July 23, 2015

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11181 Marwill Avenue
West Olive, MI 49460
USA

Phone: +1 616 847 1680
Fax: +1 616 847 9970
www.cardno.com

www.cardnojfnew.com

John Iacoangelli
Project Manager and Principal
Beckett and Raeder
535 West Williams Street
Suite 101
Ann Arbor, MI 48013

Subject: Site review of Grand Traverse Town Center Plantings at Basin #1 and Basin #2

Dear Mr.Iacoangelli:

On July 14 and 17, Cardno visited the Grand Traverse Town Center Development for the purpose of reviewing the plantings conducted in Basin#1 and associated basin and swales and in Basin #2 and associated basins and swales. The site is located in Acme Township, Grand Traverse County, Michigan.

It is our understanding that the plantings and erosion control blanket were installed by a landscaping contractor in June of 2015. The plants and seed installed were based upon the planting plan prepared by King and MacGregor Environmental. The plants and seed were installed in the basins in compliance with the approved planting plan based on observations made during our field visits in July 2015. Our review included walking each basin and swale taking representative photos and noting the overall appearance of the plants, species occurring in each area, presence/absence of plan elements such as habitat structures, height of the water in relation to the elevation of the plantings/seeded areas and erosion issues.

Basin #1

Basin #1 is designed to be seeded above the 654 contour elevation. Most of the area was proposed to be seeded with a small area reserved for plug installation. The review of this basin revealed that there were no plants emerging from the seed mix specified in the planting plan. The identifiable plants included lamb's quarters (*Chenopodium album*), crabgrass (*Digitaria sanguinalis*), bindweed (*Convolvulus arvensis*), and smartweed (*Polygonum pensylvanicum*). These are opportunistic "weedy" species that are typically found in new planted areas without a sufficient temporary cover crop. In area planted with plugs, lake sedge (*Carex lacustris*), rice cutgrass (*Leersia oryzoides*), and arrowhead (*Sagittaria latifolia*) were three of the listed plug species in the planting plan identified. The installed plugs appeared to be doing well and there were no signs of stress or herbivory (Photo 1). The plugs were being irrigated by sprinklers, but it is unknown the frequency of irrigation on these plants. The existing water level occurred at an elevation approximately two feet below the plug elevation (Photo 2) which could be a hydrology issue for these plants once the sprinklers are removed from the area. The basin design shows four habitat structures (whole trees) to be placed within the basin, these habitat structures are not present. Placement of the habitat structures after planting may incur damage to the grades or plantings.

Basin #1A

The overflow from Basin #1 flows into Basin #1A. Basin #1A appears to have suitable hydrology within the basin to support hydrophytic vegetation (Photo 3). The hydrology varies from saturated soils to three inches of inundation. This entire basin was planted with plugs. All of the plants observed were listed in the planting list. The three-square bulrush (*Scirpus pungens*) and river

bulrush (*Scirpus fluviatilis*) did not survive through the initial planting phase. The cattail (*Typha latifolia*) plants appeared to have an approximately 50% survival rate. The lake sedge and rice cutgrass appears to be doing well with no mortality observed. Water plantain (*Alisma plantago-aquatica*) also appears to be doing very well.

Basin #1B

Overflow from Basin #1A flows into Basin #1B. Basin #1B also appears to have suitable hydrology for supporting hydrophytic plants (Photo 4). A large majority of this basin was inundated with approximately six inches of water. All of the plants observed were listed in planting plan. The entire area in this basin appears to have been planted with plugs. Plants observed with 100% mortality included the three-square bulrush and river bulrush. Cattail appeared to have a 50% mortality. Rice cutgrass and lake sedge appeared to be doing well and did not have any mortality (Photo 5). No other species were observed in this basin.

