APPENDIX B: STORMWATER MEMORANDUM

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R.A.SMITH & ASSOCIATES, INC.

Memo

DATE: November 21, 2007

TO: Village of McFarland, Ad Hoc East Side Growth Committee

FR: R.A. Smith & Associates

RE: Stormwater Management for East Side Neighborhood Growth Area

This memorandum is not intended to provide detailed stormwater modeling for the entire neighborhood, but rather to document factors considered in planning for the area and to provide a discussion of the relative merit of different approaches to stormwater management.

In the Year 2000, the Village hired Town & Country Engineering to complete a study of a portion of the East Neighborhood and define measures to prevent increases in peak flow rates of stormwater runoff into Mud Lake. The report concluded that a regional detention approach would be beneficial because:

1. It is in the Village's best interests to have as few of these ponds as possible to make maintenance most efficient.
2. Overall construction costs will probably be less expensive to construct fewer, larger ponds.
3. The effects of fewer ponds are more predictable.
4. It is more likely that 100-year flood control can be achieved as well as meeting the ordinance required 25-year storm conditions.

This study indicated three preferred locations for naturally draining regional detention basins. The first pond is just west of the East Side Neighborhood Growth Area and north of County Highway MN. This regional pond naturally services three properties and could easily be expanded upon on the North side of CTH MN and was recommended to be pursued. The second regional pond is located west of County Highway AB and north of the Wisconsin & Southern Railroad. This pond is also an expansion of a natural ponding area servicing four properties and was recommended to be pursued. The third pond is located west of the East Side Neighborhood Growth Area and south of Elvehjem Road. The third regional pond is a proposed engineered pond. Some low quality wetland exists in this area, but no extensive ponding takes place here except in extreme rain events.

The attached map depicts the sub-basins located within the East Side Neighborhood Growth Area. The study completed by Town & Country Engineering evaluated only a portion of the neighborhood area. A significant portion of the East Side Neighborhood Growth Area is covered by two additional sub-basins located to the east of those studies in the report.

Planning Considerations

A regional detention approach would allow developers to meet on-site development requirements relating to stormwater by compensating the Village to provide equivalent mitigation in an off-site, regional facility. The following is a list of possible advantages and disadvantages to a regional detention approach:

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Advantages	Disadvantages
Village has an opportunity to strategically locate stormwater facilities to address the water quantity and quality issues for Mud Lake.	The Village must take on the responsibility of determining where to locate facilities based on priorities and opportunities. Further hydrologic modeling would be required.
May open up additional revenue sources to fund more effective regional facilities.	May complicate facility financing. Possible risk of not being fully refunded for costs of design, construction and maintenance.
The Village allocates staff to maintenance of a few public facilities rather than to review inspection and enforcement of multiple private facilities. Increases assurance of maintenance over time.	Maintenance duties become the full responsibility of the Village, including disposal of sediments (hazardous waste material).
Overall construction costs will possibly be less expensive to construct fewer, larger regional ponds.	The Village takes on the responsibility for managing the risk associated with the location and party responsible for implementing Village and WDNR water quality requirements. Recommend creating written agreements with property owners utilizing regional facilities.
Allows for fewer facilities and more space-intensive development.	Design, construction and maintenance costs become the Village's responsibility.
	Decrease the opportunity to implement infiltration practices. Infiltration technologies can perform best if decentralized throughout the basin in smaller and more abundant facilities.
	Not all low-lying areas will naturally drain to the regional detention areas and will require on-site treatment to meet the Village's stormwater quantity and quality standards.

The regional detention approach clearly assumes additional risk and responsibilities, and even perhaps additional costs for the Village. However, if this approach can offer environmental, financial, maintenance or community benefits that outweigh the disadvantages, then an off-site approach should be considered. The on-site detention approach would place the majority of these responsibilities with individual property owners and the Village would continue to be involved with review, inspection and enforcement issues for any new development.

Low-Impact Development Techniques

Although a regional detention approach was recommended in the East Basin Stormwater Management Study, it appears that there are many applications for on-site stormwater management using low impact development techniques. These techniques may be further warranted as they often represent a more sustainable method of managing stormwater than can be achieved through regional detention, which often relies on piping water off-site to detention sites. Low impact development has demonstrated advantages in improving water quality, infiltration, and groundwater recharge. Examples of sites where these techniques may be particularly applicable include:

1. Office and Light-Industrial Properties on the northeast portion of the East Side Neighborhood Growth Area are located in the eastern-most stormwater sub-basin. These are expected to develop either as large lots or as part of a unified business district under a small number of own-

ers or developers. On-site stormwater management on these sites may promote sustainable techniques and be effective for long-term maintenance.

