

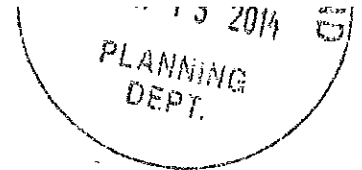
13b.

Status Update on Stormwater and Groundwater  
Monitoring Completed to Date in the Rock Creek  
Drainage, Tetra Tech  
May 6, 2014



# REVISION/CORR SUBMITTAL F

13a) Status Update on Stormwater and Groundwater Monitoring Completed to Date in the Rock Creek Drainage, Tetra Tech, May 6, 2014 (r/c May 13, 2014)



**Submittal Requirements:**

All revisions / correction submittals **MUST** contain the following:

1. A completed City of Black Diamond Revision/Correction submittal form
2. Two (2) sets of revised and/or corrected drawings/sheets (wet stamped by architect, if applicable).
3. Revised structural calculations, if applicable (must be stamped by engineer)
4. A written letter to the City that shows an itemized summary of your submittal (must include sheet and detail numbers)
5. All changes **MUST BE CLOUDED** or **HIGHLIGHTED** on each plan set

Date: 5/13/14

Permit #: PLN13-0027

Property Address: SEE THE PHASE 2 PLAT C DRAWINGS OR PROJECT NARRATIVE

Project Name: THE VILLAGES MPD PHASE 2 PLAT C PRELIMINARY PLAT

Contact Person: COLIN LUND

Phone: (425) 878-2100

Email: clund@yellowboyholdings.com

**TYPE OF SUBMITTAL:**

SUPPLEMENTAL INFORMATION FOR PLAT 2C

- ( ) **REVISION:** A change the applicant has made to a plan that is either:
1. An approved plan already issued by the City or
  2. A project under current plan review

( ) **CORRECTION:** An applicant response to a correction letter written by the City to the applicant

Permit Issued? ( ) Yes (X) No \*A plan check fee for revision is \$84 per hour with a minimum of \$42 for ½ hour

**Please describe revision/correction submittal:**

STATUS UPDATE ON STORMWATER AND GROUNDWATER MONITORING COMPLETED TO DATE IN THE ROCK CREEK DRAINAGE

Sheets Affected: \_\_\_\_\_ If more than two (2) sheets will be changed, please submit two (2) new full sets of plans. Revisions on issued permits only require submittal of the affected sheets.

**For City Use Only:**

REQ'D APPROVAL	CHECKED BY	ROUTE TO	DATE	INITIAL	COMMENTS	FEES
( )	1.BUILDING	_____	_____	_____	_____	_____
( )	2.PLANNING	_____	_____	_____	_____	_____
( )	3.FIRE	_____	_____	_____	_____	_____
( )	4.PW	_____	_____	_____	_____	_____
( )	5	_____	_____	_____	_____	_____

TOTAL \$



# MEMO

**To:** Angela Hill and Colin Lund (Yarrow Bay Holdings)  
**Cc:**  
**From:** Rob Plotnikoff, Harry Gibbons, and Jessica Blizard  
**Date:** May 6, 2014  
**Subject:** Status Update on Stormwater and Groundwater Monitoring Completed to Date in the Rock Creek Drainage

## 1.0 MONITORING REQUIREMENTS

Pursuant to Section 7.4.5 and Exhibit "O" of The Villages and Lawson Hills MPD Development Agreements (DAs), the Master Developer, in conjunction with the City of Black Diamond, will review, plan and institute the following:

- **Monitoring:** Prior to construction of the first MPD Implementing Project, the Master Developer shall cause to occur three water quality samples in three separate months during the wet season at three locations within Rock Creek to be mutually agreed to by the City and Master Developer. This sampling data shall be provided to the City and be used to establish an interim baseline phosphorous load that will then be further refined by the Baseline Monitoring section below.
- **Baseline Monitoring:** Prior to construction of the first implementing project within the Lake Sawyer drainage basin, the Master Developer, in conjunction with the City of Black Diamond shall review, plan and institute the following:
  1. Monitor pre-development phosphorus levels at pre-determined locations within the project drainage basins. Monitoring is to occur consistently over the course of at least one water year (October to September) in accordance with the procedures and criteria outlined in Chapters 6 through 12 of the QAPP (see Exhibit "O" to the DAs). Use data collected over the water year to establish a baseline phosphorus load from the project. This load should be factored to an average year rainfall volume for future comparisons of phosphorus loads for years where the rainfall is more or less than the average.
  2. Select one or two possible compensation projects. Offsite compensation projects will be on land not being actively developed for the MPDs but that includes features that currently contribute phosphorous to Lake Sawyer that are amenable to reductions of phosphorous, such as roadway segments or intersections, pastures with farm animals, or existing developed property all lacking modern stormwater controls, or erosive slopes or streams. Monitor pre-mitigation phosphorous levels at pre-determined locations within the compensating project drainage basin. Monitoring is to occur consistently over the course of at least one water year (October to September) in accordance with the procedures and criteria outlined in Chapters 6 through 12 of the QAPP (see Exhibit "O" to the DAs). Use data collected over the water year to establish a baseline phosphorous load from the compensating project. This load should be factored to an average year rainfall volume for future comparisons of phosphorous loads for years where the rainfall is more or less than the average.

