OPERATIONS AND MAINTENANCE (O&M) PLAN

REVISION 0

Camilla Wood Preserving Site

Camilla, Mitchell County, Georgia

Prepared Under:
U.S. EPA Contract No. EP-S4-09-02
U.S. EPA Task Order No. 062-RARA-04QG
Black & Veatch Project No. 049062.01.41.01.03
DCN: 49062-0150-04-A-02367R0

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Superfund Division
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APRIL 2016

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Table of Contents

Acronyms and Abbreviations **AA-1**
1.0 Introduction **1-1**
1.1 Intent of Document 1-1
1.2 Site location 1-1
1.3 Environmental Health and Safety 1-1
1.4 Organization of this Manual 1-2
2.0 Design and Function of the Remediation Components **2-1**
2.1 Introduction 2-1
2.2 Scope of Work 2-1
3.0 Post-Construction Care **3-1**
3.1 Post-construction Care Requirements 3-1
3.2 Certification of the Completion of the Post-construction Care Period 3-2
4.0 Site Monitoring, Inspection, and Maintenance **4-1**
4.1 Monitoring, Inspection and Maintenance Requirements 4-1
4.1.1 Inspections 4-1
4.1.2 Maintenance Scheduling and Performance 4-1
4.2 Inspection Items, Frequency, and Routine Maintenance 4-2
4.3 Inspection Reporting 4-2
4.4 Specific Inspection and Maintenance Objectives 4-3
4.4.1 Storm Water Detention Pond 4-3
4.4.2 Storm Water Conveyance Ditches and Drainage Structures 4-4
4.4.3 Site Security 4-4
5.0 References **5-1**

LIST OF TABLES

Table 4-1 Schedule for Inspections
Table 4-2 Schedule for Preventive (Routine) Maintenance
Table 4-3 Operation and Maintenance Inspection Report

LIST OF APPENDICES

Appendix A Figures and As-Built Surveys from RA Report, Rev 1
Appendix B Equipment Details
Appendix C Liner Warranty and Installer Contact Information

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Acronyms and Abbreviations

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
Black & Veatch	Black & Veatch Special Projects Corp.
bgs	below ground surface
cy	cubic yard
DoT	Department of Transportation
EPA	U.S. Environmental Protection Agency
EPD	Environmental Protection Division
GA	Georgia
IC	institutional control
LLDPE	Linear Low Density Polyethylene
O&M	Operations and Maintenance
Owner	City of Camilla
pH	hydrogen ion concentration
RA	Remedial Action
Site	Camilla Wood Preserving Site

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1.0 Introduction

An essential component of a comprehensive stormwater management program is the ongoing operation and maintenance (O&M) of the various components of the stormwater drainage, control, and conveyance systems. Ideally, a local program should address O&M concerns proactively instead of reacting to problems. O&M activities can include cleaning and maintenance of catch basins, drainage swales, conveyance ditches, storm sewer pipes, storm water ponds, and other structural controls.

1.1 INTENT OF DOCUMENT

Black & Veatch Special Projects Corporation, (Black & Veatch) has prepared this Post-Construction O&M Manual for the Camilla Wood Preserving Site (Site) for the U.S. Environmental Protection Agency (EPA) and the City of Camilla (owner). This manual is a supplement to the Remedial Action (RA) report documents submitted to the EPA under separate cover. Construction activities relating to the storm water pond began during Fiscal Year 2012 and were completed in early Fiscal year 2013. Repairs to the storm water detention pond were completed in late Fiscal Year 2014.

This manual is intended for use by EPA and the owner for the physical maintenance of the storm water detention pond and ditches located at the Site General components of the remedy addressed in this O&M Manual include the following:

- An engineered storm water detention pond lined with a Linear Low Density Polyethylene (LLDPE) liner.
- Open LLDPE lined storm water inlet conveyance ditch.
- Open unlined storm water inlet conveyance ditch.
- New storm water inlet structures, piping, and flap valve.
- New detention pond discharge structures, piping and gate valve.

This section briefly summarizes the background information for the Site located in the community of Camilla, Mitchell County, Georgia (GA). This section also describes general post-construction care requirements in accordance with the GA Environmental Protection Division (GAEPD) to identify when and how the post-construction care period begins and ends.

1.2 SITE LOCATION

The 40-acre Site is located about 0.25 miles west of U.S. Highway 19 in the city of Camilla, Mitchell County, GA. The former wood treating facility is bordered by South Harney Street to the west, Thomas Street to the east, and East Bennett Street to the north. Residential neighborhoods are located just north of the Site and approximately 0.25 mile to the west of the Site. A GA Department of Transportation (DoT) facility borders the Site to the southeast. The western portion of the Site, comprising approximately 23 acres, was remediated by EPA in 2006 and currently serves as an athletic complex, including soccer fields and administrative offices for Mitchell County Parks and Recreation and is the location of the storm water detention pond and conveyance ditches.

1.3 ENVIRONMENTAL HEALTH AND SAFETY

In accordance with GAEPD regulations, after construction, the owner will comply with post-construction requirements, including maintenance and monitoring throughout the post-construction care period. No

one shall dig into, excavate, or otherwise disturb the pond and storm water ditch LLDPE liners without first notifying EPA and GAEPD. At a minimum, the following personal protective equipment should be worn during O&M inspections:

- Safety glasses with side shields meeting the requirements and specifications of the current American National Standards Institute (ANSI) Z87 standard.
- Safety-toed boots meeting the requirements and specifications for impact and compression resistance, as required by American Society for Testing and Materials (ASTM) F2412/F2413 (formerly ANSI Z41, Class 75, for footwear purchased prior to March 2005).

1.4 ORGANIZATION OF THIS MANUAL

This manual discusses site-specific needs to operate, provide appropriate upkeep, and maintenance of the installed RA construction items including the facilities, equipment, and appropriate engineered and institutional controls (ICs) pertaining to post-construction at this Site. The text references GAEPD requirements as applicable.

The format of this manual provides an easy reference to specific O&M topics. Section 2 presents an overview of the design and functional description of key components of the storm water detention pond and inlet conveyance ditches, Section 3 describes the post-construction care, and Section 4 addresses site monitoring, inspection, and maintenance procedures.

Appendices are included at the end of this manual to provide supporting documentation. Appendix A contains the relevant figures and As-Built surveys from the site RA Report. Appendix B provides copies of manufacturer's catalog data detailing specific liners/equipment installed at the Camilla Wood Preserving Site as part of the construction project.

2.0 Design and Function of the Remediation Components

2.1 INTRODUCTION

This section presents an overview of the design and functional description of the following key elements of the Camilla Wood Preserving Site RA, specifically the construction of a lined storm water detention pond and site drainage improvements.

Drawings showing post-construction conditions and details of the above facility are included in Appendix A.

2.2 SCOPE OF WORK

The scope of work for this manual is post-construction inspection and O&M of the storm water detention pond and conveyance ditches. The specific tasks associated with this work includes construction of a 7-acre lined storm water detention pond and associated drainage pipes and ditches to alleviate onsite and reduce offsite flooding issues.

Major tasks associated with the completion of the storm water detention pond and ditches include the following:

- Site clearing and grubbing
- Excavation of 7-acre area to a depth of four feet below ground surface (bgs)
- Construction of berms using 25,000 cubic yards (cy) of clean onsite fill
- Grading of existing onsite conveyance ditches to improve flow
- Backfilling the conveyance ditches to the south and east of the pond and grading to direct surficial flows into new drop inlets
- Installation of detention pond inlet structure, piping and flap valve
- Installation of detention pond outlet structures, piping and gate valve
- Surveying the detention pond excavation and inlet channels
- Backfilling, potential tree replanting, and site restoration on the 3 off-site parcels
- Lining of the newly constructed detention pond and the City of Camilla open storm water release conveyance ditch with 36 mil LLDPE liner
- Installation of new permanent fencing to secure the Site

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3.0 Post-Construction Care

In accordance with the GAEPD regulations, post-construction care will begin immediately upon completion of the storm water detention pond and site drainage facilities and the authorization of a Closure Certificate, and then continue for a period of at least 30 years. Post-construction care will be conducted in accordance with EPA and GAEPD regulations by the Owner.

3.1 POST-CONSTRUCTION CARE REQUIREMENTS

The Owner will comply with post-construction requirements, including maintenance and monitoring throughout the post-construction care period. The Owner will:

- Maintain the integrity of the liner/berms, including making repairs, as necessary, to correct penetrations, subsidence, erosion, or other events.
- Maintain the condition of storm water features and appurtenances, ensuring that conveyance ditches are clear and blockages are removed.
- Ensure that the following institutional controls are enforced.
  - Restrictive convenant to limit future land use to nonresidential uses only;
  - Prohibit potable groundwater use on the property;
  - Prohibit soil removal or excavation that penetrates the liner system within the boundary of the capped area; and

Other considerations that should be taken into account include:

- Adequate access must be provided for inspection, maintenance, and landscaping upkeep, including appropriate equipment and vehicles.
- It is highly recommended that the storm water detention pond and conveyance ditches be inspected annually during winter freeze periods to look for signs of improper operation.
- It is highly recommended that sediment removal in the storm water detention pond and conveyance ditches occur every 2 to 7 years or after 50 percent of total detention pond or conveyance ditches capacity has been lost. Sediment removal should be accomplished by utilizing hand tools only, no heavy machinery. Hand tools should be plastic, fiberglass, or other non-metal material to prevent accidental cutting of the liner.
- Sediments excavated from storm water detention pond and/or conveyance ditches can be safely disposed by either land application or land filling. Periodic mowing of the storm water detention pond and conveyance ditches' buffer area is highly recommended. This includes all areas surrounding the detention pond and conveyance ditches. Care must be taken when trimming along the liner key trench so as not to cut the liner material.
- Care should be exercised while draining the detention pond to prevent rapid release and minimize the discharge of sediments.
- Regular inspections must be made to ensure there are no burrowing animals present along the berms of the detention pond or conveyance ditches in order to prevent compromise of the liner system.

- Regular inspections must be made to ensure there are no roots penetrating the detention pond or conveyance ditch berms in order to prevent compromise of the liner systems. This may require periodic spot removal of sediments in order to prevent vegetation from taking root.
- Regular inspections of the fence system should be made to ensure minimizing trespass by people and animals.
- Additionally, routine inspections should be made to identify damage to the liner systems and if necessary to schedule a qualified LLDPE liner installation company to make any necessary repairs.

3.2 CERTIFICATION OF THE COMPLETION OF THE POST-CONSTRUCTION CARE PERIOD

Post-construction care documentation is important for the termination of the post-construction care period. Post-construction certification will be required in the future to verify that the proposed care activities were conducted in accordance with the EPA-approved plan. An independent engineer is not expected to verify that every activity was conducted over the 30-year post-construction care period for certification purposes; however, a visual inspection of site conditions and a review of all internal documentation will be conducted to evaluate whether the post-construction care activities were performed adequately.

Therefore, at a minimum, the owner will be required to maintain copies of all inspection reports prepared by the EPA or other independent parties, City conducted field reports documenting inspections and completed maintenance, so that appropriate documentation will be available to certify that post-construction care has been completed.

4.0 Site Monitoring, Inspection, and Maintenance

This section addresses post-construction monitoring, inspection, and maintenance procedures for the Site. Post-construction care, as addressed in this manual, includes considerations for monitoring of erosion and sedimentation, storm water facilities maintenance, inspections, mowing, and other types of maintenance after construction completion. This post-construction manual specifies reasonable monitoring and maintenance activities for the Site facilities. Since it is difficult to predict, with certainty, the activities required over the entire operation period, this plan proposes a range of alternatives to minimize future O&M plan modifications.

4.1 MONITORING, INSPECTION AND MAINTENANCE REQUIREMENTS

After construction, the owner will comply with post-construction care requirements, including inspection, maintenance, and monitoring. Throughout the post-construction period, the owner will continue to monitor the effectiveness of the remedial measures throughout the life of the remedy. Monitoring, inspection, and maintenance requirements for the post-construction period include:

- Maintaining the integrity of the storm water detention pond system, including making necessary repairs to the liner and soil cover components, to correct the effects of erosion or other events.
- Preventing run-on and runoff from eroding or otherwise damaging the constructed berms.
- Ensuring the engineering and institutional controls are being enforced.

4.1.1 Inspections

Inspections should be performed on a regular basis (e.g. monthly or quarterly) and scheduled based on the stormwater control type and characteristics. In addition, inspections should occur after (and even during) major rainfall events of those components most critical to the effective facility operation (inlet structures and channels, outlet structure, pond perimeter).

Not all inspections can be conducted by direct human observation. For subsurface piping systems video equipment may be required. The inspection process should document observations made in the field. Comments should be archived on structural conditions, hydraulic operational conditions, evidence of vandalism, condition of vegetation, occurrence of obstructions, unsafe conditions, and build-up of trash, sediments and pollutants.

4.1.2 Maintenance Scheduling and Performance

Maintenance activities can be divided into two types: scheduled and corrective. Scheduled maintenance tasks are those that are typically accomplished on a regular basis such as monthly or quarterly. These items consist of such things as vegetation maintenance (such as grass mowing) and trash and debris removal from ditches and the pond. These tasks are required at well-defined time intervals.

Corrective tasks consist of items such as sediment removal, bank stabilization, and outlet structure repairs that are done on an as-needed basis. These tasks are typically scheduled based on inspection results. Corrective maintenance sometimes calls for more specialized expertise and equipment than for scheduled tasks.

4.2 INSPECTION ITEMS, FREQUENCY, AND ROUTINE MAINTENANCE

Inspections and maintenance will be conducted as specified in this O&M Manual. Small problems that can easily worsen to more significant problems should be addressed and repaired in a timely manner. The following items will require periodic inspection and maintenance:

- Storm water detention pond and inlet channel liners.
- Storm water structures and appurtenances.
- Site security facilities.
- Vegetative cover.

Table 4-1 presents a checklist of many of the potential problems typically associated with each of the above listed items and associated schedule of inspection. The inspection schedule is approximate. Note that all inspections may not result in written documentation unless deficiencies are found.

Table 4-2 presents a checklist of several types of maintenance items typically required for each of the above items and a schedule for routine maintenance. The schedule for routine maintenance is approximate and may be revised, based on operator experience, to an as needed basis.

4.3 INSPECTION REPORTING

An inspection log with explanations of observations made will document each inspection and become part of the operating records for the RA at the Camilla Wood Preserving Site. Inspection logs will be in a checklist/fill-in-the blank-format. All inspection reports will include the date, time, and location of inspected item, weather conditions, and name of the individual conducting the inspection. An example of a typical inspection log is provided in Table 4-3. The log is formatted to ensure a specific itinerary is followed and that all pertinent item/component identified is inspected. The log also includes a checklist of typical problems associated with each item/component to be inspected. A blank space is provided to record observations and comments/suggested corrective action. The inspection logs will be supplemented, as necessary, with written reports documenting failures/problems and mitigating actions taken.

The inspection logs will be completed for each of the specific areas or equipment listed in the inspection schedule and will be maintained in a permanent binder. Separate written reports documenting maintenance activities and RAs shall be recorded together with these logs. These inspection and maintenance logs are critical in providing a post-construction case history for the Camilla Storm Water Detention Pond project.

Preventive, non-emergency maintenance shall be completed as soon as practical to preclude further damage and minimize the need for emergency corrective action. If a hazard is determined to be imminent or has already occurred during the course of the inspection or any time between inspections, corrective actions shall be implemented immediately with notification to the appropriate authorities. An example of a typical preventive maintenance log is provided in Table 4-2.

A discussion of specific inspection and maintenance objectives for each item addressed in Tables 4-1 through 4-3 is presented in the following paragraphs.

4.4 SPECIFIC INSPECTION AND MAINTENANCE OBJECTIVES

4.4.1 Storm Water Detention Pond

Inspection of the pond will include a weekly "windshield survey" and a quarterly site walkover with a specific itinerary of observations to be made. Specific ground surface observations to be documented include:

- Exposed/damaged liner
- Vegetation deterioration
- Berm erosion
- Animal burrows/mounds
- Condition of rip rap on pond berms

Locations where deficiencies are observed should be recorded by a field sketch on the half-scale As-Built Drawings (Appendix A) with reference (distance) to easily recoverable site features. Permanent site features may be used for horizontal control in documenting minor suspect areas, however a field survey is recommended to document any areas where significant settlement or deficiencies have been observed.

Routine maintenance of grassed areas may include annual reseeding, as necessary, for those areas of sparse or stressed vegetation. As a minimum, the grass should be mowed down to 4 or 5 inches to promote growth of shallow rooted grass and to kill seedlet trees, shrubs, weeds or other pioneer species. Bare, sparsely covered and drought-damaged areas shall be reseeded no later than early September as the soil moisture content returns to normal levels. Soil testing, including hydrogen ion concentration (pH) measurements, may be performed every 3 years to determine fertilizer and lime requirements, if any. All required soil amendment additions will be completed before September 15 in a given year.

Routine maintenance activities related to the items identified above may include:

- Filling ruts and gullies in eroded berms/ conveyance ditches and re-grading fill and topsoil to match surrounding condition.
- Filling and grading areas of subsidence with fill material and topsoil to match existing surface grading.
- Removal of accumulated vegetation and debris from storm water conveyance ditches and appurtenances.
- Repair or replacement of fencing.
- Replacement of washed out or missing rip rap

Localized subsidence or surface depressions (visual or evidenced by the presence of ponded water following a rain event) will require backfilling and re-grading to reestablish final grading and to ensure proper drainage, as discussed below.

4.4.2 Storm Water Conveyance Ditches and Drainage Structures

The storm water runoff from the upstream area drains to the storm water detention pond. The surface water drainage is anticipated to remain unchanged as the site is developed for future recreational use.

Maintenance of the stormwater system is necessary to assure that local runoff is collected efficiently by the storm water conveyance ditches. The ditches and swales must be inspected at least monthly and after each major storm event. Silt and plant growth should be periodically cleared from all conveyance ditches to remove any obstruction to flow. If erosion occurs on the side slopes or berms, they should be repaired and reconstructed to their original constructed configuration.

The drainage pipes, inlets, flap valve, and headwalls must be inspected at least quarterly and after each major storm event. Maintenance of these storm water structures is very important to the proper functionality of the storm water detention pond. It is possible that over time the drain pipes and inlets will become obstructed by siltation, root growth, and/or debris. Such obstructions must be cleared so that the drainage structures are free flowing.

Fabriform at the upstream end of the lined storm water channel must be inspected for cracking, joint failures, spalling, or undermining. In addition, the drain outfall shall be inspected to verify that it is clear of obstructions and that an appropriate flow of water is being discharged.

4.4.3 Site Security

The integrity of all fencing should be inspected at least monthly during the post-construction monitoring period.

5.0 References

Black & Veatch. 2011. Black & Veatch Special Projects Corp., *100% Remedial Design Basis of Design Report for the Camilla Wood Preserving Site.* March 2011

Black & Veatch, 2015. Black & Veatch Special Projects Corp., *Remedial Action Report.* July 31, 2015.

EPA, 2009. U.S. Environmental Protection Agency, *Camilla Wood Preserving Site Record of Decision*. September, 2009.

AMEC. 2001. AMEC Earth and Environmental Center for Watershed Protection. *Georgia Stormwater Management Manual Volume 1 (Stormwater Policy Guidebook)*, August 2001.

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Tables

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Table 4-1
Operations and Maintenance Plan
Schedule for Inspections
Camilla Wood Preserving Site
Camilla, Mitchell County, Georgia

Specific Item	Typical Problems	Minimum Suggested Frequency							Notes [1]
		Monthly	Quarterly	Semi-annually	Annually	After Major Storms	Visual	Checklist / Written Report	
Stormwater Pond/Berms	Erosion	■				■	■	■	Written report will be made if problems are observed/ encountered.
	Vegetation stress	■				■	■	■	
	Settling/Ponding of Water	■				■	■	■	
	Washouts	■				■	■	■	
	Animal Burrows	■					■	■	
	Scouring	■				■	■	■	
Stormwater Channels/Structures	Erosion		■			■	■	■	Written report will be made if problems are observed/ encountered.
	Liner		■			■	■	■	
	Blockages		■			■		■	
	Fabriform	■				■	■	■	
Site Security [2]	Trespassing / Vandalism	■					■	■	Written report will be made if problems are observed/ encountered.

Notes:

1. Complete inspection log check list on a quarterly basis, unless problems are discovered more frequently. Table is for the first two years. Activities and frequencies are subject to change basd on periodic reevaluation of necessary site O&M activities.
2. Security can be enforced more frequently if required. Site security can be performed on an as needed basis.

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Table 4-2
Operations and Maintenance Plan
Schedule for Preventative (Routine) Maintenance
Camilla Wood Preserving Site
Camilla, Mitchell County, Georgia

Specific Item	Typical Maintenance	Minimum Suggested Frequency									Notes
		As needed [1]	Weekly	Monthly	Quarterly	Semi-annually	Annually	After Major Storms	Visual	File Report [2]	
Stormwater Pond/Berms	Mowing [1]	■							■		Frequency depends on visual observation/as-needed basis. Soil Testing to determine fertilizer and lime requirements may be taken at 3-year intervals, if applicable.
	Reseeding [1]	■					■				
	Fertilizing [1]	■					■				
	Dressing Slopes/ Regrading [1]	■						■	■	■	
	Blockages [1]			■				■	■	■	
Stormwater Channels/Structures	Blockages/Siltation [1]			■				■	■	■	
	Erosion			■				■	■	■	
	Fabriform	■								■	
Site Security	Inspect Fencing			■					■		

Notes:
1. Only required based on visual observation. This table is for the first two years, and subject to change based on periodic reevaluation.
2. File report at completion of maintenance activity.

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Table 4-3
Operations and Maintenance Plan
Operations and Maintenance Inspection Report
Camilla Wood Preserving Site
Camilla, Mitchell County, Georgia

Date:		Time:				Sheet:	1	of:	1
Inspector:									
Weather:							Report No.:		

ITEMS TO INSPECT	TYPICAL PROBLEMS ENCOUNTERED	CONDITIONS OBSERVED		
		Sat	Unsat	N/A
AS NEEDED				
Stormwater Pond/Berms	Erosion			
	High Vegetative Growth			
	Sparse Vegetation			
	Vegetation stress			
	Blockages			
	Settling / Ponding of Water			
	Uplift			
	Washouts			
	Mounds			
	Animal Burrows			
	Scouring			
Stormwater Channels/Structures	Erosion			
	Liner			
	Blockages			
MONTHLY				
Stormwater Ponds/Berms	Blockages			
Stormwater Channels/Structures	Erosion			
	Blockages/Siltation			
	Undermining of Fabriform			
Site Security	Trespassing / Vandalism			
AFTER MAJOR STORM				
Stormwater Pond/Berms	Erosion			
	Vegetation stress			
	Settling / Ponding of Water			
	Washouts			
	Scouring			
Stormwater Channels/Structures	Erosion			
	Liner			
	Blockages/Siltation			
	Undermining of Fabriform			

Notes:

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Appendix A. Figures and As-Built Surveys from RA Report, Rev 1

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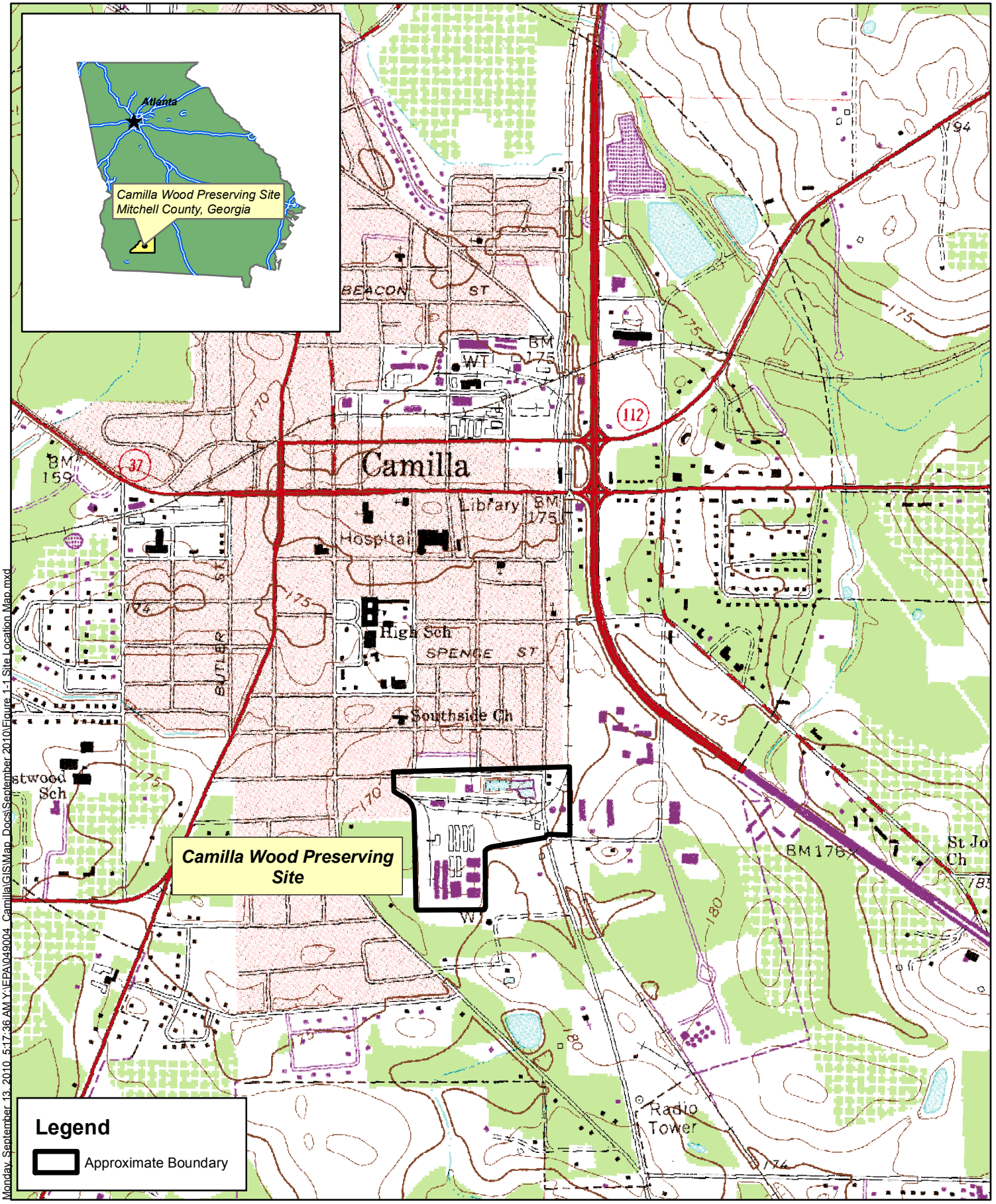
Atlanta
Camilla Wood Preserving Site
Mitchell County, Georgia
Camilla
Camilla Wood Preserving Site
Legend
Approximate Boundary
N
0
0.125
0.25
0.5
Miles
NAD83 State Plane GA West, Feet
Site Location Map
Camilla Wood Preserving Site
Mitchell County, Gerogia
Figure
1-1
Monday, September 13, 2010 5:17:36 AM Y:\EPA\049004_Camilla\GIS\Map_Docs\September 2010\Figure 1-1 Site Location Map.mxd

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Legend

Monitoring Well (by depth)

- Shallow
- Intermediate
- PHASE 1 - Excavated Soils
- PHASE 1 - Stormwater Detention Pond
- PHASE 2 - Barrier Wall
- PHASE 4 - ISCO Intermediate Treatment Area
- Site Boundary
- Railroad

N

0 250 500

Feet

NAD83 State Plane Georgia West, Feet

Remedial Elements Installed
Camilla Wood Preserving Site
Camilla, Mitchell County, Georgia

Figure 4-1

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N

0 100 200

Feet

NAD83 State Plane Georgia West, Feet

As-Built Barrier Wall Alignment
Camilla Wood Preserving Site
Camilla, Mitchell County, Georgia

Figure 4-8

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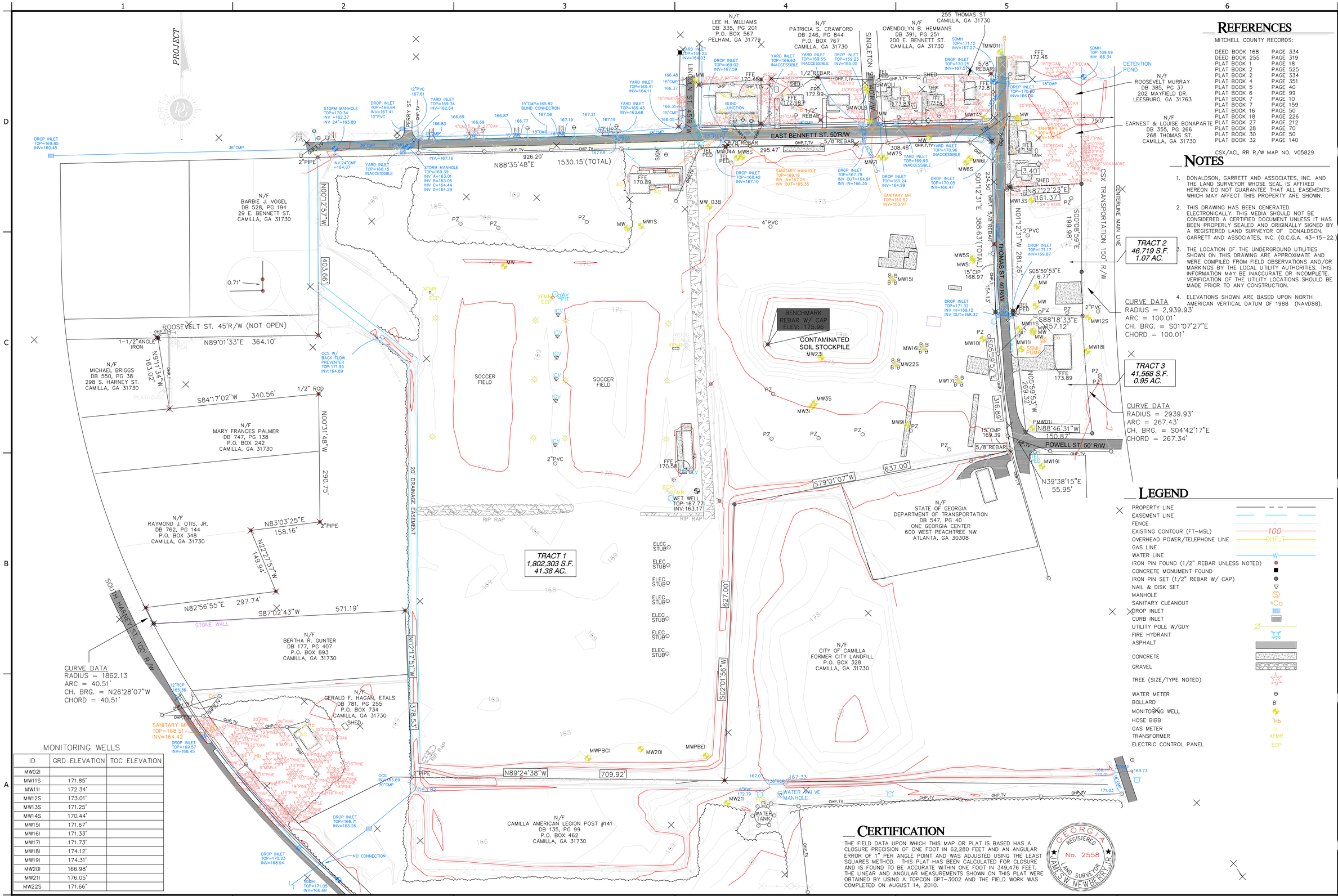

