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STORMWATER MANAGEMENT PLAN & REPORT

BADGER DRIVE
EAGLE PASS

VILLAGE OF HARTLAND
WAUKESHA COUNTY WI

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SUBDIVISION DEVELOPMENT – BADGER DRIVE/EAGLE PASS, MADISON WI

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1. Project Description and Site

The proposed project is a residential subdivision located in the Village of Hartland, Waukesha County, Wisconsin. The development site covers approximately 5.5 acres of currently wooded land and will be divided into 7 single-family residential lots. Two new cul-de-sac roadways (extensions of Eagle Pass and Badger Drive) will provide access to the lots. The entire project lies within the Bark River Watershed (LR13). Appendix A shows the approximate location of Hartland and the Bark River Watershed.

Key stormwater management features of the design include a swale and a combined bio-filtered forebay and infiltration basin system. This design drains the northern lots (and Badger Road cul-de-sac) via a vegetated swale to a storm sewer; middle and eastern lots flow into the same storm sewer that discharges into the infiltration basin; and the remaining southern lots drain via a new catch basin into a biofiltration forebay before discharging to the main infiltration basin. All runoff from the site is ultimately routed into a new infiltration basin on the south side of Eagle Pass for groundwater recharge and water quality treatment. Storm sewers are designed for the 25-year storm and the infiltration basin can store the 100-year storm under frozen conditions without any discharge. These details can be found in Appendix C.

2. Regulatory Standards

The design complies with:

Village of Hartland Stormwater Ordinance (Ch. 76)
- § 76-7(c)(2)(a): Peak-flow control for 2-, 10-, and 100-yr, 24-hr storms
- § 76-7(c)(2)(d): Water-quality volume (WQv) and pollutants (≥ 80% TSS, ≥ 30% TP)
- § 76-7(c)(3)(a): Infiltration ≥ 90% of pre-development (site < 40 % impervious)

Wisconsin Administrative Code NR 151 (Post-Construction Performance Standards)
- NR 151.12: Volume control and pollutant removal requirements
- NR 151.125: Pretreatment practices to remove solids before infiltration

Wisconsin Administrative Code NR 216 (Construction Site Stormwater Permits)
- NOI/NOT requirements and contractor inspection logs

WDNR Stormwater Technical Standards (maximum extent practicable)
- Std 1003 (“Infiltration Basin”):
  - Minimum 2-ft separation to seasonal high groundwater
  - Maximum 2-ft infiltration depth under normal operation; emergency overflow weir at 100-yr event with 1 ft freeboard
  - Drawdown ≤ 72 hr for 2 ft working storage
  - Forebay pretreatment sized to ≥ 10 % of WQv
  - Outlet orifice/riser sized for 24-hr release of WQv
- Std 1004 (“Bioretention”):
  - Media blend and underdrain design for the biofiltered forebay

WDNR Guidance Documents
- “Modeling Post-Construction Storm Water Management Treatment” (publication WT-19-0023) for P8 modeling compliance.
- “Site Evaluation & Design for Infiltration” (publication 1002) for soils and infiltration testing

3. Drainage Summary

The existing development project site is a mix of grassland and woods. The drainage can be summarized by slopes to the south and east. The site does not contain floodplain per the FEMA Map Center. The DNR wetland viewer does not show wetlands on the subject property. Subsurface soils are comprised of two types on the property: Theresa silt loam (ThB) and Hochheim loam (HmB/HmC2). These soils are well-drained silt loams but differ in their runoff characteristics:

- Theresa silt loam (ThB) – This soil is Hydrologic Soil Group C, with moderately low infiltration capacity. It is well-drained with moderate permeability in the subsoil. Slopes range from 2–6% under natural wooded conditions. Accordingly, a Runoff Curve Number (RCN) of 70 (for HSG C woodland) will be used.
- Hochheim loam (HmB, HmC2) – This soil is classified as Hydrologic Soil Group D, with high runoff potential and low infiltration rates. Slopes are range from 2–12% under natural wooded conditions. Accordingly, a Runoff Curve Number (RCN) of 77 (for HSG C woodland) will be used.

Pre-development hydrologic modeling will assume the wooded condition with representative curve numbers (as noted above) per local ordinance guidelines. Existing topography includes gentle to moderate slopes (especially where Hochheim loam is mapped), and drainage presently occurs via natural sheet flow and shallow depressions toward the site's southeast edge.

