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Agenda

City of Brookings
Common Council Meeting
Brookings City Hall Council Chamber
898 Elk Drive, Brookings Oregon
January 30, 2006 7:00 p.m.
Special Meeting

I. Call to Order

II. Pledge of Allegiance

III. Roll Call

IV. Public Hearing

A. Continuation of file No. ANX-3-05, a request to annex 607 acres of land consisting of 14 tax lots in seven different ownerships located on the side and top of the area known as *Harbor Hills*, including 3.4± miles of Highway 101 right-of-way extending from the Brookings city limit line on the Chetco River Bridge, south to the southerly property line of the subject property abutting the highway; identified as Assessor's Maps 41-13-10, Tax lot 300; 41-13-14, Tax lots 200, 201. 203, 300, 307, 308, 310, 312; 40-13-15A, Tax lot 100; 40-13-15B, Tax lots 5200, 5300, and 40-13-15DA, Tax lots 100, and 101; HW3, applicant. Criteria used to decide this application can be found in Section 148-Annexation, of the Brookings Land Development Code. The Planning Commission made a recommendation of approval of this application on December 6, 2005.

V. Adjournment

CITY OF BROOKINGS

CITY COUNCIL

File No. ANX-3-05

SUPPLEMENTAL

No. 19

Materials received from Applicant-January 20th until 4:30 p.m. January 27, 2006

TABLE #19 for ANX-3-05

Materials received between January 23th and January 27, 2006				
EXHIBIT NUMBER:	DATE REC'D.	RECEIVED FROM:	# of Pages	DOCUMENTS
DDDDDDDDD	01-23-06	EGR & Associates	33 pages	CSWMP Workplan as approved by ORWD
EEEEEEEEE	01-27-06	HW3, LLC	2 pages	letter

Exhibit DDDDDDDDD

RECEIVED

JAN 2 3 2005

Per ..DC......

Harbor Hills Special Plan Area Comprehensive Surface Water Management Plan Work Plan

June 2005

Prepared for:
HW3 LLC
City of Brookings
Curry County
Oregon Department of Water Resources

Prepared by:

EGR & Associates, Inc.
Engineers and Geologists

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TABLE OF CONTENTS

BACKGROUND AND PURPOSE

1 Organization

This document is organized into two major sections. The first Section called Background and Purpose describes the land use process, the goals of that process as formulated for this area, pertinent data and analysis already underway, and the goals and purposes of the Comprehensive Storm Water Management Plan (CSWMP). The second Section called CSWMP Work Plan is organized in the form and order in which the final CSWMP document is expected to be presented. Within that organizational form the various work elements that must be accomplished for the CSWMP are described. Background details of existing data, preliminary analysis, understanding between parties (City of Brookings, WRD, HW3 and EGR), and current understanding of the process, physical situation, and potential outcomes can be found in this first section, and not necessarily in the CSWMP Work Plan.

2 Background

The Joint Management Agreement (JMA) between the City of Brookings and Curry County describes the requirement for a Comprehensive Storm Water Management Plan (CSWMP) for the Harbor Hills Special Plan Area (HHSPA). The CSWMP is required as part of the JMA between the City of Brookings and Curry County to manage development on the Harbor Hills. The JMA was formulated, in part, in response to concerns of the agricultural interests on the Harbor Bench Farm District (HBFD) and information from the Oregon Water Resources Department (WRD) regarding water supply and water issues effecting the Harbor Bench.

The primary issues are related to the surface water supply that originates on the Harbor Hills and that flows to the Bench and either provides for groundwater recharge or crosses the bench as surface flow. A secondary issue is the potential effect of development upon peak stream flows which if increased can cause increased potential for flooding, erosion, and/or sedimentation on the Bench. Historical changes to the Bench surface water system and related hydraulics have resulted in severe erosion with down cutting and sloughing of stream banks along the length of a number of streams crossing the Bench. As a result, the Bench aquifer has been impacted and a reduction of available groundwater has likely already occurred. Increases of flooding, erosion of fields, and sedimentation on the Bench have been documented anecdotally.

3 Purpose of the Work Plan

The Comprehensive Storm Water Management Plan Work Plan (CSWMP Work Plan) is a document describing the work tasks that will be performed, and the work products which will be prepared, during the development of the Comprehensive Storm Water Management Plan (CSWMP).

This work plan then describes how the CSWMP will address the issues described herein. Detailed recommendations will be dependant upon the scientific findings conducted during preparation of the CSWMP. Preparation of the CSWMP requires:

- a conceptual understanding of the surface and groundwater systems and how they interact,
- that alternatives be provided for the range of engineering design and operational methods that are appropriate and available to allow development of the Harbor Hills Special Plan Area without adverse impact to the Harbor Bench Farm District,
- to provide standards of performance to which future planning, design, operations, and development must adhere, and,
- to provide for future monitoring of the water management system to verify that these standards and protective measures have been met and continue to be met.

Acceptable management techniques and alternatives will include methods to avoid, restore, enhance, mitigate, and/or remediate any impacts that have occurred or could be expected to occur while accommodating hillside development in the HHSPA. Therefore the work plan will include work tasks where analysis is performed, goals defined for water management, standards for water quality and quantity are defined, and recommendations made for design and operation of water management systems associated with development on the HHSPA.

4 Joint Management Agreement

The City of Brookings and Curry County Urban Growth Area Joint Management Agreement (JMA) requires that a comprehensive surface water management plan (CSWMP) be prepared for the Harbor Hills Special Plan Area (HHSPA) prior to land use approvals for new development to address surface water run-off, stream channel erosion, and potential impacts on the surface water and groundwater balance of the Harbor Bench aquifer (Section X.F.1 of the JMA). The CSWMP shall include, but not be limited to:

1. Baseline data on stream discharges and velocities, Harbor Bench groundwater levels and water quality; (Section X.F.1a of the JMA)
2. Standards to assure that stream channels, groundwater levels and water quality will not be adversely affected by future development; (Section X.F.1b of the JMA)
3. Provisions for on-going monitoring of stream discharges and velocities, groundwater levels and water quality; and (Section X.F.1e of the JMA)
4. Provision for remedial actions should impacts on stream channels, groundwater levels or water quality result from development. (Section X.F.1d of the JMA)
5. The JMA also requires that the effects of existing and planned public roads on surface water runoff, stream channel erosion and Harbor Bench groundwater resources be addressed in the development of the CSWMP (Section X.F.3 of the JMA).

EGR & Associates, Inc. is preparing the CSWMP for the County and City to meet the requirements of the JMA.

4.1 Baseline Data Collection

For the CSWMP, the data and information collected to date have been sufficient to provide the basis for the conceptual level of engineering design and analysis necessary for preparing a storm water management plan. Conceptual level of engineering entails determining the order of magnitude of the engineering designs that are necessary. Thus, the uncertainty in the existing data is taken into account and the engineered solution is presumed to require designs to handle the upper bound of possible peak flows. Similarly, the low flow values including uncertainties, are presumed to include the lowest flows possible for which engineering solutions may be required. The feasibility of achieving these designs are then reported, alternatives analyzed and presented in the CSWMP Report. For example, if data indicate a peak flow of 50 cfs and a base flow (low flow) of ½ cfs, with an estimated uncertainty 100% then the engineering feasibility and design criteria for surface water management would conceptually design to a 100 cfs peak flow and a replacement value of the full ½ cfs.

Initial baseline data collection has been ongoing for the past 2 years. Additionally, a significant amount of data was collected for previous studies and reports on the Harbor Bench aquifer and the Harbor Hills. All of the data, plus the anecdotal information from HBFD farmers, will be used in preparing the CSWMP. Recommendations for changing the data collection program, and the surface water and groundwater modeling efforts will also be made in the CSWMP if changes are found to be appropriate.

4.1.1 Existing Historic and Baseline Data

Baseline data to date has consisted of water level recorders placed in 7 strategically placed culverts (across several watersheds, and up and down individual watersheds), manual stream flow measures on a significant number of culverts within and across many watersheds, rainfall data collected from 4 precipitation gauges (3 totalizing and 1 tipping bucket), data from the AgriMet weather station on the Bench, and the NOAA weather station at the Brookings Airport, water level data from 2 wells (continuous recorder data), pump test data from the Lissner report, well log and flow data from the Lissner Report, water level data from wells in the state well net, and several geologic reports.