2. Large Lot Residential sites on the eastern edge of the neighborhood are located in low areas and in areas where poor spoils are present. The intent of providing large lots was to reduce impervious surfaces and promote infiltration of stormwater from these properties.

These properties will be required to meet the Village's stormwater quantity and quality goals. Therefore, other stormwater management practices will need to be considered. There are many low-impact development techniques that promote a reduction in impervious surfaces and are designed to replicate the natural infiltration process to be considered. A few passive stormwater reduction and water quality management measures were discussed in the Year 2000 East Basin Stormwater Management Study. However, there have been many advances in this development approach since that time and the following is a listing of various low-impact stormwater reduction practices.

- **Downspout Disconnection -** This practice involves disconnecting roof downspouts from sewers, directing downspouts away from impervious areas such as driveways and roads that provide direct connections to a public stormwater system, and directing them to a storage facility or pervious areas for infiltration. Downspouts can be directed to rain barrels, rain gardens, on-site filters, vegetated filters, french drains and swales at a low cost. Issues to consider with this technique are contributing impervious area, soils permeability, slope of receiving area, and proximity to buildings. This method is most applicable to residential areas where there are sufficient pervious surfaces, but also has applications in commercial and light industrial areas. On-site systems need to be maintained to ensure proper drainage to avoid nuisance flooding.
- **Rain Barrels -** Rain barrels are storage devices that collect rainwater from rooftops and are designed to hold between 50-100 gallons of water. They are typically used in residential applications where the collected rainwater is then used for irrigating landscaped areas. Several factors must be considered before employing this practice, including: climate considerations, algae and mosquito control, physical site suitability, and homeowner ability and willingness to operate effectively. To avoid nuisance problems, rain barrels require proper maintenance. Mosquito control, ice formation, and overflow drainage are all critical issues that need to be addressed. Barrels should be emptied in winter to prevent ice formation.
- **Rain Gardens -** Rain gardens are small, vegetated depressions used to capture and infiltrate stormwater runoff. Runoff can enter the garden via sheet flow or downspout disconnection. A rain garden depression, usually 6 to 18 inches deep, is filled with an appropriate soil mixture and planted with native shrubs, grasses, and flowering plants. Water is detained in the ponding area (usually no more than 24 hours) until it either infiltrates or evapotranspires. Rain gardens can be applied to both new and existing developments. Due to space requirements, they are most applicable for residential and light commercial uses. They work best in areas with well-drained soils. Performance can be enhanced in low permeable soils by providing an underdrain system or soil amendments. Rain gardens must be properly maintained (regular watering can be significantly reduced or eliminated if native plants are used) to ensure proper performance and promote public acceptance.
- **Green Roofs -** Soil and vegetation installed on top of a conventional flat or slightly sloped roof (up to 30% slopes provided special strapping and erosion control devices are used). Extensive green roofs have a thin layer of soil and are usually composed of grasses and mosses, while intensive green roofs have a thicker soil layer and contain shrubs, trees and other vegetation. A green roof may be installed on a newly constructed building, or an existing building can be retrofit with a green roof. Lightweight extensive green roofs can be used in most retrofit projects without costly structural reinforcement. Green roof maintenance may include watering, fertilizing, and weeding, and is typically greatest in the first two years when plants are becoming established. Maintenance will largely depend on the type of green roof system installed and the type of vegetation planted.
- **Green Parking Lots -** Various measures used to reduce the effective impervious area of a parking lot and promote infiltration and/or evapotranspiration. Green parking lot techniques include setting maximums for the number of parking lots created, minimizing the dimensions of parking lots spaces, utilizing porous paving systems in overflow parking areas, using bioretention areas or other on-site filtering systems to treat stormwater, using stormwater trees to treat stormwater and provide shading and cooling, encouraging shared parking and providing

economic incentives for structured parking. All of these techniques can be applied to new development and some can be applied in redevelopment projects, depending on the extent and parameters of the project. This practice is most applicable in commercial, industrial and multi-family land uses because they have the greatest percentage of parking lot cover. In highly developed urban areas, some of these techniques can be incorporated into an existing parking as a retrofit, such as bioretention, stormwater trees, and porous paving systems.

