FOR THE RECORD

Date: 05.15.2015 (Review Draft)
05.21.2015 (Revised and Final)

From: John Iacoangeli
To: **Karly Wentzloff, Chairperson**
ACME TOWNSHIP PLANNING COMMISSION
6042 Acme Road
Traverse City, MI 49690

Project: **Village at Grand Traverse (VGT-Phase 1 SUP#2009-1P)**
Final Engineering
Stormwater Collection and Treatment System

Issuance

This memorandum is issued to conclude the final review and approval of the stormwater and constructed wetlands facilities consistent with SUP #2009-1P and SUP 2004-11P. Consistent with professional protocols a draft was issued for review and comment to the Applicant on May 15, 2015. Based on the Applicant's review additional narrative was incorporated in the final version that provides additional background and explanation into the process of evaluation and design performed by their technical working group.

Background

The current provision of #9.g. of Permit No. 2009-1P states:

g. The Application will adequately meet the environmental requirements set out in SUP 2004-11P and the Master Plan for purposes of Phase I and review of the same if the following conditions are met to the satisfaction of Acme Township's consultant and staff. As recognized by SUP 2004-11P and the Court of Appeals Opinion, Acme Township shall review these standards for each subsequent Phase and has the right to approve or deny each subsequent Phase for the same.

1. *Final engineered drawings, detailed wetland maintenance/monitoring plans, revised stormwater calculations, hydrograph/retention times for each phase and respective wetland basins shall be provided and approved by Acme Township staff prior to construction* ***and/or*** *issuance of land use permit(s)..*[1]

The stormwater system approved in the SUP was based on the MDEQ BMP (September 1997) "Constructed Wetland Use in Nonpoint Source Control."[2] The description from the MDEQ BMP is attached to the memo. Please take notice of the NOTE that <u>says this</u>

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[1] Page 4; Permit No. 2009-01; The Village at Grand Traverse LLC. ("VGT")
[2] http://www.michigan.gov/documents/deq/deq-wb-nps-conw_250610_7.pdf

BMP should never be used during the construction phase of any project or for sedimentation control. (underline added)

The concept for the constructed wetlands was outlined in a report authored by King & MacGregor entitled, "Stormwater Management Recommendations," dated December 22, 2011[3]. In that report two conceptual designs were presented to explain how the stormwater system would work using a combination of slow release structures, plunge pools, micro pools, grass swales, and wetland mix plant materials. As the title suggests, the 2011 King & MacGregor report did not set forth engineering plans for the construction of the detention basin system, but rather articulated a "conceptual approach" to addressing runoff from the site based on the Michigan Department of Environmental Quality's (MDEQ) "pond/wetland" stormwater BMP.

The applicant's engineer of record, Gourdie Fraser, Inc., submitted preliminary drawings for portions of the overall stormwater system in June 2011. The initial technical review focused on the size and impervious areas of the two watersheds within the development parcel and the size of the basins that would collect the storm water prior to release into the constructed wetland system. Detailed engineering was completed in July and August 2012 to take into account more information about site conditions and development features to assure that the constructed wetland system could be implemented while still complying with the other relevant Township storm water ordinance (storage/detention, discharge rate, etc.) Construction of the east and west basins was done concurrent with installation of the water and sanitary sewer infrastructure due to the amount of earth movement and grading activities that would be taking place on-site as outlined in the SUP.

As noted by the MDEQ BMP the constructed wetland should occur after site stabilization and construction is finished. The final engineering for a constructed wetland is a delicate balance between stormwater flows, release rates into the treatment train, the type and sustainability of wetland plant materials, and soil conditions. In order to accomplish the final engineering for the stormwater system numerous designs backed up with hydro CAD modeling were performed by the Applicant's consultants and reviewed by the Township consultants. It should be understood that a constructed wetland may take several years to fully establish and function as designed. The establishment is contingent on normal growing conditions and annual average precipitation.

In addition to telephone conference calls and e-mail exchanges between technical personnel there were five technical review meetings that involved all or some of the various engineers and environmental scientists. Most of the sessions were attended by professional engineers that were reviewing designs, release rates, and hydro CAD model calculations. These meetings were held November 26, 2014, January 8, 2015, February 19, 2015, March 3, 2015 and May 5, 2015.

[3] Page 690/1003 from the 2009-01P Site Plan Permit

The framework for the design and review, which is based on the Site Plan approval, is divided into two components:

1. The final engineered stormwater system needs to meet the Acme Township Storm Water Control Ordinance (2007-01), and
2. The final engineered stormwater system needs to meet or exceed the MDEQ BMP for a constructed wetland.

As the engineering design and review effort continued, the size, geographic area, and shape of the stormwater facilities (including the constructed wetlands) changed. The final engineered plans (attached) reflect the actual application of the "pond/wetland" stormwater BMP on an existing site where the functionality is the same but the physical form is different than the conceptual drawings included in the SUP document.

As build-out proceeds on the GTTC site the need to re-evaluate the stormwater facilities consistent with the provisions of the SUP and future site plan approvals will be required. A product of this 6-month engineering effort has resulted in a baseline hydro CAD model that can be adjusted to reflect additional impervious surface area as development occurs so that it can be determined if the stormwater facilities can accommodate the runoff or whether new facilities will need to be added.

Personnel involved in the preliminary and final engineering plans include:

Developer		
Gordie Fraser	Terry Boyd, P.E. VGT Engineer of Record	Performed engineering and modeling for storm system
Horizon Environmental	Allen Reilly, Jr. Christopher Miron, P.E. Environmental Scientists and Engineers	Performed technical review of engineering; evaluated hydro CAD modeling and final design details.
King and MacGregor	Matt MacGregor Environmental Scientists	Performed design for the constructed wetlands.
Township		
Beckett & Raeder	John Iacoangeli, AICP Heath Hartt, P.E. Landscape Architects, Planners and Engineers	Performed overall review coordination; performed preliminary engineer review for stormwater and basin sizing.
Gosling Czubak	Robert Verschaeve, P.E. Engineers and Scientists	Review modeling and calculations and performed engineering review for compliance with Township Stormwater ordinance and SUP.

Grobbel Environmental	Chris Grobbel, Ph.D. Environmental Scientists	Performed preliminary review.
Cardno	Adam Crowe, Biologist Kara Grisamer, P.E. Environmental Scientists and Engineers	Performed final review on the wetland construction details and compliance with the MDEQ BMP for a constructed wetland.

Review

Please find attached the following memoranda:

- Robert Verschaeve, P.E., Gosling Czubak, final engineering review, dated May 7, 2015
- Adam Crowe, Cardno, final wetland design review, dated May 15, 2015

Conclusion

Based on the technical review performed by Gosling Czubak and Cardno and their respective observations and recommendations the final engineering for the stormwater system is complete and approved.

The Occupancy Checklist that was developed for Phase 1 (Permit No. 2009-1P) requires that the full storm water facilities system needs to be completed by September 1, 2015. However, if the Developer determines that full construction of the storm water facilities system is in conflict with Section 3.17 and 3.18 of the MDEQ Administrative Consent Order[4], dated April 16, 2015, which limits further disturbance of the construction site they will need to request and seek approval from the Acme Township Planning Commission for a minor amendment from Permit No. 2009-1P.

[4] Pages 10 and 11 of 40: MDEQ Administrative Consent Order entered into April 16, 2015

Technical Memo – Storm Water Review

To: John Iacoangeli - Beckett & Raeder, Inc.