The data have been used to estimate base flow patterns and volumes, overall volume of surface water discharge (to be compared to total rainfall), and peak flow events (magnitude, timing, and duration). Several culverts have had cross section and velocity measurements taken manually to assist in correlating the estimated flows through the culverts to the recorded depths of flow obtained from the continuous recorders installed within them.

Initial analysis of the data indicate it has sufficient precision for the level of analysis necessary to develop the conceptual level of engineering necessary for the CSWMP document. The magnitude of the largest expected storm event, assuming the most conservative assumptions and conditions for any desired recurrence interval, can be calculated using standard statistical practice. This will provide an upper bound on storm flows and a check point for correlation to known precipitation events and responses. The level of error can be estimated and the proper engineering safety factors applied to accommodate any potential storm event or low flow circumstance.

4.1.2 Potential Recommendations for Changes to Monitoring Program

In most hillside development planning processes, only peak flows from storms are of concern for design engineers. In this case, not only are peak flows important, but just as important are the base flows of the streams for irrigation water.

In similar conditions of development, streams and groundwater locations are monitored along with a comparison stream outside the development area. From the Lissner Report, conversations with HBFD farmers, the surface water and groundwater data collected to date, and conversations with WRD personnel, a preliminary list of possible longer term monitoring locations and monitoring system adjustments is presented here. These are the type of recommendations the CSWMP will make to adjust the current monitoring system to provide data for the next stage of the process and the future long term monitoring program as required in the JMA (See Section 4.3 below).

The suggestions found here are preliminary and may be changed significantly in the CSWMP adoption process. Meanwhile data collection is ongoing and being expanded in a manner consistent with past data collection and anticipated future data needs. Additionally, future data collection may result in further recommendations to adjust the monitoring system during the MPOD review process. Water management monitoring sites, facilities, and procedures which will be reviewed in the CSWMP and MPOD process include:

1. Possible Equipment Changes - Will be Reviewed in the CSWMP
    a. The need for more permanent monitoring locations for the length of time the JMA requires monitoring now that the initial magnitude of the flows has been determined for the CSWMP process. Criteria are for locations and equipment that are less subject to damage and/or difficulties with readings at high or low flow rates.
    b. Base flows are critical for irrigation so at selected locations, where feasible, low flow gauging equipment will be installed or the existing data collection point will be modified to increase low flow data fidelity.
    c. Gauges that record the peak flow depth during the monitoring interval will be installed at selected locations.
    d. Staff Plates (referenced to surveyed temporary bench mark) will be installed to back up the continuous recorders and allow for quick, consistent, water level checking.
    e. The location within specific culverts of the existing continuous recorders will be adjusted to a more stable region in the interior of the of the culvert.
2. Possible Streams to be Monitored - Will be Reviewed in the CSWMP

   a. Cooley Creek as an undeveloped comparison watershed (Paired Catchments). Monitoring will be with continuous recorders at the base of the hill, on the Bench (at Highway 101), and at Oceanview.
   b. McVay Creek at the same general locations as described above.
   c. Johnson Creek at the same general locations as described above.
   d. Pedrioli Creek at the same general locations as described above.
   e. Dahlia Creek at the same general locations as described above.
3. Possible Well/Groundwater Monitoring - Will be Reviewed in the CSWMP
   a. The continuous recorders in the wells in the Hastings Field between McVay and Cooley Creek, and the well next to Johnson Creek, called the Itzen well.
   b. The continuous recorder data from the State operated well at the Yock property plus wells measured by hand during the Lissner report and since then.
   c. Slug tests of the wells and piezometers on the Harbor Hills to determine average gross hydraulic conductivity of the bedrock.
   d. Use WRD pump test data for the Bench wells/aquifers. Supplement with additional well/aquifer tests on the bench if sufficient data cannot be found. A southern well/aquifer test would be preferred to supplement the WRD tests already conducted on the northern end of the Bench.
   e. Existing well log data with a reported hydraulic capacity can be used to approximate hydraulic conductivity as a check on pump test data.
4. Possible Stream Reach Surveys - Will be Reviewed in the CSWMP
   a. Stream locations where cross section surveys have been conducted and are not to be disturbed, and some select locations where remediation and restoration of streams has taken place will periodically be monitoring for erosion and sedimentation. The location and timing of these surveys will be described more fully in the CSWMP. A site on Cooley Creek, as part of the paired catchments, will be included is a survey location.
5. Future Monitoring System Modifications - Will be Reviewed in the CSWMP and MPOD
   a. Locations of the ongoing monitoring sites and potential future system modifications will be described in the CSWMP and recommended changes suggested there.
   b. Locations of the long term monitoring sites and potential future system modifications will again be described in the MPOD and recommended changes suggested there.
   c. Generally, changes to the ongoing monitoring system will not likely take place after the MPOD stage of the process.

The CSWMP will provide recommendations for ongoing data collection, supplemental data locations that would be desirable, and specific recommendations for more permanent data collection devices (for example base flow weirs) that will be required to implement the recommendations of the CSWMP for future ongoing monitoring. Section 4.3 of the CSWMP Work Plan describes the work task of preparing these recommendations.

At this time, and based on our knowledge of the data collected to date, it is expected, as detailed above, that generally the CSWMP will recommend additional continuous recorder monitoring sites at the north end of the project, modifications and continued operation of selected existing recorder sites, base flow monitoring sites, collection of existing WRD well monitoring data, and a paired catchments monitoring group (Cooley Creek verses McVay Creek/Johnson Creek). The paired catchments will track watershed responses caused by climatic effects in undeveloped verses developed areas. The additional monitoring locations at the north end of the project will address the apparent differences in the runoff and recharge characteristics in these watersheds.

4.2 *Standards of Development*

The CSWMP will contain development standards for performance. Sections 7.3 and 7.4 of the CSWMP Work Plan describe the work task elements to be completed that address these requirements of the CSWMP. These standards will include:

1. a limit on the increase in peak flow for the design storm intensity. This limit will be based upon downstream stream channel conditions to prevent erosion, sedimentation, and flooding.
2. water quality standards will be based upon published DEQ water quality standards. Turbidity will be the major water quality parameter that needs to be tracked but others will be addressed in the CSWMP as well.
3. possible water quality protection measures will be listed along with alternative management methods.
4. standards for storm water runoff models and general model parameters limitations (broken down by watersheds) to be used in calculating the peak flow design criteria (useable by future design engineers).
5. detention basin design standards and performance standards for the detention basins (i.e. locational limitations on lined or unlined detention facilities, no infiltration galleries or drywells on the hill, etc.).
6. base flow runoff rate standards to be maintained (as a consequence of development, not climatic and other variations).
7. limits on impacts to the Bench aquifer (i.e. no reduction in net Bench recharge and water levels from development practices).
8. identification of potential offsite improvements for storm water protection, Bench recharge, erosion protection, storm water storage, and storm water detention and restoration and enhancement of Bench streams and drainage ways.
9. storm water treatment standards to control turbidity and sedimentation.

10. operational standards for the water management system including standards for maintenance [i.e. sedimentation], operations, control, and management [form a water control district?].
11. remediation methods available to provide or maintain water rights if expected surface water and groundwater responses change.
12. other standards as may become apparent are necessary as the CSWMP is developed and approved.

Many of the standards in the CSWMP will be in the form of goals and objectives which must be met (i.e. no loss of water levels in the Bench aquifer), but not specific target values (i.e. the elevation of water table). Requirements for site specific numerical values and supplemental analysis will be provided during the MPOD and the tentative subdivision phases of development.

4.3 Ongoing Monitoring

The JMA calls for ongoing monitoring of the aquifer conditions on the Bench as well as surface water flow rates, and water quality parameters (primarily turbidity) during development and for a post development period (duration is not specifically identified in the JMA). The CSWMP will recommend timing, period over which monitoring will occur, locations and types of monitoring for the ongoing monitoring of the HHSPA and HBFD areas (See Section 4.1.2 above). Stream sections and observation of sedimentation will also be included to monitor the erosion and sediment accumulation that may occur as a result of development activities. Section 8.0 describes the CSWMP work task to accomplish this plan element.

