shall not be operated within 2 feet of any structure. Towed or self-propelled vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist is not permitted.

The passage of heavy equipment will not be allowed:

- Over cast-in-place conduits within 14-days after placement of the concrete
- Over cradled or bedded precast conduits within 7 days after placement of the concrete cradle or bedding
- Over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or 2 feet, whichever is greater, except as may be specified in section 10.

Compacting of earth backfill adjacent to structures shall not be started until the concrete has attained the strength specified in section 10 for this purpose. The strength is determined by compression testing of test cylinders cast by the contractor's quality control personnel for this purpose and cured at the work site in the manner specified in ASTM C 31 for determining when a structure may be put into service.

When the required strength of the concrete is not specified as described above, compaction of earth backfill

adjacent to structures shall not be started until the following time intervals have elapsed after placement of the concrete.

Structure	Time interval (days)
Vertical or near-vertical walls with earth loading on one side only	14
Walls backfilled on both sides simultaneously	7
Conduits and spillway risers, cast-in-place (with inside forms in place)	7
Conduits and spillway risers, cast-in-place (inside forms removed)	14
Conduits, pre-cast, cradled	2
Conduits, pre-cast, bedded	1
Cantilever outlet bents (backfilled both sides simultaneously)	3

7. Reworking or removal and replacement of defective earthfill

Earthfill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced by acceptable earthfill. The replacement earthfill and the foundation, abutment, and earthfill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control, and compaction.

8. Testing

During the course of the work, the engineer will perform quality assurance tests required to identify material; determine compaction characteristics; determine moisture content; and determine density of earthfill in place. Tests performed by the engineer will be used to verify that the earthfills conform to contract requirements of the specifications and not as a replacement for the contractor's quality control program.

Densities of earthfill requiring Class A compaction will be determined in accordance with ASTM D 1556, D 2167, D 2922, or D 2937 except that the volume and moist weight of included rock particles larger than those used in the compaction test method specified for the type of fill will be determined and deducted from the volume and moist weight of the total sample before computation of density or, if using the nuclear gauge, added to the specified density to bring it to the measure of equivalent composition for comparison (See ASTM D 4718). The density so computed is used to determine the percent compaction of the earthfill matrix. Unless otherwise specified, moisture content is determined by one of the following methods: ASTM D 2216, D 3017, D 4643, D 4944, or D 4959.

9. Measurement and payment

For items of work for which specific unit prices are established in the contract, the volume of each type and compaction class of earthfill and earth backfill within the specified zone boundaries and pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified in section 10, no deduction in volume is made for embedded items, such as, but not limited to, conduits, inlet structures, outlet structures, embankment drains, sand diaphragm and outlet, and their appurtenances.

The pay limits shall be as defined below, with the further provision that earthfill required to fill voids resulting from overexcavation of the foundation, outside the specified lines and grades, will be included in the measurement for payment only under the following conditions:

- Where such overexcavation is directed by the engineer to remove unsuitable material, and
- Where the unsuitable condition is not a result of the contractor's improper construction operations as determined by the engineer.

Earthfill beyond the specified lines and grades to backfill excavation required for compliance with OSHA requirements will be considered subsidiary to the earthfill bid item(s).

Method 1—The pay limits shall be as designated on the drawings.

Method 2—The pay limits shall be the measured surface of the foundation when approved for placement of the earthfill and the specified neat lines of the earthfill surface.

Method 3—The pay limits shall be the measured surface of the foundation when approved for placement of the earthfill and the measured surface of the completed earthfill.

Method 4—The pay limits shall be the specified pay limits for excavation and the specified neat lines of the earthfill surface.

Method 5—The pay limits shall be the specified pay limits for excavation and the measured surface of the completed earthfill.

Method 6—Payment for each type and compaction class of earthfill and earth backfill is made at the contract unit price for that type and compaction class of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work.

Method 7—Payment for each type and compaction class of earthfill and earth backfill is made at the contract unit price for that type and compaction class of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work except furnishing, transporting, and applying water to the foundation and earthfill material. Water applied to the foundation and earthfill material is measured and payment made as specified in Construction Specification 10.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 10 of this specification.

10. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. SUBSIDIARY ITEM , EARTHFILL -DIKES, SUB-GRADES, AND BACKFILLS

This item shall consist of the work and materials necessary to; construct the pond dikes, construct diversion dikes, construct access road(s) and heavy use concrete pad sub-grade areas, backfill concrete walls, concrete pads and gravel fill areas, grade lots to drain to solid separators, and fill areas noted on drawings. These shall be constructed to the lines, grades, elevations, and locations shown on drawings and as described in this specification. **Final elevation tolerances are +/- 0.1'. Contractor shall have the equipment and ability to transfer elevations from construction stakes and blue tops.**

1. All earthfills shall have a workmanlike finish (i.e. smoothed and graded with proper equipment).

2. Material for earthfills shall come from excavation of pond and ditches; refer to **Bid Items 7 & 8, Excavation**.

3. Compaction shall be Class C for dikes, sub-grades and fill areas. Compaction of earthfill shall be accomplished by a minimum of two passes over entire lift thickness with machine track or wheel. Lift thickness shall be 6 inches. In subgrade fill areas each lift shall also be leveled prior to machine compaction to insure uniform compaction.

4. Excess excavated material (if any) not used for backfill or fill shall be used to construct mounds in lot areas and also used to fill and grade lot areas. Mounds shall be constructed with 8:1 side slopes or flatter and shall have a smooth and uniform appearance when completed. ***This area shall be free draining after grading.***

5. Stockpiled topsoil materials shall be redistributed over areas to be seeded. Refer to Specification 26.

6. The moisture content of the fill material shall be maintained within the limits required to:

    - Prevent bulking or dilatence of the material under the action of hauling or compacting equipment.
    - Prevent the adherence of the fill material to the treads and tracks of the equipment.
    - Insure the crushing and blending of the soil clods and aggregation into a homogenous mass. Soils shall possess sufficient moisture to form a ball, which deforms plastically without cracking when kneaded by hand.

7. No payment will be made for this item. Compensation will be considered as included in the payment for **Bid Item 7 & 8, Excavation.**

B. BID ITEM 10, EARTHFILL -GRAVEL FILL FOR ACCESS ROADS

This item shall consist of performing the work necessary to supply and place gravel for the access road (s) and other specified areas (e.g. dikes) to the locations, dimensions, and grades shown on drawings. **Final elevation tolerances are +/- 0.1'. Contractor shall have the equipment and ability to transfer elevations from construction stakes and blue tops.**

1. All gravel earthfills shall have a workmanlike finish (i.e. smoothed and graded with proper equipment).

2. The gravel materials, noted in drawings, for construction of access roads shall:
   a. have a uniform range of sizes, with no more than 15% passing the No. 200 sieve and stones no larger than 2".
   b. be compacted in 6" lifts by 2 passes over entire surface with a vibratory roller or rubber tire type compactor.
   c. be leveled and graded with a road grader.

3. All organic material and topsoil shall be removed prior to areas with fill as shown on drawings and replaced with compacted mineral earthfill. These areas shall be graded, roller compacted, and smoothed prior to geotextile and fill placement. These areas shall be brought up to top of subgrade in low lying areas with earthfill material (mineral soils; not topsoil or organic materials). **Payment for this subgrade preparation shall be made under Bid Item 7, Excavation - topsoil stripping.**

4. Gravel material shall be underlain with a woven geotextile (except under concrete areas). Refer to Construction Specification 95, Geotextile for requirements and payment for geotextile.

5. The access road shall be shaped as shown on drawings.

6. Items subsidiary to this Bid item are:
   Pollution Control, Construction Specification 5
   Construction Surveys, Construction Specification 7
   Mobilization & Demobilization, Construction Specification 8
   Water for Construction, Construction Specification 10
   Removal of Water, Construction Specification 11

7. In section 9, Measurement and payment, Method 2 and Method 6 shall apply.

C. BID ITEM 11, EARTHFILL -DRAINFILL FOR CONCRETE AREAS

This item shall consist of performing the work necessary to supply drainfill for concrete areas to the locations, dimensions, and grades shown on drawings. **Final elevation tolerances are +/- 0.1'. Contractor shall have the equipment and ability to transfer elevations from construction stakes and blue tops.**

1. All drainfills shall have a workmanlike finish (i.e. smoothed and graded with proper equipment).

2. Drainfill shall be clean, well graded gravel or sand with stones no larger than 1" and shall have no more than 12% fines passing the No. 200 sieve.

3. All organic material and topsoil shall be removed from areas with fill as shown on drawings, and replaced with compacted mineral earthfill. These areas shall be graded, roller compacted, and smoothed prior to geotextile and fill placement. These areas shall be brought up to top of subgrade in low lying areas with earthfill material (mineral soils; not topsoil or organic materials). **Payment for this subgrade preparation shall be made under Bid Item 7, Excavation - topsoil stripping.**

4. **Delivery of the drainfill described above shall be paid for under this Bid Item. Drainfill shall be delivered to the heavy use concrete pad areas and solid separator foundation areas as directed by the engineer or his/her representative. Placement of drainfill will be paid for under *Bid Item 13*, Structure Concrete.**

5. Items subsidiary to this Bid item are:

   Pollution Control, Construction Specification 5
   Construction Surveys, Construction Specification 7
   Mobilization & Demobilization, Construction Specification 8
   Water for Construction, Construction Specification 10
   Removal of Water, Construction Specification 11

6. In section 9, Measurement and payment, Method 2 and Method 6 shall apply.

Construction Specification 26—Topsoiling

1. Scope

The work consists of furnishing and spreading topsoil to specified depths at locations shown on the drawings.

2. Quality of topsoil

Topsoil shall consist of friable surface soil reasonably free of grass, roots, weeds, sticks, rocks, or other unsuitable material. Additional quality requirements, if any, are in section 7 of this specification.

3. Furnishing

Method 1—Topsoil shall be salvaged from designated earth surfaces that will be disturbed by construction activities. After designated sites have been cleared and grubbed, the topsoil shall be removed from the designated areas and stockpiled at locations shown on the drawings or acceptable to the engineer. Unsuitable material encountered during removal of topsoil shall be disposed of at locations shown on the drawings or approved by the engineer, or it will be otherwise hauled and disposed of at locations removed from the construction site. The contractor is responsible for complying with all local rules and regulations and the payment of any and all fees that may result from the disposal at locations outside the construction work limits.

Method 2—Topsoil shall be furnished from an offsite source designated by the contractor. The engineer shall be granted access to the source for inspection and acceptance before delivery to the site. Test results and samples shall be provided when specified in section 7 of this specification.

4. Stockpiling

Stockpiles of topsoil shall not conflict with the requirements of Construction Specification 5, Pollution Control, when made a part of this contract.

5. Spreading

Method 1—Spreading shall not be conducted when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to uniform spreading operations. Surfaces designated to receive a topsoil application shall be lightly scarified just before the spreading operation.

Following the spreading operation, the topsoil surface shall be left reasonably smooth and without ruts or surface irregularities that could contribute to concentrated waterflow downslope.

Method 2—Spreading shall not be performed when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to uniform spreading operations. Surfaces designated to receive a topsoil application shall be lightly scarified just before the spreading operation. Where compacted earthfills are designated to be topsoiled, the topsoil shall be placed concurrently with the earthfill and shall be bonded to the compacted fill with the compacting equipment.

Following the spreading operation, the topsoil surface shall be left reasonably smooth and without ruts or surface irregularities that could contribute to concentrated waterflow downslope.

6. Measurement and payment

Method 1—The total surface covered by topsoil is measured and the area(s) computed to the nearest

square yard. Payment for furnishing and placing topsoil is made at the contract unit price.

Method 2—The total surface covered by topsoil, except the surface area of embankments, levees, dikes, and other earthfills not included for payment, is measured and the area(s) computed to the nearest square yard.

Payment for topsoil spread on the surface of embankments, levees, dikes, and other earthfills is included in the measurement and payment for that item of earthfill where topsoil application occurred.

Method 3—For items of work for which specific unit prices are established in the contract, the volume of topsoil furnished and spread is computed to the nearest cubic yard by the method of average cross-sectional end areas from surveys of the excavated topsoil stockpile or, if not stockpiled, cross-sectional surveys of the borrow area(s). Payment for furnishing and spreading topsoil is made at the contract unit price.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 7 of this specification.

All payment methods—Payment will constitute full compensation for all labor, equipment, material, and all other items necessary and incidental to the completion of the work. This includes excavating, stockpiling, hauling, spreading, and the wasting of unsuitable excavated material.

7. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. BID ITEM 9, TOPSOILING

This item shall consist of the work and materials necessary to place topsoil in areas to be seeded as described in this specification.

1. In section 3, Furnishing, Method 1 shall apply.

2. In section 5, Spreading, Method 2 shall apply.

3. All areas disturbed by construction operations with the exception of graded lot areas, mounds and pond in-slopes and bottoms, which do **not** need topsoiling.

4. Topsoil depth shall be 6" minimum.

5. Excess topsoil shall be placed in diversions dikes and/or mounds (if required).

6. In section 6, Measurement and payment, Method 1 shall apply.

Construction Specification 32—Structure Concrete

1. Scope

The work shall consist of furnishing, forming, placing, finishing, and curing portland cement concrete as required to build the structures described in section 24 of this specification.

2. Material

Aggregates shall conform to the requirements of Material Specification 522, Aggregates for Portland Cement Concrete, unless otherwise specified. The grading of coarse aggregates shall be as specified in section 24.

Portland cement shall conform to the requirements of Material Specification 531, Portland Cement, for the specified type.

Fly ash shall conform to the requirements of Material Specification 532, Mineral Admixtures for Concrete.

Air-entraining admixtures shall conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete. If air-entraining cement is used, any additional air-entraining admixture shall be of the same type as that in the cement.

Water reducing and/or retarding admixtures shall conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete.

Curing compound shall conform to the requirements of Material Specification 534, Concrete Curing Compound.

Preformed expansion joint filler shall conform to the requirements of Material Specification 535, Preformed Expansion Joint Filler.

Waterstops shall conform to the requirements of Material Specifications 537, Nonmetallic Waterstops, and 538, Metal Waterstops, for the specified kinds.

Water used in mixing and curing concrete shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter, or other deleterious substances.

3. Class of concrete

Concrete for structure concrete shall be classified as follows:

Class of concrete	Maximum net water content (gal/bag)	Minimum cement content (bags/yd^3)
3000M	6	5.5
4000M	6	6

4. Air content and consistency

Unless otherwise specified, the slump shall be 3 to 5 inches. If air entrainment is specified, the air content, by volume, shall be 4 to 7 percent of the volume of the concrete. When specified, directed, or approved by the

engineer, a water-reducing, set-retarding, or other admixture shall be used. High range, water reducing agents (superplasticizers) may be used to increase workability, reduce water content, and control concrete temperature in hot weather. The maximum slump after adding high range water reducing agents shall be 7.5 inches.

5. Design of the concrete mix

The proportions of the aggregates shall be such as to produce a concrete mixture that works readily into the corners and angles of the forms and around reinforcement when consolidated, but does not segregate or exude free water during consolidation.

Fly ash may be used as a partial substitution for portland cement in an amount of no more than 25 percent (by weight) of the cement in the concrete mix, unless otherwise specified.

Before the concrete is placed, the contractor shall furnish the contracting officer, for approval, a statement of the materials and mix proportions (including admixtures, if any) intended for use. The statement shall include evidence satisfactory to the contracting officer that the materials and proportions will produce concrete conforming to this specification. The materials and proportions so stated shall constitute the "job mix." After a job mix has been approved, neither the source, character, or grading of the aggregates nor the type or brand of cement or admixture shall be changed without prior notice to the contracting officer. If such changes are necessary, no concrete containing such new or altered material shall be placed until the contracting officer has approved a revised job mix.

6. Inspection and testing

The engineer shall have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for the engineer to inspect materials, equipment, and processes and to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with manufacture and delivery of the concrete.

7. Handling and measurement of material

Materials shall be stockpiled and batched by methods that prevent segregation or contamination of aggregates and ensure accurate proportioning of the ingredients of the mix. Except as otherwise provided in section 8, cement and aggregates shall be measured as follows:

Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weight. The batch weight of each aggregate shall be the required saturated, surface-dry weight plus the weight of surface moisture it contains.

Water shall be measured, by volume or by weight, to an accuracy within 1 percent of the total quantity of water required for the batch.

Admixtures shall be measured within a limit of accuracy of 3 percent.

8. Mixers and mixing

Concrete shall be uniform and thoroughly mixed when delivered to the work site. Variations in slump of more than 1 inch within a batch are considered evidence of inadequate mixing and shall be corrected by increasing mixing time or other acceptable alternative.

For stationary mixers, the mixing time after all cement and aggregates are in the mixer drum shall be not less than 1.5 minutes. When concrete is mixed in a truck mixer, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 nor more than 100.

Unless otherwise specified, volumetric batching and continuous mixing at the construction site are permitted. To produce concrete meeting the specified proportioning and uniformity requirements, the batching and mixing equipment shall conform to the requirements of ASTM Specification C 685 and shall be demonstrated by tests with the job mix before the concrete is placed. Concrete made by this method shall be produced, inspected, and certified in conformance with sections 6, 7, 8, 13, and 14 of ASTM Specification C 685.

No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery point.

9. Forms

Forms shall be of wood, plywood, steel, or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags, or other irregularities. Forms shall be coated with a nonstaining form release agent before being set into place.

Metal ties or anchorages within the forms shall be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least 1 inch without injury to the concrete. Ties designed to break off below the surface of the concrete shall not be used without cones.

All edges that will be exposed to view when the structure is completed shall be chamfered, unless finished with molding tools as specified in Section 18.

10. Preparation of forms and subgrade

Prior to placement of concrete, the forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings and the temperature of all surfaces to be in contact with the new concrete shall be not be less than 40 degrees Fahrenheit. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed. Rock surfaces shall be cleaned by air-water cutting, wet sandblasting, or wire brush scrubbing, as necessary, and shall be wetted immediately before placement of concrete. The earth surface shall be firm and damp. Placement of concrete on mud, dried earth, or uncompacted fill or frozen subgrade is not permitted.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly.

Weepholes in walls or slabs shall be formed with nonferrous material.

11. Conveying

Concrete shall be delivered to the site and discharged into the forms within 1-1/2 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.

The engineer may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the

mixer to the forms as rapidly as practicable by methods that prevent segregation of the aggregates and assure no loss of mortar occurs.

12. Placing

Concrete shall not be placed until the subgrade, forms, steel reinforcement, and embedded items have been inspected and approved. No concrete shall be placed except in the presence of the engineer. The contractor shall give reasonable notice to the engineer each time concrete is to be placed. Such notice shall provide sufficient time for the engineer to inspect the subgrade, forms, steel reinforcement, and other preparations for compliance with the specifications. Other preparations include, but are not limited to, the concrete mixing plant; delivery equipment system; placing, finishing, and curing equipment and system; schedule of work; workforce; and heating or cooling facilities, if applicable. Deficiencies are to be corrected before concrete is delivered for placing.

The concrete shall be deposited as closely as possible to its final position in the forms. It shall be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates or excessive laitance. Formed concrete shall be placed in horizontal layers not more than 20 inches thick. Concrete shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation. When high range water reducing agents are used, the concrete shall not be allowed to drop more than 10 feet. Hoppers and chutes, pipes, or "elephant trunks" shall be used as necessary to prevent segregation and the splashing of mortar on the forms and reinforcing steel above the layer being placed.

Immediately after the concrete is placed in the forms, it shall be consolidated by spading, hand tamping, or vibration as necessary to ensure a smooth surface and dense concrete. Each layer shall be consolidated to ensure monolithic bond with the preceding layer. If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when spaded or vibrated, the contractor shall discontinue placing concrete and shall make a construction joint according to the procedure specified in section 13.

If placing is discontinued when an incomplete horizontal layer is in place, the unfinished end of the layer shall be formed by a vertical bulkhead.

13. Construction joints

Construction joints shall be made at the locations shown on the drawings. If construction joints are needed that are not shown on the drawings, they shall be placed in locations approved by the engineer.

Where a feather edge would be produced at a construction joint, as in the top surface of a sloping wall, an insert form shall be used so that the resulting edge thickness on either side of the joint is not less than 6 inches.

In walls and columns, as each lift is completed, the top surface shall be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be retightened. New concrete shall not be placed until the hardened concrete has cured at least 12 hours.

The surface of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings, or debris by washing and scrubbing with a wire brush or wire broom or by other means approved by the engineer. The surface shall be kept moist for at least 1 hour before the new concrete is placed.

14. Expansion and contraction joints

Expansion and contraction joints shall be made only at locations shown on the drawings.

Exposed concrete edges at expansion and contraction joints shall be carefully tooled or chamfered, and the joints shall be free of mortar and concrete. Joint filler shall be left exposed for its full length with clean and true edges.

Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed.

When open joints are specified, they shall be constructed by the insertion and subsequent removal of a wooden strip, metal plate, or other suitable template in such a manner that the corners of the concrete are not chipped or broken. The edges of open joints shall be finished with an edging tool before the joint strips are removed.

15. Waterstops

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in metal waterstops shall be soldered, brazed, or welded. Joints in rubber or plastic waterstops shall be cemented, welded, or vulcanized as recommended by the manufacturer.

16. Removal of forms

Forms shall not be removed without the approval of the engineer. Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that permits the concrete to take the stresses of its own weight uniformly and gradually.

17. Finishing formed surfaces

Immediately after the forms are removed:

a. All fins and irregular projections shall be removed from exposed surfaces.

b. The holes produced on all surfaces by the removal of form ties, cone-bolts, and she-bolts shall be cleaned, wetted, and filled with a dry-pack mortar. The mortar will consist of one part portland cement, three parts sand that will pass a No. 16 sieve, and just sufficient water to produce a consistency such that the filling is at the point of becoming rubbery when the material is solidly packed.

18. Finishing unformed surfaces

All exposed surfaces of the concrete shall be accurately screeded to grade and then float finished, unless specified otherwise.

Excessive floating or troweling of surfaces while the concrete is soft is not permitted.

Adding dry cement or water to the surface of the screeded concrete to expedite finishing is not allowed.

Joints and edges on unformed surfaces that will be exposed to view shall be chamfered or finished with molding tools.

19. Curing

Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period, or until curing compound is applied as specified below. Moisture shall be maintained by sprinkling, flooding, or fog spraying, or by covering with continuously moistened canvas, cloth mats, straw, sand, or other approved material. Wood forms left in place during the curing period shall be kept continuously wet. A formed surface shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be

applied in such a way that the concrete surface is not eroded or otherwise damaged.

Concrete, except at construction joints, may be coated with the approved curing compound instead of continued application of moisture, except as otherwise specified in section 24. The compound shall be sprayed on the moist concrete surface as soon as free water has disappeared, but shall not be applied to any surface until patching, repairs, and finishing of that surface are completed. The compound shall be applied at a uniform rate of not less than 1 gallon per 175 square feet of surface and shall form a continuous adherent membrane over the entire surface. Curing compound shall be thoroughly mixed before applying and continuously agitated during application. Curing compound shall not be applied to a surface requiring bond to subsequently placed concrete, such as construction joints, shear plates, reinforcing steel, and other embedded items. If the membrane is damaged during the curing period, the damaged area shall be resprayed at the rate of application specified above. Any surface covered by the membrane shall not be trafficked unless protected from wear.

20. Removal and replacement or repair

When concrete is honeycombed, damaged, or otherwise defective, the contractor shall remove and replace the structure or structural member containing the defective concrete or, where feasible, correct or repair the defective parts. The contracting officer determines the required extent of removal, replacement, or repair. Before starting repair work, the contractor shall obtain the contracting officer's approval of the plan for repairs. The contractor shall perform all repair work in the presence of the engineer.

21. Concreting in cold weather

Concrete shall not be mixed nor placed when the daily minimum atmospheric temperature is less than 40 degrees Fahrenheit unless facilities are provided to prevent the concrete from freezing. The use of accelerators or antifreeze compounds is not allowed.

22. Concreting in hot weather

The contractor shall apply effective means to maintain the temperature of the concrete below 90 degrees Fahrenheit during mixing, conveying, and placing.

23. Measurement and payment

For items of work for which specific unit prices are established in the contract, concrete is measured to the neat lines shown on the drawings and the volume of concrete is computed to the nearest 0.1 cubic yard. Measurement of concrete placed against the sides of an excavation without using intervening forms is made only to the neatness or pay limits shown on the drawings. No deduction in volume is made for chamfers, rounded or beveled edges, or for any void or embedded item that is less than 5 cubic feet in volume.

Payment for each item of structure concrete is made at the contract unit price or the contract lump sum; whichever is applicable for that item. Such payment constitutes full compensation for all labor, material, equipment, transportation, tools, forms, falsework, bracing, and all other items necessary and incidental to the completion of the work except items listed for payment elsewhere in the contract. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 24 of this specification.

24. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. BID ITEM 13, STRUCTURE CONCRETE

This item shall consist of placing the drainfill, and furnishing and placing concrete and steel reinforcement to construct the heavy use concrete pads, curbs, walls, footings, head walls, and solid separators. These items shall be placed in the locations and to the elevations, depths and grades shown on the drawings. This item also includes the work necessary to install the 3" steel pipe posts (and posts in freestall barn) to the locations and depths shown on drawings.

1. **Steel pipe posts shall be paid for and supplied under Bid Item 14, Fence.** Posts shall be embedded at the locations and to the depths shown on drawings. Pipes shall be plumb and aligned. When concrete surrounding post has hardened sufficiently, each pipe shall be filled to the top with concrete or a sand mortar mix.

2. Portland cement shall be Type II or IIA. Type I with 20 % fly-ash may be used with prior approval of engineer and if the strength of the design mix is not compromised. Air entrainment shall be added and in accordance with material specification 533.

3. Concrete shall be Class 4000M (6 bag/cy) and shall have a minimum 28 day, in the field, compressive strength of 3000 psi. Test cylinders will be cast, field cured and submitted for testing by the engineer or his/her representative to insure that concrete conforms with minimum strength requirements. ***Concrete may also be tested by way of petro-graphic analysis to insure that a Class 4000M (6 bag/cy) is delivered.*** Concrete testing under 3000 psi will not be certified and the supplier will incur costs for replacing defective concrete.

4. Coarse aggregate shall conform to ASTM C 33 size designation number 67.

5. Solid separator components (pad & walls) shall meet or exceed the following specifications:

   a. Concrete shall be placed as specified in this specification and as shown on drawings.

   b. Solid separator pipe and fittings shall be as described in specification 44. **Payment for pipe, fittings and installation will be included under Bid Item 5.**

   c. Pipe fitting shall be cast in wall at the locations shown on drawings and as described in drawings.

   d. Landowner will be responsible for screen materials, construction and installation.

6. An approved set retarder shall be added to the concrete mix if concrete is poured between May 15 and September 15. Set retarder requirement may be waived with prior approval of engineer.

7. Drainfill bedding shall be clean, well graded gravel or sand with no stones larger than 1" and shall have no more than 12% fines passing the No. 200 sieve. Drainfill shall be compacted by two passes over a 4" lift with a vibratory roller or plate compactor. **Payment for delivering drainfill will be included under Bid Item 11, Earthfill. Paving contractor will be responsible for placement and compacting drainfill.**

8. Concrete pads shall have a grooved, broomed or meshed non skid surface ***as shown in drawings***. ***Pads, walls and curbs shall be straight and true, and have a skilled, workmanlike finish.***

9. 1¼" deep sawcuts (No expansion joint material) filled with a flexible caulking shall be placed at the 15' intervals. Areas where 1-1/4" deep sawcuts are not feasible, 1-1/4" preformed strips and/or grooving tooling shall be used to achieve continuous 1-1/4" deep separation. Control joint spacing shall be 15' apart if not shown on drawings. Sawcuts shall be cut within 36 hours of concrete placement. Sealant shall conform to Material Specification 536 and conform to ASTM C-920. Curing compound shall conform to ASTM C-309 type 1 or 2 and ***shall be placed immediately (within 5 minutes) after floating and final finish is completed.***

10. ***Contractor shall provide the engineer a design mix 7 days prior to concrete placement for approval. Contractor shall give at least 48 hours notice to the inspector prior to concrete placement. A batch ticket shall be provided by the supplier for each load of concrete delivered to the site. The batch ticket shall state the class of concrete, amount of cement, coarse and fine aggregates, water and any admixtures used. Note: Material certification will be for all materials, be current(within 6 months), and the engineer can require the ready mix supplier to provide further testing results if he/she determines the provided certification is inadequate.***

11. Items subsidiary to this Bid item are:
    Pollution Control, Construction Specification 5; Construction Surveys, Construction Specification 7
    Mobilization & Demobilization, Construction Specification 8
    Water for Construction, Construction Specification 10
    Removal of Water, Construction Specification 11
    Steel Reinforcement, Construction Specification 34

12. Payment will be as described in section 23, Measurement and payment.

Construction Specification 34—Steel Reinforcement

1. Scope

The work shall consist of furnishing and placing steel reinforcement for reinforced concrete or pneumatically applied mortar.

2. Material

Steel reinforcement shall conform to the requirements of Material Specification 539, Steel Reinforcement (for concrete). Before reinforcement is placed, the surface of the bars and fabric and any metal supports shall be cleaned to remove any loose, flaky rust, mill scale, oil, grease, or other undesirable coatings or foreign substances. Epoxy-coated steel reinforcement shall be free of surface damage. After placement, the reinforcement shall be maintained in a clean and serviceable condition until it is completely embedded within the concrete.

3. Bar schedule, lists and diagrams

Any supplemental bar schedules, bar lists or bar-bending diagrams required in section 10 of this specification to accomplish the fabrication and placement of steel reinforcement shall be provided by the contractor. Before reinforcement is placed, the contractor shall furnish four copies of any such lists or diagrams to the contracting officer for approval. Acceptance of the reinforcement is not based on approval of these lists or diagrams, but on inspection of the steel reinforcement after it has been placed, tied, and supported and is ready to receive concrete.

4. Bending

Reinforcement shall be cut and bent in compliance with the requirements of the American Concrete Institute Standard 315. Bars shall not be bent or straightened in a manner that will injure or weaken the material. Bars with kinks, cracks, or improper bends will be rejected.

5. Splicing bar reinforcement

Method 1—Splices of reinforcement shall be made only at locations shown on the drawings and provided by the steel schedule. Placement of bars at the lap splice locations shown, when not in contact, shall not be farther apart than one-fifth the shown lap length and in any case no greater than 6 inches.

Method 2—Splices of reinforcement shall be limited to those locations shown on the drawings. Splice lengths shall be determined before fabrication and meet the requirements of ACI Standard 318, Building Code Requirements for Reinforced Concrete, based upon design information in section 10 of this specification. Bar placement drawings and schedules shall be provided for approval before fabrication. The drawings shall show all splice locations, layouts, and lap dimensions.

6. Splicing welded wire fabric

Unless otherwise specified, welded wire fabric shall be spliced in the following manner:

End-to-end—Adjacent sections shall be spliced end-to-end (longitudinal lap) by overlapping a minimum of one full mesh plus 2 inches plus the length of the two end overhangs. The splice length is measured from the end of the longitudinal wires in one piece of fabric to the end of the longitudinal wire in the lapped piece of fabric.

Side-to-side—Adjacent sections shall be spliced side to side (transverse lap) a minimum of one full mesh plus 2 inches. The splice length shall be measured from the centerline of the first longitudinal wire in one piece of fabric to the centerline of the first longitudinal wire in the lapped piece of fabric.

7. Placing

Reinforcement shall be accurately placed and secured in position to prevent its displacement during the placement of concrete. Tack welding of bars is not permitted. Metal chairs, metal hangers, metal spacers, and concrete chairs may be used to support the reinforcement. Metal hangers, spacers, and ties shall be placed in such a manner that they are not exposed in the finished concrete surface. The legs of metal chairs or side form spacers that may be exposed on

any face of slabs, walls, beams, or other concrete surfaces shall have a protective coating or finish. The coating or finish can be hot dip galvanizing, epoxy coating, plastic coating, or stainless steel. Metal chairs and spacers not fully covered by a protective coating or finish shall have a minimum cover of 0.75 inch of concrete over the unprotected metal part. The exception is that those with plastic coatings may have a minimum cover of 0.5 inch of concrete over the unprotected metal part. Precast concrete chairs shall be manufactured of the same class of concrete as specified for the structure and shall have the tie wires securely anchored in the chair or a V-shaped groove at least 0.75 inch in depth molded into the upper surface to receive the steel bar at the point of support. Precast concrete chairs shall be clean and moist at the time concrete is placed.

High density or structural plastic rebar accessories designed to ensure maximum concrete bond may be substituted for metal or concrete accessories in spacer applications as approved by the contracting officer. Exposure of plastic rebar accessories at the finished concrete surface shall be kept to a minimum. Plastic rebar accessories, when used, shall be staggered along adjacent parallel bars and shall be placed at intervals no closer than 12 inches. Plastic rebar accessories shall not be used in concrete sections 6 inches or less in thickness.

Reinforcement shall not be placed until the prepared site has been inspected and approved. After placement of the reinforcement, concrete shall not be placed until the reinforcement has been inspected and approved by the contracting officer's technical representative (COTR).

8. Storage

Steel reinforcement stored at the work site shall be placed on platforms, skids, or other supports. This is done so that contact with the ground is avoided and the material is protected from mechanical damage and/or corrosion.

9. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the weight of steel reinforcement placed in the concrete in accordance with the drawings is determined to the nearest pound by computation from the placing drawings. Measurement of hooks and bends is based on the requirements of ACI Standard 315. Computation of weights of reinforcement is based on the unit weights established in tables 34–1 and 34–2 of this specification. Computation of weights for welded wire fabric not shown in table 34–2 shall be based on ACI Standard 315. The area of welded wire fabric reinforcement placed in the concrete in accordance with the drawings is determined to the nearest square foot by computation from the placing drawings with no allowance for required laps. The weight of steel reinforcing in extra splices or extra-length splices approved for the convenience of the contractor or the weight of supports and ties is not included in the measurement for payment.

Payment for furnishing and placing reinforcing steel is made at the contract unit price. Such payment constitutes full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work including preparing and furnishing bar schedules, lists, or diagrams; furnishing and attaching ties and supports; and furnishing, transporting, storing, cutting, bending, cleaning, and securing all reinforcements.

Method 2—For items of work for which specific unit prices are established in the contract, the weight of bar reinforcement placed in the concrete in accordance with the drawings is determined to the nearest pound by computation from the placing drawings. Measurement of hooks and bends is based on the requirements of ACI Standard 315. Computation of weights of bar reinforcement is based on the unit weights established in table 34–1 of this specification. The weight of steel reinforcing in extra splices or extra length splices approved for the convenience of the contractor or the weight of supports and ties is not included in the measurement for payment.

The area of welded wire fabric reinforcement placed in the concrete in accordance with the drawings is determined to the nearest square foot by computation from the placing drawings with no allowance for required laps.

Payment for furnishing and placing bar reinforcing steel is made at the contract unit price for bar reinforcement. Payment for furnishing and placing welded wire fabric reinforcing steel is made at the contract unit price for welded

wire fabric reinforcement. Such payment constitutes full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work including preparing and furnishing bar schedules, lists, or diagrams; furnishing and attaching ties and supports; and furnishing, transporting, cutting, bending, cleaning, and securing all reinforcement.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items to which they are made subsidiary are identified in section 10 of this specification.

10. Items of work and construction details

Table 34–1 Standard reinforcing bars

Bar size no.	Weight (lb/ft)
3	0.376
4	0.668
5	1.043
6	1.502
7	2.044
8	2.670
9	3.400
10	4.303
11	5.313
14	7.650
18	13.600

Table 34–2 Rectangular welded wire fabric

Style designation 1/		Weight
by steel wire gauge	by W-number	(lb/100 ft²)
6 x 6 – 10 x 10	6 x 6 – W1.4 x W1.4	21
6 x 6 – 8 x 8	6 x 6 – W2.1 x W2.1	30
6 x 6 – 6 x 6	6 x 6 – W2.9 x W2.9	42
6 x 6 – 4 x 4	6 x 6 – W4.0 x W4.0	58
4 x 4 – 10 x 10	4 x 4 – W1.4 x W1.4	31
4 x 4 – 8 x 8	4 x 4 – W2.1 x W2.1	44
4 x 4 – 6 x 6	4 x 4 – W2.9 x W2.9	62
4 x 4 – 4 x 4	4 x 4 – W4.0 x W4.0	85
4 x 12 – 8 x 12	4 x 12 – W2.1 x W0.9 2/	25
4 x 12 – 7 x 11	4 x 12 – W2.5 x W1.1 2/	31

1/ Style designation is defined in ACI Standard 315 of the American Concrete Institute.
2/ Welded smooth wire fabric with wires smaller than size W1.4 is manufactured from galvanized wire.

10. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. SUBSIDIARY ITEM, STEEL REINFORCEMENT

This item shall consist of the work and materials necessary to supply and place reinforcing steel as shown on drawings and as described in this specification.

1. In section 5, Splicing bar reinforcement, Method 1 shall apply and minimum splice length shall be 30 times the bar diameter (e.g. 30 times 0.5" =15" overlap for #4 rebar).

2. Minimum concrete cover over reinforcing steel is 2 inches unless otherwise shown or specified.

3. *Rebar shall be welded and properly grounded in free-stall buildings and waterer pads. Outside aprons, 12' pads, head-walls, solid separators, reception pit, and perimeter stem wall do not need to be welded and grounded.*

4. No payment will be made for this item. Compensation will be considered as included in the payment for **Bid Item 13, Structure Concrete**.

Construction Specification 44—Corrugated Polyethylene Tubing

1. Scope

The work consists of furnishing and installing tubing and the necessary fittings and appurtenances as shown on the drawings and as outlined in this specification.

2. Material

Corrugated polyethylene tubing and fittings shall conform to the material requirements as outlined in Material Specification 548, Corrugated Polyethylene Tubing.

When perforations are specified, the water inlet area shall be a minimum of 1 square inch per lineal foot of tubing. The inlets either shall be circular perforations or slots equally spaced along the length and circumference of the tubing. Unless otherwise specified, circular perforations shall not exceed 3/16 inch in diameter, and slot perforations shall not be more that 1/8 inch wide.

Geotextile filter socks, when required, shall meet the material requirements outlined in section 9 of this specification.

Granular bedding material, when specified, shall conform to the requirements specified in section 9 of this specification.

The tubing shall be appropriately marked with ASTM or AASHTO designation.