Basin #1C

Water overflows a low head rock berm and flows into Basin #1C. Basin #1C has saturated soil at the location of the low head berm by Basin #1B and gradually inundates with water to a depth of 6-12 inches at the low head berm leading into the discharge swale (Photo 6). In this basin arrowhead, cattails, bur reed (*Sparganium eurycarpum*), water plantain, rice cutgrass, and lake sedge were observed. Approximately 50% of the cattails observed were dead, 90% of the bur reed were dead, and the river bulrush were all dead. The rice cutgrass, lake sedge, arrowhead, and water plantain did not appear to have any mortality. It appeared that this basin had suitable hydrology to support hydrophytic vegetation.

Discharge Swale (Basin 1)

The water overflows a low head berm in Basin #1C and flows into swale that ultimately discharges to a natural wetland area. The upper part of the swale was inundated and gradually transitioned into saturated soils (Photos 7 and 8). The plants observed in the swale included rye (*Lolium perenne*), redtop grass (*Agrostis gigantea*), curly dock (*Rumex crispus*), timothy (*Phleum pratense*), water plantain, sedge species (*Carex spp.*), rough-leaved goldenrod (*Solidago rugosa*), and big bluestem (*Andropogon gerardii*). Of the plants included on the planting list for the swale, sedges, big bluestem, and water plantain were listed. The other plants are volunteer species. This swale appeared to be effective in conveying water through the channel to discharge into the natural wetland. No sedimentation was observed being discharged into the natural wetland.

Basin #2

This basin is designed for an emergent wetland shelf of planted plugs from the 645 contour elevation up to the 650 contour elevation. The planted plugs and seeded area appear to be planted from the 648 contour elevation upwards to the 650 contour elevation, however this is an approximate observation and not verified with any survey equipment. The water level in the basin at the time of the site investigation appeared to be at the culvert invert elevation of 644 (four feet below the planted area) (Photo 9). The area had received 0.40 inches precipitation on the day that the site investigation had been conducted. Currently, the plug area is being irrigated with sprinklers, however if the water level remains at the current elevation, the plants will not have sufficient hydrology when the sprinkler system is removed. In the seeded areas (Photo 10), plants observed included lamb's quarters, crabgrass, field bindweed, yellow rocket (*Barbarea vulgaris*), white clover (*Trifolium repens*), smartweed, and common thistle (*Cirsium arvense*). None of these plants were in the seed mix, however if the area was seeded this year, it is not surprising that there are no seedlings appearing yet. Seven arrowhead plants and one lake sedge were observed in the plug area (Photo 11). The river bulrush and three-square bulrush were dead stalks (Photo 12). The ground appears to be compacted where the plugs were planted which makes it difficult for young seedlings to take root. Investigation of the soil in the plug area revealed the absence of organic soil.

Swale (Basin 2)

The overflow from Basin 2 appears to occur at the 654 contour elevation. The overflow leads into a swale which winds down to two created wetland depressions. Vegetation in the swale (Photo 13) includes foxtail (*Setaria glauca*), big bluestem, Queen Anne's lace (*Daucus carota*), red clover, curly dock, timothy, and seedbox (*Ludwigia alternifolia*). Big bluestem is the only plant observed that was in the planting list for the swale. The swale appears to be conveying water to the wetland depressions without any visible signs of erosion or sedimentation.

Basin #2A

This basin appears to be receiving water from precipitation and is saturated (Photo 14). Inundation occurs along the low head rock berm between Basin 2A and 2B (Photo 15). The plants (Photo 16) in this basin are stressed and have been grazed by wildlife (deer and/or waterfowl). The open holes absent of plugs are evidence of wildlife herbivory. The entire depression has been planted with plugs. The plants in the plant list that were observed include three-square bulrush, lake sedge, arrowhead, water plantain, and dead river bulrush.