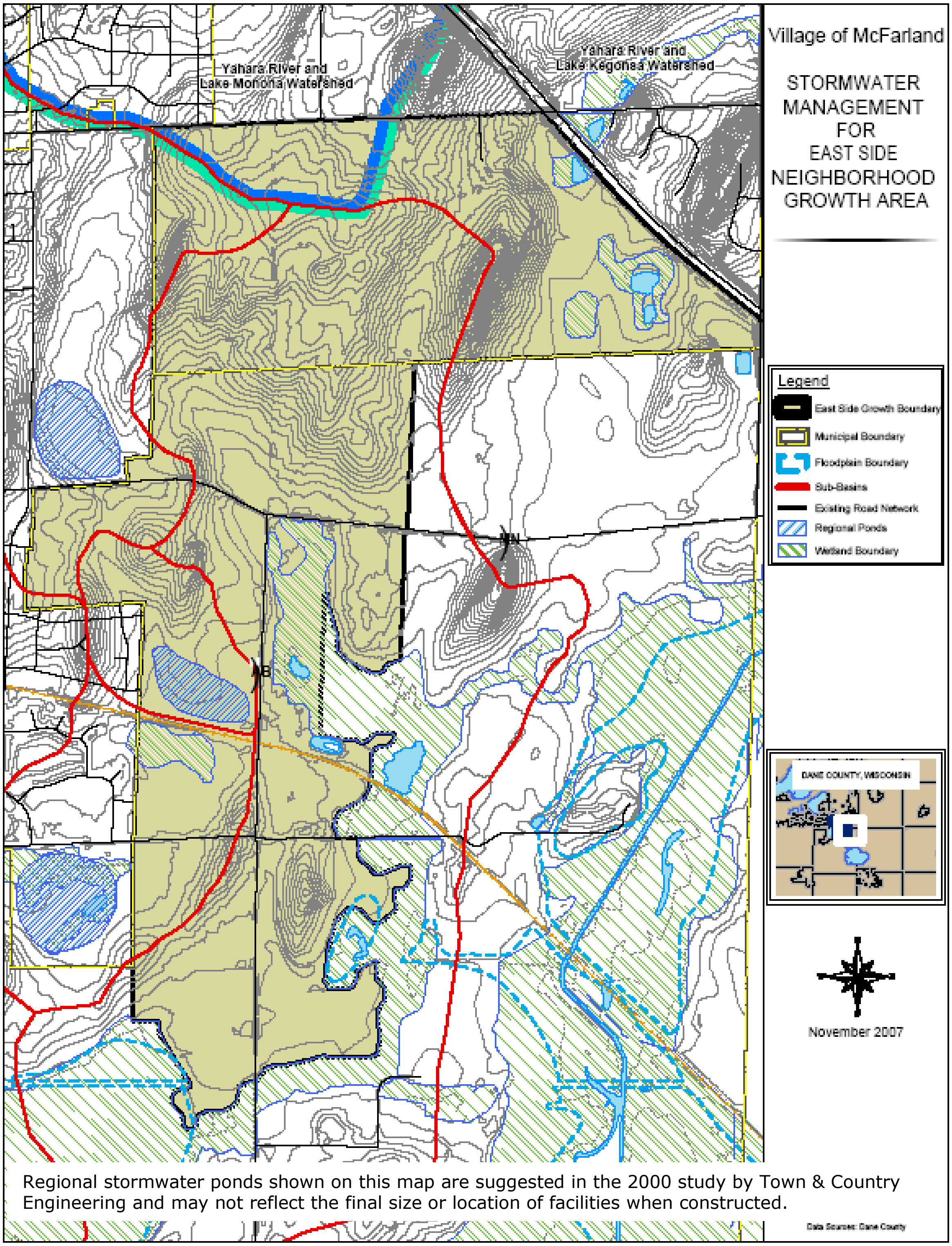
- **Stormwater Trees -** Stormwater trees are trees planted individually or in groups in urban areas such as: parking lots, right-of-ways, along streets, parks, schools, public lands, vacant land, highway cloverleafs, and neighborhood open spaces, to provide shade and stormwater retention (interception and evapotranspiration) and to add aesthetic value. Individual trees may be planted using tree pits, tree box filters or stormwater planters. Stormwater trees are limited to areas where there is sufficient room to plant the tree (and allow it to grow), as well as to provide space for pedestrians, street parking, utilities, and adequate distance from structures. Good soil conditions are also important, and planting groups of stormwater trees may be more feasible on public land, such as schools and parks, due to ownership and available space. Stormwater trees provide the most benefit for locations with high annual rainfall and land uses with low impervious cover. This practice is most effective at reducing peak runoff rates in land uses with large amounts of open space.
- **Porous Pavement -** The use of porous asphalt or concrete, modular block systems, grass pavers, or gravel pavers to allow stormwater to percolate through the 'pavement'. Each variant has specific design specifications and different levels of applicability. Porous pavement systems are best used in low traffic and low load bearing areas such as parking lots (particularly overflow parking areas), parking lanes along residential streets, driveways, sidewalks, emergency access roads, maintenance roads and trails, road shoulders, etc. While some studies have indicated maintenance challenges in cold climate regions, others have indicated the performance is not limited in these situations so long as appropriate maintenance measures are taken.
- **Bioretention -** Landscaped depressions planted with grass, shrubs, and/or trees. These depressions are designed to incorporate many of the pollutant removal mechanisms that operate in forested ecosystems. During storms, runoff ponds above the mulch and soil in the system, while runoff from larger storms is generally diverted past the facility to the storm drain system. The remaining runoff filters through the mulch and prepared soil mix. Typically, the filtered runoff is collected in a perforated underdrain and returned to the storm drain system. Bioretention is commonly applied in smaller parking lot islands or within small pockets in residential land uses. Bioretention requires seasonal landscaping maintenance. In many cases, bioretention areas require intense attention initially to establish the plants, but less maintenance is required in the long term. In many cases, maintenance tasks can be completed by a landscaping contractor.
- **Onsite Filtering Practices -** Practices such as sand filters, bioretention cells, swales, and filter strips that use a filter media (sand, soil, gravel, peat, or compost) to reduce stormwater runoff and capture pollutants. In addition, most filtering practices are typically applied to small drainage areas (five acres or less) for the treatment of smaller storm events. Filtering practices are designed for pollutant removal; however, in certain situations they can be used to increase infiltration and flow path, thus providing some reduction in runoff volume and peak discharge. Filter strips and swales, for example, are effective practices for increasing flow path and time of concentration. Bioretention cells, swales, and filters can be designed without underdrains to promote infiltration.
- **Pocket Wetlands -** Pocket wetlands are a type of constructed stormwater wetland designed to receive runoff from limited drainage areas (i.e., less than 25 acres). Stormwater wetlands (a.k.a. constructed wetlands) incorporate wetland plants in a shallow pool. As stormwater runoff flows through the wetland, pollutant removal is achieved by settling and biological uptake within the practice. Stormwater wetlands are among the most effective stormwater practices in terms of pollutant removal, and also offer aesthetic value. While natural wetlands can sometimes be used to treat stormwater runoff that has been properly pretreated, stormwater wetlands are fundamentally different from natural wetland systems. Stormwater wetlands are designed specifically for the purpose of treating stormwater runoff, and typically have less biodiversity than natural wetlands both in terms of plant and animal life. Pocket wetlands are ideal for urban areas because they require less space than other types of stormwater wet-

