Appendix C – Conceptual Stormwater Management Plan

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Memo

To:	Eric Mead, P.E., P.M.P.		
From:	Ryan Asman, E.I.T. Beth Peterson, P.E.	Project:	Factoria Recycling and Transfer Station
CC:			
Date:	August 30, 2010	Job No:	000000000124743
Subject:	Conceptual Stormwater Management Plan (Attachments available upon request)		

Introduction

The proposed Factoria Recycling and Transfer Station (FRTS) requires the construction of surface and storm water management systems to mitigate the impacts of development "on natural and existing man-made drainage systems" (KCSWDM, 2009). This document describes the conceptual stormwater features that will be required to meet local, state, and federal regulatory requirements; objectives of sustainability, including LEED Gold and Salmon Safe certification; and goals to preserve natural surface water features through the implementation of best management practices.

Background

The King County Department of Natural Resources and Parks, Solid Waste Division (KCSWD) is in the process of design and engineering for the replacement of the Factoria RTS, a solid waste transfer facility owned and operated by KCSWD. The Factoria RTS is one of eight County transfer stations where waste is collected, transferred into large tractor-trailers, and subsequently hauled to the Cedar Hills Regional Landfill (CHRLF) in Maple Valley, Washington. Commercial haulers and residential and business self-haul customers use the Factoria RTS. The Factoria RTS was originally constructed in the 1960s and is nearing the end of its useful life.

The Factoria RTS is situated on an approximately 10.7-acre parcel that is constrained by steep topography, wetlands, streams, and a large utility corridor easement occupied by Olympic Pipeline and Puget Sound Energy distribution lines and Puget Sound Energy (PSE) overhead power lines. The transfer station operation and household hazardous waste (HHW) collection are contained within one large building on the site. Southeast 32nd Street dead-ends at the Factoria RTS entrance, where a scalehouse is located to weigh vehicles upon entering and exiting the site.

The County intends to maintain operation of the existing transfer station during construction of its replacement on adjacent property. To help facilitate that goal, the County purchased adjacent property northwest of the site that contains two warehouse buildings, bringing the total size of the project site to approximately 10.7 acres (Figure 1). The new Factoria RTS will include an enclosed solid waste transfer and processing area, an employee/administration facility, a scalehouse with weigh station plaza, a fueling facility, a maintenance shop, an HHW collection area, a recycling facility, and a vactor truck decant area.

The warehouses will be deconstructed to make way for the new transfer station facility and administration offices during Phase 1 construction. Demolition of the existing station, construction of the HHW area and the recycling facility, relocation of the scalehouse, and final site improvements will be completed during Phase 2. Project completion is scheduled for late 2014.

Project Setting

The Factoria RTS is located at 13820 Southeast 32nd Street (Section 10, Township 24 North, Range 5 East) within the City of Bellevue, Washington. The existing facility is located in the light industrial area between SE 30th Street and SE

32nd Street. The project site is centered at latitude 47° 34' 54.54" North and longitude 122° 9' 34.79" West. Topography of the site generally slopes down from southeast to northwest.

The proposed FRTS site is approximately 11.4 acres, assuming the proposed lot line adjustment on the south side of the parcel is pursued and implemented as proposed in site plan Concept 2B. The adjacent Eastgate property to the south is approximately 14.5 acres, and currently has two stormwater ponds, located in the northeast and northwest corners of the property. The storm drainage infrastructure and respective catchment area for these stormwater features is unknown at present, and further field reconnaissance will be performed prior to Phase II of the project when detailed stormwater design will be performed.