Since it is anticipated that stream restoration and remediation of past practices and impacts could be a major portion of the storm water management plan, the CSWMP will provide recommendations for survey locations and timing of surveys as appropriate. At least two stream survey locations have been established already on the Crockett property by Mr. Gerald LaRue in 2002. These survey locations will be evaluated for continued use during the development of the CSWMP. As mentioned previously, Cooley Creek will have a recommended location for the paired catchments comparison.

Likewise, current existing monitoring locations will be evaluated during development of the CSWMP for suitability as ongoing monitoring locations. It is further expected that recommendations to supplement this base line monitoring system may be included with site specific MPOD documents and potentially again at the tentative subdivisions stage of the process if it is found that future monitoring is necessary to demonstrate compliance with the CSWMP and to protect the water resources of the HHSPA and HBFD.

4.4 Provisions for Remedial Actions

The CSWMP will provide conceptual alternatives for remedial actions that may be used if unanticipated impacts to surface water flows, recharge to the bench, sedimentation, erosion, or water quality (turbidity) occur. This is described in Section 9.0 of the CSWMP Work Plan. These remedial action alternatives will be listed in the CSWMP and the conditions and standards under which they may be required. In the MPOD process these alternatives could be further refined and supplemented by the developer and the public approval process.

The CSWMP will address the first review of the types of remedial actions that could be taken should mitigation and engineering actions not meet the standards set in the CSWMP for water quality and quantity. Remedial alternatives reviewed and developed in the CSWMP, and further refined in the MPOD, could include measures that are similar to these described below. It is unknown currently the viability of these or additional alternatives that may be developed during the CSWMP, MPOD, and following processes. Suggestions include:

1. restoring and enhancing stream reaches with flow arrestors to slow stream velocities that have been inducing erosion. Such arrestors could allow for some additional stream flow during storm events.
2. restoring and enhancing stream reaches by constructing flow arrestors to capture stream gravels and raise the stream channels to pre-historic and historic levels.
3. raising the level of the stream course to induce Bench recharge.
4. installing detention ponds which allow for recharge to the bench.
5. installing lined ponds for maintaining surface water right flows on the Bench.
6. secondary sources of water for supplemental water discharge to the Bench.

4.5 *Effects of Roads and Hard Surface on Runoff & Erosion*

Roads and hard surfaces generally are known to produce shorter times of concentration and higher peak flows of surface water, and modestly increases the total surface water discharge from a given area. The increased peak flow rate can, without protection, induce or exacerbate downstream erosion and/or sediment deposition. Increases in run-off concurrently create the potential for a loss of recharge or late season surface water flows to and across the Bench. The analysis of the effect of roads and hard surfaces is described in the CSWMP Work Plan in Sections 6.0, 5.2 and 5.3. Descriptions of work elements to address mitigation measures and standards will be found in Section 7.0.

5 The Comprehensive Surface Water Management Plan

The purpose of the Comprehensive Surface Water Management Plan (CSWMP), for the Harbor Hills Special Plan Area (HHSPA), is to describe the potential impacts of new development on the land and water resources located within the Harbor Bench Farm District (HBFD), set goals and standards for performance and engineering design, and present a range of mitigating solutions that may be used by those developments to minimize the identified impacts. For example, the CSWMP goals and standards will set limits on runoff rates from a given area. Then the developer of that area(s) could select from several engineering practices as listed in the alternatives to accomplish those goals and standards. The developer could even propose other methods they believe would accomplish the same ends, with a review and approval processes. Protecting base flow would be accomplished through a similar process.

Further, the CSWMP will recommend, where appropriate, remedial solutions that may be implemented either in response, or proactively, to impacts that were not directly anticipated.

The goals of the HHSPA CSWMP as described in the JMA are as follow:

1. Minimize stream channel erosion and sediment accumulation in the HHSPA and the HBFD from increased runoff due to development within the HHSPA;
2. Avoid loss of base flow in Harbor Bench streams due to development activities within the HHSPA;
3. Avoid loss of groundwater on the Harbor Bench due to development within the HHSPA;
4. Minimize surface and rill erosion in the HHSPA from development and construction activities;
5. Minimize the potential for flooding on the Harbor Bench from increased runoff due to development within the HHSPA; and
6. Minimize the effect on the Harbor Bench aquifer and surface water quality and quantity due to development within the HHSPA.

The CSWMP, when completed, will identify potential impacts on the Harbor Bench water resources due to new development that may occur within the HHSPA and will identify a range of development standards that may be employed to mitigate those impacts. The magnitude orthose impacts will be modeled, and the selected alternatives for managing surface water will be modeled as to their effectiveness. Also, CSWMP, when completed, will include the baseline hydrologic conditions required by the JMA and provisions for ongoing monitoring of water resources with a mechanism for the incorporation of future mitigation activities as new data is assembled.

The CSWMP will be the guiding document for the MPOD design features for storm water management. The MPOD will include engineering infrastructure designs (but not construction level plans), and operational and management structure to implement and maintain the storm water system. Future specific design and construct elements of the system will then be implemented according to the MPOD outline.

5.1 History of the CSWMP Work Plan

Development of the CSWMP Work Plan has been to provide a detailed description of the information, analysis, goals, and work products to be developed in the CSWMP for the HHSPA.

An outline for the scope of work for compliance with Section F of the JMA was first prepared in the Fall of 2002. That outline was briefly reviewed and given verbal acknowledgement by the Oregon Department of Water Resources on September 15, 2004 as containing all the elements necessary for an acceptable hydrologic study. That outline was primarily focused on the groundwater and surface water investigation aspects of the CSWMP and did not focus on the engineering aspects or subsequent requirements of the land use planning and development process. These later elements have been found, upon more careful review of the JMA, to be the primary focus of the CSWMP.

Many elements of that original outline have been incorporated into this work plan. Some elements originally described individually have now been combined under broader headings for the purposes of this work plan. Other elements have been deemed not necessary for the comprehensive planning document, but will be appropriate at later stages of the process (MPOD and tentative subdivision). The CSWMP is a document for overall planning purposes for a broad geographic area, while the MPOD and tentative subdivision plans will be site and developer specific and used to define and implement progressively more specific and detailed recommendations.

The CSWMP Work Plan identifies the framework for collection of good quality data, analysis, modeling based upon the data, and findings with reasonable and supportable results that form the framework for a regional planning document that when adhered to will ensure protection of the region's valuable water resources while enabling carefully planned development.

6 Brookings Land Use Code and Land use Planning Process

The City of Brookings land use code requires that developers within the HHSPA complete the following steps when developing land for residential, commercial or other urban uses:

6.1 Inclusion in the UGB of the City of Brookings

Completed. The CSWMP is required as a consequence of the process that included much of the HHSPA in the City of Brookings UGB.

6.2 CSWMP

The City land use process requires the CSWMP must be adopted as part of the City's Comprehensive Plan documents before any specific land use decisions can be approved. It would not be unexpected that critical elements of the Comprehensive Plan (such as the CSWMP) could be reviewed and amended periodically in areas where development is active. Opportunity for WRD review of CSWMP revisions would be expected.

6.3 Annexation

Prior to development to urban standards, the City must annex property within the HHSPA. Annexation applications of lands within the HHSPA must demonstrate that it is feasible to comply with the requirements of the CSWMP.

6.4 MPOD

After annexation, a MPOD must be prepared by individual developers and presented to and approved by the City. The storm water management elements of the MPOD must address the water management issues with greater specificity and detail and demonstrate compliance with the policies, goals, and guidelines of the CSWMP. The WRD will be afforded an opportunity to comment on these elements of MPOD documents.

6.5 Detailed Plans (tentative subdivision)

Detailed engineering plans with specific selected designs and construction plans will be prepared for the tentative subdivision stage of the land use process. Included in these applications are detailed engineered plans for stormwater management elements of the development. These third and most detailed of storm water plans must demonstrate compliance with the MPOD prepared for the area and again with the CSWMP. Opportunity will be afforded to the WRD for review of these elements of the tentative subdivision plans.

The format of the next section is in the form and order of the expected final CSWMP document. Thus the work plan describes each section and subsection with the specific work tasks that will be completed to prepare the CSWMP. The numbering system starts over in this section to be consistent with expected future section numbering in the CSWMP document (forms the basis for an outline)

CSWMP Work Plan

1 Authorization

The authority under which the CSWMP was developed will be described.

2 Purpose

A description of the purpose of the CSWMP and any necessary background to the document will be provided.