3. Handling and storage

Tubing shall be delivered to the job site and handled by means that provide adequate support to the tubing and do not subject it to undue stresses or damage. When handling and placing corrugated polyethylene tubing, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting (by metal edges and/or surface or rocks). The manufacturer's special handling requirements shall be strictly observed. Special care shall be taken to avoid impact when the pipe must be handled at a temperature of 40 degrees Fahrenheit or less.

Tubing shall be stored on a relatively flat surface so that the full length of the tube is evenly supported. Unless the tube is specifically manufactured to withstand exposure to ultraviolet radiation, it shall be covered with an opaque material when stored outdoors for 15 days or longer.

4. Excavation

Unless otherwise specified or approved by the engineer, excavation for and subsequent installation of each tube line shall begin at the outlet end and progress upgrade. The trench or excavation for the tubing shall be constructed to the lines, depths, cross sections, and grade shown on the drawings, specified in Section 9 of this specification, or as approved by the engineer.

Trench shields, shoring and bracing, or other suitable methods necessary to safeguard the contractor's employees and the works of improvement and to prevent damage to the existing improvements shall be furnished, placed, and subsequently removed by the contractor.

5. Preparing the tubing bed and blinding the tubing

When a granular filter or envelope is specified, the filter or envelope material shall be placed in the bottom of the trench just before the tubing is laid. The tubing shall then be laid and the filter and envelope material placed to a depth over the top of the tubing of not less than that shown on the drawings or as specified in section 9 of this specification.

When a granular filter or envelope is not specified, the bottom of the trench shall be shaped to form a semicircular or trapezoidal groove in its center. This groove shall provide support for not less than a fourth of the outside circumference of the tubing. After the tubing is placed in the excavated groove, it shall be capped with friable material

from the sides of the trench. The friable material shall be placed around the tubing, completely filling the trench to a depth of at least 3 inches over the top of the tubing. For material to be suitable, it must not contain hard clods, rocks, frozen soil, or fine material that will cause a silting hazard to the drain. Tubing placed during any day shall be blinded (place required soil material around and over pipe) and temporarily capped before construction activities are completed for that day.

6. Placement and joint connections

All tubing shall be installed to grade as shown on the drawings. After the tubing is placed in the trench and blinded, allow sufficient time for the tubing to adapt to the soil temperature before backfilling.

Maximum allowable stretch of the tubing is 5 percent. Special precautions must be implemented on hot, bright days to ensure that the stretch limit is not exceeded and excessive deflection does not occur as a result of installation procedures, including backfill operations.

Unless otherwise specified in section 9 of this specification or shown on the drawings, connections are made with manufactured junctions comparable in strength with the specified tubing. All split fittings shall be securely fastened with nylon cord or plastic zip ties before any backfill is placed. All buried ends shall be supplied with end caps unless otherwise approved by the engineer.

7. Backfilling

Unless otherwise specified in section 9 of this specification, the backfilling of the trench shall be as shown on the drawings and completed as rapidly as is consistent with the soil conditions. Automatic backfilling machines may be used only when approved by the engineer. Backfill shall extend above the ground surface and be well rounded and centered over the trench.

8. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the quantity of each kind and size of tubing is determined to the nearest foot of length measured along the centerline of the installed tubing. Payment for each kind and size of tubing is made at the contract unit price for that kind and size of tubing. Such payment constitutes full compensation for all labor, equipment, tools, and all other items necessary and incidental to furnishing, transporting, and installing the tubing, including excavation, shoring, geotextile or granular filter (when specified), backfill and all fittings, appurtenances, and other items required to complete the work. Payment for appurtenances listed separately in the bid schedule is made at the contract unit price(s) for the size and type of appurtenance listed.

Method 2—For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of tubing is determined to the nearest foot by measurement of the laid length along the crown centerline of the tubing. Payment for each kind, size, and class of tubing is made at the contract unit price for the kind, size, and class. Such payment constitutes full compensation for furnishing, transporting, and installing the tubing, including shoring, all fittings, thrust blocks, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule are made at the contract prices for those items.

Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 9 of this specification.

9. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. BID ITEM 5, CORRUGATED PE TUBING - 18" PIPE

This item shall consist of the work and materials necessary to install the pipes, necessary fittings and appurtenances.

1. The pipe (s) shall:

   a. be 18" diameter, corrugated, polyethylene pipe with smooth interior and shall conform to ASTM Specification F-667 and/or AASHTO —294. **All fittings/connections shall be water-tight.**

   b. be installed at the locations and to the lines, grades and lengths shown on drawings.

   c. be fitted with concrete headwall or chute at outlet ends (payment will be under **Bid Item 13**).

   d. be cast into solid separator wall or fitted with a concrete headwall as described on drawings (payment will be under **Bid Item 13**)

   e. have ends miter cut conforming to fill/headwall.

   f. be backfilled with suitable material from excavations and as described in No. 3 below.

2. *When working in or near township/county/state road right-of way the contractor shall be responsible for traffic control pursuant to the Federal Highway Administration Manual of Uniform Traffic Control Devices and/or local government approved means. The contractor shall obtain any necessary permits from the township, county or state before working within the right-of-way.*

3. **Initial backfill** compaction shall be accomplished by hand and or power tamping. Enough effort shall be applied to provide a firm, dense fill. **Final backfill** compaction is required where pipe trenches cross roads or other areas designated on drawings. Final backfill compaction shall be accomplished with power tamping equipment for fine textured soils and vibratory plate compactors for course textured materials. Final backfill of trench excavation in non-designated areas shall extend 6" above finished ground surface and shall be well rounded over the trench.

4. Items subsidiary to this Bid item 5 are:
   Pollution Control, Construction Specification 5; Water for Construction, Construction Specification 10
   Mobilization & Demobilization, Construction Specification 8
   Removal of Water, Construction Specification 11
   Construction Surveys, Construction Specification 7

5. In section 8, Measurement and payment, Method 2 shall apply.

Construction Specification 45—Plastic Pipe

1. Scope

The work consists of furnishing and installing plastic pipe (except corrugated polyethylene tubing) and the necessary fittings and appurtenances as shown on the drawings or as specified herein.

2. Material

Pipe, fittings, and gaskets shall conform to the requirements of Material Specification 547, Plastic Pipe, and as specified in section 14 of this specification or as shown on the drawings.

Perforated pipe shall conform to the requirements of Material Specification 547, Plastic Pipe, and as specified in section 14 of this specification or as shown on the drawings.

Unless otherwise specified, concrete shall conform to the requirements of Construction Specification 32, Structure Concrete, and section 8 of this specification.

Unless otherwise specified, earth backfill shall conform to the requirements of Construction Specification 23, Earthfill.

Unless otherwise specified, drainfill shall conform to the requirements of Construction Specification 24, Drainfill.

3. Handling and storage

Pipe shall be delivered to the job site and handled by means that provide adequate support to the pipe and do not subject it to undue stresses or damage. When handling and placing plastic pipe, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting (by metal edges and/or surface or rocks). The manufacturer's special handling requirements shall be strictly observed. Special care shall be taken to avoid impact when the pipe must be handled at a temperature of 40 degrees Fahrenheit or less.

Pipe shall be stored on a relatively flat surface so that the barrels are evenly supported. Unless the pipe is specifically manufactured to withstand exposure to ultraviolet radiation, it shall be covered with an opaque material when stored outdoors for 15 days or longer.

4. Excavation

Excavation shall be in accordance with Construction Specification 21, Excavation, and section 14 of this specification or as shown on the drawings.

The pipe foundation shall be excavated a minimum of 4 inches lower than the pipe grade shown on the drawings or staked in the field whenever bedrock, boulders, cobbles, or other material that may cause pipe damage is encountered at planned pipe grade.

5. Laying the pipe

Plastic pipe conduits complete with fittings and other related appurtenances shall be installed to the lines and grades shown on the drawings or specified in section 14 of this specification. The pipe shall be installed so that there is no reversal of grade between joints unless otherwise shown on the drawings. The pipe shall not be dropped or dumped on the bedding or into the pipe trench. The ground surface near the pipe trench shall be free of loose rocks and stones greater than 1 inch in diameter. This ensures that rock will not be displaced

and impact the pipe.

Just before placement, each pipe section shall be inspected to ensure that all foreign material is removed from inside the pipe. The pipe ends and the couplings shall be free of foreign material when assembled. At the completion of a work shift, all open ends of the pipeline shall be temporarily closed off using a suitable cover or plug.

Care shall be taken to prevent distortion and damage during hot or cold weather. During unusually hot weather (daytime high temperature of more than 90 °F), the pipe assembled in the trench shall be lightly backfilled or shaded to keep it as near to ground temperature as possible until final backfill is placed. Backfill operations should be performed during daily construction periods when the ground temperature and the temperature of the pipe do not vary more than 40 degrees Fahrenheit.

Perforated pipe shall be installed with the perforations down and oriented symmetrically about the vertical centerline. Perforations shall be clear of any obstructions on the inside and outside of the pipe when the pipe is approved by the engineer for backfill.

During installation, the pipe shall be firmly and uniformly bedded throughout its entire length, to the depth and in the manner specified in section 14 of this specification or as shown on the drawings. Bell-holes shall be placed in bedding material under bells, couplings, and other fittings to assure the pipe is uniformly supported throughout its entire length. Blocking or mounding beneath the pipe to bring the pipe to final grade is not permitted.

6. Pipe embedment

Earth bedding—The pipe shall be firmly and uniformly placed on compacted earthfill bedding or an inplace earth material bedding of ample bearing strength to support the pipe without noticeable settlement. The earth material on which the pipe is placed shall be of uniform density to prevent differential settlement.

Unless otherwise specified, a groove that closely conforms to the outside surface of the pipe shall be formed in the bedding. The depth of the groove shall be equal to or greater than 0.3 of the pipe diameter.

Earth bedding shall be compacted to a density not less than adjacent undisturbed inplace earth material or be compacted earth backfill. Earthfill material used for compacted earth bedding shall be free of rocks or stones greater than 1 inch in diameter and earth clods greater than 2 inches in diameter. The pipe shall be loaded sufficiently during the compaction of bedding under the haunches and around the sides of the pipe to prevent displacement from its final approved placement.

Sand, gravel, or crushed rock bedding—When sand, gravel, or crushed rock bedding is specified, the pipe shall be firmly and uniformly placed on the bedding material. Material for bedding shall not exceed 1 inch in diameter. Unless otherwise specified in section 14 of this specification or shown on the drawings, the coarse-grained bedding material shall be carefully placed and compacted to a depth equal to or greater than 0.3 of the diameter of the pipe above the bottom of the pipe. The pipe shall be loaded sufficiently during backfilling and compaction around the sides to prevent displacement of the pipe from its final approved placement.

Pipe encased in drainfill—The pipe shall be firmly and uniformly placed on bedding of specified drainfill. Drainfill shall be placed and compacted as specified in section 14 of this specification or as shown on the drawings to form a continuous uniform support around the entire circumference of the pipe. The pipe shall be loaded sufficiently during backfilling around the sides and during compaction to prevent displacement of the pipe.

7. Backfill

Initial backfill—Unless otherwise specified, initial backfill to 6 inches above the top of the conduit is required. Earth haunching and initial backfill material shall consist of soil material that is free of rocks, stones, or hard clods more than 1 inch in diameter. Coarse backfill material shall be the specified sand, gravel, crushed rock, or drainfill material.

Initial backfill shall be placed in two stages. In the first stage (haunching), backfill is placed to the pipe spring line (center of pipe). In the second stage, it is placed to 6 inches above the top of the pipe.

The first stage material shall be worked carefully under the haunches of the pipe to provide continuous support throughout the entire pipe length. The haunching backfill material shall be placed in layers that have a maximum thickness of about 6 inches and are compacted as specified in section 14 of this specification or as shown on the drawings. During compaction operations, care shall be taken to ensure that the tamping or vibratory equipment does not come in contact with the pipe and the pipe is not deformed or displaced.

When pressure testing is not specified, the pipe shall be covered with a minimum of 6 inches of backfill material as soon as possible following assembling of the pipe in the trench, but not later than within the same day that placement has occurred. When pressure testing is specified, sufficient backfill material shall be placed over the pipe to anchor the conduit against movement during pressure testing activities.

Final backfill—Final backfill shall consist of placing the remaining material required to complete the backfill from the top of the initial backfill to the ground surface, including mounding at the top of the trench. Final backfill material within 2 feet of the top of the pipe shall be free of debris or rocks larger than 3 inches nominal diameter. Coarse backfill material shall be the specified sand, gravel, crushed rock, or drainfill. Final backfill shall be placed in approximately uniform, compacted layers. Final backfill compaction requirements shall be as specified in section 14 of this specification or as shown on the drawings.

Vehicles or construction equipment shall not be allowed to cross the pipe until the minimum earth cover and required density as specified in section 14 of this specification has been obtained.

8. Pipe encasement in concrete

Concrete encasement shall be carefully placed to form a continuous uniform support around the entire circumference of the pipe as specified in section 14 of this specification or as shown on the drawings. Pipes encased in concrete shall be securely anchored to prevent movement of the pipe during concrete placement. A clear distance of 1.5 inch shall be maintained between the pipe and the reinforcing steel.

The concrete for the encasement shall conform to the requirements of Construction Specification 32, Structure Concrete, for Class 3000M concrete unless otherwise specified.

9. Joints

Unless otherwise specified in section 14 of this specification or shown on the drawings, joints shall be either bell and spigot type with elastomeric gaskets, coupling type, solvent cement bell and spigot, or jointed by butt heat fusion. When a lubricant is required to facilitate joint assembly, it shall be a type having no deleterious affect on the gasket or pipe material.

Pipe joints shall be watertight at the pressures specified except where unsealed joints are indicated.

Pipe shall be installed and joined in accordance with the manufacturer's recommendations. Laying deflections and joint fitting or stab depths shall be within the manufacturer's recommended tolerances.

When solvent cement joints are specified for PVC or ABS pipe and fittings, they shall be made in accordance with the following ASTMs and the related appendix of each ASTM; D 2855 for PVC pipe and fittings and D 2235 for ABS pipe and fittings.

Flanged, banded, heat-fusion, or elastomeric-sealed mechanical joints shall be used when joining polyethylene (PE) and high density polyethylene (HDPE) pipe and fittings unless otherwise specified in section 14 of this specification or as shown on the drawings.

Pipe ends shall be cut square and be deburred to provide a uniform, smooth surface for the jointing process. Reference marks shall be placed on the spigot ends to assist in determining when proper seating depth has been achieved within the joint.

10. Fittings

Unless otherwise specified, steel fittings, valves, and bolted connections shall be painted or coated as recommended by the manufacturer.

Fittings for nonpressure pipe shall be of the same or similar material as the pipe and shall provide the same durability, watertightness, and strength as the pipe unless otherwise specified.

11. Thrust blocks and anchors

When specified, concrete thrust blocks and anchors shall be installed as shown on the drawings or specified in section 14 of this specification.

The concrete for the thrust blocks and anchors shall conform to the requirements of Construction Specification 32, Structure Concrete, for Class 3000M concrete unless otherwise specified in section 14 of this specification.

The thrust block cavity shall be hand dug into undisturbed soil or previously placed compacted backfill. The cavity shall be formed with soil or wood to hold the freshly placed concrete without displacement until an initial set has occurred.

When excavation beyond the designated trench widths and depths as shown on the drawings or specified in section 14 of this specification occurs at locations where installation of concrete thrust blocks is required, the contractor shall install an alternative thrust block provision. The concrete thrust block shall have a thickness of one pipe diameter and a contact face area that shall be formed against the pipe as shown on the drawings or specified in section 14 of this specification. Backfill shall be placed on all sides of the thrust block and to the sides of the excavation. It shall be compacted as specified for initial backfill.

12. Pressure testing

Method 1—Pressure testing of the completed conduit is not required.

Method 2—The conduit shall be tested for leaks in the following manner:

a. Before pressure testing:
   (1) Joints of the assembled pipeline shall be allowed to cure as recommended by the manufacturer.
   (2) Pipeline shall be flushed and cleaned.

(3) All concrete anchors and thrust blocks shall be in place and allowed to cure for a minimum of 3 days.

(4) Earth backfill shall be sufficient to anchor the conduit against movement during the pressure testing and shall be compacted as specified in Section 14 of this specification or as shown on the drawings.

(5) The conduit shall be braced, anchored, or both, at each end to restrict all potential pipe movement.

(6) The ends of the conduit shall be plugged. The upstream plug shall have a standpipe installed vertically having a minimum diameter of 2 inches and shall be equipped with a shutoff valve. All high points in the line shall be vented to evacuate air pockets. The conduit and the standpipe shall be slowly filled with water such that no air is entrapped during the filling operation. After filling is complete, all vents shall be closed.

b. During pressure testing, the water level in the standpipe shall be continuously maintained at a minimum of 10 feet above the highest invert elevation of the conduit for no less than 2 hours unless otherwise specified in section 14 of this specification or as shown on the drawings.

The volume of water leakage in the 2-hour test period shall be recorded. The maximum allowable leakage (L) in gallons per hour shall not exceed 0.02 times the nominal pipe diameter (D) in inches for each 1,000 feet of pipe line, which is about 50 pipe joints ($L = 0.02 \times D$).

c. When observed leakage exceeds the allowable, leaks shall be sealed by replacement of pipe and fittings as necessary. The conduit shall be retested as described above. This procedure shall be repeated until the conduit leakage does not exceed the allowable specified above.

The contractor shall be fully responsible for any and all work required to correct leakage exceeding the amount specified.

Method 3—The conduit shall be tested for leaks in the following manner:

a. Before pressure testing:

(1) Joints of the assembled pipeline shall be allowed to cure as recommended by the manufacturer.

(2) Pipeline shall be flushed and cleaned.

(3) All concrete anchor and thrust blocks shall be in place and allowed to cure for at least 3 days.

(4) Earth backfill shall be sufficient to anchor the conduit against movement during the pressure testing and compacted as specified in section 14 of this specification or as shown on the drawings.

(5) The conduit shall be braced and/or anchored at each end to prevent all potential pipe movement.

(6) The ends of the conduit shall be plugged, and a pressure gauge shall be attached to the upstream and downstream ends. All high points along the pipeline shall be vented to permit the complete removal of all air within the pipeline. The conduit shall be slowly filled with water such that no air is entrapped during the filling operations.

b. The testing pressure specified in section 14 of this specification shall be continuously maintained at the upstream gauge for a minimum of 2 hours. The pressure at the downstream gauge shall not exceed the pressure rating of the pipe.

c. The volume of water leakage for the 2-hour test period shall be recorded. Maximum allowable leakage shall be in accordance with the following:

Allowable leakage for plastic pipe
(gal/hr/1,000 feet, or 50 pipe joints) 1/

Nominal pipe size (in)	Test pressure in the pipeline (lb/in²) 50	100	150	200
	-------- Allowable leakage -------			
4	.19	.27	.33	.38
6	.29	.41	.50	.57
8	.38	.54	.66	.76
10	.48	.68	.83	.96
12	.57	.81	.99	1.15
14	.67	.95	1.16	1.34
15	.72	1.02	1.25	1.44
16	.76	1.07	1.32	1.52
18	.86	1.22	1.49	1.72

1/ Computation basis

$$L = \frac{ND\sqrt{P}}{7,4}$$

where:
L = allowable leakage in gallons per hour
N = number of joints (pipe and fittings)
D = nominal diameter of pipe in inches
P = test pressure in pounds per square inch

d. When observed leakage exceeds the allowable, leaks shall be sealed by replacement of pipe and fittings as necessary. The conduit shall be retested as described in this section. The procedure shall be repeated until the conduit leakage does not exceed the allowable specified above.

The contractor shall be fully responsible for any and all work required to correct leakage exceeding the amount specified.

13. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe is determined to the nearest foot by measurement of the laid length along the crown centerline of the conduit. Payment for each kind, size, and class of pipe is made at the contract unit price for that kind, size, and class. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe including excavation, shoring, backfill, bedding, thrust blocks, and all fittings, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule is made at the contract prices for those items.

Method 2—For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe is determined as the sum of the nominal laying lengths of the sections used. Payment for each kind, size, and class of pipe is made at the contract unit price for the kind, size, and class. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe including excavation, shoring, backfill, bedding, thrust blocks, and all fittings, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule is made at the contract prices for those items.

Method 3—For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe is determined to the nearest foot by measurement of the laid length along the crown centerline of the conduit. Payment for each kind, size, and class of pipe is made at the contract unit price for the kind, size, and class. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe including shoring, all fittings, thrust blocks, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule is made at the contract prices for those items.

Method 4—For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe is determined as the sum of the nominal laying lengths of the pipe sections used. Payment for each kind, size, and class of pipe is made at the contract unit price for that kind, size, and class. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe including shoring, all fittings, thrust blocks, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule is made at the contract prices for those items.

Methods 3 and 4—Excavation, backfill, and bedding is paid separately under their respective bid items.

All measurement and payment methods—Compensation for any items of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in section 14 of this specification.

14. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Supply Location: house basement or above ground pumphouse.
Materials: fittings for waterers, pressure tanks, valves, fittings, gauges, ***water meter***, and other necessary equipment and tools.
Estimated Daily water Use for 500 pregnant cows, +2,000 feeders:
(gpm = gallons per minute; gpd = gallons per day)
500 x 15 gpd/hd = ~7,500 gallons;
2,000 x 10gpd/hd = ~20,000 gallons; Total = 27,500 gallons (~10 million gallons/year)
Estimated demand for 2,500 head; 27,500 gallons over an 8 hr window = ~58 gpm minimum at the furthest waterer or large capacity stock water tanks

-with headloss's the pump will need more than 58 gpm output

This is a recommendation -if a higher output is preferred by manager then design accordingly.
Plumbing shall be in accordance with North Dakota State Well Code and rural water authority.
Large stock-water tanks (500-1000 gallons) within lots are recommended if well output/flow is low. In conclusion the existing well (or rural water tap) will need to be pump tested and then designed accordingly.

Note: A water use permit would be required since the system will consume more than 12.5 ac-ft (~4 million gallons) of water per year. Application would be with the ND State Water Commission and can take up to 1 year.

A. BID ITEM 3, PLASTIC PIPE -WATERLINE

This item shall consist of performing the work and providing the materials necessary to install this Livestock Water Supply System component in accordance with this specification and at the location(s) and to the elevations, lines and grades shown on drawings. This Livestock Water Supply System component shall consist of tying into a new well or waterline (indicated on drawings) and piping to planned new waterer locations as shown on drawings.

1. Any plumbing to rural water shall be in accordance with local rural water authority's specifications and requirements.

2. All plumbing work and materials shall be in accordance with this specification and all state and local codes. **Documented certification for work and materials will be required.**

3. Any existing waterlines or tiles uncovered and/or damaged shall be repaired and reburied to original condition or better.

4. The pipeline to the new waterers shall:

   a. be 2" diameter, either schedule 40(min.) Polyvinyl Chloride (PVC) or polyethylene (PE) tubing conforming to ASTM D 2447. Use of other plastic pipe must have prior approval of the engineer.

   b. have PVC fittings conforming to ASTM D 2466, D 2467, D2464, or PE fitting conforming to ASTM D 2609 and shall be double clamped - ***(No nylon fittings).*** Use of other plastic pipe must have prior approval of the engineer.

   c. have all PVC joints cemented with a solvent conforming to ASTM D 2564.

   d. have a ***pressure rating of 160 psi or higher*** for all pipes and fittings.

   e. have a shut off valve placed at each waterer.

   f. be placed as shown on drawings and as described in this specification.

   g. have a "backflow prevention" fitting install if tying into household water supply.

   h. have thrust blocking placed at bends (fitted bends), tees and any other critical fitting area. Refer to drawings.

5. In section 6, Pipe embedment, **Earth bedding** shall apply.

6. In section 7, Backfill, **Initial backfill** compaction shall be accomplished by hand and or power tamping. Enough effort shall be applied to provide a firm, dense fill. **Final backfill** compaction is required where pipeline trenches cross roads or other areas designated on drawings. Final backfill compaction shall be accomplished with power tamping equipment for fine textured soils and vibratory plate compactors for course textured materials. Final backfill of trench excavation in non-designated areas shall extend 6" above finished ground surface and shall be well rounded over the trench.

7. In section 12, Pressure testing, Method 1 shall apply. Contractor will be responsible for repairing any defects resulting from poor workmanship (e.g. leaks).

8. Waterers shall be installed in accordance with manufacturers specifications. Electrical work shall meet all local and state electric codes. Waterers shall have a minimum 1 year warranty. A certificate of inspection shall be provided to the engineer for all electrical work.

9. **Landowner will supply and pay for waterers.**
   Contractor will be responsible for the remainder of materials including frost free hydrant or approved equal.

10. Items subsidiary to this Bid item are:
    Pollution Control, Construction Specification 5; Construction Surveys, Construction Specification 7
    Mobilization & Demobilization, Construction Specification 8
    Water for Construction, Construction Specification 10
    Removal of Water, Construction Specification 11

11. *When working in or near township/county/state road right-of way the contractor shall be responsible for traffic control pursuant to the Federal Highway Administration Manual of Uniform Traffic Control Devices and/or local government approved means. The contractor shall obtain any necessary permits from the township, county or state before working within the right-of-way.*

11. In section 13, Measurement and payment, Method 1 shall apply.

C. BID ITEM 5, PLASTIC PIPE -Electrical to waterers

This item shall consist of performing the work and providing the materials necessary to install this Livestock Water Supply System component in accordance with this specification and at the location(s) and to the elevations, lines and grades shown on drawings. This Livestock Water Supply System component shall consist of placing electrical wire in the piping trench (this will reduce the amount of trenching and disturbed grading).

1. Wire shall be sized according to electrical codes (i.e. NEC) based on calculated electrical loads and voltage drops.

2. Placement of wire in trench shall be in accordance with electrical codes (i.e. NEC).

3. Wire coatings and material shall be in accordance with electrical codes (i.e. NEC).

4. In section 13, Measurement and payment, Method 1 shall apply.

Construction Specification 51—Corrugated Metal Pipe

1. Scope

The work consists of furnishing and placing circular, arched, or elliptical corrugated metal pipe and the necessary fittings.

2. Material

Pipe and fittings shall conform to the requirements of Material Specification 551, Coated Corrugated Steel Pipe, or Material Specification 552, Aluminum Corrugated Pipe, whichever is specified.

Unless otherwise specified in section 11 of this specification, perforated pipe furnished shall conform to the requirements for Class I perforations as described in ASTM A 760 or A 762.

3. Coupling bands and hardware

Pipe joint coupling bands shall be provided meeting the requirements specified in section 11 of this specification.

Hardware consisting of coupling bands and band fastening devices, such as connecting bolts, rods, lugs, and angles used in conjunction with zinc-coated iron or steel pipe, shall be galvanized by the hot-dip method. Hardware used in conjunction with aluminum pipe and aluminum or aluminum-zinc alloy-coated iron and steel pipe shall be of the same material as the pipe except that hot-dip galvanized or cadmium-plated fasteners may be used. The surface of all band-fastening devices for pipe specified with bituminous or polymer coating shall be coated with asphalt-mastic material meeting the requirements of ASTM A 849. The coupling band shall be coated similar to that specified for the pipe unless otherwise specified in section 11 of this specification.

Coupling bands shall be installed to provide straight alignment of the connecting pipe ends. Unless otherwise specified in section 11 of this specification, the bandwidth shall be as specified in ASTM A 760 and A 762. The bands shall be positioned to overlap adjacent pipe ends equally. The coupling bands shall be corrugated to match the corrugations of the pipe section ends being connected.

4. Fabrication

Fabrication of appurtenant sections shall be performed as shown on the drawings and described in section 11 of this specification. The items may consist of inlet sections, outlet sections, end sections, elbows, skew or beveled sections, rod reinforced ends, cut-off collars, or headwalls. Fabrication of these appurtenant sections shall be made from metallic-coated material identical to that from which the attached pipe is fabricated. Fabrication shall be of a quality and finished workmanship equal to that required for the pipe.

5. Handling the pipe

The contractor shall furnish equipment as necessary to install the pipe without damaging the pipe or coating. The pipe shall be transported and handled in a manner to prevent damage to the pipe and coating.

6. Laying and bedding the pipe

Unless otherwise specified, the pipe shall be installed in accordance with the manufacturer's recommendations. Pipe shall be installed so no reversal of grade between joints results unless otherwise shown on the drawings. The pipe shall be installed with the outside laps of circumferential joints pointing upstream and with longitudinal laps at the sides near the vertical mid-height of the pipe.

Field welding of corrugated galvanized iron or steel pipe is not permitted. The pipe sections shall be joined with fabricator-supplied coupling bands meeting the specified joint requirements. The coupling shall be installed as

recommended by the fabricator.

The pipe shall be firmly and uniformly bedded throughout its full length to the depth and in the manner specified on the drawings.

Perforated pipe shall be installed with the perforations down and oriented symmetrically about a vertical centerline. Perforations shall be clear of any obstructions at the time the pipe is installed in its final position.

The pipe shall be loaded sufficiently during backfilling to prevent displacement from line and grade and to maintain full contact with the bedding during the placement operations.

7. Strutting

When required, struts or horizontal ties shall be installed in the manner specified on the drawings. Struts and ties shall remain in position until the backfill has been placed above the top of the pipe to a height of 5 feet or the pipe diameter, whichever is greater, or to the surface of the completed earth backfill when the fill height is less than 5 feet above the top of the pipe. The contractor shall remove the struts or ties following completion of the earth backfill requirements that apply.

8. Embedment in concrete

Special treatment shall be provided to the pipe surface when embedded or attached to concrete and the pipe material is aluminum or aluminum-coated and aluminum-zinc alloy-coated. Potential contact surfaces in contact with concrete and masonry surfaces shall be coated with two coats of a bituminous paint of the cutback type. Placement of the pipe shall be such that direct metal-to-metal contact with other metallic material, such as embedded steel reinforcement or water control gates, is prevented.

9. Repair of damaged coating

Any damage to the metallic coating shall be repaired by cleaning the damaged surface area by sand blasting, power disk sanding, or wire brushing. All loose and cracked coating, dirt, and any products of corrosion shall be removed before application of paint. Oil and grease material shall be removed by use of a solvent. The surface shall be clean and dry during the painting period and until the coating has completely dried.

Painting shall be accomplished by one of the following options based upon installed exposure conditions of the pipe as determined by the engineer.

Normal exterior or interior atmospheric exposure:

a. Zinc dust - zinc oxide primer, ASTM D 79 and D 520
b. Single package, moisture cured urethane prime in silver metallic color, or
c. Zinc-rich cold galvanized compound, brush, or aerosol application

Submergence in water exposure:

a. Zinc dust - zinc oxide primer, ASTM D 79 and D 520
b. Zinc dust paint, ASTM D 4146

When the metallic coating is damaged in any individual area larger than 12 square inches or if more than 0.2 percent of the total surface area of a single pipe section is damaged, that section of pipe will be rejected.

Breaks or scuffs in bituminous coatings that are less than 36 square inches in area shall be repaired by applying two coats of hot-asphaltic paint or a coating of cold-applied bituminous mastic. The repair coating shall be a minimum of 0.05 inch thick after hardening and shall bond securely and permanently to the pipe and coating. The material shall meet the minimum physical requirements for bituminous coating in ASTM A 849 and A 885.

Whenever individual breaks exceed 36 square inches in area or when the total area of breaks exceeds 0.5 percent of the total surface area of an individual pipe section, that section of pipe will be rejected.

Bituminous coating damaged by welding of coated pipe or pipe fittings shall be repaired as specified in this section for breaks or scuffs in bituminous coatings.

Breaks or scuffs in polymer coatings that are less than 36 square inches in area shall be repaired by the application of a polymer material similar to and compatible with the durability, adhesion, and appearance of the original polymer coating, as described in ASTM A 849, paragraph 6.8. The repair coating shall be a minimum thickness of 0.010 inch (10 mils) after drying. Whenever individual breaks exceed 36 square inches in area or when the total area of breaks exceeds 0.5 percent of the total surface area of the individual pipe section, that section of pipe will be rejected.

10. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the quantity of each type, class, size, and gauge of pipe is determined to the nearest 0.1 foot by measurement of the laid length of the pipe along the centerline of the pipe. Payment for each type, class, size, and gauge of pipe is made at the contract unit price for that type, class, size and gauge of pipe. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe and fittings and all other items necessary and incidental to the completion of the work except items designated as *special fittings*. Special fittings are those sections of pipe requiring special fabrication to meet layout requirements. Payment for special fittings is made at the contract unit price for special fittings (CMP).

Method 2—For items of work for which specific unit prices are established in the contract, the quantity of each type, class, size, and gauge of pipe is determined as the sum of the nominal laying lengths of the pipe sections installed. Payment for each type, class, size, and gauge of pipe is made at the contract unit price for that type, class, size, and gauge of pipe. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe and fittings and all other items necessary and incidental to the completion of the work except items designated as *special fittings*. Special fittings are those sections of pipe requiring special fabrication to meet layout requirements. Payment for special fittings is made at the contract unit price for special fittings (CMP).

Method 3—For items of work for which specific lump sum prices are established in the contract, payment for corrugated metal pipe structures is made at the contract lump sum price. Such payment constitutes full compensation for furnishing, fabricating, transporting, and installing the pipe structure complete with metal pipe, fittings, and appurtenances, and all other items necessary and incidental to completion of the work, which includes, except as otherwise specified, required excavation, dewatering, and earth backfill.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in section 11 of this specification.

11. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. BID ITEM 6, CORRUGATED METAL PIPE - 18" PIPE

This item shall consist of the work and materials necessary to install the 18" pipe and necessary fittings and appurtenances.

1. The 18" pipe shall:

   a. be corrugated, metal pipe and shall conform to Material Specification 551.

   b. be installed at the locations and to the lines, grades and lengths shown on drawings.

   c. be fitted with a flared end fitting at both ends (**payment for flared ends shall be included under this bid item**).

   d. have ends conforming to fill and have rock rip installed as detailed in drawings.

   e. be backfilled with suitable material from excavations and as described in No. 3 below.

2. *When working in or near township/county/state road right-of way the contractor shall be responsible for traffic control pursuant to the Federal Highway Administration Manual of Uniform Traffic Control Devices and/or local government approved means. The contractor and project manager shall obtain any necessary permits/approvals from the township, county or state before working within the right-of-way.*

3. **Initial backfill** compaction shall be accomplished by hand and or power tamping. Enough effort shall be applied to provide a firm, dense fill. **Final backfill** compaction is required where pipe trenches cross roads or other areas designated on drawings. Final backfill compaction shall be accomplished with power tamping equipment for fine textured soils and vibratory plate compactors for course textured materials. Final backfill of trench excavation in non-designated areas shall extend 6" above finished ground surface and shall be well rounded over the trench.

4. Items subsidiary to this Bid item are:
   Pollution Control, Construction Specification 5
   Water for Construction, Construction Specification 10
   Mobilization & Demobilization, Construction Specification 8
   Removal of Water, Construction Specification 11
   Construction Surveys, Construction Specification 7

5. In section 8, Measurement and payment, Method 1 shall apply.

Construction Specification 92—Field Fence

1. Scope

The work shall consist of furnishing and installing field fence, including gates and fittings.

2. Material

Material for field fence shall conform to the requirements of Material Specification 591. All wooden posts shall be of the same species, when available.

3. Setting posts

Concrete or wood posts shall be set in holes and backfilled with earth except where otherwise specified. Wood posts may be driven when approved by the engineer. Steel posts shall be driven unless otherwise specified.

Holes for installing fence posts shall be at least 6 inches larger than the diameter or side dimension of the posts.

Earth backfill around posts shall be thoroughly tamped in layers not thicker than 4 inches and shall completely fill the posthole up to the ground surface. Concrete backfill around posts shall be rodded into place in layers not thicker than 12 inches and shall completely fill the posthole to the surface of the ground. Backfill, either earth or concrete, shall be crowned-up around posts at the ground surface.

No stress shall be applied to posts set in concrete for a period of not less than 24 hours following the development of a firm set of the concrete.

4. Corner assembly

Unless otherwise specified in section 11, corner assemblies shall be installed at all points where the fence alignment changes 15 degrees or more.

5. End panels

End panels shall be built at gates and fence ends.

6. Pull post assembly

Pull post assembly (bracing within a section of straight fence) shall be installed at the following locations:

a. In straight fence sections, at intervals not to exceed 660 feet.

b. At any point where the vertical angle described by two adjacent reaches of wire is upward and exceeds 10 degrees (except as provided in section 11 of this specification).

c. At the beginning and end of each curved fence section.

7. Attaching fencing to posts

The fencing shall be stretched and attached to posts as follows:

a. The fencing wire or netting shall be placed on the side of the post opposite the area being protected except for installation along curved sections.

b. The fencing wire or netting shall be placed on the outside for installation along curved sections.

c. The fencing wire or netting shall be fastened to each end post, corner post, and pull post by wrapping each horizontal strand around the post and tying it back on itself with not less than three

tightly wound wraps.

d. The fencing wire or netting shall be fastened to wooden line posts by means of steel staples. Woven-wire fencing shall be attached at alternate horizontal strands. Each strand of barbed wire shall be attached to each post. Steel staples shall be driven diagonally with the grain of wood and at a slight downward angle and shall not be driven so tightly as to bind the wire against the post.

e. The fencing wire or netting shall be fastened to steel or concrete line posts with either two turns of 14 gauge galvanized steel or iron wire or in accordance with recommendations provided by the post's manufacturer.

f. Wire shall be spliced by means of a Western Union splice or by suitable splice sleeves applied with a tool designed for that purpose. The Western Union splice shall have no less than eight wraps of each end about the other. All wraps shall be tightly wound and closely spaced. Splices made with splice sleeves shall have a tensile strength no less than 80 percent of the strength of the wire being spliced.

8. Stays

Stays shall be attached to the fencing at the spacing outlined in section 11 or as shown on the drawings to ensure maintenance of the proper spacing of the fence wire strands.

9. Crossings at depressions and watercourses

Where fencing is installed parallel to the ground surface, the line posts subject to upward pull shall be anchored.

a. If the fence wire or netting is installed parallel to the ground surface, the line posts subject to uplift shall be anchored by means of extra embedment or by special anchors as detailed on the drawings.

b. If the fence wire is installed with the top wire straight and parallel to the ground surface on either side of the depression, extra length posts shall be used to allow normal post embedment. Unless otherwise specified, excess space between the bottom of the fence and the ground shall be closed with extra strands of barbed wire or with netting.

10. Measurement and payment

Method 1—The length of each type and kind of fence is measured to the nearest foot along the profile of the fence, including gate openings. Payment for each type and kind of fence is made at the contract unit price for that type and kind of fence. Such payment constitutes full compensation for completion of the work, including fabricating and installing gates.