lands. In a pocket wetland design, the bottom of the wetland intersects the groundwater, which helps to maintain the permanent pool. In the absence of a high groundwater table, supplemental irrigation may be required to sustain the wetland vegetation. Stormwater wetlands require regular maintenance and inspection. Typical activities include sediment removal, plant harvesting, invasive species removal, and periodic plant replacement.

Funding Alternative – Stormwater Utility

A stormwater utility is a mechanism set up to generate funding specifically for stormwater management tasks within a municipality. The premise is to charge for services provided to developed properties generating runoff, as well as the service to properties being protected from the effects of runoff. Therefore, users within the district pay a stormwater utility fee, and the revenue thus generated directly supports the administration, planning, implementation and maintenance of stormwater management programs. In general, storm water utilities are designed to pay for stormwater management practices benefiting the municipality as a whole and typically do not generate funding for any new site development. Therefore, developing properties are still required to meet Village standards for stormwater quantity and quality goals at their own expense.

One of the benefits of setting up a stormwater utility is that it is set up so that the "users" pay, as opposed to a general stormwater program that draws on the general tax fund or uses property taxes for revenue. Most stormwater utilities are set up so that all developed parcels within a municipality are charged a user fee based on the amount of impervious area on the parcel. Impervious surfaces are solid surfaces that prevent rainfall from infiltrating back into the ground, thus leading the rainfall to run off these surfaces in greater quantities, at higher velocities with an increased pollutant loading. Therefore, a large commercial parcel, which may be 80 to 90 percent impervious, produces a larger amount of stormwater runoff than a residential parcel of equal area, which may be only 30 to 40 percent impervious. With a stormwater utility, the commercial property owner pays a proportionally higher fee than a residential property owner because the impact of his land use on the stormwater system is greater than that of the residential property owner. Examples of impervious surfaces include, but are not limited to driveways, rooftops, patios, porches, sidewalks, parking lots, loading docks and compacted gravel. There are many different types of storm water utilities with variations in fee structures, but the underlying theme of the majority of these storm water utilities is that the contributors will pay their proportionate share of the required revenues.



Regional stormwater ponds shown on this map are suggested in the 2000 study by Town & Country Engineering and may not reflect the final size or location of facilities when constructed.