From: Robert Verschaeve, P.E. – Gosling Czubak Engineering Sciences, Inc.

Date: May 7, 2015

RE: Grand Traverse Town Center
Final Engineering Storm Water Review

A review has been completed as requested by Beckett & Raeder, Inc. limited to the storm water control plans and engineering calculations for the storm water detention basins of the Grand Traverse Town Center project in Acme Township. Plans and calculations have been prepared by the design engineer, Gourdie Fraser, in conjunction with Horizon Environmental and reflect modifications to the slow release outlet structures of Basins #1 and #2. Proposed additional treatment tiers to the outlet swales from Basins #1 and #2 are also shown on the plans.

This review is based on the Acme Township Storm Water Control Ordinance No. 2007-01 and the Special Use Permit (SUP) #2009-01P. It is noted the SUP requires "innovative" storm water Best Management Practices (BMP) to remove sediment, nutrients, and pollutants.

The latest drawings provided for review are plan sheets C312 "Basin #1 Detail" and C313 "Basin #2 Detail" revision no. 6 dated 05/05/2015. Engineering calculations for Watersheds #1 and #2 dated 05/05/2015 are also provided. An "Overall Grading Plan", sheet C300 dated 09/05/2012 was previously provided.

It is noted that other proposed modifications regarding vegetation have been prepared and are included in sheets C613 "Basin #1 Planting Plan" and C614 "Basin #2 Planting Plan". Both drawings are Revision #2 dated 05/07/2015 prepared by King and Macgregor. It is understood commentary regarding those plans as well as commentary on the wetlands and treatment components of the storm water system has been prepared by Cardno Inc. for your consideration.

Commentary on Storm water Control Plans and Calculations

The site is divided into watershed #1 and watershed #2 with storm water runoff from each watershed directed to a detention basin servicing that watershed. The engineering calculations presented detail the amounts of impervious area, pervious area, and total area of each watershed. The impervious areas include the paved roads, parking, and water surfaces of each watershed. The Meijer store roof is also included in the impervious area for watershed #1.

Measurements were scaled off of the provided drawings to calculate the areas and found to match what was presented in the calculations. Measurements scaled off the drawings of the detention basins also match values presented in the calculations.

The calculations show design criteria requirements of a storm water detention system as required by the Acme Township Storm water Control Ordinance. This criterion includes "Treatment Volume" and "Flood Control Volume" requirements. The "Treatment Volume" requirement is the volume of runoff from the 1.5 year, 24 hour rainfall event with post development conditions or a minimum of 5,000 cft per impervious acre. A maximum release rate of .05 cfs/impervious acre is also given. In both watersheds, the minimum volume requirement of 5,000 cft per impervious acre controls. For watershed #1, the minimum volume required is 90,950 cft with a maximum release rate of .91 cfs. For watershed #2, the minimum volume required is 27,650 cft with a maximum release rate of .27 cfs. The plans and calculations show both detention basins #1 and #2 are capable of storing the minimum treatment volumes with a release rate below the maximum allowed.

The "Flood Control Volume" requirement is that the basin be sized to detain the 25-year rainfall event from the entire contributing area with a maximum release rate of .13 cfs/acre. Additionally, minimum storage requirements per acre at the maximum release rate are also included via a table based on the "C" factor of the watershed. In both watersheds, it is shown that the minimum volume requirements control. For watershed #1, the minimum required flood control storage volume is 352,634 cft with a maximum release rate of 6.14 cfs. For watershed #2, the minimum required flood control storage volume is 247,511 cft with a maximum release rate of 5.12 cfs. The plans and calculations show both detention basins #1 and #2 capable of storing the minimum flood control volumes with release rates below the maximum allowed.

Bioswales are shown on the C300 drawing that collect runoff from the Meijer store and parking lot and provide pre-treatment of this runoff from watershed 1. Additionally, catch basin sumps along the road provide for localized sediment collection for both watersheds 1and 2. These initial BMP's can be considered as equivalent pre-treatment with respect to sediment forebay criteria in the Ordinance.

It is noted the inlet pipes at Basin #2 are shown below the permanent water level in that basin. It was noted by the design engineer that site constraints at this location necessitated placing these inlet pipe inverts below the permanent water level. Additional hydraulic calculations were provided showing that the pipes will function in this situation and flood volume water levels won't rise above the rim elevations of the drainage structures causing flooding or uncontrolled release of runoff.

Outlet risers are shown over five feet tall in both basins and 36 inches in diameter. Risers over five feet tall are required to be 48 inches in diameter per the Ordinance. The MDEQ Nonpoint Source Best Management Practices Manual BMP for a Wet Detention Basin describes guidelines for outlets. It is noted that outlets "should have an accessible, above-ground cap to allow easy cleaning" and outlets "should be designed so that trapped trash and debris can be easily removed". The outlets provided meet the criteria of this BMP and leaving the current outlets structures in place in this case is acceptable in our professional opinion.

Future Build-Outs

The impervious areas presented in the calculations are only those of the current phase 1 build-out of the development as shown on the C300 plan sheet. It is understood that the developer intends to address storm water from future build outs as they are proposed and would employ advanced analysis, sizing, and controls. The following items are needed going forward:

- *As-built plans for phase 1 are required that accurately show and include the following: the boundary for each watershed, total acreage within each watershed boundary, and built-out impervious area within each boundary for phase 1. Specifically, C300 needs to be updated to reflect the noted items above and the latest C312 and C313 revisions.*

- *As future build-outs are analyzed for storm water, additional pre-treatment techniques should continue to be employed for the individual future build-out phases.*

- *As future build-outs are analyzed for storm water, calculations for the existing basins will need to be updated as well. Further modifications to the outlet structures may be necessary to keep release rates below the maximums allowed.*

Summary

Overall, the detention basins that have been constructed have the capacity to detain the required runoff volumes from the phase 1 build-out to the Ordinance standards. This runoff is also released downstream at rates below the maximum allowed per the Ordinance. As-built plans need to be provided when the proposed modifications are completed and future build-outs need to be analyzed as described.

Grand Traverse Town Center Development Storm water Plan Review

Cardno
Shaping the Future

Document Information

Prepared for	Beckett and Raeder, Inc.
Project Name	Grand Traverse Town Center Storm Water Plan Review
Project Number	j1536061.00
Project Manager	John Iacoangeli/ Beckett & Raeder
	Adam Crowe/ Cardno
Date	05/15/2015

Prepared for:

Beckett and Raeder, Inc.
535 West William, Suite 101, Ann Arbor, MI, 48103

Prepared by:

Cardno
Shaping the Future

Cardno Inc.
11181 Marwill Ave. West Olive, MI, 49460

Table of Contents

Executive Summary

Cardno Inc. was contracted on March 09, 2015 by Beckett and Raeder, Inc. to provide technical review and comment on the storm water detention and treatment plan associated with the Grand Traverse Town Center Development Site (Site). The Site, located in Acme Township, Grand Traverse County Michigan, consists primarily of newly constructed and proposed commercial and retail buildings. Construction activities are ongoing at the Site and much of the project area surface is currently either paved or cleared and graded.

Storm water detention and treatment at the Site relies on two detention basins, the east basin and the west basin, draining 47 acres and 40 acres respectively. These basins including the outflow swales are the focus of the review process undertaken by Cardno. This document will include review narrative, comment and remediation suggestions relating to the functionality, constructability and the state and local regulatory compliance status of the predicted storm water detention plan and vegetation planting plan.