**Note:** The SW-4 location (Ginder Creek at the north end of the culvert crossing under Roberts Drive) was selected as a monitoring site during the 2012-2013 water year pursuant to the Villages MPD Condition of Approval No 84 and Exhibit "O" for pre-mitigation phosphorus monitoring associated with a possible compensating phosphorus reduction project within the Lake Sawyer drainage basin. The compensating phosphorus reduction project that the Master Developer selected is the Ginder Creek Stormwater Treatment Pond.

These "Baseline Monitoring" requirements were further expanded for The Villages MPD Preliminary Plat 1A pursuant to the City of Black Diamond Hearing Examiner's approval decision dated December 10, 2012. Specifically, the City's Hearing Examiner asked that the "Baseline Monitoring" be expanded to include "a significant increase in the amount of sampling to provide for an acceptable error of 0.05 and the use of hydrograph separation, smearing and other techniques to estimate separate loadings for base flows." An Expanded Baseline Monitoring Program for Preliminary Plat 1A that was approved by the City on July 19, 2013 and includes the following:

- Storm event monitoring at three Rock Creek locations during three separate storm events in the 2013-2014 water year. Three samples collected at each site during each storm event (total of 9 samples for each of the three sites = **27 total samples + 9 replicate samples**).
  - Flow monitoring data will be generated at the time of sampling and will be used to estimate separate loadings for base flows.
  - This expanded baseline monitoring program significantly increases the amount of sampling in Rock Creek and is sufficient to provide for an acceptable error of 0.05.
  - Analysis of the water quality sampling and flow data from water years 2011-2012, 2012-2013, and 2013-2014 will include development of hydrograph separation, smearing and other techniques to estimate separate phosphorus loadings for base flows.
- Project Design Phase: In conjunction with City of Black Diamond review, prepare on-site drainage designs with phosphorus mitigation solutions which include the following:
    1. Phosphorus control menu items from the 2005 DOE Manual (or later manuals if adopted and imposed for later Project phases).
    2. Any additional AKART (all known and reasonable technologies) not identified in 1. above, that are in compliance with The Villages MPD Permit Approval Condition No. 76 or the Lawson Hills MPD Permit Approval Condition No. 79.
    3. Drainage designs should include contingency planning for augmentation of treatment so that future interventions can be made if needed.
  - Project Construction Phase: Upon commencement of implementing project construction the following shall be instituted:
    1. Monitoring shall be performed at all drainage facility outlet points to establish post-construction phosphorus levels. This monitoring is to occur consistently over the course of the water year in accordance with the procedures and criteria outlined in the QAPP (see Exhibit "O" to the DAs).
    2. Regular comparisons shall be made to determine if stormwater management strategies are achieving goals established in the design phase. If levels are exceeding goals, source control interventions shall be implemented within 30 days of obtaining a substandard sampling measurement.
    3. Upon completion of the water year compare actual loads to pre-development loads. If loads are exceeding pre-development loads, institute compensatory project(s) within 6 months (subject to City approvals). Mitigation projects can include on-site or off-site measures that reduce the Tp input to the Lake Sawyer Basin.
  - Project Build-Out Phase: Continue monitoring of drainage outlets for five years following the completion of development that discharges into that facility to confirm compliance with the no net phosphorus goal as per

procedures noted above. Completion shall be defined as the date the City's maintenance bond, as required by BDMC 14.04.360 and the Black Diamond Engineering Design and Construction Standards (Exhibit "E" to the DAs) Section 1.5, is released or expires for a given facility. If data show variations from the standard, institute source control or improved maintenance solutions. If these interventions are insufficient, institute alternate compensatory projects or mitigations.

## **2.0 SURFACE WATER MONITORING**

Consistent with the monitoring requirements set forth in Section 1.0 above, numerous water quality samples have been collected in key locations during storm events and routine monitoring as described below.

