

Grand Traverse Town Center  
Development  
Constructed Wetland  
Inspection Report



## Document Information

Prepared for           Beckett and Raeder, Inc.  
Project Name           Grand Traverse Town Center Storm Water Basins Monitoring  
Project Number        j1536061.00  
Project Manager       John Iacoangeli/ Beckett & Raeder  
                              Joe von Wahlde/ Cardno  
                              James Edelyn / Barr Engineering  
Date                     07/31/2016

Prepared for:

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

Prepared by:



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



Grand Rapids and Ann Arbor, MI

# Table of Contents

<b>1</b>	<b>Introduction .....</b>	<b>1</b>
<b>2</b>	<b>Site Layout.....</b>	<b>1</b>
<b>3</b>	<b>Methodology.....</b>	<b>1</b>
3.1	Biological Monitoring of Storm Water Basins and Treatment Train .....	1
<b>4</b>	<b>Site Observations.....</b>	<b>2</b>
4.1	East Side .....	2
4.1.1	Basin .....	2
4.1.2	Marsh Pool #1 .....	2
4.1.3	Marsh Pool #2 .....	3
4.1.4	Marsh Pool #3 .....	3
4.1.5	Grassed Swale.....	3
4.2	West Side .....	3
4.2.1	Basin .....	3
4.2.2	Grassed Swale.....	4
4.2.3	Marsh Pool #1 .....	4
4.2.4	Marsh Pool #2 .....	4
<b>5</b>	<b>Summary and Recommendations .....</b>	<b>4</b>

# 1 Introduction

---

Cardno Inc. and Barr Engineering were contracted by Acme Township and the Village at Grand Traverse, LLC (VGT), respectively to assess the conditions of the wetland plantings within the site storm water management system at the Grand Traverse Town Center (Site) located in Acme Township, Grand Traverse County Michigan. The Site consists primarily of newly constructed and proposed commercial and retail buildings. 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.

This document summarizes the progress of the storm water detention basins and associated plantings after one year since implementation. Cardno and Barr will provide recommendations to Acme Township for further action and monitoring at the site.

# 2 Site Layout

---

The storm water system for the Site is comprised of two basins, the east basin (Basin #1) and the west basin (Basin #2). Basin #1 empties into three marsh pools separated by low berms and then empties into a grassed swale before exiting through natural wetlands adjacent to Acme Creek. Basin 2 empties into a grassed swale which flows into two marsh pools separated by a low berm and then flows into the natural wetland adjacent to Acme Creek.

# 3 Methodology

---

## 3.1 Biological Monitoring of Storm Water Basins and Treatment Train

Monitoring of the vegetation within the storm water basins, marsh pools, and grassed swales was accomplished by senior biologists, Laurie Beth Nederveld of Barr Engineering and Joe von Wahlde of Cardno. Each area was walked in a meander style survey method and plant species were identified within each habitat. Unknown species at the time of the investigation were collected and brought back for keying out to species. General observations of wildlife presence and use were noted. Additionally, observations were recorded on sediment deposition within the planted zones, turbidity in the water, water depth within the basins, pools, and swales, and general plant health. Representative photographs were taken in each area.

Plants species recorded in the field were compiled into the attached list located in Appendix A. Representative photographs were labeled and can be found in Appendix B.

## 4 Site Observations

### 4.1 East Side

#### 4.1.1 Basin

The main storm water basin (Basin #1) is lacking significant emergent vegetation on the north and east edges. The water in the basin appears to be approximately two feet or deeper and there is vegetation growing below the surface of the water. The south end of the basin, near the outlet, has the greatest density of vegetation within the whole basin. The banks along the north and east side are sparsely vegetated with wetland vegetation and there is approximately 50% bare ground along the water's edge.

Of the species planted for the Basin Shelf plant list, approximately 41% of the species were present in Basin #1. Of the species planted for the herbaceous plant list, approximately 56% were present in Basin #1. Comparing the number of plants identified and species present in Basin #1 in 2016 with 2015, there is marked improvement. Reed canary grass (*Phalaris arundinacea*) was observed in small clumps in the south end of the basin.

Wildlife observations include northern leopard frog (*Lithobates pipiens*), tadpoles, killdeer (*Charadrius vociferus*), mallards (*Anas platyrhynchos*), water strider (*Gerridae*) species, water boatman (*Corixidae spp.*) species and damselfly (*Ondonata*) species. Canada goose (*Branta canadensis*) droppings were also observed at the water's edge which could be a reason for the lack of vegetation. Herbivory of plant vegetation was observed near the basin's edge.

The water levels observed in 2016 were higher than observed in 2015, however the areas that are now inundated are not vegetated. We approximated the water depth to be an average of two feet deep in the basin.