Method 2—The length of each type and kind of fence is measured to the nearest foot along the profile of the fence, excluding gate openings. Payment is made at the contract unit price for the specified height of fence. The number of each size and type of gate installed is determined. Payment is made at the contract unit price for that type and size of gate. Such payment constitutes full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 11 of this specification.

11. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. BID ITEM 14, FIELD FENCE & STAFF GAUGE

This item shall consist of the work and materials necessary to install the fence shown on drawings. The fence shall be constructed within the guidelines of this specification. Alternate fence designs shall have prior approval of the engineer. Also included under this specification are 3" steel pipe posts and warning signs for pond.

1. The fence shall consist of 4 strands of barbed wire. Spacing between wire strands shall be 11". The bottom strand shall be 12" from ground level. Feedlot fence shall be as described in drawings

2. Pond fence shall be woven wire (48" high) and shall have 1 strand of barbed on top (8" above top of woven wire).

3. Line posts shall be spaced a maximum of 16' apart.

4. Gates shall be standard bar gates (5 bar minimum). Gates shall be hung according to manufacturer's specifications. Gates shall be attached to single brace assemblies or a large secure post approved by engineer or his/her designated representative prior to post and gate placement. Gate locations will be marked in the field.

5. Signs shall be attached to fence around ponds. These signs shall be placed on all sides of containment area (1 per side). The signs shall have the words "contaminated water - keep out" printed on them. The signs shall be professionally made and printed to resist outdoor conditions.

6. Staff gauge materials and installation shall be included under this bid item.

7. Outlet invert of solid separator pipe shall serve as pump down marker for ponds. A pump down marker/staff gauge will be installed in ponds as shown on drawings

8. 3" steel pipe post shall be supplied and paid for under this specification. Installation of 3" steel pipe post will be paid for under **Bid Item 13, Structure Concrete**.

9. Items subsidiary to this Bid item are:
   Construction Surveys, Construction Specification 7
   Mobilization & Demobilization, Construction Specification 8

10. In section 10, Measurement and payment, Method 1 shall apply.

Construction Specification 95—Geotextile

1. Scope
This work consists of furnishing all material, equipment, and labor necessary for the installation of geotextiles.

2. Quality
Geotextiles shall conform to the requirements of Material Specification 592 and this specification.

3. Storage
Before use, the geotextile shall be stored in a clean, dry location out of direct sunlight, not subject to extremes of either hot or cold temperatures, and with the manufacturer's protective cover undisturbed. Receiving, storage, and handling at the job site shall be in accordance with the requirements listed in ASTM D 4873.

4. Surface preparation
The surface on which the geotextile is to be placed shall be graded to the neat lines and grades as shown on the drawings. It shall be reasonably smooth and free of loose rock and clods, holes, depressions, projections, muddy conditions, and standing or flowing water (unless otherwise specified in section 7 of this specification).

5. Placement
Before the geotextile is placed, the soil surface will be reviewed for quality assurance of the design and construction. The geotextile shall be placed on the approved prepared surface at the locations and in accordance with the details shown on the drawings and specified in section 7 of this specification. It shall be unrolled along the placement area and loosely laid, without stretching, in such a manner that it conforms to the surface irregularities when material or gabions are placed on or against it. The geotextile may be folded and overlapped to permit proper placement in designated area(s).

Method 1—The geotextile shall be joined by machine sewing using thread material meeting the chemical requirements for the geotextile fibers or yarn. The sewn overlap shall be 6 inches, and the sewing shall consist of two parallel stitched rows at a spacing of about 1 inch and shall not cross (except for any required re-stitching). The stitching shall be a lock-type stitch. Each row of stitching shall be located a minimum of 2 inches from the geotextile edge. The seam type and sewing machine to be used shall produce a seam strength, in the specified geotextile, that provides a minimum of 90 percent of the tensile strength in the weakest principal direction of the geotextile being used, when tested in accordance with ASTM D 4884. The seams may be factory or field sewn.

The geotextile shall be temporarily secured during placement of overlying material to prevent slippage, folding, wrinkling, or other displacement of the geotextile. Unless otherwise specified, methods of securing shall not cause punctures, tears, or other openings to be formed in the geotextile.

Method 2—The geotextile shall be joined by overlapping a minimum of 18 inches (unless otherwise specified) and secured against the underlying foundation material. Securing pins, approved and provided by the geotextile manufacturer, shall be placed along the edge of the panel or roll material to adequately hold it in place during installation. Pins shall be steel or fiberglass formed as a U, L, or T shape or contain "ears" to prevent total penetration through the geotextile. Steel washers shall be provided on all but the U-shaped pins. The upstream or upslope geotextile shall overlap the abutting downslope geotextile. At vertical laps, securing pins shall be inserted through the bottom layers along a line through approximately the mid-point of the overlap. At horizontal laps and across slope labs, securing shall be inserted through the bottom layer only. Securing pins shall be placed along a line about 2 inches in from the edge of the placed geotextile at intervals not to exceed 12 feet unless otherwise specified. Additional pins shall be installed as necessary and where appropriate to prevent any undue slippage or movement of the geotextile. The use of securing pins will be held to the minimum necessary. Pins are to remain in place unless otherwise specified.

Should the geotextile be torn or punctured, or the overlaps or sewn joint disturbed, as evidenced by visible geotextile damage, subgrade pumping, intrusion, or grade distortion, the backfill around the damaged or displaced area shall be removed and restored to the original approved condition. The repair shall consist of a patch of the same type of geotextile being used and overlaying the existing geotextile. When the geotextile seams are required to be sewn, the overlay patch shall extend a minimum of 1 foot beyond the edge of any damaged area and joined by sewing as required for the original geotextile except that the sewing shall be a minimum of 6 inches from the edge of the damaged geotextile. Geotextile panels joined by overlap shall have the patch extend a minimum of 2 feet from the edge of any damaged area.

Geotextile shall be placed in accordance with the following applicable specification according to the use indicated in section 7:

Slope protection—The geotextile shall not be placed until it can be anchored and protected with the specified covering within 48 hours or protected from exposure to ultraviolet light. In no case shall material be dropped on uncovered geotextile from a height of more than 3 feet.

Subsurface drains—The geotextile shall not be placed until drainfill or other material can be used to provide cover within the same working day. Drainfill material shall be placed in a manner that prevents damage to the geotextile. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet.

Road stabilization—The geotextile shall be unrolled in a direction parallel to the roadway centerline in a loose manner permitting conformation to the surface irregularities when the roadway fill material is placed on its surface. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet. Unless otherwise specified, the minimum overlap of geotextile panels joined without sewing shall be 24 inches. The geotextile may be temporarily secured with pins recommended or provided by the manufacturer, but they shall be removed before the permanent covering material is placed.

6. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the quantity of geotextile for each type placed within the specified limits is determined to the nearest specified unit by measurements of the covered surfaces only, disregarding that required for anchorage, seams, and overlaps. Payment is made at the contract unit price. Such payment constitutes full compensation for the completion of the work.

Method 2—For items of work for which specific unit prices are established in the contract, the quantity of geotextile for each type placed with the specified limits is determined to the nearest specified unit by computing the area of the actual roll size or partial roll size installed. The computed area will include the amount required for overlap, seams, and anchorage as specified. Payment is made at the contract unit price. Such payment constitutes full compensation for the completion of the work.

Method 3—For items of work for which specific lump sum prices are established in the contract, the quantity of geotextile is not measured for payment. Payment for geotextiles is made at the contract lump sum price and constitutes full compensation for the completion of the work.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 7 of this specification.

7. ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

A. BID ITEM 12, GEOTEXTILE

Geotextile under gravel fill shall be class II woven.

1. For geotextile under gravel fill; In section 5, Placement, Method 2 for *Road stabilization* shall apply.

2. Geotextile under rock riprap shall be class I, non-woven.

3. Items subsidiary to this Bid item are:
   Construction Surveys, Construction Specification 7
   Mobilization & Demobilization, Construction Specification 8

4. In section 6, Measurement and payment, Method 1 shall apply.

K_2S ENGINEERING INC

CONSTRUCTION SPECIFICATION

825. CLAY LINER

1. SCOPE

This work shall consist of the construction of clay liners for agricultural waste management systems.

2. GENERAL

A clay liner to the specified thickness shall cover the pond bottom and interior side slopes up to the design storage elevation.

3. MATERIALS

All clay liner fill materials shall be obtained from required excavation and borrow areas. The selection, blending, routing, and disposition of materials shall be subject to approval by the engineer or his/her designated representative. Material used for the clay liner shall be either CL or CH Unified Classification or other approved material which will meet seepage requirements. Clay liner fill materials shall contain no frozen material, ice, snow, sod, brush, roots, rocks larger than 3 inches, or other perishable materials. No fill shall be placed on a frozen surface.

4. FOUNDATION PREPARATION FOR LINER

The foundation shall be stripped as described in Section 3 of Construction Specification 23, Earthfill.

If the in-place material is not suitable for the liner, the area shall be excavated to a depth of 2 feet below planned finished grade. If the in place material is suitable for the liner, the area shall be excavated to a depth 1½ feet below planned finished grade.

In areas not requiring liner fill material to get 2 feet below planned grade, the foundation shall be loosened thoroughly by scarifying or plowing to a minimum depth of 6 inches. These areas, unless otherwise specified, shall then be compacted to at least **95 percent of the Standard Proctor** density with moisture content as described in number 6, Moisture Content for Liner. Foundation and abutment surfaces shall not be steeper than 1:1 unless otherwise specified.

Areas that are low after stripping shall be filled to 2 feet below planned finished grade. This fill shall be placed in accordance with Construction Specification 23, Earthfill.

5. FILL FOR LINER

All foundation preparation shall be completed before placing fill for the liner. The fill shall be placed such that the distribution of materials is essentially uniform throughout the entire fill and is free from lenses, pockets, streaks or layers of material differing substantially from surrounding material.

Fill, adjacent to structures, shall be placed in a manner that will prevent damage to the structures and allow the structures to assume the backfill loads gradually and uniformly. Heavy equipment shall not be operated within 2 feet of any structure. Vibratory rollers shall not be operated within 5 feet of any structure.

Fill, adjacent to structures, shall be placed in a manner that will prevent damage to the structures and allow the structures to assume the backfill loads gradually and uniformly. Heavy equipment shall not be operated within 2 feet of any structure. Vibratory rollers shall not be operated within 5 feet of any structure.

Fill shall be placed in approximately equal horizontal layers. Fill layer thickness shall not exceed 6 inches for machine compaction. Fill layer thickness adjacent to structures shall not exceed 4 inches for hand directed power tampers.

After placement the fill materials shall be spread and blended by motor grader or other approved equipment.

Liner materials shall not contain frozen material, sod, topsoil, brush, roots, or other perishable materials. The maximum rock particles incorporated in the liner material shall be 3 inches. Rock particles larger than the maximum size specified shall be removed prior to compaction of the liner.

6. MOISTURE CONTENT FOR LINER

Fill, unless otherwise specified, shall be **placed at optimum moisture or up to 3 percent above optimum moisture or 1 percent below optimum.**

Moisture Content shall be controlled as follows and is subject to the approval of the engineer or his/her designated representative: The application of water to the fill materials shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the materials after placement on the fill if necessary. Uniform moisture distribution shall be obtained by disking, blading, or other approved methods prior to compaction of the layer. Material that is too wet when deposited on the fill shall either be removed or be dried to the acceptable moisture content prior to compaction.

7. COMPACTION FOR LINER

Fill, unless otherwise specified on plans, shall be compacted to at least **95 percent** of the Standard Proctor density.

Fill adjacent to structures shall be compacted to a density equivalent to that of the surrounding fill by means of hand tamping or manually directed power tampers.

Compaction of fill adjacent to concrete structures shall not be started until the following time intervals have elapsed after placement of the concrete:

Structure	Time interval
Retaining Walls and counter forts	14 days
Walls backfilled on both sides simultaneously	7 days
Conduit, precast, cradled	2 days
Conduits, precast, bedded	1 day
Anti-seep collars and cantilever outlet bends	3 days

8. TESTING FOR LINER

The contractor will be responsible for supplying adequate documentation to the Engineer or his/her designated representative to certify the compaction requirements defined in the plans and specifications have been met. Optimum Moisture - Maximum Density and associated test data will be furnished as described by ASTM D-698 with adequate in-place density testing and documentation in accordance with ASTM D-1556 or D-2167 or equivalent methods. The location of tests must be random and distributed over the liner bottom and side slopes.

9. AMOUNT OF TESTING

Proctor Curves - A minimum of one Moisture - Density (Proctor) Curve and associated test data will be prepared in accordance with standard test method ASTM D-698 for each type of material to be incorporated into the liner.

In-place Density Tests- A minimum of 4 in place density test will be taken on each 6 inch lift. For ponds larger than 1 acre, there should be 2 additional density tests for each acre over 1 acre for each 6 inch lift. Sidewalls will be tested at a rate of 2 sidewalls for ponds under 1 ½ acres and 4 sidewalls for ponds 1 ½ acres or larger.

In lieu of conducting the density tests, there shall be a minimum of 2 permeability tests conducted on the completed liner. For ponds larger than 2 acres, one permeability test shall be conducted for each acre of liner. These tests must show that the pond when full will have a seepage rate of $^{1}/_{16}$ inch per day or less.

10. REMOVAL AND REPLACEMENT OF DEFECTIVE FILL

Fill placed at moisture contents outside the acceptable range of moisture content or otherwise not conforming to the requirements of the specification shall be reworked to meet the requirements or be removed and replaced by acceptable fill. The replacement fill and the foundation, abutment and fill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control, and compaction.

11. MEASUREMENT AND PAYMENT

Method 1

For items of work for which specific unit prices are established in the contract, the volume of the clay liner within the specified zone boundaries will be measured and computed to the nearest cubic yard by method of average cross-sectional end areas. Unless otherwise specified, no deduction in volume will be made for embedded conduits and appurtenances.

The pay limits shall be the measured surface of the foundation when approved for placement of the liner and the specified neat line of the liner surface. Fill required to fill voids resulting from over excavation of the foundation, outside the specified lines and grades, will be included in the measurement for payment only where such over excavation is directed by the project engineer to remove unsuitable material and where the unsuitable material condition is not a result of the contractor's improper construction operations as determined by the engineer or his/her designated representative.

Payment for the liner will be made at contract unit price for that type of fill. Such payment will constitute full compensation for all labor, materials, equipment, tools, and all other items necessary and incidental to the performance of the work.

Method 2

For items of work for which specific lump sum prices are established in the contract, the quantity of the clay liner will not be measured for payment. Payment for the clay liner will be made at the contract lump sum price. Such payment will constitute full compensation for all labor, materials, equipment, tools, and all other items necessary and incidental to the performance of the work.

Compensation for any item of work described in the contract, but not listed in the bid sheet will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

12. **ITEMS OF WORK AND CONDITIONS WHICH APPLY TO THIS PROJECT ARE:**

A. BID ITEM 16, CLAY LINER

This item shall consist of the work and materials necessary to construct clay liner(s) in the pond(s) to the lines, grades, elevations, and locations shown on drawings and as described in this specification.

1. Liner material shall be suitable CL or CH (Unified Soil Classification) material.

2. Clay from site has been tested and will work for clay liner material.

3. **Final grade of clay liner shall be within +/- 0.1' of design elevations.**

4. Backfilling and compacting staff gauge hole shall be included under bid item 33.

5. Items subsidiary to this Bid item are:
   Pollution Control, Construction Specification 5
   Construction Surveys, Construction Specification 7
   Mobilization & Demobilization, Construction Specification 8
   Water for Construction, Construction Specification 10
   Removal of Water, Construction Specification 11

6. In section 11, Measurement and Payment, Method 2 shall apply.

MATERIAL SPECIFICATIONS

522. AGGREGATES FOR PORTLAND CEMENT CONCRETE

531. PORTLAND CEMENT

532. MINERAL ADMIXTURES FOR CONCRETE

533. CHEMICAL ADMIXTURES FOR CONCRETE

534. CONCRETE CURING COMPOUND

536. SEALING COMPOUND FOR JOINTS IN CONCRETE

547. PLASTIC PIPE

548. CORRUGATED POLYETHYLENE TUBING

551. COATED CORRUGATED STEEL PIPE

539. STEEL REINFORCEMENT (for concrete)

591. FENCING MATERIAL

592. GEOTEXTILE

Material Specification 522—Aggregates for Portland Cement Concrete

1. Scope

This specification covers the quality of fine aggregate and coarse aggregate for use in the manufacture of portland cement concrete.

2. Quality

Aggregate shall conform to the requirements of ASTM Specification C 33 for the specified sizes. Aggregates that fail to meet any requirement may be accepted only when either:

a. The specified alternate conditions of acceptance can be proven before the aggregates are used on the job and within a period such that no work under the contract will be delayed by the requirements of such proof,

or

b. The specification for concrete expressly contains a provision of special mix requirements to compensate for the effects of the deficiencies.

3. Reactivity with alkalies

The potential reactivity of aggregates with the alkalies in cement shall be evaluated by petrographic examination and, where applicable, the chemical method of test, ASTM Designation C 289, or by the results of previous tests or service records of concrete made from similar aggregates from the same source. The standards for evaluating potential reactivity shall be as described in ASTM Specification C 33, appendix A1.

Aggregates indicated by any of the above to be potentially reactive shall not be used except under one of the following conditions:

a. Applicable test results of mortar bar tests made according to ASTM Method C 227 are available which indicate an expansion of less than 0.10 percent at 6 months in mortar bars made with cement containing not less than 0.8 percent alkalies expressed as sodium oxide; or

b. Concrete made from similar aggregates from the same source has been demonstrated to be sound after 3 years or more of service under conditions of exposure to moisture and weather similar to those anticipated for the concrete under these specifications.

Aggregates indicated to be potentially reactive, but within acceptable limits as determined by mortar bar test results or service records, shall be used only with low alkali cement, containing less than 0.60 percent alkalies expressed as sodium oxide.

4. Storing and handling

Aggregates of each class and size shall be stored and handled by methods that prevent segregation of particles sizes or contamination by intermixing with other material.

Material Specification 531—Portland Cement

1. Scope

This specification covers the quality of portland cement.

2. Quality

Portland cement shall conform to the requirements of ASTM Specification C 150 for the specific types of cement. When Type I portland cement is specified, Type IS portland blast-furnace slag cement or Type IP portland-pozzolan cement conforming to the requirements of ASTM Specification C 595 may be used unless prohibited by the specifications.

When air-entraining cement is required, the contractor shall furnish the manufacturer's written statement providing the source, amount, and brand name of the air-entraining component.

3. Storage at the construction site

Cement shall be stored and protected at all times from weather, dampness, or other destructive elements. Cement that is partly hydrated or otherwise damaged will not be accepted.

Material Specification 532—Mineral Admixtures for Concrete

1. Scope

This specification covers the quality of mineral admixtures for concrete.

2. Quality

Fly ash used as a partial substitution of portland cement shall conform to the requirements of ASTM C 618, Class C or F except the loss on ignition shall not exceed 3 percent, unless otherwise specified. Lot-to-lot variation in the loss on ignition shall not exceed 1 percent.

Blast-furnace slag used as a partial substitution of portland cement shall conform to ASTM Standard C 989 for ground granulated blast-furnace slag.

Material Specification 533—Chemical Admixtures for Concrete

1. Scope

This specification covers the quality of chemical admixtures for manufacturer of portland cement concrete.

2. Quality

Air-entraining admixtures shall conform to the requirements of ASTM Specification C 260.

Water-reducing and/or retarding admixtures shall conform to the requirements of ASTM Specification C 494, Types A, B, D, F, or G.

Plasticizing or plasticizing and retarding admixtures shall conform to ASTM Specification C 1017.

Accelerating or water-reducing and accelerating admixtures shall be noncorrosive and conform to the requirements of ASTM Specification C 494, Types C and E. The manufacturer shall provide long-term test data results from an independent laboratory verifying that the product is noncorrosive when used in concrete exposed to continuously moist conditions.

Material Specification 534—Concrete Curing Compound

1. Scope

This specification covers the quality of liquid membrane-forming compounds suitable for spraying on concrete surfaces to retard the loss of water during the concrete curing process.

2. Quality

The curing compound shall meet the requirements of ASTM Specification C 309. Unless otherwise specified, the compound shall be type 2.

3. Delivery and storage

All curing compounds shall be delivered to the site of the work in the original container bearing the name of the manufacturer and the brand name. The compound shall be stored in a manner that prevents damage to the container and protects water-emulsion types from freezing.

Material Specification 536—Sealing Compound for Joints in Concrete and Concrete Pipe

1. Scope

This specification covers the quality of sealing compound for filling joints in concrete pipe and concrete structures.

2. Type

The compound shall be a cold-application material unless otherwise specified and shall be a single component or multiple component type.

3. Quality

The sealing compound shall conform to the requirements of one of the following specifications:

- ASTM Specification C 990—Joints for concrete pipe, manholes, and precast box sections using preformed flexible joint sealants.
- ASTM Specification C 877—External sealing bands for noncircular concrete sewer, storm drain, and culvert pipe.
- ASTM Specification D 1190—Concrete joint sealer, hot poured elastic type.
- ASTM Specification C 920—Elastomeric joint sealants for cold applied sealing and caulking of joints on mortar and concrete structures not subject to fuel spills. Use type S or M, grade NS for vertical joints; type S or M, grade P or NS for horizontal joints. For class 25, use M, quality materials shall be used for both vertical and horizontal joints unless otherwise specified.

The sealing compound if used with other joint material, such as fillers or gaskets, shall be compatible.

Material Specification 547—Plastic Pipe

1. Scope

This specification covers the quality of Poly Vinyl Chloride (PVC), Polyethylene (PE), High Density Polyethylene (HDPE), and Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe, fittings, and joint materials.

2. Material

Pipe—The pipe shall be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It shall be free from visible cracks, holes, foreign inclusions, or other defects. The dimensions of the pipe shall be measured as prescribed in ASTM D 2122.

Unless otherwise specified, the pipe shall conform to the requirements listed in this specification and the applicable reference specifications in table 547–2, the requirements specified in Construction Specification 45, Plastic Pipe, and the requirements shown on the drawings.

Fittings and joints—Fittings and joints shall be of a schedule, SDR or DR, pressure class, external load carrying capacity, or pipe stiffness that equals or exceeds that of the plastic pipe. The dimensions of fittings and joints shall be compatible with the pipe and measured in accordance with ASTM D 2122. Joint and fitting material shall be compatible with the pipe material. The joints and fittings shall be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It shall be free from visible cracks, holes, foreign inclusions, or other defects.

Fittings and joints shall conform to the requirements listed in this specification, the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, the requirements specified in Construction Specification 45, and the requirements shown on the drawings.

Solvents—Solvents for solvent welded pipe joints shall be compatible with the plastic pipe used and shall conform to the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, fitting, or joint.

Gaskets—Rubber gaskets for pipe joints shall conform to the requirements of ASTM F 477, Elastomeric Seals (Gaskets) for Jointing Plastic Pipe.

3. Perforations

When perforated pipe is specified, perforations shall conform to the following requirements unless otherwise specified in Construction Specification 45 or shown on the drawings:

a. Perforations shall be either circular or slots.

b. Circular perforations shall be 1/4 ± 1/16-inch diameter holes arranged in rows parallel to the axis of the pipe. Perforations shall be evenly spaced along each row such that the center-to-center distance between perforations is not less than eight times the perforation diameter. Perforations may appear at the ends of short and random lengths. The minimum perforation opening per foot of pipe shall be as shown in table 547–1.

Table 547–1 Perforations

Nominal pipe size (inches)	Minimum number of rows		Minimum opening/foot (square inches)
	circular	slot	
4	2	2	0.22
6	4	2	0.44
8	4	2	0.44
10	4	2	0.44
12	6	2	0.66

Rows shall be arranged in two equal groups at equal distance from the bottom on each side of the vertical centerline of the pipe. The lowermost rows of perforations shall be separated by an arc of not less than 60 degrees or more than 125 degrees. The uppermost rows of perforations shall be separated by an arc not to exceed 166 degrees. The spacing of rows between these limits shall be uniform. The minimum number of rows shall be as shown in table 547–1.

c. Slot perforations shall be symmetrically located in two rows, one on each side of the pipe centerline. Slot perforations shall be located within the lower quadrants of the pipe with slots no wider than 1/8 inch and spaced not to exceed 11 times the perforation width. Minimum perforation opening per lineal foot of pipe shall be as shown in table 547–1.

d. On both the inside and outside of the pipe, perforations shall be free of cuttings or frayed edges and of any material that would reduce the effective opening.

Table 547–2 Pipe specification

Pipe	Specification
Poly vinyl chloride (PVC) pipe	
Plastic pipe - Schedules 40, 80, 120	ASTM D 1785
	ASTM D 2466
Pressure rated pipe - SDR Series	AWWA C 900
	ASTM D 2241
Plastic drain, waste, and vent pipe and fittings	ASTM D 2665
Joints for IPS PVC pipe using solvent weld cement	ASTM D 2672
Composite sewer pipe	ASTM D 2680
Type PSM PVC sewer pipe and fittings	ASTM F 3034
Large-diameter gravity sewer pipe and fittings	ASTM F 679
Smooth-Wall Underdrain Systems for Highway, Airport, and Similar Drainage	ASTM F 758
Type PS-46 gravity flow sewer pipe and fittings	ASTM F 789
Profile gravity sewer pipe and fittings based on controlled inside diameter	ASTM F 794
Corrugated sewer pipe with a smooth interior and fittings	ASTM F 949
Pressure pipe, 4-inch through 12-inch for water distribution	AWWA C 900
Water transmission pipe, nominal diameters 14-inch through 36-inch	AWWA C 905
Polyethylene (PE) plastic pipe	
Schedule 40	ASTM D 2104
SIDR-PR based on controlled inside diameter	ASTM D 2239
Schedules 40 and 80 Based on outside diameter	ASTM D 2447
SDR-PR based on controlled outside diameter	ASTM D 3035
High density polyethylene (HDPE) plastic pipe	
Plastic pipe and fittings	ASTM D 3350
SDR-PR based on controlled outside diameter	ASTM F 714
Plastic moldings and extrusion compounds	ASTM D 1248
Heat joining polyolefin pipe and fittings	ASTM D 2657
Acrylonitrile-butadiene-styrene (ABS) pipe	
Plastic pipe, schedules 40 and 80	ASTM D 1527
Plastic pipe, SDR-PR	ASTM D 2282
Schedule 40 plastic drain, waste, and vent pipe	ASTM D 2661
Composite sewer pipe	ASTM D 2680
Sewer pipe and fittings	ASTM D 2751

Material Specification 548—Corrugated Polyethylene Tubing

1. Scope

The specification covers the quality of corrugated polyethylene tubing and fittings.

2. Tubing

Corrugated polyethylene tubing shall conform to the requirements of ASTM F 405, ASTM F 667, ASTM F 894, AASHTO M 252, or AASHTO M 294 for the appropriate tubing sizes and fittings.

3. Fittings

ASTM F 405	3-6 inch diameter pipe and fittings
ASTM F 667	8-, 10-, 12-, 15-, 18-, and 24-inch diameter pipe and fittings
ASTM F 894	18- to 120-inch diameter pipe and fittings
AASHTO M 252	3- to 10-inch diameter N12 pipe and fittings
AASHTO M 294	12- to 36-inch diameter N12 pipe and fittings

Material Specification 551—Coated Corrugated Steel Pipe

1. Scope

This specification covers the quality of zinc-coated, aluminum-coated, aluminum-zinc alloy-coated, and polymer-coated corrugated steel pipe and fittings.

2. Pipe

All pipe shall be metallic zinc-coated, aluminum-coated, or aluminum-zinc alloy-coated corrugated steel pipe and fittings conforming to the requirements of ASTM A 742, A 760, A 761, A 762, A 849, A 875, A 885, and A 929 for the specified type, class, fabrication of pipe and coating, and to the following additional requirements:

a. When closed riveted pipe is specified:

   (1) Pipe shall be fabricated with circumferential seam rivet spacing that does not exceed 3 inches except that 12 rivets are sufficient to secure the circumferential seams in 12-inch pipe.

   (2) Longitudinal seams that will be within the coverage area of a coupling band, the rivets shall have flat heads or the rivets and holes shall be omitted and the seams shall be connected by welding to provide a minimum of obstruction to the seating of the coupling bands.

b. Double riveting or double spot welding for pipe less than 42 inches in diameter may be required. When double riveting or double spot welding is specified, the riveting or welding shall be performed in a manner specified for pipe 42 inches or greater in diameter.

3. Coatings

Coatings described herein, unless otherwise specified, equally refer to the inside and outside pipe surfaces.

When coatings in addition to metallic coatings are specified, they shall conform to the requirements of ASTM A 742, A 760, A 761, A 762, A 849, A 875, A 885, and A 929 for the specified type.

Polymer-coated pipe, unless otherwise specified on the drawings or in the construction specifications, shall be coated on each side with a minimum thickness of 0.01 inches (10 mils), designated as grade 10/10 in ASTM A 762.

4. Coupling bands

Coupling bands are to be provided for each section of pipe. The hardware for fastening the coupling band tightly to the connecting pipe shall be fabricated to permit tightening sufficiently to provide the required joint tensile strength and, if required, watertightness without failure of its fastening.

Gaskets, if specified, are to be provided for each coupling band. The fabrication of coupling bands and fastening hardware, in addition to the above, shall be sufficient to provide the required gasket seating without warping, twisting, or bending.

5. Fittings

Fittings shall be fabricated from steel conforming to ASTM A 742, A 849, A 875, A 885, and A 929. The coating of fittings shall be the same as that specified for the contiguous corrugated coated pipe.

Welded surfaces and adjacent surfaces damaged during welding shall be treated by removing all flux residue and weld splatter. The affected surfaces shall be cleaned to bright metal by sand blasting, power disk sanding, or wire brushing. The cleaned area shall extend at least 0.5 inch into the undamaged section of the coated area. Repair and coating application of damaged and uncoated pipe surface areas shall be in accordance with ASTM A 780.

Material Specification 539—Steel Reinforcement (for concrete)

1. Scope

This specification covers the quality of steel reinforcement for reinforced concrete.

2. Quality

All reinforcement shall be free from loose or flaky rust, soil, oil, grease, paint, or other deleterious matter.

Steel bars for concrete reinforcement shall be grade 40, 50, or 60 deformed bars conforming to one of the following specifications:

- Deformed and plain billet-steel bars for concrete reinforcement—ASTM A 615
- Rail-steel deformed and plain bars for concrete reinforcement—ASTM A 616 with the S1 supplemental requirements
- Axle-steel deformed and plain bars for concrete reinforcement—ASTM A 617.

Dowels shall be plain round bars conforming to the same specifications listed above for steel bars.

Fabricated deformed steel bar mats for concrete reinforcement shall conform to the requirements of ASTM A 184.

Plain steel welded wire fabric for concrete reinforcement shall conform to the requirements of ASTM A 185.

Deformed steel welded wire fabric for concrete reinforcement shall conform to the requirements of ASTM A 497.

Epoxy-coated steel bars for concrete reinforcement shall conform to the requirements of ASTM A 775.

3. Dimensions of welded wire fabric

Gauges, diameters, spacing, and arrangement of wires for welded steel wire fabric shall be as defined for the specified style designations.

4. Storage

Steel reinforcement inventories at the site of the work shall be stored above the ground surface on platforms, skids, or other supports and shall be kept clean and protected from mechanical injury and corrosion.

Material Specification 591—Field Fencing Material

1. Scope

This specification provides the minimum quality requirements for the material used in the construction of field fences.

2. Wire gauge

When the size of steel wire is designated by gage number, the diameter shall be as defined for U.S. Steel Wire Gauge.

3. Fencing

Fencing material shall conform to the requirements of ASTM A 121 for barbed wire, ASTM A 116 for woven wire, ASTM A 390 for poultry fence or netting, and ASTM A 854 for high-tensile wire. Barbed wire and woven wire shall be class 3 zinc coated unless otherwise specified. High-tensile wire shall have type I zinc coating unless otherwise specified.

4. Stays, fasteners, and tension wire

Stays and fasteners shall conform to the requirements of the appropriate ASTM for the fencing material specified unless otherwise specified. Tension wires shall have a tensile strength not less than 58,000 pounds per square inch. Stays, fasteners and tension wire shall have class 3 zinc coating as specified in ASTM A 641.

5. Wood fence posts and braces

Unless otherwise specified, wood posts shall be of black locust, red cedar, osage orange (Bois d'Arc), redwood, pressure treated pine, or other wood of equal life and strength. At least half the diameter or diagonal dimension of red cedar or redwood posts shall be in heartwood. Pressure treatment shall conform to Material Specification 585, Wood Preservatives and Treatment. The posts shall be sound, new, free from decay, with all limbs trimmed substantially flush with the body. All posts shall be substantially straight throughout their full length.

Wood braces shall be of wood material equal to or better than construction grade Douglas fir. Wood braces shall be pressure treated in conformance with Material Specification 585.

6. Steel fence posts and braces

Steel fence posts and braces shall conform to the requirements of ASTM A 702 for steel fence posts and ASTM A 53 for bracing pipes. Posts with punched tabs for fastening the wires shall not be installed.

7. Concrete fence posts

Concrete fence posts shall be manufactured to the specified requirements of size, shape, and strength.

8. Panel gates

Panel gates shall be the specified types, sizes, and quality and shall include the necessary fittings required for installation. The fittings shall consist of not less than two hinges and one latch or galvanized chain for fastening. Latches shall be of such design that a padlock may be used for locking. All fittings shall not be of lesser quality than the gate manufacturer's standard.

9. Wire gates

Wire gates shall be the type shown on the drawings, constructed in accordance with specifications, at the locations, and to the dimensions shown on the drawings. The material shall conform to the kinds, grades, and sizes specified for new fence, and shall include the necessary fittings and stays.

10. Staples

Staples required to secure the fence wire to wood posts shall be 9-gauge galvanized wire with a minimum length of 1.5 inches for soft woods and a minimum length of 1 inch for close-grain hardwoods.

11. Galvanizing

All iron and steel fencing material, except as otherwise specified, shall be zinc coated by the hot dip process meeting the requirements of Material Specification 582. Clips, bolts, and other small hardware may be protected by electro-deposited zinc or cadmium coating.

Material Specification 592—Geotextile

1. Scope

This specification covers the quality of geotextiles.

2. General requirements

Fibers (threads and yarns) used in the manufacture of geotextile shall consist of synthetic polymers composed of a minimum of 85 percent by weight polypropylenes, polyesters, polyamides, polyethylene, polyolefins, or polyvinylidene-chlorides. They shall be formed into a stable network of filaments or yarns retaining dimensional stability relative to each other. The geo-textile shall be free of defects and conform to the physical requirements in tables 592–1 and 592–2. The geotextile shall be free of any chemical treatment or coating that significantly reduces its porosity. Fibers shall contain stabilizers and/or inhibitors to enhance resistance to ultraviolet light.

Thread used for factory or field sewing shall be of contrasting color to the fabric and made of high strength polypropylene, polyester, or polyamide thread. Thread shall be as resistant to ultraviolet light as the geotextile being sewn.

3. Classification

Geotextiles shall be classified based on the method used to place the threads or yarns forming the fabric. The geotextiles will be grouped into woven and nonwoven types.

Woven—Fabrics formed by the uniform and regular interweaving of the threads or yarns in two directions. Woven fabrics shall be manufactured from monofilament yarn formed into a uniform pattern with distinct and measurable openings, retaining their position relative to each other. The edges of fabric shall be selvedged or otherwise finished to prevent the outer yarn from unraveling.

Nonwoven—Fabrics formed by a random placement of threads in a mat and bonded by heat-bonding, resin-bonding, or needle punching. Nonwoven fabrics shall be manufactured from individual fibers formed into a random pattern with distinct, but variable small openings, retaining their position relative to each other when bonded by needle punching, heat, or resin bonding. The use of nonwovens other than the needle punched geotextiles is somewhat restricted (see note 3 of table 592–2).

4. Sampling and testing

The geotextile shall meet the specified requirements (table 592–1 or 592–2) for the product style shown on the label. Product properties as listed in the latest edition of the "Specifiers Guide," Geotechnical Fabrics Report, (Industrial Fabrics Association International, 1801 County Road BW, Roseville, MN 55113-4061) and that represent minimum average roll values, are acceptable documentation that the product style meets the requirements of these specifications.

For products that do not appear in the above directory or do not have minimum average roll values listed, typical test data from the identified production run of the geotextile will be required for each of the specified tests (tables 592–1 or 592–2) as covered under clause AGAR 452.236-76.

5. Shipping and storage

The geotextile shall be shipped/transported in rolls wrapped with a cover for protection from moisture, dust, dirt, debris, and ultraviolet light. The cover shall be maintained undisturbed to the maximum extend possible before placement.

Each roll of geotextile shall be labeled or tagged to clearly identify the brand, class, and the individual production run in accordance with ASTM D 4873.

Table 592–1 Requirements for woven geotextiles

Property	Test method	Class I	Class II & III	Class IV
Tensile strength (pounds) 1/	ASTM D 4632 grab test	200 minimum in any principal direction	120 minimum in any principal direction	180 minimum in any principal direction
Elongation at failure (percent) 1/	ASTM D 4632 grab test	<50	<50	<50
Puncture (pounds) 1/	ASTM D 4833	90 minimum	60 minimum	60 minimum
Ultraviolet light (% residual tensile strength)	ASTM D 4355 150-hr exposure	70 minimum	70 minimum	70 minimum
Apparent opening size (AOS)	ASTM D 4751	As specified, but no smaller than 0.212 mm (#70) 2/	As specified, but no smaller than 0.212 mm (#70) 2/	As specified, but no smaller than 0.212 mm (#70) 2/
Percent open area (percent)	CWO-02215-86	4.0 minimum	4.0 minimum	1.0 minimum
Permitivity sec^{-1}	ASTM D 4491	0.10 minimum	0.10 minimum	0.10 minimum

1/ Minimum average roll value (weakest principal direction).
2/ U.S. standard sieve size.
Note: CWO is a USACE reference.