Basin #2B

The water overflowing the low head rock berm between Basin 2A and 2B flows into Basin 2B. The hydrology in Basin 2B is dry to saturated (Photo 17). It does not appear that it receives much water from Basin 2A. There appears to be approximately 25% mortality among the arrowhead and water plantain plantings (Photo 18). River bulrush appears to have approximately 75% mortality. Lake sedge appears to be doing well. The design of Basin 2B indicates that water will overflow a low head berm and flow through a swale to a natural wetland adjacent to a stream (Photo 19). The swale appears to be well vegetated and no sediment is entering the natural wetland. There is some debris in the swale that should be removed (Photo 20).

Summary

The basins and swales appear to have been planted with plugs and it is too early to determine the survivability of the seed planted. There is concern with water levels in the main basins (Basin #1 and Basin #2), specifically Basin #2. Given the current water levels in these basins, it appears the plants will not survive after the sprinklers are removed. The current plugs in the basins are not thriving under the current conditions and may require supplemental planting. Herbivory of the planted plugs also appears to be a cause for a reduction in the amount plants. The basins occurring lower in the treatment train appear to have more suitable hydrology, but the plugs may have been affected by deeper water depths or herbivory.

Sincerely,

Joseph R. von Wahlde, PWS
Senior Consultant
Cardno
616-847-1680x22
Email: joe.vonwahlde@cardno.com

Attachment:
Photo Documentation

Photograph No. 1. Basin #1 Plug installation area.

Photograph No. 2. Water level in Basin #1 below planting elevation.

Grand Traverse Town Center Plantings
Representative Photographs
Acme Township, Grand Traverse County

JFNew # 153606100

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Photograph No. 3. Basin #1A

Photograph No. 4. Basin #1B

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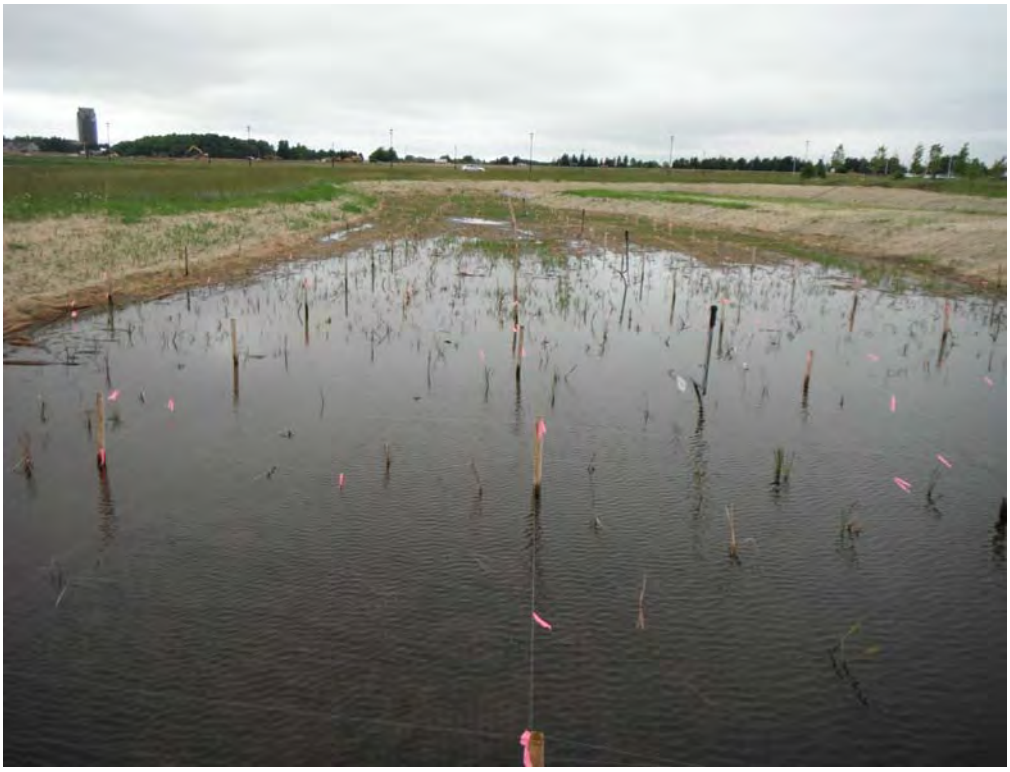
Photograph No. 5. Basin #1B facing east.