Regulatory Requirements

Stormwater management on the FRTS and Eastgate development sites is regulated by the City of Bellevue Utilities Department (Utility), Storm and Surface Water Engineering Standards (Standards); the Storm and Surface Water Utility Code, Chapter 24.06 of the Bellevue City Code, is the basis for the Standards. Requirements included in these standards mandate that the owner of new developments or re-developments manage both the quantity and quality of surface and storm water from the developed site. At the discretion of the Utility, more stringent requirements may be enforced. The Utility developed a *Storm Drainage Thresholds Worksheet for MR #6 and MR #7* that was used in determining physical parameters necessary for evaluating Minimum Requirement #7 – Flow Control. The worksheet was used in determining respective areas of pervious and impervious surfaces that are used as inputs in the hydrologic model that determines detention volumes required for meeting flow control criteria. The present analysis addresses the minimum requirements set forth for flow control (MR7); water quality control (Minimum Requirement #6) was not analyzed in the present evaluation, but will be required in future analyses as the design progresses.

The developed, or proposed, condition is compared to the 100-year, 24-hour storm, peak flow event discharging from the site at the pre-developed condition. The Bellevue City Code and Standards (2010) requires that the developed, or proposed, condition must not exceed the discharge rate from the predeveloped condition for the 100-year, 24-hour storm event by a discharge rate of more than 0.1 cfs. The Code also requires that the hydrologic modeling of the pre-developed condition assumes 100% forested land. The present analysis sizes flow control volumes to mitigate flows in exceedance of the pre-developed peak flow event. In addition to the 100-year peak flow frequency requirement, flow duration requirements (SMMWW 2005) for the developed condition are as follows:

1) If the post developed flow duration values exceed any of the predeveloped flow levels between 50% and 100% of the 2-year predeveloped peak flow values (100 Percent Threshold) then the flow duration requirement has not been met.
2) If the post-developed flow duration values exceed any of the predeveloped flow levels between 100% of the 2-year and 100% of the 50-year predeveloped peak flow values more than 10 percent of the time (110 Percent Threshold) then the flow duration requirement has not been met.
3) If more than 50 percent of the flow duration levels exceed the 100 percent threshold then the flow duration requirement has not been met.

Existing Conditions

The site of the proposed FRTS consists of five county-owned parcels including the existing Factoria Transfer Station (FTS); it is located in the approximately 459-acre East Creek sub-basin of the Mercer Slough basin. It is anticipated that approximately 11.4 acres on the north end of the site will be used for the development of the proposed FRTS, with the remaining 14.5 acres to the south (Eastgate property) being set aside for future development. Geotechnical investigations (Shannon & Wilson 2010) and the presence of multiple wetlands on the site indicate the need for construction dewatering, as well as a long-term groundwater management system. Retaining walls constructed on the site will require underdrains in order to convey groundwater flowing through the site.

The major surface water features on the site are tributaries and wetlands in the East Creek sub-basin and are described below.

Stream 0263

Stream 0263 originates west of 139th Avenue SE, approximately 600 feet east of the existing facility and flows northwesterly through the northeast corner site. Stream 0263 continues to flow north and discharges into East Creek approximately 800 feet north of the limits of proposed development. The stream channel is generally narrow (approximately 4-feet wide), confined, and deeply incised in the upper reach south of SE 30th Street. The channel substrate is predominantly cobbles and gravels, with little or no pool formation occurring. Riparian vegetation is dominated by reed canarygrass and Himalayan blackberry.

A stormwater detention pond for a neighboring commercial development is located approximately 250 feet southeast of the site. This detention pond is approximately 100 feet wide and 120 feet long, and it discharges into Stream 0263 at an outlet location that is approximately 200 feet downstream from the pond. The detention pond appears to be contributing to channel incision downstream and the consequential sediment aggradation that is occurring in the downstream Wetland 3.

Stream A

Stream A originates from Wetland 2 and flows into a 2-ft wide, 300-foot long triangular-shaped open channel to the south of the warehouse buildings. Stream A flows westerly for approximately 300 feet before making a 90-degree turn to the north through a riprap-lined channel at the western edge of the proposed development area. Stream A then flows north for approximately 300 feet before entering a 4 foot vertical drop structure that discharges into a culvert under SE 30th Street. Stream A eventually discharges into East Creek approximately 650 feet north of the project study area. The stream channel south of the warehouse buildings is stagnant and shallow, creating a swamp-like condition where organic debris regularly accumulates. Reed canarygrass, water-cress, giant horsetail, and lady fern grow in the channel and riparian zone within this reach.