Table 592–2 Requirements for nonwoven geotextiles

Property	Test method	Class I	Class II	Class III	Class IV 3/
Tensile strength (lb) 1/	ASTM D 4632 grab test	180 minimum	120 minimum	90 minimum	115 minimum
Elongation at failure (%) 1/	ASTM D 4632	≥ 50	≥ 50	≥ 50	≥ 50
Puncture (pounds)	ASTM D 4833	80 minimum	60 minimum	40 minimum	40 minimum
Ultraviolet light (% residual tensile strength)	ASTM D 4355 150-hr exposure	70 minimum	70 minimum	70 minimum	70 minimum
Apparent opening size (AOS)	ASTM D 4751	As specified max. #40 2/	As specified max. #40 2/	As specified max. #40 2/	As specified max. #40 2/
Permittivity sec^{-1}	ASTM D 4491	0.70 minimum	0.70 minimum	0.70 minimum	0.10 minimum

1/ Minimum average roll value (weakest principal direction).
2/ U.S. standard sieve size.
3/ Heat-bonded or resin-bonded geotextile may be used for classes III and IV. They are particularly well suited to class IV. Needle-punched geotextiles are required for all other classes.

II-E. OPERATION & MAINTENANCE PLAN & REQUIREMENTS

OPERATION AND MAINTENANCE PLAN & REQUIREMENTS
AG WASTE SYSTEM
T-T Ranch (Jeff Topp)

Since it is difficult to design or plan for certain weather trends (e.g. ice flows, flash floods, human and animal activities) and management styles it is necessary to have a plan in place to address these issues.

Site and layout was selected by landowner(s). Backfilling of heavy use pads, cleaning out solid separator, and repairing eroded areas, managing water in feed areas, are some items that will require at minimum, annual maintenance.

Since the selected site and layout has lot slopes that are greater than and less than the recommended 3-5%, maintaining lot drainage and transport of solids (erosion) will require, at minimum, annual maintenance.

Access roads are designed for low speed (0-5 mph) farm vehicle traffic and are to be maintained to prevent accidents (e.g. sand, salt, or plow to remove ice/snow, maintain road as designed to prevent water ponding and muddy conditions).

1. Accumulated solids shall be removed from settling area(s), dirty water diversions, and feedlot areas a minimum of one time per year, to maintain design volume and minimize transport of solids into holding pond. It is recommended that feedlot areas are cleaned regularly (weekly) to minimize transport of solids to settling areas and promote good herd health.

2. Screens, piping, and appurtenances in solid separator area(s) shall be inspected after all storm events, and cleaned of any accumulated debris and/or solids to allow for proper drainage and function of settling area. Any damaged or deteriorated components shall be repaired to original condition immediately.

3. Holding Pond(s) and/or containment areas is/are designed to store 365 days worth of rainfall and runoff from the feedlot areas. The pond or containment area will have to be pumped annually at a minimum except for; dryer than normal years when the holding pond/containment area(s) water may evaporate to acceptable depths, or wetter than normal years when containment area/pond(s) may need to be pumped more than one-time per year. A marker post will indicate when the holding pond/containment area(s) will need to be pumped down to maintain design capacity.

4. Holding pond(s), containment areas, settling area, and feedlot waste shall be applied as specified in Nutrient Management Plan or Waste Utilization Plan when developed.

5. Earthwork (dikes, berms, ditches, etc.) shall be inspected annually for signs of seepage, rodent damage, settlement, misalignment, or erosion. Damaged areas need to be repaired to original design grades and specifications.

6. Vegetation on containment dike shall be clipped or grazed annually as a minimum and only when area is **dry and firm.** Regrade, seed and mulch any areas which become damaged immediately.

7. Vegetation in diversion channels or on dikes shall be grazed or clipped annually as a minimum and only when area(s) is **dry and firm.** Do not overgraze diversion areas. Planting of row crops will not be permitted within diversion channels. Regrade, seed and mulch any areas which become damaged immediately.

8. Removal of accumulated sediment within holding pond may be necessary over time to maintain design volume, if necessary, care shall be taken to prevent damage to pond design dimensions.

9. Repair any damage to fences, gates, marker posts, and safety signs immediately.

10. Plant species for reseeding on pond dikes shall be as specified in original design or other approved shallow rooted plant species.

11. The landowner/producer is responsible for back-up power and water if existing system goes down due to power outage or pump fails, etc.

12. Inspect concrete work annually for major damage. Repair as needed to maintain original design requirements.

13. Inspect pipes after major storm events for damage and debris. Remove any debris from inlet or outlet. Repair any damage immediately.
    In ***no*** event should pipes be entered by the producer(s)or his/her work persons. A professional that is cognizant of safety guidelines for entering wastewater tanks/pipes should be hired to enter or inspect if needed.

14. ***Pasture areas or other light-use areas used for occasional feeding should be maintained so that existing vegetation is not greatly disturbed, but if these areas are later found to be contributing nutrients and/or pollutants in excess to local, state or federal tolerances, to the local tributaries or waters of the state, these areas may need to be considered for some type of containment or alternative treatment.***

OPERATION AND MAINTENANCE CONCURRENCE

I have reviewed the above operation and maintenance requirements for the practices installed in this project. The requirements have been fully explained to me. I agree to operate and maintain the best management practices as outlined above.

Landowners'/Producers'
Signature_____Date_____

III. COST ESTIMATES

ENGINEER'S ESTIMATE

06/03/09

Topp Farms
Ag Waste System
Eddy County North Dakota

note: unit prices should be adjusted depending on cost-share program guidlines

		UNIT	QUANTITY		UNIT PRICE($)		TOTAL	
Working facility								
	Buildings		5,880	ft^2	12.00	/ft^2	$70,560.00	
	working chutes & related items		2	Each	10000.00	/Each	$20,000.00	
	scale		1	Each	10000.00	/Each	$10,000.00	$100,560.00
SITE PREP.								
	Windbreak/Board Fence Removal		0	Ft	5.50	/Ft	$0.00	
	Feedlot Fence Removal		2,500	Ft	3.50	/Ft	$8,750.00	
	other Fence		1,000	Ft	0.50	/Ft	$500.00	
	Manure Removal		1	acres	1000.00	/ac	$1,000.00	
	Waterer removal		2	job	150.00	/job	$300.00	
	power pole relocat		3	job	2000.00	/job	$6,000.00	
	Tree removal		1	acres	1000.00	/ac	$1,000.00	$17,550.00
Excavation & Earthfill								
	Excavation & Earthfills		70,923	Cu. Yds.	2.25	/Cu. Yds.	$159,576.75	
	Clay Liner Fill(placement)		13,019	Cu. Yds.	3.75	/Cu. Yds.	$48,820.74	
	Clay Liner fill(hauing)		13,019	Cu. Yds.	1.00	/Cu. Yds.	$13,018.86	
	Topsoil stripping		14,860	Cu. Yds.	1.85	/Cu. Yds.	$27,491.31	
	Topsoiling		14,860	Cu. Yds.	1.50	/Cu. Yds.	$22,290.25	
	Water for Construction		0	kgal	$13.00	/Kgal	$0.00	$271,197.91
EROSION BLANKET								
	Erosion Blanket N.A.G. S150			SQ YD	1.50	/SQ YD	$0.00	
	Erosion Blanket N.A.G. C125		0	SQ YD	2.00	/SQ YD	$0.00	
	Staple (1000CT/BOX)		0	BOXES	55.00	/EA	$0.00	
	Blanket Installation		0	SQ YD	1.50	/SQ YD	$0.00	$0.00
SOLID SEPARATORS								
	Concrete-In Place		45	Cu. Yds.	400.00	/Cu. Yds.	$18,000.00	
	Drainfill		36	Cu. Yds.	15.00	/Cu. Yds.	$540.00	
	Screens		4	Each	120.00	/Each	$480.00	
	18"PE pipe		120	Ft	12.90	/Ft	$1,548.00	
	elbows		0	Each	485.00	/Each	$0.00	$20,568.00
UNDERGROUND OUTLET PIPES/CULVERTS								
	30" PE		0	Ft.	25.00	/Ft.	$0.00	
	24" PE		0	Ft.	19.65	/Ft.	$0.00	
	18" PE		0	Ft	12.90	/Ft	$0.00	
	Installation	+SS Pipe	180	Ft	10.00	/Ft	$1,800.00	
	18" CMP		60	Each	31.50	/Each	$1,890.00	
	18" flared end		2	Each	135.00	/Each	$270.00	
	Bar Guards		0	Each	50.00	/Each	$0.00	$3,960.00
ACCESS RD.								
	Gravel		3,336	Cu. Yds.	15.00	/Cu. Yds.	$50,040.00	
	Woven Geotextile		13,343	YD^2	1.00	/YD^2	$13,343.11	
	Geotextile Placement		13,343	YD^2	1.00	/YD^2	$13,343.11	$76,726.22
ROCK RIP RAP								
	Rock Rip Rap		0	Cu. Yds.	40.00	/Cu. Yds.	$0.00	
	Non-Woven Geotextile		0	YD^2	1.00	/YD^2	$0.00	
	Geotextile Placement		0	YD^2	1.00	/YD^2	$0.00	$0.00
HEAVY USE AREAS								
	Concrete-In Place (curb)		86	Cu. Yds.	400.00	/Cu. Yds.	$34,238.68	
	Concrete-In Place (curb)			Cu. Yds.	400.00	/Cu. Yds.	$0.00	
	Concrete-In Place(headwall)		6	Cu. Yds.	275.00	/Cu. Yds.	$1,532.53	
	Concrete-In Place		575	Cu. Yds.	275.00	/Cu. Yds.	$158,209.88	
	Concrete-In Place(silage pad)		0	Cu. Yds.	275.00	/Cu. Yds.	$0.00	
	Drainfill		484	Cu. Yds.	15.00	/Cu. Yds.	$7,254.84	
	Steel Pipe Post			Each	0.00	/Each	$0.00	$201,235.93
FENCING								
	Windbreak Fence		0	Ft	11.00	/Ft	$0.00	
	Woven Wire Fence		4,108	Ft	1.50	/Ft	$6,162.00	
	FeedlotFencing		11,747	Ft	12.00	/Ft	$140,964.00	
	other Fence		1,000	Ft	1.50	/Ft	$1,500.00	
	staff gauge		3	Each	500.00	/Each	$1,500.00	
	Warning Signs		12	Each	20.00	/Each	$240.00	$150,366.00
WATER SUPPLY								
	Well modification		1	Each	7000.00	/Each	$7,000.00	
	Waterer		10	Each	600.00	/Each	$6,000.00	
	Trenching		4,887	Ft	2.75	/Ft	$13,439.25	
	Waterline		4,987	Ft	2.25	/Ft	$11,220.75	
	Electrical		1	LS	10000.00	/LS	$10,000.00	
	light poles		8	Each	350.00	/Each	$2,800.00	
	Misc. fittings, curb stop etc.		1	LS	600.00	/LS	$600.00	$51,060.00
SEEDING								
	Shaping, Grading & Seeding		7.6	AC	600	/Acre	$4,560.00	$4,560.00
						TOTAL	$897,784.06	
	Mobilization, Profit, Contingency				5	%	$44,889.20	
						GRAND TOTAL =	$942,673.26	

Jeff Topp AWS **Eddy County ND**

Code	Practice Name	Component	Unit Type	EQIP 60%	(existing AFO) 70%	TOTAL UNITS	Unit type	TOTAL COSTSHARE	TOTAL COST
313	Waste Storage Facility (No.)	Excavated Pond	CuYd	$1.35	$1.58	34,728	CuYd	$54,870.24	$78,386.06
356	Dike (Ft.)	Dike	CuYd	$1.71	$2.00	13,601	CuYd	$27,202.00	$38,860.00
362	Diversion (Ft.)	Diversion	CuYd	$1.84	$2.14	7,823	CuYd	$16,741.22	$23,916.03
382	Fence (Ft.)	Barbed Wire	Foot	$0.62	$0.73	1,000	Foot	$730.00	$1,042.86
382	Fence (Ft.)	Feedlot Fence	Foot	$5.15	$6.01	11,747	Foot	$70,599.47	$100,856.39
382	Fence (Ft.)	Woven Wire Fence	Foot	$0.93	$1.08	4,108	Foot	$4,436.64	$6,338.06
500	Obstruction Removal	Obstruction Removal	Ea	$648.00	$756.00	3	Ea	$2,268.00	$3,240.00
500	Obstruction Removal	Feedlot Fence Removal	ft	$2.92	$3.40	2,500	ft	$8,500.00	$12,142.86
500	Obstruction Removal	Other Fence Removal	ft	$0.40	$0.46	1,000	ft	$460.00	$657.14
516	Pipeline (Ft.)	Pipeline - Backhoe - Shallow	Foot	$2.77	$3.23	180	Foot	$581.40	$830.57
516	Pipeline (Ft.)	Pipeline - Backhoe - Frost Free w/hookup	Foot	$3.02	$3.52	4,887	Foot	$17,202.24	$24,574.63
521D	Pond Sealing or Lining (CuYd)	Clay Lining	Cu. Yd.	$4.39	$5.12	13,019	Cu. Yd.	$66,657.28	$95,224.69
560	Access Road (Ft.)	New single lane	CuYd	$1.45	$1.69	44,849	CuYd	$75,794.81	$108,278.30
561	Heavy Use Area Protection (Ac.)	Heavy Use Protection, Gravel on Geotextile	Cu. Yd.	$19.80	$23.10	3,336	CuYd	$77,061.60	$110,088.00
561	Heavy Use Area Protection (Ac.)	Heavy Use Protection, Concrete	Cu. Yd.	$214.83	$250.64	575	Cu. Yd.	$144,118.00	$205,882.86
614	Watering Facility (No.)	Water Fountain	Ea	$226.80	$264.60	10	Ea	$2,646.00	$3,780.00
620	Underground Outlet (Ft.)	Inlet/Outlet Structure	Diameter inch foot	$0.77	$0.89	3,240	Diameter inch foot	$2,883.60	$4,119.43
632	Solid / Liquid Waste Separation Facility	Solid Separation Facility - Concrete	CuYd	$311.27	$363.15	45	CuYd	$16,341.75	$23,345.36
342	Critical Area Planting (Ac.)	Seedbed Preparation, Seed & Seeding, Shaping, Native & Introduced	Acre	$327.06	$381.57	8	Acre	$3,052.56	$4,360.80
484	Mulching (Ac.)	Mulch, Treader	SqYd	$0.10	$0.12	38,720	SqYd	$4,646.40	$6,637.71

Note: this is only an estimate, NRCS Staff will need to review and determine what items are actually cost shared.

	COST SHARE	TOTAL COST
TOTAL	**$596,793.21**	**$852,561.73**

IV. COMPREHENSIVE NUTRIENT MANAGEMENT PLAN ITEMS

IV-A. NUTRIENT MANAGEMENT PLAN

IV-A-1 NUTRIENT MANAGEMENT PLAN SUMMARY

IV-A-1. Nutrient Management Plan Summary

The T-T Ranch confines up to 500 beef cows for up to 180 days and up to 2,000 feeders up to 365 days. Seven fields have been identified for manure application and maps of these fields are included, calculations show that fields 1 & 2 provide enough acres to utilized the nutrients produced from the 2,500 head, but it is recommended that all fields are used for manure application. This most likely scenario (with the fields being close to the feedlot) has been represented in the land application spreadsheets. Crop rotations on these fields will likely vary from what is shown, but will be a rotation of corn, soybeans and a small grain. Market variability and weather conditions will be a determining factor in yearly crop choices. Calculations show that there is ample land for manure application, and maintaining rotation on spreading areas should more than adequately account for manure nutrients. Fields should be tested annually to track nutrient levels. If soil test results indicate a build up of nutrients in fields, then other fields may need to be identified/used for manure application in the future.

It is recommended that manure application fields are soil tested annually and manure is tested annually to help make prudent decisions on what fields to apply manure and at what rates.

It is also recommended that manure piles are mixed regularly and composted to provide a more uniform material for spreading on hayfields, as well as decreasing the volume of solids that need to be hauled.

Site & Field Locations:

Refer to section IV-A-2

Record Keeping:

Record keeping forms are included in section IV-A-3d.

North Dakota Department of Health (NDDH) requires record keeping for most animal feeding operations. Whether your operation is required to keep records or not it is still advisable to keep records for the possibility of neighbor complaints or other legal issues that may arise.

The record keeping forms included in section III-A-3d cover the NDDH requirements if used.

Manure Sampling:

Sampling can be hired out or done using the following sampling procedure.

-the following is a method described by North Dakota State University (NDSU) Extension Service.

Sampling Procedures: Because manure can be variable, it is important to get an adequate number of sub samples and mix them well to get a composite sample. A clean tiling spade or similar device and a clean five-gallon plastic (not metal) bucket work well for sampling solid manure.

Solid manure piles

- Take at least 20 sub samples
- Sample various locations and depths in the pile
- Mix thoroughly
- Take a two pound composite sample
- Place the composite sample in a plastic bag
- Expel air from the bag and seal it

Liquid manure storages

- Agitate or mix the manure to suspend solids (This is usually done before emptying the storage.)
- Take about five sub samples of the agitated manure from the storage structure, pump or manure wagon.
- Thoroughly mix the sub-samples
- Take a composite sample of whatever size the laboratory requires
- Put the sample in a plastic bottle, leaving some room for expansion or gas
- Secure the lid on the bottle and put the bottle in a plastic bag

Important note: *All samples should be refrigerated or frozen if they cannot be transported to the lab immediately.*

Timing of sampling: Sampling and testing just prior to manure application will let you calculate the application rate necessary to meet the crop requirements. However, if that is not possible, take samples of the material as it is being spread. The test results will still be valuable.

- Manure samples taken from the spreader will more accurately represent the material actually being spread.
- You will know what nutrients amounts have been applied, so you can account for them in future nutrient application planning.
- You will begin to create a useful record of your operation. Although manure composition varies greatly from one AFO to another, it tends to be more consistent from time to time on a given AFO unless the type of livestock or the feed ration is changed.

What information do you want from the manure test?

For certain

- Total nitrogen
- Phosphorus

Maybe

- Inorganic and organic nitrogen (indicates how quickly N is available to plants)
- Moisture content
- Potassium
- Total salts (electrical conductivity)

How should the information be reported?

- Nutrient content should be reported on an as-is basis rather than a dry matter basis because that is how you will be land applying it.
- Nutrient concentration should be reported as pounds per ton or pounds per 1000 gallons because that is how you will be calibrating the application machinery.
- Phosphorus content should be reported as P2O5 equivalent rather than as elemental P, because that is how fertilizer recommendations are made.

Available Labs for manure testing (not inclusive):

Stearns DHIA
825 12th St South -PO box 227
Sauk Centre MN 56378
Ph. 320-352-2028

AgSource Soil & Forage Lab
106 N. Cecil Street
Bonduel WI 54107
Ph. 715-758-2178

Soil Sampling:

Sampling can be hired out or done using the following sampling procedure.

-the following is a method described by North Dakota State University (NDSU) Extension Service.

-refer to NDSU SF 990 for further information.

These are only recommendations, if producers have methods (or professionals employed) proven, then continue using those methods.

Importance of Soil Sampling: Soil tests measure the relative nutrient status of soils and are used as a basis for profitable and environmentally responsible fertilizer application. The accuracy of a soil test result is influenced by the laboratory analysis but may be influenced even more by the quality of the soil sample. Sample collection is extremely important in the accuracy and repeatability of a soil test. Sample handling following collection is also important. A soil sample which does not represent the area being sampled will be misleading and result in over or under-application of fertilizer. It is therefore very important to collect and handle soil samples properly.

When to Sample: Soil samples to be analyzed for soil pH, salt content, zinc (Zn) and phosphorus (P) can be taken nearly any time of year. Potassium (K) values from samples taken in frozen soil may test high compared to other times of the year. Sulfur (S) and chloride (Cl) are mobile in the soil, so sampling in the fall or spring is recommended.

Most soil samples in North Dakota are taken for nitrate-nitrogen (NO_3-N) analysis. When samples are collected in the fall before September 15, a sampling date adjustment (SDA) should be used to compensate for additional N releases anticipated from soil organic matter and previous crop residue decomposition. Soil samples for NO_3-N may be taken without sampling date adjustment after September 15. After this date, most additional N releases from soil micro-biological activity are low. Soil samples may be taken for NO_3-N as early as August 1. The SDA adds one-half pound of NO_3-N to the soil test analysis for each day the sample is collected prior to September 15 (Table 1).

Table 1. **Sampling date adjustments if soil samples are taken in the fall prior to September 15.**

Date of Sampling	Sampling Date Adjustment
	lb of NO_3-N/acre
August 1	23
August 15	15
August 30	8
September 5	5
September 15	0

Producers should not be reluctant to sample in early August following small grain harvest because of fear of greater N release from organic matter and residues compared to late fall sampling. If yields were relatively high, the SDA adjustment represents potential N release well. Sampling fields before tillage also increases the reliability of the 0-6 inch soil core depth because of more uniform soil conditions compared to tilled fields. Waiting to sample small grain fields until late fall increases the risk of N uptake by small grain regrowth, which may contain up to 100 lb N/acre. Sampling standing row crops for NO_3-N is not recommended.

Fall soil sampling results for NO_3-N and S are similar in most years to spring sampling. However, warmer than normal winters followed by an early spring combined with good soil moisture could increase NO_3-N and S levels through organic matter and residue mineralization. Green sugarbeet leaves or other crop residues with relatively high N content may also contribute to early mineralization and increase spring NO_3-N levels compared to a fall soil sampling. In sandy soils with high rainfall or snow-melt following a fall sampling, levels of NO_3-N and S in the spring compared to a fall sampling may decrease as nitrate and sulfate is leached out of the sampling zone. In most situations, however, fall sampling is a good guide to N and S application.

Depth Of Sampling: Soil sampling and analysis assumes 2,000,000 lb/acre of soil from 0-6 inches in depth. This weight per unit volume (bulk density) assumes a medium soil texture with some compaction typically found following cropping and harvest. Bulk density differences can make a difference of 10% in soil test results. Bulk density is ignored in commercial soil sampling, but consistency in soil sampling techniques is important because of soil bulk density differences, especially in surface cores. The depth of sampling required depends mainly on the nutrient of interest, the crop to be fertilized, and in some cases, the tillage system in place (Figure 1).

Figure 1. Depth recommended generally for soil analysis of certain properties and nitrate analysis for crops.
-pull sample from in between crop rows -not directly in row.

Soil Surface	Soil Properties	Crops
0-6 inch	pH, P,K, OM, Cl, S, Ca, Mg, CEC, Zn, $NH4^+$-N, Fe, Mn, Cu, soluble salts, NA	Alfalfa, clovers (analyze only 0-6 inch depth, nitrate analysis at deeper depths not necessary).
6-24 inch	Soluble salts, NO_3-N, S, Cl (in addition to 0-6 inch depth)	Wheat, barley, oats, durum, corn, soybean, dry bean, potato, canola, crambe, mustard, sunflower, grass hay, pasture, millet, canary seed, flax, safflower , buckwheat, lentil, field pea, sorghum, sudangrass. (Separate 0-24 inch depth into a 0-6 inch and 6-24 inch depth.)

Figure 1. (CONTI.)

24-48 inch	NO_3-N, in addition to the 0-6 inch and 6-24 inch depths	Sugarbeet, malting barley. (Sunflower if greater than 30 lb N/acre are anticipated at the 24-48 inch depth.) (Separate cores into 0-6 inch, 6-24 inch and 24-48 inch depths.)

Crops: For most crops, NO_3-N should be determined on the 0-24 inch depth. For sugarbeet and malting barley, the 24-48 inch depth should also be sampled to fine-tune N rates necessary to improve beet and grain quality. Sunflower also may use deep N; however, deeper sampling is conducted not to improve quality, but to save money on N fertilizer when there is reason to suspect the presence of large quantities of N at deep depths, such as following years of growing shallow rooted crops, following fallow, and when previous crop yields have been low.

Tillage System: Under conventional tillage and conservation tillage, sampling 0-6 inch, 6-24 inch and the 24-48 inch depths described previously are appropriate. Under long-term no-till, stratification of soil non-mobile nutrients and soil pH will occur. Phosphate and soil pH stratification are common, with high P and lower pH levels at the surface 0-2 inch depth and lower P and higher pH levels at deeper depths. If the lower depths become depleted in P, application of more deeply placed P may be beneficial, especially in drier seasons. Soil pH tends to become acid at the surface, especially if N fertilizers are applied to the surface. Separating the 0-6 inch depth into a 0-2 inch depth and 2-6 inch depth would identify these trends.

Sampling Tools: Soil is variable not only over an area, but also with depth. A proper soil sample is taken from a uniform volume from the top of the sample depth to the bottom. Wedge shaped samples, or a handful of soil from the surface and one at depth, are not appropriate and will not give consistent results. The best sample is taken using a soil probe. There are hand-probes and automated probes available at nearly every price range. The probe should be designed to gather soil from the appropriate depth.

Soil Sample Handling: Samples intended for NO_3-N sampling should be stored in ice chests during transport. Moist samples subjected to heat will increase N mineralization and test values will increase during transport/storage. Samples intended for NO_3-N determination should be air-dried immediately after collection to prevent alteration of NO_3-N concentrations due to microbial activity. Spread samples uniformly on clean paper in a dust free area. Another procedure is to transport the samples immediately to a soil testing laboratory in a cold ice chest. Usually, the soil laboratory attaches a drying charge for wet soil samples. Rubber gloves should be used to handle samples intended for chloride analysis to prevent contamination from chloride in perspiration.

Soil samples intended for Zn analysis should not come into contact with any galvanized surface, including the soil sampling tool, plastic bucket (not metal), drying container or grinder.

Soil Sampling Collecting, where & how: Where to collect a soil sample and how many samples to collect depends on the sampling goal. Traditionally in North Dakota, the goal has been to provide one soil test level to describe a field. This approach works well in some situations, especially when the test value is low. However, because of the variability of nutrients in the field, one test level from a field may not represent a large part of the field. Some producers, having received a high soil test report, continue to apply the same fertilizer rates as in the past because they lack confidence in the test. Recent research has developed methods to increase the confidence in soil test values while keeping sampling costs low.

Sampling goals can be separated into two categories; determining nutrient levels in *Whole Fields*, or determining *Within Field Values.*

Note: areas that have never been tested and had years of manure applied should be tested separately from areas that have not had manure.

Determining Whole Field Nutrient Values: Collecting a selectively random sample composite is the traditional North Dakota sampling strategy for determining whole field nutrient values. A field composite sample should consist of at least 20 selectively random soil cores. A field sampled in this manner should give the field mean plus or minus 15% at least 80% of the time. Selectively random sampling means that the field is sampled only in areas which represent most of the field area. Unusual landscape features such as eroded areas, saline or sodic zones and old building lots are not sampled. Also, avoid sampling in dead furrows or back furrows, under old manure or hay piles, sugarbeet tare piles, animal droppings, next to ditches, sloughs and roads, known banded fertilizer locations, and small depressions.

There are often questions about what constitutes a "field." Some samplers collect one composite sample per section or one per quarter-section. Others separate the field into large landscape zones and treat each as a field. Some may divide a quarter into three to four equal sub-fields and sample each individually. Generally, the smaller the area, the more representative of the area the sample values will be.

Using a composite soil sample to direct fertilizer recommendations has several advantages:

- It is relatively inexpensive. Soil sampling is relatively quick, only 20 to 30 cores are needed to represent a field, and only one analysis is required for each field.
- Results are mostly reproducible.
- Results can easily be tracked from year to year.

Composite soil samples, however, have several inherent disadvantages:

- "Unusual areas" not sampled may comprise significant acreage in a field.
- Large portions of the field may be over- or under-fertilized.
- There is a low level of confidence that high soil test values represent most of the field.
- Sometimes it is difficult to distinguish which locations are unusual.

Composite sampling is most representative when within field variability is low. Low within field variability is most common when composite soil test levels are low. A field composite test of 20 lb NO_3-N/acre means that at least 95% of the area sampled contains levels between 10 and 30 lb NO_3-N/acre.

Collecting at least 20 soil cores from a field results in a large amount of soil being collected. In some soils, such as fine sandy loams, the soil may break up easily in a bucket, enabling thorough mixing before a 2/3 pint subsample is obtained for analysis. However, many soils do not break up easily. It may be necessary to take the entire sample out of the field, dry and grind it to obtain a good mixture. The resulting sample, whatever the method of collection and preparation, must represent the 20 core locations to provide the most accurate and reproducible results.

Sampling for within field nutrient: Because of the limitations of composite soil testing, and because of the growing popularity of site-specific farming, different methods of obtaining nutrient values within fields are needed. Sampling for determining within-field nutrient levels can be accomplished through two different methods; grid sampling and directed sampling. Grid sampling reveals fertility patterns through dense systematic sampling, while the directed sampling method assumes there is a predictable and logical reason for fertility patterns to exist and uses this reason to reduce sample number while maintaining high quality information compared to dense grid sampling. Directed sampling has also been called "zone sampling," "smart sampling"and "smart zones."

However, the regular grid can easily contain bias because of streaking of fertilizer or manure applications in the past. With GPS technology (Global Positioning Satellite receivers), grid sampling need not be regularly spaced. Irregularly spaced interval positions can reproducibly be located as accurately as regularly spaced grids. Irregular grids, such as the systematic unaligned grid, also provide the opportunity for greater statistical evaluation through a process called "kriging" (pronounced "kreeging"). Many researchers prefer kriging as an estimator of values between actual samples because it carries an estimate of error along with the estimated value. Other estimators such as inverse distance, polynomial and triangulation carry no such estimate of error. Other grid sampling types are random, random stratified, staggered start, and the diamond/triangle/hexagon grid pattern.

Grid Sampling Grid sampling can be a good tool for sampling within field nutrient levels if samples are taken densely enough. The accepted grid spacing from recent research, including in North Dakota, is about one sample per acre. This approach, however, is very expensive and time-consuming, and has forced many commercial soil samplers and producers to accept less information about their fields and use a 2.5 acre grid or larger. In North Dakota, even a 2.5 acre grid is considered expensive and prohibitive. A 4-5 acre grid is more commonly used. The 4-5 acre grid has been used to reveal variability in soil test levels, but it may not be very accurate in representing within-field nutrient levels nor does it represent fertility patterns well. The use of a 4-5 acre grid should not be considered a dense systematic grid.

Directed Sampling: A more practical approach for North Dakota producers that combines low cost with a high degree of meaningful nutrient information is directed sampling. Directed sampling is based on some prior knowledge of the field, or some logical basis. The basis of most North Dakota directed sampling is the effect of landscape position on soil nutrient levels, particularly nitrogen. Soil pH, P, K, and Zn are non-mobile factors or nutrients in soil. The levels and patterns of non-mobile nutrients within fields are similar from year to year. North Dakota research has also shown that patterns of NO_3-N, S and Cl, which are mobile soil nutrients, are also stable between years because the patterns are affected by the landscape.

Soil Testing Summary: Soil testing is the basis for fertilizer recommendations in North Dakota. A composite soil sample is a good first step in understanding relative levels among fields. Within-field management of nutrients based on grid sampling or directed sampling may inspire more confidence in soil test recommendations and provide more accurate field nutrient level information.

A composite field test requires from 20 to 30 cores to represent a field. By sampling three to four zones in the field, each with eight soil cores, the time spent sampling in the field and the cost of analysis is only increased a small amount, while the information gathered about the field is greatly increased.

Sampling should be considered seriously and soil samples handled properly to provide consistent results. Producers would not dare go to the field without checking the oil in their tractor engines. One should approach soil testing in a similar manner.

Timing, Rate and Frequency of Manure Applications.

Manure will need to be applied at agronomic rates and in the areas described on application maps. Avoid areas that discharge directly into ditches, wetlands, waterbodies, or streams (refer to buffers on application maps). Apply manure uniformly over field(s) and at rates determined through manure and soil testing.

To make the best use of manure nutrients, manure application should coincide with the time when crops are most in need of manure nutrients. The compromise, then, is to apply manure in the spring and/or in the fall, or in both seasons, but plan the applications for those times when they will be least offensive to neighbors. Producers should avoid holidays and be aware of wind conditions, so that neighbors will be in the downwind direction as little time as possible. Application in early evening, when air is still, is conducive to greater emissions than at midday , when air is more turbulent, allowing odor and other gases to dissipate more readily. Notifying neighbors of manure application plans is also a very important strategy to be undertaken.

Threatened and Endangered Species & National Environmental Protection Act (NEPA) conformance.

This plan has been developed to address sensitive areas by establishing buffers (non- application areas) and recommending best management practices to prevent the destruction/degradation of water bodies, habitat, water biota, and wildlife.

Plan Variations

This plan may be amended if it fails to achieve the environmental protection that it is designed to or technology provides for a better alternative. Changes to the plan will require approval from governing agencies -i.e. North Dakota Department of Health.

Approximate scale: 1" = 3000'

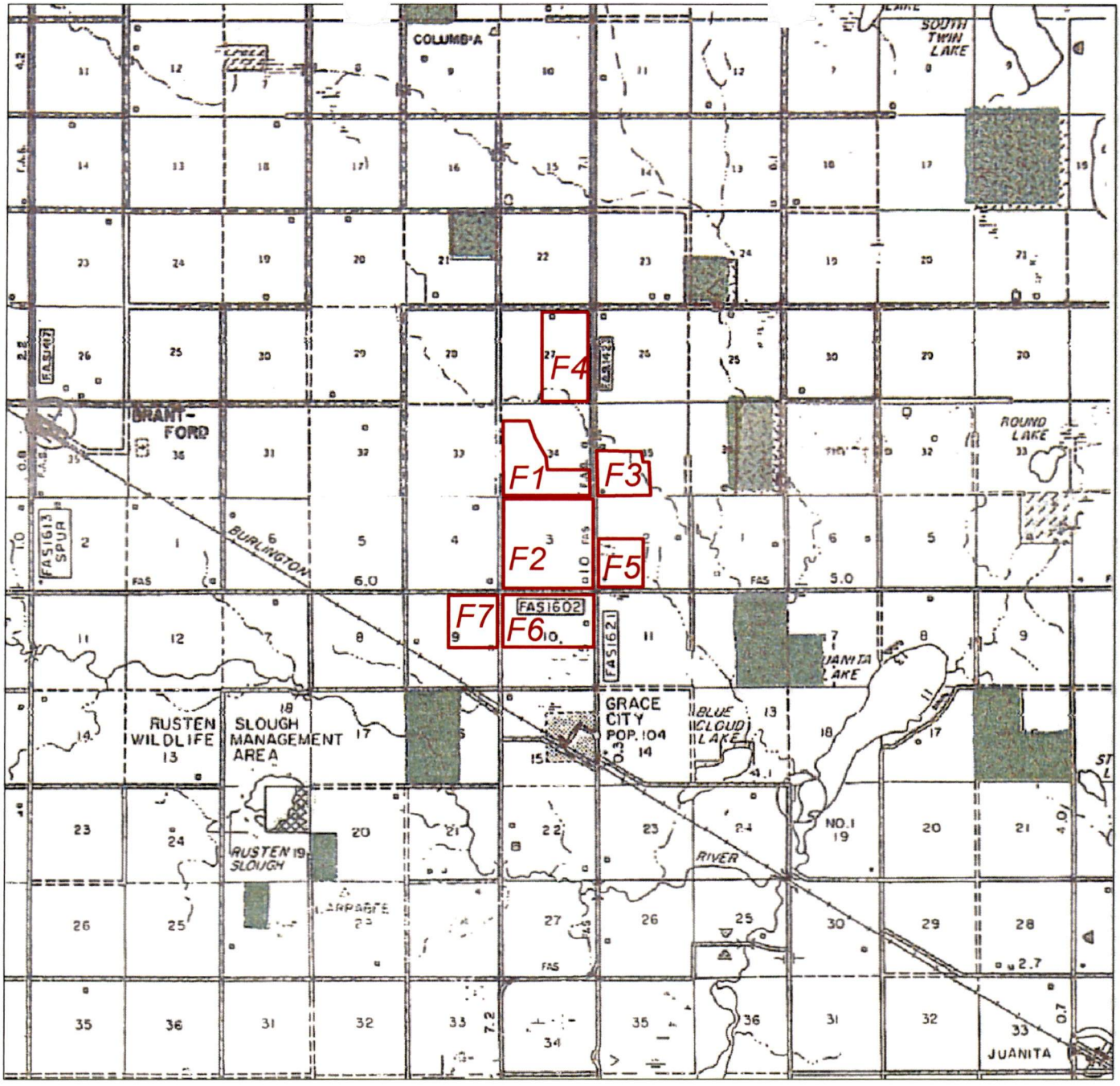
△ Public Well or Irrigation Well (none known within 2 miles from ND Water Commision Data -only test holes & Domestic Wells)

▭ Existing Livestock Dugout/pond (1 dugouts located -but more are likely in riparian & wetland/low areas)

Existing Gravel Pit (none known within 2 miles)

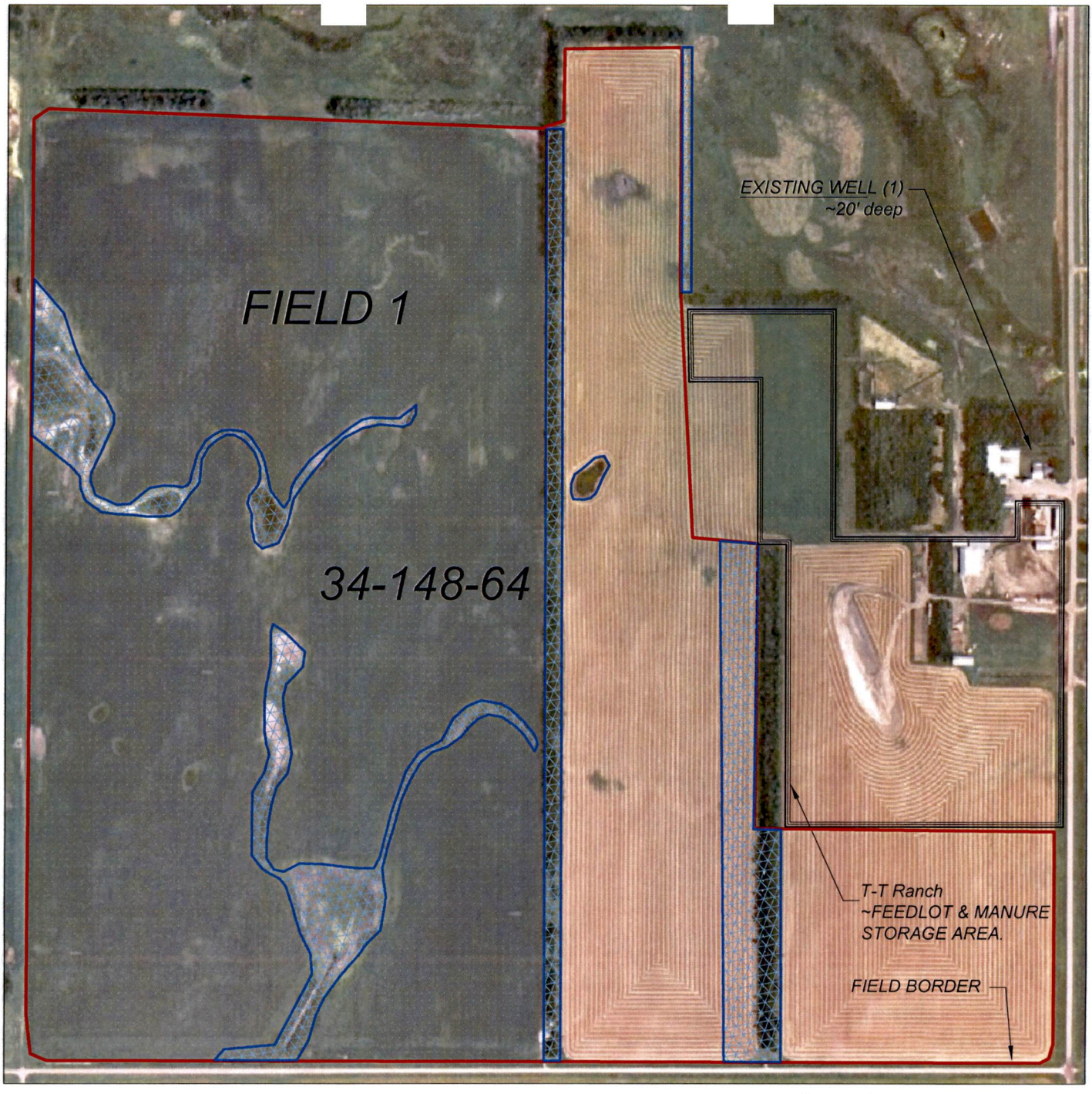
THE PROJECT AREA DOES NOT APPEAR TO OVERLIE A NDDH IDENTIFIED SENSITIVE AQUIFER.