Wetland Habitats Vegetation Restoration and Replacement

In addition to the engineering review of the detention basin and swale design, an examination of the proposed modifications to the final plan regarding wetland creation and vegetation augmentation has been completed and included in this report. Modifications to the initially proposed treatment train design have been put forth in the updated plan revisions dated 05/05/2015. Additionally a project goal of rapid vegetation establishment has been set forth for the Site in spring of 2015 as stated in the Draft Vegetation Augmentation Plan developed by King and MacGregor Environmental Inc. dated 02/23/2015 (VAP). The VAP report includes a detailed description of proposed plant species selection, stocking rate and site location. This report contains comments and recommendations regarding the establishment and continued viability of wetland habitat within the storm water treatment system.

1 Vegetation Component

1.1 Basin Redesign implications on Wetland Habitats

1.1.1 Treatment Train Concept

The Special Use Permit #2009-01P as adopted on 04/03/2012 (SUP) stipulates that “innovative” best management practices (BMPs) must be employed in the design and construction of the storm water treatment systems associated with the Site. In keeping with this condition a treatment train concept has been refined and is represented in the final plan. The treatment train concept takes into consideration the potential benefits of introducing ecological functions and natural constituents into storm water treatment systems to augment engineered control structures.

The incorporation of wetland habitats as a part of the system at the Site has been an integral part of Site plans from the earliest design phases of the project. The original design incorporated a treatment train design consisting of three basins in succession that encompassed designed and maintained wetland habitats with varying depth regimes to control runoff velocity, retention time, treatment of water quality and to provide a diversity in habitat. A report completed by King and MacGregor Environmental Inc. date March 9, 2015 shows a multifaceted comparison of function, footprint and practical water quality benefits between the original preliminary design and the plan dated 09/05/2012. Further plan revisions incorporated on 05/5/2015 increased the presence of each depth regime in both basins. The final design

is an adaptation of the treatment train concept consisting of multiple depth regimes and wetland habitat types.

This section of the report will focus on the functional comparison of these two designs as presented by King and MacGregor Environmental Inc. in their comparison report as well as the additional final plan revisions that resulted from reviewer feedback. The final plan design has been demonstrated to perform the storm water detention function from a runoff volume and flow rate standpoint in compliance with applicable regulations by Hydro Cad calculations and professional opinion. Here we will focus on the establishment, maintenance and function of proposed vegetative components of the wetland habitats.

1.1.2 Deviation from Preliminary Engineering Plans

The intended goal of the most recent plan revisions to both basins (05/05/2015) has been to more closely resemble the approved preliminary plan from the standpoint of surface area per habitat type and the three tier concept. The functional benefits of wetland habitats on water quality and groundwater recharge are directly proportional to the amount of habitat present in most cases. To this end the final plan design with the additional modifications proposed has increased or maintained surface area of each habitat type in both except for semi wet habitats. The semi wet habitat is reduced from preliminary plans because portions of the swale will be converted to high and low marsh habitat.

With the addition of the final plan modifications (05/05/2015) the treatment system will retain the three tier concept. Armored and compacted clay berms will provide impoundment and retention of hydrology sufficient to create a moist soil environment conducive to wetland development. These berms will provide for flow through as well during storm events, while providing a functional benefit of velocity decrease. Within each basin, the wetland cell modifications are proposed within low gradient reaches that will provide the highest probability of successful establishment for these habitat types.

It is our conclusion that the modifications reflected in the final engineering plans and specifications will effectively provide positive treatment functions upon the successful establishment of an intact hydrophytic vegetative community. The wetland cells are in keeping with the treatment train concept as originally proposed in the approval of the special use permit. The wetlands, when established, will provide some phytoremediation function regarding uptake of dissolved and suspended particulate in the Site runoff. Additionally, the retention and infiltration capacity of the constructed wetlands will be significantly greater than the null alternative. With appropriate maintenance and accessibility, the proposed modifications will provide an opportunity to showcase innovative landscape design to the public in an aesthetically pleasing way.

1.1.3 A Word on Establishment of Constructed Wetlands

Wetland habitats are formed naturally where groundwater or surface water resources create a semi permanently saturated or inundated soil condition for long periods during the growing season. The physical conditions required of a wetland can be reproduced through applied engineering practices but the successful establishment of functional wetland habitats requires careful selection of planted species, consistent manipulation of hydrologic conditions and site preparation and maintenance.

In a dynamic system such as a storm water treatment train, hydrologic conditions can vary widely on a seasonal basis presenting a challenge to the establishment of introduced vegetation. Additionally, soil conditions at constructed sites often have minimal or no organic topsoil remaining on site. Many desirable wetland species require a thick, nutrient rich organic topsoil layer to establish and thrive. Conversely, invasive and exotic plant species tend to thrive on moist, disturbed sites such as a constructed storm water basin and swale system.

To maximize the speed of successful hydrophytic plant community establishment, it is suggested that careful and specific attention be given to planting plan revisions. Species selection within various areas at the Site should focus on four things; 1.) species suitability relative to saturation level, native status and

intended function. 2.) species resistance to dissolved and suspended pollutants in the water. 3.) species root system stratification relative to sprawl and depth. The highest degree of soil erosion prevention and resistance to ice scour is achieved when the selected plant species form a stratified root mass network. 4.) Practicability of using bare root or dormant plant materials with a previously developed root system. Once vegetation is well established, a micro climate is allowed to develop which facilitates soil saturation, retention of organic matter and the persistence of wetland conditions. Years one through five are critical in the development of a successful constructed wetland habitat.

It is expected that the proposed modifications to the final plan will be successful through diligent manipulation of hydrology, soil augmentation, species selection and implementation of the five year monitoring program. In compliance with the SUP, a five year wetland monitoring plan supplemented by a maintenance plan that will continue in perpetuity has been agreed to by The Village at Grand Traverse LLC (TVGT) as per an agreement signed July 24, 2013. Specific performance criteria for vegetation establishment and persistence, sediment accumulation thresholds and relative percent native species to invasive should be based on standard MDEQ mitigation monitoring performance criteria modified to suit this application. These criteria should be stated prior to the establishment of year one vegetation to avoid ambiguity in the monitoring and maintenance program.

2 Conclusions

2.1 Environmental Compliance with Special Use Permit

Proposed modifications to the final storm water treatment system are found to be in keeping with the SUP #2009-01P approved March 6, 2012 and meet or exceed MDEQ BMP standards given the successful establishment of hydrophytic plant communities within the system. Based on the findings of Cardno biologists and the recommendations detailed above The treatment train system proposed fulfills the SUP requirement for innovation, functionality, protection of public health and environmental resources. The wetland habitats within the system are expected to provide enhanced function to the system as well as an increase in local biological diversity.

Constructed Wetland Use in Nonpoint Source Control

New BMP, September, 1997

Description

Constructed wetlands are excavated basins with irregular perimeters and undulating bottom contours into which wetland vegetation is purposely placed to enhance pollutant removal from stormwater runoff. Stormwater enters a constructed wetland through a forebay where the larger solids and course organic material settle out. The stormwater discharged from the forebay passes through emergent vegetation which acts to filter organic materials and soluble nutrients. The vegetation can also remove some dissolved nutrients. Constructed wetlands can also be designed to reduce peak stormwater flows.