There are no adjacent or receiving waterways. During large storms, the existing site discharges to the southern property resulting in standing water. For the purpose of this report, the receiving water system will remain unchanged between the pre- and post- conditions.

The total lot area is 5.5 acres with a disturbed area of 5.1 acres. The pre-development aggregate runoff coefficient is 55, per Waukesha County stormwater management requirements, reflecting the predominantly wooded conditions and well-drained soils (primarily ThB Theresa silt loam, with minor areas of Hochheim loams, HmB and HmC2). There are no discernable offsite areas that contribute runoff to this development.

The proposed site is divided into four drainage areas:

- Northern area (Badger Rd) – (~1.65 acres) Mostly open/wooded lots and Badger cul-de-sac. Runoff here is collected in a grass swale that conveys to a storm sewer that drains to the infiltration basin.
- Central/Eastern area – (~1.80 acres) Runoff from these lots drain via the swale/storm system under Eagle Ave directly into the infiltration basin. This area has minimal impervious surface.
- Southern area (Eagle Rd) – (~1.60 acres) Remaining southern lots drain to a new catch basin on Eagle Avenue. That catch basin discharges into a biofiltration forebay (see Section 5).
- Off-site (~ 2.00 acres) Roughly 2 acres is excpeted to drain to outlot 2 from east of the property line

All three areas combine to drain approximately 7.1 acres to the new infiltration basin. (The total impervious area is only about 0.5 ac, reflecting the curb and road surfaces.) The system is designed so that each area's runoff is conveyed at non-erosive velocities (via the swale or pipes) to the respective pretreatment devices before entering the main infiltration basin. The stormwater pond outlot was tested per WDNR site evaluation procedures (with accepted infiltration rates of 1.63 in/hr shown in Appendix B).

4. Pretreatment Summary

To meet water quality requirements, runoff is pre-treated as follows:

- Swale Pretreatment: The northern drainage swale (receiving Badger Drive discharges) is proposed as a vegetated filter, reducing sediment loads and moderating flows before they enter the infiltration pond. As such, the swale is proposed as a pretreatment device for the infiltration facility. The project plans include a separate storm sewer outfall to the infiltration pond. The swale as proposed has a 10' bottom width with 3:1 maximum side slopes, as shown on the proposed grading plan. Based on P8 analysis in Appendix D, the effectiveness of this proposed pre-treatment device is 74%.
- Biofiltration Forebay: Runoff from the southern roadway areas (Eagle Pass) is routed into a small forebay prior to discharge to the infiltration basin. This facility is required to perform pre-treatment of storm sewer discharge, and therefore an engineered biofilter system is proposed. This device allows sediment settling and some infiltration through soil into a subsurface perforated pipe. The subsurface underdrain is discharged to the infiltration basin. Pursuant to P8 modeling, the biofilter achieves ~ 99% removal of TSS from its inflow. This exceeds typical guidelines (80% TSS removal for residential areas) and thus provides robust pretreatment. The forebay also has an overflow weir, 2-foot ponding depth and engineered soil to infiltrate/filter inflow to a 6-inch perforated underdrain with sock discharging to the infiltration basin. Any excess water bypasses through a vegetated weir protected with a turf reinforcement mat (TRM) into the infiltration basin.

These pretreatment devices ensure the water entering the infiltration basin has most particulates and sediment removed, protecting the basin from clogging and meeting NR 151.125 requirements. The following, including details from 9.0, result in the planting schedule:

Surface Type:

- Media Blend (per WDNR Std 1004):
  - 60 % coarse sand (0.2–1.0 mm)
  - 20 % compost (high-quality, screened, < 3 % organic matter)
  - 20 % topsoil (loam, pH 6.5–7.5)
- Underdrain: 6-inch perforated pipe wrapped in filter sock, bedded in clean ¾-inch crushed stone (12-inch deep)
- Mulch Layer: 2-inch shredded hardwood mulch over planting zones to suppress weeds and retain moisture
- Bypass Weir Protection: Turf Reinforcement Mat (TRM) channel lined with native sod

Planting Options:

Plant Type	Species	Spacing	Bloom Period	Notes
Sedges (Grasses)	Carex stipata (Awl-fruit sedge)	12″	Jun–Jul	Good root mass
Rushes	Juncus effusus (Soft rush)	12″	Jun–Aug	Tolerates wet/dry
Wildflowers (Perennial)	Asclepias incarnata (Swamp milkweed)	18″	Jul–Sep	Pollinator habitat
Wildflowers (Perennial)	Rudbeckia fulgida (Black-eyed Susan)	18″	Jul–Sep	Stabilizes surface
Grasses (Ornamental)	Panicum virgatum (Switchgrass)	24″	Aug–Sep	Deep roots enhance infiltration
Groundcover	Lobelia cardinalis (Cardinal flower)	12″	Jul–Sep	Moisture-loving underplant

This planting approach and surface-type specification will:

- Promote deep rooting and year-round infiltration
- Provide robust sediment removal (> 90 % TSS)
- Satisfy pretreatment requirements under NR 151.125 and WDNR Std 1003/1004
- Ensure a stable, vegetated forebay that resists erosion and maintains permeability

5. Infiltration Basin Design

The infiltration basin is sized to infiltrate the site's stormwater volume while also providing flood control. It is designed per WDNR Standard 1003, with the following key features:

- **Pre-Treatment:** (See Section 4.0) The infiltration basin receives pre-treated runoff from two (2) sources (Badger Drive and Eagle Drive) via two (2) separate outfalls.
- **Effective Infiltration Area:** The basin has an effective infiltration area of roughly 0.2 acres. It doesn't exceed 2 ft ponding through the 10-year storm.
- **Ponding Depth:** The maximum ponding depth of water in the infiltration zone is 2.0 feet, per the standard. Events at the 25-year storm or higher are stored in the basin and infiltrated in less than 48-hours.
- **Overflow Spillway:** An emergency spillway is provided on the southern end of the basin. It is sized for the 100-year, 24-hr storm and provides ≥1 foot of freeboard. Runoff in excess of the basin's infiltration capacity during extreme events flows harmlessly offsite, protected by a turf reinforcement mat (TRM) through this overflow weir.
- Berms: See Plans. Typical berm configuration is proposed at a 6' minimum width with maximum slopes of 4:1.

The basin bottom is graded level (0% slope) to maximize contact area. The side slopes are 4:1 (horizontal: vertical) for safety and uniform infiltration. Per standard, the bottom is kept at least 3 feet above the seasonal high-water table (confirmed by the Geotechnical Data in Appendix B).

6. Hydraulic Performance

Hydrologic modeling (HydroCAD) confirms that the infiltration basin meets the required volumes and peak controls:

- **Storage/Infiltration Volume:** The basin provides approximately 1.5 acre-feet of total storage/infiltration capacity. Under design storms, runoff is captured and infiltrated. In other words, for modeled storms up through the design storm, no surface outflow leaves the basin. This meets the infiltration performance standard consequently (i.e. the water quality volume is infiltrated).
- **Peak Outflows:** Because nearly all flow infiltrates, the modeled post-development peak discharge from the basin is effectively zero for design storms. There is no increase in downstream peak flows relative to pre-development. The 100-yr event does generate additional depth above 2 ft, but that excess will infiltrate over time.
- **Frozen Condition:** The 100-year runoff event was modeled in frozen conditions, with zero (0 cfs) discharge. The pond reaches a height of 946.25 elevation with the overflow outlet at 947.5 (ft). The pond contains this modeled event which begins to overflow at 946.5' through the primary outlet. the primary outlet is a 12 in pipe which ties into the existin Eagle Sewer.

Thus, under design storm conditions the basin is fully effective: it detains and infiltrates runoff for water quality and baseflow benefits. Detailed calculations for existing conditions, design conditions and the 100-year frozen conditions are found in Appendix C. For convenience, a peak discharge summary has been provided below:

Storm Event (24-hr)	Pre Outflow (cfs)	Post Outflow (cfs)	Max Basin Depth (ft)
2-year (2.7″)	0.3	0.0	0.1
10-year (3.8″)	3.5	0.0	0.6
100-year (6.2″)	10.9	0.0	2.2
100-year (Frozen)	10.9	0.0	3.3

Key takeaways:

- "Max Basin Depth" is the highest water level above the infiltration basin floor.
- "Peak Outflow" remains zero because the basin's infiltration rate (1.6 in/hr) and storage capacity retain all inflow.
- Only 100-yr events exceeds the 2 ft depth limit; however, that excess head drains via infiltration over time and never discharges offsite or to the existing municipal storm sewer system.