3 Public Involvement

The City of Brookings public process includes public involvement during review and adoption of the CSWMP to ensure that the Plan addresses community values and concerns as well as technical objectives and standards. This program will be developed in conjunction with City and County staff. Elements of the public involvement program may include interviews with community leaders, key property and business owners and interested persons, public surveys, public workshops and, as appropriate, public hearings prior to final adoption. Meetings with area farmers and interested persons have occurred on at least two occasions already.

4 Study Area Description and Data Collection

This section will describe the existing site conditions, study area, the local and regional geology, and the area hydrology. Information collected from the research for this section will be used in the development of site specific surface and ground water hydrology models (see Section 5 below).

4.1 *Existing Site Conditions*

The purpose of this section is to summarize the boundaries of the HHSPA and HBFD, describe the study area's physical characteristics, identify existing hydraulic structures, and summarize any existing water rights and other base line conditions. Information gathered for this section will serve as the background for the CSWMP study.

4.1.1 Description of Harbor Hills Special Plan Area

This section will describe the area included within the Harbor Hills Special Plan Area and will include a map showing the plan area boundary.

4.1.2 Description of Harbor Bench Farm District

This section will describe the area included within the Harbor Bench Farm District and will include a map showing the district boundary.

4.1.3 Description of the Study Area

This section will describe the CSWMP study area and will include a map showing the study area boundary. The study area may extend beyond the current limits of the HHSPA and the HBFD in order to develop appropriate groundwater and surface water models, and include watersheds of interest.

4.1.4 Existing Topography and Physiographic Features

This section will describe the general topography of the study area and will include topographic mapping as applicable. Sources of this data will include USGS maps, new topographic mapping prepared for the study area, other local studies, maps from utilities, and information from previous studies.

4.1.5 Existing Storm Water Systems

This section will describe the existing storm water systems and structures located within the HHSPA and the HBFD. Maps will be prepared as needed to show the location of existing hydraulic structures and conveyances. The significance of these structures will be addressed in other sections of the plan. This includes both man made structures and conveyances, as well as natural (pre-existing) stream channels. On the Bench some "existing" streams are not natural but were started as field drains and surface flow control structures. Over time these have become entrenched and through the operations of the State Highway Department and others have become drainage ways serving more than the original area. Other drainage systems have been modified significantly to accommodate agricultural practices. It is beyond the scope of the CSWMP to discern the history of all drainage systems, but each will be mapped and defined as to carrying capacity, vulnerabilities (erosion, down cutting, sloughing, flooding, etc.), and potential restoration, enhancement, remediation, and other protections.

4.2 Existing Water Rights

This section will describe all surface and groundwater rights that are listed with the WRD within the HHSPA and the HBFD. Mapping will be provided to show the locations of water use and points of diversion in the study area.

4.3 Data Collection

This section will summarize and identify relevant previous studies, climate data, erosion and sedimentation reports (generally verbal), groundwater data, and stream flow records. Information collected will be used to develop parameters of site specific models.

4.3.1 Previous Studies

Readily available existing literature for the locality will be utilized in analysis of the site. This literature includes publications from the U.S. Geological Survey (USGS), U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), State of Oregon Water Resource Department (WRD), the Oregon Department of Geology and Mineral Industries (DOGAMI), the City of Brookings, Curry County and other reliable sources.

In particular, this plan will be supplemented by review of previous hydrologic and geologic studies for the area including: Widmier (1962), Dott (1971), Ramp (1975), Beaulieu and Hughes (1976), and Lissner (1977); and topographic mapping available from the USGS and private sources.

4.3.2 Historical Climactic Data

Historic weather data from the AgriMet weather station located on Harbor Bench and the NOAA weather station located in Brookings have been obtained and will be updated as the CSWMP, MPOD, and tentative subdivisions are submitted. On-site weather data have been collected and will be correlated with the data from the existing government weather stations. Ongoing weather data for the Harbor Hills will not rely on an independently operated weather station. Weather stations are difficult to maintain for keeping accurate rainfall data.

The correlation between a weather station on the hill relative to those on the Bench allows for estimating rainfall on the hill based upon the Bench measurements. This data will be used in conjunction with the stream depth data and the resulting calculated stream flows based on water level data collected from continuous recorders at various locations. The magnitude of the change in precipitation from the Bench to Hillside can be statistically estimated and included as part of the engineering safety factor in design.

4.3.3 Site Specific Climactic Data

Climatic data including precipitation, temperature, wind velocity and direction, and humidity measurements have been obtained from an on site weather station located in the upper McVay Creek watershed. The data collected from this weather station will be compared against the AgriMet data to determine the magnitude of the rainfall contrast which exists from the bottom to top of the hills (see above). As the CSWMP, MPOD, and tentative subdivision plans go forward this station will likely not be continued as part of the official data collection and ongoing monitoring.

4.3.4 Stream Flow and Groundwater Level Data

Site specific data, including seven stream level gauges and water levels in two wells on the bench, have been collected, compiled and will be included in the site evaluation and modeling completed as part of the hydrology study and resulting design considerations. Geologic, water level, slope stability, and other pertinent data collected as part of the geotechnical site investigation will also be used to supplement data collected as part of the hydrology investigation.

New monitoring locations at the north end of the study area will likely be recommended in the CSWMP to be included in future monitoring. Additionally, any modification to existing sites deemed appropriate will be recommended in the CSWMP document. These recommendations will be described with the justification for the change or addition. A watershed to the south of the HHSPA, and out of the development area, will also likely be added as a recommendation of the CSWMP to act as a comparison of developed and undeveloped areas (paired catchments). This final watershed will be used to determine if effects on stream flow and recharge are the result of climatic or other natural causes, or whether the impacts are caused from development activities.

It is anticipated that the CSWMP will recommend five watersheds will be monitored for flow at the base of the hill, on the first part of the bench (approximately at Highway 101), and at Oceanview. Two watersheds will be at the north end of the Bench (Dahlia & Pedrioli), two on the south end (Johnson & McVay), and one at the south end outside the development area (Cooley). The data will supplement the data already collected and will be used for the MPOD portion of the process.

These monitoring locations will then likely be recommended in the CSWMP for long term monitoring sites until such time it is determined that one or more are no longer needed for that purpose.

4.3.5 Site Specific Topography and Stream Section Surveys

The CSWMP will recommend locations for stream surveys and other hydrologic features such as ditches and culverts within the HBFD, including the paired catchments with Cooley Creek. This information will be necessary to determine the conveyance capacity of the channels, define the potential for flooding over bank, and estimate the flooding potential caused by future upstream development. Local jurisdictions, utility districts, or prior development may have produced topography maps that may be sufficient; otherwise cross-section data and pipe elevations may need to be collected by field surveys.

At specific locations on the major streams and in sensitive stream section locations the CSWMP will recommend stream channel surveys to be conducted to enable measuring of stream channel changes over time. Both sedimentation and erosion are possible. Since some sections of streams may be modified as storm water management techniques of this program to restore and enhance stream sections, the locations and initial surveys are expected to be decided when the more specific plans are addressed, but prior to development. Any enhancements, restorations, remediations or other activities to benefit Bench streams are expected prior to development or in conjunction with such development. Significant enhancements to restore Bench streams have already occurred in select locations, and could be employed in many other locations as evident from conversations with Bench farmers.

4.4 *Summary of Study Area Geology*

This section will summarize the regional and local geology for the HHSPA and the HBFD. This information will be used in following sections as background data for site specific hydrogeologic modeling, to identify hazard areas, and a base for proposed development standards.

4.4.1 General and Regional Geology

A synopsis of existing data and interpretations of the regional geology as it relates to the local geology will be included in the CSWMP.

4.4.2 Local Geology

A synopsis of existing data and interpretations of the local geology will be included in the CSWMP.

4.4.3 Site Specific Geology

The site specific geology will be interpreted from existing documentation and supplemented by findings of geotechnical reports and on-site observations. This information will be included in the CSWMP for specific locations where it is pertinent to such a document. More commonly the site specific information will be described in the tentative subdivision level of detailed design, and land use process. Topics of discussion will include bedrock geologic units, hillside soils, terrace deposits, structural geology, geologic hazards, slope erosion and mass movement. Recommendations will be made for use in developing study area specific models and standards.

4.5 Summary of Study Area Hydrology

This section will describe and define the HHSPA and HBFD hydrogeology, aquifers, and surface water features.