The use of constructed wetlands can be looked at from two ways. First, a constructed wetland may be used primarily to maximize pollutant removal from stormwater runoff and also help to control stormwater flows. Or, it may be used primarily to control stormwater flows, with increased pollutant removal capabilities.

Secondary benefits of constructed wetland include preservation and restoration of the natural balance between surface waters and ground waters, increased wildlife habitats, and higher property values than if the same area was turned into a rectangular stormwater basin.

The following criteria dictate the feasibility of using a constructed wetland for stormwater treatment: 1) the type of wetland designed and its characteristics; 2) the hydrologic characteristics of the designed wetland; 3) the vegetation planted within the wetland (to utilize and lower nutrients and pollutants); 4) the type and volume of nutrients and pollutants entering the wetland prior to treatment; and 5) soil texture.

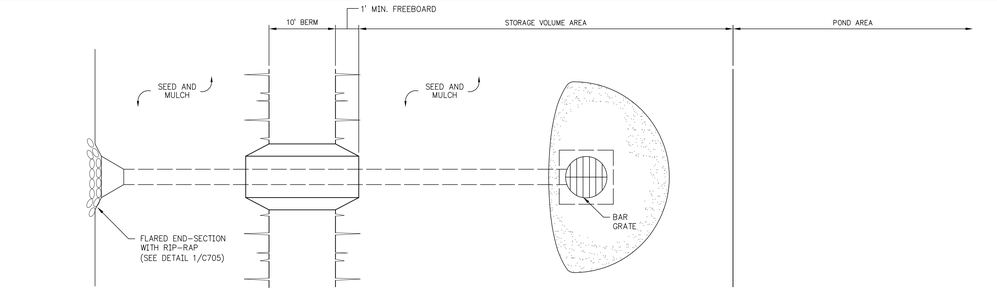
Note: **This BMP should never be used during the construction phase of any project or for sedimentation control.** Runoff from construction sites is typically very sediment-laden. Such runoff will choke the constructed wetland and may render it useless in a short amount of time. **Existing natural wetland systems should *never* be destroyed to construct another wetland habitat for stormwater treatment.**

Other Terms Used to Describe

Wetlands include fens, bogs, swamps and marshes.

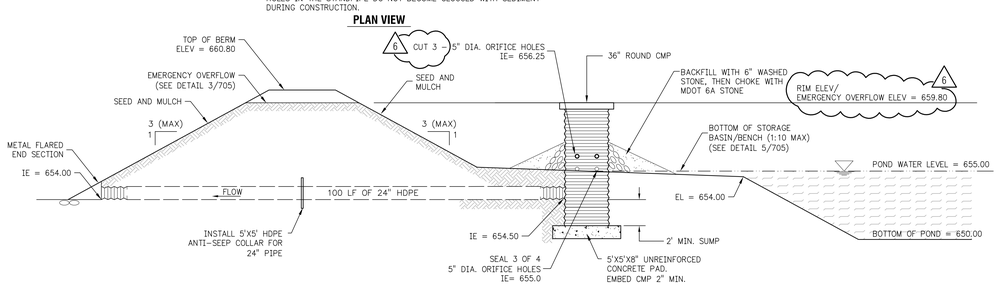
Pollutants Controlled and Impacts

In addition to trapping sediment, nutrients and soluble pollutants may be taken up and assimilated into the plant tissues where they are held until harvesting or the annual fall die-back.



NOTE: EXTREME CARE MUST BE EXERCISED TO ENSURE THAT THE OUTLET HOLES IN THE STANDPIPE DO NOT BECOME CLOGGED WITH SEDIMENT DURING CONSTRUCTION.

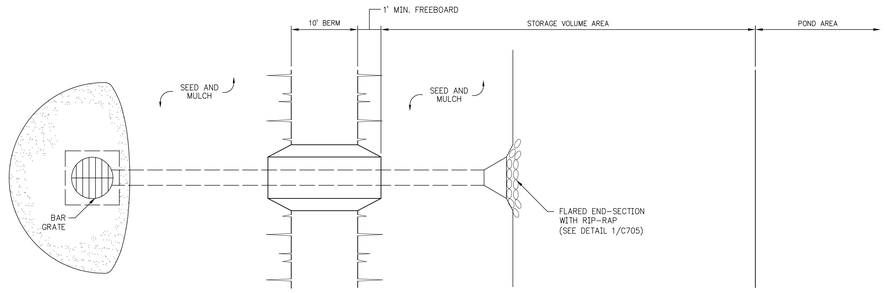
PLAN VIEW



PROFILE VIEW

1 / C312 BASIN #1 SLOW RELEASE DETAIL

NO SCALE



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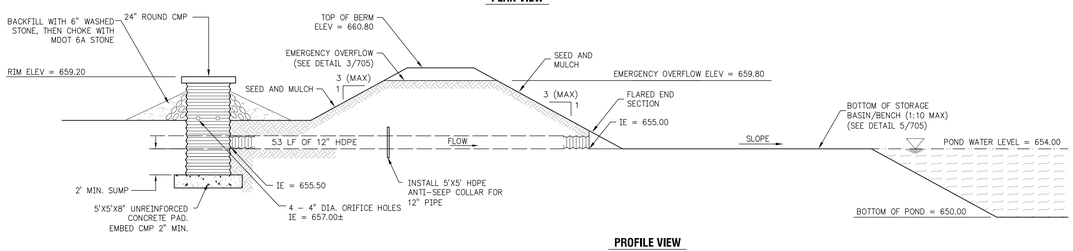
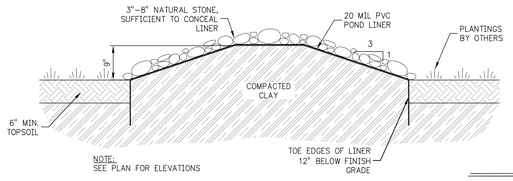
PLAN VIEW