Sheet No.				
1 of 9	K_2S ENGINEERING INC. 4209 94TH AVE SE YPSILANTI, ND 58497 Phone 701-489-3322	CNMP T-T Ranch 2 Mile Radius Map -Aerial Photo	Date Drawn 5-09 Drawn By skk Date Checked 5-09 Checked by jak File: CNMP maps.dwg	Date Approved By ... SHANE K. JELLBERG P.E. 5-09 ... Title ..... 1 OF 9



F1 = FIELD 1

Sheet No. 2 of 9	K_2S ENGINEERING INC. 4209 94TH AVE SE YPSILANTI, ND 58497 Phone 701-489-3322	CNMP T-T Ranch Field Index Map -Field 1-7	Date Drawn 5-09 Drawn By skk Date Checked 5-09 Checked by jak File: CNMP maps.dwg	Date Approved By SHANE KJELLBERG P.E. 5-09 Title 2 OF 9



Approximate scale: 1" = 750'

buffer areas (do not apply manure in these areas)

Field 1:

Total field area ~429 acres

Total field area - buffer areas = ~386 acres = applicable area

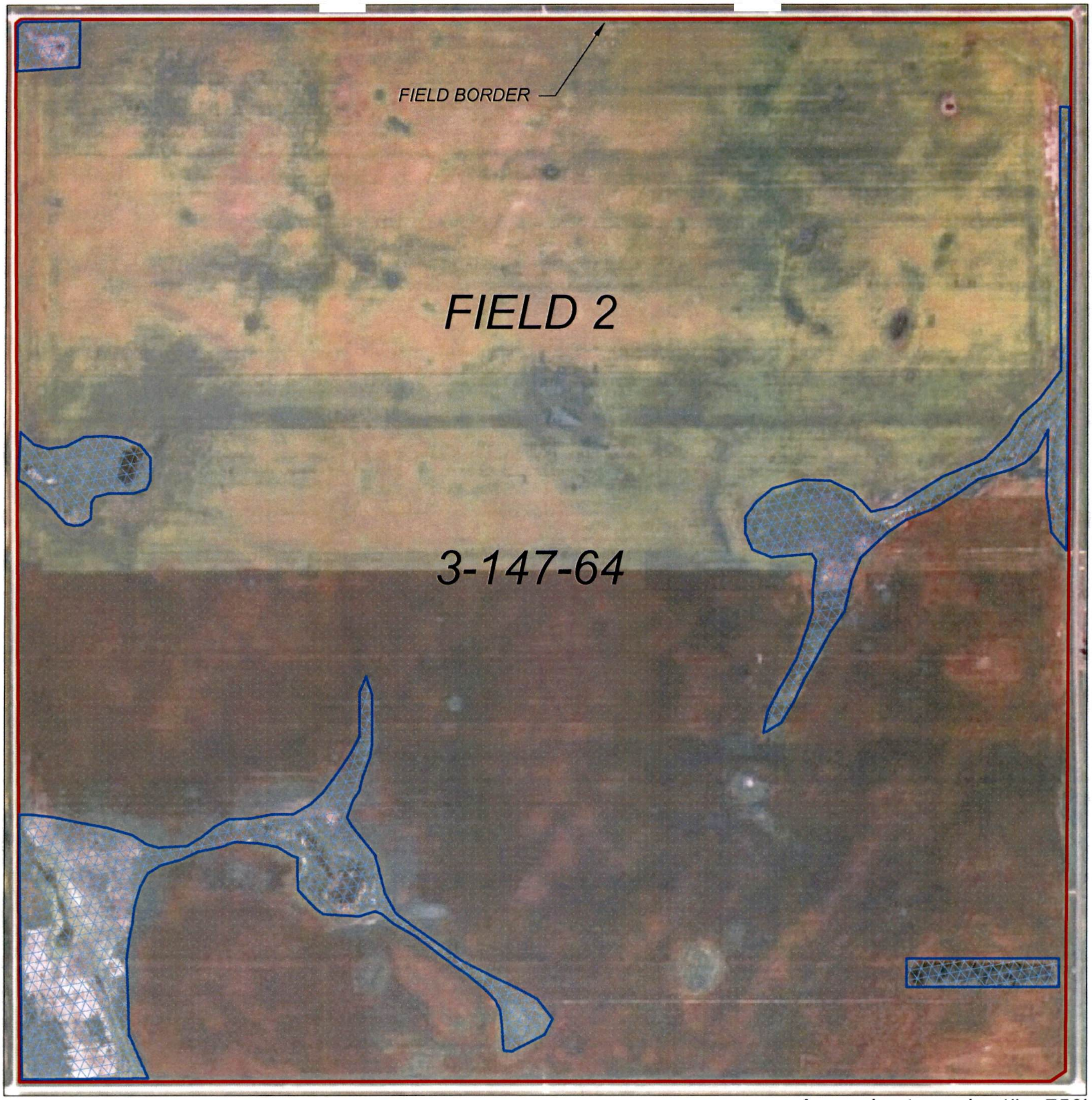
3 of 9 Sheet No.	K_2S ENGINEERING INC. 4209 94TH AVE SE YPSILANTI, ND 58497 Phone 701-489-3322	CNMP T-T Ranch Field 1	Date Drawn 5-09 Drawn By skk Date Checked 5-09 Checked by jak File: CNMP maps.dwg

Date

Approved By SHANE KJELLBERG P.E. 5-09

Title

3 OF 9



Approximate scale: 1" = 750'

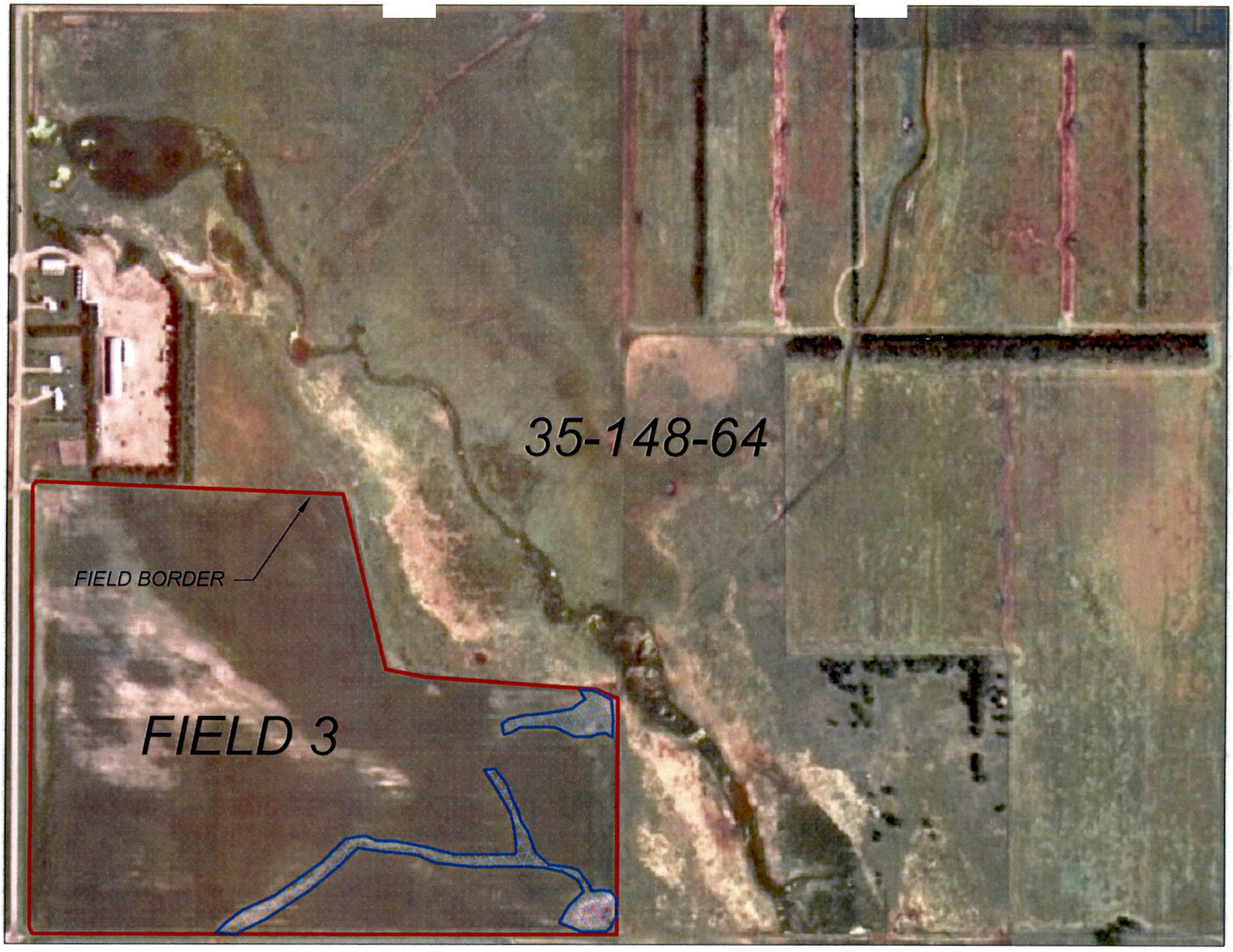
buffer areas (do not apply manure in these areas)

Field 2:

Total field area ~629 acres

Total field area - buffer areas = ~581 acres = applicable area

Sheet No. 4 of 9	K2S ENGINEERING INC. 4209 94TH AVE SE YPSILANTI, ND 58497 Phone 701-489-3322	CNMP T-T Ranch Field 2	Date Drawn 5-09 Drawn By skk Date Checked 5-09 Checked by jak File: CNMP maps.dwg	Date Approved By SHANE KJELLBERG P.E. 5-09 Title 4 OF 9



Approximate scale: 1" = 750'

buffer areas (do not apply manure in these areas)

Field 3:

Total field area ~93 acres

Total field area - buffer areas = ~89 acres = applicable area

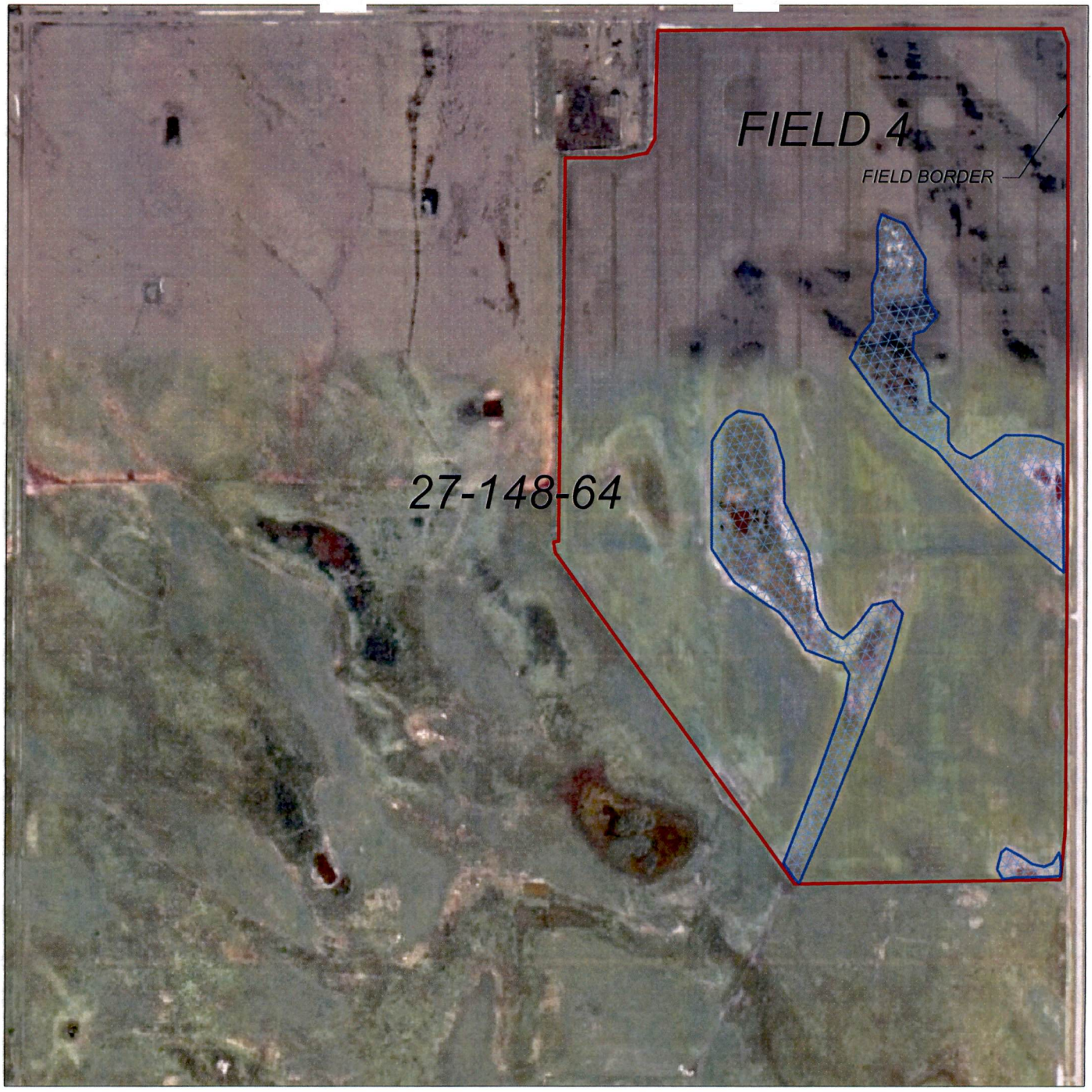
Sheet No.

K_2S ENGINEERING INC.
4209 94TH AVE SE
YPSILANTI, ND 58497
Phone 701-489-3322

CNMP
T-T Ranch
Field 3

Date Drawn	5-09
Drawn By	skk
Date Checked	5-09
Checked by	jak
File: CNMP maps.dwg	

Date
Approved By SHANE KJELLBERG P.E. 5-09
Title



Approximate scale: 1" = 750'

buffer areas (do not apply manure in these areas)

Field 4:

Total field area ~217 acres

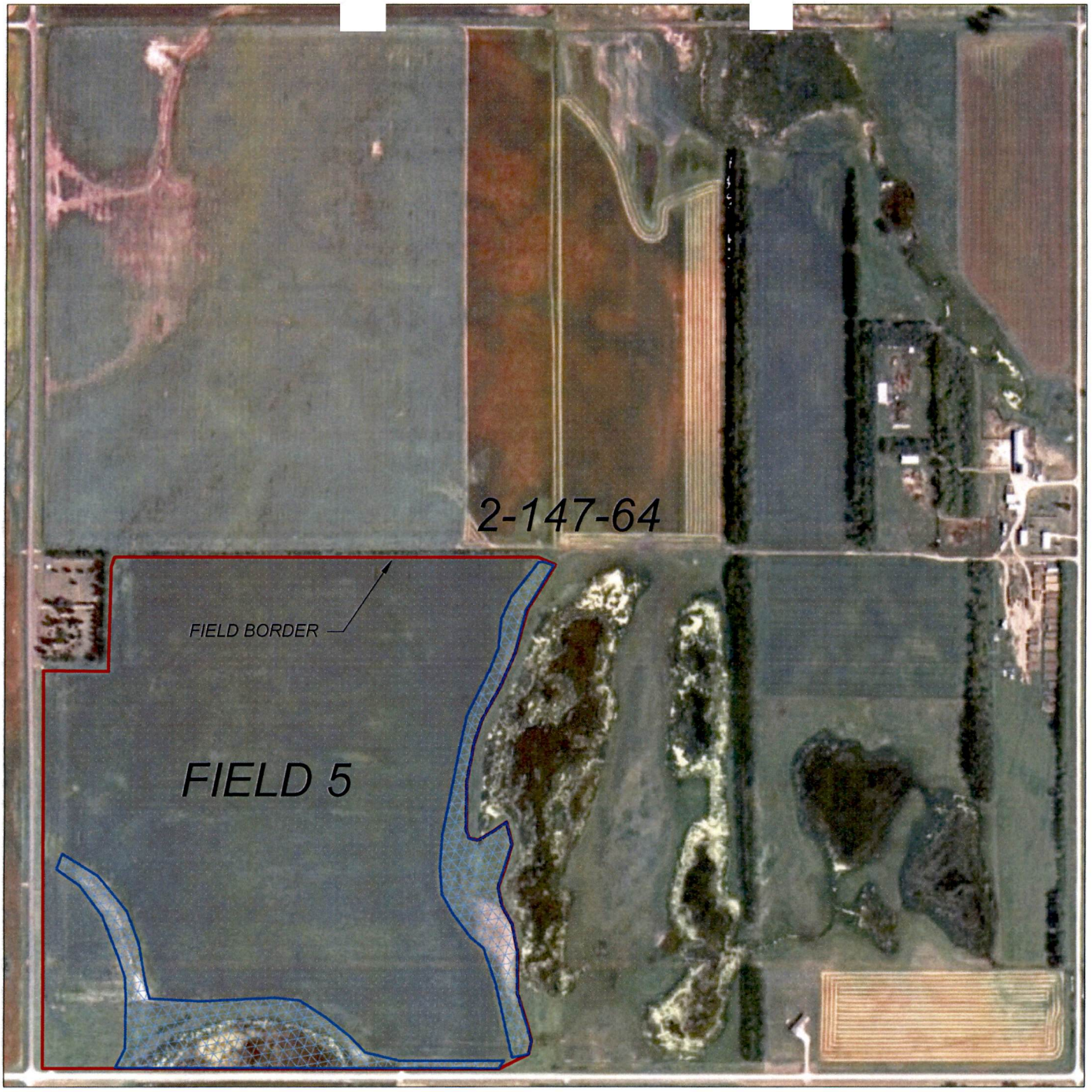
Total field area - buffer areas = ~189 acres = applicable area

K_2S ENGINEERING INC.
4209 94TH AVE SE
YPSILANTI, ND 58497
Phone 701-489-3322

CNMP
T-T Ranch
Field 4

Date Drawn	5-09
Drawn By	skk
Date Checked	5-09
Checked by	jak
File: CNMP maps.dwg	

Date
Approved By SHANE K JELLBERG P.E. 5-09
Title



Approximate scale: 1" = 750'

buffer areas (do not apply manure in these areas)

Field 5:

Total field area ~135 acres

Total field area - buffer areas = ~115 acres = applicable area

Sheet No.

K_2S ENGINEERING INC.
4209 94TH AVE SE
YPSILANTI, ND 58497
Phone 701-489-3322

CNMP
T-T Ranch
Field 5

Date Drawn	5-09
Drawn By	skk
Date Checked	5-09
Checked by	jak
File: CNMP maps.dwg	

Date
Approved By SHANE K JELLBERG P.E. 5-09
Title

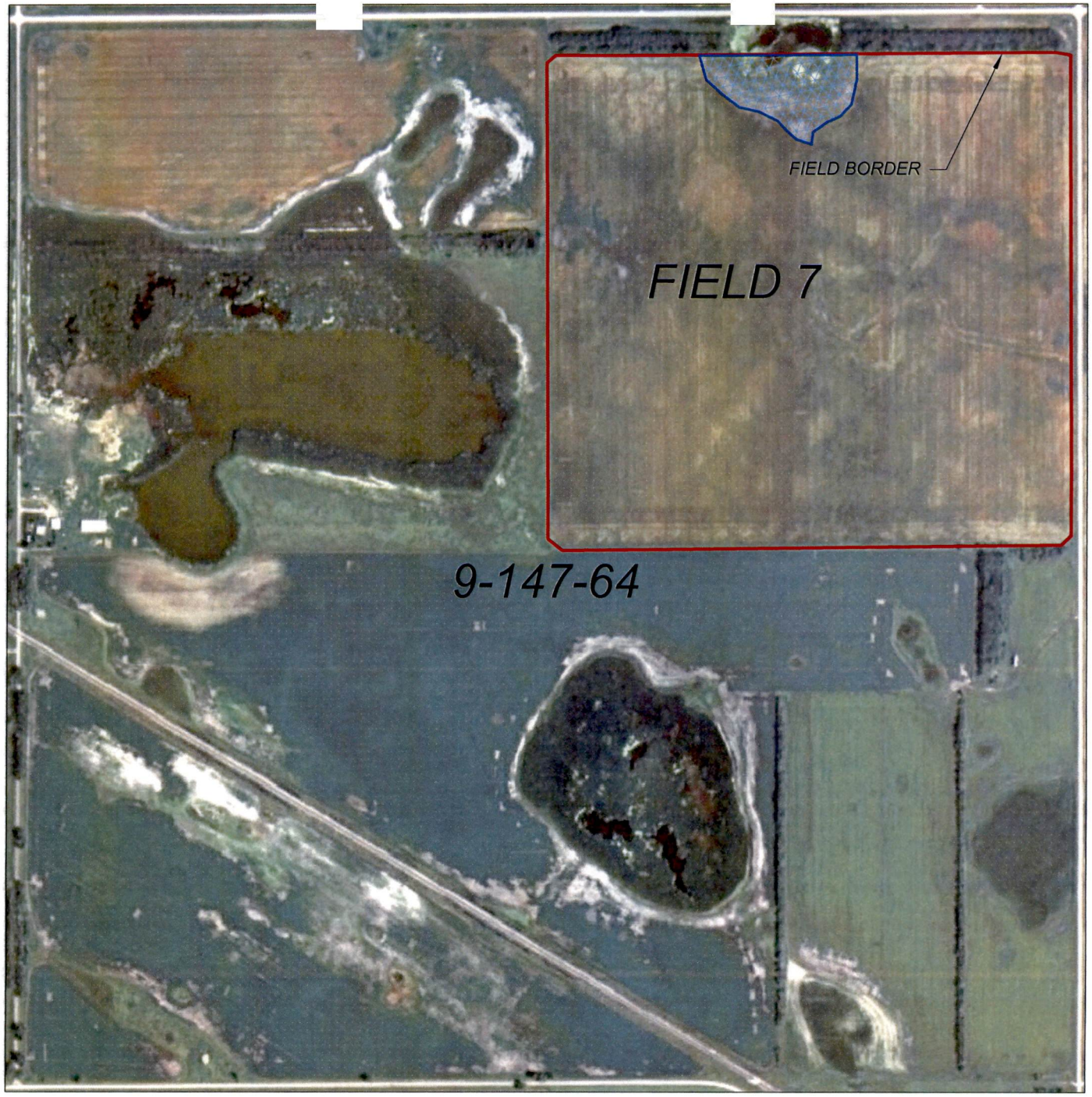
Approximate scale: 1" = 750'

buffer areas (do not apply manure in these areas)

Field 6:

Total field area ~316 acres

Total field area - buffer areas = ~266 acres = applicable area



Approximate scale: 1" = 750'

buffer areas (do not apply manure in these areas)

Field 7:

Total field area ~147 acres

Total field area - buffer areas = ~142 acres = applicable area

Sheet No.

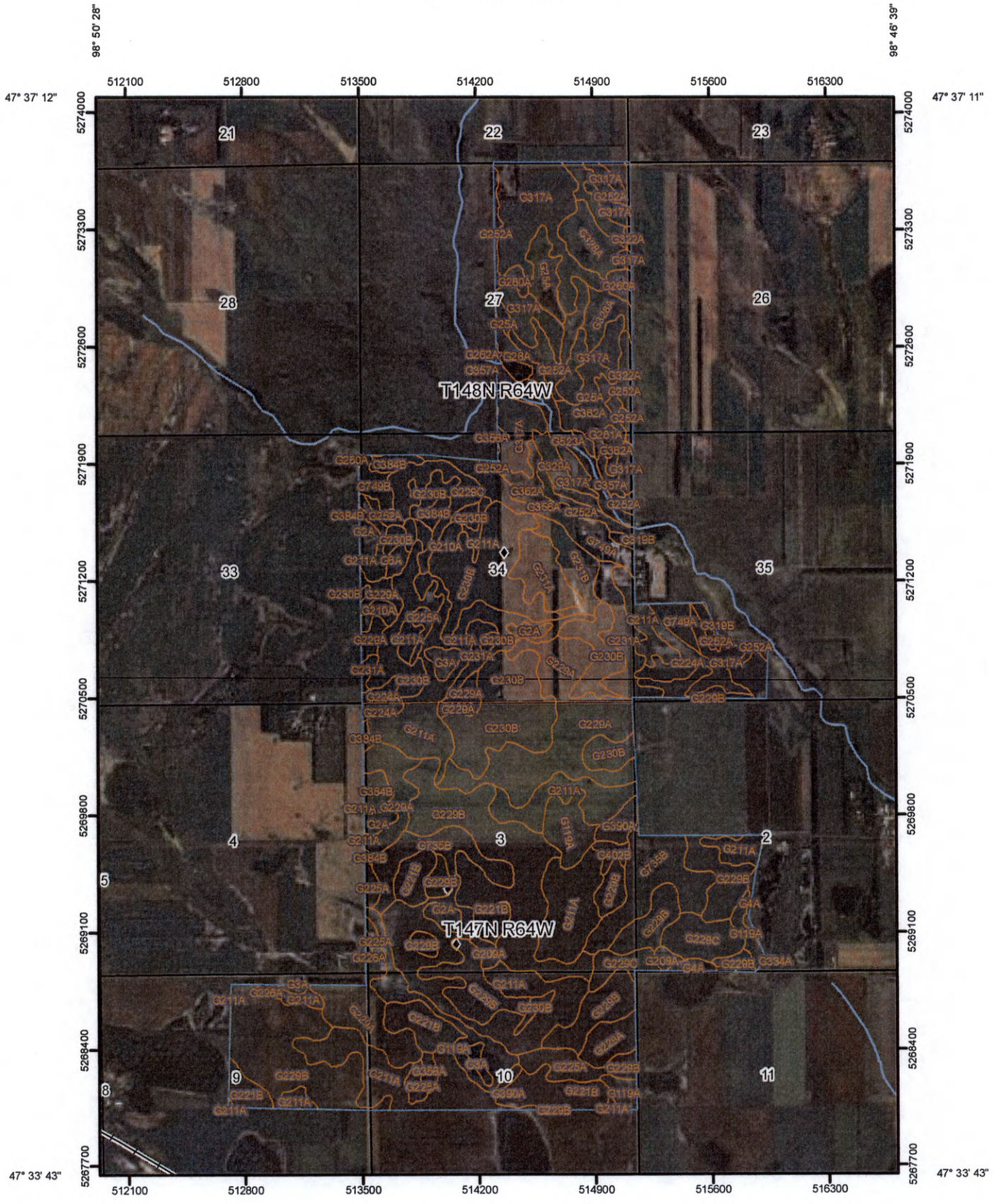
K_2S ENGINEERING INC.
4209 94TH AVE SE
YPSILANTI, ND 58497
Phone 701-489-3322

CNMP
T-T Ranch
Field 7

Date Drawn	5-09
Drawn By	skk
Date Checked	5-09
Checked by	jak
File: CNMP maps.dwg	

Date
Approved By SHANE KJELLBERG P.E. 5-09
Title
9 OF 9

Soil Map—Eddy County, North Dakota, and Foster County, North Dakota
(T-T Ranch CNMP)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities
- PLSS Township and Range
- PLSS Section

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:30,700 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at scales ranging from 1:12,000 to 1:20,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 14N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Eddy County, North Dakota
Survey Area Data: Version 11, Mar 31, 2008

Soil Survey Area: Foster County, North Dakota
Survey Area Data: Version 16, Apr 24, 2008

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Date(s) aerial images were photographed: 7/22/2005; 7/19/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

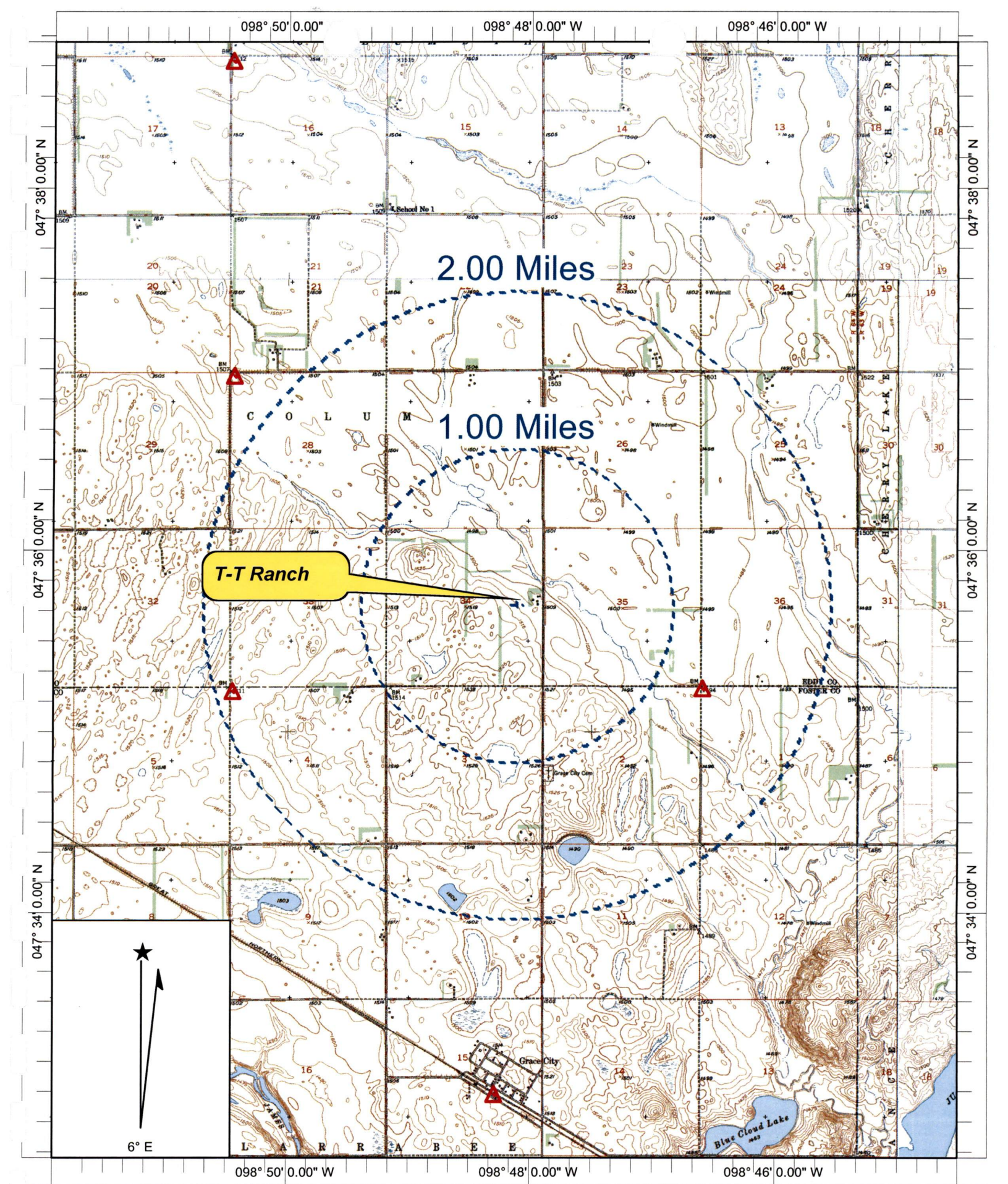
Map Unit Legend

Eddy County, North Dakota (ND027)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
G2A	Tonka silt loam, 0 to 1 percent slopes	6.1	0.3%
G3A	Parnell silty clay loam, 0 to 1 percent slopes	6.9	0.3%
G6A	Vallers loam, 0 to 1 percent slopes	9.7	0.4%
G25A	Marysland loam, 0 to 1 percent slopes	43.8	1.9%
G26A	Marysland loam, very poorly drained, 0 to 1 percent slopes	7.3	0.3%
G210A	Fram-Tonka complex, 0 to 3 percent slopes	13.1	0.6%
G211A	Fram-Wyard loams, 0 to 3 percent slopes	80.1	3.5%
G221A	Emrick-Cathay loams, 0 to 3 percent slopes	3.1	0.1%
G224A	Cathay-Larson loams, 0 to 3 percent slopes	30.2	1.3%
G225A	Larson-Cathay loams, 0 to 3 percent slopes	5.0	0.2%
G229A	Heimdal-Emrick loams, 0 to 3 percent slopes	49.5	2.1%
G229B	Heimdal-Emrick loams, 3 to 6 percent slopes	11.6	0.5%
G229C	Heimdal-Esmond-Sisseton loams, 6 to 9 percent slopes	26.8	1.2%
G230B	Heimdal-Esmond loams, 3 to 6 percent slopes	175.1	7.6%
G231A	Embden-Heimdal complex, 0 to 3 percent slopes	73.7	3.2%
G231B	Embden-Heimdal complex, 3 to 6 percent slopes	23.9	1.0%
G252A	Wyrene sandy loam, 0 to 2 percent slopes	76.2	3.3%
G260A	Totten-Marysland loams, 0 to 1 percent slopes	10.5	0.5%
G261A	Totten-Marysland loams, very poorly drained, 0 to 1 percent slopes	8.1	0.3%
G262A	Totten loam, loamy substratum, 0 to 1 percent slopes	0.3	0.0%
G317A	Falsen loamy coarse sand, 0 to 2 percent slopes	178.5	7.7%
G319B	Lohnes-Claire loamy coarse sands, 0 to 6 percent slopes	6.3	0.3%
G322A	Arveson-Tiffany fine sandy loams, 0 to 1 percent slopes	10.4	0.4%
G328A	Garborg sandy loam, 0 to 2 percent slopes	42.5	1.8%
G329A	Wyndmere fine sandy loam, 0 to 2 percent slopes	11.5	0.5%
G330A	Wyndmere fine sandy loam, loamy substratum, 0 to 2 percent slopes	0.0	0.0%
G356A	Lemert-Totten complex, 0 to 2 percent slopes	5.3	0.2%
G357A	Letcher-Wyrene sandy loams, 0 to 2 percent slopes	9.5	0.4%

Eddy County, North Dakota (ND027)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
G362A	Stirum-arveson saline, fine sandy loams, 0 to 1 percent slopes	19.1	0.8%
G384B	Maddock-Hecla loamy fine sands, 0 to 6 percent slopes	11.6	0.5%
G523A	Lowe loam, channeled, 0 to 2 percent slopes	26.6	1.1%
G749A	Towner-Heimdal fine sandy loams, 0 to 3 percent slopes	48.8	2.1%
G749B	Towner-Heimdal complex, 3 to 6 percent slopes	10.2	0.4%
Subtotals for Soil Survey Area		**1,041.3**	**44.9%**
Totals for Area of Interest		**2,318.6**	**100.0%**

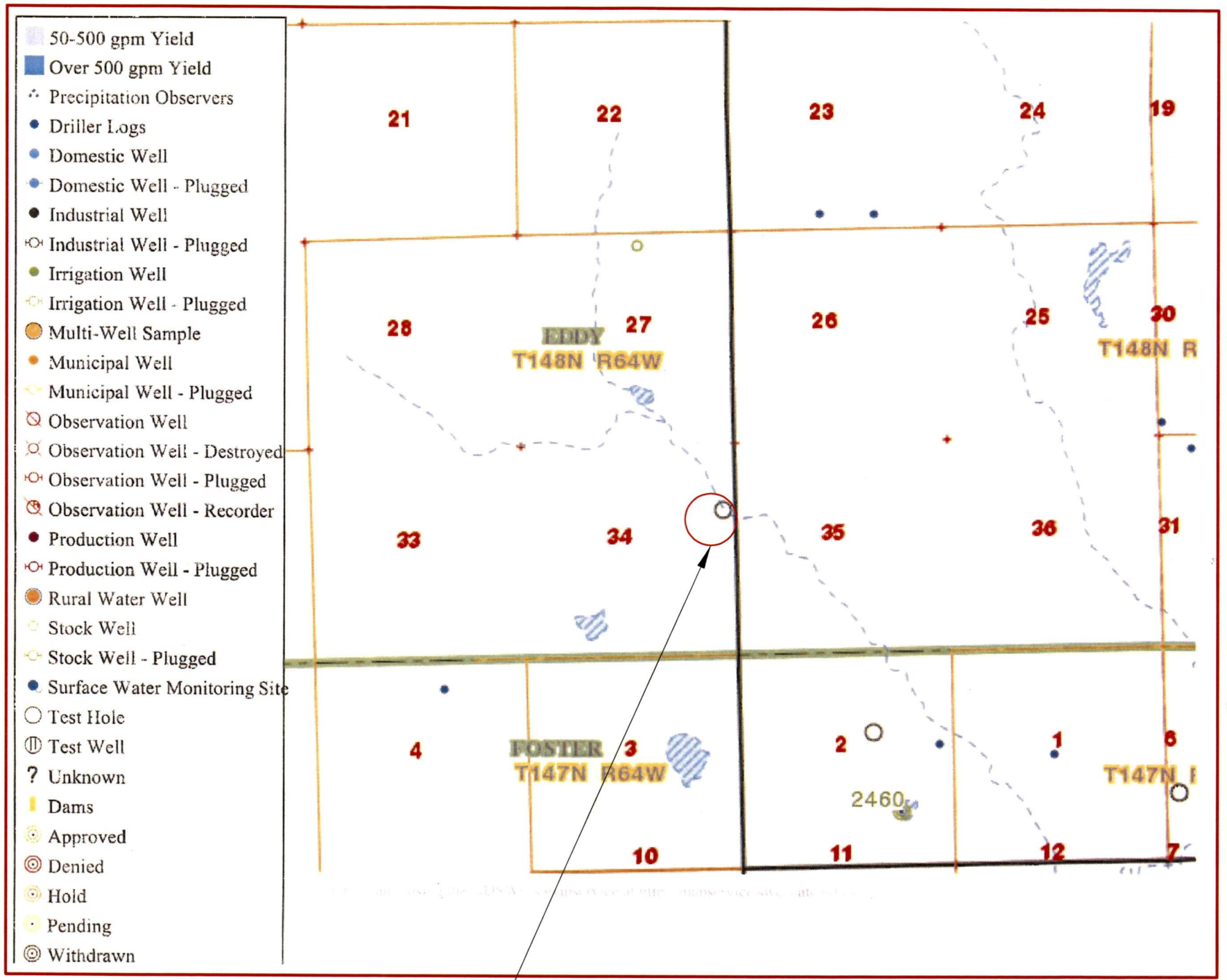
Foster County, North Dakota (ND031)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
G2A	Tonka silt loam, 0 to 1 percent slopes	11.6	0.5%
G3A	Parnell silty clay loam, 0 to 1 percent slopes	6.0	0.3%
G4A	Southam silty clay loam, 0 to 1 percent slopes	6.7	0.3%
G119A	Vallers-Hamerly loams, saline, 0 to 3 percent slopes	75.7	3.3%
G209A	Fram-Tonka-Parnell complex, 0 to 3 percent slopes	8.4	0.4%
G211A	Fram-Wyard loams, 0 to 3 percent slopes	295.0	12.7%
G221B	Heimdal-Cathay loams, 3 to 6 percent slopes	85.9	3.7%
G224A	Cathay-Larson loams, 0 to 3 percent slopes	4.3	0.2%
G225A	Larson-Cathay loams, 0 to 3 percent slopes	31.1	1.3%
G226A	Uranda-Larson loams, 0 to 3 percent slopes	3.9	0.2%
G229A	Heimdal-Emrick loams, 0 to 3 percent slopes	166.7	7.2%
G229B	Heimdal-Emrick loams, 3 to 6 percent slopes	352.7	15.2%
G229C	Heimdal-Esmond-Sisseton loams, 6 to 9 percent slopes	39.6	1.7%
G230B	Heimdal-Esmond loams, 3 to 6 percent slopes	64.3	2.8%
G334A	Ulen-Hecla fine sandy loams, 0 to 2 percent slopes	0.0	0.0%
G358A	Letcher fine sandy loam, 0 to 2 percent slopes	4.5	0.2%
G384B	Maddock-Hecla loamy fine sands, 0 to 6 percent slopes	12.0	0.5%
G390A	Hecla fine sandy loam, loamy substratum, 0 to 2 percent slopes	12.6	0.5%
G402B	Embden-Egeland fine sandy loams, 0 to 6 percent slopes	6.1	0.3%
G735B	Towner-Dickey loamy fine sands, 3 to 6 percent slopes	89.9	3.9%
G749B	Towner-Heimdal complex, 3 to 6 percent slopes	0.0	0.0%

Foster County, North Dakota (ND031)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Subtotals for Soil Survey Area		1,277.3	55.1%
Totals for Area of Interest		2,318.6	100.0%



Name: GRACE CITY
Date: 5/13/2009
Scale: 1 inch equals 4000 feet

Location: 047° 35' 43.35" N 098° 48' 13.20" W
Caption: T-T Ranch CNMP



K_2S ENGINEERING INC.
4209 94TH AVE SE
YPSILANTI, ND 58497
Phone 701-489-3322

Sheet No. 1 of 1

CNMP
T-T Ranch
ND State Water Commission Map

Date Drawn 5-09
Drawn By skk
Date Checked 5-09
Checked by jak
File: CNMP maps.dwg

Approved By ..... Date .....
Title .....