4.5.1 Area Hydrogeology

The area hydrogeology has been mapped and described by many, including the DOGAMI, USGS, the WRD, and others. A synopsis of existing data and interpretations of the area hydrogeology will be included in the CSWMP.

4.5.2 Study Area Aquifers

Water levels on the Harbor Bench have been measured in two existing wells, one located in the Itzen field (next to Johnson Creek) and one in the Hastings field (between McVay Creek and Colley Creek). The data will be supplemented by available water level data from the existing Harbor Bench water level monitoring network[1]. (These locations will be shown on a figure in the CSWMP).

Aquifer testing has been performed on the Yock wells (reportedly at least 4 aquifer tests) which were performed by the WRD during the 1970's. The one test report given in the Lissner report will be used in the CSWMP since it is adequate for general conceptual planning purposes. If the data from the 4 WRD ran aquifer tests can be found they will included for estimating aquifer parameters in the northern portion of the bench for the MPOD and later planning purposes.

If the WRD aquifer test data cannot be found then additional aquifer tests will be performed, with one test to the north and one to the south on the bench. The test data will be used to

[1] A set of observation wells was established by the Oregon State of Engineer's Office in 1966 to monitor groundwater level changes on a monthly basis. The data collected from these wells is presented in the Lissner 1977 report. Some data has been collected since 1977, including a continuous recorder. Additional continuous recorder data has been collected for this study. A public hearing or other forum will be conducted to solicit documented, as well as anecdotal, water level data from the residents in the area with private water wells.

refine the models for detailed design work for stream restoration and enhancement, and aquifer impacts of storm water storage on the Bench. This testing, if required, will include at least a 24-hour constant flow pump test. Any pumping test will include a pumping well and at least one other well as an observation well. The desired pumping rate will be determined by a step drawdown test prior to the initiation of the pumping test if the well's capacity is not already known from use records of the well's owner..

Data from all monitoring wells in the WRD network will be incorporated as available.

Long term monitoring of the aquifer water levels will aid in setting water level standards to be used as targets for determining if adverse impacts to the aquifer have occurred. Generally the standards for aquifers is expected to be no measurable decline in aquifer water levels as a result of development. The goal, to the extent it can feasibly be accomplished, is for there to be a net gain in aquifer water levels as a result of storm water management on the hill.

4.5.3 Study Area Surface Water

Baseline stream flow data for the first conceptual level engineering work for the CSWMP will use the existing stream stage data collected to date. The data have sufficient accuracy for conducting conceptual engineering, using appropriate safety factors based on the data limitations, for the necessary storm water systems and water management alternatives necessary to protect streams and aquifers from both peak flows (flooding and erosion primarily) and the loss of base flows (from lack of recharge or increased rate of early runoff).

This initial stream flow data set will be supplemented and refined with additional data and new monitoring locations, as recommended in the CSWMP. New data will be used for the preparation of the MPOD and tentative subdivision levels of engineering plans.

A number of monitoring locations were suggested in the Background and Purpose Section of this document. These will likely be recommended or modified in the CSWMP. Stream stage data have been collected on 1 to 15 minute intervals at these selected locations in major drainage culverts at road crossings using water level transducers and data loggers. The CSWMP will recommend the future sampling interval. The CSWMP will use engineering fundamentals to estimate corresponding flow rates. For low base flows, a low level weir will be installed in the stream channel near the base of the hill for measuring flows of less than 1 cfs or so. All of the monitoring locations described above will be monitored with continuous recorders.

Stream discharges and stream velocities for baseline stream depth data will be determined by calculation from the monitored water depths in the road culvert crossings. These will be checked by manual measurements.

The existing surface water quality will be measured quarterly during the study period by means of turbidity testing at selected locations on Dahlia, Pedrioli, Johnson, McVay and Cooley Creeks. Turbidity will be measured at the base of the hill and at Oceanview on the Harbor Bench. During each quarter both high flow (during a storm event) and low flow turbidity measurements will be taken and recorded. Summer quarter storm events may not be possible given climatic conditions.

The data collected will be used to develop site specific surface and groundwater hydrology models as described in Section 5.

5 Surface Water and Groundwater Hydrology Models

Surface water and groundwater models can be beneficial in determining irregularities in the way water is moving though the natural system, the places where data and information are inadequate, and explore the impact of changes to the area (development, climate, water use, land use, roads, farming practices, etc.). For the CSWMP, the initial models to be used will be selected and set up. In that process the selected models may be found to be performing adequately, or not beneficial, need to be changed, need to be modified, or other means found to address the question. CSWMP will make recommendations regarding the models proposed in this work plan, so that the models to be used in the MPOD process and beyond, perform to the necessary level of functionality, adequate for engineering solutions to be ascertained and incorporated into infrastructure designs. Each of multiple development areas will have standards for both peak flow rates and base flow goals. Each developer then, will be responsible to select alternatives or suites of alternatives to accomplish those goals and standards appropriate to their area. As necessary, these goals and standards will apply down to the lot.

Therefore, in the CSWMP the models will be selected and tested to determine their overall feasibility. It should be noted that models are generally poorly designed to address steep slopes and sudden slope changes as are found at this location. Thus many smaller models or models broken into smaller parts may be necessary to adequately address the issues listed above in a rigorous fashion.

5.1 *Model Setup Requirements*

For the CSWMP, the study area will be divided into watershed basins and, where necessary, sub-basins. Data already collected, and future data, will be used to check models that will be developed for both surface water and groundwater hydrology conditions. These models will be based upon watershed delineation, topography, soil characteristics, soil loss calculations, infiltration calculations, evapotranspiration, soils water balances, stream base flows, stream losses, stream gains, time of concentration calculations, and a summary of design storms. Each model will be used to inform the other models. In general it is expected a series of surface water and groundwater models will be developed with emphasis on peak storm flows and base flow conditions of streams.

This computer modeling will be used to develop the relationships between surface water runoff from the HHSPA, and the bedrock and Harbor Bench aquifers. These relationships dictate the availability of water for both surface water and groundwater rights holders on the Harbor Bench.

5.2 *Hydrologic Characteristics of the Model Area*

The purpose of this section will be to develop watershed basins for the HHSPA and HBFD and determine basin dependant hydrologic characteristics that will be used to select specific modeling parameters. Examples of potential parameters include NRCS soil classifications, NRCS curve runoff numbers, erosion potential, Manning's roughness coefficients, losing and gaining stream reaches (groundwater/surface water interactions), soil water capacity, hydraulic conductivity, soil thickness, soil infiltration rates, rooting zone depth, vegetation characteristics, slope, slope aspect, bedrock permeability, and standard precipitation design storms.

5.2.1 Watershed Basin Delineation

Watershed basin and sub-basin boundaries and areas will be measured from the detailed topographic mapping and available USGS topographic maps.

5.2.2 Watershed Basin Vegetation Characteristics

Characterization of the historic vegetation coverage of the project area and changes to the vegetation coverage will be provided by review of existing historic aerial photographs and comparison with current vegetative conditions.

5.2.3 Watershed Basin Soil Characteristics

Permeability and infiltration rates for the soils will be collected from the existing literature and supplemented by on-site geotechnical investigations. Runoff coefficients for various slopes and soil unit/cover materials will be developed based on site specific precipitation and stream flow measurements.

5.2.4 Watershed Basin Soil Loss Calculations

Standard engineering methods, such as the Soil Conservation Service (SCS) TR-51, Procedures for Computing Sheet and Rill Erosion on Project Areas, will be used to estimate basin soil loss due to erosion.

5.2.5 Watershed Basin Base Flows

Standard hydrology methods will be used to estimate basin base flows. These estimated flows will calibrated to the measured stream stages discussed above.

5.2.6 Watershed Basin Runoff Time of Concentration

Standard engineering methods will be used to estimate runoff time of concentration of each basin. Time of concentration calculations will consider overland sheet flow, shallow concentrated flow and channel flow components using methods of analysis described in standard engineering references such as SCS TR-55, Urban Hydrology for Small Watersheds, and the Oregon Department of Transportation (ODOT) Hydraulics Manual.