Water flowing out of the basin into the first marsh pool is clear which indicates the basin is effective in minimizing sedimentation.

#### 4.1.2 Marsh Pool #1

The water flowing into Marsh Pool #1 (formerly labeled Basin 1A in 2015) is clear and snails were observed in the sediment at the outflow. This marsh pool is very dense with vegetation throughout the entire pool.

Of the species planted from the Basin Shelf seed mix, approximately 41% of the total species were observed in this pool. From the herbaceous plant list, approximately 44% of the total species were observed in this pool. In 2015, it was reported that the three-square bulrush (*Scirpus pungens*) and river bulrush (*Scirpus fluviatilis*) were not observed, these species were observed in 2016 so the appropriate conditions must have been present for these species to bounce back. Broadleaf cattail (*Typha latifolia*) was also present and appears to have become denser than was reported in 2015. Reed canary grass was observed in small quantities intermixed with the native vegetation.

Wildlife observed included snails, northern leopard frogs and green frogs (*Rana clamitans*), and tadpoles. The vegetation was fairly dense prohibiting observations of other wildlife species.

Water depths ranged from four inches at the outlet to six inches at the berm separating the first and second pool. These water depths have increased since the 2015 visit when water depths ranged from saturation to three inches. This is probably due to the increased storm water input into the basin from the Meijer store parking lot. Water was flowing well between the two marsh pools and the water was not turbid.

### 4.1.3 Marsh Pool #2

Vegetation in Marsh Pool #2 was also fairly dense and has grown up well since the observation conducted in 2015. In 2015, it was identified that river bulrush and three-square bulrush were not observed, however river bulrush was observed in 2016. Cattails have also increased in density from last year. Of the total species planted from the Basin Shelf seed mix, approximately 36% were observed in Marsh Pool #2. Of the total species planted from the herbaceous plant list, approximately 56% were observed in this pool. Reed canary grass was observed in small quantities intermixed with the native vegetation.

Water depths ranged from 21 inches at the berm separating Pool 1 from Pool 2 to seven inches at the berm separating Pool 2 from Pool 3. An increase in water depths occurred between observations recorded in 2015 of six inches to this year probably due to increase storm water input.

Wildlife observed in Pool 2 included northern leopard frogs, damselflies, dragonflies, mallard, and red-wing blackbird (*Agelaius phoeniceus*). There was a mallard hen that was flushed along the bank of Pool #2 and her observed behavior indicated that she had a nest or ducklings nearby.

### 4.1.4 Marsh Pool #3

Pool 3 was dense with vegetation and had improved since the 2015 visit. In 2015, it was observed that 50% of the area planted for cattails had dead vegetation and 90% of the area planted to bur reed (*Sparganium eurycarpum*) were dead. Observations in 2016 indicated that these two species bounced back and did not show any signs of mortality. Of the species planted for the Basin Shelf mix, approximately 32% were observed. Of the species planted from the herbaceous plants, approximately 33% were observed. Reed canary grass was present in small quantities intermixed with the native vegetation.

Water depths ranged from two inches at the berm separating Pool 2 from Pool 3 to nine inches at the berm exiting to the grassed swale. These water depths were comparable to the water depths observed in 2015.

Wildlife observed included northern leopard frogs.

### 4.1.5 Grassed Swale

There was no observed flow leaving Pool #3 into the grassed swale, however the grassed swale did have water present within it. Water depths ranged from two to four inches. Of the total species in the Grassed Swale seed mix, 32% were observed in the swale. Reed canary grass was present within this habitat, though not in great abundance. There were several clumps of reed canary grass observed towards the west end of the swale. Wildlife observations included deer browsing of the arrowhead (*Sagittaria Sp.*) plants and deer tracks. No erosion within the wetland was observed at the grass swale outlet location.

## 4.2 West Side

### 4.2.1 Basin

This basin (Basin #2) has improved since the site visit in 2015. In 2015, the primary issue was the lack of water in the basin. The water level in 2015 appeared to be approximately four feet below the planting shelf of the basin. In the 2016, the planted shelf was inundated and vegetation was growing out into the water. The water level was at the top of the culvert compared to being at the culvert invert elevation in 2015. There was little to no bare ground observed within the basin planting area.

Of the species planted for the Basin Shelf plant list, approximately 32% of the species were present in Basin #2. Of the species planted for the herbaceous plant list, approximately 56% were present in Basin #2. Dead river bulrush stalks were observed in 2015 and no river bulrush was observed in the basin this year, however three-square bulrush was observed in the basin which was also observed as dead stalks last year.

There are additional wetland species that were not planted occurring in the basin this year which supplements the absent planted vegetation.