1 OF 1

STATE OF NORTH DAKOTA
BOARD OF WATER WELL CONTRACTORS
900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58501

WELL DRILLER'S REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

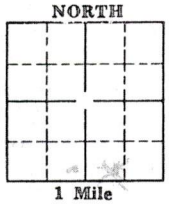
1. WELL OWNER

Name John Tapp

Address Grace City

2. WELL LOCATION

Sketch map location must agree with written location.



County Eddy

SE ¼ SW ¼ SE ¼ Sec. 33 Twp. 148 N. Rg. 64 W.

3. PROPOSED USE

☐ Domestic ☐ Geothermal
☒ Stock ☐ Irrigation ☐ Industrial
☐ Municipal ☐ Test Hole

4. METHOD DRILLED

☐ Cable ☐ Reverse Rotary ☐ Bored
☒ Forward Rotary ☐ Jetted ☐ Other

If other, specify

5. WATER QUALITY

Was a water sample collected for chemical analysis?

☐ Yes ☒ No

If so, to what laboratory was it sent

6. WELL CONSTRUCTION

Diameter of hole 9 inches. Depth 160 feet.

Casing: ☐ Steel ☒ Plastic ☐ Concrete
☐ Threaded ☐ Welded ☐ Other

If other, specify

Pipe Weight:	Diameter:	From:	To:
200 lb/ft.	5 inches	0 feet	75 feet
____ lb/ft.	____ inches	____ feet	____ feet
____ lb/ft.	____ inches	____ feet	____ feet
____ lb/ft.	____ inches	____ feet	____ feet

Was perforated pipe used? ☐ Yes ☒ No

Length of pipe perforated ____ feet

Was casing left open end? ☐ Yes ☒ No

Was a well screened installed? ☒ Yes ☐ No

Material Plastic Diameter 5 inches
(stainless steel, bronze, etc.)

Slot size 50 set from 75 feet to 155 feet

Slot size ____ set from ____ feet to ____ feet

Slot size ____ set from ____ feet to ____ feet

Slot size ____ set from ____ feet to ____ feet

Was a packer or seal used? ☐ Yes ☒ No

If so, what material

7. WATER LEVEL

Static water level 10 feet below land surface

If flowing: closed-in pressure ____ psi

GPM flow ____ through ____ inch pipe

Controlled by: ☐ Valve ☐ Reducers ☐ Other

If other, specify

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Other

Pumping level below land surface:

____ ft. after 2 hrs. pumping 10 gpm

____ ft. after ____ hrs. pumping ____ gpm

____ ft. after ____ hrs. pumping ____ gpm

9. WELL LOG

Formation	Depth (ft.) From	To
Top Soil	0	1
Gray Till	1	8
Coarse Gravel with Rock	8	12
Gray Till	12	60
Black Shale Shale	60	160

(Use separate sheet if necessary.)

10. DATE COMPLETED October 17 1981

11. WAS WELL PLUGGED OR ABANDONED?

☐ Yes ☒ No

If so, how

12. REMARKS:

STATE OF NORTH DAKOTA
BOARD OF WATER WELL CONTRACTORS
900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58501

WELL DRILLER'S REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

1. WELL OWNER

Name Wallace Topp

Address Buse City ND

2. WELL LOCATION

Sketch map location must agree with written location.

NORTH

1 Mile

County Foster

¼ ¼ NE ¼ Sec. 4 Twp. 147 N. Rg. 64 W.

3. PROPOSED USE

☒ Domestic ☐ Irrigation ☐ Industrial
☐ Stock ☐ Municipal ☐ Test Hole

4. METHOD DRILLED

☒ Cable ☐ Reverse Rotary ☐ Bored
☐ Forward Rotary ☐ Jetted ☐ Other

If other, specify

5. WATER QUALITY

Was a water sample collected for chemical analysis?
☒ Yes ☐ No

If so, to what laboratory was it sent Lab by owner

6. WELL CONSTRUCTION

Diameter of hole 6 inches. Depth 26 feet.

Casing: ☒ Steel ☐ Plastic ☐ Concrete
☐ Threaded ☐ Welded ☐ Other

If other, specify

Pipe Weight:	Diameter:	From:	To:
11 lb/ft.	4 inches	1 feet	72 feet
lb/ft.	inches	feet	feet
lb/ft.	inches	feet	feet
lb/ft.	inches	feet	feet

Was perforated pipe used? ☐ Yes ☐ No

Length of pipe perforated feet

Was casing left open end? ☒ Yes ☐ No

Was a well screened installed? ☐ Yes ☐ No

Material (stainless steel, bronze, etc.) Diameter inches

Slot size set from feet to feet

Slot size set from feet to feet

Slot size set from feet to feet

Slot size set from feet to feet

Was a packer or seal used? ☐ Yes ☐ No

7. WATER LEVEL

Static water level 28 feet below land surface

If flowing: closed-in pressure psi

GPM flow through inch pipe

Controlled by: ☐ Valve ☐ Reducers ☐ Other

If other, specify

8. WELL TEST DATA

☐ Pump ☒ Bailer ☐ Other

Pumping level below land surface:

artesian strength ft. after 2 hrs. pumping 5 gpm

ft. after hrs. pumping gpm

ft. after hrs. pumping gpm

9. WELL LOG

Formation	Depth (ft.) From	To
yellow clay	1	18
blue clay	18	20
rock	20	21
blue clay	21	24
shale	30	91

(Use separate sheet if necessary.)

10. DATE COMPLETED Oct 25-72

11. WAS WELL PLUGGED OR ABANDONED?

☐ Yes ☒ No

If so, how

12. REMARKS:

a good water soft well

STATE OF NORTH DAKOTA
BOARD OF WATER WELL CONTRACTORS
900 E. BOULEVARD • BISMARCK, NORTH DAKOTA 58501

WELL DRILLER'S REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

1. WELL OWNER

Name

Address

2. WELL LOCATION

Sketch map location must agree with written location.

NORTH

1 Mile

County

¼ ¼ ¼ Sec. Twp. N. Rg. W.

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Industrial
☐ Stock ☐ Municipal ☐ Test Hole

4. METHOD DRILLED

☐ Cable ☐ Reverse Rotary ☐ Bored
☐ Forward Rotary ☐ Jetted ☐ Other
If other, specify

5. WATER QUALITY

Was a water sample collected for chemical analysis?
☐ Yes ☐ No
If so, to what laboratory was it sent

6. WELL CONSTRUCTION

Diameter of hole inches. Depth feet.
Casing: ☐ Steel ☐ Plastic ☐ Concrete
☐ Threaded ☐ Welded ☐ Other
If other, specify

Pipe Weight:	Diameter:	From:	To:
lb/ft.	inches	feet	feet
lb/ft.	inches	feet	feet
lb/ft.	inches	feet	feet
lb/ft.	inches	feet	feet

Was perforated pipe used? ☐ Yes ☐ No
Length of pipe perforated feet
Was casing left open end? ☐ Yes ☐ No
Was a well screened installed? ☐ Yes ☐ No
Material Diameter inches
(stainless steel, bronze, etc.)
Slot size set from feet to feet
Slot size set from feet to feet
Slot size set from feet to feet
Slot size set from feet to feet
Was a packer or seal used? ☐ Yes ☐ No

7. WATER LEVEL

Static water level feet below land surface
If flowing: closed-in pressure psi
GPM flow through inch pipe
Controlled by: ☐ Valve ☐ Reducers ☐ Other
If other, specify

8. WELL TEST DATA

☐ Pump ☐ Bailer ☐ Other
Pumping level below land surface:
ft. after hrs. pumping gpm
ft. after hrs. pumping gpm
ft. after hrs. pumping gpm

9. WELL LOG

Formation	Depth (ft.) From	Depth (ft.) To

(Use separate sheet if necessary.)

10. DATE COMPLETED

11. WAS WELL PLUGGED OR ABANDONED?

☐ Yes ☐ No
If so, how

12. REMARKS:

IV-A-3a RUSLE2 CALCULATIONS & SOIL WIND EROSION CALCULATIONS

USDA NRCS Natural Resources Conservation Service

Rusle Program Version:
Rusle Science Version:
Data Base:

RUSLE2 Erosion Calculation Record

File: plans\foster/eddy -Topp
Access Group: R2_NRCS_Fld_Office

Inputs:

Owner name	*Location*	*Info*
T-T Ranch	**North Dakota\Foster County**	**Manure Application Fields 1-7**

Field name	*Soil*	*Slope T Value*	*Slope length, ft*	*Slope steepness, %*
1 -sect 34	Foster County\37B HEIMDAL-ESMOND LOAMS, 3 TO 6 PERCENT SLOPES\ESMOND loam 34%	5.0	500	2.0
2 -sec 3	Foster County\36B HEIMDAL-EMRICK LOAMS, 3 TO 6 PERCENT SLOPES\HEIMDAL loam 63%	5.0	500	3.0
3 -sec 35	Foster County\61 LARSON-CATHAY LOAMS, 0 TO 2 PERCENT SLOPES\LARSON loam 38%	2.0	500	2.0
4 -sec 27	Eddy County, North Dakota\G318A Falsen coarse sandy loam, 0 to 2 percent slopes\Falsen coarse sandy loam 65%	5.0	500	1.0
5 -sec 2	Eddy County, North Dakota\G229B Heimdal-Emrick loams, 3 to 6 percent slopes\Heimdal loam 42%	5.0	500	3.0
6 -sec 10	Eddy County, North Dakota\G211A Fram-Wyard loams, 0 to 3 percent slopes\Fram loam 46%	5.0	500	2.0
7 -sec 9	Eddy County, North Dakota\G229B Heimdal-Emrick loams, 3 to 6 percent slopes\Heimdal loam 42%	5.0	500	3.0

Results:

Field name	*Description*	*Contouring system*	*Support practices*	*Terrace/diversion system*	*Cons. plan. soil loss, t/ac/yr*	*Sed. delivery, t/ac/yr*	*Soil conditioning index (SCI)*	*STIR value*	*Wind & irrigation-induced erosion for SCI*	*Fuel cost*
1 - sect 34		a. rows up-and-down hill	-- none --	-- none --	0.54	0.54	0.26	94	0	31.18
2 -sec 3		a. rows up-and-down hill	-- none --	-- none --	0.83	0.83	0.24	94	0	31.18
3 -sec 35		a. rows up-and-down hill	-- none --	-- none --	0.61	0.61	0.26	94	0	31.18

4 -sec 27		a. rows up-and-down hill	-- none --	-- none --	0.15	0.15	0.29	94	0	28.06
5 -sec 2		a. rows up-and-down hill	-- none --	-- none --	0.84	0.84	0.24	94	0	31.18
6 -sec 10		a. rows up-and-down hill	-- none --	-- none --	0.55	0.55	0.26	94	0	31.18
7 -sec 9		a. rows up-and-down hill	-- none --	-- none --	0.84	0.84	0.24	94	0	31.18

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

ESTIMATED SOIL LOSS FROM WIND EROSION

Eddy County, ND

5/14/2009

Completed by (initials): skk

Name Jeff Topp
Farm T-T Ranch

Tract
Field(s) 1 Sect 34

☑ Existing Conditions
☑ Planned Conditions

Design Soil G230B Heimdal 2e PI= 0.68
County Yield 48
Wind Direction Factor 1.4 (Ridge or windbreak orientation vs. prevailing wind erosion direction.)

No-Till Cropping Sequence	Tillage prior to, or % Cover for **Critical Period** 1st	2nd	3rd	Unsheltered Distance (feet)	Wind Barrier Height (feet)	Wind Barrier Spacing (feet)	Ridge Height for **Critical Period** (inches)	Ridge Spacing (inches)	SGE Over Winter	Annual Wind Erosion (tons/ac.)
corn			30	2	0.5				975	0.0
soybeans			10	500	0.05				575	3.0
wheat			40	0.5	0.25				2475	0.0
corn			30	2	0.5				1825	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0

WIND EROSION

C Value	40	Soil Loss	0.8	tons/acre/year
I Value	56	T Value	5	tons/acre/year
WEG	5			

Remarks:

Click on "Conventional-Till" to compute as if previous residue was tilled in each year. Click on "No-Till" to compute erosion with half of previous crop residue production retained and added to current crop residue production.

ESTIMATED SOIL LOSS FROM WIND EROSION — Eddy County, ND — 5/14/2009

Completed by (initials): skk

Name Jeff Topp
Farm T-T Ranch
Tract
Field(s) 2 Sect 3

☑ Existing Conditions
☑ Planned Conditions

Design Soil G229B Heimdal 2e PI= 0.73
County Yield 48
Wind Direction Factor 1.4 (Ridge or windbreak orientation vs. prevailing wind erosion direction.)

No-Till Cropping Sequence	Tillage prior to, or % Cover for **Critical Period** 1st	2nd	3rd	Unsheltered Distance (feet)	Wind Barrier Height (feet)	Wind Barrier Spacing (feet)	Ridge Height for **Critical Period** (inches)	Ridge Spacing (inches)	SGE Over Winter	Annual Wind Erosion (tons/ac.)
corn			30	2	0.5				1050	0.0
soybeans			10	500	0.05				600	2.7
wheat			40	0.5	0.25				2625	0.0
corn			30	2	0.5				1950	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0

WIND EROSION

C Value	40	Soil Loss	0.7	tons/acre/year
I Value	56	T Value	5	tons/acre/year
WEG	5			

Remarks:

Click on "Conventional-Till" to compute as if previous residue was tilled in each year. Click on "No-Till" to compute erosion with half of previous crop residue production retained and added to current crop residue production.

ESTIMATED SOIL LOSS FROM WIND EROSION

Eddy County, ND

5/14/2009

Completed by (initials): skk

Name Jeff Topp
Farm T-T Ranch

Tract
Field(s) 3 Sect 35

☑ Existing Conditions
☑ Planned Conditions

Design Soil G225A Larson 4s PI= 0.58
County Yield 48
Wind Direction Factor 1.4 (Ridge or windbreak orientation vs. prevailing wind erosion direction.)

No-Till Cropping Sequence	Tillage prior to, or % Cover for **Critical Period** 1st	2nd	3rd	Unsheltered Distance (feet)	Wind Barrier Height (feet)	Wind Barrier Spacing (feet)	Ridge Height for **Critical Period** (inches)	Ridge Spacing (inches)	SGE Over Winter	Annual Wind Erosion (tons/ac.)
corn			30	2	0.5				825	0.0
soybeans			10	500	0.05				525	3.3
wheat			40	0.5	0.25				2175	0.0
corn			30	2	0.5				1575	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0

WIND EROSION

C Value	40	Soil Loss	0.8	tons/acre/year
I Value	56	T Value	2	tons/acre/year
WEG	5			

Remarks:

Click on "Conventional-Till" to compute as if previous residue was tilled in each year. Click on "No-Till" to compute erosion with half of previous crop residue production retained and added to current crop residue production.

ESTIMATED SOIL LOSS FROM WIND EROSION

Eddy County, ND

5/14/2009

Completed by (initials): skk

Name Jeff Topp
Farm T-T Ranch

Tract
Field(s) 4 Sect 27

☑ Existing Conditions
☑ Planned Conditions

Design Soil G318A Falsen 6e PI= 0.51
County Yield 48
Wind Direction Factor 1.4 (Ridge or windbreak orientation vs. prevailing wind erosion direction.)

No-Till Cropping Sequence	Tillage prior to, or % Cover for **Critical Period** 1st	2nd	3rd	Unsheltered Distance (feet)	Wind Barrier Height (feet)	Wind Barrier Spacing (feet)	Ridge Height for **Critical Period** (inches)	Ridge Spacing (inches)	SGE Over Winter	Annual Wind Erosion (tons/ac.)
corn			30	2	0.5				675	0.0
soybeans			10	500	0.05				475	14.9
wheat			40	0.5	0.25				1925	0.0
corn			30	2	0.5				1350	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0

WIND EROSION

C Value	40	Soil Loss	3.7	tons/acre/year
I Value	86	T Value	5	tons/acre/year
WEG	3			

Remarks:

Click on "Conventional-Till" to compute as if previous residue was tilled in each year. Click on "No-Till" to compute erosion with half of previous crop residue production retained and added to current crop residue production.

ESTIMATED SOIL LOSS FROM WIND EROSION

Eddy County, ND

5/14/2009

Completed by (initials): skk

Name Jeff Topp
Farm T-T Ranch

Tract
Field(s) 5 Sect 2

☑ Existing Conditions
☑ Planned Conditions

Design Soil G229B Heimdal 2e PI= 0.73
County Yield 48
Wind Direction Factor 1.4 (Ridge or windbreak orientation vs. prevailing wind erosion direction.)

No-Till Cropping Sequence	Tillage prior to, or % Cover for **Critical Period** 1st	2nd	3rd	Unsheltered Distance (feet)	Wind Barrier Height (feet)	Wind Barrier Spacing (feet)	Ridge Height for **Critical Period** (inches)	Ridge Spacing (inches)	SGE Over Winter	Annual Wind Erosion (tons/ac.)
corn			30	2	0.5				1050	0.0
soybeans			10	500	0.05				600	2.7
wheat			40	0.5	0.25				2625	0.0
corn			30	2	0.5				1950	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0

WIND EROSION

C Value	40	Soil Loss	0.7	tons/acre/year
I Value	56	T Value	5	tons/acre/year
WEG	5			

Remarks:

Click on "Conventional-Till" to compute as if previous residue was tilled in each year. Click on "No-Till" to compute erosion with half of previous crop residue production retained and added to current crop residue production.

ESTIMATED SOIL LOSS FROM WIND EROSION

Eddy County, ND

5/14/2009

Completed by (initials): skk

Name Jeff Topp
Farm T-T Ranch

Tract
Field(s) 6 Sect 10

☑ Existing Conditions
☑ Planned Conditions

Design Soil G211A Fram 2e PI= 0.82
County Yield 48
Wind Direction Factor 1.4 (Ridge or windbreak orientation vs. prevailing wind erosion direction.)

No-Till Cropping Sequence	Tillage prior to, or % Cover for **Critical Period** 1st	2nd	3rd	Unsheltered Distance (feet)	Wind Barrier Height (feet)	Wind Barrier Spacing (feet)	Ridge Height for **Critical Period** (inches)	Ridge Spacing (inches)	SGE Over Winter	Annual Wind Erosion (tons/ac.)
corn			30	2	0.5				1200	0.0
soybeans			10	500	0.05				650	11.0
wheat			40	0.5	0.25				2925	0.0
corn			30	2	0.5				2200	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0

WIND EROSION

C Value	40	Soil Loss	2.7	tons/acre/year
I Value	86	T Value	5	tons/acre/year
WEG	4L			

Remarks:

Click on "Conventional-Till" to compute as if previous residue was tilled in each year. Click on "No-Till" to compute erosion with half of previous crop residue production retained and added to current crop residue production.

ESTIMATED SOIL LOSS FROM WIND EROSION — Eddy County, ND — 5/14/2009

Completed by (initials): skk

Name Jeff Topp
Farm T-T Ranch
Tract
Field(s) 7 Sect 9

☑ Existing Conditions
☑ Planned Conditions

Design Soil G229A Heimdal 2e PI= 0.82
County Yield 48
Wind Direction Factor 1.4 (Ridge or windbreak orientation vs. prevailing wind erosion direction.)

No-Till Cropping Sequence	Tillage prior to, or % Cover for **Critical Period** 1st	2nd	3rd	Unsheltered Distance (feet)	Wind Barrier Height (feet)	Wind Barrier Spacing (feet)	Ridge Height for **Critical Period** (inches)	Ridge Spacing (inches)	SGE Over Winter	Annual Wind Erosion (tons/ac.)
corn			30	2	0.5				1200	0.0
soybeans			10	500	0.05				650	2.4
wheat			40	0.5	0.25				2925	0.0
corn			30	2	0.5				2200	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0
									0	0.0

WIND EROSION

C Value	40	Soil Loss	0.6	tons/acre/year
I Value	56	T Value	5	tons/acre/year
WEG	5			

Remarks:

Click on "Conventional-Till" to compute as if previous residue was tilled in each year. Click on "No-Till" to compute erosion with half of previous crop residue production retained and added to current crop residue production.

HELP

Name: T-T Ranch
County: **Eddy**

Tract / Field(s) 1
Acres: 386

May 14, 2009

Leaching and Soil Surface Runoff Potential

Soil Information G230B **Heimdal-Esmond loams, 3 to 6 percent slopes**

NA	**Surface Water Risk**	**NA**
NA	**Ground Water Risk**	**NA**

The potential for runoff and leaching is not a concern for this soil map unit. Complete the Phosphorous Index below if agricultural waste will be applied to this field.

Phosphorus Risk Screening Tool

If agricultural waste will be applied to this soil map unit, *and* soil test Phosphorous is > 20 ppm Olsen (or > 20 ppm Mehlich 3 or, > 30 ppm Bray) *and* runoff water reaches surface water, complete the Phosphorous Index

Phosphorous Index

HELP

THE PHOSPHORUS INDEX IS NOT INTENDED TO BE AN EVALUATION SCALE FOR DETERMINING WHETHER LANDUSERS ARE ABIDING WITHIN WATER QUALITY OR NUTRIENT MANAGEMENT STANDARDS THAT HAVE BEEN ESTABLISHED BY LOCAL, STATE, OR FEDERAL AGENCIES.

Score	Inputs	
0	less than 2 tons/acre/year	Soil Erosion by Wind and Water in (tons/acre/year)
0	NA	Surface Water Risk
2	Olsen 20-40 ppm	Soil Test Phosphorous (STP)
1	less than 30 pounds/acre	Phosphorous Fertilizer Application Rate (pounds P_2O_5/acre) from all Sources
5	Surface Applied with No Incorporation, or Fall/Winter Applied with Spring Incorporation	Phosphorous Fertilizer / Manure Application Method
1	200-1000 feet	Distance to Permanent Surface Water or Water Course

Check all Best Management Practices that apply:

- ☐ Cover or Green Manure Crop
- ☐ Filter Strips
- ☐ Contour Buffer Strips
- ☐ Established No-till System

0 Best Management Practice Credit Total

9 **Medium** **Phosphorous Index Rating**

This field has a MEDIUM potential for off-site P movement. Organic nutrient application rates may be calculated according to crop nitrogen requirements.

Name:	T-T Ranch	Tract / Field Number(s):	1	Date:	05/14/09
HELP County:	Eddy	Acres:	386	Assisted By:	skk

Establish realistic yield goals before attempting to use this spreadsheet. Nutrient requirements of a crop depend on the total production of that crop.

CROPS & YIELDS

Rotation / Crops	Yield Goal	Units	Required Nutrients for Yield Goal N	P_2O_5	K_20
Corn, Grain	120	bushels	144.0	84.0	139.9
Soybeans	40	bushels	0.0	62.0	88.0
Wheat	50	bushels	125.0	53.6	135.5
Corn, Grain	120	bushels	144.0	84.0	139.9
		0	0.0	0.0	0.0
		0	0.0	0.0	0.0

SOIL MAPPING UNIT INFORMATION

Soil Map Unit	Soil Map Unit Name	Surface Water Risk	Ground Water Risk
G230B	Heimdal-Esmond loams, 3 to 6 percent slopes	NA	NA

HELP

SOIL TEST INFORMATION

Soil Test Date or Field Number	Lbs./acre 0-24 in. depth N	ppm (Olsen) 0-6 in. P	Optional Information for Documentation Only ppm 0-6 in. K_20	pH	O.M.%	E.C.
1	35	20	148	6.4		
1						
1						
1						

NUTRIENT RISK ASSESSMENT INFORMATION

Soil Erosion by wind and water (tons/acre/year)	less than 2 tons/acre/year
Soil Test Phosphorous (P) ppm	Olsen 20-40 ppm
Phosphorous fertilizer application rate (pounds P_2O_5/acre)	less than 30 pounds/acre
Phosphorous fertilizer application method	Surface Applied with No Incorporation, or Fall/Winter Applied with Spring Incorporation
Distance to Surface Water (feet)	200-1000 feet
Best Management Practices Planned	

PHOSPHOROUS INDEX

Medium

This field has a MEDIUM potential for off-site P movement. Organic nutrient application rates may be calculated according to crop nitrogen requirements.

MANAGEMENT CONSIDERATIONS

Nutrient Thresholds **Nitrogen:** Maximum accumulation of N 180 lbs./ac **Phosphorous:** Maximum accumulation of P 150ppm

General Management Statements

- Soil testing should be completed at least every other year to monitor nitrogen and at least once every five years to monitor phosphorus levels. Soil samples should be taken to the rooting depth of each crop in the rotation to reduce the risk of leaching nitrate nitrogen out of the root zone.
- Fall application of anhydrous ammonia and urea should be delayed until soil temperature is less than 45 degrees Fahrenheit. When soil temperatures are above 45 degrees Fahrenheit, microbial activity increases, converting ammonia to nitrate-nitrogen (NO3). Nitrate-nitrogen is a very mobile form of nitrogen and can leach below the crop root zone.
- Nutrient application should avoid areas sensitive to surface and ground water contamination. Follow federal, state and local guidelines for specific setbacks need to minimize impacts to sensitive areas. Schedule manure applications to minimize offsite impacts by potenially offensive odors. Drainage (surface and subsurface) should be considered when evaluating distance to water.

Site Specific Nutrient Management Considerations

See management statements above.

Additional Planning Remarks

Planned crop rotaion, yields and rates show that field one can be applied to every other year.

Shane Kjellberg ,K2S Engineering Inc.		5-09			
Technical Service Provider	Date	Producer	Date	NRCS	Date

This worksheet is intended to provide nutrient and resource assessments. This worksheet is NOT intended to provide crop / fertilizer recommendations. The Natural Resources Conservation Service assumes no liability for any use of this worksheet outside of the intended purpose.

AGRICULTURAL WASTE INFORMATION

Enter information to estimate Agricultural Waste volume and nutrient content for either Solids or Liquids: Leave days of storage blank, if agricultural waste application is not planned. Soil tests and nutrient tests of the agricultural waste must be used to establish accurate application rates. Data generated is NOT to be used for ag waste system design specifications, rather it provides waste volumes and nutrient values to develop waste utilization plans. Refer to the AgSolids or AgLiquids EXCEL worksheets (or other approved design methods) for ag waste system design specifications.

HELP

Days of Storage	Animal Type	Number	Weight (lbs.)	Bedding Lbs./day	Soil Conditions and Timing of Waste Incorporation
180	Beef	500	1200	1000	Warm dry soil, incorporation after 7 or more days
365	Beef	2000	800		

Solid Agricultural Waste Information

NOTE: Leave all boxes blank, if Solid Agricultural Waste application is not planned.

Enter specific Solid Agricultural Waste System information; type of collection/handling system, curve number, watershed acres, feedlot slope (%) and years of accumulation. If known, enter solid agricultural waste test values, number of tons of manure available to apply.

HELP

Tons	Collection, Storage and Spreading System
	Open lot surface storage - solids spreading

Enter data from the AgSolids Design Spreadsheet			
Curve Number	Acres in Watershed	Feedlot Slope %	Years of Solids Accumulation
90	20	3	1

Value of Solid Agricultural Waste as a Fertilizer Source			
Total Lbs. Of Nutrients Available		$/Lb	
N	28,409	$ 0.12	$ 3,409
P_2O_5	9,826	$ 0.20	$ 1,965
K_2O	21,381	$ 0.02	$ 428
Total Estimated Value of Nutrients			$ 5,802

	N	P_2O_5	K_2O
Solid Agricultural Waste Test Values (Lbs./Ton)	8	3.24	7.05
Solid Agricultural Waste Nutrient Book Values (Lbs./Ton)	4.0	1.6	3.5

Feedlot Runoff - Liquid and Nitrogen Amounts for application				
Gallons		Lbs. N Available		Lbs Nitrogen / 1000 gal
1,808,708		4,148		2.3

Estimated amount of Solid Agricultural Waste available for application				
Tons		Cubic Yards		Bushels
6,065		7,488		162,472

Liquid Agricultural Waste Information

NOTE: Leave these boxes blank, if Liquid Agricultural Waste application is not planned.

Additional information needed to compute waste volume and nutrient content for Liquid Agricultural Waste System. Enter information regarding the Collection and Storage System, Added Water per Day, the Ag Waste pond dimensions, and Liquid Ag Waste nutrient test values.

HELP

Collection and Storage System	Added Water per day (gallons)

Ag Waste pond design information from the AgLiquid spreadsheet						
Rectangular	Top Width (Ft)			Circular	Diameter (Ft)	
	Top Length (Ft)					

Disposal System	Approximate Minimum Water Requirements, gal./day *					
	Dairy	Swine	Beef	Poultry	Sheep	Horses
Irrigation	0	0	0	0	0	0
Pump ,Inject	0	0	0	0	0	0

* AWMFH, pages 11-3 & 11-4

Value of Liquid Agricultural Waste as a Fertilizer Source			
Total Lbs. Of Nutrients Available		$/Lb	
N	0	$ 0.24	$ -
P_2O_5	0	$ 0.25	$ -
K_2O	0	$ 0.10	$ -
Total Estimated Value of Nutrients			$ -

	N	P_2O_5	K_2O
Liquid Agricultural Waste test results (Lbs./1000 Gallons)			
Liquid Agricultural Waste Nutrient Book Values (Lbs./1000 Gallons)	0.0	0.0	0.0

Estimated amount of Liquid Agricultural Waste available for application				
Cubic Feet		Gallons		Acre Inches
0		0		0.0

A buildup of heavy metals may result after many years of manure application on the same fields. Avoid spreading manure on frozen soil, never in waterways, natural or man made channels.

Annual Crop / Nutrient Analysis

Enter appropriate information for prior crop or forage credits, agricultural waste and / or commercial fertilizers planned or applied to meet the specified yield goal for each crop.

2010	Current Crop	Corn, Grain		
		N	P_2O_5	K_2O
Recommended Nutrients Lbs. / acre based on yield goal		144.0	84.0	139.9
Field 1 — Available Nutrients Lbs. / Acre		35.0	105.6	129.6
First Year Nitrogen Credits for:				
Previous Crop	Yield / Lbs.			
Previous Forage Legume or Crop				
Second Year Nitrogen Credits for:				
Other Nutrient Credits				
SubTotal of **Available Nutrients Lbs.**		35.0	105.6	129.6
Solid Agricultural Waste Application Rates				
Estimated rates to meet the:				
Crop Nitrogen needs	27.3 tons/acre			
Crop Phosphorous needs	-13.3 tons/acre			
Planned Application Rate	**15.7** tons/acre	62.8	25.4	55.3
Liquid Agricultural Waste Application Rates				
Estimated rates to meet the:				
Crop Nitrogen needs	1000 gal/acre			
Crop Phosphorous needs	1000 gal/acre			
Planned Application Rate	1000 gallons/acre	0.0	0.0	0.0
Commercial Fertilizer				
Urea (46-0-0)	110 lbs./ac.	50.6	0.0	0.0
		0.0	0.0	0.0
		0.0	0.0	0.0
SubTotal **Nutrients Applied Lbs.**		113.4	25.4	55.3
Total Nutrients: **(Applied + Available) Lbs.**		148.4	131.0	185.0
Nutrients Needed to meet desired Yield Goal **(Lbs./Acre)**		4.4	47.0	45.1
Indicates if total planned/applied nutrients are (SHORT) or in (EXCESS)		EXCESS	EXCESS	EXCESS

Agricultural Waste Application Information

Area required for ag. waste application based on crop Nitrogen requirements	223	Acres
Area required for ag. waste application based on crop Phosphorous requirements	-455	Acres
Area required for Planned Application Rate of **Solid** Agricultural Waste	386	Acres

Nitrogen accumulation is less than or meets the established threshold

Phosphorous accumulation is less than or meets the established threshold

Remarks:

Reviewed By: Date:

2011	Current Crop	Soybeans		
		N	P_2O_5	K_2O
Recommended Nutrients Lbs. / acre based on yield goal		0.0	62.0	88.0
Field 1 — Available Nutrients Lbs. / Acre		0.0	0.0	0.0
First Year Nitrogen Credits for:				
Previous Crop	Yield / Lbs.			
Previous Forage Legume or Crop				
Second Year Nitrogen Credits for:				
Other Nutrient Credits				
SubTotal of **Available Nutrients Lbs.**		0.0	0.0	0.0
Solid Agricultural Waste Application Rates				
Estimated rates to meet the:				
Crop Nitrogen needs	0.0 tons/acre			
Crop Phosphorous needs	38.3 tons/acre			
Planned Application Rate	tons/acre	0.0	0.0	0.0
Liquid Agricultural Waste Application Rates				
Estimated rates to meet the:				
Crop Nitrogen needs	1000 gal/acre			
Crop Phosphorous needs	1000 gal/acre			
Planned Application Rate	1000 gallons/acre	0.0	0.0	0.0
Commercial Fertilizer				
		0.0	0.0	0.0
Ammonium Polyphosphate (10-34-0)	50 lbs./ac.	5.0	17.0	0.0
Potash, KCl (0-0-60)	80 lbs./ac.	0.0	0.0	48.0
carry-over from year 1	lbs./ac.	4.40	47.03	45.07
	lbs./ac.			
SubTotal **Nutrients Applied Lbs.**		9.4	64.0	93.1
Total Nutrients: **(Applied + Available) Lbs.**		9.4	64.0	93.1
Nutrients Needed to meet desired Yield Goal **(Lbs./Acre)**		9.4	2.0	5.1
Indicates if total planned/applied nutrients are (SHORT) or in (EXCESS)			EXCESS	EXCESS

Agricultural Waste Application Information

Area required for ag. waste application based on crop Nitrogen requirements		Acres
Area required for ag. waste application based on crop Phosphorous requirements	158	Acres
Area required for Planned Application Rate of Agricultural Waste		Acres

Nitrogen accumulation is less than or meets the established threshold

Phosphorous accumulation is less than or meets the established threshold

Remarks:

Reviewed By: Date:

Annual Crop / Nutrient Analysis

Enter appropriate information for prior crop or forage credits, agricultural waste and / or commercial fertilizers planned or applied to meet the specified yield goal for each crop.