PROFILE VIEW

2 / C312 TEMPORARY POND RELEASE DETAIL

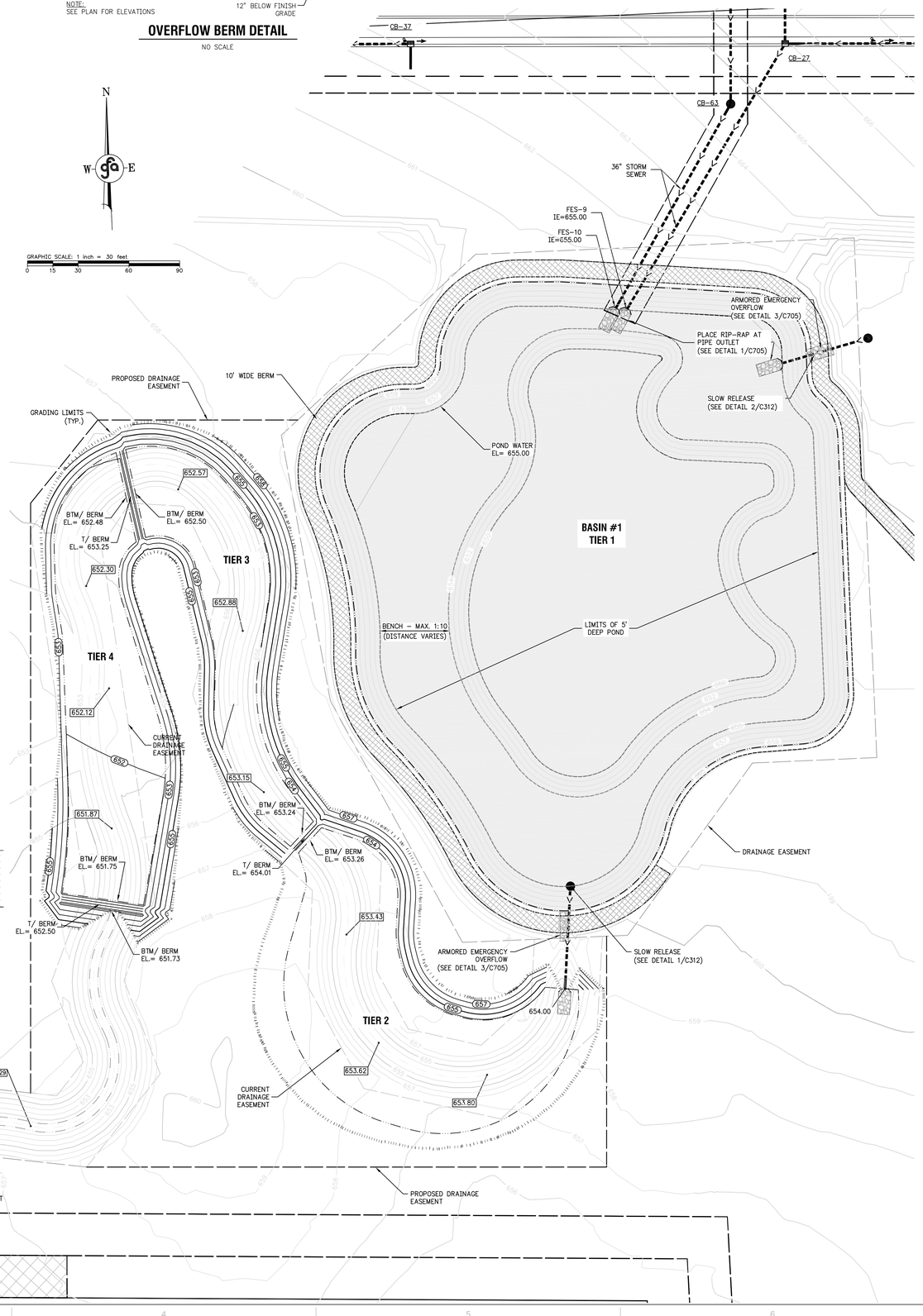
NO SCALE



NOTE:
SEE PLAN FOR ELEVATIONS

OVERFLOW BERM DETAIL

NO SCALE



GENERAL NOTES

1. REFER TO SHEET C100 FOR BENCHMARK INFORMATION.

GRAND TRAVERSE TOWN CENTER

ACME TOWNSHIP, GRAND TRAVERSE COUNTY, MI

VILLAGE AT GRAND TRAVERSE, LLC
CINCINNATI, OH 45209-1955
3805 EDWARDS ROAD, SUITE 700
(513) 241-5800

REVISION NO.	REVISION	REV. DATE
4	SLOW RELEASE REVISIONS	02/25/2015
5	GC REVIEW COMMENTS	04/15/2015
6	GOSLING CZUBAK REV.	05/05/2015
3	CREATE TIERED DRAINAGE SWALE	02/13/2015

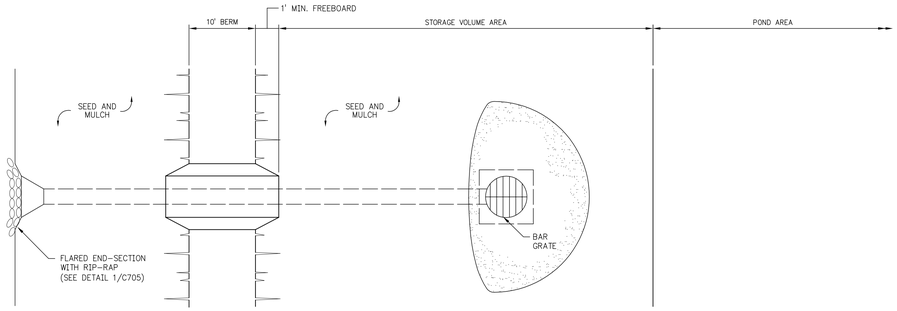
CONSTRUCTION MANAGED BY:

DESIGNED BY:

Gourdie-Fraser
Municipal | Development | Transportation
123 W Front Street Traverse City, Michigan 49684
phone: (231) 946-5874, fax (231) 946.3703

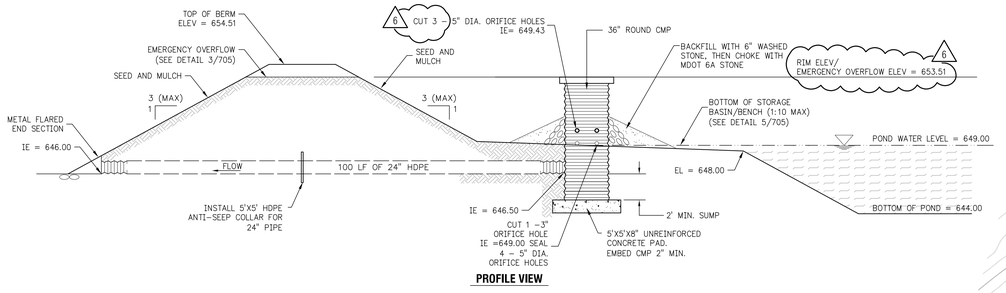
BASIN #1 DETAIL

DRAWN BY	ISSUE	ISSUE DATE	SHEET NO.
TGR	-	-	C312
CHECKED BY	MANAGER	GFA PROJECT NO.	
TLMB	T. BOYD P.E.	12102	



NOTE: EXTREME CARE MUST BE EXERCISED TO ENSURE THAT THE OUTLET HOLES IN THE STANDPIPE DO NOT BECOME CLOGGED WITH SEDIMENT DURING CONSTRUCTION.