Stream B

Stream B is located to the south of the existing transfer facility and is approximately 2 feet wide. The ephemeral channel is vegetated with Himalayan blackberry, and its flow path leads to a buried culvert located south of SE 32nd Street. Field reconnaissance by HDR scientists observed no surface water in Stream B, and it is possible that this channel is no longer hydrologically active. Investigation of topographic maps indicates that Stream B was hydrologically connected to Wetland 4 historically, but development on the site has altered the natural hydrology.

Wetland 2

Wetland 2 is a 0.38-acre slope wetland located on a moderate to steep slope northwest of the existing transfer station (Figure 2). Wetland 2 is downstream of a paved driveway (SE 32nd Street) to the west, and is approximately 120 feet wide and 200 feet long.

Wetland 3

Wetland 3 is a 1.8-acre slope wetland located at the north end of the study area and east of SE 30th Street; 0.96-acres of Wetland 3 are on the proposed development site. Wetland 3 continues to extend north outside the study area is likely to extend up to the Puget Sound Energy (PSE) facility and its private driveway located at the east end of SE 30th Street. The PSE transmission line easement is located east of the study area, running north-to-south, and two underground fuel pipelines owned by the Olympic Pipeline Company cross Wetland 3 within the easement.

Wetland 4

Wetland 4 is approximately 40-feet by 100-feet, and is a 0.06-acre slope wetland that is located immediately north of SE 32nd Street and west of the existing transfer station. It is located on a gently-sloped hillside that slopes down from the paved SE 32nd Street to the north.

Hydrologic Modeling

HDR modeled two scenarios to determine the volume of detention facilities that will be required for management of runoff volumes from the FRTS site. The first scenario included management of runoff on the proposed FRTS site, and the second scenario included the addition of runoff volumes from the adjacent Eastgate property. The Western Washington Hydrology Model, version 3.0 (WWHM3) was used in evaluating flow control for the scenarios. The

proposed conceptual stormwater management system will require maximization of underground storage below the trailer parking/maneuvering area located in the northwest portion of the project for both scenarios due to a lack of available above ground space. Results of the WWHM3 models can be found in Attachment A. A summary of the land use as input into the WWHM3 model are shown in Tables 1 through 3.

Land-use types for the proposed condition were determined based on the preferred alternative for the FRTS, and assumptions were made about the types of plantings and landscaping that would be implemented in a final design. Greater uncertainty lies in the assumptions made about the future development of the Eastgate property, but it was conservatively estimated that 12.2 acres of the site surface area will be impervious. The percent impervious for the proposed development was assumed to be 85%, based on Bedient and Huber (1992). A summary of the proposed surface types for the FRTS, Eastgate, and combined sites can be found in Tables 1 through 3, respectively.

Table 1. Surfaces for proposed FRTS development.

FRTS Proposed Surfaces		
Pervious		
Forest (type C[1], steep[2])	2.7	ac
Lawn (saturated, flat)	0.8	ac
Lawn (type C, flat)	2.6	ac
Sub-total	6.1	ac
Impervious		
Roads (moderate)	1.7	ac
Roof tops (flat)	1.6	ac
Parking (flat)	2.0	ac
Sub-total	5.3	ac
Total Area of FRTS	11.4	ac

[1] There are three basic soil types: A/B (outwash soils), C (till), and SAT (saturated/ wetland/hydric soils).
[2] There are also three land slope categories: flat (0-5%), moderate (5-15%), and steep (>15%)

Table 2. Surfaces for proposed Eastgate development.