2012	CROP	Wheat		
		N	P_2O_5	K_2O
Field 1	Available Nutrients Lbs. / Acre	0.0	0.0	0.0
First Year Nitrogen Credits for:				
Previous Crop	Yield Lbs.			
Previous Forage Legume or Crop				
Second Year Nitrogen Credits for:				
Other Nutrient Credits				
	SubTotal of **Available Nutrients Lbs.**	0.0	0.0	0.0
Solid Agricultural Waste				
Estimated rates to meet the:				
Crop Nitrogen needs	31.3 tons/acre			
Crop Phosphorous needs	33.1 tons/acre			
Planned Application Rate	15.7 tons/acre	62.8	25.4	55.3
Liquid Agricultural Waste				
Estimated rates to meet the:				
Crop Nitrogen needs	1000 gal/acre			
Crop Phosphorous needs	1000 gal/acre			
Planned Application Rate	1000 gallons/acre	0.0	0.0	0.0
Commercial Fertilizer				
Urea (46-0-0)	100 lbs./ac.	46.00	0.00	0.00
Ammonium Polyphosphate (10-34-0)	100 lbs./ac.	10.00	34.00	0.00
Potash, KCl (0-0-60)	130 lbs./ac.	0.00	0.00	78.00
carry-over from year 2	lbs./ac.	9.40	2.03	5.07
	lbs./ac.			
	SubTotal **Nutrients Applied Lbs.**	128.2	61.5	138.4
	Total Nutrients: **(Applied + Available) Lbs.**	128.2	61.5	138.4
	Nutrients Needed to meet desired Yield Goal **(Lbs./Acre)**	3.2	7.9	2.9
	Indicates if total planned/applied nutrients are (SHORT) or in (EXCESS)	EXCESS	EXCESS	EXCESS

Agricultural Waste Application Information

Area required for ag. waste application based on Nitrogen requirements	194	Acres
Area required for ag. waste application based on Phosphorous requirements	183	Acres
Area required for Planned Application Rate of **Solid** Agricultural Waste	386	Acres

Nitrogen accumulation is less than or meets the established threshold

Phosphorous accumulation is less than or meets the established threshold

Remarks:

Reviewed By: Date:

2014	CROP	Corn, Grain		
		N	P_2O_5	K_2O
Field 1	Available Nutrients Lbs. / Acre	0.0	0.0	0.0
First Year Nitrogen Credits for:				
Previous Crop	Yield Lbs.			
Previous Forage Legume or Crop				
Second Year Nitrogen Credits for:				
Other Nutrient Credits				
	SubTotal of **Available Nutrients Lbs.**	0.0	0.0	0.0
Solid Agricultural Waste				
Estimated rates to meet the:				
Crop Nitrogen needs	36.0 tons/acre			
Crop Phosphorous needs	51.9 tons/acre			
Planned Application Rate	tons/acre	0.0	0.0	0.0
Liquid Agricultural Waste				
Estimated rates to meet the:				
Crop Nitrogen needs	1000 gal/acre			
Crop Phosphorous needs	1000 gal/acre			
Planned Application Rate	1000 gallons/acre	0.0	0.0	0.0
Commercial Fertilizer				
Urea (46-0-0)	260 lbs./ac.	119.60	0.00	0.00
Ammonium Polyphosphate (10-34-0)	250 lbs./ac.	25.00	85.00	0.00
Potash, KCl (0-0-60)	240 lbs./ac.	0.00	0.00	144.00
carry-over from year 2	lbs./ac.	3.20	7.92	2.91
	lbs./ac.			
	SubTotal **Nutrients Applied Lbs.**	147.8	92.9	146.9
	Total Nutrients: **(Applied + Available) Lbs.**	147.8	92.9	146.9
	Nutrients Needed to meet desired Yield Goal **(Lbs./Acre)**	3.8	8.9	7.0
	Indicates if total planned/applied nutrients are (SHORT) or in (EXCESS)	EXCESS	EXCESS	EXCESS

Agricultural Waste Application Information

Area required for ag. waste application based on Nitrogen Requirements	168	Acres
Area required for ag. waste application based on Phosphorous Requriements	117	Acres
Area required for Planned Application Rate of Agricultural Waste		Acres

Nitrogen accumulation is less than or meets the established threshold

Phosphorous accumulation is less than or meets the established threshold

Remarks:

Reviewed By: Date:

HELP

Name: T-T Ranch
County: **Eddy**

Tract / Field(s) 2
Acres: 581

May 14, 2009

Leaching and Soil Surface Runoff Potential

Soil Information G229B **Heimdal-Emrick loams, 3 to 6 percent slopes**

NA	**Surface Water Risk**	**NA**
NA	**Ground Water Risk**	**NA**

The potential for runoff and leaching is not a concern for this soil map unit. Complete the Phosphorous Index below if agricultural waste will be applied to this field.

Phosphorus Risk Screening Tool

If agricultural waste will be applied to this soil map unit, *and* soil test Phosphorous is > 20 ppm Olsen (or > 20 ppm Mehlich 3 or, > 30 ppm Bray) *and* runoff water reaches surface water, complete the Phosphorous Index

Phosphorous Index

HELP

THE PHOSPHORUS INDEX IS NOT INTENDED TO BE AN EVALUATION SCALE FOR DETERMINING WHETHER LANDUSERS ARE ABIDING WITHIN WATER QUALITY OR NUTRIENT MANAGEMENT STANDARDS THAT HAVE BEEN ESTABLISHED BY LOCAL, STATE, OR FEDERAL AGENCIES.

Score	Inputs	
0	less than 2 tons/acre/year	Soil Erosion by Wind and Water in (tons/acre/year)
0	NA	Surface Water Risk
1	Olsen <20 ppm	Soil Test Phosphorous (STP)
1	less than 30 pounds/acre	Phosphorous Fertilizer Application Rate (pounds P_2O_5/acre) from all Sources
5	Surface Applied with No Incorporation, or Fall/Winter Applied with Spring Incorporation	Phosphorous Fertilizer / Manure Application Method
1	200-1000 feet	Distance to Permanent Surface Water or Water Course

Check all Best Management Practices that apply:

- ☐ Cover or Green Manure Crop
- ☐ Filter Strips
- ☐ Contour Buffer Strips
- ☐ Established No-till System

0 Best Management Practice Credit Total

8 **Medium** **Phosphorous Index Rating**

This field has a MEDIUM potential for off-site P movement. Organic nutrient application rates may be calculated according to crop nitrogen requirements.

	Name:	T-T Ranch		Tract / Field Number(s):	2	Date:	05/14/09
HELP	County:	Eddy		Acres:	581	Assisted By:	skk

Establish realistic yield goals before attempting to use this spreadsheet. Nutrient requirements of a crop depend on the total production of that crop.

CROPS & YIELDS

Rotation / Crops	Yield Goal	Units	Required Nutrients for Yield Goal N	P_2O_5	K_2O
Corn, Grain	120	bushels	144.0	84.0	139.9
Soybeans	40	bushels	0.0	62.0	88.0
Wheat	50	bushels	125.0	53.6	135.5
Corn, Grain	120	bushels	144.0	84.0	139.9
		0	0.0	0.0	0.0
		0	0.0	0.0	0.0

SOIL MAPPING UNIT INFORMATION

Soil Map Unit	Soil Map Unit Name	Surface Water Risk	Ground Water Risk
G229B	Helmdal-Emrick loams, 3 to 6 percent slopes	NA	NA

HELP

SOIL TEST INFORMATION

Soil Test Date or Field Number	Lbs./acre 0-24 in. depth N	ppm (Olsen) 0-6 in. P	Optional Information for Documentation Only ppm 0-6 in. K_2O	pH	O.M.%	E.C.
2	35	20	148	6.4		
2						
2						
2						

NUTRIENT RISK ASSESSMENT INFORMATION

Soil Erosion by wind and water (tons/acre/year)	less than 2 tons/acre/year
Soil Test Phosphorous (P) ppm	Olsen <20 ppm
Phosphorous fertilizer application rate (pounds P_2O_5/acre)	less than 30 pounds/acre
Phosphorous fertilizer application method	Surface Applied with No Incorporation, or Fall/Winter Applied with Spring Incorporation
Distance to Surface Water (feet)	200-1000 feet
Best Management Practices Planned	

PHOSPHOROUS INDEX

Medium

This field has a MEDIUM potential for off-site P movement. Organic nutrient application rates may be calculated according to crop nitrogen requirements.

MANAGEMENT CONSIDERATIONS

Nutrient Thresholds — **Nitrogen:** Maximum accumulation of N 180 lbs./ac | **Phosphorous:** Maximum accumulation of P 150ppm

General Management Statements

- Soil testing should be completed at least every other year to monitor nitrogen and at least once every five years to monitor phosphorus levels. Soil samples should be taken to the rooting depth of each crop in the rotation to reduce the risk of leaching nitrate nitrogen out of the root zone.
- Fall application of anhydrous ammonia and urea should be delayed until soil temperature is less than 45 degrees Fahrenheit. When soil temperatures are above 45 degrees Fahrenheit, microbial activity increases, converting ammonia to nitrate-nitrogen (NO3). Nitrate-nitrogen is a very mobile form of nitrogen and can leach below the crop root zone.
- Nutrient application should avoid areas sensitive to surface and ground water contamination. Follow federal, state and local guidelines for specific setbacks need to minimize impacts to sensitive areas. Schedule manure applications to minimize offsite impacts by potenially offensive odors. Drainage (surface and subsurface) should be considered when evaluating distance to water.

Site Specific Nutrient Management Considerations

See management statements above.

Additional Planning Remarks

Planned crop rotaion, yields and rates show that fields 1 & 2 provide sufficient acres to treat manure from planned feedlot. It is reccomended that other fields are used in rotations to limit build-up of other elements.

Shane Kjellberg ,K2S Engineering Inc. — Technical Service Provider — Date

5-09 — Producer — Date

NRCS — Date

This worksheet is intended to provide nutrient and resource assessments. This worksheet is NOT intended to provide crop / fertilizer recommendations. The Natural Resources Conservation Service assumes no liability for any use of this worksheet outside of the intended purpose.

AGRICULTURAL WASTE INFORMATION

Enter information to estimate Agricultural Waste volume and nutrient content for either Solids or Liquids: Leave days of storage blank, if agricultural waste application is not planned. Soil tests and nutrient tests of the agricultural waste must be used to establish accurate application rates. Data generated is NOT to be used for ag waste system design specifications, rather it provides waste volumes and nutrient values to develop waste utilization plans. Refer to the AgSolids or AgLiquids EXCEL worksheets (or other approved design methods) for ag waste system design specifications.

HELP

Days of Storage	Animal Type	Number	Weight (lbs.)	Bedding Lbs./day	Soil Conditions and Timing of Waste Incorporation
180	Beef	500	1200	1000	Warm dry soil, incorporation after 7 or more days
365	Beef	2000	800		

Solid Agricultural Waste Information

NOTE: Leave all boxes blank, if Solid Agricultural Waste application is not planned.

Enter specific Solid Agricultural Waste System information; type of collection/handling system, curve number, watershed acres, feedlot slope (%) and years of accumulation. If known, enter solid agricultural waste test values, number of tons of manure available to apply.

HELP

Tons	Collection, Storage and Spreading System
	Open lot surface storage - solids spreading

Enter data from the AgSolids Design Spreadsheet			
Curve Number	Acres in Watershed	Feedlot Slope %	Years of Solids Accumulation
90	20	3	1

Value of Solid Agricultural Waste as a Fertilizer Source			
	Total Lbs. Of Nutrients Available	$/Lb	
N	28,409	$ 0.12	$ 3,409
P_2O_5	9,826	$ 0.20	$ 1,965
K_2O	21,381	$ 0.02	$ 428
	Total Estimated Value of Nutrients		**$ 5,802**

	N	P_2O_5	K_2O
Solid Agricultural Waste Test Values (Lbs./Ton)	8	3.24	7.05
Solid Agricultural Waste Nutrient Book Values (Lbs./Ton)	4.0	1.6	3.5

Feedlot Runoff - Liquid and Nitrogen Amounts for application				
Gallons		Lbs. N Available		Lbs Nitrogen / 1000 gal
1,808,708		4,148		2.3

Estimated amount of Solid Agricultural Waste available for application				
Tons		Cubic Yards		Bushels
6,065		7,488		162,472

Liquid Agricultural Waste Information

NOTE: Leave these boxes blank, if Liquid Agricultural Waste application is not planned.

Additional information needed to compute waste volume and nutrient content for Liquid Agricultural Waste System. Enter information regarding the Collection and Storage System, Added Water per Day, the Ag Waste pond dimensions, and Liquid Ag Waste nutrient test values.

HELP

Collection and Storage System	Added Water per day (gallons)

Ag Waste pond design information from the AgLiquid spreadsheet						
Rectangular	Top Width (Ft)			**Circular**	Diameter (Ft)	
	Top Length (Ft)					

Disposal System	Approximate Minimum Water Requirements, gal./day *					
	Dairy	Swine	Beef	Poultry	Sheep	Horses
Irrigation	0	0	0	0	0	0
Pump ,Inject	0	0	0	0	0	0

* AWMFH, pages 11-3 & 11-4

Value of Liquid Agricultural Waste as a Fertilizer Source			
	Total Lbs. Of Nutrients Available	$/Lb	
N	0	$ 0.24	$ -
P_2O_5	0	$ 0.25	$ -
K_2O	0	$ 0.10	$ -
	Total Estimated Value of Nutrients		**$ -**

	N	P_2O_5	K_2O
Liquid Agricultural Waste test results (Lbs./1000 Gallons)			
Liquid Agricultural Waste Nutrient Book Values (Lbs./1000 Gallons)	0.0	0.0	0.0

Estimated amount of Liquid Agricultural Waste available for application				
Cubic Feet		Gallons		Acre Inches
0		0		0.0

A buildup of heavy metals may result after many years of manure application on the same fields. Avoid spreading manure on frozen soil, never in waterways, natural or man made channels.

Annual Crop / Nutrient Analysis

Enter appropriate information for prior crop or forage credits, agricultural waste and / or commercial fertilizers planned or applied to meet the specified yield goal for each crop.

2010	Current Crop	Corn, Grain		
		N	P_2O_5	K_2O
Recommended Nutrients Lbs. / acre based on yield goal		144.0	84.0	139.9
Field 2	Available Nutrients Lbs. / Acre	35.0	105.6	129.6
First Year Nitrogen Credits for:				
Previous Crop	Yield / Lbs.			
Previous Forage Legume or Crop				
Second Year Nitrogen Credits for:				
Other Nutrient Credits				
SubTotal of **Available Nutrients Lbs.**		35.0	105.6	129.6
Solid Agricultural Waste Application Rates				
Estimated rates to meet the:				
Crop Nitrogen needs	27.3 tons/acre			
Crop Phosphorous needs	-13.3 tons/acre			
Planned Application Rate	**10.5** tons/acre	42.0	17.0	37.0
Liquid Agricultural Waste Application Rates				
Estimated rates to meet the:				
Crop Nitrogen needs	1000 gal/acre			
Crop Phosphorous needs	1000 gal/acre			
Planned Application Rate	1000 gallons/acre	0.0	0.0	0.0
Commercial Fertilizer				
Urea (46-0-0)	150 lbs./ac.	69.0	0.0	0.0
		0.0	0.0	0.0
		0.0	0.0	0.0
SubTotal **Nutrients Applied Lbs.**		111.0	17.0	37.0
Total Nutrients: **(Applied + Available) Lbs.**		146.0	122.6	166.7
Nutrients Needed to meet desired Yield Goal **(Lbs./Acre)**		2.0	38.6	26.7
Indicates if total planned/applied nutrients are (SHORT) or in (EXCESS)		EXCESS	EXCESS	EXCESS

Agricultural Waste Application Information

Area required for ag. waste application based on crop Nitrogen requirements	223	Acres
Area required for ag. waste application based on crop Phosphorous requirements	-455	Acres
Area required for Planned Application Rate of **Solid** Agricultural Waste	578	Acres

Nitrogen accumulation is less than or meets the established threshold

Phosphorous accumulation is less than or meets the established threshold

Remarks:

Reviewed By: Date:

2011	Current Crop	Soybeans		
		N	P_2O_5	K_2O
Recommended Nutrients Lbs. / acre based on yield goal		0.0	62.0	88.0
Field 2	Available Nutrients Lbs. / Acre	0.0	0.0	0.0
First Year Nitrogen Credits for:				
Previous Crop	Yield / Lbs.			
Previous Forage Legume or Crop				
Second Year Nitrogen Credits for:				
Other Nutrient Credits				
SubTotal of **Available Nutrients Lbs.**		0.0	0.0	0.0
Solid Agricultural Waste Application Rates				
Estimated rates to meet the:				
Crop Nitrogen needs	0.0 tons/acre			
Crop Phosphorous needs	38.3 tons/acre			
Planned Application Rate	tons/acre	0.0	0.0	0.0
Liquid Agricultural Waste Application Rates				
Estimated rates to meet the:				
Crop Nitrogen needs	1000 gal/acre			
Crop Phosphorous needs	1000 gal/acre			
Planned Application Rate	1000 gallons/acre	0.0	0.0	0.0
Commercial Fertilizer				
		0.0	0.0	0.0
Ammonium Polyphosphate (10-34-0)	75 lbs./ac.	7.5	25.5	0.0
Potash, KCl (0-0-60)	120 lbs./ac.	0.0	0.0	72.0
carry-over from year 1	lbs./ac.	2.00	38.61	26.74
	lbs./ac.			
SubTotal **Nutrients Applied Lbs.**		9.5	64.1	98.7
Total Nutrients: **(Applied + Available) Lbs.**		9.5	64.1	98.7
Nutrients Needed to meet desired Yield Goal **(Lbs./Acre)**		9.5	2.1	10.7
Indicates if total planned/applied nutrients are (SHORT) or in (EXCESS)			EXCESS	EXCESS

Agricultural Waste Application Information

Area required for ag. waste application based on crop Nitrogen requirements		Acres
Area required for ag. waste application based on crop Phosphorous requirements	158	Acres
Area required for Planned Application Rate of ____ Agricultural Waste		Acres

Nitrogen accumulation is less than or meets the established threshold

Phosphorous accumulation is less than or meets the established threshold

Remarks:

Reviewed By: Date:

Annual Crop / Nutrient Analysis

Enter appropriate information for prior crop or forage credits, agricultural waste and / or commercial fertilizers planned or applied to meet the specified yield goal for each crop.

2012 CROP				Wheat		
				N	P_2O_5	K_2O
Field 2 — Available Nutrients Lbs. / Acre				0.0	0.0	0.0
First Year Nitrogen Credits for:						
Previous Crop		Yield	Lbs.			
Previous Forage Legume or Crop						
Second Year Nitrogen Credits for:						
Other Nutrient Credits						
SubTotal of **Available Nutrients Lbs.**				0.0	0.0	0.0
Solid Agricultural Waste						
Estimated rates to meet the:						
Crop Nitrogen needs	31.3	tons/acre				
Crop Phosphorous needs	33.1	tons/acre				
Planned Application Rate	**10.5**	tons/acre		42.0	17.0	37.0
Liquid Agricultural Waste						
Estimated rates to meet the:						
Crop Nitrogen needs		1000 gal/acre				
Crop Phosphorous needs		1000 gal/acre				
Planned Application Rate	1000 gallons/acre			0.0	0.0	0.0
Commercial Fertilizer						
Urea (46-0-0)	150	lbs./ac.		69.00	0.00	0.00
Ammonium Polyphosphate (10-34-0)	110	lbs./ac.		11.00	37.40	0.00
Potash, KCl (0-0-60)	165	lbs./ac.		0.00	0.00	99.00
carry-over from year 2		lbs./ac.		9.50	2.11	10.74
		lbs./ac.				
SubTotal **Nutrients Applied Lbs.**				131.5	56.5	146.8
Total Nutrients: **(Applied + Available) Lbs.**				131.5	56.5	146.8
Nutrients Needed to meet desired Yield Goal **(Lbs./Acre)**				6.5	3.0	11.3
Indicates if total planned/applied nutrients are (SHORT) or in (EXCESS)				EXCESS	EXCESS	EXCESS

Agricultural Waste Application Information		
Area required for ag. waste application based on Nitrogen requirements	194	Acres
Area required for ag. waste application based on Phosphorous requirements	183	Acres
Area required for Planned Application Rate of **Solid** Agricultural Waste	578	Acres

Nitrogen accumulation is less than or meets the established threshold

Phosphorous accumulation is less than or meets the established threshold

Remarks:

Reviewed By: Date:

2014 CROP				Corn, Grain		
				N	P_2O_5	K_2O
Field 2 — Available Nutrients Lbs. / Acre				0.0	0.0	0.0
First Year Nitrogen Credits for:						
Previous Crop		Yield	Lbs.			
Previous Forage Legume or Crop						
Second Year Nitrogen Credits for:						
Other Nutrient Credits						
SubTotal of **Available Nutrients Lbs.**				0.0	0.0	0.0
Solid Agricultural Waste						
Estimated rates to meet the:						
Crop Nitrogen needs	36.0	tons/acre				
Crop Phosphorous needs	51.9	tons/acre				
Planned Application Rate		tons/acre		0.0	0.0	0.0
Liquid Agricultural Waste						
Estimated rates to meet the:						
Crop Nitrogen needs		1000 gal/acre				
Crop Phosphorous needs		1000 gal/acre				
Planned Application Rate	1000 gallons/acre			0.0	0.0	0.0
Commercial Fertilizer						
Urea (46-0-0)	260	lbs./ac.		119.60	0.00	0.00
Ammonium Polyphosphate (10-34-0)	250	lbs./ac.		25.00	85.00	0.00
Potash, KCl (0-0-60)	240	lbs./ac.		0.00	0.00	144.00
carry-over from year 2		lbs./ac.		6.50	2.97	11.25
		lbs./ac.				
SubTotal **Nutrients Applied Lbs.**				151.1	88.0	155.3
Total Nutrients: **(Applied + Available) Lbs.**				151.1	88.0	155.3
Nutrients Needed to meet desired Yield Goal **(Lbs./Acre)**				7.1	4.0	15.3
Indicates if total planned/applied nutrients are (SHORT) or in (EXCESS)				EXCESS	EXCESS	EXCESS

Agricultural Waste Application Information		
Area required for ag. waste application based on Nitrogen Requirements	168	Acres
Area required for ag. waste application based on Phosphorous Requriements	117	Acres
Area required for Planned Application Rate of _____ Agricultural Waste		Acres

Nitrogen accumulation is less than or meets the established threshold

Phosphorous accumulation is less than or meets the established threshold

Remarks:

Reviewed By: Date:

HELP

Name: T-T Ranch
County: **Eddy**

Tract / Field(s) 3
Acres: 89

May 14, 2009

Leaching and Soil Surface Runoff Potential

Soil Information G225A **Larson-Cathay loams, 0 to 3 percent slopes**

NA	**Surface Water Risk**	**NA**
NA	**Ground Water Risk**	**NA**

The potential for runoff and leaching is not a concern for this soil map unit. Complete the Phosphorous Index below if agricultural waste will be applied to this field.

Phosphorus Risk Screening Tool

If agricultural waste will be applied to this soil map unit, *and* soil test Phosphorous is > 20 ppm Olsen (or > 20 ppm Mehlich 3 or, > 30 ppm Bray) *and* runoff water reaches surface water, complete the Phosphorous Index

Phosphorous Index

HELP

THE PHOSPHORUS INDEX IS NOT INTENDED TO BE AN EVALUATION SCALE FOR DETERMINING WHETHER LANDUSERS ARE ABIDING WITHIN WATER QUALITY OR NUTRIENT MANAGEMENT STANDARDS THAT HAVE BEEN ESTABLISHED BY LOCAL, STATE, OR FEDERAL AGENCIES.

Score	Inputs	
0	less than 2 tons/acre/year	Soil Erosion by Wind and Water in (tons/acre/year)
0	NA	Surface Water Risk
2	Olsen 20-40 ppm	Soil Test Phosphorous (STP)
1	less than 30 pounds/acre	Phosphorous Fertilizer Application Rate (pounds P_2O_5/acre) from all Sources
5	Surface Applied with No Incorporation, or Fall/Winter Applied with Spring Incorporation	Phosphorous Fertilizer / Manure Application Method
1	200-1000 feet	Distance to Permanent Surface Water or Water Course

Check all Best Management Practices that apply:

- ☐ Cover or Green Manure Crop
- ☐ Filter Strips
- ☐ Contour Buffer Strips
- ☐ Established No-till System

0 Best Management Practice Credit Total

9 **Medium** **Phosphorous Index Rating**

This field has a MEDIUM potential for off-site P movement. Organic nutrient application rates may be calculated according to crop nitrogen requirements.

HELP

Name: T-T Ranch
County: **Eddy**

Tract / Field(s) 4
Acres: 189

May 14, 2009

Leaching and Soil Surface Runoff Potential

Soil Information G318A **Falsen coarse sandy loam, 0 to 2 percent slopes**

NA	**Surface Water Risk**	**NA**
High	**Ground Water Risk**	**Poor Filter**

See "Management Considerations to Address Soil Surface Runoff or Leaching Concerns" on the "Nutrient Management Planner" sheet by clicking on the "Nutrient Management Planner" tab below. Complete the Phosphorous Index below if agricultural waste will be applied to this field.

Phosphorus Risk Screening Tool

If agricultural waste will be applied to this soil map unit, *and* soil test Phosphorous is > 20 ppm Olsen (or > 20 ppm Mehlich 3 or, > 30 ppm Bray) *and* runoff water reaches surface water, complete the Phosphorous Index

Phosphorous Index

HELP

THE PHOSPHORUS INDEX IS NOT INTENDED TO BE AN EVALUATION SCALE FOR DETERMINING WHETHER LANDUSERS ARE ABIDING WITHIN WATER QUALITY OR NUTRIENT MANAGEMENT STANDARDS THAT HAVE BEEN ESTABLISHED BY LOCAL, STATE, OR FEDERAL AGENCIES.

Score	Inputs	
0	less than 2 tons/acre/year	Soil Erosion by Wind and Water in (tons/acre/year)
0	NA	Surface Water Risk
1	Olsen <20 ppm	Soil Test Phosphorous (STP)
1	less than 30 pounds/acre	Phosphorous Fertilizer Application Rate (pounds P_2O_5/acre) from all Sources
5	Surface Applied with No Incorporation, or Fall/Winter Applied with Spring Incorporation	Phosphorous Fertilizer / Manure Application Method
1	200-1000 feet	Distance to Permanent Surface Water or Water Course

Check all Best Management Practices that apply:

- ☐ Cover or Green Manure Crop
- ☐ Filter Strips
- ☐ Contour Buffer Strips
- ☐ Established No-till System

0 Best Management Practice Credit Total

8 **Medium** **Phosphorous Index Rating**

This field has a MEDIUM potential for off-site P movement. Organic nutrient application rates may be calculated according to crop nitrogen requirements.

MANURE NUTRIENT ANALYSIS REPORT

AgSource
Soil & Forage Laboratory
A subsidiary of Cooperative Resources International

AGSOURCE SOIL & FORAGE LABORATORY
106 N. CECIL STREET
BONDUEL, WI 54107
PHONE (715)758-2178 FAX (715)758-2620

ACCT: 084

K2S ENGINEERING INC
4209 94TH AVE SE
YPSILANTI, ND 58497

ANALYSIS FOR: K2S
DATE PROCESSED: 05/12/2009
DATE SAMPLED: / /
SAMPLE NUMBER: 96044
MATERIAL: Beef
SAMPLE TYPE: TOPP JEFF
STORAGE SYSTEM: SOLID

DRY MATTER, % 35.40

MOISTURE, % 64.60

	Estimated Available Nutrient Credits			
	Total Nutrients lbs/ton	In 1st Year of Application lbs/ton	If Applied 2 Consecutive Yrs lbs/ton	If Applied 3 Consecutive Yrs lbs/ton
Nitrogen (Injected)	8.00	2.80	3.60	4.00
Nitrogen(Surface Applied)	8.00	2.00	2.80	3.20
Phosphorus as P_2O_5	3.24	1.95	2.27	2.43
Potassium as K_2O	7.05	5.64	6.35	6.70
Sulfur	1.06	0.64	0.74	0.80
Estimated Value of Available Nutrients		$6.97	$8.23	$8.86

MINOR ELEMENTS *3

Calcium:	N/R	Zinc:	N/R
Magnesium:	N/R	Manganese:	N/R
Copper:	N/R	Sodium:	N/R
Iron:	N/R		

NH4-N:	0.080%
NO3-N:	0.004%

COMMENTS

*1 Applications of manure on the same field for 2 consecutive years increases availability of N, P, K, and S by 10%, and for 3 or more consecutive years by 15%.
Availability of N changes depending on application technique.
Injection or incorporation within 3 days of application results in higher N availability.

*2 Value based on commercial fertilizer costs as of 05/01/2009.
N (Urea) $0.57/lb, P2O5 (Triple Superphosphate) $0.67/lb, K2O (Potash) $0.74/lb,
S (Elemental Sulfur) $0.56/lb.

*3 If minor elements are requsted, they are reported on a 'dry matter' basis.
If ammonia, nitrate or pH are requested, they are reported on an 'as is' basis.

CENTROL CONSULTING

SOIL TEST REPORT

FIELD
COUNTY EDDY
TWP COLUMBRA
QTR W1/2
PREV CROP FLAX

SAMPLE
SECTION 34
ACRES 286.0

FIELD 1

W E S

SUBMITTED FOR:

JEFF TOPP
1255 82 AVE NE

GRACE CITY, ND 58445

SUBMITTED BY: F02461

BRIAN FOSTER
1225 2ND AVE SW

JAMESTOWN, ND 58401

REF # 10286884
LAB # 7175 BOX # 728

DATE SAMPLED 10/14/ 6 DATE RECEIVED 10/16/ 6 DATE REPORTED 10/17/06

NUTRIENT IN THE SOIL		INTERPRETATION V LOW	LOW	MED	HIGH
0- 6"	20 lb/ac				
6-24"	36 lb/ac				
0-24"	56 lb/ac	**********			
rate N					
sphorus (Olsen)	11 ppm	**********			
assium	180 ppm	**********	**********		
lor... 0-24"	28 lb/ac	**********			
ur 0- 6"	84 lb/ac	**********	**********		
6-24"	360+ lb/ac	**********	**********		
ron					
nganese					
per	0.52 ppm	**********			
gnesium					
cium					
um					
ic Matter					
onate (CCE)					
ble 0- 6"	0.40 mmho/cm	**********			
6-24"	0.48 mmho/cm	**********	**********		

1ST CROP CHOICE		
WHEAT		
YIELD GOAL	50 Bushels	
SUGGESTED GUIDELINES		
Control		
LB/ACRE		APPLICATION
N	66	
P_2O_5	32	Broadcast
K_2O	10	Band(Starter)*
Cl	12	Broadcast
S	0	
B		
Zn		
Fe		
Mn		
Cu	2	Broadcast
Mg		
Lime	0.0	

2ND CROP CHOICE		
BARLEY		
YIELD GOAL	85 Bushels	
SUGGESTED GUIDELINES		
Control		
LB/ACRE		APPLICATION
N	76	
P_2O_5	38	Broadcast
K_2O	17	Broadcast
Cl	12	Broadcast
S	0	
B		150# 46-0-0 for Corn
Zn		
Fe		
Mn		
Cu	2	Broadcast
Mg		
Lime	0.0	

3RD CROP CHOICE		
SOYBEANS		
YIELD GOAL	40 Bushels	
SUGGESTED GUIDELINES		
Control		
LB/ACRE		APPLICATION
N	0	
P_2O_5	24	Broadcast
K_2O	0	
Cl	0	
S	0	
B	0	
Zn		
Fe		
Mn		
Cu	0	
Mg		
Lime	0.0	

Soil pH	Buffer pH	Cation Exchange Capacity	% Base Saturation (Typical Range)				
			% Ca	% Mg	% K	% Na	% H
7.6							

26 LBS OF 0-0-60 = 12 LBS OF CHLORIDE

* CAUTION: SEED PLACED FERTILIZER CAN CAUSE INJURY *

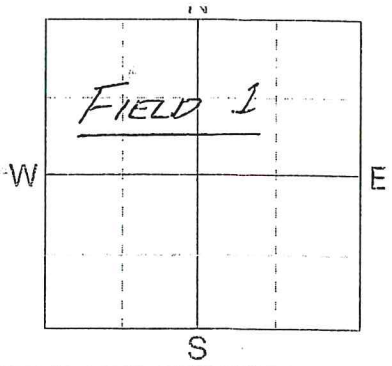
Crop Removal: Crop 1: P2O5= 31 K2O= 19 Crop 2: P2O5= 40 K2O= 43 Crop 3: P2O5= 35 K2O= 60

AGVISE LABORATORIES

P.O. BOX 187, BENSON, MN 56215
(320) 843-4109

SOIL TEST REPORT

FIELD	S FARM	SAMPLE	
COUNTY	EDDY		
TWP	COLUMBIA	SECTION	34
QTR	S1/2	ACRES	200.0
PREV CROP	WHEAT		



SUBMITTED FOR:

T - T RANCH
1255 82ND AVE NE

GRACE CITY, ND 58445

SUBMITTED BY: TT0771

T - T RANCH
1255 82ND AVE NE

GRACE CITY, ND 58445

REF # 8808849
LAB # 27406 BOX # 6170

DATE SAMPLED

DATE RECEIVED 9/ 3/ 7

DATE REPORTED 9/ 4/07

NUTRIENT IN THE SOIL			INTERPRETATION			
			VLOW	LOW	MED	HIGH
0- 6"	19	lb/ac				
6-18"	16	lb/ac				
0-18"	35	lb/ac	******			
itrate N						
hosphorus Bray 1	60	ppm				
assium	246	ppm				
loride 0- 6"	11	lb/ac				
6-18"	16	lb/ac				
fur 0- 6"	30	lb/ac				
6-18"	72	lb/ac				
ron						
nc						
anganese						
pper	0.62	ppm				
agnesium						
cium						
dium						
anic Matter						
bonate (CCE)						
ible 0- 6"	0.30	mmho/cm	******			
s						

1ST CROP CHOICE		
GRAIN CORN		
YIELD GOAL	120 BU	
SUGGESTED GUIDELINES		
	BAND	
LB/ACRE		APPLICATION
N	109	
P_2O_5	15	Band (2x2) #
K_2O	10	Band (2x2) #
Cl	**	
S	0	
B		
Zn		
Fe		
Mn		
Cu	0	
Mg		
Lime	0.0	

2ND CROP CHOICE		
SOYBEANS		
YIELD GOAL	40 BU	
SUGGESTED GUIDELINES		
	BAND	
LB/ACRE		APPLICATION
N	0	
P_2O_5	10	Band(Starter)#
K_2O	0	
Cl	0	
S	5	Band (Trial)
B		
Zn		
Fe		
Mn		
Cu	0	
Mg		
Lime	0.0	

3RD CROP CHOICE		
WHEAT		
YIELD GOAL	50 BU	
SUGGESTED GUIDELINES		
	BAND	
LB/ACRE		APPLICATION
N	100	
P_2O_5	15	Band(Starter)#
K_2O	10	Band(Starter)#
Cl	13	Band
S	0	
B		
Zn		
Fe		
Mn		
Cu	1	Band (Trial)
Mg		
Lime	0.0	

Soil pH	Buffer pH	Cation Exchange Capacity	% Base Saturation (Typical Range)				
			% Ca	% Mg	% K	% Na	% H
6.4							

** SOIL CHLORIDE LEVEL IS LOW, HOWEVER YIELD DATA IS LIMITED FOR THIS CROP. 28 LBS OF 0-0-60 = 13 LBS OF CHLORIDE

CAUTION: SEED PLACED FERTILIZER CAN CAUSE INJURY

Crop Removal: Crop 1: P2O5= 48 K2O= 32 Crop 2: P2O5= 35 K2O= 60 Crop 3: P2O5= 31 K2O= 19

AGVISE Band guidelines will build P & K test levels to the medium range over many years.