7. Water Quality Treatment

The combined system (swale/forebay → infiltration basin) provides excellent pollutant removal: sediment and debris are trapped in the swale and forebay, and the infiltration basin allows settling and soil adsorption of remaining TSS, nutrients, and metals. Overall, the design meets the 80% TSS and 30% TP removal goal for the site. Detailed calculations are shown in Appendix D. For convenience, a water quality summary is included below:

Control Objective	Regulatory Target	Performance	Compliant?
Infiltration Volume Retention	≥ 90 %	92 %	Yes
Total Suspended Solids (TSS) Removal	≥ 80 %	99 %	Yes
Total Phosphorus (TP) Removal	≥ 30 %	96 %	Yes

Notes:

- "Modeled Performance" based on P-8 output (see Appendix D).
- Infiltration retention reflects post-development volume infiltrated vs. pre-development infiltration.
- This demonstrates the swale/biofiltered forebay → infiltration basin process meets both volume and pollutant-removal goals.
- Swale + biofiltered forebay remove coarse sediment and debris.
- Infiltration basin provides secondary settling and soil adsorption of fine particles, nutrients, and metals.
- Pretreatment and infiltration complies with NR 151.125 (protects groundwater by filtering solids and isolating high-concentration sources).

8. Erosion Controls

The Wisconsin DNR requires that all construction sites must lose less than 5 tons per acre of sediment during the construction of the project. The DNR Soil Loss & Sediment Discharge Calculation Tool version 2.0 was used to determine the construction site sediment discharge. The calculations show that with no controls in place, the soil loss is 3.7 tons/acre and the sediment discharge is 3.8 tons/acre. This meets the DNR requirements. Calculations can be found in Appendix E.

During construction of the subdivision, effective erosion and sediment control practices will be implemented to protect neighboring properties and waterways from sedimentation. The project will disturb approximately 5-acres of land, which exceeds the 1-acre threshold requiring a permit. A detailed Erosion Control Plan can be found in Appendix A. The controls will be in place before land disturbance and maintained until final stabilization, per WDNR technical standards (1057/1053/1062/1056) and local Hartland requirements:

- Perimeter Sediment Barriers: Install silt fence or heavy-duty erosion log barriers downslope of all disturbed areas to intercept and trap sediment from sheet flow. These barriers will be in place before land-disturbing activities begin and will be maintained until vegetation is established.
- Stabilized Construction Entrance: Provide a tracked stone construction entrance (tracking pad) at the entrance to the site (e.g., where construction traffic exits to a public road). The pad will consist of large aggregate underlain by geotextile, designed to remove mud from vehicle tires and prevent soil tracking onto roadways.
- Inlet Protection: Any new or existing storm sewer inlets will be protected with geotextile fabric drop-in filters or rock baskets. This prevents sediment from entering the storm sewer system during construction.
- Runoff Diversion and Flow Control: As needed, temporary swales or berms will divert upland runoff around disturbed areas. Check dams (e.g., straw wattles or rock checks) may be placed in long swales to slow down flow and encourage sediment settling on-site.
- Soil Stockpile Management: Topsoil or fill stockpiles will be kept away from downslopes and protected with silt fence or covered with tarps. If they will be inactive for more than a week, they will be temporarily seeded to minimize erosion.
- Temporary Stabilization: Exposed soils will be stabilized with straw mulch and/or temporary seed if they are not worked for 14 days or more. After final grading, all disturbed areas will be promptly landscaped or seeded with grass and covered with mulch or erosion control matting on steeper slopes to establish vegetative cover.
- Construction Sequencing: Land-disturbing activities will be phased when possible. The stormwater basins will ideally be rough graded first and used as a temporary sediment trap/basin during construction to catch runoff sediment. The permanent basin outlet may be installed with a temporary weir or filter to function in this interim sediment control role.

Below is a phased schedule for the 5-acre subdivision, showing key earthwork and erosion-control tasks. All perimeter controls, stabilized entrances, inlet protection, and diversion measures must be installed before any land disturbance. Weekly inspections and maintenance run continuously through final stabilization.