Eastgate Dev. Proposed Surfaces		
Pervious		
Forest (type C[1], steep[2])	1.2	ac
Lawn (type C, moderate)	1.1	ac
Sub-total	2.3	ac
Impervious		
Roof tops (flat)	6.1	ac
Parking (flat)	6.1	ac
Sub-total	12.2	ac
Total Area of Eastgate	14.5	ac

[1] There are three basic soil types: A/B (outwash soils), C (till), and SAT (saturated/ wetland/hydric soils).
[2] There are also three land slope categories: flat (0-5%), moderate (5-15%), and steep

(>15%)

Table 3. Surfaces for the combined development of FRTS and Eastgate.

FRTS+Eastgate Surfaces		
Pervious		
Forest (type C, steep)	3.9	ac
Lawn (saturated, flat)	0.8	ac
Lawn (type C, flat)	2.6	ac
Lawn (Type C, moderate)	1.1	ac
Sub-total	8.4	ac
Impervious		
Roads (moderate)	1.7	ac
Roof tops (flat)	7.7	ac
Parking (flat)	8.1	ac
Sub-total	17.5	ac

[1] There are three basic soil types: A/B (outwash soils), C (till), and SAT (saturated/ wetland/hydric soils).
[2] There are also three land slope categories: flat (0-5%), moderate (5-15%), and steep (>15%)

The detention volume required to manage stormwater runoff from the FRTS site is approximately 3.59 acre-feet; the detention volume required to manage stormwater runoff from both the FRTS and Eastgate development site is approximately 8.25 acre-ft. Table 4 compares of the results of the two scenarios, and Table 5 illustrates that the mitigated peak flows do not exceed the predeveloped condition flow rates.

Table 4. Comparison of the two stormwater management scenarios.

Stormwater Scenario	*Catchment Area (acres)*	*Detention Volume (acre-ft)*
FRTS[1]	11.4	5.29
FRTS + Eastgate	25.9	8.25

[1] Assumes approval of boundary line adjustment.

Table 5. Flow frequency for the two scenarios from WWHM3.

	FRTS Scenario		*FRTS & Eastgate Combined*	
	Predeveloped	*Mitigated Flow*	*Predeveloped*	*Mitigated Flow*
Recurrence Interval	(CFS)	(CFS)	(CFS)	(CFS)
2 Year	0.39	0.20	0.89	0.61
5 Year	0.61	0.26	1.39	0.99
10 Year	0.76	0.31	1.73	1.30
25 Year	0.95	0.37	2.16	1.79
50 Year	1.09	0.42	2.47	2.22
100 Year	1.23	0.48	2.79	2.71