REFERENCES

MITCHELL COUNTY RECORDS:

DEED BOOK 168	PAGE 334
DEED BOOK 255	PAGE 319
PLAT BOOK 1	PAGE 18
PLAT BOOK 2	PAGE 525
PLAT BOOK 2	PAGE 334
PLAT BOOK 4	PAGE 351
PLAT BOOK 5	PAGE 40
PLAT BOOK 6	PAGE 99
PLAT BOOK 7	PAGE 10
PLAT BOOK 7	PAGE 159
PLAT BOOK 16	PAGE 50
PLAT BOOK 18	PAGE 226
PLAT BOOK 27	PAGE 212
PLAT BOOK 28	PAGE 70
PLAT BOOK 30	PAGE 50
PLAT BOOK 32	PAGE 140

CSX/ACL RR R/W MAP NO. V05829

NOTES

1. DONALDSON, GARRETT AND ASSOCIATES, INC. AND THE LAND SURVEYOR WHOSE SEAL IS AFFIXED HEREON DO NOT GUARANTEE THAT ALL EASEMENTS WHICH MAY AFFECT THIS PROPERTY ARE SHOWN.
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3. THE LOCATION OF THE UNDERGROUND UTILITIES SHOWN ON THIS DRAWING ARE APPROXIMATE AND WERE COMPILED FROM FIELD OBSERVATIONS AND/OR MARKINGS BY THE LOCAL UTILITY AUTHORITIES. THIS INFORMATION MAY BE INACCURATE OR INCOMPLETE. VERIFICATION OF THE UTILITY LOCATIONS SHOULD BE MADE PRIOR TO ANY CONSTRUCTION.
4. ELEVATIONS SHOWN ARE BASED UPON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

MONITORING WELLS

ID	GRD ELEVATION	TOC ELEVATION
MW02I		
MW11S	171.85'	
MW11I	172.34'	
MW12S	173.01'	
MW13S	171.25'	
MW14S	170.44'	
MW15I	171.67'	
MW16I	171.33'	
MW17I	171.73'	
MW18I	174.12'	
MW19I	174.31'	
MW20I	166.98'	
MW21I	176.05'	
MW22S	171.66'	

LEGEND

- PROPERTY LINE
- EASEMENT LINE
- FENCE
- EXISTING CONTOUR (FT-MSL) — 100
- OVERHEAD POWER/TELEPHONE LINE — OHP,T
- GAS LINE
- WATER LINE — W
- IRON PIN FOUND (1/2" REBAR UNLESS NOTED)
- CONCRETE MONUMENT FOUND
- IRON PIN SET (1/2" REBAR W/ CAP)
- NAIL & DISK SET
- MANHOLE
- SANITARY CLEANOUT — Co
- DROP INLET
- CURB INLET
- UTILITY POLE W/GUY
- FIRE HYDRANT
- ASPHALT
- CONCRETE
- GRAVEL
- TREE (SIZE/TYPE NOTED)
- WATER METER
- BOLLARD — B
- MONITORING WELL
- HOSE BIBB — Hb
- GAS METER
- TRANSFORMER — XFMR
- ELECTRIC CONTROL PANEL — ECP

CERTIFICATION

THE FIELD DATA UPON WHICH THIS MAP OR PLAT IS BASED HAS A CLOSURE PRECISION OF ONE FOOT IN 62,280 FEET AND AN ANGULAR ERROR OF 1" PER ANGLE POINT AND WAS ADJUSTED USING THE LEAST SQUARES METHOD. THIS PLAT HAS BEEN CALCULATED FOR CLOSURE AND IS FOUND TO BE ACCURATE WITHIN ONE FOOT IN 349,476 FEET. THE LINEAR AND ANGULAR MEASUREMENTS SHOWN ON THIS PLAT WERE OBTAINED BY USING A TOPCON GPT-3002 AND THE FIELD WORK WAS COMPLETED ON AUGUST 14, 2010.

GEORGIA REGISTERED No. 2558 LAND SURVEYOR JAMES W. NEWBERRY JR.

BLACK & VEATCH
Special Projects Corp.
1120 SANCTUARY PARKWAY SUITE 200
ALPHARETTA, GEORGIA 30009
PHONE: (770) 751-8800 FAX: (770) 751-8822
WEBSITE: WWW.BV.COM

Rev.	Description	Date	Apr.

Drawn by: JH | Check by:
Project #: 49682 | Design by: JH | Review by:
Date: AUG 2010
SCALE: 1" = 100'

CAMILLA WOOD PRESERVING SITE

CAMILLA, MITCHELL COUNTY, GA

EXISTING SITE SURVEY

DRAWING NO.
C-03

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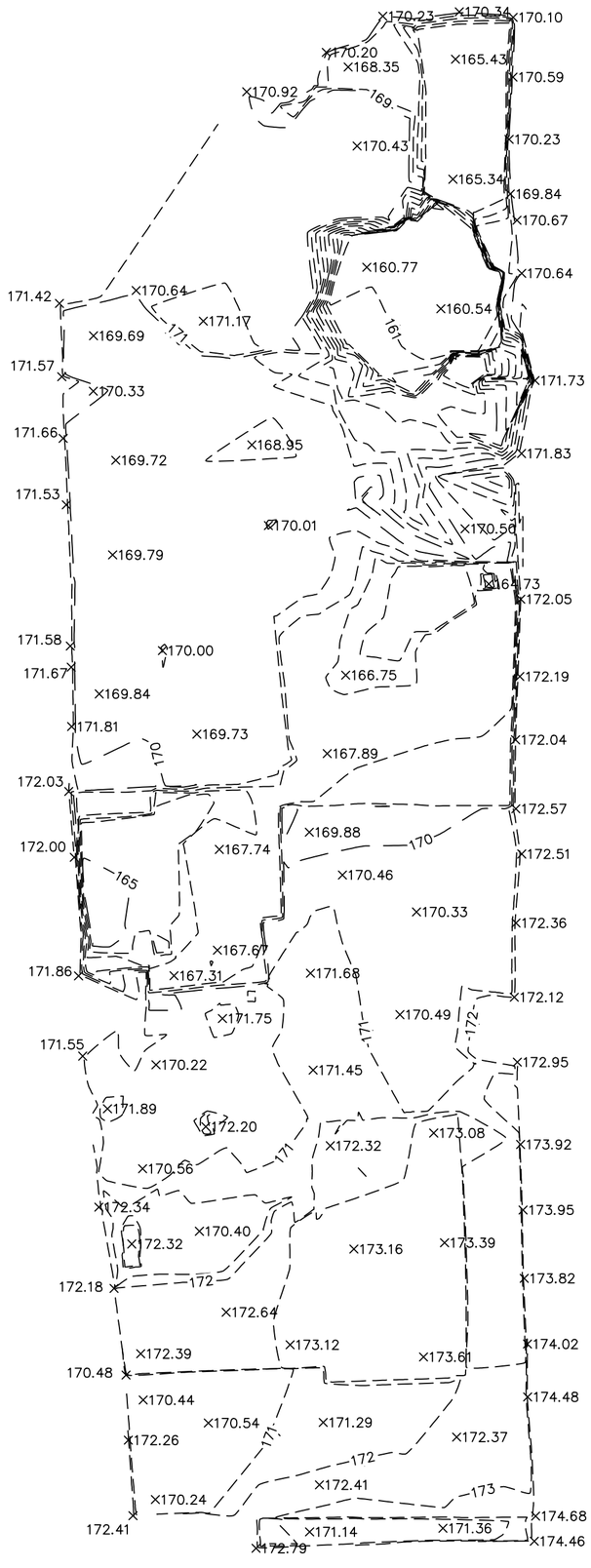

LEGEND

CONTOUR LINE — — — —453— — — —

SPOT ELEVATION ⊕ *386.29*

NOTES

1. THIS DRAWING HAS BEEN GENERATED ELECTRONICALLY. THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT UNLESS IT HAS BEEN PROPERLY SEALED AND ORIGINALLY SIGNED BY A REGISTERED LAND SURVEYOR OF DONALDSON, GARRETT AND ASSOCIATES, INC. AUTHORITY OF O.C.G.A. 43–15–22.
2. ONE FOOT CONTOUR INTERVAL SHOWN.
3. ELEVATIONS SHOWN ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM, NAVD 88, BASED ON EXISTING SITE BENCHMARKS ESTABLISHED BY GPS OBSERVATION UTILIZING THE LEICA SMARTNET GEORGIA REFERENCE NETWORK.

40 0 40 80 120

GRAPHIC SCALE IN FEET

GEORGIA REGISTERED No. 2558 JAMES W. NEWBERRY, JR. LAND SURVEYOR

EXCAVATION SURVEY

CAMILLA WOOD PRESERVING SITE
EXCAVATION AREA 2

Prepared For

GARRETT CONSULTING, INC.

CITY OF CAMILLA MITCHELL COUNTY GEORGIA

REVISED: 09/18/12 – ADDITIONAL EXCAVATION	R.L.S. NO. 2558	SCALE: 1" = 40'
	DATE: JULY 20, 2012	
	CHKD: JWN	C&G: N/A
	DRWN: GREG DAVIS	DRAWING NO. 4944–12–C
	PROJ. NO.: 2608–001–D1	FIELD BOOK: DC

DONALDSON, GARRETT, & ASSOCIATES, INC.
MACON • CHARLOTTE
4875 RIVERSIDE DRIVE P.O. BOX 7306
MACON, GA 31210
(478)474–5350 Fax: (478) 477–2534
http://www.dg–a.com

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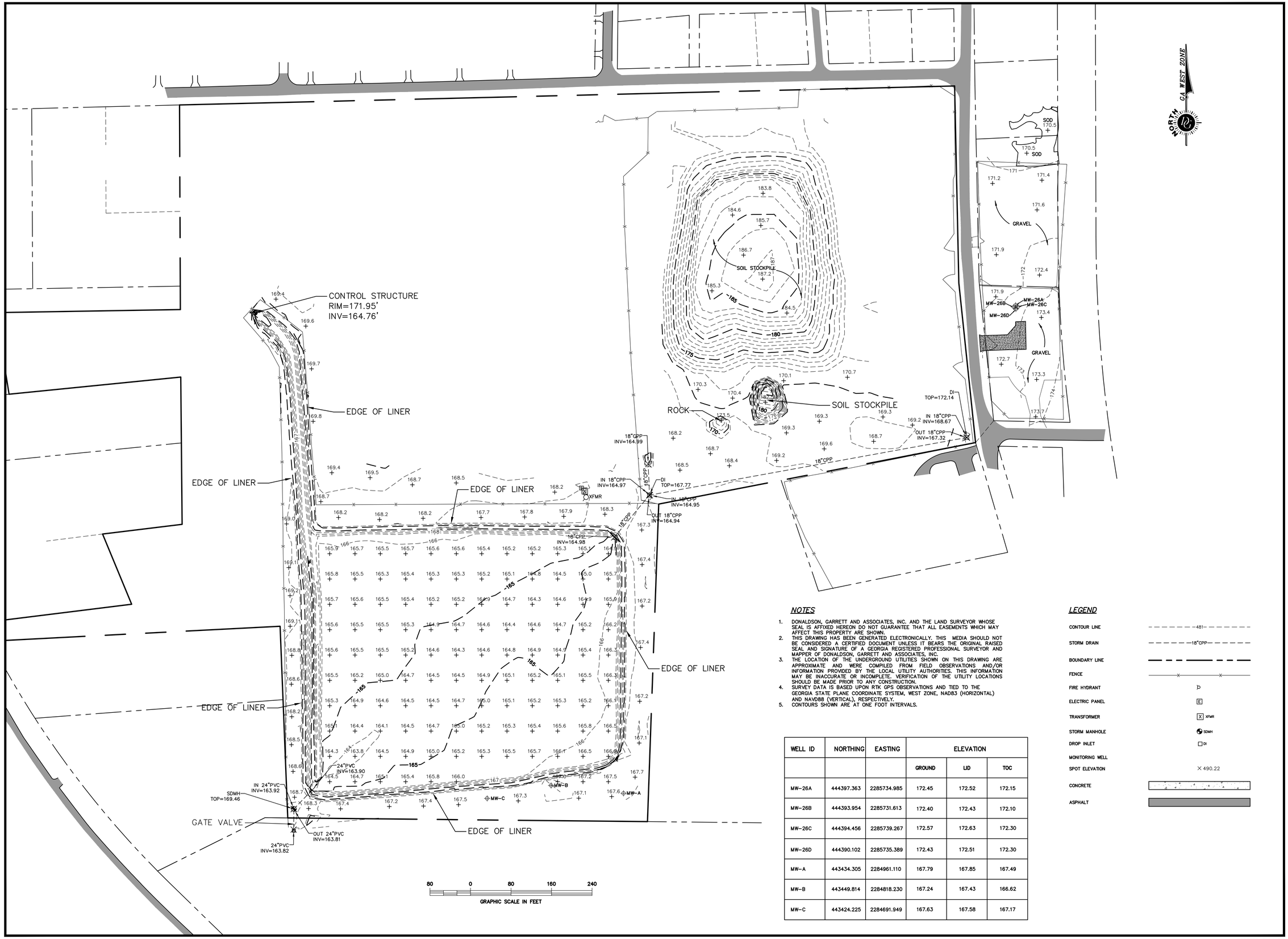

NOTES

1. DONALDSON, GARRETT AND ASSOCIATES, INC. AND THE LAND SURVEYOR WHOSE SEAL IS AFFIXED HEREON DO NOT GUARANTEE THAT ALL EASEMENTS WHICH MAY AFFECT THIS PROPERTY ARE SHOWN.
2. THIS DRAWING HAS BEEN GENERATED ELECTRONICALLY. THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT UNLESS IT BEARS THE ORIGINAL RAISED SEAL AND SIGNATURE OF A GEORGIA REGISTERED PROFESSIONAL SURVEYOR AND MAPPER OF DONALDSON, GARRETT AND ASSOCIATES, INC.
3. THE LOCATION OF THE UNDERGROUND UTILITIES SHOWN ON THIS DRAWING ARE APPROXIMATE AND WERE COMPILED FROM FIELD OBSERVATIONS AND/OR INFORMATION PROVIDED BY THE LOCAL UTILITY AUTHORITIES. THIS INFORMATION MAY BE INACCURATE OR INCOMPLETE. VERIFICATION OF THE UTILITY LOCATIONS SHOULD BE MADE PRIOR TO ANY CONSTRUCTION.
4. SURVEY DATA IS BASED UPON RTK GPS OBSERVATIONS AND TIED TO THE GEORGIA STATE PLANE COORDINATE SYSTEM, WEST ZONE, NAD83 (HORIZONTAL) AND NAVD88 (VERTICAL), RESPECTIVELY.
5. CONTOURS SHOWN ARE AT ONE FOOT INTERVALS.

WELL ID	NORTHING	EASTING	ELEVATION		
			GROUND	LID	TOC
MW-26A	444397.363	2285734.985	172.45	172.52	172.15
MW-26B	444393.954	2285731.613	172.40	172.43	172.10
MW-26C	444394.456	2285739.267	172.57	172.63	172.30
MW-26D	444390.102	2285735.389	172.43	172.51	172.30
MW-A	443434.305	2284961.110	167.79	167.85	167.49
MW-B	443449.814	2284818.230	167.24	167.43	166.62
MW-C	443424.225	2284691.949	167.63	167.58	167.17

LEGEND

- CONTOUR LINE — 481
- STORM DRAIN — 18"CPP
- BOUNDARY LINE
- FENCE
- FIRE HYDRANT
- ELECTRIC PANEL — E
- TRANSFORMER — X XFMR
- STORM MANHOLE — SDMH
- DROP INLET — DI
- MONITORING WELL
- SPOT ELEVATION — × 490.22
- CONCRETE
- ASPHALT

DONALDSON, GARRETT, & ASSOCIATES, INC.
MACON • CHARLOTTE
4875 RIVERSIDE DRIVE P.O. BOX 7306
MACON, GA 31210-7306
(478)474-5350 Fax (478) 477-2534
http://www.dg-a.com

TOPOGRAPHIC SURVEY
FOR
GARRETT CONSULTING, INC.
OF
CAMILLA WOOD PRESERVING SITE
MITCHELL COUNTY GEORGIA
CAMILLA

REVISIONS	DATE

SCALE:
HORIZONTAL: 1" = 80'
VERTICAL: N/A

DATE:	11/5/2012
DRAWING #:	3173-12-D
PROJ. #:	2608-001-D1
DSGN:	
DRWN:	BS
CHKD:	JWN
APVD:	JWN
RLS No:	2558

SHEET 1 OF 1

F605TPS-FINAL.DWG/5 PLOT DATE: 12/11/2012 BY: jay

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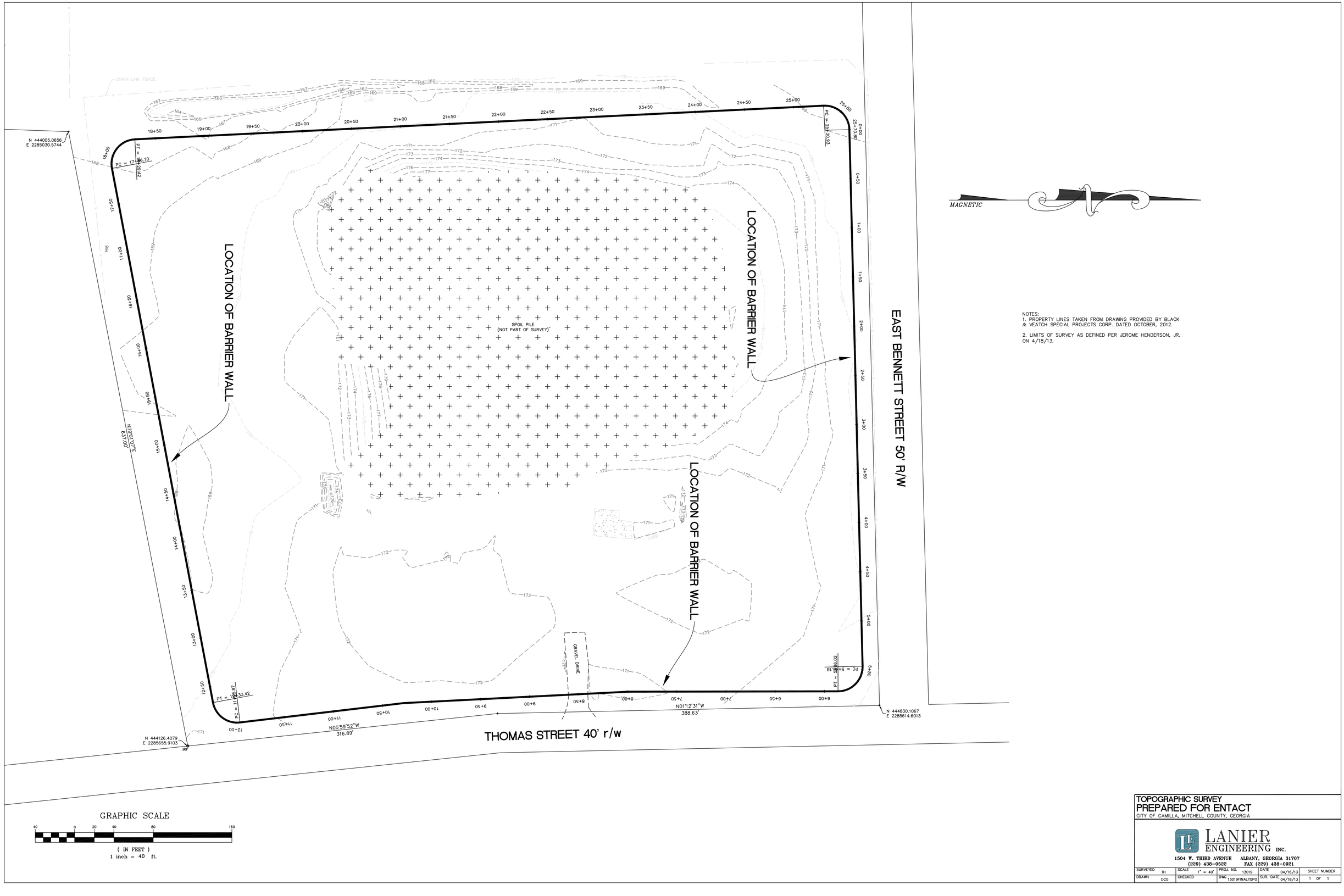

NOTES:
1. PROPERTY LINES TAKEN FROM DRAWING PROVIDED BY BLACK & VEATCH SPECIAL PROJECTS CORP. DATED OCTOBER, 2012.

2. LIMITS OF SURVEY AS DEFINED PER JEROME HENDERSON, JR. ON 4/18/13.

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

TOPOGRAPHIC SURVEY
PREPARED FOR ENTACT
CITY OF CAMILLA, MITCHELL COUNTY, GEORGIA

LANIER ENGINEERING INC.
1504 W. THIRD AVENUE ALBANY, GEORGIA 31707
(229) 438-0522 FAX (229) 438-0921

SURVEYED TH	SCALE 1" = 40'	PROJ. NO. 13019	DATE 04/16/13	SHEET NUMBER	
DRAWN DCG	CHECKED	DWG 13019FINALTOPO	SUR. DATE 04/18/13	1 OF 1	

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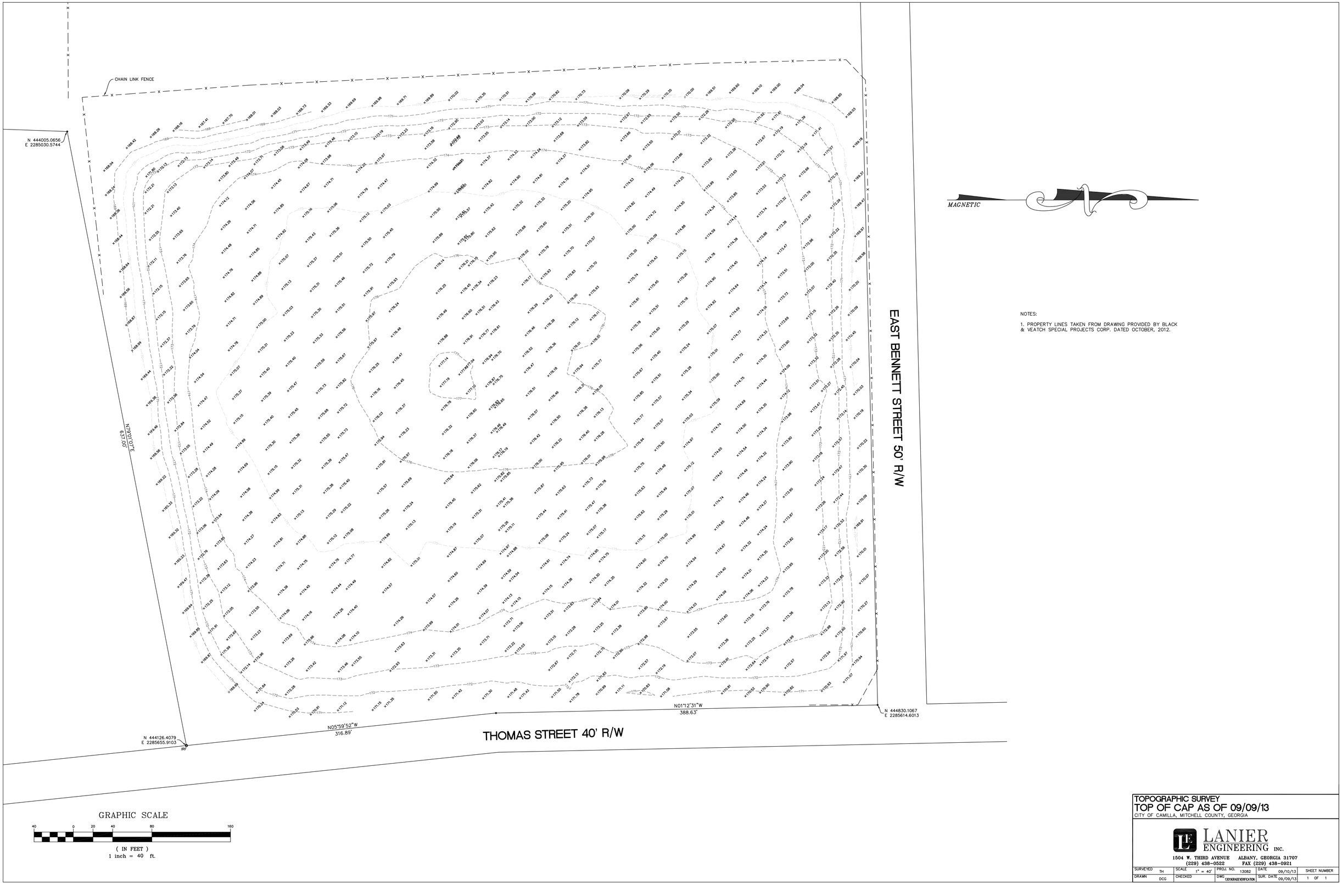

MAGNETIC

NOTES:

1. PROPERTY LINES TAKEN FROM DRAWING PROVIDED BY BLACK & VEATCH SPECIAL PROJECTS CORP. DATED OCTOBER, 2012.

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

TOPOGRAPHIC SURVEY
TOP OF CAP AS OF 09/09/13
CITY OF CAMILLA, MITCHELL COUNTY, GEORGIA

LANIER ENGINEERING INC.
1504 W. THIRD AVENUE ALBANY, GEORGIA 31707
(229) 438-0522 FAX (229) 438-0921

SURVEYED TH	SCALE 1" = 40'	PROJ. NO. 13082	DATE 09/10/13	SHEET NUMBER
DRAWN DCG	CHECKED	DWG 13019GRADEVERIFICATION	SUR. DATE 09/09/13	1 OF 1

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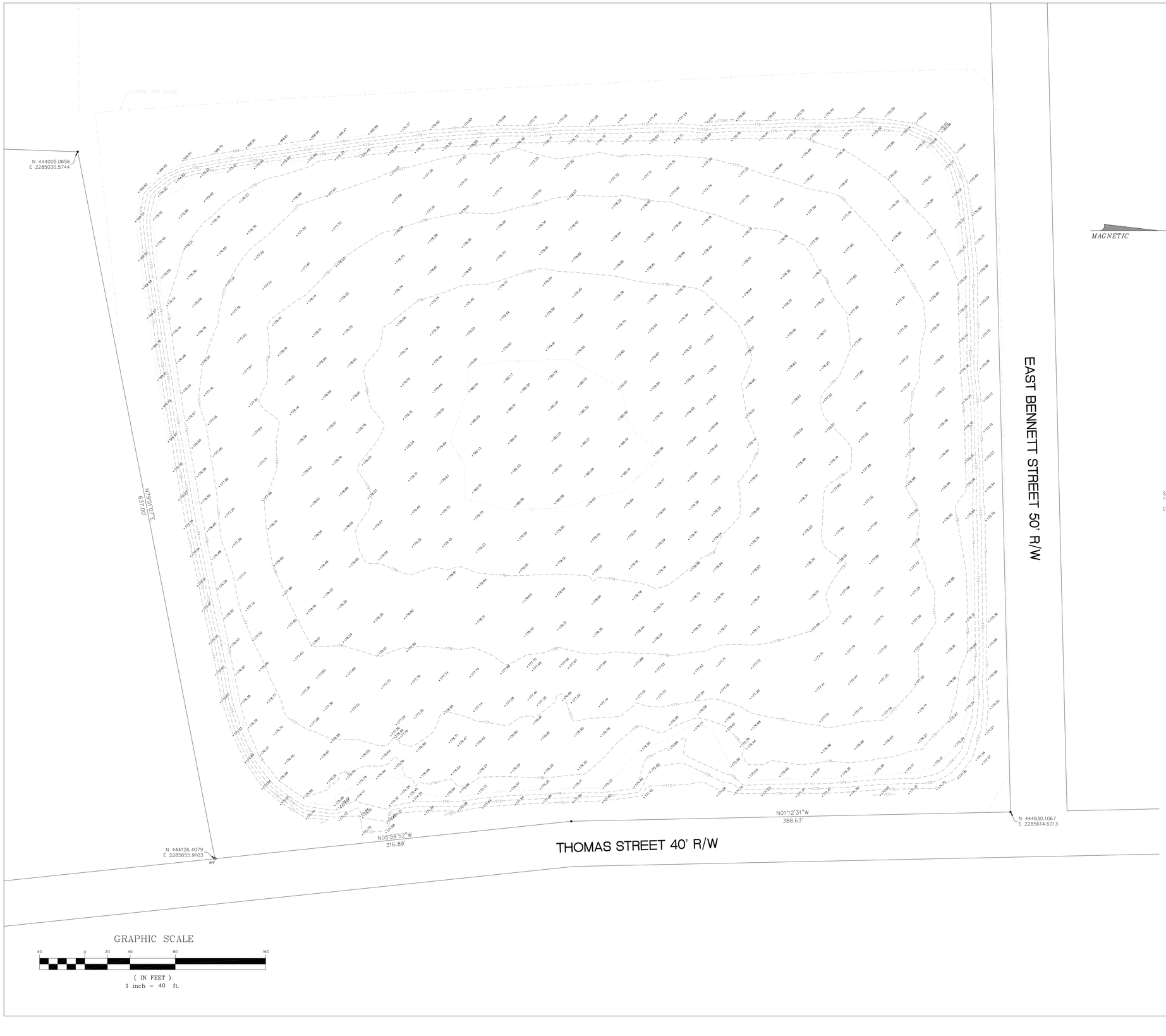

MAGNETIC

NOTES:

1. PROPERTY LINES TAKEN FROM DRAWING PROVIDED BY BLACK & VEATCH SPECIAL PROJECTS CORP. DATED OCTOBER, 2012.

Site Volume Table: Unadjusted

Site	Surf1	Surf2	Cut cuyds	Fill cuyds	Net cuyds	Method
13019 Entact	original site	08-14-13	69	47675	47606 (F)	Grid
	original site	09-09-13	10	56731	56721 (F)	Grid
	original site	11-14-13	0	106025	106025 (F)	Grid
	09-09-13	11-14-13	2	49862	49860 (F)	Grid

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

TOPOGRAPHIC SURVEY
TOPO AS OF 11/14/13
CITY OF CAMILLA, MITCHELL COUNTY, GEORGIA

LANIER ENGINEERING INC.
1504 W. THIRD AVENUE ALBANY, GEORGIA 31707
(229) 438-0522 FAX (229) 438-0921

SURVEYED TH	SCALE 1" = 40'	PROJ. NO. 13082	DATE 11/16/13	SHEET NUMBER
DRAWN DCG	CHECKED	DWG 13019GRADEVERIFICATION	SUR. DATE 11/14/13	1 OF 1

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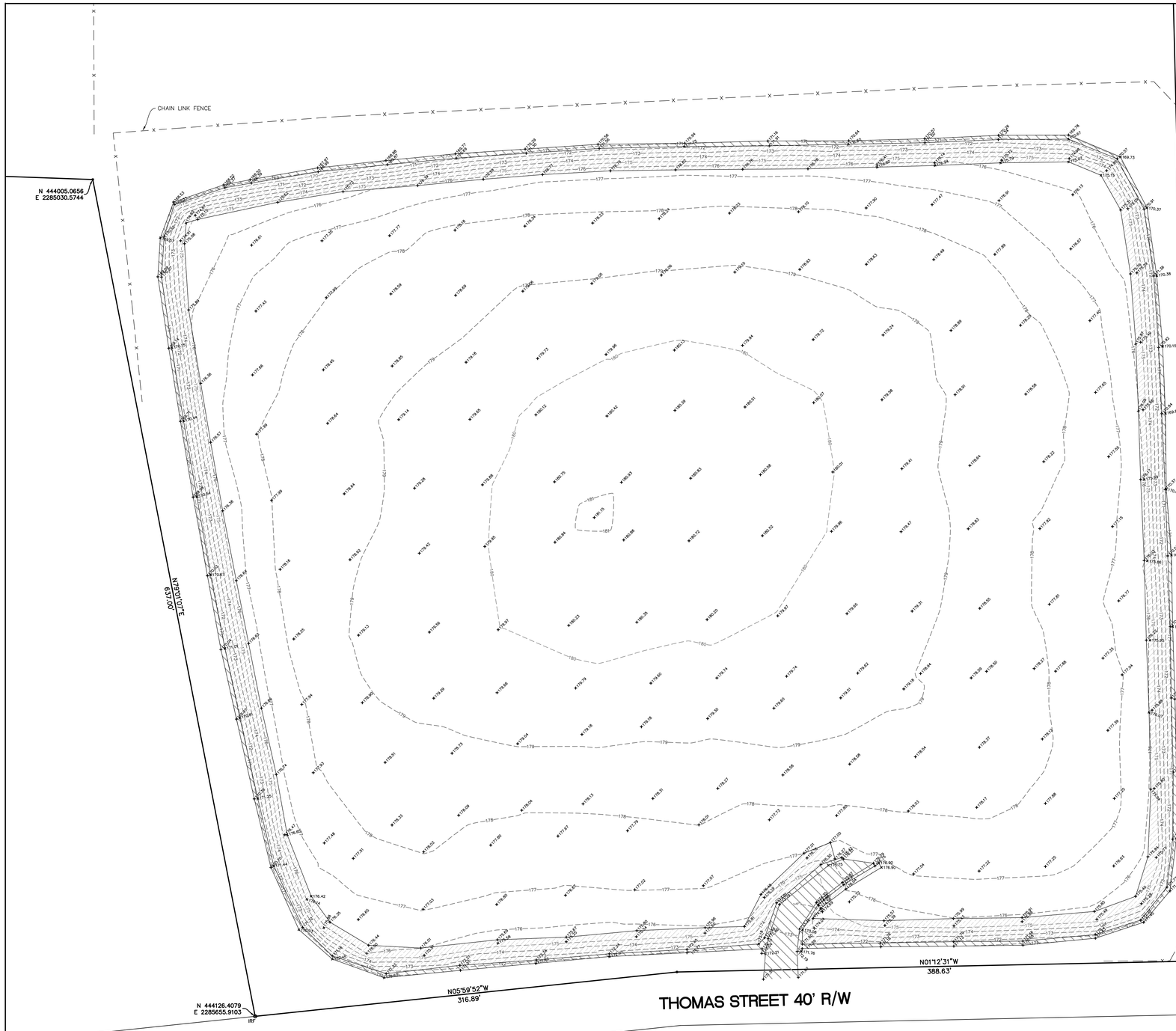

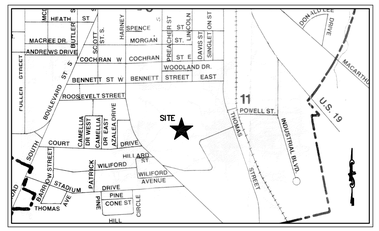

LOCATION MAP

MAGNETIC

NOTES:

1. PROPERTY LINES TAKEN FROM DRAWING PROVIDED BY BLACK & VEATCH SPECIAL PROJECTS CORP. DATED OCTOBER, 2012.

Site Volume Table: Unadjusted

Site	Surf1	Surf2	Cut cuyds	Fill cuyds	Net cuyds	Method
13019 Entact	original site	08-14-13	69	47675	47606 (F)	Grid
	original site	09-09-13	10	56731	56721 (F)	Grid
	original site	11-14-13	0	106025	106025 (F)	Grid
	original site	01-21-14	9	114455	114446 (F)	Grid
	11-14-13	01-21-14	9	8430	8421 (F)	Grid

LEGEND

GRAVEL

SOD

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

TOPOGRAPHIC ASBUILT SURVEY
TOPO AS OF 01/21/14
CITY OF CAMILLA, MITCHELL COUNTY, GEORGIA

LANIER ENGINEERING INC.
1504 W. THIRD AVENUE ALBANY, GEORGIA 31707
(229) 438-0522 FAX (229) 438-0921

SURVEYED	TH	SCALE	1" = 40'	PROJ. NO.	13082	DATE	01/22/14	SHEET NUMBER
DRAWN	DCG	CHECKED		DWG	13019GRADEVERIFICATION	SUR. DATE	01/21/14	1 OF 1

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MAP SHOWING A SPECIFIC PURPOSE SURVEY OF:

A PORTION OF CAMILLA WOOD PRESERVING SITE, MITCHELL COUNTY, GEORGIA

VICINITY MAP
NOT TO SCALE

MONITORING WELL TABULATION

DESCRIPTION	NORTHING	EASTING	TOP OF PIPE ELEVATION (NAVD88)	CONCRETE ELEVATION (NAVD88)	GROUND ELEVATION (NAVD88)
AFMW-01I	444237.666	2286078.691	179.25	179.54	179.47
AFMW-02I	444710.913	2285967.004	175.07	175.60	175.64
AFMW-03I	444532.816	2285959.529	176.58	176.78	176.73
AFMW-05I	444545.826	2285970.749	177.08	177.39	177.32
AFMW-06I	444405.026	2285970.859	178.03	178.40	178.17
CMW-01I	444455.375	2285714.001	174.02		172.15
CMW-01S	444499.593	2285715.509	174.11		172.15
F15-MW	444545.587	2284507.861	169.59	169.75	169.68
ISEB1	444360.209	2285471.822	178.37	178.70	178.70
LMW-1I	444966.786	2284941.675	169.43	169.73	169.77
MASMW-01I	443832.983	2286321.809	179.86	180.24	180.19
MASMW-02I	443816.875	2286075.348	178.67	178.96	178.79
MW-26D	444390.239	2285735.361	172.31	172.54	172.43
EW-01	444439.501	2285764.345	171.85	172.10	172.08
MW-01A	444696.567	2285710.185	173.15	171.81	171.28
MW-01I	444631.566	2284787.053	171.29	168.70	168.90
MW-01S	444636.045	2284817.892	171.38	168.81	168.82
MW-02	444162.715	2285608.833	169.46	169.84	169.92
MW-02I	444367.728	2284920.009	169.55	169.74	169.55
MW-02S	444360.999	2284922.149	169.36	169.70	169.61
MW-03A	444635.883	2285111.980	178.30	178.61	178.62
MW-03I	444226.605	2285207.028	178.87	179.20	179.16
MW-03S	444234.578	2285211.976	179.01	179.27	179.31
MW-04AI	444791.669	2285036.699	169.56	169.93	169.81
MW-04S	444160.997	2285602.486	169.58	170.01	170.13
MW-05I	444557.910	2285571.073	175.07	175.29	175.23
MW-05S	444563.601	2285571.230	175.46	175.69	175.62
MW-06I	444790.728	2285565.459	175.29	175.60	175.62
MW-06S	444780.835	2285556.872	175.73	176.07	175.89
MW-07I	444792.507	2285360.861	176.05	176.34	176.22
MW-07S	444792.803	2285371.384	176.10	176.37	176.21
MW-08S	444794.061	2285047.342	169.86	170.18	170.02
MW-09I	444184.077	2285422.866	178.18	178.52	178.57
MW-11I	444357.450	2285682.046	171.91	172.23	172.25
MW-11S	444403.708	2285676.395	171.44	171.73	171.75
MW-12S	444428.892	2285833.703	172.51	172.94	172.89
MW-13S	444694.709	2285704.174	170.56	171.05	171.14
MW-14S	444881.647	2285597.936	169.74	170.37	170.42
MW-15I	444516.629	2285388.689	179.41	179.81	179.87
MW-16I	444359.002	2285459.478	178.75	179.06	179.20
MW-17I	444284.597	2285539.402	177.56	177.82	177.89
MW-18I	444352.038	2285830.336	173.48	174.04	173.98
MW-19I	444091.878	2285728.168	173.78	174.20	174.21
MW-22A	444323.221	2285395.660	179.79	180.02	180.12
MW-23I	444358.268	2285219.817	180.34	180.64	180.68
MW-26A	444397.562	2285734.952	172.17	172.54	172.40
MW-26B	444394.199	2285731.578	172.11	172.43	172.36
MW-26C	444394.567	2285739.027	172.31	172.66	172.55
MW-30D	444404.005	2285735.767	172.17	172.45	172.34
MW-31I	444471.287	2285791.932	174.90	172.37	172.23
MW-32D	444357.372	2285592.677	175.60	175.96	175.97
MW-33D	444347.898	2285815.972	173.46	173.73	173.70
MW-34D	444275.671	2285818.142	173.93	174.27	174.23
MW-35D	444423.912	2285764.212	172.24	172.54	172.43
MW-36D	444437.988	2285789.666	171.81	172.22	172.13
MW-3B	444680.868	2284973.359	171.28	169.41	169.32
PMW-01I	444178.346	2285706.267	172.58	172.81	172.78
SMW-01I	444874.578	2285337.580	169.12	169.61	169.77
SMW-02I	444950.538	2285329.877	171.37	171.64	171.51
SMW-02S	444943.381	2285330.020	171.20	171.51	171.37
TMW-01I	445031.067	2285633.876	170.72	171.04	

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

SURVEY NOTES:

1. *THE SPECIFIC PURPOSE OF THIS SURVEY IS TO SHOW MONITORING WELL LOCATIONS AS REQUESTED BY THE CLIENT.*
2. *COORDINATES AND BEARINGS ARE BASED THE STATE PLANE COORDINATE SYSTEM FOR THE STATE OF GEORGIA, WEST ZONE, NAD–83.*
3. *ELEVATIONS SHOWN HEREON ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM 88 (NAVD 88).*
4. *MEASUREMENTS AND DIMENSIONS SHOWN HEREON ARE IN FEET AND TENTHS AND HUNDREDTHS OF A FOOT, AND ARE BASED ON THE STANDARD U.S. SURVEY FOOT.*
5. *THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED ABOVE AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS AT THAT TIME.*
6. *STANDARD FIELD CALIBRATIONS FOR EQUIPMENT WERE PERFORMED ON THIS SURVEY AND RESULTS ARE WITHIN MANUFACTURER'S SPECIFICATIONS.*

ARC SURVEYING & MAPPING, INC.

5202 San Juan Ave.
Jacksonville, Florida 32210
Tel. (904)3848377 • Fax (904)3848388
www.arcsurveyors.com
Licensed Business # 6487

No.	Symbol	Date	Description	Approved

File name: 140202.dwg
Reference files:

Party Chief: R.H.
Dwn by: JKM
Drawing Date: 03-07-14
Field Bk/Pg: 13-11
Ckd by: RJS
Survey Date: 03-05-14

Survey Performed for:
BLACK & VEACH
1120 SANCTUARY PARKWAY, SUITE 200
ALPHARETTA, GA 30009

MITCHELL COUNTY, GEORGIA

SPECIFIC PURPOSE TO SHOW MONITOR WELL LOCATIONS AND ELEVATIONS

PROJECT NO.
14–02–02

FILE NO.
C–14–10

SHEET 1 OF 1

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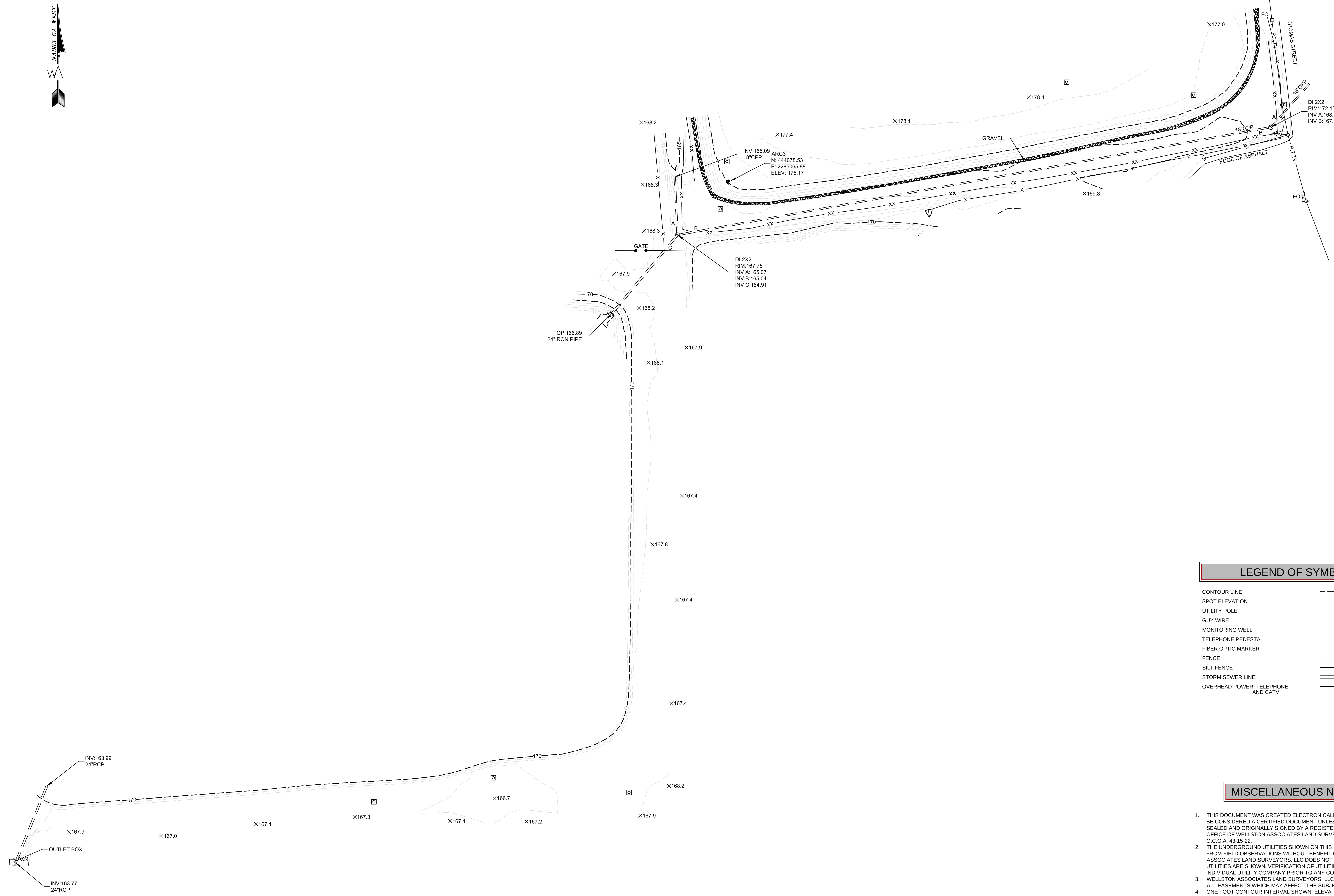

LEGEND OF SYMBOLS

CONTOUR LINE	180
SPOT ELEVATION	×166.7
UTILITY POLE	
GUY WIRE	
MONITORING WELL	
TELEPHONE PEDESTAL	
FIBER OPTIC MARKER	FO
FENCE	x
SILT FENCE	xx
STORM SEWER LINE	
OVERHEAD POWER, TELEPHONE AND CATV	P,T,TV

MISCELLANEOUS NOTES

1. THIS DOCUMENT WAS CREATED ELECTRONICALLY. THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT UNLESS IT HAS BEEN PROPERLY SEALED AND ORIGINALLY SIGNED BY A REGISTERED LAND SURVEYOR AT THE OFFICE OF WELLSTON ASSOCIATES LAND SURVEYORS, LLC AUTHORITY O.C.G.A. 43-15-22.
2. THE UNDERGROUND UTILITIES SHOWN ON THIS DRAWING WERE COMPILED FROM FIELD OBSERVATIONS WITHOUT BENEFIT OF EXCAVATION. WELLSTON ASSOCIATES LAND SURVEYORS, LLC DOES NOT GUARANTEE THAT ALL UTILITIES ARE SHOWN. VERIFICATION OF UTILITIES SHOULD BE MADE BY THE INDIVIDUAL UTILITY COMPANY PRIOR TO ANY CONSTRUCTION.
3. WELLSTON ASSOCIATES LAND SURVEYORS. LLC DOES NOT GUARANTEE THAT ALL EASEMENTS WHICH MAY AFFECT THE SUBJECT TRACT ARE SHOWN.
4. ONE FOOT CONTOUR INTERVAL SHOWN. ELEVATIONS SHOWN ARE REFERENCED TO SITE DATUM.

50 0 50 100 150

GRAPHIC SCALE IN FEET

Revisions

No.	Date	Description
1	8-27-14	ADJUSTED FROM NAVD 88 TO SITE DATUM

WELLSTON ASSOCIATES
LAND SURVEYORS, LLC
506 OSIGIAN BOULEVARD, SUITE 2
WARNER ROBINS, GEORGIA 31088
OFFICE (478) 971-3382
FAX (478) 971-1400

TOPOGRAPHIC SURVEY
FOR
CAMILLA WOOD PRESERVING SITE
GEOSYNTEC CONSULTANTS

MITCHELL COUNTY CAMILLA GEORGIA

Project No.:	1027-026
Drawing No.:	TS
Drawn By:	MH
Checked By:	SHJ
R.L.S. No.:	3171
Date:	8-13-14
Scale:	1"=50'

Sheet No.:

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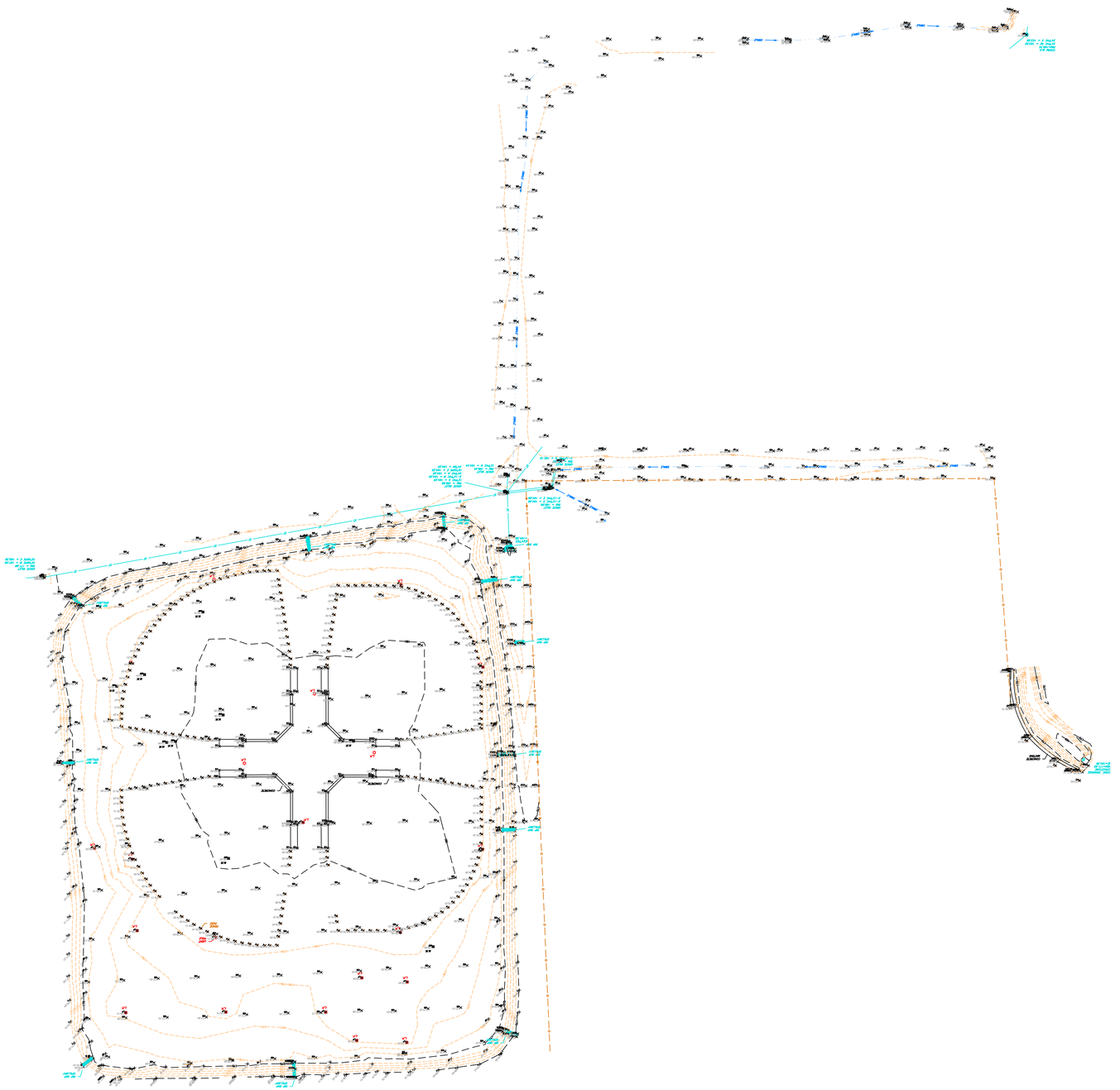

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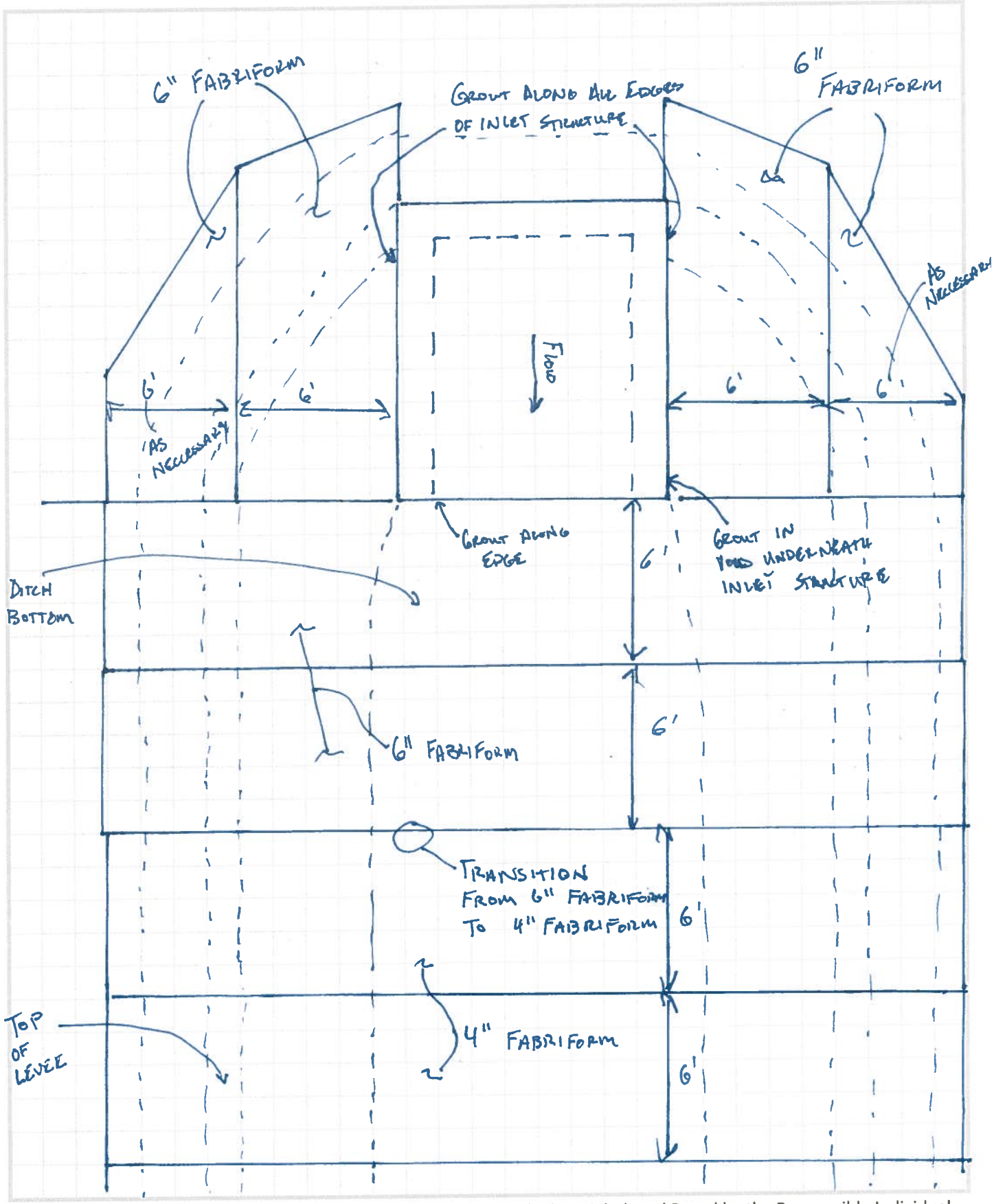
BLACK & VEATCH

Client EPA
Project Name CAMILLA W.P. Unit
Project No. 049062 File No.
Title DETAIL OF ~~OUTLET~~ STRUCTURE INLET

Prepared By MATT MEPPE
Date 20
Verified By
Date 20
Page 1 of 2



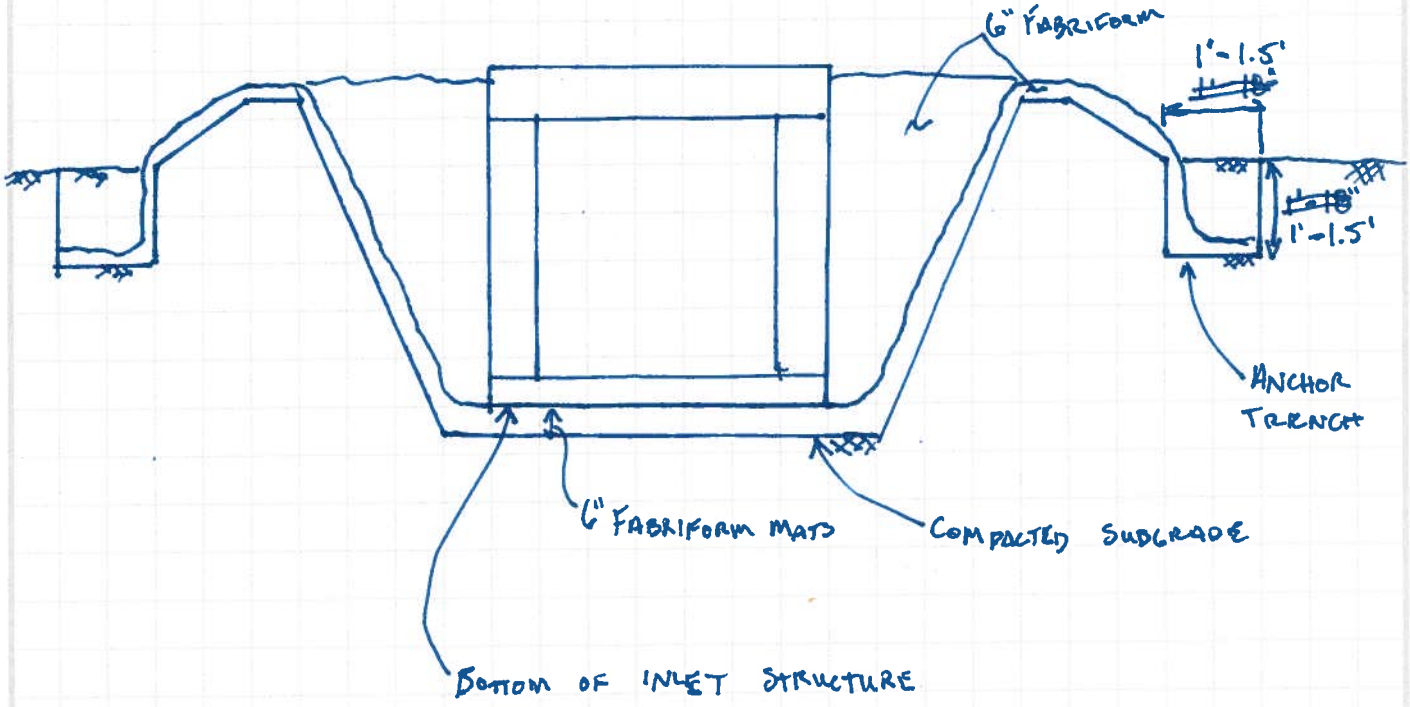
DO NOT WRITE IN THIS SPACE

Revised, Superseded, and Void Calculations Must Be Clearly Identified, Initialed, and Dated by the Responsible Individual.