5.2.7 Watershed Basin Changes in Losing and Gaining Reaches

Interactions between surface water and groundwater will play an important role in the modeling and engineering of the surface water management system. Precipitation that infiltrates the soil zone on the hillside commonly will be shorter term base flow for the streams coming off the hillside. Deeper infiltration, that may reach into the bedrock, could be contributing to the longer term base flow. Additionally, these stream flows contribute recharge to the bench aquifers as they reach the base of the hillside. Both surface water and groundwater models will be utilized to describe and model these conditions and the impact of this interaction on water supply. Measuring this seepage rate will be undertaken only if it becomes necessary in order to reach an engineering solution, particularly with regard to base flow.

5.2.8 Watershed Basin Design Storms

Using historical rainfall data and NOAA Atlas 2 site specific rainfall design storms will be created for standard recurrence intervals. These design storms will be used in the surface water model to produce an estimate of the direct runoff hydrographs.

5.3 *Groundwater Modeling*

Groundwater modeling will be performed in order to:

- determine the interactions between the bedrock aquifer in the Harbor Hills and under the Harbor Bench, with the Harbor Bench terrace deposit alluvial aquifer;
- estimate the interaction between the hillside soils profile and colluviums, and the surface water flow from the hillside (first gaining stream section);
- estimate the loss of water at the base of the hill and the head of the alluvial fans to losing stream reaches (losing stream section);
- estimate the gaining stream reaches at the lower portions of the Bench crossing streams (second gaining stream section);
- to assist in the calibration of storm water runoff and surface water infiltration models; and
- gauge the effects of proposed development and storm water management on:
    - the bedrock aquifer,
    - Harbor Bench aquifer, and
    - Hillside soils aquifer.

5.3.1 Models Groundwater Conditions of the Study Area

Several simple groundwater models (using ModFlow as a simple analytical tool) will be used for representative groundwater flows, base flow calculations, stream losses and gains, and base flows from groundwater sources. A series of simple one dimensional and two dimensional models of the interactions described above will be prepared and ran. These models will be used to estimate the magnitude of these interactions that occur. From a sensitivity analysis of these models it can be determined which factors are most likely to cause a negative or positive impact, and which parameters can change with little impact. This information is useful in designing alternatives that are cost effective and operationally efficient. It also allows for avoiding those alternatives which may be too difficult to accomplish.

By breaking the models into individual models of specific parameters and surface water/groundwater interactions, specific methods to control these features can be reviewed and evaluated. Calibration and sensitivity analysis are key components of using any such model.

5.3.2 Groundwater Questions to be Modeled

Groundwater conditions on the Harbor Hills are expected to influence base flow conditions on the streams, and secondarily, through those base flows influence groundwater recharge on the Bench. Therefore modeling the current conditions (calibration) and modeling the impact of changes on the Hill (development scenarios) will allow for determining the impact of the development on various aspects of the hydrology of the groundwater, surface water and their interaction. Following is a list of the questions or issues, and the modeling that will be used to respond to those issues. The final modeling is expected during the MPOD process with only preliminary results necessary to provide the conceptual level of design protections and standards necessary for a comprehensive protection plan. Groundwater model issues include:

1. What is the quantity of water that recharges the bedrock on the Hill and flows through the bedrock to the Bench and recharges the Bench aquifer? This will be modeled using a ModFlow model that simply mimics bedrock flows (based upon slug tests) from the Hills to the Bench. The model will not be used to mimic stream flow discharges or other parameters. Calibration will look at precipitation/recharge/ET relative to known heads of groundwater in the Harbor Hills and the hydraulic conductivity from the slug tests. The gross flow will be calculated, and simulated with the reduction of recharge expected from the development. Calibration is based upon observed groundwater head (elevation indicators such as water levels in wells and piezometers, spring elevations, and location of initial stream flow on the hillside). These indicate the maximum hydraulic conductivity the bedrock can have and still maintain a water elevation of that particular height.

2. What is the quantity of base flow in the streams as they are on the hillside that comes from the colluvium/soils, and what portion comes from the bedrock? This will be modeled with two simple ModFlow models (one for colluvium/soils and one for bedrock) or a slightly more complex model including both. A vertical 2-D model may be used to account for the steep hillside with both colluvium/soils and bedrock conditions. Model results will then be used to calculate overall flows to stream reaches, and calibrated against existing base stream flow data. Results, when calibrated, will be used to inform the surface water flow models.

   The values arrived at with the ModFlow model for this question and the recharge question posed in number 1 above, can be checked against the model outputs as completed by the water balance procedure of the HSPF model (see Section 5.4.1 #4).

3. What is the quantity of water that is lost in various streams as they cross the upper Bench (top of the alluvial fans)? This will be modeled with a simple ModFlow model that describes the stream reach bed characteristics and underlying alluvial materials hydraulic conductivity. Loosing stream reaches indicate the quantity of water that is

recharging the aquifer. Recharge from precipitation and losses from ET will not be included in this model, but simple stream reach characteristics will be adjusted to meet the known measured losses across the upper Bench. Two models will be developed, one for the north end of the Bench and one for the south end of the Bench since they have differing aquifer characteristics, and different water rights issues (groundwater/surface water use [north] verses surface water only use [south]).

4. How does the Harbor Bench aquifer(s) respond to direct pumping and loss of water to incised streams? Two simple models will mimic just the lower Bench aquifer north and south (below where the streams are losing water to the Bench). Precipitation, recharge, ET, and inflow for the previous model will be used along with hydraulic conductivity, and storage to mimic known stream flows and irrigation pumping rates. The models will be calibrated to known base flows before the irrigation season, and during pumping periods. Results will be used to calculate overall groundwater discharges to the streams and by way of pumping. The models will then be used to determine the differences in groundwater levels if stream reaches have their thalwegs (bed levels) raised by stream restoration and enhancement actions. Additionally, the changes in lower Bench streams flows can be modeled resulting from the raising the stream thalweg.

5.3.3 Ground Water Modeling Conclusions and Recommendations

Results of the groundwater modeling will be used to inform the surface water models and estimate flows (surface and sub-surface) to the HBFD. Actual recommendations and conclusions will be prepared as appropriate, but primarily the groundwater modeling recommendations will be tied to the surface water conclusions and recommendations as listed below under the surface water modeling section.

5.4 Surface Water Hydrology and Hydraulics Modeling

Hydrology involves the total flow of a watershed, both peak flows and base flows. The hydraulics of a system involves the ability of the streams, channels and ditches (natural and man made) and the conveyances (culverts, bridge openings, etc.) to pass storm flows. Therefore surface water modeling for the HHSPA and HBFD must address the following issues:

1. Peak flows and designs for hydraulic structures to accommodate these expected flows. This is a classic engineering design issue for storm water flow. Culverts, stream crossings, detention basin sizing, and flood control will all depend upon these values.

2. Base flow design criteria. The base flows of the streams coming from the HHSPA and crossing the HBFD are critical to the health of the farming community on the bench. Impacts to the base flow will very likely be influenced by development of impervious surfaces, changes to stream reaches, added hydraulic structures, dewatering for slope stability control, and stream restoration and enhancement projects. Both groundwater models and the surface water model will be used to investigate this issue.

Surface water modeling will require use of several different models to answer the questions necessary to properly engineer the surface water management of the HHSPA and HBFD. At present it appears that HSPF, HEC-HMS, EPA-SWMM, and HEC-RAS will all be used in various configurations to address the issues regarding surface water flow. Additional models, or variations of these models, will be used in different situations as the conditions warrant.

5.4.1 Surface Water Questions to be Modeled

The CSWMP and later planning documents require that the issues mentioned in Section 5.1 above be addressed. The models described here will be made nominally operational, checked for overall usability, and utilized (in a preliminary fashion) in the CSWMP preparation. It is fully expected these models may be refined, or even replaced by different models, as experience and understanding is gained. The CSWMP will make recommendations for any such modifications, changes, additions, or deletions of any model elements. New modeling results will likely be seen again during the MPOD process as a refinement to previous work presented in the CSWMP process (a more preliminary stage of design and review). The following are the anticipated models which will be used, and the questions they will attempt to answer:

1. Peak Flow Hydrology & Hydraulics: EPA-SWMM will be used to model both hydrology and hydraulics, particularly with regard to storm events and peak flows. This model can also be utilized to determine when a stream is not performing to standard conditions or expectations. For example, early runs of this model indicated the smaller culverts at the north end of the HHSPA should be overwhelmed by the storm events they were obviously handling. This can only be occurring if the basins are performing in a non-standard fashion.