[1] Point of compliance

Proposed Stormwater System

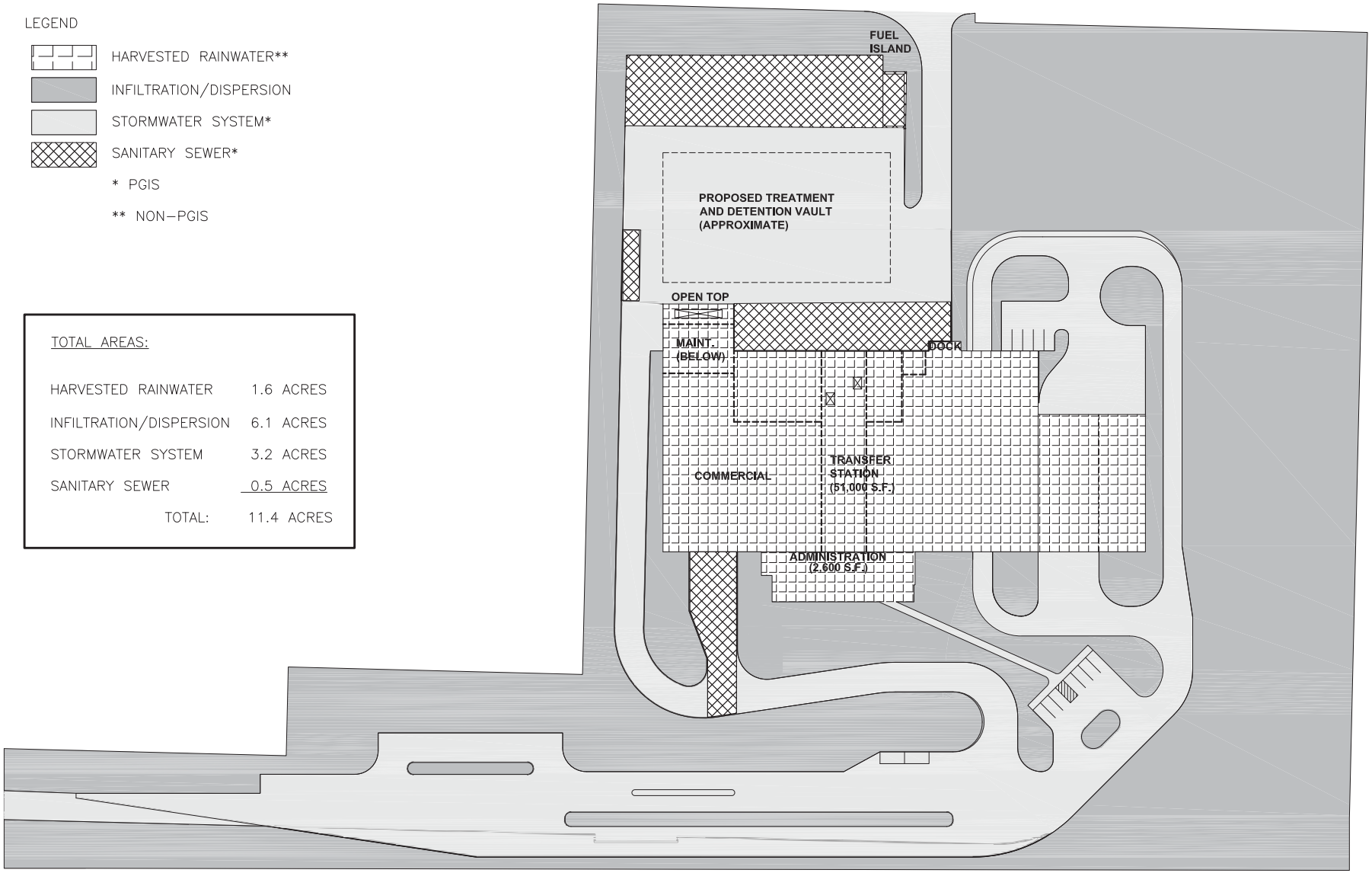
Surface water runoff for the proposed FRTS development will require treatment in the form of flow control and water quality. The site consists of paved pollution-generating impervious surfaces (PGIS), pervious landscaped areas, and impervious rooftops (Non-PGIS). Areas of long-term trailer storage, as well as areas with high potential of trailer leakage, will be managed separately and discharged to the sanitary sewer, as shown in Figure 1. The areas of pavement

LEGEND

- HARVESTED RAINWATER**
- INFILTRATION/DISPERSION
- STORMWATER SYSTEM*
- SANITARY SEWER*

* PGIS

** NON–PGIS



TOTAL AREAS:

HARVESTED RAINWATER	1.6 ACRES
INFILTRATION/DISPERSION	6.1 ACRES
STORMWATER SYSTEM	3.2 ACRES
SANITARY SEWER	0.5 ACRES
TOTAL:	11.4 ACRES

JRM J&A

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER

PROJECT NUMBER

King County
Department of
Natural Resources and Parks
Solid Waste Division

FACTORIA RECYCLING AND TRANSFER STATION

CONCEPTUAL STORMWATER MANAGEMENT PLAN

0 1" 2"

FILENAME PreferredStormwtrPlan.dwg

SCALE 1" = 40'

SHEET **FIG. 1**

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subjected to lower levels of contamination will be conveyed to the on-site water quality treatment facilities, before being discharged into the stormwater system. The rooftop runoff will be conveyed to a cistern or reservoir for use in the truck washdown, as well as for landscape irrigation. Finally, the pervious landscaped areas will either be infiltrated via rain gardens, or dispersed as appropriate.