BLACK & VEATCH

Client EPA
Project Name CAMILLA W.P. Unit
Project No. 049062 File No.
Title DETAIL OF ~~OUTLET~~ STRUCTURE INLET

Prepared By MATT WEPPEL
Date 20
Verified By
Date 20
Page 2 of 2



DO NOT WRITE IN THIS SPACE

Appendix B. Equipment Details

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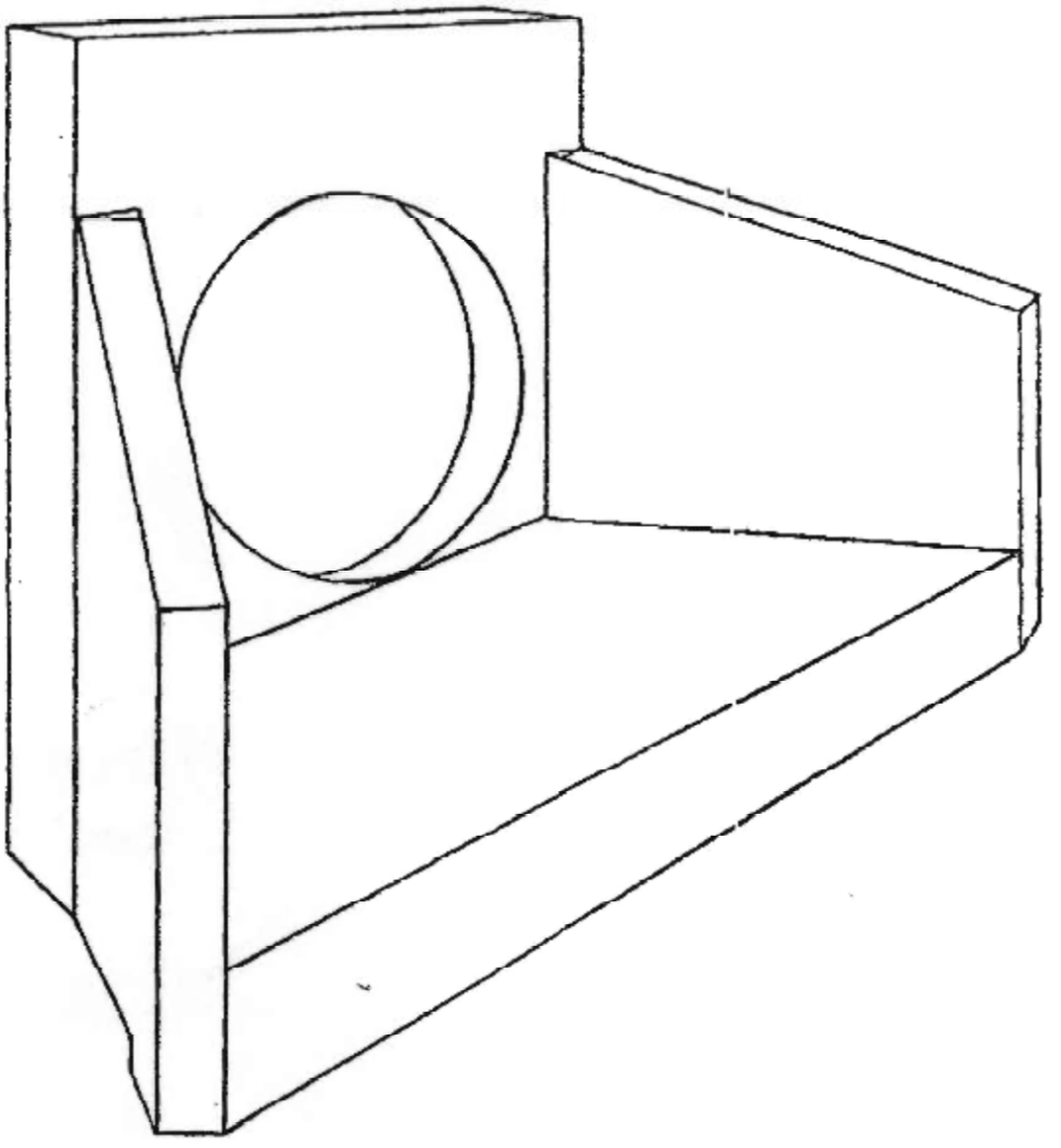


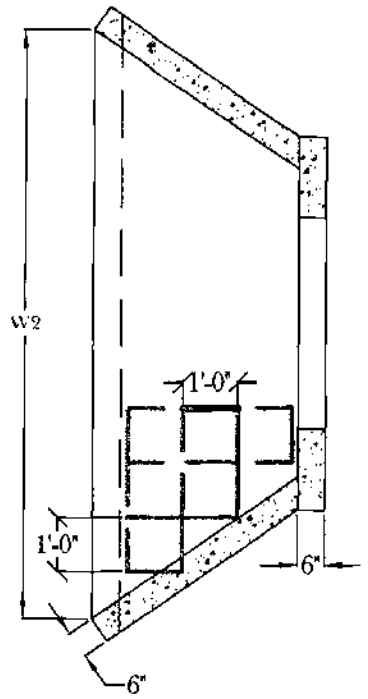
- AVAILABLE WITH CORRUGATED METAL PIPE STUB CAST-IN OR WITH OVERSIZE HOLE FOR CONCRETE PIPE.

PRECAST REINFORCED CONCRETE HEADWALLS

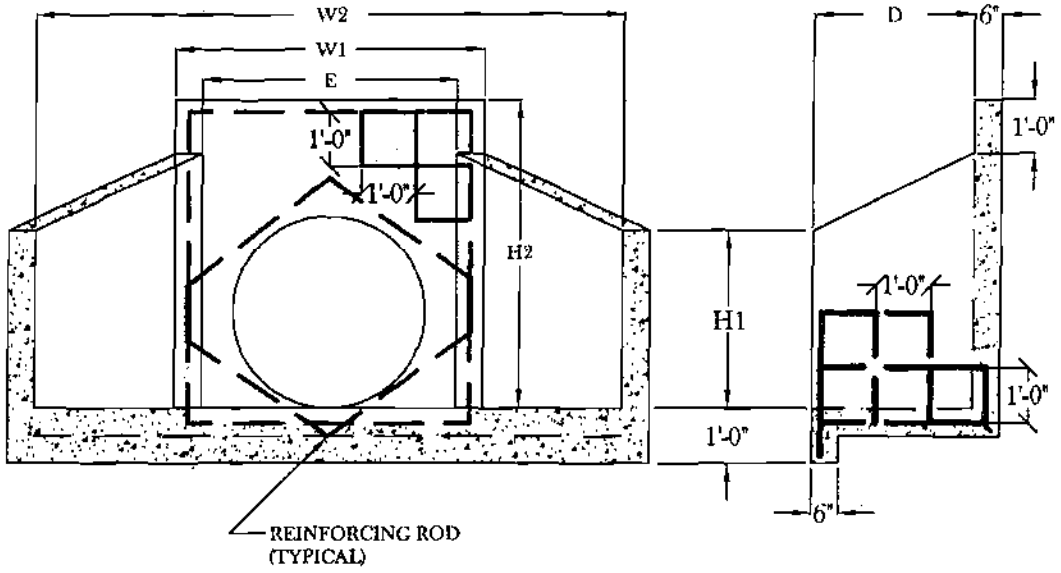
B&B
PRECAST & PIPE
DALLAS, GEORGIA
770-445-6521
Fax: 770-445-8293
P.O. Box 948 – Dallas, GA 30132

NOTES:
1. USE NEXT LARGER SIZE FOR CONCRETE PIPE
2. ALL CONCRETE TO BE 4,000 PSI
3. ALL EXPOSED EDGES TO HAVE 3/4" CHAMFER
4. NO. 4 REINFORCING ROD TO BE USED IN ALL HEADWALLS

RCP Pipe		HEADWALL DIMENSION								
I.D.	Hole Size	INSIDE DIA. PIPE	W1	W2	H1	H2	D	E	WT. (LBS)	SQ. FT. BASE AREA
12"	18"	12",15",18"	3'-2"	4'-10"	1'-3"	3'-2"	1'-3"	1'-9"	1,550	7.34
15"	24"	21",24"	3'-8"	6'-1"	1'-9"	3'-8"	1'-6"	2'-3"	2,100	9.90
18"	26"	30"	4'-2"	7'-2"	2'-0"	4'-2"	1'-10"	2'-9"	2,850	13.50
24"	36"	36"	4'-8"	8'-4"	2'-4"	4'-8"	2'-2"	3'-3"	3,700	17.65
30"-36"	42"-48"	42"- 48"	5'-8"	10'-10"	3'-3"	5'-8"	2'-11"	4'-3"	5,600	28.60
42"-48"	54"-60"	54"- 60"	6'-10"	11'-9"	3'-6"	6'-8"	3'-4"	5'-2"	7,500	36.27
54"	72"	66"- 72"	8'-1"	12'-0"	3'-8"	7'-7"	3'-4"	6'-2"	8,500	40.00
60"	78"	84"- 90"	9'-4"	12'-8"	4'-0"	9'-0"	3'-4"	7'-6"	10,000	44.00
72"	96"	84"-96"	10'-2"	17'-4"	6'-0"	10'-0"	4'-0"	9'-0"	12,000	47.00



PLAN



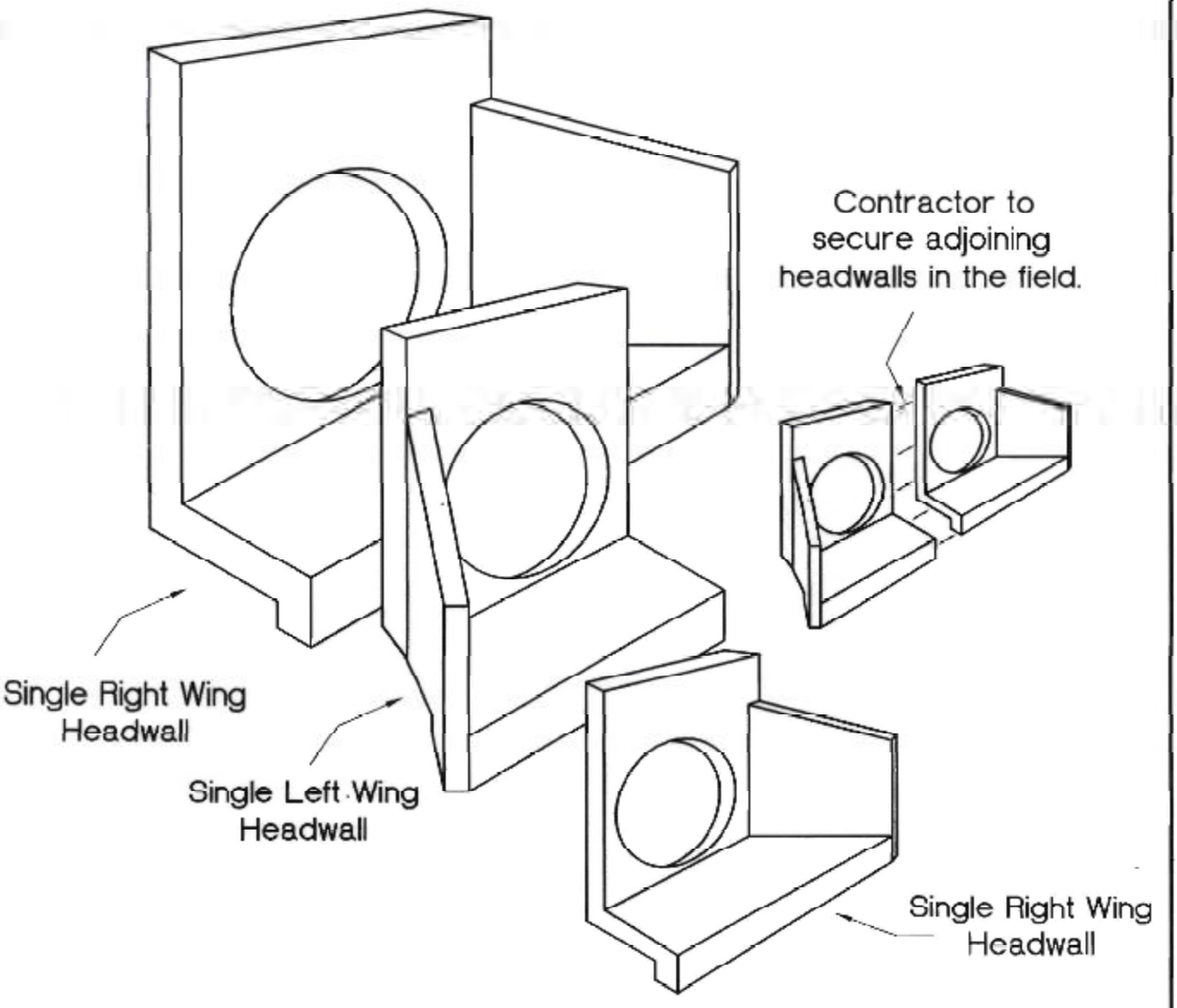
SECTION

PRECAST & PIPE
DALLAS, GEORGIA
770-445-6521
Fax: 770-445-8293
P.O. Box 948 – Dallas, GA 30132

Project:

Contractor:

STANDARD PRECAST HEADWALL



Available With Corrugated Metal Pipe Stub Cast In Or With Oversize Hole For Concrete Or Plastic Pipe

B&B
PRECAST & PIPE
DALLAS, GEORGIA
770-445-6521
Fax: 770-445-6293
P.O. Box 948 – Dallas, GA 30132

Precast Concrete Double Run Headwalls

SECTION	DATE 02-21-06	REVISION
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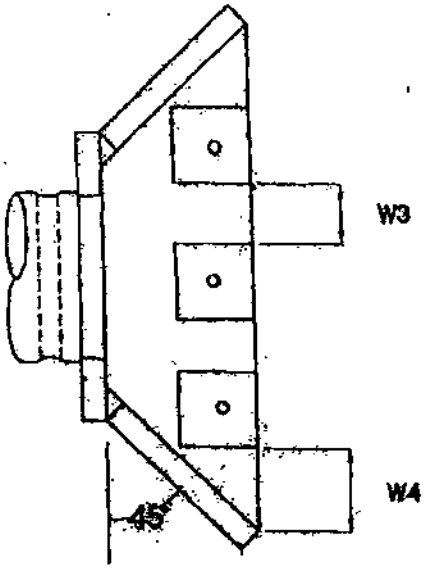
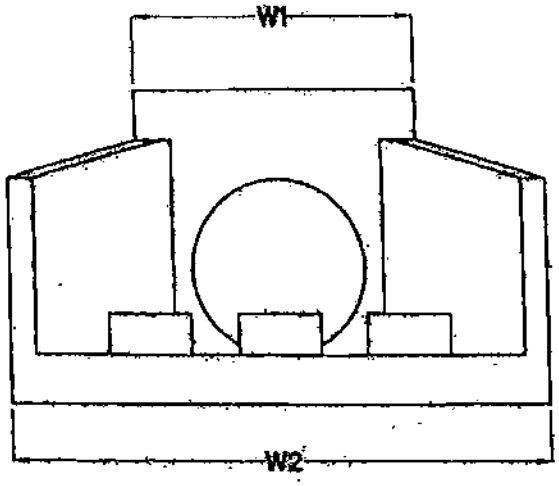


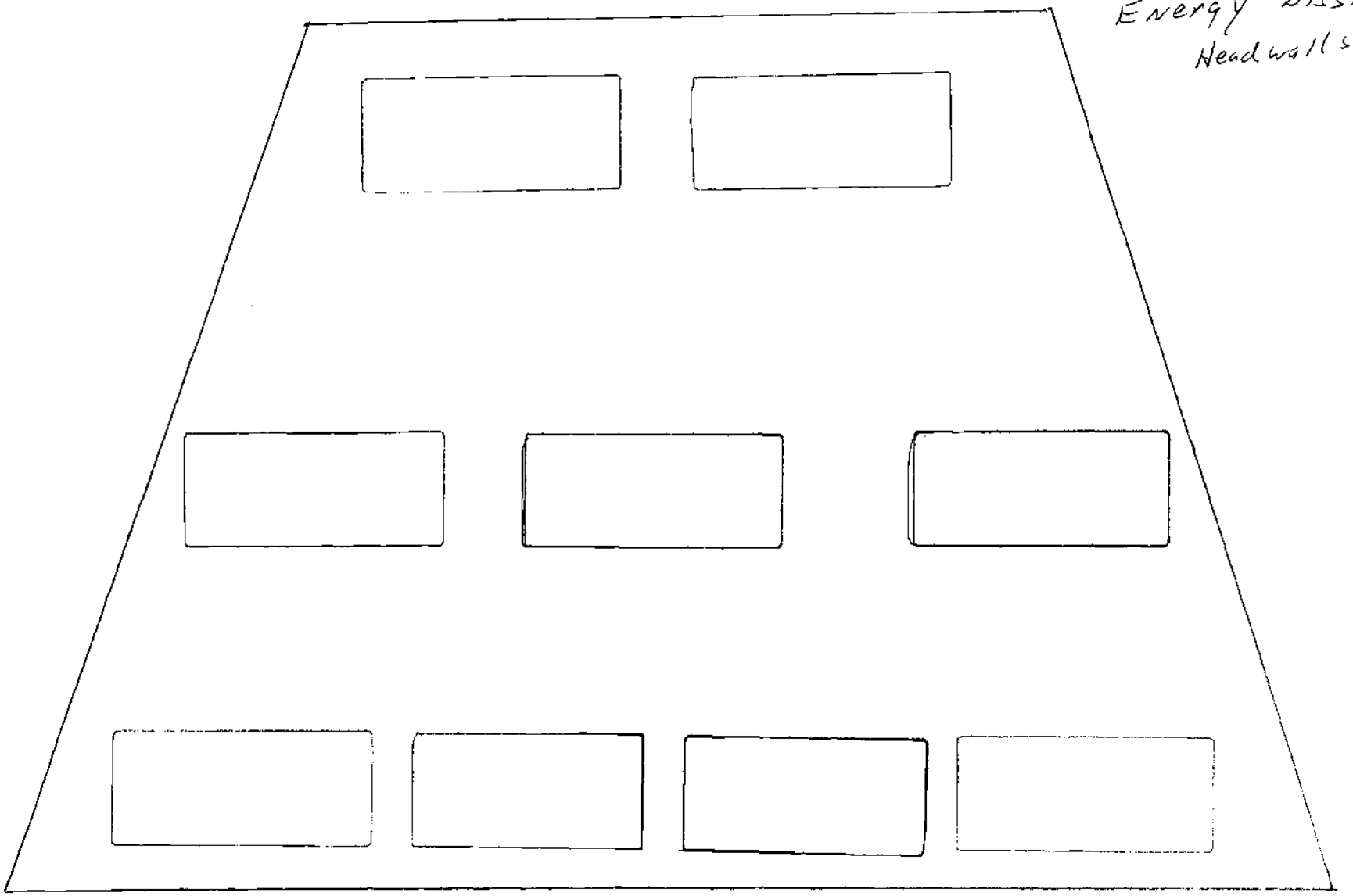


4000 PSI Concrete Standard

	DIMENSIONS: HEADWALLS WITH DISSIPATORS						
INSIDE DIA. OF PIPE	W 1	W2	W3	W4	BLOCK LENGTH & WIDTH	BLOCK HEIGHT	NUMBER OF BLOCKS
12"	2'-6"	3'-9"	N/A	N/A	12" X 12"	6"	N/A
15" & 18"	3'-2"	4'-9"	6"	6'-8" VARIES	12" X 12"	6"	5
24"	4'-2"	8'-2"	6"	6'-8" VARIES	12" X 12"	6"	5
30" & 36"	4'-8"	8'-8"	6"	6'-8" VARIES	12" X 12"	6"	5
42" & 48"	5'-8"	10'-11"	6"	6'-8" VARIES	12" X 12"	6"	9
54" & 60"	6'-5"	12'-6"	6"	6'-8" VARIES	12" X 12"	6"	9
66" & 72"	8'-5"	13'-5"	6"	6'-8" VARIES	12" X 12"	6"	9
78",84",90", & 96"	10'-2"	15'-10"	6"	6'-8" VARIES	12" X 12"	6"	11

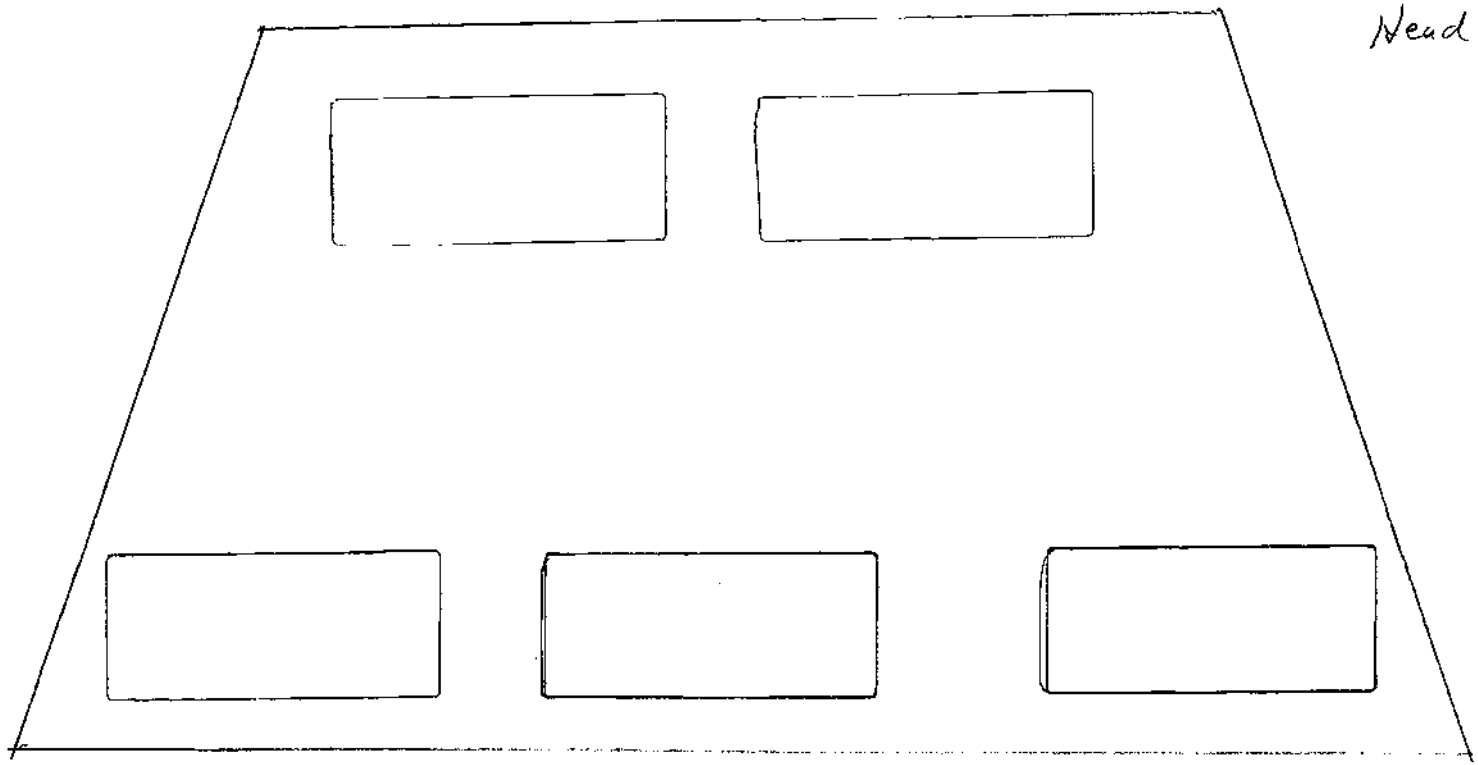
42" and up

9 Blocks on Large Energy Dissipator Headwalls



12" To 36"

5 BLOCKS
ON SMALL
Energy Dissipator
Head walls



PF-25 CAST IRON FLAP VALVES

FOR PUMP DISCHARGE

FLANGE STYLE

Waterman Model PF-25 flap valves are designed for use on pump discharge lines and other pipe end closures to prevent entrance of back water. These valves are furnished with a variety of frame styles to fit most installation needs. A 7½° inclined seating plane is used to ensure that the valve will not "hang open" from slight pipe sagging or off grade. A positive stop prevents over opening.

The flange model (PF-25F) may be furnished with either iron or bronze seat faces. Bronze hinge pins are standard. Drilling is ANSI 125 lb. standard.

Model PF-25F

- **Cast Iron Body**
- **Flange or Compression Mounted**
- **Cast Iron Cover**
- **Aluminum Cover Optional**
- **Cast Iron, Bronze or Resilient Seat Faces**
- **Bronze Hinge Pins**
- **7½° Seating Plane**

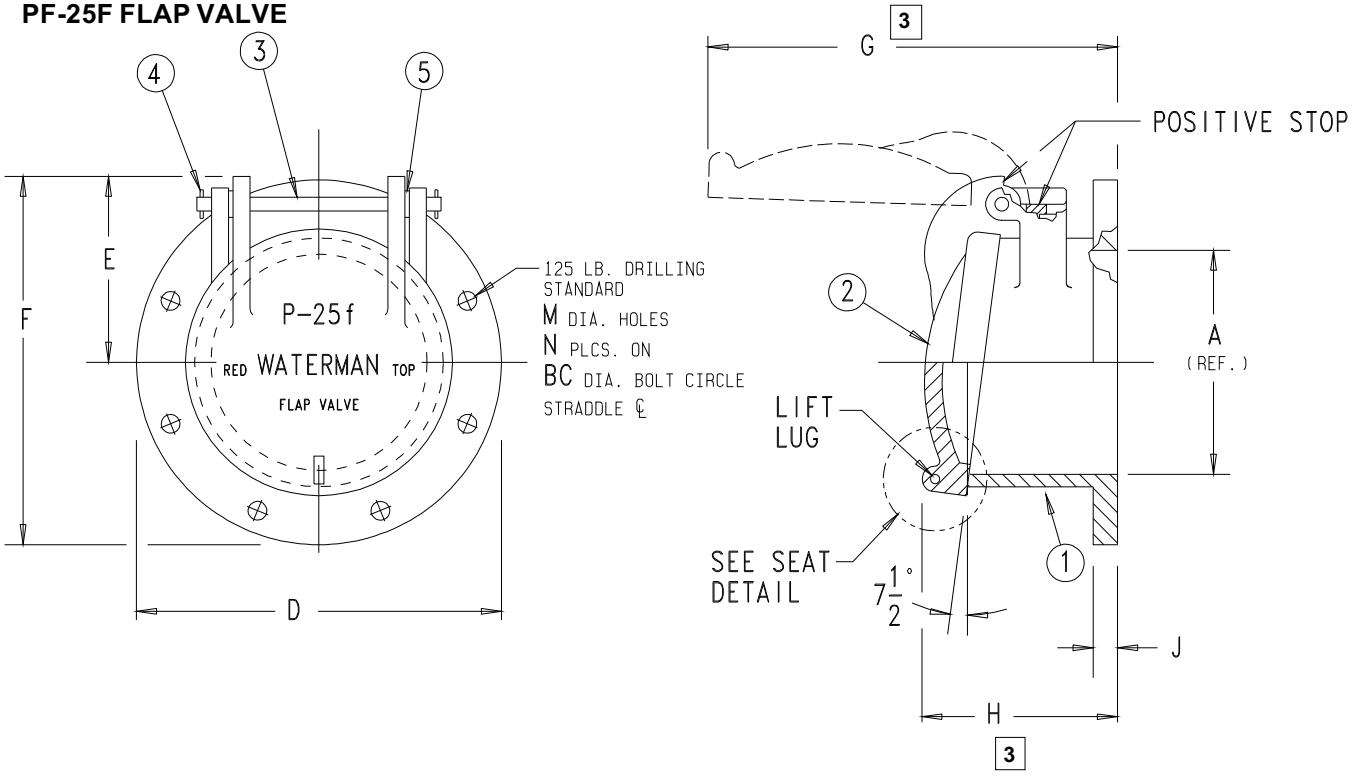
COMPRESSION STYLE

The popular compression model (PF-25W) uses time proven wedge type seals to install quickly and easily on plain end standard steel pipe. A special gasket is furnished for use with O.D. sized steel pipe. This model is standard with a cast iron frame with machined seat face and a cast iron cover with a resilient neoprene rubber seat face. Follow ring is cast iron with rubber wedge gasket and plated steel draw bolts.

Valves are available with aluminum covers and neoprene seat faces where extra sensitivity is desired. Taper setting collars can be provided as an aid for installation on concrete pipe.

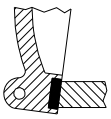
Model PF-25W

PF-25F FLAP VALVE



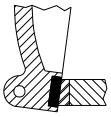
ALTERNATE SEATS AVAILABLE

MACHINED IRON



RESILIENT SEAT IN COVER. MACHINED IRON SEAT BODY*

BRONZE SEAT COVER & BODY



RESILIENT SEAT IN COVER. BRONZE SEAT IN FRAME

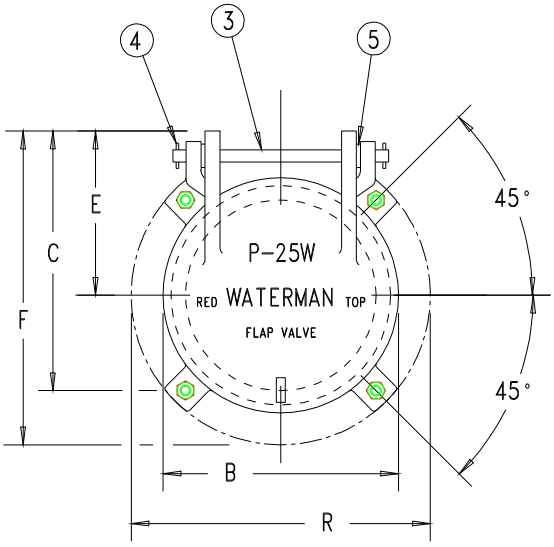
***standard configuration**

PARTS LIST	
No.	**Name**
1	BODY(flanged)
2	COVER
3	HINGE PIN
4	SPRING PIN
5	WASHER

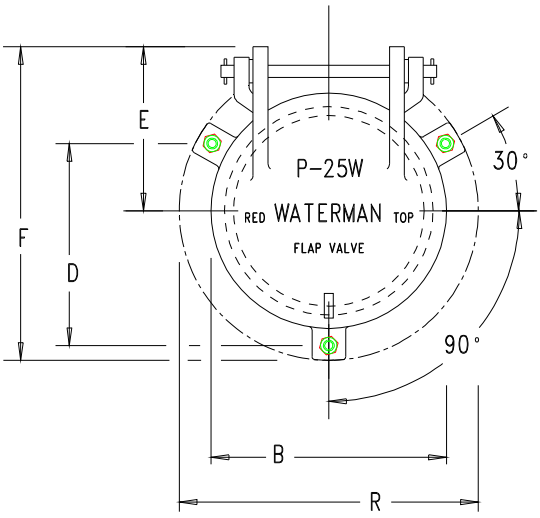
1. Designed for use on pump discharge lines.
2. 25 Lb. drilling available on request.
3. If grout pad mounting is used, add grout thickness to dimensions.