2. Peak Flow Hydrology: HEC-HMS can be used to generate peak flow hydrographs, for the HHSPA, that can then be used by hydraulic analysis models. For the CSWMP the results from HEC-HMS will be used in two ways. First, stormwater runoff hydrographs will be created to check the hydrology modeling produced by the SWMM model. Second, HEC-HMS will be used to create hydrographs to be used by HEC-RAS in the analysis of the Harbor Bench stream beds. This model will not be used particularly for base flow calculations.

3. Open Channel Hydraulic: HEC-RAS will be used to analyze the response to peak flow discharges as they cross the HBFD. Flood analysis will allow for determining the necessary stream cross sections to pass the expected peak flow conditions (so any possible restoration and enhancement structures will not cause flooding). Coupled with the EPA-SWMM model above, the full flow path of peak events through hydraulic structures and down stream courses can be modeled. Of course, the impact of changes to the peak flow size, duration, intensity, and timing as results from development activities can be accommodated by these models.

4. Continuous Surface Water Hydrology (base flows): HSPF will be used for modeling the very important base flows. This model incorporates continuous water balance calculations so that multiple drought years, wet years or mixed years of precipitation

can be incorporated. The model will be informed by and act as a check on the groundwater modeling results from Section 5.3.2 questions #1 and #2 regarding base flows from the hillside soils profile, bedrock discharges, and drainage from slope stability structures. These two sources of model outputs should have similar results. Further, the model also includes parameters such as specific precipitation events, ET, vegetation conditions, soils discharges, soils losses, and many other parameters. Of course, changes to these conditions from development practices, and the effect of those changes on the base flow will readily show the impact of developmental. This model will reflect disturbance to the hydrology flow system better than the groundwater model. Such modeling will allow for proper engineering to overcome any adverse impact to the base flows. This model will also produce similar peak flow results as determined using the HEC-RAS and SWMM models and thus will also act as a check on these models for their appropriate use in engineering design.

5.4.2 Surface Water Model Calibration

These models will be calibrated to existing data. The primary use of these models will be to predict base flow and low flow conditions, as well as the peak storm water flows. The model results will allow for providing engineered measures to protect low flows throughout the irrigation season, and the control of peak flows during storm events.

5.4.3 Surface Water Modeling Conclusions and Recommendations

Engineering practices that the CSWMP may recommend could include, but not be limited to, on-site and off-site detention structures, desynchronization of storm water discharges, stream restoration (erosion control) and stream enhancement structures, changes to current hydraulic flow structures, and other types of remediation and enhancements that can be accommodated on the hillside and the bench. These engineering solutions to HHSPA and HBFD issues will be checked in preparation for the MPOD process based on the models listed above, or their replacements if a model is found to not be performing adequately. WRD personnel will be consulted during any model change or model problem resolution.

Data from the models will be provided so that standard engineering methods can be used to determine the capacity of existing hydraulic structures and streams. The results of this analysis will be used to define the flooding potential in the HBFD. Methods that future engineers may use include the HEC-RAS model, EPA-SWMM model, and standard conveyance calculation methods. Erosion control features to remediate, restore, and enhance past damage to the Harbor Bench crossing streams, drainages, and flow channels can be accomplished with standard engineering practices once the model has provided the expected peak flows and hence the peak velocities are calculable.

The summary of this section will include existing conditions, target base flow minimums (with and without drought conditions), storm water modeling for standard storm recurrence intervals, capacity of major existing hydraulic structures and stream channels, and areas of concern.

5.5 Summary

A summary of the groundwater and surface hydrology models of existing site conditions will be presented.

6 Development Impact Analysis and Results

The purpose of this section is to evaluate the potential groundwater and surface water impacts on the HHSPA and the HBFD from development inside of the HHSPA. This section will attempt to define the magnitude of potential development, identify the threshold of potential impacts, and identify deficiencies in the existing stormwater collection system.

The annexation application anticipates, for planning purposes only about 2,000 units, most of which will be in the form of multi-family units. These units would most likely be clustered along the top of the hill, with far fewer single family units on the hillside below.

Though the actual number of units could be greater or smaller, the final number of units will be based upon the carrying capacity of the site with respect to water, sewer, stormwater, and access to buildable sites.

From the number of units to be placed on the hillside, an estimated total area of impervious surface, and the distribution of that area can be prepared with sufficient detail to model the impact to surface flows and groundwater recharge.

6.1 Development Densities of the HHSPA

A range of probable development densities and types within the HHSPA will be analyzed. The range of development density will be based upon land use regulations and site constraints; such as steep slopes, potential unstable areas and riparian corridors.

This analysis will be used in estimating increased impervious surfaces and changed surface features that may increase runoff. Results of this section will be used to create development standards and conditions for the HHSPA to mitigate potential groundwater and surface water impacts on the HBFD.

6.2 Groundwater Impacts

This section will provide an estimate of groundwater impacts from proposed development in the HHSPA. Estimates of potential impacts will be gauged by modifying the calibrated groundwater and surface water models to include the proposed development and remedial actions, if any.

6.2.1 Groundwater Quantity Impacts

The type and level of probable development within the HHSPA and the effect on runoff and recharge will be assessed to estimate the likelihood of groundwater quantity impacts. The groundwater standards will be set by the WRD and their laws and rules prescribing protections for existing groundwater rights. No adverse impact to groundwater rights will be allowed, and with very low yield water rights this generally will mean no measurable impact on groundwater levels on the Bench.

Some restoration and enhancement of streams could greatly improve the groundwater situation while providing a method of easing storm water conditions for the hillside. The groundwater models developed in Section 5.3 will be utilized to estimate changes between pre-development and post-development conditions in recharge and groundwater levels, while both the groundwater and surface water model will estimate the impacts to surface water flows and their interaction with the groundwater aquifers.

6.2.2 Groundwater Quality Impacts

The type and level of probable development within the HHSPA will be assessed to estimate the likelihood of groundwater quality impacts. All groundwater quality standards will be referenced to DEQ standards for groundwater. The primary groundwater quality parameter of concern will likely be the small quantities of oils and grease from road surfaces and driveways that may find there way into the groundwater. This is very unlikely to be a serious problem, just as it is a vanishingly small problem in developed areas in Bookings and Harbor today. All sewage will be removed to treatment facilities off the hillside, and no leachfield lines will be used.

6.3 Surface Water Impacts

The purpose of this section is to use the site specific surface water models to analyze the potential impacts of development in the HHSPA to surface water quantity and quality in the HBFD. Similar model techniques to those used in Section 5.4 will be employed to estimate the surface water impacts based on development of the HHSPA. Some restoration and enhancement of streams could greatly improve the surface water and stream situation while providing a method of easing storm water conditions for the hillside. The models developed in Sections 5.3 and 5.4 will be utilized to estimate changes between pre-development and post-development conditions on surface water flows from the hillside, and the impacts to surface water flows coming onto the Bench and as surface water crosses the Bench. This is true of both peak and base flows.

6.3.1 Surface Water Quantity (Flood Impact Analysis)

The type and level of probable development within the HHSPA and the effect on runoff will be assessed to estimate the likelihood of flood impacts on existing hydraulic structures and conveyances. The surface hydrology model developed in Section 5.4 will be utilized to estimate changes between pre-development and post-development conditions in surface water flows at existing hydraulic structures and in existing conveyances.

6.3.2 Surface Water Quantity (Base Flow Analysis)

The type and level of probable development within the HHSPA and the effect on runoff will be assessed to estimate the likelihood of base flow impacts on stream flows and water rights. The surface hydrology model developed in Section 5.4 will be utilized to estimate changes between pre-development and post-development conditions in surface water flows. The standard will be from WRD laws and rules that protect surface water users from loss of their usual and customary quantity of water. Because it is already known from anecdotal evidence that base flows are historically quite low and commonly existing Bench water rights are not fully met, then the WRD standard will be no reduction in base flow would be acceptable on the HBFD.

6.3.3 Surface Water Quality

The type and level of probable development within the HHSPA will be assessed to estimate the likelihood of surface water quality impacts due to erosion and transport of sediment as well as illicit discharge of harmful substances into the storm drainage system. Water quality standards will be from DEQ laws and rules regarding surface water quality. Turbidity will be the primary concern on the bench, though there is low level of risk regarding oil and grease from road and driveway surfaces. Methods for control of impacts to water quality from these sources are well understood and readily engineered.