### **2011/2012 Monitoring Year**

During the 2011-2012 water year, three water quality samples were collected in three separate months (December 2011, January 2012, and March 2012) during the wet season at three locations within Rock Creek to characterize pre-development conditions and establish an interim baseline phosphorus load that would then be further refined by the 2012-2013 Baseline Monitoring Program (set forth below). See TetraTech's Technical Memorandum titled "The Villages and Lawson Hills MPDs Pre-Construction Stormwater Monitoring in Rock Creek and the Establishment of an Interim Baseline Phosphorus Load" dated July 23, 2012 for more information. The estimated interim baseline phosphorous load established pursuant to this sampling was a net increase of 10.0 kg/yr from The Villages MPD and a net increase of 7.4 kg/yr from Lawson Hills MPD (Triad Associates Tech Memo, January 2011).

### **2012/2013 Monitoring Year**

During the 2012-2013 water year, a total of 236 samples were collected including: monthly baseline sampling, 6 storm sampling events, and continuous water level monitoring (Table 1). Seven sites were visited along with Hammerhead Ditch during both monthly baseline sampling and the 6 storm sampling events. Water level logging devices were downloaded monthly from all seven sites in order to develop flow rating curves that will be used to calculate annual total phosphorus loads once remaining monitoring results for 2013/2014 sampling have been processed. See TetraTech's 2012-2013 Phosphorus Monitoring Report dated November 2013 (Revised January 2014) for more information. Tetra Tech is currently using data collected during the 2011/2012, 2012/2013, and 2013/2014 water years to establish a baseline phosphorous load for both The Villages and Lawson Hills MPDs.

### **2013/2014 Monitoring Year**

During the 2013-2014 water year, three stormwater monitoring events have been conducted at four sites during three different events throughout the storm period. Sample collection sites included Hammerhead Ditch, Abrams Rd., Auburn Black Diamond Rd., and 312<sup>th</sup> St. These monitoring events have been coupled with monitoring at two groundwater well piezometers for an eleven week period beginning January 2014 and ending March 2014. V28 and V29 groundwater well sites were visited weekly for a period of eleven weeks in order to determine water quality conditions in groundwater that influence downgradient surface water.

Table 1. Sample sites and number of samples collected during each of the monitoring years

Monitoring Year	Rock Creek at SE 312 <sup>th</sup> St	Rock Creek at SE Auburn-Black Diamond Rd	Rock Creek at Abrams Rd	Rock Creek at the Ditch at Robert's Drive	The Basin at SR 169	Glinder Creek	Mud Creek	Hammerhead Ditch	V29 (groundwater well)	Routine Monitoring (at 7 sites)	Total No. of Replicates	Total number of Samples
2011/2012	9	9	9								9	36
2012/2013	18	18	18	18	18	18	17	3*		101	7	236
2013/2014	9	9	9					9	22		4	62

Note: \*Water was in the Hammerhead Ditch Site on only one storm sampling event.

### 3.0 GROUNDWATER WELL MONITORING

During water year 2013-2014, groundwater wells were monitored on 11 different dates during a variety of precipitation and flow conditions. Two wells were monitored on each sampling date. Specific monitoring wells and dates sampled are shown below in Table 2. At each site samples and field measurements were collected, and water level in each well was noted. Approximate recharge rates were determined for each well. Monitoring well with sample id MWV29-01 was dry and unable to be sampled. All other wells contained water. Monitoring well MWV29-05 was not able to be monitored until later in the sampling period due to a stuck well cap that had to be manually removed with a saw.

Table 2. Groundwater sample collection sites and collection dates

Monitoring Well ID	Date Sampled
MWV29-02	1/21/2014
	2/3/2014
	2/24/2014
	2/27/2014
	3/13/2014
	3/27/2014
MWV29-03	2/3/2014

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	2/6/2014
	2/13/2014
	2/24/2014
	2/27/2014
	3/13/2014
	3/27/2014
	1/21/2014
	2/6/2014
<b>MWV29-04</b>	2/13/2014
	3/4/2014
	3/17/2014
	4/3/2014
	3/4/2014
<b>MWV29-05</b>	3/17/2014
	4/3/2014

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#### 4.0 NEXT STEPS & REMAINING WORK

Tetra Tech is currently summarizing results from routine monitoring and from storm event monitoring for the water years: 2011/2012, 2012/2013, and 2013/2014. In addition to establishing a baseline phosphorous load from The Villages and Lawson Hills MPDs, as noted above, the following products are under development by Tetra Tech based on use of tools and products from all monitoring efforts:

1. Analysis of water quality sampling and flow data;
2. Hydrograph separation (e.g., stormflow versus baseflow);
3. Smearing (*aka* correlation between flow and nutrient concentration);
4. Phosphorus loading for baseflows; and
5. Identify any additional sampling deemed necessary to provide for an acceptable error of 0.05.

The initial products for hydrograph separation are complete and tools for conducting "smearing" have been developed. Tetra Tech is now embarking on assembly of results for each of the five elements set forth above.