GATE DIMENSIONS IN INCHES										
GATE SIZE A	4	6	8	10	12	14	16	18	20	24
BC	7½	9⅛	11¾	14¼	17	18¾	21¼	22¾	25	29½
D	9	11	13½	16	19	21	23½	25	27½	32
E	4⅝	5 11/16	6⅞	8⅛	9⅜	10 7/16	11⅝	12¼	13⅜	15½
F	9⅛	11 3/16	13⅝	16⅛	18⅞	20 15/16	23⅜	24¾	27⅛	31½
G	8¼	11⅞	14¼	16¼	18⅝	22¼	24¼	26¼	28¾	32¾
H	6¼	7⅝	8	8	8½	10½	10½	10½	11	11
J	1	1	1	1	1	1	1	1⅛	1⅛	1¼
M	¾	⅞	⅞	1	1	1⅛	1⅛	1¼	1¼	1⅜
N	8	8	8	12	12	12	16	16	20	20

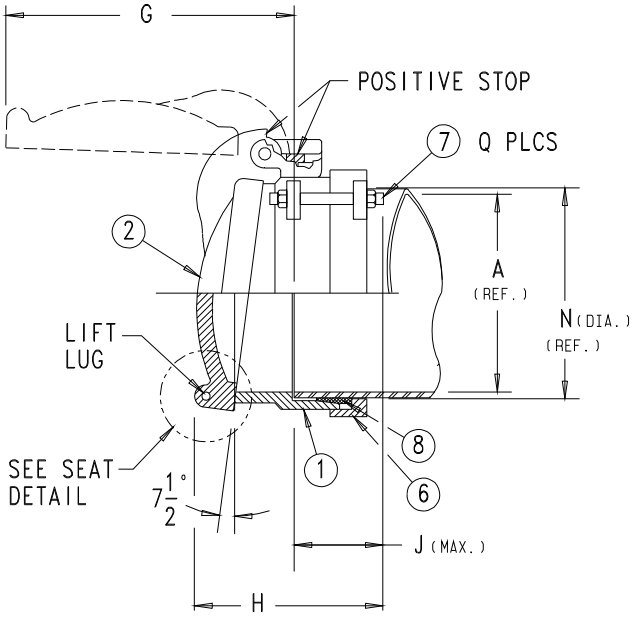
PF-25W FLAP VALVE

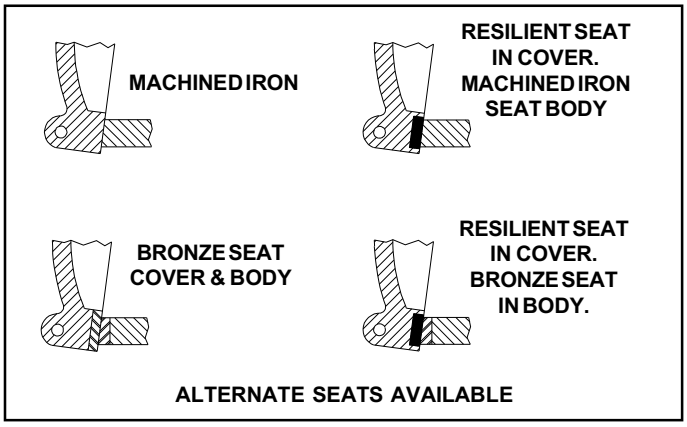


6" - 14"



4" and 5"





GATE DIMENSIONS IN INCHES							
GATE SIZE A	4	5	6	8	10	12	14
B	5⅝	6¾	8	9⅞	12½	14½	16
C	-	-	6	7½	9 1/8	10½	12
D	4½	5½	-	-	-	-	-
E	5¼	5½	6	7½	8¼	9½	10½
F	9	9½	10	12¼	14¼	17	18½
G	7	8⅜	9¾	11¾	14	16½	18¼
H	5¼	5¼	6¼	6¼	6½	7	7½
J	2	2¼	2⅝	2⅝	2⅝	2⅝	2⅝
N	4⅝	5⅝	6¾	8¾	10⅞	12⅞	14⅛
Q	3	3	4	4	4	4	4
R	6½	8	9⅜	11¾	13⅞	15⅞	17⅝

1. Designed for use on pump discharge lines.

PARTS LIST	
No.	**Name**
1	BODY (standard)
2	COVER
3	HINGE PIN
4	SPRING PIN
5	WASHER
6	FOLLOW RING
7	RING BOLT, NUT & WASHER
8	PIPE SEAL GASKET (compression gasket)

TYPICAL SPECIFICATIONS
PF-25 FLAP GATE

General
The Flap gate shall be designed to allow free outflow and prevent backflow for maximum seating heads up to 25 feet. Flap Gates shall be Waterman Model PF-25 or Equal.

Construction
The frame shall be of cast Iron (ASTM A-126 Class B) and shall be the flangeback or compression type, as indicated on the plans. The seating face shall be inclined from vertical at an angle of 7½ degrees to assure a positive closure. For flangeback gates that are to be mounted on flanges or on thimbles, the frame shall be drilled to match. For compression type frames, a cast iron follow ring with neoprene pipe seal gasket will be included along with plated steel draw bolts to effect a tight seal between the gate and pipe.

The cover shall be cast iron (ASTM A-126 Class B) or cast aluminum (ASTM B-26) and shall be domed to withstand the seating head specified. An integral cast lifting eye shall be included for manual operation.

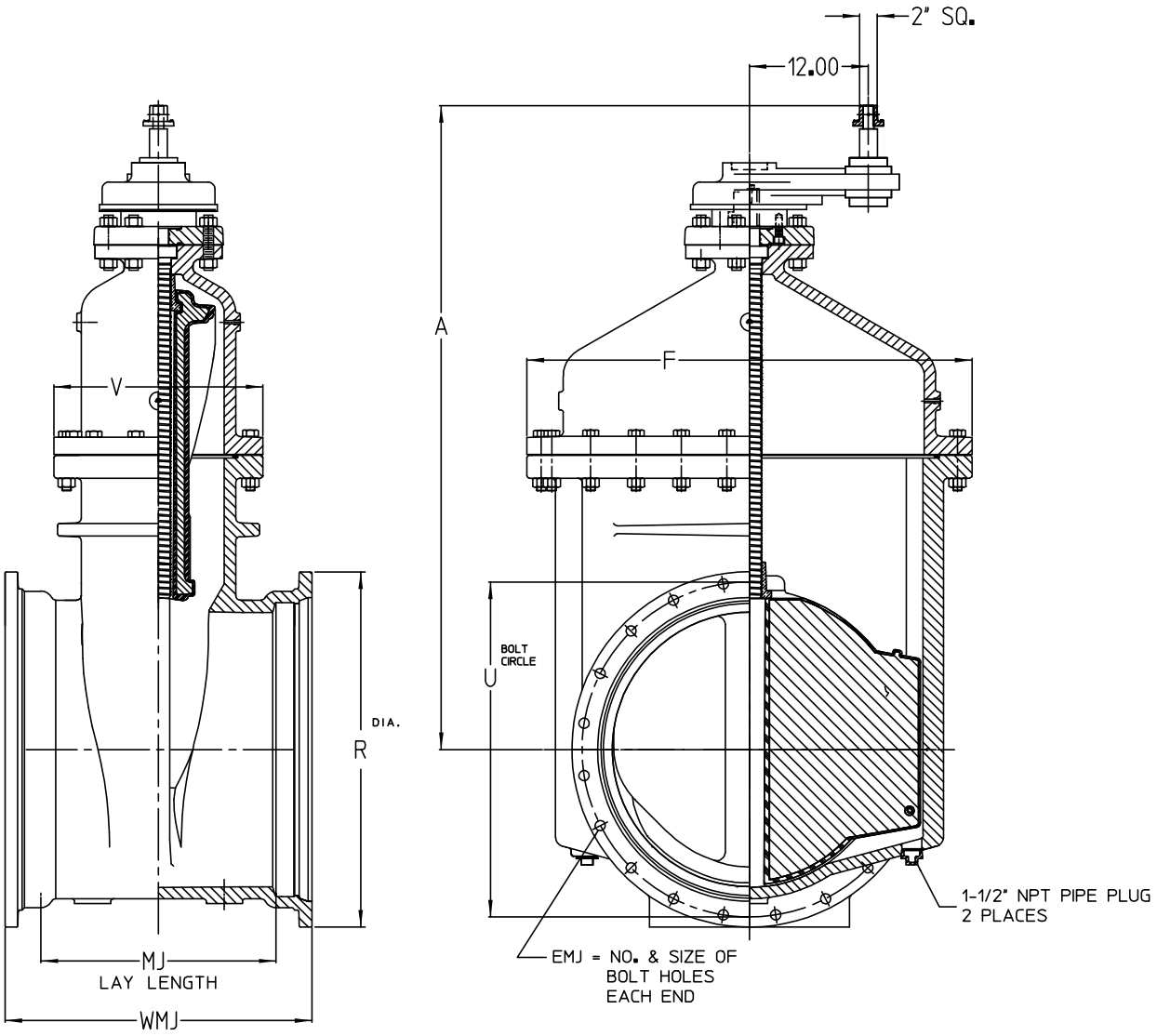
The seating surfaces on the frame and cover shall be: Bronze on frame and neoprene in cover **or** machined iron on frame and neoprene on cover. All machined seats shall have a minimum 63 microinch finish.

The hinge links shall be cast as one piece with the cover and shall be attached to the frame by means of a bronze hinge pin. A positive stop shall be included to prevent over-opening of the cover.

Finish
All cast iron shall be painted with manufacturers standard shopcoat paint (or paint as specified). All other parts will not require any further finish.

AMERICAN Flow Control Submittal Information

20" - 24" SERIES 2500 RESILIENT WEDGE GATE VALVE
NRS MECHANICAL JOINT ENDS WITH SPUR GEAR ACTUATOR (MJ X MJ)



91-21406

Size	20"	24"
A	49.50	57.63
EMJ	14 - .88	16 - .88
F	34.50	39.00
MJ	16.50	18.63
R	27.13	31.75
U	25.50	30.00
V	16.25	17.75
WMJ	23.50	25.63
Turns to Open	186	228
Weight	1570 lbs.	2350 lbs.

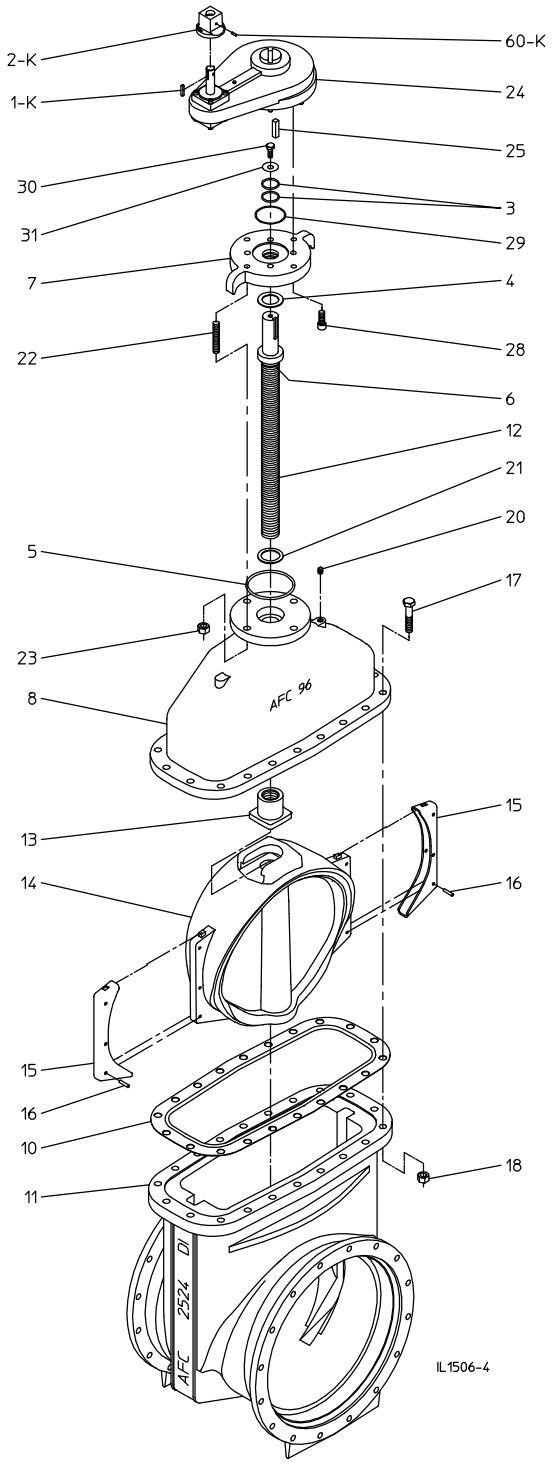
AMERICAN FLOW CONTROL

THE RIGHT WAY

AMERICAN Flow Control
P.O. Box 2727
Birmingham, Al. 35202-2727
Phone: 1-800-326-8051
Fax: 1-800-610-3569
E-mail: afcsales@american-usa.com

Waterous Company
125 Hardman Avenue South
South St. Paul, Mn. 55075-1191
Phone: 1-888-266-3686
Fax: 1-800-601-2809
E-mail: afcsales@american-usa.com

WWW.AMERICAN-USA.COM



Ref. No.	Description	Material
1-K	Key for operating nut	Steel
2-K	Operating Nut	Ductile Iron ASTM A536
3	O-Ring	Rubber
4	Upper Thrust Washer	Delrin
5	Stuffing Box Gasket	Rubber O-Ring
6	O-Ring	Rubber
7	Stuffing Box	Ductile Iron ASTM A536
8	Bonnet	Ductile Iron ASTM A536
10	Throat Flange Gasket	Rubber
11	Valve Body	Ductile Iron ASTM A536
12	Stem	Manganese Bronze, ASTM B763, UNS C86700
13	Wedge Nut	Manganese Bronze, ASTM B584, UNS C87600
14	Resilient Wedge	EPDM Rubber Encapsulated Ductile Iron ASTM A536
15	Wedge Cover	Acetal Polymer
16	Wedge Cover Pin	Acetal Polymer
17	Hex Head Bolt	304 Stainless Steel
18	Hex Nut	304 Stainless Steel
20	Pipe Plug	Stainless Steel
21	Lower Thrust Washer	Delrin
22	Stud	304 Stainless Steel
23	Hex Nut	304 Stainless Steel
24	Spur Gear Actuator	Rotork IS-7 (3:1)
25	Key	Hardened Steel
28	Socket Head Capscrew	304 Stainless Steel
29	Actuator Gasket	Rubber O-Ring
30	Hex Head Bolt	304 Stainless Steel
31	Washer	Steel
60-K	Pin for Operating Nut	Stainless Steel

OPTIONAL MATERIALS ARE AS FOLLOWS

BOLTS and NUTS: 316 Stainless Steel
STEM: Cast NDZ-S Bronze, ASTM B763, UNS C99500
STEM: Stainless Steel

Open Direction ☐ Left(C.C.W.) ☐ Right(C.W.)

Construction shown is typical of the 24-inch size with mechanical joint end connections and is illustrative only. Construction of other sizes and end connection types vary slightly. See elsewhere on this drawing for specific details.

NOTES:
1. Mechanical joint ends are in accordance with ANSI/AWWA C111/A21.11.
2. Fusion -bonded epoxy coated in accordance with AWWA C550.
3. Certified to ANSI/NSF Standard 61.
4. Meets requirements of AWWA C515 with rated working pressure of 250 psig.

AMERICAN FLOW CONTROL
THE RIGHT WAY

AMERICAN Flow Control
P.O. Box 2727
Birmingham, Al. 35202-2727
Phone: 1-800-326-8051
Fax: 1-800-610-3569
E-mail: afcsales@american-usa.com

Waterous Company
125 Hardman Avenue South
South St. Paul, Mn. 55075-1191
Phone: 1-888-266-3686
Fax: 1-800-601-2809
E-mail: afcsales@american-usa.com

WWW.AMERICAN-USA.COM

DURA•SKRIM® K30B, K36B & K45B

Scrim Reinforced Polyethylene

RAVEN INDUSTRIES

Product Description

DURA•SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA•SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

Product Use

DURA•SKRIM® K30B, K36B and K45B are used in applications that require exceptional outdoor life and demand high tear strength and resistance to thermal expansion.

DURA•SKRIM® K30B, K36B and K45B are manufactured from a very chemical-resistant, Linear Low Density Polyethylene with excellent cold crack performance.

Size & Packaging

DURA•SKRIM® K30B, K36B and K45B are available in a variety of widths and lengths to meet the project requirements. Large diameter mill rolls are available to assure an efficient seaming process. Factory welded panels are accordion folded and tightly rolled on a heavy-duty core for ease of handling and time saving installation.

DURA-SKRIM® K-SERIES

Containment Liner

Product	Part #
DURA•SKRIM	K30B
DURA•SKRIM	K36B
DURA•SKRIM	K45B

APPLICATIONS

- Waste Lagoon Liners
- Floating Covers
- Daily Landfill Covers
- Modular Tank Liners
- Tunnel Liners
- Remediation Liners
- Earthen Liners
- Interim Landfill Covers
- Remediation Covers
- Landfill Caps
- Erosion Control Covers
- Canal Liners
- Disposal Pit Liner
- Water Containment Ponds
- Heap Leach Liner

DURA•SKRIM® K30B, K36B & K45B

Scrim Reinforced Polyethylene

ISO 9001:2008 CERTIFIED MANAGEMENT SYSTEM

PRO-FORMA DATA SHEET

PROPERTIES	TEST METHOD	DURA♦SKRIM K30B		DURA♦SKRIM K36B		DURA♦SKRIM K45B	
		Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages
Appearance		Black	Black	Black	Black	Black	Black
Thickness		27 mil	30 mil	32 mil	36 mil	40 mil	45 mil
Weight LBS/MSF, (OZ/YD^2)		116 (16.7)	125 (18.0)	136 (19.6)	155 (22.3)	175 (25.2)	200 (28.8)
Construction		Dense scrim reinforced polyethylene					
***Ply Adhesion - LBF/IN**	ASTM D 6636	17 or FTB	20 or FTB	21 or FTB	28 or FTB	24 or FTB	32 or FTB
Tensile Strength - LBF/IN	ASTM D 7003	165 MD 159 TD	182 MD 170 TD	170 MD 166 TD	186 MD 175 TD	178 MD 170 TD	195 MD 180 TD
Tensile Elongation at Break % (FILM BREAK)	ASTM D 7003	480 MD 430 TD	540 MD 500 TD	500 MD 450 TD	575 MD 520 TD	520 MD 470 TD	590 MD 550 TD
Tensile Elongation at Break % (SCRIM BREAK)	ASTM D 7003	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD
Tongue Tear Strength - LBF	ASTM D 5884	185 MD 160 TD	195 MD 185 TD	160 MD 120 TD	180 MD 140 TD	140 MD 120 TD	175 MD 145 TD
Grab Tensile - LBF (SCRIM BREAK)	ASTM D 7004	260 MD 245 TD	270 MD 255 TD	280 MD 270 TD	300 MD 290 TD	260 MD 245 TD	270 MD 255 TD
Grab Tensile Elongation at Break % (SCRIM BREAK)	ASTM D 7004	25	32	25	32	25	32
High Pressure OIT (HPOIT)	ASTM D 5885	1000 min	2400 min	1000 min	2400 min	1000 min	2400 min
Puncture Resistance - LBF	ASTM D 4833	85	100	110	120	120	133
Maximum Use Temperature		180° F		180° F		180° F	
Minimum Use Temperature		-70° F		-70° F		-70° F	

*Raven modified QC procedure

PRO-FORMA Sheet Contents:

The data listed in this Pro-Forma data sheet is representative of initial production runs. These values may be revised at anytime without notice as additional test data becomes available.

DURA♦SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA♦SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage.

RAVEN INDUSTRIES

Engineered Films Division
P.O. Box 5107
Sioux Falls, SD 57117-5107
Ph: (605) 335-0174 • Fx: (605) 331-0333

Toll Free: **800-635-3456**
Email: **efdsales@ravenind.com**
www.ravenefd.com

Limited Warranty available at www.RavenEFD.com

SIGMA

COMPACT MJ

C153 Mechanical Joint Ductile Iron Fittings

SIGMA

Weights in Pounds, Less Accessories / Dimensions in inches
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

C153 Mechanical Joint Compact Fittings

3-48" Ductile Iron Mechanical Joint Fittings Class 350

MATERIAL: Ductile Iron ASTM A536

PRESSURE: 350PSI WATER WORKING PRESSURE (CLASS 350) 3" - 24": & 250 PSI 30" - 48"

TESTING: In accordance with ANSI / AWWA C153 / A21.53 & UL - FM requirements

LAYING LENGTH:Short body design - straight section of body deleted to provide a compact and lighter fitting without reducing strength or flow characterisitics, in accordance with ANSI / AWWA C153 / A21.53

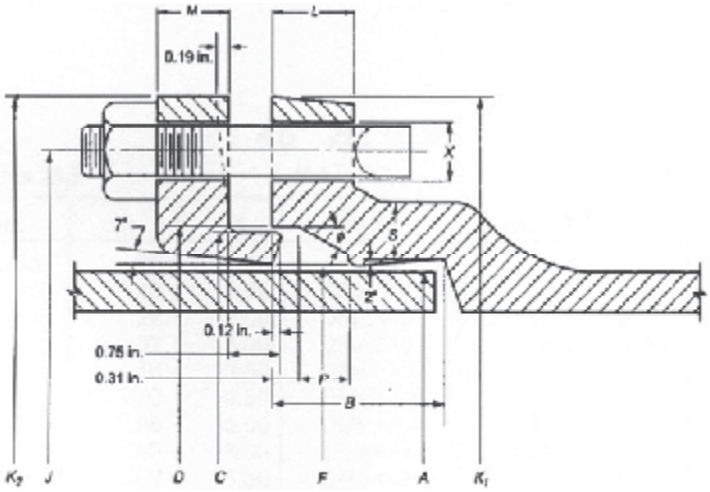
CEMENT LINING: In accordance with ANSI / AWWA C104 / A21.4 COATING: Tar coated (bituminous) inside and out in accordance with ANSI / AWWA C104 / A21.4

GASKETS: SBR in accordance with ANSI / AWWA C111 / A21.11

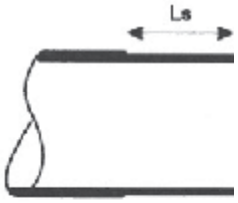
T-BOLTS: Low Alloy corrosion resistant high strength steel in accordance with ANSI / AWWA C111 / A21.11

APPROVALS: 3"-16" Underwriters Laboratories listed and Factory Mutual Approved.

STANDARDS: Certified to NSF61 Standard ANSI / AWWA C153 / A21.53 for Compact Ductile Iron Fittings 3"-48" for water and other liquids.



Mechanical Joint Detail



Plain End Detail

Size	A	B	C	D	F	J	K1	K2	L	M	P	S	X	Bolts			
														No	Size	Len	L_S
3	3.96	2.50	4.84	4.94	4.06	6.19	7.62	7.69	0.58	0.62	0.63	0.39	3/4	4	5/8	3.0	5.5
4	4.80	2.50	5.92	6.02	4.90	7.50	9.06	9.12	0.60	0.75	0.75	0.39	7/8	4	3/4	3.5	5.5
6	6.90	2.50	8.02	8.12	7.00	9.50	11.06	11.12	0.63	0.88	0.75	0.43	7/8	6	3/4	3.5	5.5
8	9.05	2.50	10.17	10.27	9.15	11.75	13.31	13.37	0.66	1.00	0.75	0.45	7/8	6	3/4	3.5	5.5
10	11.10	2.50	12.22	12.34	11.20	14.00	15.62	15.62	0.70	1.00	0.75	0.47	7/8	8	3/4	3.5	5.5
12	13.20	2.50	14.32	14.44	13.30	16.25	17.88	17.88	0.73	1.00	0.75	0.49	7/8	8	3/4	3.5	5.5
14	15.30	3.50	16.40	16.54	15.44	18.75	20.25	20.25	0.79	1.25	0.75	0.55	7/8	10	3/4	4.0	8.0
16	17.40	3.50	18.50	18.64	17.54	21.00	22.50	22.50	0.85	1.31	0.75	0.58	7/8	12	3/4	4.0	8.0
18	19.50	3.50	20.60	20.74	19.64	23.25	24.83	24.75	1.00	1.38	0.75	0.68	7/8	12	3/4	4.0	8.0
20	21.60	3.50	22.70	22.84	21.74	25.50	27.08	27.00	1.02	1.44	0.75	0.69	7/8	14	3/4	4.0	8.0
24	25.80	3.50	26.90	27.04	25.94	30.00	31.58	31.50	1.02	1.56	0.75	0.75	7/8	16	3/4	4.5	8.0
30	32.00	4.00	33.29	33.46	32.17	36.88	39.12	39.12	1.31	2.00	1.00	0.82	1 1/8	20	1	5.5	8.0
36	38.30	4.00	39.59	39.76	38.47	43.75	46.00	46.00	1.45	2.00	1.00	1.00	1 1/8	24	1	5.5	8.0
42	44.50	4.00	45.79	45.96	44.67	50.62	53.12	53.12	1.45	2.00	1.00	1.25	1 3/8	28	1 1/4	6.0	8.0
48	50.80	4.00	52.09	52.26	50.97	57.50	60.00	60.00	1.45	2.00	1.00	1.35	1 3/8	32	1 1/4	6.0	8.0

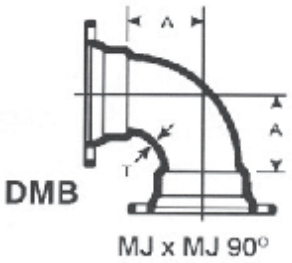
Weights in Pounds, Less Accessories / Dimensions in inches
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

SIGMA

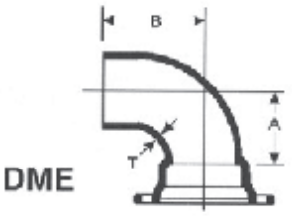
C153 Mechanical Joint Compact Fittings

90 Degree Bends

	MJ x MJ			MJ x PE				
Size	Item No.	Wt.	A	Item No.	Wt.	A	B	t
2	DMB290	17	3.00					0.30
3	DMB390	19	3.50	DME390	16	3.25	8.50	0.33
4	DMB490	25	4.00	DME490	22	4.00	9.50	0.34
6	DMB690	39	5.00	DME690	41	5.00	11.50	0.36
8	DMB890	57	6.50	DME890	58	6.50	12.50	0.38
10	DMB1090	89	7.50	DME1090	88	7.50	13.00	0.40
12	DMB1290	108	9.00	DME1290	114	9.00	14.50	0.42
14	DMB1490	210	11.50	DME1490	211	11.50	19.50	0.47
16	DMB1690	264	12.50	DME1690	248	12.50	20.50	0.50
18	DMB1890	335	14.00	DME1890	325	14.00	21.00	0.54
20	DMB2090	400	15.00	DME2090	390	15.00	22.50	0.57
24	DMB2490	565	16.75	DME2490	575	17.00	25.00	0.61
30	DMB3090	930	21.50	DME3090	865	21.50	30.50	0.66
36	DMB3690	1,450	24.50	DME3690	1,355	24.50	33.50	0.74
42	DMB4290	2,205	29.25	DME4290	2,055	29.25	38.25	0.82
48	DMB4890	2,990	33.25	DME4890	2,805	33.25	42.25	0.90



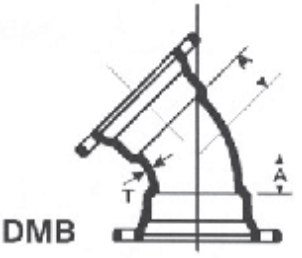
MJ x MJ 90°



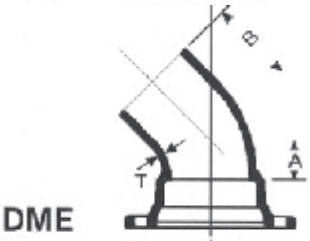
MJ x PE 90°

45 Degree Bends

	MJ x MJ			MJ x PE				
Size	Item No.	Wt.	A	Item No.	Wt.	A	B	T
2	DMB245	10	1.50					0.30
3	DMB345	16	1.50	DME345	13	1.50	7.00	0.33
4	DMB445	22	2.00	DME445	19	2.00	7.50	0.34
6	DMB645	32	3.00	DME645	34	3.00	8.50	0.36
8	DMB845	46	3.50	DME845	49	3.50	9.00	0.38
10	DMB1045	70	4.50	DME1045	70	4.50	10.00	0.40
12	DMB1245	86	5.50	DME1245	93	5.50	11.00	0.42
14	DMB1445	160	5.00	DME1445	146	5.00	13.00	0.47
16	DMB1645	202	5.50	DME1645	212	5.50	13.50	0.50
18	DMB1845	250	6.00	DME1845	235	6.00	13.00	0.54
20	DMB2045	305	7.00	DME2045	290	7.00	14.00	0.57
24	DMB2445	405	7.50	DME2445	390	7.50	14.50	0.61
30	DMB3045	780	10.50	DME3045	715	10.50	19.50	0.66
36	DMB3645	1135	11.50	DME3645	1,040	12.00	21.00	0.74
42	DMB4245	1610	14.00	DME4245	1,460	14.00	23.00	0.82
48	DMB4845	2090	15.00	DME4845	1,905	15.00	24.00	0.90



MJ x MJ 45°

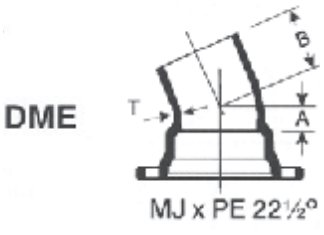


MJ x PE 45°

22-1/2 Degree Bends

	MJ x MJ			MJ x PE				
Size	Item No.	Wt.	A	Item No.	Wt.	A	B	T
3	DMB322	15	1.00	DME322	12	1.00	6.50	0.33
4	DMB422	18	1.50	DME422	18	1.50	7.00	0.34
6	DMB622	31	2.00	DME622	29	2.00	7.50	0.36
8	DMB822	46	2.50	DME822	43	2.50	8.00	0.38
10	DMB1022	64	3.00	DME1022	61	3.00	8.50	0.40
12	DMB1222	80	3.50	DME1222	79	3.50	9.00	0.42
14	DMB1422	136	3.75	DME1422	133	3.75	11.25	0.47
16	DMB1622	172	3.75	DME1622	166	3.75	11.75	0.50
18	DMB1822	255	4.50	DME1822	235	6.00	13.00	0.54
20	DMB2022	310	4.50	DME2022	300	7.00	14.00	0.57
24	DMB2422	412	4.50	DME2422	395	7.50	14.50	0.61
30	DMB3022	665	6.75	DME3022	600	6.75	15.75	0.66
36	DMB3622	960	7.75	DME3622	865	7.75	16.75	0.74
42	DMB4222	1350	9.00	DME4222	1,200	9.00	18.00	0.82
48	DMB4822	1760	10.00	DME4822	1,575	10.00	19.00	0.90