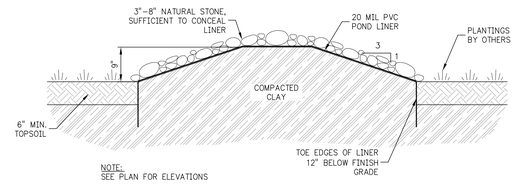
PLAN VIEW



PROFILE VIEW

1 C313 **BASIN #2 SLOW RELEASE DETAIL**

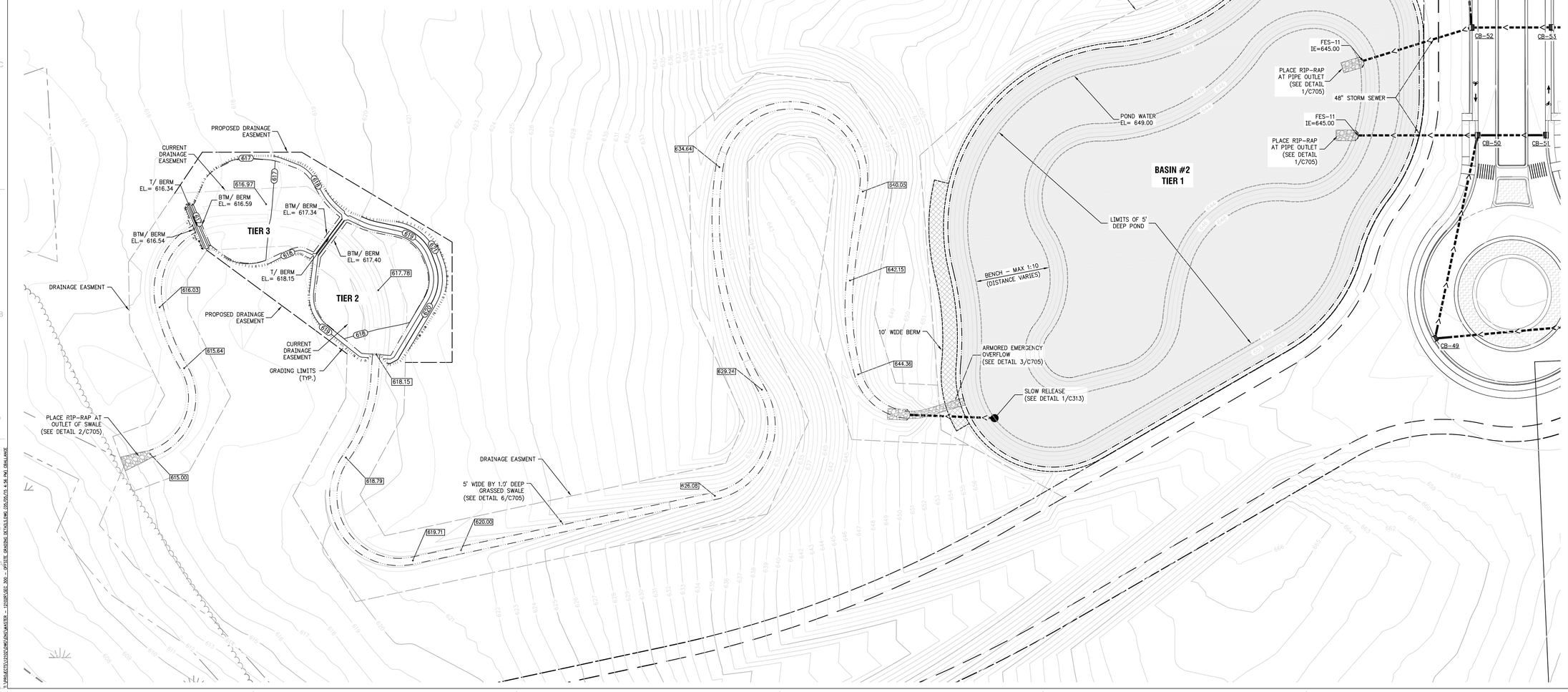
NO SCALE



NOTE:
SEE PLAN FOR ELEVATIONS

OVERFLOW BERM DETAIL

NO SCALE



GENERAL NOTES

1. REFER TO SHEET C100 FOR BENCHMARK INFORMATION.

GRAND TRAVERSE TOWN CENTER

ACME TOWNSHIP, GRAND TRAVERSE COUNTY, MI

VILLAGE AT GRAND TRAVERSE, LLC
CINCINNATI, OH 45209-1955
3805 EDWARDS ROAD, SUITE 700
(513) 241-5800

REVISION NO.	REVISION	REV. DATE
4	SLOW RELEASE REVISIONS	02/27/2015
5	GC REVIEW COMMENTS	04/15/2015
6	GOSLING CZUBAK REV.	05/05/2015
3	SLOW RELEASE REVISIONS	02/25/2015

CONSTRUCTION MANAGED BY:

DESIGNED BY:

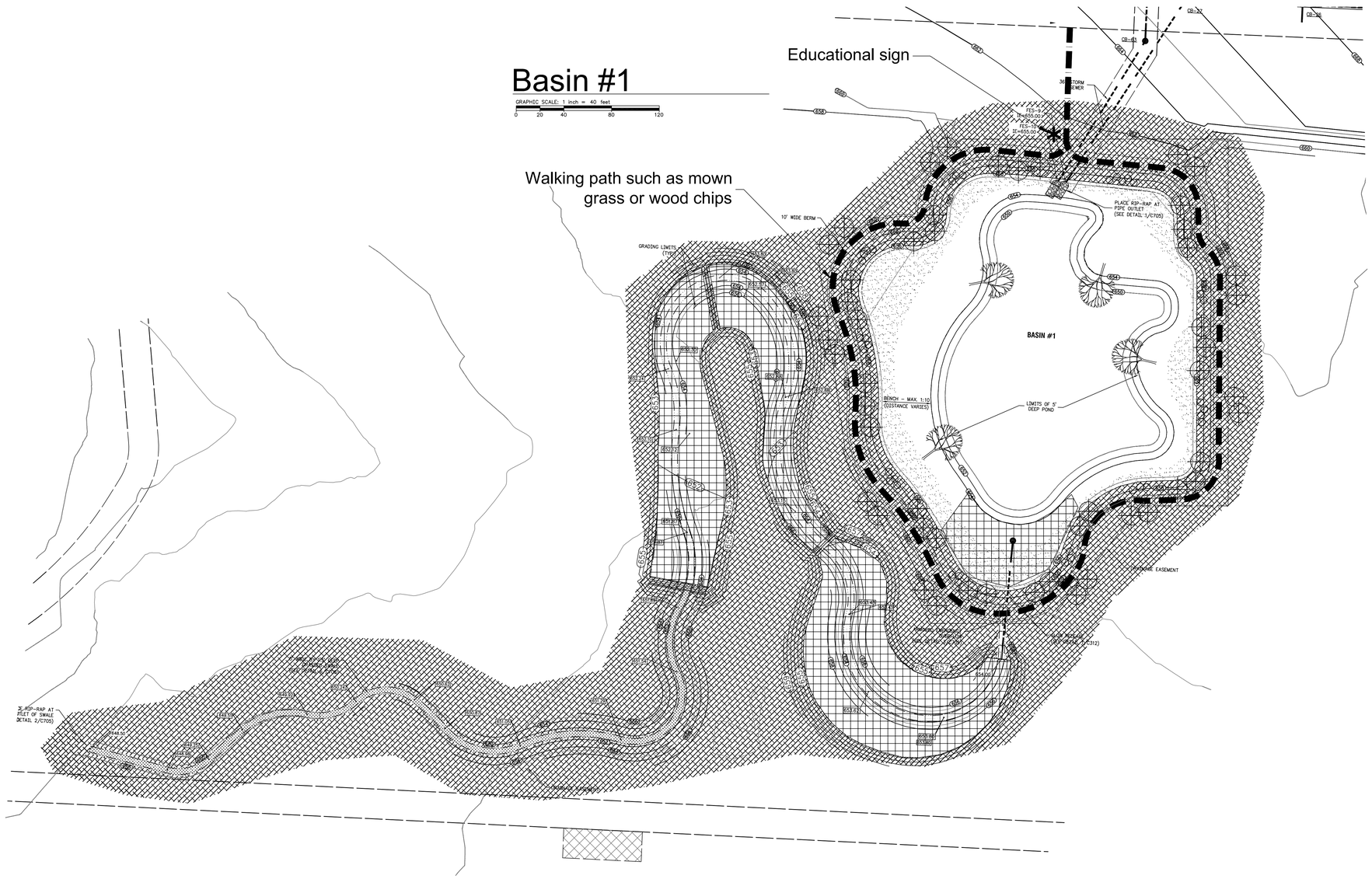
Gourdie-Fraser
Municipal | Development | Transportation
123 W Front Street Traverse City, Michigan 49684
phone: (231) 946-5874, fax (231) 946.3703

BASIN #2 DETAIL

DRAWN BY	ISSUE	ISSUE DATE	SHEET NO.
TGR	-	-	C313
CHECKED BY	MANAGER		GFA PROJECT NO.
TLMB	T. BOYD P.E.		12102

Basin #1

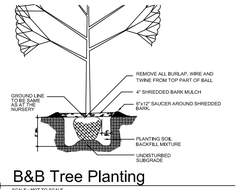
GRAPHIC SCALE: 1 inch = 40 feet
0 20 40 80 120



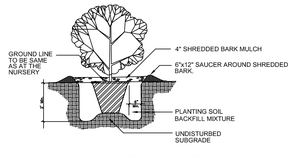
Key

Refer to seed and planting schedule for species.