Construction Schedule and Erosion Control Implementation

Task Description	Duration (weeks)	Timeline	Erosion Control Measures
Mobilization & Control Installation	1	9/8/25 - 9/15/25	• Install perimeter silt fence/log barriers • Construct stabilized stone entrance • Protect inlets with filters/baskets • Install temporary diversions/check dams
Rough Grading & Basin Excavation	3	9/15/25 - 9/29/25	• Stockpile management with silt fence/tarps • Phase grading to limit disturbed area • Use basin excavation spoil as temporary sediment trap
Storm Sewer & Utility Installation	4	9/22/25 - 10/13/25	• Inlet protection on each pipe connection • Maintain diversion swales around work • Inspect and repair controls weekly
Fine Grading of Lots, Roads & Swales	4	10/6/25 - 10/27/25	• Temporary seeding/mulch within 14 days on inactive plots • Check dams in long swales • Monitor stockpiles and repair silt fence
Biofiltered Forebay & Infiltration Basin Construction	2	10/20/25 - 10/27/25	• Install engineered soil media and underdrain • Construct overflow weirs with riprap aprons • Maintain forebay access for sediment removal
Temporary Stabilization & Interim Seeding	2	11/3/25 - 11/10/25	• Straw mulch or erosion control mat on slopes • Temporary seed stockpiles if idle >7 days • Weekly inspection and repair
Final Grading, Permanent Seeding & Demobilization	2	11/17/25 - 11/24/25	• Final seed and mulch all disturbed areas (Std 1058/1059) • Remove temporary controls as vegetation establishes • Leave construction entrance until site clean
Ongoing	12	9/8/25 - 11/24/25	• Weekly and post-storm (≥0.5″) inspections • Maintain logs per NR 216 NOI requirements • Immediate repair of failed controls

Notes:

- If any area will remain undisturbed for >14 days, temporary stabilization (mulch or seed) must be applied within 7 days of last disturbance.
- The rough-graded infiltration basin limits downstream sediment by serving as a temporary sediment trap until final outlet structure is installed.
- All embankments and slopes shall conform to WDNR Standard 1003 and local embankment standards (4:1 side slopes maximum).
- Contractor inspection reports shall be logged on the State Construction Site Inspection form (Appendix G).

9. Maintenance

Responsibilities

- Owner: Long-term maintenance of all post-construction BMPs per the recorded Stormwater Maintenance Agreement (Appendix F).
- Contractor: Construction-phase inspections and repairs of erosion and sediment controls until final stabilization and Notice of Termination (NOT) is issued by WDNR.

Short-Term (Construction-Phase) O&M

The Contractor shall:

- Conduct weekly inspections of all erosion and sediment controls.
- Inspect controls within 24 hours after any rainfall ≥ 0.5 inches that produces runoff.
- Document each inspection on the State of Wisconsin Construction Site Inspection Report (Appendix G), including:
  - Date, time, and exact location
  - Inspector's name
  - Condition of controls
  - Maintenance or repairs performed
  - Current phase of construction
- Make repairs immediately to maintain effectiveness until permanent vegetation.

Long-Term (Post-Construction) O&M

Maintenance tasks are organized by BMP type. All work shall follow WDNR Technical Standards and the Maintenance Agreement (Appendix F).

Swale

- Mow twice per year (spring/fall) to maintain and remove encroaching vegetation.
- Remove debris and sediment buildup annually or after major storms.
- Inspect vegetation cover and reseed bare areas per WDNR Std 1059.

Biofiltered Forebay

- Access via 12-ft wide mown corridor; inspect quarterly.
- Remove accumulated sediment and replace media if depth exceeds 6 inches.
- Check and clean perforated underdrain pipe and fabric for clogging; flush as needed.
- Inspect and repair forebay embankment (4:1 side slopes) and riprap spillway annually.

Infiltration Pond

- Maintain the 12-ft maintenance access to the pond floor; mow and inspect semi-annually.
- Inspect inlet and outlet quarterly; remove sediment to restore 10% WQv capacity.
- Check for signs of surface clogging; scarify or aerate if infiltration drops below 0.5 in/hr.
- Inspect overflow weir annually; clear obstructions to maintain 1 ft freeboard.
- Repair eroded embankments immediately; recompact and reseed per WDNR Std 1003.