MJ x MJ 22½°



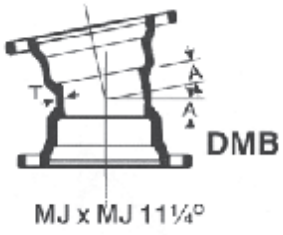
MJ x PE 22½°

SIGMA

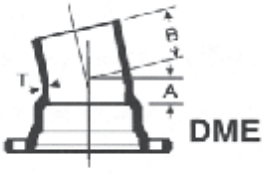
Weights in Pounds, Less Accessories / Dimensions in inches
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

C153 Mechanical Joint Compact Fittings

11-1/4 Degree Bends



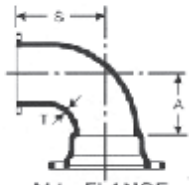
MJ x MJ 11¼°



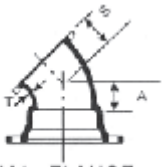
MJ x PE 11¼°

	MJ x MJ			MJ x PE				
Size	Item No.	Wt.	A	Item No.	Wt.	A	B	T
3	DMB311	14	1.00	DME311	12	1.00	6.50	0.33
4	DMB411	16	1.25	DME411	17	1.25	6.25	0.34
6	DMB611	30	1.50	DME611	27	1.50	7.00	0.36
8	DMB811	42	1.75	DME811	39	1.75	7.25	0.38
10	DMB1011	58	2.00	DME1011	52	2.00	7.50	0.40
12	DMB1211	67	2.25	DME1211	69	2.25	7.75	0.42
14	DMB1411	93	2.50	DME1411	118	2.50	10.50	0.47
16	DMB1611	148	2.50	DME1611	136	2.50	10.50	0.50
18	DMB1811	205	3.00	DME1811	235	6.00	13.00	0.54
20	DMB2011	245	3.00	DME2011	300	7.00	14.00	0.57
24	DMB2411	315	3.00	DME2411	400	7.50	14.50	0.61
30	DMB3011	600	4.75	DME3011	535	4.75	13.75	0.66
36	DMB3611	820	5.00	DME3611	725	5.00	14.00	0.74
42	DMB4211	1,180	6.00	DME4211	1,030	6.00	15.00	0.82
48	DMB4811	1,475	6.50	DME4811	1,290	6.50	15.50	0.90

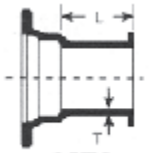
MFB



MJ x FLANGE
90° BEND



MJ x FLANGE
45° BEND



MFA

MJ x Flange Bends & Adapters

	90 deg. bends				45 deg. bends				Adapters			
Size	Item No.	A	S	Wt.	Item No.	A	S	Wt.	Item No.	L	Wt.	T
3	MFB390	3.50	5.50	21	MFB345	1.50	3.00	17	MFA3	3.50	18	0.33
4	MFB490	4.00	6.50	28	MFB445	2.00	4.00	34	MFA4	3.50	24	0.34
6	MFB690	5.00	8.00	46	MFB645	3.00	5.00	57	MFA6	3.50	36	0.36
8	MFB890	6.50	9.00	71	MFB845	3.50	5.50	83	MFA8	4.00	52	0.38
10	MFB1090	7.50	11.00	121	MFB1045	4.50	6.50	122	MFA10	4.00	67	0.40
12	MFB1290	9.00	12.00	155	MFB1245	5.50	7.50	159	MFA12	4.00	80	0.42
14									MFA14	5.00	126	0.47
16	MFB1690	12.50	15.00	280	MFB1645	5.50	8.00	290	MFA16	5.00	166	0.50
18									MFA18	5.00	206	0.54
20	MFB2090	15.00	18.00	441	MFB2045	7.00	9.50	338	MFA20	5.00	275	0.57
24	MFB2490	16.75	22.00	618	MFB2445	7.50	11.00	442	MFA24	5.00	324	0.61
30									MFA30	7.00	420	0.66

MJ x Flange 22-1/2 Bends

MFB

Size	Item No.	A	S	T	Wt.
3	MFB322	1.00	3.00	0.33	15
4	MFB422	1.50	4.00	0.34	23
6	MFB622	2.00	5.00	0.36	37
8	MFB822	2.50	5.50	0.38	56
10	MFB1022	3.00	6.50	0.40	81
12	MFB1222	3.50	7.50	0.42	114

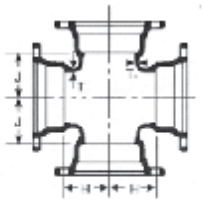
Weights in Pounds, Less Accessories / Dimensions in inches
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

SIGMA

C153 Mechanical Joint Compact Fittings

Crosses

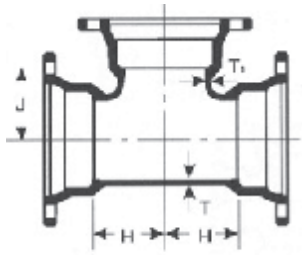
Size		Item No.	H	J	T	T1	Wt.
Run	Branch						
3	3	DMC33	3.00	3.00	0.33	0.33	35
4	3	DMC43	3.50	4.00	0.34	0.33	49
4	4	DMC44	4.00	4.00	0.34	0.34	57
6	4	DMC64	4.00	5.00	0.36	0.34	68
6	6	DMC66	5.00	5.00	0.36	0.36	75
8	4	DMC84	4.00	6.50	0.38	0.34	99
8	6	DMC86	5.00	6.50	0.38	0.36	108
8	8	DMC88	6.00	6.00	0.38	0.38	105
10	3	DMC103	3.00	7.50	0.40	0.33	115
10	4	DMC104	4.00	7.50	0.40	0.34	98
10	6	DMC106	5.00	7.50	0.40	0.36	118
10	8	DMC108	6.50	7.50	0.40	0.38	138
10	10	DMC1010	7.00	7.00	0.40	0.40	145
12	4	DMC124	4.00	8.75	0.42	0.34	100
12	6	DMC126	5.00	8.75	0.42	0.36	140
12	8	DMC128	6.50	8.75	0.42	0.38	162
12	10	DMC1210	7.50	8.75	0.42	0.40	190
12	12	DMC1212	8.50	8.50	0.42	0.42	213
14	8	DMC148	8.00	10.50	0.47	0.38	259
14	14	DMC1414	10.50	10.50	0.47	0.47	299
16	6	DMC166	6.50	11.50	0.50	0.36	250
16	8	DMC168	7.50	11.50	0.50	0.38	289
16	10	DMC1610	8.50	11.50	0.50	0.40	345
16	12	DMC1612	9.50	11.50	0.50	0.42	397
16	16	DMC1616	11.50	11.50	0.50	0.50	385
20	20	DMC2020	14.00	14.00	0.57	0.57	605
24	24	DMC2424	16.00	16.00	0.61	0.61	830
30	30	DMC3030	22.00	22.00	0.66	0.66	1840
36	36	DMC3636	26.00	26.00	0.74	0.74	2655
42	42	DMC4242	30.00	30.00	0.82	0.82	3725
48	48	DMC4848	33.50	33.50	0.90	0.90	4955



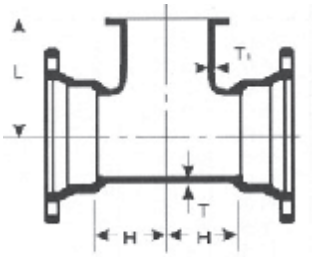
DMC

Tees

SIZE		MJ x MJ						MJ x Flange			
Run	Br.	Item No.	Wt.	H	J	T	T1	Item No.	Wt.	H	L
2	2	DMT22	16	3.00	3.00	0.30	0.30				
3	3	DMT33	28	3.00	3.00	0.33	0.33	DMF33	28	3.00	5.50
4	2	DMT42	29	3.00	4.00	0.34	0.30				
4	3	DMT43	30	3.50	4.00	0.34	0.33				
4	4	DMT44	32	4.00	4.00	0.34	0.34	DMF44	38	4.00	6.50
6	3	DMT63	42	3.50	5.00	0.36	0.33	DMF63	51	3.50	8.00
6	4	DMT64	46	4.00	5.00	0.36	0.34	DMF64	54	4.00	8.00
6	6	DMT66	56	5.00	5.00	0.36	0.36	DMF66	56	5.00	8.00
8	3	DMT83	52	3.50	6.50	0.38	0.33	DMF83	70	4.00	9.00
8	4	DMT84	60	4.00	6.50	0.38	0.34	DMF84	72	4.00	9.00
8	6	DMT86	72	5.00	6.50	0.38	0.36	DMF86	83	5.00	9.00
8	8	DMT88	86	6.50	6.50	0.38	0.38	DMF88	94	6.50	9.00
10	3	DMT103	75	4.00	7.50	0.40	0.33				
10	4	DMT104	78	4.00	7.50	0.40	0.34	DMF104	89	4.00	11.00
10	6	DMT106	90	5.00	7.50	0.40	0.36	DMF106	107	5.00	11.00
10	8	DMT108	105	6.50	7.50	0.40	0.38	DMF108	115	6.50	11.00
10	10	DMT1010	120	7.50	7.50	0.40	0.40	DMF1010	130	7.50	11.00
12	3	DMT123	90	4.00	8.75	0.42	0.33				
12	4	DMT124	94	4.00	8.75	0.42	0.34	DMF124	115	4.00	12.00
12	6	DMT126	110	5.00	8.75	0.42	0.36	DMF126	120	5.00	12.00
12	8	DMT128	125	6.50	8.75	0.42	0.38	DMF128	146	6.50	12.00



MJ x MJ
DMT



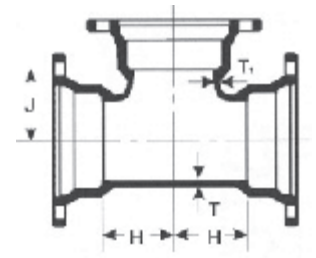
MJ x FLANGE
DMF

SIGMA

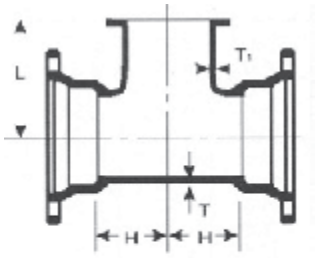
Weights in Pounds, Less Accessories / Dimensions in inches
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

C153 Mechanical Joint Compact Fittings

Tees (continued)



MJ x MJ
DMT



MJ x FLANGE
DMF

SIZE		MJ x MJ						MJ x Flange			
Run	Br.	Item No.	Wt.	H	J	T	T1	Item No.	Wt.	H	L
12	10	DMT1210	140	7.50	8.75	0.42	0.40	DMF1210	174	7.50	12.00
12	12	DMT1212	160	8.75	8.75	0.42	0.42	DMF1212	198	8.75	12.00
14	4	DMT144	172	5.50	10.50	0.47	0.34				
14	6	DMT146	182	6.50	10.50	0.47	0.36				
14	8	DMT148	206	7.50	10.50	0.47	0.38				
14	10	DMT1410	228	8.50	10.50	0.47	0.40				
14	12	DMT1412	234	9.50	10.50	0.47	0.42				
14	14	DMT1414	280	10.50	10.50	0.47	0.47				
16	6	DMT166	228	6.50	11.50	0.50	0.36	DMF166	213	6.50	15.00
16	8	DMT168	248	7.50	11.50	0.50	0.38	DMF168	260	7.50	15.00
16	10	DMT1610	264	8.50	11.50	0.50	0.40	DMF1610	287	8.50	15.00
16	12	DMT1612	280	9.50	11.50	0.50	0.42	DMF1612	312	9.50	15.00
16	14	DMT1614	316	10.50	11.50	0.50	0.47				
16	16	DMT1616	322	11.50	11.50	0.50	0.50				
18	6	DMT186	275	6.50	12.50	0.54	0.36	DMF186	261	6.50	15.50
18	8	DMT188	295	7.50	12.50	0.54	0.38				
18	10	DMT1810	315	8.50	12.50	0.54	0.40				
18	12	DMT1812	335	9.50	12.50	0.54	0.42				
18	14	DMT1814	380	10.50	12.50	0.54	0.47				
18	16	DMT1816	428	11.50	12.50	0.54	0.50				
18	18	DMT1818	448	12.50	12.50	0.54	0.54				
20	6	DMT206	348	6.50	14.00	0.57	0.36	DMF206	345	6.50	17.00
20	8	DMT208	345	8.00	14.00	0.57	0.38	DMF208	384	8.00	17.00
20	10	DMT2010	370	9.00	14.00	0.57	0.40				
20	12	DMT2012	441	10.00	14.00	0.57	0.42				
20	14	DMT2014	440	11.00	14.00	0.57	0.47				
20	16	DMT2016	465	12.00	14.00	0.57	0.50				
20	18	DMT2018	505	13.00	14.00	0.57	0.54				
20	20	DMT2020	535	14.00	14.00	0.57	0.57				
24	6	DMT246	415	7.00	16.00	0.61	0.36	DMF246	460	7.00	19.00
24	8	DMT248	445	8.00	16.00	0.61	0.38	DMF248	418	8.00	19.00
24	10	DMT2410	470	9.00	16.00	0.61	0.40				
24	12	DMT2412	500	10.00	16.00	0.61	0.42				
24	14	DMT2414	550	11.00	16.00	0.61	0.47				
24	16	DMT2416	580	12.00	16.00	0.61	0.50				
24	18	DMT2418	630	13.00	16.00	0.61	0.54				
24	20	DMT2420	660	14.00	16.00	0.61	0.57				
24	24	DMT2424	720	16.00	16.00	0.61	0.61				
30	6	DMT306	700	7.00	20.00	0.66	0.36				
30	8	DMT308	739	8.50	20.00	0.66	0.38				
30	12	DMT3012	830	10.00	20.00	0.66	0.42				
30	16	DMT3016	959	12.50	20.00	0.66	0.50				
30	20	DMT3020	995	15.00	20.00	0.66	0.57				
30	24	DMT3024	1060	16.00	20.00	0.66	0.61				
30	30	DMT3030	1323	20.00	20.00	0.66	0.66				
36	12	DMT3612	1205	10.00	23.50	0.74	0.43				
36	16	DMT3616	1350	12.50	23.50	0.74	0.52				
36	24	DMT3624	1498	16.00	23.50	0.74	0.61				
36	30	DMT3630	1767	20.00	23.50	0.74	0.66				
36	36	DMT3636	1900	23.50	23.50	0.74	0.74				
42	12	DMT4212	1410	10.00	29.50	0.82	0.43				
42	24	DMT4224	2270	20.00	27.50	0.82	0.61				
42	30	DMT4230	2425	22.00	29.50	0.82	0.66				
42	36	DMT4236	3000	30.00	30.00	0.82	0.74				
42	42	DMT4242	3175	30.00	30.00	0.82	0.82				
48	24	DMT4824	2870	23.00	32.00	0.90	0.61				
48	30	DMT4830	3050	23.00	32.00	0.90	0.66				
48	36	DMT4836	3900	33.50	32.25	0.90	0.74				
48	42	DMT4842	4100	33.50	33.50	0.90	0.82				
48	48	DMT4848	4250	33.50	33.50	0.90	0.90				

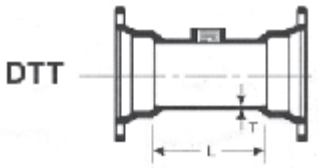
Weights in Pounds, Less Accessories / Dimensions in inches
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

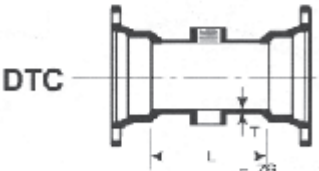
SIGMA

C153 Mechanical Joint Compact Fittings

Tapped Tees and Crosses

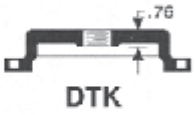
Size	TEE		CROSS		T	L	Tap Size
	Item No.	Wt.	Item No.	Wt.			
3	DTT3	35	DTC3	19	0.33	6.0	2
4	DTT4	45	DTC4	23	0.34	8.0	2
6	DTT6	70	DTC6	37	0.36	10.0	2
8	DTT8	95	DTC8	53	0.38	13.0	2
10	DTT10	130	DTC10	68	0.40	14.0	2
12	DTT12	165	DTC12	88	0.42	17.5	2
16	DTT16	178	DTC16	178	0.50	23.0	2
20	DTT20	259	DTC20	259	0.57	28.0	2
24	DTT24	320	DTC24	320	0.61	32.0	2

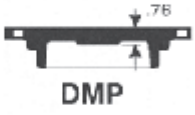


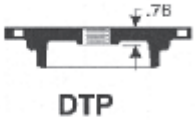


Caps and Plugs

Size	CAP SOLID	CAP TAPPED	Wt.	PLUG SOLID	PLUG TAPPED	Wt.
	Item No.	Item No.		Item No.	Item No.	
3	DMK3	DTK3	8	DMP3	DTP3	8
4	DMK4	DTK4	9	DMP4	DTP4	10
6	DMK6	DTK6	15	DMP6	DTP6	16
8	DMK8	DTK8	22	DMP8	DTP8	26
10	DMKI0	DTK10	32	DMP10	DTP10	36
12	DMK12	DTK12	42	DMP12	DTP12	46
14	DMK14	DTK14	66	DMP14	DTP14	75
16	DMK16	DTK16	92	DMP16	DTP16	95
18	DMK18	DTK18	114	DMP18	DTP18	121
20	DMK20	DTK20	125	DMP20	DTP20	135
24	DMK24	DTK24	166	DMP24	DTP24	175
30	DMK30	DTK30	345	DMP30	DTP30	355
36	DMK36	DTK36	628	DMP36	DTP36	688

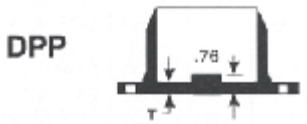






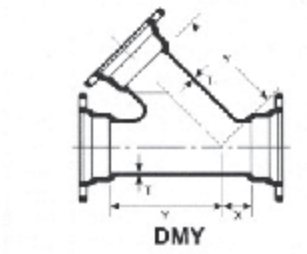
Push In Plugs

Size	SOLID PLUG	TAPPED PLUG	Wt.	T
	Item No.	Item No.		
4	DPP4	PTP4	12	0.43
6	DPP6	PTP6	20	0.47
8	DPP8	PTP8	27	0.49
10	DPP10	PTP10	36	0.52
12	DPP12	PTP12	47	0.54
16	DPP16	PTP16	59	0.60



Wyes (45 degree laterals)

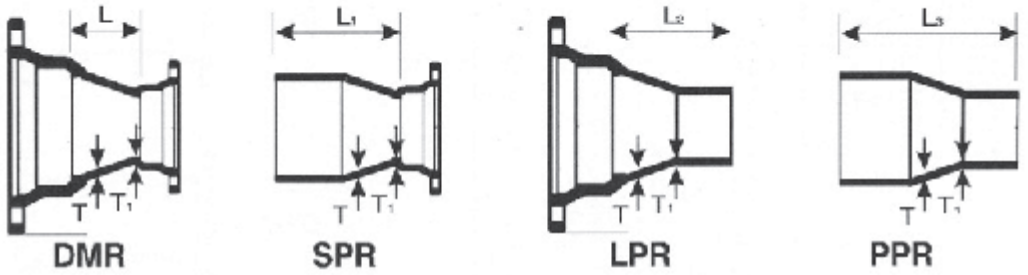
Size		Item No.	X	Y	T	T1	Wt.
Run	Branch						
3	3	DMY33	2.0	8.5	.34	.34	36
4	4	DMY44	2.5	9.5	.35	.35	45
6	4	DMY64	1.5	11.0	.37	.35	67
6	6	DMY66	3.0	13.0	.37	.37	93
8	4	DMY84	0.5	13.0	.39	.35	93
8	6	DMY86	2.0	14.5	.39	.37	113
8	8	DMY88	3.5	16.0	.39	.39	136
10	4	DMY104	0.0	15.0	.41	.35	118
10	6	DMY106	1.0	16.0	.41	.37	136
10	8	DMY108	2.5	17.0	.41	.39	170
10	10	DMY1010	3.5	19.0	.41	.41	199
12	4	DMY124	0.0	16.5	.43	.35	150
12	6	DMY126	1.5	18.5	.43	.37	186
12	8	DMY128	1.5	18.5	.43	.39	188
12	10	DMY1210	3.0	20.0	.43	.41	223
12	12	DMY1212	4.5	22.5	.43	.43	272



SIGMA

Weights in Pounds, Less Accessories / Dimensions in inches
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

C153 Mechanical Joint Compact Fittings



Reducers

Size	Item No.	Wt.	L	Item No.	Wt.	L1	Item No.	Wt.	L2	Item No.	Wt.	L3	T	T1
4 x 2	DMR42	16	2.50	SPR42	14	8.00							0.34	0.30
4 x 3	DMR43	18	3.00	SPR43	17	8.50	LPR43	18	8.50	PPR43	14	14.00	0.34	0.33
6 x 3	DMR63	22	5.00	SPR63	24	10.50	LPR63	19	10.50	PPR63	19	16.00	0.36	0.33
6 x 4	DMR64	24	4.00	SPR64	25	9.50	LPR64	25	9.50	PPR64	22	15.00	0.36	0.34
8 x 4	DMR84	32	5.00	SPR84	30	10.50	LPR84	34	10.50	PPR84	30	16.00	0.38	0.34
8 x 6	DMR86	36	4.00	SPR86	35	9.50	LPR86	32	9.50	PPR86	30	15.00	0.38	0.36
10 x 4	DMR104	46	7.00	SPR104	43	12.50	LPR104	43	12.50	PPR104	46	18.00	0.40	0.34
10 x 6	DMR106	47	5.00	SPR106	46	10.50	LPR106	42	10.50	PPR106	46	16.00	0.40	0.36
10 x 8	DMR108	50	4.00	SPR108	42	9.50	LPR108	50	9.50	PPR108	49	15.00	0.40	0.38
12 x 4	DMR124	58	9.00	SPR124	60	14.50	LPR124	60	14.50	PPR124	58	20.00	0.42	0.34
12 x 6	DMR126	58	7.00	SPR126	58	12.50	LPR126	58	12.50	PPR126	58	18.00	0.42	0.36
12 x 8	DMR128	57	5.00	SPR128	54	10.50	LPR128	55	10.50	PPR128	59	16.00	0.42	0.38
12 x10	DMR1210	61	4.00	SPR1210	59	9.50	LPR1210	59	9.50	PPR1210	59	15.00	0.42	0.40
14 x 6	DMR146	100	9.00	SPR146	100	16.90	LPR146	104	14.50	PPR146	93	22.30	0.47	0.36
14 x 8	DMR148	100	7.00	SPR148	98	14.90	LPR148	98	12.40	PPR148	94	20.30	0.47	0.38
14 x 10	DMR1410	100	5.00	SPR1410	94	12.90	LPR1410	92	10.40	PPR1410	90	18.30	0.47	0.40
14 x 12	DMR1412	100	4.00	SPR1412	90	11.90	LPR1412	92	9.40	PPR1412	88	17.30	0.47	0.42
16 x 6	DMR166	124	11.00	SPR166	125	18.90	LPR166	136	16.50	PPR166	93	24.30	0.50	0.36
16 x 8	DMR168	124	9.00	SPR168	121	16.90	LPR168	128	14.40	PPR168	121	22.30	0.50	0.38
16 x 10	DMR1610	124	7.00	SPR1610	105	15.00	LPR1610	123	12.50	PPR1610	119	20.50	0.50	0.40
16 x 12	DMR1612	112	5.00	SPR1612	109	12.90	LPR1612	108	10.50	PPR1612	99	18.30	0.50	0.42
16 x 14	DMR1614	140	4.00	SPR1614	126	12.00	LPR1614	132	12.00	PPR1614	129	19.70	0.50	0.47
18 x 6	DMR186	194	16.00										0.54	0.36
18 x 8	DMR188	190	13.00	SPR188	170	20.00	LPR188	195	19.50	PPR188	170	27.40	0.54	0.38
18 x 10	DMR1810	195	10.00	SPR1810	165	18.00	LPR1810	185	17.40	PPR1810	160	25.50	0.54	0.40
18 x 12	DMR1812	180	7.00	SPR1812	150	15.50	LPR1812	175	14.00	PPR1812	150	19.50	0.54	0.42
18 x 14	DMR1814	190	6.00	5PR1814	175	15.00	LPR1814	190	15.00	PPR1814	160	23.00	0.54	0.47
18 x 16	DMR1816	193	5.00	SPR1816	170	12.50	LPR1816	190	12.50	PPR1816	145	18.00	0.54	0.50
20 x 6	DMR206	232	22.00	SPR206	201	30.00	LPR206	231	27.50	PPR206	106	35.50	0.57	0.36
20 x 8	DMR208	227	19.00	SPR208	198	27.00	LPR208	227	24.50	PPR208	106	32.50	0.57	0.38
20 x 10	DMR2010	230	14.00	SPR2010	200	22.00	LPR2010	210	19.00	PPR2010	180	27.50	0.57	0.40
20 x 12	DMR2012	205	12.00	SPR2012	170	17.50	LPR2012	205	16.00	PPR2012	190	21.50	0.57	0.42
20 x 14	DMR2014	200	10.00	SPR2014	190	18.00	LPR2014	205	17.90	PPR2014	195	26.00	0.57	0.47
20 x 16	DMR2016	200	7.00	SPR2016	185	13.50	LPR2016	200	13.50	PPR2016	170	19.00	0.57	0.50
20 x 18	DMR2018	225	4.00	SPR2018	200	12.00	LPR2018	225	12.00	PPR2018	190	20.00	0.57	0.54
24 x 6	DMR246	322	28.00	SPR246	284	36.00	LPR246	320	33.50	PPR246	283	41.50	0.61	0.36
24 x 8	DMR248	318	25.00	SPR248	282	33.00	LPR248	316	30.50	PPR248	281	38.50	0.61	0.38
24 x 10	DMR2410	312	22.00	SPR2410	276	30.00	LPR2410	310	27.50	PPR2410	274	35.50	0.61	0.40
24 x 12	DMR2412	305	16.00	SPR2412	275	21.50	LPR2412	290	21.00	PPR2412	240	22.50	0.61	0.42
24 x 14	DMR2414	310	14.00	SPR2414	310	22.00	LPR2414	315	21.90	PPR2414	295	25.00	0.61	0.47
24 x 16	DMR2416	320	12.00	SPR2416	285	17.50	LPR2416	285	17.50	PPR2416	285	23.00	0.61	0.50
24 x 18	DMR2418	308	10.00	SPR2418	300	18.00	LPR2418	310	18.00	PPR2418	290	21.00	0.61	0.54
24 x 20	DMR2420	300	7.00	SPR2420	270	13.50	LPR2420	275	13.50	PPR2420	240	14.00	0.61	0.57
30 x 16	DMR3016	633	30.00	SPR3016	565	39.00	LPR3016	623	39.00	PPR3016	555	48.00	0.66	0.50
30 x 18	DMR3018	658	28.00	SPR3018	590	37.00	LPR3018	635	37.00	PPR3018	567	46.00	0.66	0.54
30 x 20	DMR3020	628	24.00	SPR3020	560	33.00	LPR3020	603	33.00	PPR3020	535	42.00	0.60	0.57
30 x 24	DMR3024	478	10.00	SPR3024	495	24.50	LPR3024	526	24.50	PPR3024	458	33.50	0.66	0.61
36 x 20	DMR3620	975	36.00	SPR3620	874	45.00	LPR3620	950	45.00	PPR3620	849	54.00	0.74	0.57
36 x 24	DMR3624	770	19.00	SPR3624	746	33.00	LPR3624	810	33.00	PPR3624	709	42.00	0.74	0.61
36 x 30	DMR3630	650	15.50	SPR3630	725	24.50	LPR3630	758	24.50	PPR3630	657	33.50	0.74	0.66
42 x 24	DMR4224	1356	40.00	SPR4224	1204	49.00	LPR4224	1319	49.00	PPR4224	1167	58.00	0.82	0.61
42 x 30	DMR4230	1083	20.00	SPR4230	931	29.00	LPR4230	1015	29.00	PPR4230	863	38.00	0.82	0.66
42 x 36	DMR4236	1114	15.50	SPR4236	962	24.50	LPR4236	1013	24.50	PPR4236	861	33.50	0.82	0.74
48 x 30	DMR4830	1779	40.00	SPR4830	1594	49.00	LPR4830	1711	49.00	PPR4830	1526	58.00	0.90	0.66
48 x 36	DMR4836	1641	28.00	SPR4836	1456	37.00	LPR4836	1540	37.00	PPR4836	1355	46.00	0.90	0.74
48 x 42	DMR4842	1426	15.50	SPR4842	1241	24.50	LPR4842	1274	24.50	PPR4842	1089	33.50	0.90	0.82

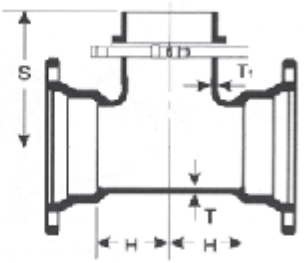
Weights in Pounds, Less Accessories / Dimensions in inches
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

C153 Mechanical Joint Compact Fittings

Tees: MJ x Swivel (Hydrant Tees)

Size	Item No.	H	S	T	T1	Wt
6 x 6	DMH66	5.00	10.00	0.36	0.36	77
8 x 6	DMH86	5.00	11.00	0.38	0.36	89
8 x 8	DMH88	6.50	11.00	0.38	0.38	116
10 x 6	DMH106	5.00	12.50	0.40	0.36	113
10 x 8	DMH108	6.50	12.50	0.40	0.38	129
12 x 6	DMH126	5.00	13.50	0.42	0.36	128
12 x 8	DMH128	6.50	13.50	0.42	0.38	149
14 x 6	DMH146	6.50	15.00	0.47	0.36	211
16 x 6	DMH166	6.50	16.00	0.50	0.36	248
16 x 8	DMH168	7.50	16.00	0.50	0.38	298
18 x 6	DMH186	6.50	17.00	0.54	0.36	300
20 x 6	DMH206	6.50	18.50	0.57	0.36	358
20 x 8	DMH208	8.00	18.50	0.57	0.38	382
24 x 6	DMH246	7.00	19.00	0.61	0.36	458
24 x 8	DMH248	8.00	19.00	0.61	0.38	477