CENTROL CONSULTING

SOIL TEST REPORT

FIELD	S OF FEEDLOT	SAMPLE	
COUNTY	EDDY		
TWP	COLUMBRA	SECTION	34
QTR	E1/2	ACRES	165.0
PREV CROP	CORN		

Field 1

W E S

SUBMITTED FOR:

JEFF TOPP
1255 82 AVE NE

GRACE CITY, ND 58445

SUBMITTED BY: F02461

BRIAN FOSTER
1225 2ND AVE SW

JAMESTOWN, ND 58401

REF # 10286883
LAB # 7173 BOX # 793

DATE SAMPLED 10/14/ 6 DATE RECEIVED 10/16/ 6 DATE REPORTED 10/17/06

NUTRIENT IN THE SOIL		INTERPRETATION V LOW	LOW	MED	HIGH
0- 6"	42 lb/ac				
6-24"	48 lb/ac				
0-24"	90 lb/ac	**********			
trate-N					
Olsen osphorus	20 ppm	**********	**********		
assium	288 ppm	**********	**********	**********	
lorid					
fur					
ron					
n					
nganese					
per					
gnesium					
cium					
ium					
nic Matter					
onate (CCE)					
ble 0- 6"	0.21 mmho/cm	*****			
6-24"	0.24 mmho/cm	******			

1ST CROP CHOICE			2ND CROP CHOICE			3RD CROP CHOICE		
SOYBEANS			FLAX			CORN		
YIELD GOAL	40 Bushels		YIELD GOAL	30 Bushels		YIELD GOAL	120 Bushels	
SUGGESTED GUIDELINES			SUGGESTED GUIDELINES			SUGGESTED GUIDELINES		
Central			Central			Central		
LB/ACRE		APPLICATION	LB/ACRE		APPLICATION	LB/ACRE		APPLICATION
N	0		N	0		N	60	
P_2O_5	0		P_2O_5	0		P_2O_5	20	Band (2x2) *
K_2O	0		K_2O	0		K_2O	0	
Cl			Cl			Cl		
S			S			S		
B			B			B		
Zn			Zn			Zn		
Fe			Fe			Fe		
Mn			Mn			Mn		
Cu			Cu			Cu		
Mg			Mg			Mg		
Lime	0.0		Lime	0.0		Lime	0.0	

Soil pH	Buffer pH	Cation Exchange Capacity	% Base Saturation (Typical Range)				
			% Ca	% Mg	% K	% Na	% H
6.3							

* CAUTION: SEED PLACED FERTILIZER CAN CAUSE INJURY *

Crop Removal: Crop 1: P2O5= 35 K2O= 60 Crop 2: P2O5= 27 K2O= 15 Crop 3: P2O5= 48 K2O= 32

CENTROL CONSULTING

SOIL TEST REPORT

FIELD	JET-RAYS-1/2	SAMPLE	RAYS-1/2
COUNTY	FOSTER		
TWP	LARABEE		
QTR	~~NW~~ S 1/2	SECTION	3
PREV CROP	SOYBEANS	ACRES	309.0

FIELD 2

W

S

SUBMITTED FOR:

T T RANCH
1255 82ND AVE NE

GRACE CITY, ND 58445

SUBMITTED BY: F02461

BRIAN FOSTER
1225 2ND AVE SW

JAMESTOWN, ND 58401

REF # 10521247
LAB # 7231 BOX # 2834

DATE SAMPLED 10/23/ 7 DATE RECEIVED 10/24/ 7 DATE REPORTED 10/26/07

NUTRIENT IN THE SOIL		INTERPRETATION V LOW	LOW	MED	HIGH
0- 6"	8 lb/ac				
6-24"	15 lb/ac				
0-24"	23 lb/ac	****			
Nitrate N					
Olsen Phosphorus	8 ppm	**********			
Potassium	148 ppm	**********	**********		
Chloride					
Sulfur					
Boron					
Zinc					
Iron					
Manganese					
Copper					
Magnesium					
Calcium					
Sodium					
Organic Matter					
Carbonate (CCE)					
Soluble Salts 0- 6"	0.36 mmho/cm	**********			
6-24"	0.43 mmho/cm	**********			

1ST CROP CHOICE: WHEAT		
YIELD GOAL	55 Bushels	
SUGGESTED GUIDELINES Centrol		
LB/ACRE		APPLICATION
N	91	
P_2O_5	43	Broadcast
K_2O	31	Broadcast
Cl		
S		
B		
Zn		
Fe		
Mn		
Cu		
Mg		
Lime	0.0	

2ND CROP CHOICE: CORN		
YIELD GOAL	120 Bushels	
SUGGESTED GUIDELINES Centrol		
LB/ACRE		APPLICATION
N	97	
P_2O_5	49	Broadcast
K_2O	44	Broadcast
Cl		
S		
B		
Zn		
Fe		
Mn		
Cu		
Mg		
Lime	0.0	

3RD CROP CHOICE: BARLEY		
YIELD GOAL	85 Bushels	
SUGGESTED GUIDELINES Centrol		
LB/ACRE		APPLICATION
N	89	
P_2O_5	47	Broadcast
K_2O	36	Broadcast
Cl		
S		
B		
Zn		
Fe		
Mn		
Cu		
Mg		
Lime	0.0	

Soil pH	Buffer pH	Cation Exchange Capacity	% Base Saturation (Typical Range) % Ca	% Mg	% K	% Na	% H
7.3							

NITROGEN CREDITS GRANTED: CROP 1 = 20 CROP 2 = 30 CROP 3 = 20

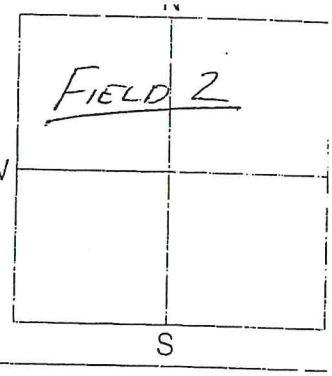
Crop Removal: Crop 1: P2O5= 34 K2O= 21 Crop 2: P2O5= 48 K2O= 32 Crop 3: P2O5= 40 K2O= 43

CENTROL CONSULTING

SOIL TEST REPORT

FIELD
COUNTY FOSTER
TWP LARRABEE
QTR N1/2
PREV CROP CORN

SAMPLE
SECTION 3
ACRES 309.0



SUBMITTED FOR:
JEFF TOPP
1255 82 AVE NE
GRACE CITY, ND 58445

SUBMITTED BY: F02461
BRIAN FOSTER
1225 2ND AVE SW
JAMESTOWN, ND 58401

REF # 10286882
LAB # 7171 BOX # 793

DATE SAMPLED 10/14/ 6 DATE RECEIVED 10/16/ 6 DATE REPORTED 10/17/06

NUTRIENT IN THE SOIL		INTERPRETATION V LOW	LOW	MED	HIGH
0- 6"	23 lb/ac				
6-24"	24 lb/ac				
0-24"	47 lb/ac	********			
trate N					
hosphorus Olsen	10 ppm		**********		
otassium	169 ppm			**********	**********
lorid					
lfur					
oron					
c					
on					
nganese					
oper					
gnesium					
lcium					
dium					
nic Matter					
onate (CCE)					
uble 0- 6"	0.19 mmho/cm	*****			
s 6-24"	0.29 mmho/cm	*******			

1ST CROP CHOICE	
SOYBEANS	
YIELD GOAL	40 Bushels
SUGGESTED GUIDELINES	
Control	
LB/ACRE	APPLICATION
N 0	
P_2O_5 29	Broadcast
K_2O 0	
Cl	
S	
B	
Zn	
Fe	
Mn	
Cu	
Mg	
Lime 0.0	

2ND CROP CHOICE	
FLAX	
YIELD GOAL	30 Bushels
SUGGESTED GUIDELINES	
Control	
LB/ACRE	APPLICATION
N 33	
P_2O_5 0	
K_2O 0	
Cl	
S	
B	
Zn	
Fe	
Mn	
Cu	
Mg	
Lime 0.0	

3RD CROP CHOICE	
CORN	
YIELD GOAL	120 Bushels
SUGGESTED GUIDELINES	
Control	
LB/ACRE	APPLICATION
N 103	
P_2O_5 40	Broadcast
K_2O 28	Broadcast
Cl	
S	
B	
Zn	
Fe	
Mn	
Cu	
Mg	
Lime 0.0	

Soil pH	Buffer pH	Cation Exchange Capacity	% Base Saturation (Typical Range)				
			% Ca	% Mg	% K	% Na	% H
6.4							

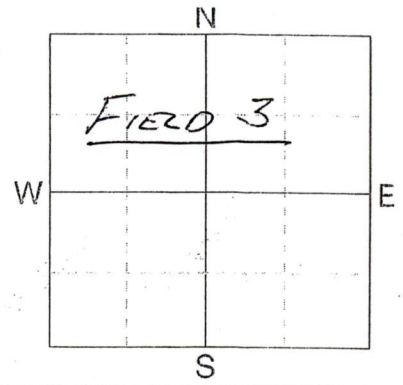
Crop Removal: Crop 1: P2O5= 35 K2O= 60 Crop 2: P2O5= 27 K2O= 15 Crop 3: P2O5= 48 K2O= 32

AGVISE LABORATORIES

P.O. BOX 187, BENSON, MN 56215
(320) 843-4109

SOIL TEST REPORT

FIELD	SOUTH RUDYS	SAMPLE	
COUNTY	EDDY		
TWP	COLUMBIA	SECTION	35
QTR	SW	ACRES	90.0
PREV CROP	MALTING BARLEY		



SUBMITTED FOR:

T - T RANCH
1255 82ND AVE NE

GRACE CITY, ND 58445

SUBMITTED BY: TT0771

T - T RANCH
1255 82ND AVE NE

GRACE CITY, ND 58445

REF # 8808841
LAB # 27385 BOX # 6156

E SAMPLED | DATE RECEIVED 9/ 3/ 7 | DATE REPORTED 9/ 4/07

NUTRIENT IN THE SOIL		INTERPRETATION (V LOW / LOW / MED / HIGH)
0- 6"	19 lb/ac	
6-16"	23 lb/ac	
0-16"	42 lb/ac	*******
litrate N		
Olsen hosphorus	28 ppm	**********
ssium	239 ppm	**********
0- 6"	18 lb/ac	**********
hloride 6-16"	26 lb/ac	
0- 6"	62 lb/ac	**********
ur 6-16"	200+ lb/ac	**********
on		
inc		
anganese		
per	0.49 ppm	**********
agnesium		
ium		
ium		
anic Matter		
rbonate (CCE)		
ble 0- 6"	0.42 mmho/cm	**********

1ST CROP CHOICE: GRAIN CORN, YIELD GOAL 120 BU			2ND CROP CHOICE: SOYBEANS, YIELD GOAL 40 BU			3RD CROP CHOICE: WHEAT, YIELD GOAL 50 BU		
SUGGESTED GUIDELINES			SUGGESTED GUIDELINES			SUGGESTED GUIDELINES		
BAND			BAND			BAND		
LB/ACRE		APPLICATION	LB/ACRE		APPLICATION	LB/ACRE		APPLICATION
N	102		N	0		N	93	
P_2O_5	15	Band (2x2) $	P_2O_5	10	Band(Starter)$	P_2O_5	15	Band(Starter)$
K_2O	10	Band (2x2) $	K_2O	0		K_2O	10	Band(Starter)$
Cl	0		Cl	0		Cl	0	
S	0		S	0		S	0	
B			B			B		
Zn			Zn			Zn		
Fe			Fe			Fe		
Mn			Mn			Mn		
Cu	0		Cu	0		Cu	2	Band
Mg			Mg			Mg		
Lime	0.0		Lime	0.0		Lime	0.0	

Soil pH	Buffer pH	Cation Exchange Capacity	% Base Saturation (Typical Range)				
			% Ca	% Mg	% K	% Na	% H
7.2							

$ CAUTION: SEED PLACED FERTILIZER CAN CAUSE INJURY $

Crop Removal: Crop 1: P2O5= 48 K2O= 32 Crop 2: P2O5= 35 K2O= 60 Crop 3: P2O5= 31 K2O= 19

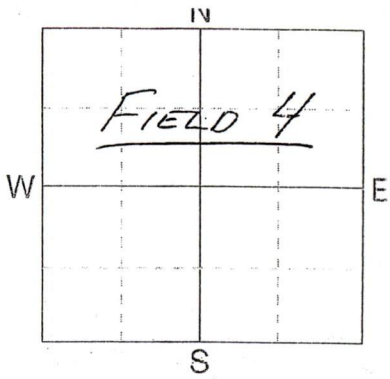
AGVISE Band guidelines will build P & K test levels to the medium range over many years.

AGVISE LABORATORIES

P.O. BOX 187, BENSON, MN 56215
(320) 843-4189

SOIL TEST REPORT

FIELD	CALVIN'S	SAMPLE	
COUNTY	EDDY		
TWP	COLUMBIA	SECTION	27
QTR	E1/2	ACRES	200.0
PREV CROP	WHEAT		



SUBMITTED FOR:

T - T RANCH
1255 82ND AVE NE

GRACE CITY, ND 58445

SUBMITTED BY: TT0771

T - T RANCH
1255 82ND AVE NE

GRACE CITY, ND 58445

REF # 8808818
LAB # 27399 BOX # 6166

DATE SAMPLED

DATE RECEIVED 9/ 3/ 7

DATE REPORTED 9/ 4/07

NUTRIENT IN THE SOIL		INTERPRETATION	1ST CROP CHOICE	2ND CROP CHOICE	3RD CROP CHOICE
		V LOW / LOW / MED / HIGH	GRAIN CORN	SOYBEANS	
			YIELD GOAL 110 BU	YIELD GOAL 40 BU	YIELD GOAL
			SUGGESTED GUIDELINES	SUGGESTED GUIDELINES	SUGGESTED GUIDELINES
			BAND	BAND	
			LB/ACRE APPLICATION	LB/ACRE APPLICATION	LB/ACRE APPLICATION
0- 6"	14 lb/ac		N 110	N 0	N
6-16"	8 lb/ac		P_2O_5 30 Band *	P_2O_5 27 Band *	P_2O_5
0-16"	22 lb/ac	****	K_2O 28 Band *	K_2O 20 Band *	K_2O
Nitrate N			Cl **	Cl 0	Cl
Olsen Phosphorus	11 ppm	**********	S 0	S 0	S
Potassium	131 ppm	**********	B	B	B
Chloride 0- 6"	10 lb/ac	**********	Zn	Zn	Zn
Chloride 6-16"	13 lb/ac		Fe	Fe	Fe
Sulfur 0- 6"	36 lb/ac	**********	Mn	Mn	Mn
Sulfur 6-16"	36 lb/ac	**********	Cu 0	Cu 0	Cu
Boron			Mg	Mg	Mg
Zinc			Lime 0.0	Lime 0.0	Lime
Iron					
Manganese					
Copper	0.51 ppm	**********			
Magnesium					
Calcium					
Sodium					
Organic Matter					
Carbonate (CCE)					
Soluble 0- 6" Salts	0.44 mmho/cm	**********			

Soil pH	Buffer pH	Cation Exchange Capacity	% Base Saturation (Typical Range)				
			% Ca	% Mg	% K	% Na	% H
8.1							

** SOIL CHLORIDE LEVEL IS LOW, HOWEVER YIELD DATA IS LIMITED FOR THIS CROP. 37 LBS OF 0-0-60 = 17 LBS OF CHLORIDE

* CAUTION: SEED PLACED FERTILIZER CAN CAUSE INJURY *

Crop Removal: Crop 1: P2O5= 44 K2O= 30 Crop 2: P2O5= 35 K2O= 60

AGVISE Band guidelines will build P & K test levels to the medium range over many years.

IV-A-3d MANURE MANAGEMENT RECORD KEEPING FORMS

Inspection Records ***Farm/ Ranch:*** ***Year:***

	Date:	Daily Water Line checks (initial if no problems)							Weekly Checks (initial if no problems)			Weekly Pond Depth Reading	Corrective Action (date, repairs notes, initials)
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Diversions	Dikes	Storage Structure		
Week 1													
Week 2													
Week 3													
Week 4													
Week 5													
Week 6													
Week 7													
Week 8													
Week 9													
Week 10													
Week 11													
Week 12													
Week 13													

Additional notes:

Inspection Records ***Farm/ Ranch:*** ***Year:***

	Date:	Daily Water Line checks (initial if no problems)							Weekly Checks (initial if no problems)			Weekly Pond Depth Reading	Corrective Action (date, repairs notes, initials)
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Diversions	Dikes	Storage Structure		
Week 14													
Week 15													
Week 16													
Week 17													
Week 18													
Week 19													
Week 20													
Week 21													
Week 22													
Week 23													
Week 24													
Week 25													
Week 26													

Additional notes:

Inspection Records ***Farm/ Ranch:*** ***Year:***

	Date:	Daily Water Line checks (initial if no problems)							Weekly Checks (initial if no problems)			Weekly Pond Depth Reading	Corrective Action (date, repairs notes, initials)
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Diversions	Dikes	Storage Structure		
Week 27													
Week 28													
Week 29													
Week 30													
Week 31													
Week 32													
Week 33													
Week 34													
Week 35													
Week 36													
Week 37													
Week 38													
Week 39													

Additional notes:

Inspection Records ***Farm/ Ranch:*** ***Year:***

	Date:	Daily Water Line checks (initial if no problems)							Weekly Checks (initial if no problems)			Weekly Pond Depth Reading	Corrective Action (date, repairs notes, initials)
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Diversions	Dikes	Storage Structure		
Week 40													
Week 41													
Week 42													
Week 43													
Week 44													
Week 45													
Week 46													
Week 47													
Week 48													
Week 49													
Week 50													
Week 51													
Week 52													

Additional notes:

Inspection Records ***Farm/ Ranch:*** ***Year:***

	Date:	Daily Water Line checks (initial if no problems)							Weekly Checks (initial if no problems)			Weekly Pond Depth Reading	Corrective Action (date, repairs notes, initials)
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Diversions	Dikes	Storage Structure		
Week 1													
Week 2													
Week 3													
Week 4													
Week 5													
Week 6													
Week 7													
Week 8													
Week 9													
Week 10													
Week 11													
Week 12													
Week 13													

Additional notes:

Inspection Records ***Farm/ Ranch:*** ***Year:***

	Date:	Daily Water Line checks (initial if no problems)							Weekly Checks (initial if no problems)			Weekly Pond Depth Reading	Corrective Action (date, repairs notes, initials)
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Diversions	Dikes	Storage Structure		
Week 14													
Week 15													
Week 16													
Week 17													
Week 18													
Week 19													
Week 20													
Week 21													
Week 22													
Week 23													
Week 24													
Week 25													
Week 26													

Additional notes:

Inspection Records ***Farm/ Ranch:*** ***Year:***

	Date:	Daily Water Line checks (initial if no problems)							Weekly Checks (initial if no problems)			Weekly Pond Depth Reading	Corrective Action (date, repairs notes, initials)
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Diversions	Dikes	Storage Structure		
Week 27													
Week 28													
Week 29													
Week 30													
Week 31													
Week 32													
Week 33													
Week 34													
Week 35													
Week 36													
Week 37													
Week 38													
Week 39													

Additional notes:

Inspection Records ***Farm/ Ranch:*** ***Year:***

	Date:	Daily Water Line checks (initial if no problems)							Weekly Checks (initial if no problems)			Weekly Pond Depth Reading	Corrective Action (date, repairs notes, initials)
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Diversions	Dikes	Storage Structure		
Week 40													
Week 41													
Week 42													
Week 43													
Week 44													
Week 45													
Week 46													
Week 47													
Week 48													
Week 49													
Week 50													
Week 51													
Week 52													

Additional notes:

Monthly Weather Conditions ***Farm/ Ranch:***

Month:_____ ***Year:_____***

Day	Sky	Temp. (F)	Wind Direction	Wind Speed (MPH)	Rainfall Amounts* -inches		Additional Notes:
					Overnight	Daytime	
ex.	PC	55	NW	5-10	0.1	trace	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Notes:

***required**

Monthly Weather Conditions ***Farm/ Ranch:***

Month:_____ ***Year:_____***

Day	Sky	Temp. (F)	Wind Direction	Wind Speed (MPH)	Rainfall Amounts* -inches		Additional Notes:
					Overnight	Daytime	
ex.	PC	55	NW	5-10	0.1	trace	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
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18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Notes:

***required**

Monthly Weather Conditions ***Farm/ Ranch:***

Month:_____ ***Year:_____***

Day	Sky	Temp. (F)	Wind Direction	Wind Speed (MPH)	Rainfall Amounts* -inches		Additional Notes:
					Overnight	Daytime	
ex.	PC	55	NW	5-10	0.1	trace	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
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21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Notes:

***required**

Monthly Weather Conditions ***Farm/ Ranch:***

Month:_____ ***Year:_____***

Day	Sky	Temp. (F)	Wind Direction	Wind Speed (MPH)	Rainfall Amounts* -inches		Additional Notes:
					Overnight	Daytime	
ex.	PC	55	NW	5-10	0.1	trace	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Notes:

***required**

Monthly Weather Conditions ***Farm/ Ranch:***

Month:_____ ***Year:_____***

Day	Sky	Temp. (F)	Wind Direction	Wind Speed (MPH)	Rainfall Amounts* -inches		Additional Notes:
					Overnight	Daytime	
ex.	PC	55	NW	5-10	0.1	trace	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
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20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Notes:

***required**

Monthly Weather Conditions ***Farm/ Ranch:***

Month:_____ ***Year:_____***

Day	Sky	Temp. (F)	Wind Direction	Wind Speed (MPH)	Rainfall Amounts* -inches		Additional Notes:
					Overnight	Daytime	
ex.	PC	55	NW	5-10	0.1	trace	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Notes:

***required**

Manure Transfer Log ***Farm/ Ranch:***

-record of manure tranferred to land not owned or operated by livestock owner.

Date:	Recipient's Name	Address	Amount (tons or gallons)	Type (liquid or solid)	Was a copy of the most recent nutrient analysis provided to the recipient? (yes or no)	Notes

Discharge/spill report from storage ponds, storage facilities, sediment basins, containment areas, manure transfer equipment

-pond overflows, or spills of manure outside of production areas.

Spill Date:	Description of Spill	Estimated Volume Spilled (tons or gallons)	Actions Taken	Date Corrected

Manure Transfer Log ***Farm/ Ranch:***

-record of manure tranferred to land not owned or operated by livestock owner.

Date:	Recipient's Name	Address	Amount (tons or gallons)	Type (liquid or solid)	Was a copy of the most recent nutrient analysis provided to the recipient? (yes or no)	Notes

Discharge/spill report from storage ponds, storage facilities, sediment basins, containment areas, manure transfer equipment

-pond overflows, or spills of manure outside of production areas.

Spill Date:	Description of Spill	Estimated Volume Spilled (tons or gallons)	Actions Taken	Date Corrected

Manure Transfer Log ***Farm/ Ranch:***

-record of manure tranferred to land not owned or operated by livestock owner.

Date:	Recipient's Name	Address	Amount (tons or gallons)	Type (liquid or solid)	Was a copy of the most recent nutrient analysis provided to the recipient? (yes or no)	Notes

Discharge/spill report from storage ponds, storage facilities, sediment basins, containment areas, manure transfer equipment

-pond overflows, or spills of manure outside of production areas.

Spill Date:	Description of Spill	Estimated Volume Spilled (tons or gallons)	Actions Taken	Date Corrected

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Spill Date:	Description of Spill	Estimated Volume Spilled (tons or gallons)	Actions Taken	Date Corrected

IV-B. FEED MANAGEMENT PLAN

III 1. Feed Management Plan Summary

No recommendations on feed management are made for the following reasons:

1. Soil phosphorous levels appear to be manageable.

2. The amount of feedstock (containing phosphorus) imported onto this farm/system is negligible. This means that the amount of nutrients entering this system through feedstock is from feedstock grown primarily on this farm. Therefore the nutrients are within this farm cycle (animal⇒manure⇒field⇒crop⇒animal⇒ repeat).

IV-C. MORTALITY MANAGEMENT PLAN

IV-C-1 MORTALITY MANAGEMENT PLAN SUMMARY

IV-C Mortality Management Plan Summary

Mortality Management on the Topp Farm will consist of a burial pit at the location shown on the map in Section IV-C-2.
Composting and burning may also be employed in the same location. A description of the practices to be used is described on the map in Section IV-C-2.

-the following information is modified from Livestock and Poultry Environmental Stewardship Program, Lesson 51, Mortality Management by Don Stettler of the USDA-NRCS

Part 1. Estimating Mortalities

To estimate how many mortalities your operation will have, use the following table.

Type of Livestock or Poultry	Column A Average Mortality Rate (%)	Column B Average Weight (lb.)
Cattle and Horses		
birth	9.0	100
weanling	2.5	600
yearling	1.0	900
mature	0.75	1,400

Part 2. Estimating Your Mortality Production

First, calculate the total number of each category of livestock present on your farm over a year's time.

Then, multiply the total in each category by the average mortality rate for that category. Then divide by 100. This gives you the total number of mortalities to plan for in each category.

To calculate total weight of mortalities, multiply the number of mortalities in each category by the average weight for that category. Then sum the weights from all the livestock categories.

Example:

Mature Cows = 300; No. Of Mortalities = 300 x 0.75/100 = 2.25 (use 2); Weight of Mortalities = 1100 lbs. x 2 = 2,200 lbs.

Birth = 300; No. Of Mortalities = 300 x 9/100 = 27; Weight of Mortalities = 100 lbs. x 27 = 2,700 lbs.
Total weight = 4,900 lbs.

Part 3. Acceptable Methods of Handling Mortality

North Dakota state law (NDCC 36-14-19) specifies the methods for properly handling mortality animals. There are two cases where special conditions must be taken.

- If an animal has died from Anthrax, the carcass must be burned at the place where it died. If it must be moved, it may not be dragged over the ground, but must be carried and all body openings of the carcass must be plugged with cotton that is saturated with a strong antiseptic solution.
- If a hog dies from hog cholera or swine erysipelas, the carcass hide must remain intact and it must be buried within 36 hours, or given to a licensed rendering plant within that time.

Dead animals are to be disposed of within 36 hours by one of four acceptable methods.

They are:

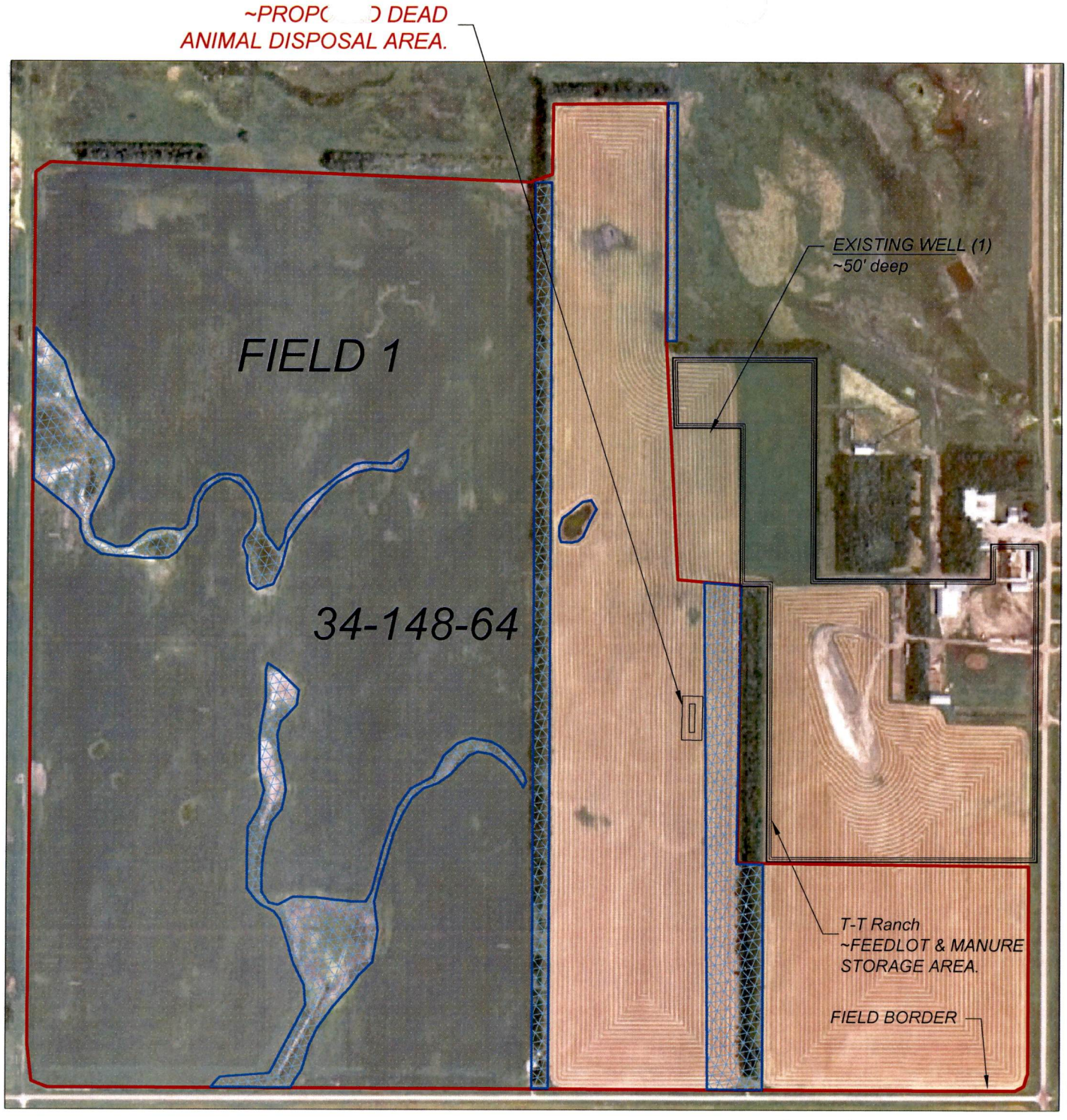
- **Burning** - This can be done with an appropriate incinerator or in a pit. The Health Department air quality division has requirements for burning and must be notified of the method that will be used for burning dead animals.
- **Bury** - If this method is used, the dead animals must be buried on the owners land and be at least four feet below the ground level and covered with dirt to that depth. They cannot be buried in an area where there could be a surface or groundwater impact such as along river banks or in sandy soils with high water tables. The best locations for burying are on higher areas with heavy clay soil that are away from water and drainage ways. Disposing of dead animals at landfills is acceptable if the landfill operator agrees to take them.
- **Composting** - This method may be used provided the operator has a proper facility for composting and a proper operational plan. This includes maintaining the proper Carbon to Nitrogen (C to N) ratio and proper moisture content so it will heat. The compost must reach a high enough temperature to kill pathogens and breakdown the carcass. This will require monitoring the compost consistency, temperature, and moisture regularly and turning the compost as necessary in the heating cycle. The site must also have controls to contain any runoff from the composting area and vector controls to prevent rodents or other animals from getting into the compost. The Health Department has guidelines for composting dead animals that provide specific information on what is required for a proper composting system.
- **Rendering** - Licensed rendering plants may handle dead animals. For their own protection, the livestock owner should ensure that rendering plant is licensed. The livestock owner may need to provide temporary storage of the dead animals until they can be picked up, or may have to haul them to the rendering plant or pickup site. Dead animals can be disposed of by other methods only if it is approved by the state veterinarian. No carcass may be disposed of along any public highway or along any stream, lake, or river, nor be buried near or adjoining any such place.

Part 4. Choosing the Best Disposal Method for Your Operation

Disposal Methods	Advantages	Disadvantages
Rendering	1) Conserves nutrients contained in the dead animals. 2) Minimal capital investment unless preservation is used. 3) Low maintenance	1) Increases sanitary precautions to prevent disease transmission. 2) Storage of animals is required until pickup. 3) Fees charged for pickup. 4) Rendering service may not be available.
Composting[1]	1) Conserves nutrients contained in the dead animals. 2) Low odor. 3) Environmentally safe. 4) No need to store dead animals.	1) High initial cost. 2) Labor intensive. 3) Regular monitoring and maintenance is required. 4) Cropland required for utilization of finished compost.
Incineration	1) Sanitary. 2) Final except for ashes.	1) Nutrients contained in the dead animals are wasted. 2) Initial cost. 3) Fuel costs. 4) Equipment operation and maintenance costs. 5) Potential air quality impairment.
Sanitary Landfills	1) Simplicity. 2) No capital investment. 3) No maintenance.	1) Nutrients contained in the dead animals are wasted. 2) Few landfills accept dead animals. 3) Transportation costs. 4) Not permitted in many areas.
Burial	1) Capital limited to land and excavating equipment.	1) Nutrients contained in the dead animals are wasted. 2) Increases sanitary precautions to prevent disease transmission. 3) Storage of carcasses until burial may be necessary. Difficult if ground is frozen. 4) Land area becomes significant for large operations. 5) Siting requirements.
Disposal pits	1) Simplicity.	1) Nutrients contained in the dead animals are wasted. 2) Exacting soil and drainage conditions are required. 3) Satisfactory location may not be convenient to facilities. 4) Possibility of environmental hazards. 5) Not permitted in many areas.

[1] - If composted mortalities will be applied to your land, the nutrients in the compost must be added to the manure nutrient production calculated in section 4, prior to calculating your land base requirement.

IV-C-2 MORTALITY MANAGEMENT PLAN MAP



Approximate scale: 1" = 750'

buffer areas (do not dipose of dead animals in these areas)

Proposed Dead Animal disposal area -west of feedlot.
Area will be on the higher elevation and not on the side-slope or low area (wetland).
Soil maps indicate limited soils for dead animal burial and/or burning.
Pit depth will vary from 4-8' deep. Pit dimensions: ~8-10' wide by 15-20' long.
Pit bottom shall be lined with 1' of clay material from clay borrow area.
Dead animals (burned remains or whole carcass) shall be placed in pit and covered with soil within 48 hours from time of death (exception: during winter months and frozen conditions -animals shall be buried within 48 hours of thaw). Refer to Section IV-C-1 for burial details.

Sheet No.			
1 of 1	K_2S ENGINEERING INC. 4209 94TH AVE SE YPSILANTI, ND 58497 Phone 701-489-3322	CNMP T-T Ranch Mortality Management Map	Date Drawn 5-09 Drawn By skk Date Checked 5-09 Checked by jak File: CNMP maps.dwg

Date
Approved By ... SHANE KJELLBERG P.E. 5-09 ..
Title .....
1 OF 1

Mortality Log

Farm/ Ranch:

Date:	Type of Livestock	Weight of Livestock lbs.	Disposal Method	Disposal Date:	Notes:
ex.	cow	1,100	buried in pit		-covered with 2' of soil
Total Weight:					

Mortality Log

Farm/ Ranch:

Date:	Type of Livestock	Weight of Livestock lbs.	Disposal Method	Disposal Date:	Notes:
ex.	cow	1,100	buried in pit		-covered with 2' of soil
Total Weight:					

NORTH DAKOTA DEPARTMENT OF HEALTH
Division of Water Quality
Bismarck, ND

SFN 8296 (6/96)

APPLICATION FOR APPROVAL OF LIVESTOCK WASTE SYSTEM

NAME OF APPLICANT: ***Jeff Topp***

INDIVIDUAL ***X*** COOPERATIVE _____ PARTNERSHIP _____

NAME OF LIVESTOCK OPERATION: ***T-T Ranch***

ADDRESS OF OWNER OR APPLICANT: ***1255 82 Ave NE*** (RR, Street, or PO Box No.)

Grace City ND (City) ***58445*** (Zip Code) ***701-674-3119*** (Telephone No.)

LOCATION OF LIVESTOCK ENTERPRISE: (Legal Land Description)

_____ 1/4 ***E1/2*** 1/4 Section ***34*** Township ***148*** Range ***64***

County ***Eddy*** Lat. _____ Long. _____ (If available)

TYPE OF FACILITY:

(a) Existing ***X*** Planned _____ Addition _____

(b) Confined in barn _____ Have access to outside lot _____

(c) Unpaved or dirt ***X*** Hard surfaced _____ Other _____

TYPE AND NUMBER OF LIVESTOCK:

Days/year livestock concentrated on-site: ***365 days-feeders; 180 days-cows***
(for example, Dec. - May, 180 days)

Existing number, and maximum number of livestock at the facility:

Existing Number	Maximum Design Number	Type	Average Weight
ex 130	250	Beef Cattle	1,200 lbs
400	***500***	***Beef Cows***	***1,200 lbs***
1,000	***2,000***	***Beef feeders***	***800 lbs.***

FORMATION:

st the area of any outside livestock lots: ~15-25 acres.

rea contributing surface flow from outside the lot (not diverted): ~0 acres.

s the runoff from a 25-year/24-hour rain event contained on the property:

YES (This varies across the State from 3.5 to 4.1 in. of rain).

Soil type at waste storage site and livestock lot: (From soil survey)

Depth from ground surface to the seasonal high water table at:

Waste storage site >4' Livestock holding area >8'

This was determined by: (check one) Soil boring X Estimate _____

How much land is available for disposing of waste: >10,000 acres.

How will dead animals be disposed of? refer to section IV-C

The maps and site information submitted should be as detailed and accurate as possible. Incomplete information may result in delays with the approval, or future problems at the site.

A. Submit the following information with this application form:

1. A topographic map of the area with at least a two-mile radius. refer to section IV-A-2

2. A current map of the area with at least a two-mile radius that has the following marked to the best of your knowledge:

   a. All inhabitable farms or dwellings. refer to section IV-A-2

   b. All land within this two-mile radius on which waste will be applied. refer to section IV-A-2

   c. Any livestock waste ponds and dugouts. refer to section IV-A-2

   d. Any well within 1/4 mile and any public or irrigation wells within 2 miles. Also, list any abandoned wells you are aware of and their status. refer to section IV-A-2

   e. If dead animals are disposed of on-site, indicate on the map where this is done.

3. A sketch of the facility site with the following information:

   a. Dimensions and distances, include depth of wells on-site. refer to section II-C

   b. All existing and proposed structures, with labels (e.g., barns, diversions, fences). sec. II-C

   c. Identify drainage patterns through the facility site. refer to section II-C

B. Please check on the following information and, if it is available, include it when submitting this application:

1. Any applicable zoning requirements (city, county, township). ***application may be required***

2. Any water quality information you are aware of, such as:

   a. Well water quality analyses. ***none known***

   b. Surface water analyses (stock ponds, creeks, etc.). ***none known***

   c. Analyses of livestock waste or runoff. ***refer to section IV-A-3c***

3. Any geologic/hydraulic or soils information you are aware of:

   a. Well logs for wells at the facility. ***none at the site -area logs in section IV-A-2***

   b. Geologic, ground water, or surface water studies done in the area and who did the studies. ***test pits by K2S Engineering Inc.***

   c. Personal observation (gravel pits, wetlands, etc.). ***area has numerous wetlands***

C. Give a brief description of the proposed livestock waste system, including how waste and/or runoff will be collected, stored, and land applied. Indicate if waste is incorporated into the soil and, if so, how is this done. (Use a separate sheet, if necessary).

refer to design & CNMP

I certify that, to the best of my knowledge, this information is correct and accurate.

(Applicant Signature) (Date)

APPLICATION FOR PRELIMINARY APPROVAL OF A LIVESTOCK WASTE SYSTEM:

The Department of Health has the responsibility to review and approve concentrated livestock facilities to ensure surface and ground waters are protected from pollution by livestock waste. The first step to initiate the evaluation process is to complete this application form and return it to the Department with the information requested.

The application should be completed as accurately and completely as possible. Incomplete information will slow down the process. If you have any questions, contact the Department at 701-328-5219 for assistance.

ABOUT THE APPLICATION:

The application requests information on the proposed facility location, size, and other operational information. Maps with the information requested may be available at various places such as your County Extension Office, or the County Auditors Office. Soils information may be found at your local Natural Resources Conservation Service (NRCS) Office. If you cannot find all the information requested, you can contact the Health Department for assistance. Please be sure all of the information requested is included with the application.

PART A: Requests maps and sketches. Please make sure all requested information is clearly marked. If waste is to be applied to a neighbor's land, indicate whether a signed or verbal agreement has been made.

PART B: Requests information that you may personally be aware of. You do not need to collect any new data. If a ground water, surface water, or geologic study was completed in the area, indicate when the study was done and who did it. The Department can then get the data collected from the study.

PART C: This gives us an overview of the operation, including how waste is land applied, as well as provide information on any unique features at the site. We encourage producers to test the waste for nutrient content so it can be applied according to the needs of the crop being grown. Over-applying waste can lead to nitrogen being leached into the ground water or waste and nutrients being washed off the field and into lakes or streams.

FINAL APPROVAL:

The Department will review the application and respond with an evaluation of the site, including any areas of concern for surface or ground water impacts. This is done to allow operators to address areas of water quality concerns in the facility design. This detailed design plan of the facility and livestock waste system should then be submitted to the Department. It must include specifics on the volume of waste produced, the volume of waste that can be stored, dimensions of the storage structure, diversions, and embankments and also include method and rate waste is land applied. An operation and maintenance plan should be included to ensure the waste storage facility does not overflow and that waste is properly land applied.

If the final detailed design plan is already completed when submitting the application, it can be submitted, along with this preliminary application.