Wildlife observations include green frogs, killdeer, mallards, and white-tailed deer (*Odocoileus virginianus*) scat. No plant herbivory was observed near the basin's edge.

Green algal mats are abundant throughout the basin which is most likely a result of the storm water input into the basin.

Water flowing out of the basin into the grassed swale is clear which indicates the basin is effective in minimizing sedimentation.

#### **4.2.2 Grassed Swale**

The grassed swale was more vegetated and had more hydrology in it compared with observations recorded in 2015. The majority of plants observed in 2015 were upland plants and only one plant observed came from the planting list. This year, of the total species in the Grassed Swale seed mix, 42% were observed in the swale. There were no invasive species observed within the swale. Wildlife observations included frogs, water boatman species, and deer tracks.

#### **4.2.3 Marsh Pool #1**

The appearance of this Marsh Pool has drastically changed since observations were recorded in 2015. In 2015, there was dead vegetation and sparse vegetation as a result of herbivory. In 2016, the vegetation is denser than in 2015. There is still some signs of herbivory, but it has not had a deleterious effect on the vegetation.

Of the species planted from the Basin Shelf seed mix, approximately 32% of the total species were observed in this pool. From the herbaceous plant list, approximately 33% of the total species were observed in this pool. In 2015, it was reported that the river bulrush was dead. It was not observed in 2016 in this pool. There were no invasive species.

Wildlife observed included northern leopard frogs and green frogs. Water depths averaged four inches (at pool center) in this pool.

#### **4.2.4 Marsh Pool #2**

The hydrology in this pool has increased since observations in 2015. In 2015, the hydrology ranged from dry surface to a saturated surface. In 2016, the average water depth was approximately six inches (at pool center). Of the species planted from the Basin Shelf seed mix, approximately 32% of the total species were observed in this pool. From the herbaceous plant list, approximately 33% of the total species were observed in this pool. In 2015, lake sedge (*Carex lacustris*) was the only surviving plant species that was planted. In 2016, there are three planted species observed in this pool and other supplemental wetland species that have been colonized into this habitat. There were no invasive species observed. Water flowing out of this pool, through the swale, and into the natural wetland adjacent to Acme Creek was not turbid. No erosion within the wetland was observed at the grass swale outlet location.

## **5 Summary and Recommendations**

Overall, the plantings in the storm water basins, marsh pools, and grassed swales have become denser and improved from observations in 2015. The number of observed plant species compared with the species in the plant list averages to approximately 30% for Basin #1 and 37% for Basin #2. There are approximately seven to nine planted species in each of the areas and approximately the same number of species that are supplemental wetland plants that have colonized voluntarily into the areas. This equals a

total of about 18 wetland species within the second year of monitoring for the Site which is very good. (Although this is an engineered storm water management system and not a wetland mitigation project, performance standards used to judge wetland mitigation projects suggest that 20 species by the end of a five year monitoring period is a successful outcome).

Water depths have increased from observations between 2015 and 2016 which is primarily due to the building out of the site and more storm water entering the system. There is more hydrology for the plant life and wildlife. Water leaving the system was clear on the day of the site investigation which means the basins are effective and water quality leaving the site is good.

The following represents the key findings/recommendations identified during the 2016 wetland/inspection monitoring activities:

1) Density of vegetation in Basin #1,

The density and spread of vegetation in Basin #1 should continue to be monitored. The lack of vegetation in Basin #1 could be attributed to herbivory of the vegetation by Canada geese and other wildlife or it could be a result of increase water input into the system before the young plants could get established. If herbivory is kept in check, planted species present within the basin will have a better opportunity to spread through the basin to help colonize the shoreline in future years. Supplemental plantings in this basin may be necessary in the future if it is determined that the lack of vegetation is compromising the function/performance of the storm water management system (as measured by ongoing monitoring of water quality in Acme Creek)<sup>10</sup>

2) Presence of reed canary grass in Basin #1 and within the discharge swales

The presence of reed canary grass in Basin #1 should be monitored. This is an invasive species that could choke out planted species. This invasion is a minor concern currently because there are only single stems of this plant or small clumps. Eradication may be necessary in the future if it is determined that the presence of this species is compromising the function/performance of the storm water management system (as measured by ongoing monitoring of water quality in Acme Creek).

3) Presence of algal mats in Basin #2

Persistent algal mats have the potential to diminish establishment of wetland plants. Use of lower phosphorous or no phosphorous fertilizers should help to minimize the algal concentration in the basin.

---

<sup>10</sup> Inspection, Monitoring and Maintenance Plan for the Storm Water Management System, Horizon Environmental Corporation, September 2015