DMH

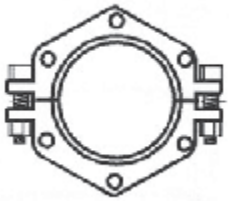


MJ x SWIVEL TEE

Swivel Gland

Size	Item No.	Wt.
4	HR4	8
6	HR6	18
8	HR8	15
10	HR10	18
12	HR12	24

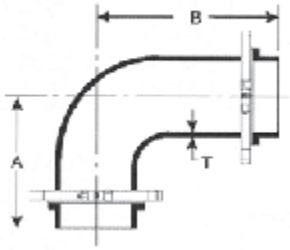
HR



Swivel x Solid 90 Degree Bend

Size	Item No.	A	B	T	Wt.
6	SSB690	10.50	16.00	.36	52
8	SSB890	12.50	18.00	.38	74
10	SSB1090	13.00	20.00	.40	102

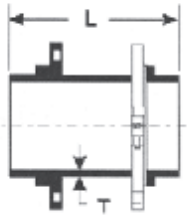
SSB



Swivel x Solid Adapter

Size	Item No.	L	T	Wt.
4	SSA413	13.00	0.34	29
6	SSA613	13.00	0.36	47
6	SSA618	18.00	0.36	58
6	SSA624	24.00	0.36	69
6	SSA630	30.00	0.36	66
6	SSA636	36.00	0.36	75
6	SSA648	48.00	0.36	94
6	SSA660	60.00	0.36	112
6	SSA672	72.00	0.36	131
8	SSA813	13.00	0.38	52
10	SSA1013	13.00	0.40	69
12	SSA1213	13.00	0.42	87

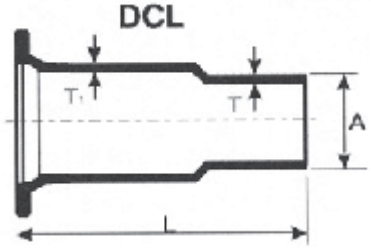
SSA



Dual Cutting-In Sleeves

Size	Item No.	Wt.	T	T1	A	L
3	DCL3	34	0.34	0.36	3.96	20
4	DCL4	50	0.35	0.37	4.80	20
6	DCL6	62	0.37	0.39	6.90	20
8	DCL8	90	0.39	0.41	9.05	20
10	DCL10	105	0.41	0.43	11.10	20
12	DCL12	128	0.43	0.45	13.20	20

DCL

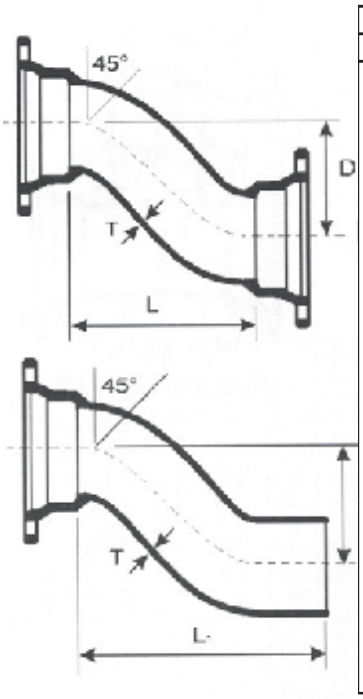


SIGMA

Weights in Pounds, Less Accessories / Dimensions in inches
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

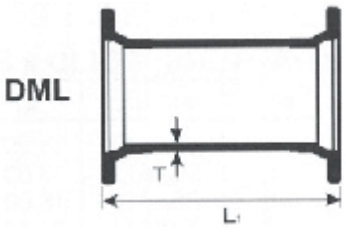
C153 Mechanical Joint Compact Fittings

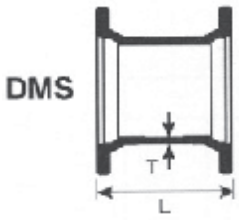
Offsets



MJ x MJ Size	Item No.	Wt.	D	L	L1	T	MJ x PE Item No.	Wt.
3 x 6	DM036	30	6.00	9.00	14.50	0.33	DMQ36	29
3 x 12	DM0312	40	12.00	15.00	20.50	0.33	DMQ312	39
3 x 18	DM0318	49	18.00	21.00	26.50	0.33	DMQ318	48
3 x 24	DM0324	55	24.00	27.00	32.50	0.33	DMQ324	53
4 x 6	DM046	45	6.00	10.00	15.50	0.34	DMQ46	44
4 x 12	DM0412	55	12.00	16.00	21.50	0.34	DMQ412	54
4 x 18	DM0418	65	18.00	22.00	27.50	0.34	DMQ418	63
4 x 24	DM0424	75	24.00	28.00	33.50	0.34	DMQ424	72
6 x 6	DM066	41	6.00	12.00	17.50	0.36	DMQ66	54
6 x 12	DM0612	65	12.00	18.00	23.50	0.36	DMQ612	64
6 x 18	DM0618	75	18.00	24.00	29.50	0.36	DMQ618	72
6 x 24	DM0624	85	24.00	30.00	35.50	0.36	DMQ624	82
8 x 6	DM086	84	6.00	13.00	18.50	0.38	DMQ86	78
8 x 12	DM0812	90	12.00	19.00	24.50	0.38	DMQ812	88
8 x 18	DM0818	100	18.00	25.00	30.50	0.38	DMQ818	96
10 x 6	DM0106	105	6.00	15.00	20.50	0.40	DMQ106	102
10 x 12	DM01012	135	12.00	21.00	26.50	0.40	DMQ1012	132
10 x 18	DM01018	165	18.00	27.00	32.50	0.40	DMQ1018	160
12 x 6	DM0126	124	6.00	17.00	22.50	0.42	DMQ126	112
12 x 12	DM01212	153	12.00	23.00	28.50	0.42	DMQ1212	146
12 x 18	DM01218	190	18.00	29.00	34.50	0.42	DMQ1218	184
12 x 24	DM01224	202	24.00	35.00	40.50	0.42	DMQ1224	194
12 x 30	DM01230	213	30.00	41.00	46.50	0.42	DMQ1230	205

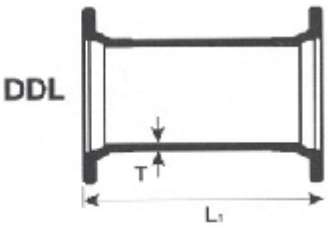
Sleeves





Size	Item No.	Wt.	L	Item No.	Wt.	L1	T
3	DMS3	13	7.50	DML3	18	12.00	0.33
4	DMS4	17	7.50	DML4	20	12.00	0.34
6	DMS6	28	7.50	DML6	33	12.00	0.36
8	DMS8	38	7.50	DML8	46	12.00	0.38
10	DMS10	49	7.50	DML10	62	12.00	0.40
12	DMS12	56	7.50	DML12	76	12.00	0.42
14	DMS14	111	9.50	DML14	140	15.00	0.47
16	DMS16	123	9.50	DML16	170	15.00	0.50
18	DMS18	160	9.00	DML18	200	15.00	0.54
20	DMS20	195	9.00	DML20	255	15.00	0.57
24	DMS24	255	9.00	DML24	335	15.00	0.61
30	DMS30	500	15.00	DML30	640	24.00	0.66
36				DML36	925	24.00	0.74
42				DML42	1150	24.00	0.82
48				DML48	1435	24.00	0.90

Dual Purpose Sleeves



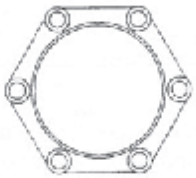
Item No.	L1	T	Wt.
DDL3	23	12	0.33
DDL4	32	12	0.34
DDL6	50	12	0.36
DDL8	65	12	0.38
DDL10	89	12	0.40
DDL12	104	12	0.42

Weights in Pounds, Less Accessories / Dimensions in inches
Ductile Iron Class 350 per ANSI/AWWA C153/A21.53

SIGMA

C153 Mechanical Joint Compact Fittings

Mechanical Joint Accessories



MJ Glands

Size	Item No.	Wt.
2	DG2	2
3	DG3	4
4	DG4	5
6	DG6	6
8	DG8	7
10	DG10	10
12	DG12	15
14	DG14	23
16	DG16	28
18	DG18	30
20	DG20	43
24	DG24	50
30	DG30	85
36	DG36	115
42	DG42	180
48	DG48	275

MJ Gaskets

Size	Item No.	Wt.	Item No.	Wt.
2	MG2			
3	MG3	0.25	TG3	0.50
4	MG4	0.30	TG4	0.60
6	MG6	0.50	TG6	0.75
8	MG8	0.75	TG8	1.10
10	MG10	0.80	TG10	1.30
12	MG12	1.00	TG12	1.65
14	MG14	1.30		
16	MG16	1.45		
18	MG18	1.60		
20	MG20	1.90		
24	MG24	2.10		
30	MG30	2.30		
36	MG36	2.75		
42	MG42	3.20		
48	MG48	3.65		

Gasket/Bolt Packs

Size (in.)	Item No.	Wt. (lb.)
3	MGP3	3
4	MGP4	4
6	MGP6	6
8	MGP8	7
10	MGP10	8
12	MGP12	9

MJ Gland Packs

Size (in.)	Item No.	Wt. (lb.)
2	DGP2	6
3	DGP3	7
4	DGP4	8
6	DGP6	12
8	DGP8	15
10	DGP10	20
12	DGP12	25
14	DGP14	37
16	DGP16	43
18	DGP18	47
20	DGP20	61
24	DGP24	72

Includes: Gland, MJ Gasket, and Standard Tee Bolts & Nuts

Low Alloy, Corrosion Resistant Steel T-Head Bolts

Standard Bolts

Size (in.)	Item No.	Wt. (lb.)
3	MGP3	3
4	MGP4	4
6	MGP6	6
8	MGP8	7
10	MGP10	8
12	MGP12	9

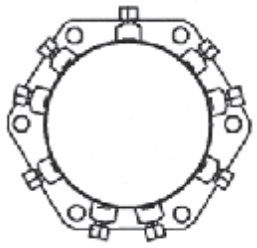
Anti-Rotation Bolts

Size (in.)	Item No.	Wt. (lb.)
3	MGP3	3
4	MGP4	4
6	MGP6	6
8	MGP8	7
10	MGP10	8
12	MGP12	9

MJ Retainer Glands

Pipe Size	Item No.	Wt.	IRON PIPE O.D	Rating (psi)	Qty	Size	Torque (ft-lbs)
3	RMG3	5	3.96	350	4	5/8 X 2	85
4	RMG4	7	4.80	350	4	5/8 X 2	85
6	RMG6	12	6.90	350	6	5/8 X 2	85
8	RMG8	16	9.05	250	9	5/8 X 2	85
10	RMG10	22	11.10	250	16	5/8 X 2	85
12	RMG12	28	13.20	250	16	5/8 X 2	85
14	RMG14	45	15.30	250	20	5/8 X 2	85
16	RMG16	52	17.40	250	24	5/8 X 2	85
18	RMG18	62	19.50	200	24	5/8 X 2	85
20	RMG20	75	21.60	200	28	3/4 X	110
24	RMG24	97	25.80	200	32	3 3/4 X	110
30	RMG30	196	32.00	100	40	3 3/4 X 3	110
36	RMG36	246	38.30	100	48	3/4 X 2-1/2	110
42	RMG42	302	44.50	100	56	3/4 X 2-1/2	110
48	RMG48	380	50.80	100	64	3/4 X 2-1/2	110

RMG



Retainer Packs

Size	Item No.	Wt.
3	RGP3	9
4	RGP4	10
6	RGP6	15
8	RGP8	19
10	RGP10	25
12	RGP12	32

SIGMA

The Total SIGMA Line Card

Mechanical Joint Fittings*

- Compact, DI, 2"–48" (AWWA C153)
- Full Body, DI, 3"–48" (AWWA C110)

Push-On Fittings*

- Compact DI, 4"–24" (AWWA C153), TYTON® Joint
- Full Body, CI/DI, 4"–24" (AWWA C110)

Flanged Fittings

- DI Fittings 2" – 54" (AWWA C110)
- CI Fittings 3" – 12" (AWWA C110)

*Sizes 3-24 Available with AWWA C116 Fusion Bonded Epoxy
All Fittings Products sizes 4-48" available with PROTECTO 401® Ceramic Epoxy Lining for wastewater applications

Mechanical Joint Accessories

- Gland Packs
- Valve Packs
- Bolt Packs
- T Bolts & nuts
- BLUE T Bolts & Nuts

Retainer Glands with Set Screws 3" – 48"
Flange Adapters (ZIP FLANGE®): 4" – 48"
OMNI-SLEEVE™ (all-in-one patented wall sleeve)
Threaded Flanges & Flange Adapters

- 3" – 54" (for DI Pipe Fabrication)
- Drilled and Tapped Flanges
- 250 lb Drilled Flanges
- Anchor Flanges
- MJ Bell Adapters – Threaded Bell + PE Adapter

Municipal Construction Castings

- **Valve Boxes & Service Boxes, risers and extensions**
- **Service Boxes & Curb Boxes**
- **Meter Boxes & Lids**
- **Manhole Covers, Grates, & Frames, Risers Rings**
- **Ornamental & Architectural Castings**

PV-LOK™ (Serration Type Restraints)

PVM Series: Pipe to MJ Bells

- 4" – 48" Restraints for PVC Pipe with DI Pipe OD
- 2" – 12" Restraints for PVC Pipe with Steel Pipe OD

PVP* Series: Spigot PVC Pipe to PVC Pipe Bells

- 4" – 48" Restraints for PVC with DI Pipe OD
- 2" – 12" Restraints for PVC Pipe with Steel Pipe OD

PVPF Series: Pipe to PVC Pressure Fittings

- 4" – 48" Restraints for PVC Pipe with DI Pipe OD
- 4" – 8" Restraints for PVC with Steel Pipe OD

*Also for use with DI pipe in 4" – 16" range

ONE-LOK™ (Wedge-Action Type Restraints)

SLD Series: DI Pipe to MJ Bells

- 3" – 48" Restraints for DI Pipe
- 4" – 12" 20" Available for Large Size CI Pipe OD (SLDM)
- 4" – 12" Split Restraints (SSLD)
- 4" – 24" Harness Restraint for DI pipe joints (SLDH)

SLC Series: PVC Pipe to MJ Bells

- 4" – 36" Restraints for PVC Pipe with DI Pipe OD
- 4" – 12" Restraints for PVC Pipe with Steel Pipe OD

*3" – 24" restraints are available in loose or packaged with MJ gasket and T-head bolts & nuts. 30" – 48" available as a package only.

Extended Products

- Tie-Rod Accessories
  - Duc lugs
  - Threaded Rods
  - Eye Bolts
  - Pipe Hangers and Clamps
- Flange Accessory Kits
- Pipe Lubricant
- Hydraulic Cement
- Tracer Wire
- Detectable Tape

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Maryland	Arkansas	Georgia	Colorado	Wisconsin
Delaware	Missouri	North Carolina	Alaska, Hawaii	Michigan
Virginia	Kansas	South Carolina	Idaho, Utah	Minnesota
New England	New Mexico	Tennessee	Nevada	North Dakota
Eastern Canada	Nebraska	MIssissippi	Washington	South Dakota
Pennsylvania	Oklahoma		Oregon, Wyoming	Ohio
	Iowa		Montana	Kentucky
	Puerto Rico		Western Canada	West Virgina

N-12® WT IB PIPE (PER AASHTO)

It's a revolution that began nearly 15 years ago when ADS pioneered the watertight joint for corrugated polyethylene pipe. The ADS N-12 WT IB pipe (per AASHTO) – our third generation of watertight joint technology – has set the standard in watertight performance.

Today's N-12 WT IB pipe (per AASHTO) incorporates patented technology developed in the aerospace industry. A 2" wide proprietary polymer composite is fused to the outside wall of the integral bell, improving the joint's integrity and tolerance control. A patented gasket, that meets all requirements of ASTM F477, increases its sealing forces as intermittent internal or external hydrostatic pressure occurs. Flared bell and spigot significantly improve ease of installation. N-12 WT IB pipe (per AASHTO) is so advanced in its design that it is easy to put your confidence in for long-term reliability.

APPLICATIONS:

Storm Sewers	Culverts & Cross Drains
Sanitary Sewers	Slope/Edge Drains
Retention/Detention	Mining/Forestry/Industrial
Roof Drainage	Ditch Enclosures

FEATURES:

- 4" – 60" (100 - 1500 mm) diameters available
- Nominal 20 ft. (6m) and 13 ft. (4m) lengths available
- Integral bell and factory-installed gasket
- Joint meets or exceeds ASTM D3212 lab test as well as ASTM F2487 and ASTM F1417 watertight field test
- Exceptional joint strength
- Excellent abrasion and corrosion resistance
- Light weight
- Structural strength that will support H-25 or HL-93 live loads with 1' (0.3 m) minimum cover; 60" (1500 mm) pipe requires 2' (0.6 m) cover for H-25 or HL-93 loads

BENEFITS:

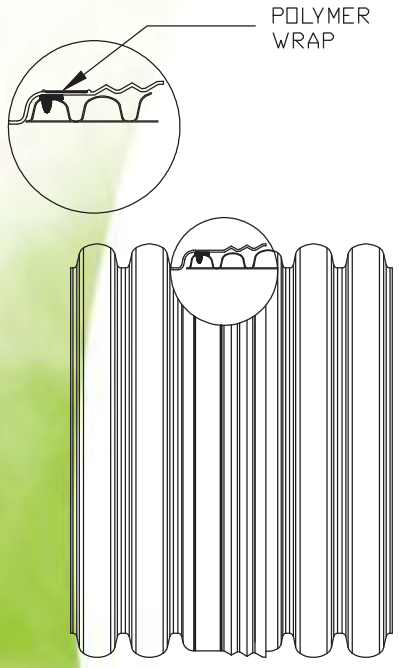
- Variety of diameters and lengths fit any project
- Pipe requires no extra couplers, grout or other sealants for installation due to built-in bell and factory-installed gasket. This means fewer components to risk performance.
- Installation cost savings from lower shipping costs, fewer people, and less heavy equipment required.
- Hydraulic efficiency from smooth interior
- Long-term durability of HDPE

ADS Service: ADS representatives are committed to providing you with the answers to all your questions, including specifications, and installation and more.

ADS N-12® WT IB PIPE (PER AASHTO) SPECIFICATION

SCOPE
This specification describes 4- through 60-inch (100 to 1500 mm) ADS N-12 WT IB pipe (per AASHTO) for use in gravity flow drainage applications.

PIPE REQUIREMENTS
N-12 WT IB pipe (per AASHTO) shall have a smooth interior and annular exterior corrugations.
- 4- through 10-inch (100 to 250 mm) shall meet AASHTO M252, Type S.
- 12- through 60-inch (300 to 1500 mm) shall meet AASHTO M294, Type S or ASTM F2306.
- Manning's "n" value for use in design shall be 0.012.



JOINT PERFORMANCE
4- through 60-inch (100 to 1500 mm) pipe shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

12-through 60-inch (300-1500 mm) diameters shall have a reinforced bell with a bell tolerance device. The bell tolerance device shall be installed by the manufacturer.

FITTINGS
Fittings shall conform to AASHTO M252, AASHTO M294 or ASTM F2306.. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of AASHTO M252, AASHTO M294 or ASTM F2306.

FIELD PIPE AND JOINT PERFORMANCE
To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM F2487. Appropriate safety precautions must be used when field testing any pipe material. Contact the manufacturer for recommended leakage rates.

MATERIAL PROPERTIES
Virgin material for pipe and fitting production shall be high-density polyethylene conforming with the minimum requirements of cell classification 424420C for 4- through 10-inch (100 to 250 mm) diameters, and 435400C for 12- through 60-inch (300 to 1500 mm) diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%. The 12- through 60-inch (300 to 1500mm) virgin pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Sections 9.5 and 5.1 of AASHTO M294 and ASTM F2306, respectfully.

INSTALLATION
Installation shall be in accordance with ASTM D2321 and ADS published installation guidelines, with the exception that minimum cover in trafficked areas for 4- through 48-inch (100 to 1200 mm) diameters shall be one foot (0.3 m) and for 54- and 60-inch (1350-1500 mm) diameters, the minimum cover shall be 2 foot (0.6 m) in single run applications. Backfill for minimum cover situations shall consist of Class 1, Class 2 (minimum 90% SPD) or Class 3 (minimum 90% SPD) material. Maximum fill heights depend on embedment material and compaction level; please refer to Technical Note 2.02. Contact your local ADS representative or visit our website at www.ads-pipe.com for a copy of the latest installation guidelines.

PIPE DIMENSIONS

Nominal Pipe I.D.* in. (mm)	4 (100)	6 (150)	8 (200)	10 (250)	12 (300)	15 (375)	18 (450)	24 (600)	30 (750)	36 (900)	42 (1050)	48 (1200)	54 (1350)	60 (1500)
Nominal Pipe O.D.** in. (mm)	4.8 (122)	6.9 (175)	9.1 (231)	11.4 (290)	14.5 (368)	18 (457)	22 (559)	28 (711)	36 (914)	42 (1050)	48 (1200)	54 (1350)	61 (1549)	67 (1702)
Perforations	All diamters available with or without perforations.													

*Check with sales representative for availability by region.
**Pipe O.D. values are provided for reference purposes only, values stated for 12- through 60-inch are ±1 inch. Contact a sales representative for exact values.

BRO 10582 09/10 MH

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

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BIG BLUE™

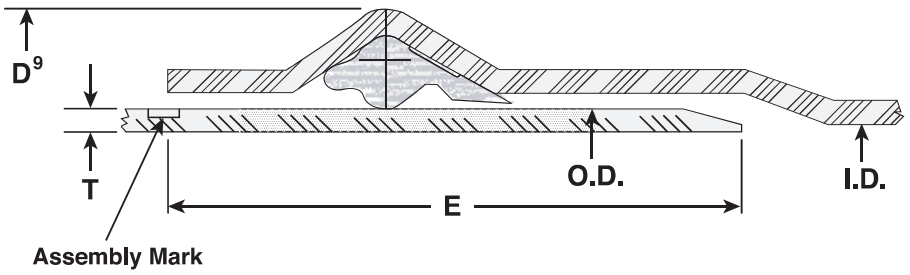
SUBMITTAL AND DATA SHEET

PIPE SIZE (IN)	AVERAGE O.D. (IN)	NOM. I.D. (IN)	MIN. T. (IN)	MIN. E (IN)	APPROX. D[9] (IN)	APPROX. WEIGHT (LBS/FT)
Rated 235 psi (DR 18)						
14	15.30	13.50	0.850	8.00	19.00	26.75
16	17.40	15.35	0.967	9.25	21.62	34.86
18	19.50	17.20	1.083	13.00	24.22	48.95
20	21.60	19.06	1.200	14.50	26.85	54.22
24	25.80	22.76	1.433	12.00	32.06	77.97
Rated 200 psi (DR 21)*						
14	15.30	13.75	0.729	8.00	18.22	23.07
16	17.40	15.64	0.829	9.25	20.72	30.04
18	19.50	17.53	0.929	13.00	23.22	37.27
20	21.60	19.42	1.029	14.50	25.72	46.71
24	25.80	23.19	1.229	12.00	30.72	67.53
30	32.00	28.77	1.524	16.75	38.10	103.71
36	38.30	34.43	1.824	19.02	45.60	152.16
Rated 165 psi (DR 25)						
14	15.30	14.00	0.612	8.00	17.94	19.48
16	17.40	15.92	0.696	9.25	20.41	25.38
18	19.50	17.85	0.780	13.00	22.87	31.99
20	21.60	19.77	0.864	14.50	25.34	39.46
24	25.80	23.61	1.032	12.00	30.27	56.98
30	32.00	29.29	1.280	16.75	37.12	88.49
36	38.30	35.05	1.532	19.02	44.43	128.41
42	44.50	40.73	1.780	22.43	51.62	176.02
48*	50.80	46.49	2.032	24.78	58.93	231.22
Rated 125 psi (DR 32.5)*						
14	15.30	14.30	0.471	8.00	17.48	15.14
16	17.40	16.27	0.535	9.25	19.88	19.63
18	19.50	18.23	0.600	13.00	23.30	24.75
20	21.60	20.19	0.665	14.50	24.38	30.54
24	25.80	24.12	0.794	12.00	29.47	44.11
30	32.00	29.91	0.985	16.75	35.94	68.45
36	38.30	35.80	1.178	19.02	43.01	99.22
42	44.50	41.60	1.369	22.43	49.98	135.49
48	50.80	47.49	1.563	24.78	56.73	178.49

JM Eagle *Building essentials for a better tomorrow™*

PIPE SIZE (IN)	AVERAGE O.D. (IN)	NOM. I.D. (IN)	MIN. T. (IN)	MIN. E (IN)	APPROX. D^9 (IN)	APPROX. WEIGHT (LBS/FT)
Rated 100 psi (DR 41)						
14	15.30	14.52	0.37	8.00	16.07	12.01
16	17.40	16.51	0.42	9.25	18.28	15.63
18	19.50	18.50	0.47	13.00	20.49	19.72
20	21.60	20.49	0.52	14.50	22.70	24.31
24	25.80	24.48	0.62	12.00	27.11	35.10
30	32.00	30.35	0.78	16.75	35.12	54.65
36	38.30	36.30	0.93	19.02	42.04	78.97
42	44.50	42.18	1.08	22.43	48.84	108.19
48	50.80	48.14	1.23	24.78	55.76	142.10
Rated 80 psi (DR 51)**						
18	19.50	18.69	0.382	11.09	20.30	15.92
24	25.80	24.72	0.506	14.90	26.86	28.39
30	32.00	30.67	0.627	16.75	34.50	44.08
36	38.30	36.71	0.751	19.02	41.30	64.32
42	44.50	42.65	0.872	22.43	47.99	88.10
48	50.80	48.69	0.996	24.78	54.78	115.79

* Prior to ordering or specifying, consult JM Eagle™ for product and/or listing availability.
** UL 1285 up to 24"



I.D. : Inside Diameter
O.D. : Outside Diameter
T. : Wall Thickness
D^9 : Bell Outside Diameter
E : Distance between Assembly Mark to the end of spigot.

Product Standard:	ANSI/AWWA C905
Pipe Compound:	ASTM D1784 Cells Class 12454
Gasket:	ASTM F477
Integral Bell Joint:	ASTM D3139
Certifications:	ANSI/NSF Standard 61
	UL Standard 1285 (up to 24")
Pipe Length:	20 feet laying length
Installation:	AWWA C605
	JM Eagle™ Installation Guide

FDT# 00002274

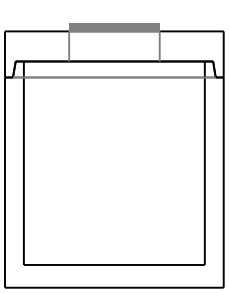
Customer: SUBMITTALS
Job Name: CAMILLA
State - County - City: GA - - CAMILLA

Structure Name: DI 1
Structure Type: Drop Inlet

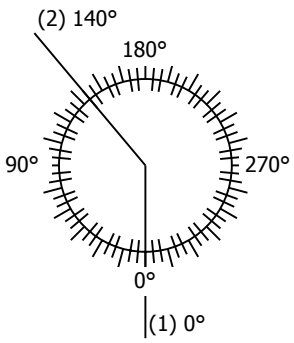
UNDER by 3.75"

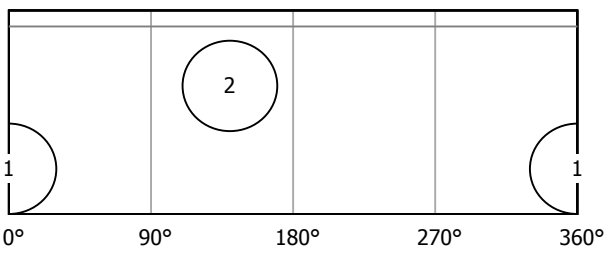
Qty	Unit	Description	Height (ft)	Weight (lbs)
1	Each	24"x24" Grate & Frame: 4608-6235 (2X2)	0.188′	215
1	Each	48" Flat Top w/ 2x2 Hole	0.667′	1867
1	Each	48" Base: 4.5′	4.500′	5279
1		24" Hole		
1		24" Hole		
			5.354′	7361

Position	Elevation	Degree	Pipe	Connector
Rim	172.50′			
Invert 1	167.00′	0°	18" HDPE	24" Hole
Invert 2	168.81′	140°	18" HDPE	24" Hole



Elevation View





Expanded Elevation View

FDT# 00002274

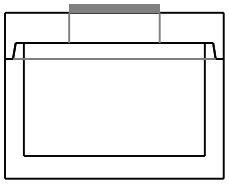
Customer: SUBMITTALS
Job Name: CAMILLA
State - County - City: GA - - CAMILLA

Structure Name: DI 2
Structure Type: Drop Inlet

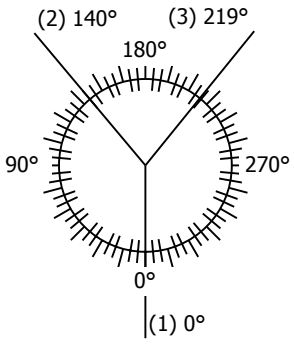
OVER by 0.25"

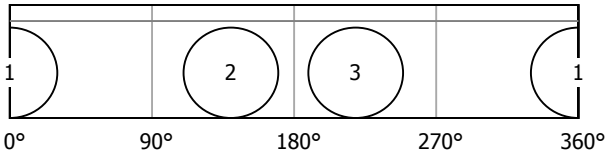
Qty	Unit	Description	Height (ft)	Weight (lbs)
1	Each	24"x24" Grate & Frame: 4608-6235 (2X2)	0.188′	215
1	Each	48" Flat Top w/ 2x2 Hole	0.667′	1867
1	Each	48" Base: 2.5′	2.500′	3544
1		24" Hole		
1		24" Hole		
1		24" Hole		
			3.354′	5626

Position	Elevation	Degree	Pipe	Connector
Rim	167.73′			
Invert 1	164.55′	0°	18" HDPE	24" Hole
Invert 2	164.55′	140°	18" HDPE	24" Hole
Invert 3	164.55′	219°	18" HDPE	24" Hole



Elevation View





Expanded Elevation View

FDT# 00002274

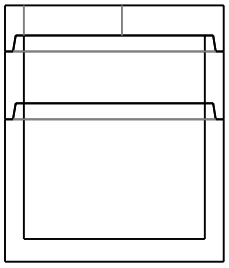
Customer: SUBMITTALS
Job Name: CAMILLA
State - County - City: GA - - CAMILLA

Structure Name: JB 3
Structure Type: Junction Box

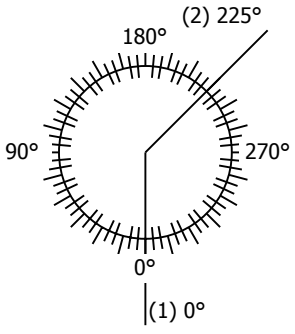
UNDER by 5"

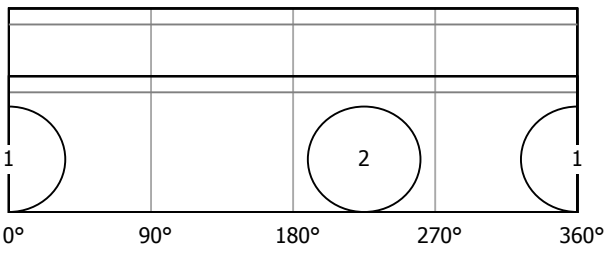
Qty	Unit	Description	Height (ft)	Weight (lbs)
1	Each	26" Ring & Cover: 1259-BD (1033)		130
1	Each	48" Flat Top w/ 26" Hole	0.667′	1867
1	Each	48" Riser: 1.5′	1.500′	1280
1	Each	48" Base: 3′	3.000′	3978
1		28" Hole		
1		28" Hole		
			5.167′	7255

Position	Elevation	Degree	Pipe	Connector
Rim	169.00′			
Invert 1	163.50′	0°	24" Ductile Iron	28" Hole
Invert 2	163.50′	225°	24" Ductile Iron	28" Hole



Elevation View





Expanded Elevation View

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Appendix C. Liner Warranty and Installer Contact Information

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DX2 GEOSYNTEX, INC.