All long-term maintenance activities and logs shall be the Owner's responsibility, with records kept on site and available to the Village upon request. The following shall be utilized for pretreatment construction:

Planting Schedule & Maintenance

Activity	Timing	Notes
Final grading and media installation	Weeks 7–8	Compact subgrade, verify elevations (+6-inch media thickness)
Soil media blend placement	Week 8	Blend on-site or deliver pre-mixed
Mulch installation	Immediately after planting	Use shredded hardwood, avoid over-application (< 2 inch)
Plant installation	Early Spring (Apr–May) or Late Fall (Sep–Oct)	Plant plugs/small-pots; water-in thoroughly
Monthly inspections (Year 1)	May–Oct	Check for settling, replace failed plants, weed control
Seasonal weeding and mulching (Years 2–5)	Spring & Fall	Replenish 1-inch mulch; remove woody volunteers
Perennial replanting (as needed)	Year 2 Spring	Replace > 20 % mortality
Underdrain & inlet/outlet inspection	Quarterly	Clear debris from sock, flush if clogged
Vegetation pruning (dead stalk removal)	Late Winter	Prevent debris buildup in spring runoff
Long-term monitoring report	Annual (January)	Summarize infiltration rate, plant health, sediment accumulation

10. Conclusions

In summary, the final design meets Hartland's ordinance and Wisconsin DNR standards for post-construction stormwater management. It provides the required water quality treatment (infiltrating the target runoff volume and achieving high TSS and TP removal) and controls peak discharges. Key standards are satisfied as follows:

Stormwater Management Compliance Summary

Requirement	Regulatory Standard	Final Design Performance	Compliant?
Peak Discharge – 100-year control (Village Ordinance)	Post-dev 100-yr peak ≤ Pre-dev 10-yr peak	100-yr post = 0.0 cfs, 10-yr pre = 3.5 cfs (0.0<3.5)	Yes
Peak Discharge – 10-year control (Village Ordinance)	Post-dev 10-yr peak ≤ Pre-dev 2-yr peak	10-yr post = 0.0 cfs, 2-yr pre = 0.3 cfs (0.0 < 0.3)	Yes
Water Quality – TSS Reduction (NR 151 & Village)	≥ 80% TSS removal	99.7% TSS removal	Yes
Water Quality – Phosphorus Reduction (Village)	≥ 30% TP reduction	97.9% TP removal	Yes
Infiltration Volume (Village)	Retain ≥ 90% of pre-dev infiltration volume on-site; drawdown in ≤ 72 hrs.	99% of pre-dev infiltration volume retained – Basin infiltrates water quality volume (draws down ~24 hrs).	Yes
Infiltration Basin Ponding Depth (WDNR Std. 1003)	Max 24 inches for effective infiltration storage	Basin infiltration depth = 24″ for design storm (meets). Note: Frozen 100-yr storm causes 39″ temporary depth	To Maximum Extent
Pretreatment for Infiltration (NR 151 & Tech. Std.)	Required for runoff from parking & roads (e.g. 80% TSS removal prior to infiltration)	Provided – Biofiltration forebay treats all paved area runoff from Eagle (engineered soil filter); vegetated swale pretreats other areas.	Yes
Protective Area (NR 151)	50 ft buffer from navigable water / wetland (if present)	Not applicable – No surface water resources on or adjacent to site. All infiltration facilities >50 ft from any wetland or stream.	N/A
Facility Side Slopes (Village & WDNR Std.)	4:1 or flatter side slopes for basins and swales	Designed – Basin interior and exterior slopes = 4:1; swale side slopes 4:1, ensuring stability and safety.	Yes
Maintenance Plan (Village & WDNR)	O&M plan needed; Ensure quarterly inspections & upkeep	O&M Plan prepared - Provides schedule of inspections (quarterly) and maintenance tasks per WDNR guidance.	Yes

Therefore, aside from the minor 100-yr exceedance which is mitigated by the overflow design, all standards are met or exceeded. The infiltration basin, combined with pretreatment, provides effective water quality treatment and flood protection. This meets both the Village of Hartland stormwater requirements and the Wisconsin DNR Stormwater Technical Standards. The detailed calculations and model outputs confirm that no downstream flooding will occur and that water will be returned to groundwater as required. The system is robust and will function as intended for both routine and extreme storms. The storm sewer structures and piping were sized according to the 25 year storm. The design details and calculations can be found in Appendix C.

APPENDIX A – CONSTRUCTION PLANS