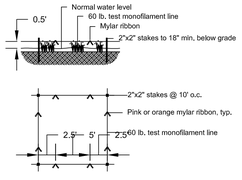
- HERBACEOUS PLANTS
- BASIN SHELF SEED MIX:
- UPLAND BUFFER SEED MIX:
- GRASSED SWALE SEED MIX:
- TREES
- SHRUBS



B&B Tree Planting
SCALE : NOT TO SCALE



Containerized Shrub Planting
SCALE : NOT TO SCALE



Notes:
1. Stagger monofilament line height at 6" and 12" above water level in perpendicular directions across grid.
2. Extend grid 2.5' min. beyond vegetation to be protected

Goose Grid Detail
SCALE: NOT TO SCALE

King & MacGregor Environmental Inc.
2520 Woodmeadow SE
Grand Rapids, MI 49546
Phone: (616) 957-1231
43050 Ford Road, Suite 130
Canton, MI 48187
Phone: (734) 354-0594

KME Project No. 11031

GENERAL NOTES

1. REFER TO SHEET C100 FOR BENCHMARK INFORMATION.

GRAND TRAVERSE TOWN CENTER

ACME TOWNSHIP, GRAND TRAVERSE COUNTY, MI

VILLAGE AT GRAND TRAVERSE, LLC
CINCINNATI, OH 45209-1955
3805 EDWARDS ROAD, SUITE 700
(513) 241-5800

REVISION NO.	REVISION	REV. DATE
0	FOR CONSTRUCTION	08/30/2012
1	REVISED PER BECKETT & RAEDER REVIEW	09/05/2012
2	REVISED BASIN PLANTING PLAN	05/07/2015
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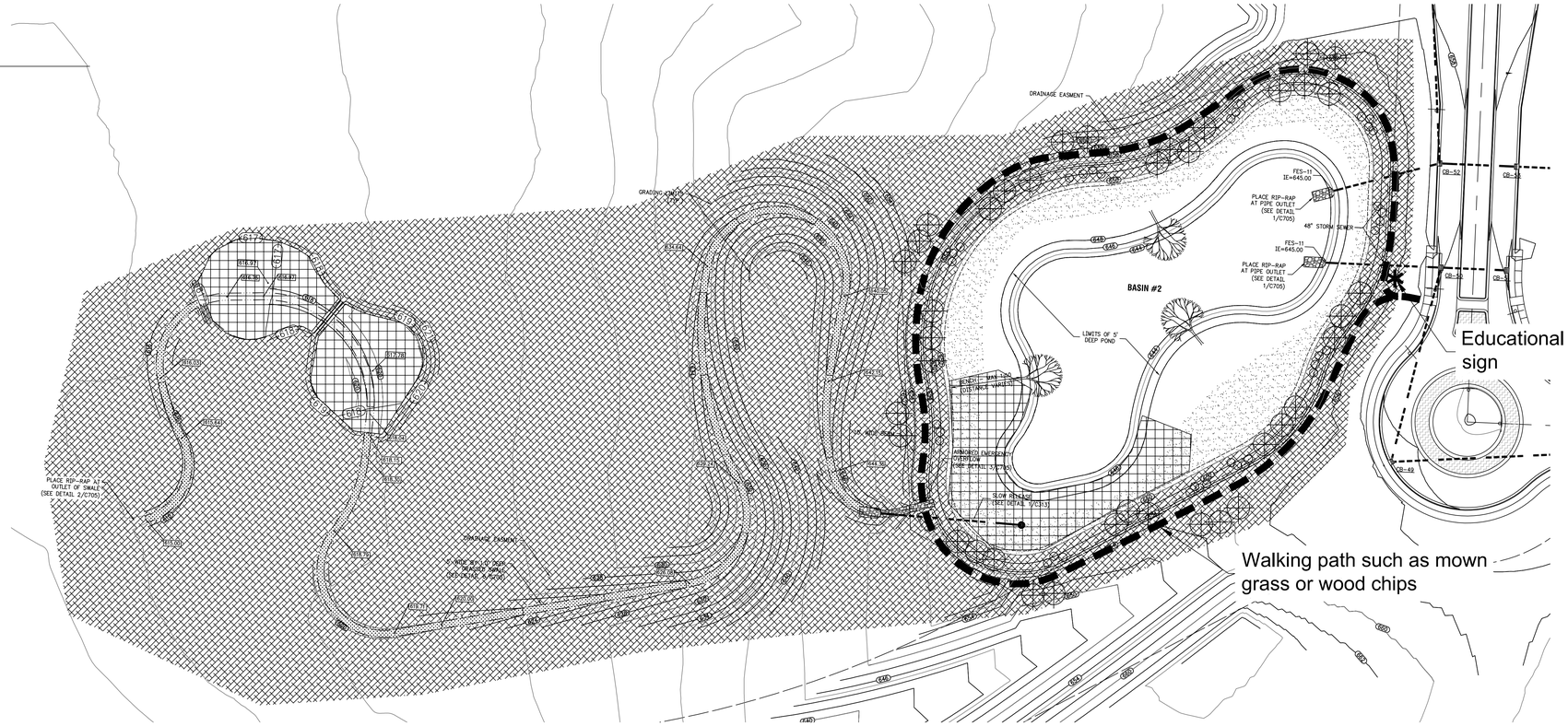
BASIN #1 PLANTING PLAN

DRAWN BY	ISSUE	ISSUE DATE	SHEET NO.
TGR	.	.	C613
CHECKED BY	MANAGER		GFA PROJECT NO.
TLMB	T. BOYD P.E.		12102

Basin #2

GRAPHIC SCALE: 1 inch = 40 feet
0 20 40 80 120



GENERAL NOTES

1. REFER TO SHEET C100 FOR BENCHMARK INFORMATION.

BASIN SHELF SEED MIX:

0.9 acres

FORBS

SPECIES	COMMON NAME	RATE (PLS OZ./AC.)
Alisma plantago-aquatica	Mud Plantain	2.5
Aster novae-angliae	New England Aster	4.0
Bidens cernua	Nodding Bur Marigold	4.0
Bidens frondosa	Common Beggarstick	4.0
Helenium autumnale	Sneezeweed	2.5
Iris virginica shrevei	Southern Blue Flag	8.0
Sagittaria latifolia	Arrowhead	2.0
Verbena hastata	Blue Vervain	4.0