LIMITED WORKMANSHIP WARRANTY

Warranty No: 47707-47724

Project No:

Effective Date: 11/21/14

Purchaser Name: Garrett Consulting Inc.

Address: 417 Overlook Trail

City, State, Zip: Dallas, GA 30132

Project Name: Camilla Wood Preserving

Description: Misc. Liner Repairs

Address: 355 Thomas Street

City, State, Zip: Camilla, GA 31730

DX2 Geosyntex, Inc., (DX2) warrants each LINER SYSTEM installed by DX2 to be free from defects in workmanship. This "Workmanship Warranty" shall be in effect from the date the installation of the LINER SYSTEM is completed and accepted by the Owner for a period of **one year** of normal use in approved applications.

This Limited Warranty does not include damages or defects in LINER SYSTEM resulting from the acts of God, casualty of catastrophe including but not limited to: earthquakes, floods, piercing hail, tornadoes or force majeure. The term "normal use" as used herein does not include, among other things, the exposure of LINER SYSTEM to harmful chemicals, abuse of LINER SYSTEM by machinery, equipment or people, excessive pressures or stress from any source, subsurface or overburdened soil conditions, and total or differential soil settlements and the effect these may have on the liner system.

Should defects or premature loss of use within the scope of the above Limited Workmanship Warranty occur, DX2 Geosyntex, Inc., will at its option, repair or replace the Liner on a pro-rated basis at the then current price in such manner as to charge the Purchaser/User only for that portion of the warranted life which has elapsed since purchase of the material. DX2 Geosyntex, Inc., will have the right to inspect and determine the cause of any alleged defect in the Liner and to take appropriate steps to repair or replace the Liner if a defect exists and is within the term of this Limited Warranty.

Any claim for any alleged breach of this warranty must be made in writing, by certified mail, to David Wise of DX2 Geosyntex, Inc., within (30) days after the alleged defect is first noticed. Should the required notice not be given, the defect and all warranties shall be deemed to have been waived by the Purchaser, and Purchaser shall have no right of recovery against DX2 Geosyntex Inc. In the event repairs and/or replacements are to be effected, said repairs and/or replacements shall not become due until the area subject to repair and/or replacement of Liner is available to DX2 Geosyntex, Inc., in a clean, dry, unencumbered condition. This includes, but is not limited to, the area made available for repair and/or replacement of Liner to be free from all water, dirt, sludge, residuals, and liquids of any kind.

DX2 Geosyntex Inc.'s, liability under this warranty shall in no event exceed the replacement cost of the material and installation sold to the Purchaser for the particular installation in which it failed. Further, under no circumstances shall DX2 Geosyntex, Inc., be liable for any special, direct, indirect, or consequential damages arising from loss due to personal injuries and product liability owing to the failure of the material or installation and no allowance will be made for repairs, replacements, or alterations made by the Purchaser without the express written consent of DX2 Geosyntex Inc.

DX2 Geosyntex, Inc., neither assumes nor authorizes any person other than an officer of DX2 Geosyntex, Inc., to assume for it any other or additional liability in connection with the LINER SYSTEM made the basis of the Limited Warranty. The Limited Workmanship Warranty on the Liner herein is given in lieu of all other possible material warranties, either express or implied, and by accepting delivery of the material, Purchaser waives all other possible workmanship warranties, except those specifically given.

The parties expressly agree that the sale hereunder is for commercial or industrial use only.

DX2 Geosyntex, Inc., Limited Workmanship Warranty is extended to the purchaser/owner and is nontransferable and non-assignable.

Purchaser acknowledges by acceptance that the Limited Workmanship Warranty given herein is accepted in preference to any and all other possible workmanship warranties.

DX2 GEOSYNTEX, INC., MAKES NO WARRANTY OF ANY KIND OTHER THAN THAT GIVEN ABOVE AND HEREBY DISCLAIMS ALL WARRANTIES, BOTH EXPRESS OR IMPLIED, OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

I hereby state I have read and understood the above and foregoing Limited Warranty and agree to such by signing hereunder:

Purchaser Name:

Signature:

Title:

Date:

DX2 Geosyntex, Inc.

David Wise

Title: Vice President

Sworn before me this 21st day of November, 2014.

Signature:

March 21, 2012 Bid #: 4066

RE: Camilla, GA

PROPOSAL FOR INSTALLATION OF rPP LINER

This Proposal for Installation of Membrane Lining System is submitted on behalf of Absorbent & Safety Solutions for the consideration for the project described herein. Absorbent & Safety Solutions is a specialist in the distribution and installation of membrane lining systems. This Proposal is intended to set forth all of the material terms and conditions upon which Absorbent & Safety Solutions will undertake and perform the Project. By executing this Proposal on behalf of Owner, Owner's authorized representative and Owner acknowledge and agree that upon acceptance, this proposal will become a legally binding contract with all material terms and conditions for Absorbent & Safety Solutions to undertake and perform the Project.

1. THE "PROJECT." Absorbent & Safety Solutions offers the following quotation to furnish and install the Liner system which is located in Camilla, GA. The following quote is for the Installation of the Membrane Liner System. Each line includes 560 LF of SS Batten.

Furnish and Install Quote

400,000 SF 36 mil r-LLDPE	**20 yr warranty**
400,000 SF 36mil rPP	**15 yr warranty**
400,000 SF 45mil rPP	**20 yr warranty**

2. TERMS OF PAYMENT. The following are the terms of payment for the Project:

A. Payment of stored material to be paid prior to mobilization. The remaining balance of contract is to be paid once project is complete.

B. Retainage is not permitted under this Proposal.

C. Absorbent & Safety Solutions retains the right to assess a late charge of 1.5% per month on any and all late payments.

D. No back charges shall be permitted under this Proposal.

3. DURATION OF PRICE QUOTE. The price quoted in this Proposal shall remain open for thirty (30) days.

4. CONDITIONS OF PRICE QUOTE.

A. The price quoted in this Proposal is based on one (1) mobilization with liner installation proceeding in a continuous, unencumbered manner. Should additional mobilizations be required, there will be a charge of $3,500 per occurrence.

B. The price quoted in this Proposal is based on installing membrane on a prepared, compacted, DRY AND MAINTAINED subbase, which preparation, compaction, and maintenance shall have been performed by a third party or parties other than Absorbent & Safety Solutions. The subbase is to be dewatered by such third parties to a minimum of one (1) foot below slope liner subgrade surface to allow for a stable, firm, and dry subgrade. Field seaming quality and duration will be compromised if excessive moisture or standing water exists in/on liner subgrade soils.

C. The price quoted in this Proposal is for material F.O.B. job site.

D. The price quoted in this Proposal is for delivery of material during the 1st quarter of 2012 with installation during the 2nd quarter of 2012, weather permitting.

5. SERVICES TO BE PROVIDED BY THIRD PARTIES AND/OR PROVIDED BY OWNER AT NO COST TO ABSORBENT & SAFETY SOLUTIONS. The prices quoted in Section 1 of this Proposal **DO NOT** include the following services and/or charges that will be associated with the Project and must be provided by third parties and/or owner at no cost to Absorbent and Safety Solutions:

A. Owner shall be responsible for digging and backfilling the required anchor trench. In all cases where the liner penetrates below the top of any slope, any embankment above the liner penetration must be removed by owner and/or a third party other than Absorbent & Safety Solutions in order to create a bench to allow for access.

B. Owner shall be responsible for any and all permits, bonds, inspections, engineering services, licenses, permits, impact fees, and taxes necessary for the construction of the Project.

C. Owner shall provide the necessary heavy equipment and a third party operator of such equipment necessary to unload the materials necessary to complete the Project. The weight of the average roll of lining material is between 3,000 to 5,000 pounds.—Unloading of materials shall be performed so as not to damage the materials. Storage of the materials, once unloaded, shall be in accordance with Section 7 herein.

D. Owner shall provide the sand for filling necessary sandbags, and such sand shall be stored within a reasonable distance to each and every location where lining shall be installed. Absorbent & Safety Solutions will provide the sandbags.

E. Owner, either by itself or by using a third party dumpster service, shall provide a container on site for the disposal of all waste material including, but not limited to, cardboard cores, roll wrappers, scrap liners, and other waste materials.

F. Owner shall be responsible for any and all required or necessary testing, including but not limited to, conformance testing, by any outside agency (an independent laboratory testing service can be employed for the anticipated 5 seam samples—1 field seam sample per 500' of field seams created—for destructive peel and shear testing).

G. Owner shall be responsible for preparation, compaction, maintenance, and sterilization of the subbase, as more fully set forth in Section 4.B. herein.

H. Owner shall be responsible for providing surveying stakes to mark the limits of the liner installation.

6. ACCESS TO SITE(S). The Owner shall provide reasonable access in and around the site(s) including, but not limited to, the areas to be lined and all reasonable ingress and egress to and from such areas. In the event the location is not accessible in an unencumbered manner, Absorbent & Safety Solutions will not be responsible for damage to landscaping. Absorbent & Safety Solutions will take reasonable efforts to prevent damage to landscaping in mobilization to the location.

7. STORAGE OF MATERIALS / SECURE WORK ENVIRONMENT.

A. The area designed for storage of materials relating to the Project must be adjacent to and accessible to the site. The material storage area shall be smooth and free of all rock and shall be graded to allow surface water to flow away from such materials. It is critical that the materials be stored in an area that will remain dry.

B. Any and all costs incurred for the repair or cleaning of the materials that were improperly unloaded and/or improperly stored shall be the sole responsibility of Owner.

C. Owner acknowledges and agrees to provide Absorbent & Safety Solutions with a secure work environment and shall reimburse Absorbent & Safety Solutions for any and all damages to materials and/or equipment incurred as a result of vandalism, labor unrest, malicious mischief, Acts of God, or theft.

8. CHANGE ORDERS. Any and all change orders shall be in writing and signed by both Absorbent & Safety Solutions and Owner before Absorbent & Safety Solutions undertakes any changes in work.

9. TIME FOR COMPLETION. The Project shall be completed by Absorbent & Safety Solutions within a reasonable time; provided, however, that Absorbent & Safety Solutions shall not be responsible for delays due to acts of God, inclement weather, strikes, lockouts, material shortages, lack of availability of utility services, fire, storm, theft, vandalism, or other causes beyond the control of Absorbent & Safety Solutions.

10. WARRANTY. Absorbent & Safety Solutions shall provide a one (1) year labor warranty from the time of completion of this Project.

11. INDEMNIFICATION. Owner hereby indemnifies and holds Absorbent & Safety Solutions harmless from any and all claims relating to environmental contamination, including any and all attorneys' fees and costs incurred by Absorbent and Safety Solutions, with the exception of such claims that are proved to have directly resulted from improper installation by Absorbent and Safety Solutions.

12. INDEPENDENT CONTRACTOR RELATIONSHIP. After this Proposal has been executed by Owner's authorized representative, Absorbent & Safety Solutions shall be an independent contractor of Owner, and nothing in this Proposal is intended to or will create any form

of partnership, joint venture, or employment relationship between Absorbent & Safety Solutions and Owner.

13. SUPERSEDES ALL PREVIOUS AGREEMENTS. This Proposal, after it has been executed by Owner's authorized representative, shall supersede any and all previous negotiations and agreements, either oral or in writing, between Absorbent & Safety Solutions and Owner with respect to the Project.

14. CHANGES IN WRITING. After it has been executed by Owner's authorized representative, this Proposal shall not be changed or modified unless such changes or modifications are in writing and signed by Absorbent & Safety Solutions and Owner.

15. UNENFORCEABLE PROVISIONS. After it has been executed by Owner's authorized representative, if any term, covenant, warranty, section, clause, condition, or provision of this Proposal is held by a court of competent jurisdiction to be invalid, void, or unenforceable, the remainder of the provisions of this Proposal shall remain in full force and effect and shall in no way be affected, impaired, or invalidated, and this Agreement shall be construed as if the invalid, void, or unenforceable provisions were omitted.

16. NO WAIVER OF RIGHTS. Failure by Absorbent & Safety Solutions to insist on or enforce any of its rights shall not constitute a waiver of those rights by Absorbent & Safety Solutions, and nothing shall constitute a waiver of Absorbent & Safety Solutions' right to insist on strict compliance with the provisions of this Agreement.

17. HEIRS AND ASSIGNS. After it has been executed by Owner's authorized representative, this Proposal shall be binding on and inure to the benefit of the parties and their respective heirs, personal representatives, devisees, legatees, successors, and assigns.

18. NOTICES. After this Proposal has been executed by Owner's authorized representative, any notice, demand, or other communication (hereinafter collectively referred to as "Notice") required or desired to be given under this Proposal shall be in writing and shall be deemed to have been sufficiently given or served, for all purposes, if sent by certified or registered mail, return receipt requested, postage prepaid, to the following addresses:

AS TO & SAFETY SOLUTIONS:
Absorbent & Safety Solutions, LLC
c/o Lenard Rodgers, Managing Member
1917 Boothe Circle, Suite 131
Longwood, Florida 32750

AS TO OWNER

19. GOVERNING LAW / ATTORNEYS' FEES. This Proposal is being executed and delivered in the state of Florida and shall be governed by and construed and enforced in accordance with the laws of the state of Florida. After it has been executed by Owner's authorized representative, if any dispute arises out of this Proposal, the prevailing party shall have the right to recover reasonable attorneys' fees, costs, and/or expenses from the non-prevailing party, including appellate attorneys' fees, costs, and/or expenses, whether such attorneys' fees, costs, and/or expenses were incurred before or during litigation, even if no formal litigation is ever initiated, or were incurred in any administrative proceeding, arbitration, mediation, or any proceeding in bankruptcy or insolvency.

Camilla, GA

20. COUNTERPARTS. This Proposal may be executed in as many counterparts as necessary, which counterparts may include facsimile signatures.

Absorbent & Safety Solutions appreciates this opportunity to assist you with your Geosynthetic requirements. Please feel free to contact our office at (407) 790-7816 if you have any questions regarding this Proposal.

If you agree to the terms of this Proposal, please sign where indicated below and return this Proposal to Absorbent & Safety Solutions at the address listed on the first page of this Proposal.

Sincerely yours,

Jerry L. Reyome

Absorbent & Safety Solutions, LLC
Production Manager

AGREEMENT TO TERMS OF PROPOSAL

The undersigned authorized representative of Owner acknowledges and agrees that he or she is authorized to execute this Proposal and enter into this legally binding contract on behalf of Owner. Owner hereby agrees to the terms and conditions of this Proposal. By doing so, the undersigned authorized representative of Owner and Owner hereby acknowledge and agree that this accepted Proposal creates a legally binding contract for Absorbent & Safety Solutions, LLC to undertake and perform the Project for Owner.

By: _____

Print Name: _____

Title: _____

Date: _____

Invoice

Absorbent & Safety Solutions

Invoice Date: 6/25/2012

Invoice No. 5140

Due Date: Upon Receive

Project Info.: ***Camilla Wood Preserving Site***
131 East Bennet Street
Camilla, GA 31730
Contact: David Wheeler
Email: dwheelerchmm@gmail.com
Ph. 678-467-1071

Bill To: ***GCI***
417 Overlook Trail
Dallas, GA 30132
Ph. 770-974-9381
Fx. 770-974-2643
Email: dwheelerchmm@gmail.com

Job Description: **Furnish & Install 476,025 sq ft of 36-Mil LLDPE Liner Including battens where required by drawings**

Line #	Item	Description	Total Charge
1	36-mil LLDPE	Stored Material Only for 476,838 sq ft of 36-Mil LLDPE Liner	
		Wire Information:	
		Bank Name: **PNC Bank**	
		ABA#: **267084199**	
		Acct Name: **Absorbent & Safety Solutions, LLC**	
		Account#: **1214717271**	

Sub-Total Amount :

Sales Tax: $ -

TOTAL AMOUNT DUE

Make Checks Payable to: **Absorbent & Safety Solutions, LLC**

Mail to: **1917 Boothe Circle Ste 131 Longwood, FL 32750**

Phone: (407)790-7816 / Toll Free: (855)485-9026 / Fax: (407)790-7401

www.abs-safety.com

RAVEN INDUSTRIES

Product Certification

Product Name: Dura-Skrim K36B **Sales Order # 190008** **Customer: IWT** **Date: June 26, 2012**

DURA°SKRIM K36B is a linear low density polyethylene geomembrane reinforced with a heavy encapsulated 1300 Denier polyester reinforcement. In addition to excellent dimensional stability the reinforcement provides exceptional tear and tensile strength.
DURA°SKRIM K36B are hereby certified to meet all current Raven Industries, Inc. published specifications, form 9/11 EFD 1251.

Note: Any resins used to make this product have met suppliers' certifications

Roll#	Length	Width	Grab Tensile (lb.)	% Elongation	Tongue Tear (lb.)	Puncture (lb.)	Weight lbs/msf
			ASTM D7004	ASTM D7004	ASTM D5884	ASTM D4833	ASTM D5261
5798694	120	200	311 MD 308 TD	32	212 MD 142 TD	117	154
5798695	120	200	311 MD 308 TD	32	212 MD 142 TD	117	154
5804584	120	200	311 MD 309 TD	32	219 MD 160 TD	111	156
5804585	120	200	311 MD 309 TD	32	219 MD 160 TD	111	156
5805228	120	200	290 MD 277 TD	28	206 MD 148 TD	118	154
5805229	120	200	290 MD 277 TD	28	206 MD 148 TD	118	154
5809819	120	200	311 MD 308 TD	32	212 MD 142 TD	117	154
5809820	120	200	311 MD 308 TD	32	212 MD 142 TD	117	154
5810715	120	200	315 MD 316 TD	32	218 MD 166 TD	109	157
5810716	120	200	315 MD 316 TD	32	218 MD 166 TD	109	157

Pamela Weiler

Pamela Weiler
Senior Quality Assurance Technician
Raven Industries - Engineered Films Division

NOVA Chemicals®

Certificate of Analysis

NOVA CHEMICALS CORPORATION
JOFFRE POLYETHYLENE AST
PO Box 5006
JOFFRE AB T4N 6A1
Canada
http://www.novachemicals.com

RAVEN INDUSTRIES INC
1809 E AVE
SIOUX FALLS SD 57104-0359
United States

May 03, 2012

Order No.:	651334	P.O.:	140787
Delivery No:	401453281/10		
Railcar/Container:	NCLX000165		
Shipping Date:	2012.05.04		
Batch:	**JS00043613**		
Product:	FG220-A HOPPER CAR 286		
Inspection Lot:	890000118675		
Mnfg. Date:	2012.02.01		
Quantity:	212,559 LB		

THE FOLLOWING TEST RESULTS WERE OBTAINED:

Characteristic	**Unit**	**Results**
Density	g/cm3	0.9202
Melt Index (190C/2.16kg)	G/10MI	2.30
Melt Flow Ratio(21.6kg/2.16kg)		26.40
Stress Exponent		1.28
Total Gels	ppm	2.98

For Shipment information or quality related issues in North America, please call NOVA Chemicals Customer Service to free at 1.866.BUY.NOVA (1.866.289.6682).
For all other countries, please call your designated Customer Service Specialist or the European Operating Center at +41.26.426.5757.

Contact(s)	**Fax**	**E-mail**
Certs Efd		efdcerts@ravenind.com

NOVA Chemicals®

Certificate of Analysis

NOVA CHEMICALS CORPORATION
JOFFRE POLYETHYLENE AST
PO Box 5006
JOFFRE AB T4N 6A1
Canada
http://www.novachemicals.com

RAVEN INDUSTRIES INC
1809 E AVE
SIOUX FALLS SD 57104-0359
United States

May 28, 2012

Order No.:	656111	P.O.:	141278
Delivery No:	401457075/10		
Railcar/Container:	NCLX003012		
Shipping Date:	2012.05.25		
Batch:	**JS00045238**		
Product:	FG220-A HOPPER CAR 286		
Inspection Lot:	890000129127		
Mnfg. Date:	2012.05.21		
Quantity:	212,559 LB		

THE FOLLOWING TEST RESULTS WERE OBTAINED:

Characteristic	**Unit**	**Results**
Density	g/cm3	0.9195
Melt Index (190C/2.16kg)	G/10MI	2.22
Melt Flow Ratio(21.6kg/2.16kg)		25.70
Stress Exponent		1.27
Total Gels	ppm	1.04

For Shipment information or quality related issues in North America, please call NOVA Chemicals Customer Service to free at 1.866.BUY.NOVA (1.866.289.6682).
For all other countries, please call your designated Customer Service Specialist or the European Operating Center at +41.26.426.5757.

Contact(s)	**Fax**	**E-mail**
Certs Efd		efdcerts@ravenind.com

RAVEN INDUSTRIES

Product Certification

Product Name: Dura-Skrim K36B **Sales Order # 189994** **Customer: IWT** **Date: June 25, 2012 r1**

DURA°SKRIM K36B is a linear low density polyethylene geomembrane reinforced with a heavy encapsulated 1300 Denier polyester reinforcement. In addition to excellent dimensional stability the reinforcement provides exceptional tear and tensile strength.
DURA°SKRIM K36B are hereby certified to meet all current Raven Industries, Inc. published specifications, form 9/11 EFD 1251.

Note: Any resins used to make this product have met suppliers' certifications

Roll#	Length	Width	Grab Tensile (lb.)	% Elongation	Tongue Tear (lb.)	Puncture (lb.)	Weight lbs/msf
			ASTM D7004	ASTM D7004	ASTM D5884	ASTM D4833	ASTM D5261
5799642	120	200	311 MD 309 TD	32%	219 MD 160 TD	111	156
5799643	120	200	311 MD 309 TD	32%	219 MD 160 TD	111	156
5800550	120	200	290 MD 277 TD	28%	206 MD 148 TD	118	154
5800551	120	200	290 MD 277 TD	28%	206 MD 148 TD	118	154
5801457	120	200	290 MD 277 TD	28%	206 MD 148 TD	118	154
5801458	120	200	290 MD 277 TD	28%	206 MD 148 TD	118	154
5802379	120	200	308 MD 306 TD	32%	215 MD 149 TD	116	156
5802380	120	200	308 MD 306 TD	32%	215 MD 149 TD	116	156
5807036	120	200	290 MD 277 TD	28%	206 MD 148 TD	118	154
5798523	45	445	311 MD 308 TD	32%	212 MD 142 TD	117	154

Pamela Weiler

Pamela Weiler
Senior Quality Assurance Technician
Raven Industries - Engineered Films Division

DURA•SKRIM® K30B, K36B & K45B

Scrim Reinforced Polyethylene

RAVEN INDUSTRIES

Product Description

DURA•SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA•SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

Product Use

DURA•SKRIM® K30B, K36B and K45B are used in applications that require exceptional outdoor life and demand high tear strength and resistance to thermal expansion.

DURA•SKRIM® K30B, K36B and K45B are manufactured from a very chemical-resistant, Linear Low Density Polyethylene with excellent cold crack performance.

Size & Packaging

DURA•SKRIM® K30B, K36B and K45B are available in a variety of widths and lengths to meet the project requirements. Large diameter mill rolls are available to assure an efficient seaming process. Factory welded panels are accordion folded and tightly rolled on a heavy-duty core for ease of handling and time saving installation.

DURA-SKRIM® K-SERIES

Containment Liner

Product	Part #
DURA•SKRIM	K30B
DURA•SKRIM	K36B
DURA•SKRIM	K45B

APPLICATIONS

- Waste Lagoon Liners
- Floating Covers
- Daily Landfill Covers
- Modular Tank Liners
- Tunnel Liners
- Remediation Liners
- Earthen Liners
- Interim Landfill Covers
- Remediation Covers
- Landfill Caps
- Erosion Control Covers
- Canal Liners
- Disposal Pit Liner
- Water Containment Ponds
- Heap Leach Liner

DURA•SKRIM® K30B, K36B & K45B

Scrim Reinforced Polyethylene

ISO 9001:2008 CERTIFIED MANAGEMENT SYSTEM

PRO-FORMA DATA SHEET

PROPERTIES	TEST METHOD	DURA♦SKRIM K30B		DURA♦SKRIM K36B		DURA♦SKRIM K45B	
		Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages
Appearance		Black	Black	Black	Black	Black	Black
Thickness		27 mil	30 mil	32 mil	36 mil	40 mil	45 mil
Weight LBS/MSF, (OZ/YD^2)		116 (16.7)	125 (18.0)	136 (19.6)	155 (22.3)	175 (25.2)	200 (28.8)
Construction		Dense scrim reinforced polyethylene					
***Ply Adhesion - lbf/in**	ASTM D 6636	17 or FTB	20 or FTB	21 or FTB	28 or FTB	24 or FTB	32 or FTB
Tensile Strength - lbf/in	ASTM D 7003	165 MD 159 TD	182 MD 170 TD	170 MD 166 TD	186 MD 175 TD	178 MD 170 TD	195 MD 180 TD
Tensile Elongation at Break % (film break)	ASTM D 7003	480 MD 430 TD	540 MD 500 TD	500 MD 450 TD	575 MD 520 TD	520 MD 470 TD	590 MD 550 TD
Tensile Elongation at Break % (scrim break)	ASTM D 7003	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD
Tongue Tear Strength - lbf	ASTM D 5884	185 MD 160 TD	195 MD 185 TD	160 MD 120 TD	180 MD 140 TD	140 MD 120 TD	175 MD 145 TD
Grab Tensile - lbf (scrim break)	ASTM D 7004	260 MD 245 TD	270 MD 255 TD	280 MD 270 TD	300 MD 290 TD	260 MD 245 TD	270 MD 255 TD
Grab Tensile Elongation at Break % (scrim break)	ASTM D 7004	25	32	25	32	25	32
High Pressure OIT (HPOIT)	ASTM D 5885	1000 min	2400 min	1000 min	2400 min	1000 min	2400 min
Puncture Resistance - lbf	ASTM D 4833	85	100	110	120	120	133
Maximum Use Temperature		180° F		180° F		180° F	
Minimum Use Temperature		-70° F		-70° F		-70° F	

*Raven modified QC procedure

PRO-FORMA Sheet Contents:

The data listed in this Pro-Forma data sheet is representative of initial production runs. These values may be revised at anytime without notice as additional test data becomes available.

DURA♦SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA♦SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage.

RAVEN INDUSTRIES

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Email: **efdsales@ravenind.com**
www.ravenefd.com

Limited Warranty available at www.RavenEFD.com

Start Up Test

Project Name:_____ Camilla Preservation Site

Location:__ Camilla, GA

Job Number:_____

Q.A. Tech.:_____Jerry Reyome

Site Supervisor: Jerome

Type of Material: RLLDPE

Sheet Thickness: 36mil

Fusion (ppi)

Min. Peel __ 45

Min. Shear_ 75

Sample Number	Date Welded	Seam Number	Technician ID Number	Machine Type & No.	Start up	Peel ppi	Peel ppi	Peel ppi	Peel ppi	Peel ppi	Shear ppi	Shear ppi	Shear ppi	Shear ppi	Shear ppi	Pass / Fail
1	20-Oct		1	Dual Wedge 1		67	50	48			82	96	120			Pass
2	21-Oct		1	Dual Wedge 1		50	68	64			110	82	88			Pass
3	22-Oct		1	Single wedge 1		61	64	66			88	75	101			Pass
4	23-Oct		1	Single wedge 1		49	78	48			77	97	90			Pass

Destructive Test Log

Project Name:_____ Camilla Preservation Site

Location:__ Camilla, GA

Job Number:_____

Q.A. Tech.:_____Jerry Reyome

Site Supervisor: Jerome

Type of Material: RLLDPE

Sheet Thickness: 36mil

Fusion (ppi)

Min. Peel __ 45

Min. Shear_ 75

Sample Number	Date Welded	Location	Technician ID Number	Machine Type & No.	Temp/Speed	Peel ppi	Peel ppi	Peel ppi	Peel ppi	Peel ppi	Shear ppi	Shear ppi	Shear ppi	Shear ppi	Shear ppi	Pass / Fail
1	20-Oct	on as-built	1	Dual Wedge 1	600/850	108	72	108	81	102	118	176	140	143	111	PASS
2	20-Oct	on as-built	1	Dual Wedge 1	600/850	70	55	57	65	67	82	85	69	87	78	PASS
3	21-Oct	on as-built	1	Dual Wedge 1	600/850	75	67	50	76	46	90	148	104	78	85	PASS
4	21-Oct	on as-built	1	Dual Wedge 1	600/850	73	86	49	83	71	98	106	88	75	77	PASS
5	21-Oct	on as-built	1	Dual Wedge 1	600/850	54	78	44	68	53	81	78	98	85	61	PASS
6	22-Oct	on as-built	1	Single Wedge 1	600/850	63	62	72	80	72	86	79	83	96	82	PASS
7	22-Oct	on as-built	1	Single Wedge 1	650/750	100	66	69	71	71	95	108	117	102	80	PASS
8	23-Oct	on as-built	1	Single Wedge 1	650/750	69	61	56	49	90	109	92	111	112	96	PASS

H #01

PROPOSED STORMWATER
DETENTION POND

EXISTING DITCH #02

EXISTING

TCH #01

TCH #01

PROPOSED STORMWATER
DETENTION POND