A stormwater treatment and detention vault will be utilized to attenuate peak flow events resulting from stormwater runoff from non-pollution generating impervious surfaces. The treatment and detention vault will be located below the proposed parking lot, north and adjacent to the main transfer building. For the combined management system scenario, the vault dimensions would be approximately 310' x 150', assuming a vault height of 8'. Managing only runoff volumes from the proposed FRTS site, the vault dimensions would be significantly reduced to roughly 170' x 170', assuming the same vault height of 8'. Greater depths were not considered due to the close proximity the water table, additional analysis may indicate that greater depths will be technically feasible. Pros and cons associated with combining the stormwater management of the two sites can be found in Table 6.

Table 6. List of pros and cons associated with combining stormwater management of FRTS and Eastgate.

Pros	***Cons***
• Greater area of developable land on Eastgate. • Lower development costs on the Eastgate site. • King County has greater control of upstream stormwater management. • Improved environmental impacts by having greater control of upland surface runoff. • Existing stormwater features on Eastgate may be impacted by retaining wall construction, and therefore temporary measures may not be necessary if a permanent system is put in place.	• Higher development costs for FRTS. • Potential transfer of basins discharge • Capacity to manage large volumes of runoff on FRTS site is uncertain. • Possibly more difficult to permit the discharge if significantly more than anticipated. • King County liable for water quality being discharged from an unknown development as part of the NPDES permit.

The conveyance system will consist of a series of interconnected pipes and catch basins that discharge into the vault. Stormwater runoff from pollution generating impervious surfaces (i.e. roads and parking areas) will be separated into a separate conveyance systems in order to separate pollution generating impervious surfaces from sources of runoff that do not require water quality treatment. The water quality treatment facilities will have a separate discharge outlet to the detention vault, after the water has gone through requisite treatment.

Some paved areas will contain greater concentrations of contaminants than others and will require treatment (see Attachment B) prior to discharge to the sanitary sewer. Further analysis of the separation of surface and sanitary discharges will be considered in Phase II of design.

The southeast corner of the site is an upland forested area, and surface water runoff that collects behind the proposed retaining wall will be conveyed in a v-bottom ditch to the northeast corner and discharged to Wetland 3. Groundwater in this region flows northwest towards the proposed retaining wall, and will be collected via an underdrain system comprised of a gravel trench and 4" perforated HDPE pipe. Groundwater flows captured in this wall will be conveyed to the northeast corner of the site and discharged to Wetland 3. Groundwater flow collected in the retaining wall underdrains will not be required to undergo water quality treatment, and will bypass the water quality treatment facilities before entering the detention vault.

Stormwater that falls on the roof of the main facility will be collected and stored in the rainwater harvesting system. The rainwater harvesting system will consist of rooftop collection drains, a conveyance system and reservoir. Water in the system will be used in the truck washdown facility, as well as for irrigation while establishing plants post-construction. It is assumed that the majority of plants utilized in landscape development will be xerophytes, requiring little or no irrigation. Excess capacity will be directly discharged to the (detention vault or Wetland 3), via an appropriately designed outlet control structure.

Pervious areas of the proposed development will be designed to maximize infiltration through the use of engineered rain gardens, bioswales, narrow area filter strips, and other applicable infiltration features. The northern part of the site is an area with a high water table, and infiltration is not likely to be considered in these areas. The upland pervious developed areas will be considered for infiltration as the backfill material can be engineered to be suitable for infiltrating.

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