GRAMINOIDS

SPECIES	COMMON NAME	RATE (PLS OZ./AC.)
Carex comosa	Bristly Sedge	4.0
Carex lacustris	Lake Sedge	4.0
Carex lupuliformis	Knobbed Hop Sedge	4.0
Elymus virginicus	Virginia Wild Rye	16.0
Glyceria striata	Fowl Manna Grass	4.0
Leersia oryzoides	Rice Cut Grass	16.0
Scirpus acutus	Hardstemmed Bulrush	4.0
Scirpus atrovirens	Dark-green Bulrush	4.0
Scirpus cyperinus	Wool Grass	4.0
Scirpus pungens	Three-square Bulrush	4.0
Scirpus fluviatilis	River Bulrush	4.0
Scirpus validus	Great Bulrush	2.0
Sparganium eurycarpum	Giant Burreed	16.0
Typha latifolia	Broadleaf Cattail	4.0
	Total:	121.0

Notes:
1. Seed mix to be sown over areas depicted on the plans. These areas are approximately from normal water level to 6 inches below normal water level.
2. Wetland consultant shall review boundaries of seeding area prior to sowing.
3. Seed shall not be sown over standing water. Pumping to lower water level in basins maybe required prior to sowing.
4. Seed shall be raked, disked, or otherwise mechanically incorporated into the topsoil immediately following sowing.

GRASSED SWALE SEED MIX:

0.3 acres

FORBS

SPECIES	COMMON NAME	RATE (PLS OZ./AC.)
Alisma plantago-aquatica	Mud Plantain	1.0
Asclepias incarnata	Swamp Milkweed	2.0
Aster novae-angliae	New England Aster	0.5
Eupatorium maculatum	Joe Pye Weed	0.5
Iris virginica shrevei	Southern Blue Flag	4.0
Lobelia cardinalis	Cardinal Flower	0.3
Lobelia siphilitica	Great Blue Lobelia	0.5
Sagittaria latifolia	Common Arrowhead	0.8
Verbena hastata	Blue Vervain	1.5

GRAMINOIDS

SPECIES	COMMON NAME	RATE (PLS OZ./AC.)
Andropogon gerardii	Big Bluestem	12.0
Carex comosa	Bristly Sedge	2.0
Carex lupulina	Common Hop Sedge	2.0
Carex stipata	Common Fox Sedge	2.0
Elymus virginicus	Virginia Wild Rye	10.0
Glyceria striata	Fowl Manna Grass	2.0
Panicum virgatum	Switch Grass	5.0
Scirpus atrovirens	Dark-green Bulrush	3.0
Scirpus cyperinus	Wool Grass	3.0
Spartina pectinata	Cord Grass	3.0

HERBACEOUS PLANTS:

SPECIES	COMMON NAME	QUANTITY
Alisma plantago-aquatica	Water Plantain	
Carex lacustris	Lake Sedge	
Leersia oryzoides	Rice Cut Grass	
Sagittaria latifolia	Arrowhead	
Scirpus fluviatilis	River Bulrush	
Scirpus pungens	Three-square bulrush	
Scirpus validus	Great Bulrush	
Sparganium eurycarpum	Giant Burreed	
Typha latifolia	Broadleaf Cattail	
	Total	10,944

1. A minimum of six species shall be selected from the list provided based on availability at time of planting.
2. Quantity of individuals of each species selected shall be approximately equal number of species.
3. Form shall be plug or tuber, depending upon species.
4. Layout of individual planting areas to be determined by Wetland Consultant in the field.
5. Plants shall be protected by Goose Grid immediately following installation.

TREES:

SPECIES	COMMON NAME	QUANTITY
Acer rubrum	Red Maple	18
Acer saccharum	Sugar Maple	18
Celtis occidentalis	Hackberry	18
Platanus occidentalis	Sycamore	18
Pinus strobus	White Pine	18
	Total	90

Notes: trees to be 2.5" caliper balled and burlapped stock. Install in locations shown with each grouping being of a single species.

SHRUBS:

SPECIES	COMMON NAME	QUANTITY
Amelanchier laevis	Serviceberry	27
Aronia prunifolia	Chokeberry	27
Cornus stolonifera	Red Twig Dogwood	27
Physocarpus opulifolius	Ninebark	27
Sambucus canadensis	American Elder	27
	Total	140

Notes: shrubs to be 2 gallon sized containerized stock. Install in locations shown with each grouping being a of single species.

UPLAND BUFFER SEED MIX:

Final Disturbed Area Adjacent to Basins

SPECIES	COMMON NAME	RATE (LBS/AC.)
Andropogon scoparius	Little Bluestem	3.000
Avena sativa	Seed Oats	20.000
Elymus virginicus	Virginia Wild Rye	1.000
Asclepias syriaca	Common Milkweed	0.063
Aster ericoides	Heath Aster	0.031
Aster nova-angliae	New England Aster	0.250
Desmodium canadense	Showy Tick Trefoil	0.031
Echinacea pallida	Pale Purple Coneflower	0.063
Echinacea purpurea	Purple Coneflower	0.375
Heliopsis helianthodes	False Sunflower	0.125
Lespedeza capitata	Roundheaded Bush Clover	0.125
Liatris spicata	Spiked Gayfeather	0.125
Monarda fistulosa	Bergamot	0.031
Parthenium integrifolium	Wild Quinine	0.375
Penstemon digitalis	Foxglove Beardtongue	0.063
Petalostemum purpureum	Purple Prairie Clover	0.250
Ratibida pinnata	Yellow Coneflower	0.250
Rudbeckia hirta	Black-eyed Susan	0.375
Rudbeckia subtomentosa	Sweet Coneflower	0.063
Solidago rigida	Rigid Goldenrod	0.375
	TOTAL	26.970

HABITAT STRUCTURES:

Whole trees to be installed horizontally. Trees shall be a minimum of 20 feet long and 12 inches in diameter at breast height (dbh). Do not trim down fine structure of limbs. At least 50% of entire structure shall extend 6 inches above projected high water level.

Notes:
1. Signs shall be of a material suitable to withstand normal climatic conditions.
2. Signs to be mounted in locations shown on the plans
3. Signs to be 24" tall by 36" wide.
4. Final graphic presentation subject to modifications that do not substantively impact the information described.

Grand Traverse Town Center Logo

Our commitment to preserving the quality of our natural resources...

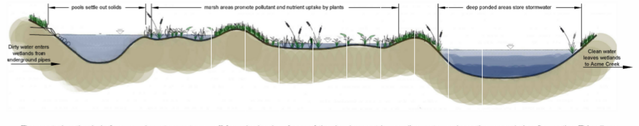
DRAFT

Stormwater Wetlands

Our commitment to the development of this property was to provide protection to the surrounding natural beauty. As part of this process, we designed and built a series of wetlands to help store and treat rainwater runoff and snow melt from the roofs, roads, parking lots and sidewalk areas of this development.

Wetlands support plants and animals such as...

Photo Photo Photo Photo Photo Photo Photo



The created wetlands before you slow stormwater runoff from the hard surfaces of the development by ponding water and creating meandering flow paths. This allows suspended solids to settle out of the water and helps reduce flooding in Acme Creek. The many different plants clean the water by absorbing pollutants and nutrients. All of these features help protect the natural beauty of Acme Creek and Grand Traverse Bay.

Educational Sign

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BASIN #2 PLANTING PLAN

DRAWN BY	ISSUE	ISSUE DATE	SHEET NO.
TGR	.	.	C614
CHECKED BY		MANAGER	GFA PROJECT NO.
TLMB		T. BOYD P.E.	12102