Photograph No. 6. Basin #1C facing north.

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Photograph No. 7. Basin #1 Swale

Photograph No. 8. Basin #1 Swale.

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Photograph No. 9. Basin #2. Water level below planting elevation.

Photograph No. 10. Basin #2. Area that was seeded.

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Photograph No. 11. Basin #2. Scattered arrowhead plant plugs.

Photograph No. 12. Basin #2. Dead River Bulrush plugs.

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Photograph No. 13. Basin #2. Swale flowing towards Basin #2A.

Photograph No. 14. Basin #2A. Facing north.

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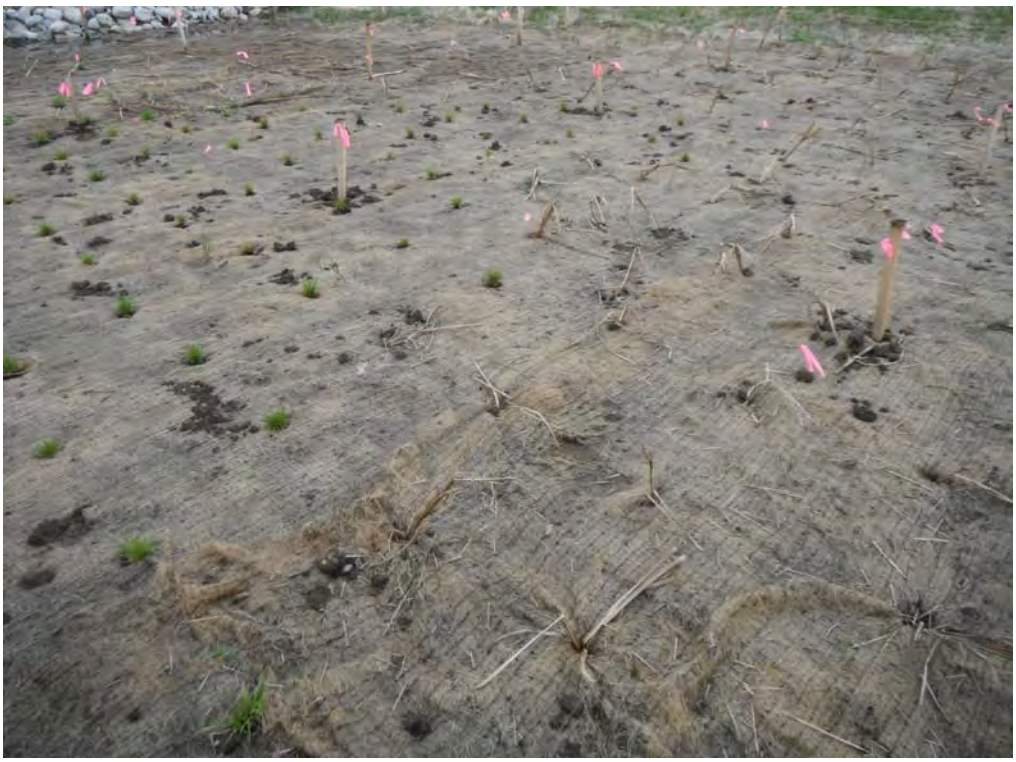
Photograph No. 15. Basin #2A. Inundation.



Photograph No. 16. Basin #2A. Stressed/dead plants.

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Photograph No. 17. Basin #2B. Facing NW.

Photograph No. 18. Basin #2B. Facing west.

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Photograph No. 19. Basin #2. Discharge swale to stream.

Photograph No. 20. Basin #2. Discharge swale. Remove debris.

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