7 Mitigation Analysis and Standards Development

The purpose of this section is to propose mitigation measures for the potential impacts identified in the previous sections. Additionally, this section will identify and provide recommendations for alternative development standards for the HHSPA.

7.1 Ground Water Impact Mitigation

As necessary potential mitigation scenarios will be evaluated using the site specific hydrogeologic and hydrologic models. The results of this modeling will be the basis for developing HHSPA development standards and best management practices.

7.1.1 Groundwater Quantity Impacts

This section will analyze possible solutions to groundwater quantity impacts that are identified in Section 6.2.1.

7.1.2 Groundwater Quality Impacts

This section will analyze possible solutions to groundwater quality impacts that are identified in Section 6.2.2.

7.2 Surface Water Impact Mitigation

This section will use the site specific surface water models to analyze potential best management practices for the mitigation of development impacts. The goal of this section will be to summarize a range of possible actions that could be employed to minimize and mitigate impacts to surface water quantity and quality.

7.2.1 Surface Water Quantity (Flooding)

This section will analyze possible solutions to flooding impacts that are identified in Section 6.3.1.

7.2.2 Surface Water Quantity (Base Flow)

This section will analyze possible solutions to base flow (water rights) impacts that are identified in Section 6.3.2.

7.2.3 Surface Water Quality

This section will analyze possible solutions to surface water quality impacts that are identified in Section 6.3.3.

7.3 Standards for Surface Water Quantity and Quality

The purpose of this section will be to identify the applicable development standards and to define performance standards for surface water quantity and quality. In general the surface water quality standards will be those adopted and published by the DEQ, and the quantity standards will be those enforced by the WRD under water rights law. Infrastructure and operations alternatives will be proposed in the CSWMP, as necessary, to meet those standards. Mitigation alternatives will be listed for any potential impacts identified in the previous section to meet those standards.

7.3.1 Applicable Federal, State and Local Standards

The CSWMP will provide development standards including standards for mitigation and/or remediation related to surface water management. Proposed standards will be consistent with applicable Federal, State and local standards where required to by law. Water Quality standards will be set by the DEQ, water quantity standards will be wet by the WRD, and development standards are set by the City of Brookings and the JMA.

7.3.2 Existing Development Standards

Relevant existing development standards will be summarized and cited. Existing development standards will be used where appropriate.

7.3.3 Alternative Development Standards for the HHSPA

Alternative development standards that are unique to the study area will be proposed under the MPOD which was design to address issues related to more challenging development sites.

7.4 Standards for Groundwater Quality and Quantity Protection

The purpose of this section will be to identify the applicable development standards and to define performance standards for groundwater quantity and quality. In general the groundwater quality standards will be those adopted and published by the DEQ, and the quantity standards will be those enforced by the WRD under water rights law. Infrastructure and operations alternatives will be proposed in the CSWMP, as necessary, to meet those standards. Mitigation alternatives will be listed for any potential impacts identified in the previous section to meet those standards.

7.4.1 Applicable Federal, State and Local Standards

The CSWMP will provide development standards including standards for mitigation and/or remediation related to groundwater management. Proposed standards will be consistent with applicable Federal, State and local standards where required to by law. Water Quality standards will be set by the DEQ, water quantity standards will be wet by the WRD, and development standards are set by the City of Brookings and the JMA.

7.4.2 Existing Development Standards

Existing development standards will be used where appropriate.

7.4.3 Alternative Development Standards for the HHSSA

Alternative development standards that are unique to the study area will be proposed where appropriate.

8 On-Going Monitoring of Stream Flow, Groundwater Levels, and Water Quality

A plan for gauging stream flow and turbidity in Dahlia, Pedrioli, Johnson, McVay and Cooley Creeks and for water level measurement in the Hastings and Itzen wells on the bench will be developed and presented in the CSWMP. This will include modifications to the existing monitoring system, additions to the existing monitoring system, inclusion of State operated monitoring points, existing weather stations, and addition of low flow weirs on the selected streams. This plan will observe industry accepted flow, turbidity and well water level measurement protocols. The weather station, though it will be operated, will not be relied upon for rainfall gauging since correlation with the existing weather station on the Bench AgriMet has been completed and the AgriMet station found to be more reliable in operation and correlated rainfall values of sufficient accuracy to allow engineering designs to proceed using a correction factor.

This monitoring is proposed to continue through the construction phase and for up to five years after complete project build-out. A sampling and analysis plan will be prepared for ongoing monitoring and will discuss responsible parties for implementation.

9 Provisions for Remedial Actions

The CSWMP will present possible remedial actions should the initial mitigation actions (on-site and off-site), storm water infrastructure, and water management infrastructure and actions fail to provide appropriate protections for existing lands and water rights. Protection from flooding, erosion, sedimentation, water quality degradation, loss of surface water rights, and groundwater rights are the objectives of the CSWMP and the JMA. These then are the parameters which the provisions for remediation must address. Standards to which the remediation must perform will be set as provided for in Sections 7.3 and 7.4 above.

Exhibit EEEEEEEEE

HW3 LLC
Land Development

P.O. Box 2767 *Harbor, Oregon 97415*

Phone: (541) 412-7566 *Fax: (541) 412-7646*

January 26, 2006

RECEIVED

JAN 27 2005

Per [illegible]

Mayor Sherman & Councilors
City of Brookings
898 Elk Drive
Brookings, OR 97415

Re: Harbor Hills Annexation ANX-3-05

Dear Mayor and Councilors:

Well, after five months of public hearings, oral testimonies and reading piles of evidence, petitions and numerous documents we are finally at the end of this annexation process. We understand the difficulty this has caused this City Council and appreciate your listening, reading and effort to comprehend all the information presented.

Crossing the Chetco River with the city limits is not only a very emotional issue it will be a historical event that should not be taken lightly. Whether approved or not, your decision, embraced by some and resented by others, will be remembered for years to come.

Choosing a reasonable density was our first step in determining feasibility of providing public services to the site. We could have chosen a number consistent with the Public Facilities Plan (PFP) or Transportation System Plan (TSP), but instead decided to use 2000 dwelling units as suggested by our engineers as being reasonable. It is this density number that has been used when considering water, sewer and other public services. However, the 2000 dwelling units should only be used for the purpose of determining if public services are or can reasonable be made available. One alternative to our using 2000 dwelling units could have been to use the Public Facilities Plan density to for the purpose of annexation and the Master Plan process to amend the PFP and TSP, if a higher density is determined reasonable based on actual development plans for the site.

Even with knowing up front the difficult process of annexation, we felt the City would be the best partner possible for this development. Many have asked...why? In simple terms and using the analogy of playing a board game, the first thing you want to know before beginning to play is the rules and how to tell when the game is over. Even though you may not like some of the rules at least you know how to play the game from the beginning to the end before you start. With the City, whether we like the rules or not, we know what they are and what the requirements are to complete the process. Even onlookers want to know the rules.

Throughout this long process the discussion and concern has often turned from annexation to development. Many of the issues raised that are associated with development cannot be fully answered until the Master Planning process is underway. Even so, we have attempted to present factual information in a professional manner and hope that was portrayed in our written and oral presentations.

We have taken your concerns seriously and diligently worked with your staff have to adequately answer the many concerns of the Planning Commission, citizens and City Council. The Master Plan process will provide the opportunity to address in detail the issues of access, topography, storm drainage, emergency services, internal circulation, density, housing types and locations and many other details that are impossible to address at this stage.

We are committed to a quality development which we and the community can be proud of being a part. Whatever it takes to accomplish this…we will do our best to make sure it happens. Mr. Westbrook shares this commitment and has put together an excellent team of professionals to perform the work necessary to reach this goal. Once the Master Plan process is complete our team will continue this commitment throughout the development of this large project.

We feel it is in the best interest of the community for this development to be in the City. We both have families who plan to live in this community for many years. We hope our children can look back and thank us for making good decisions for the future by creating opportunities so they may continue to live, work and contribute to our community.

Again, we want to thank you, the Planning Commission, city staff and all the citizens involved in this process. We look forward to working with the City of Brookings in development of this new part of the City.

Sincerely,

Jan Sirchuk, Project Manager

Leroy Blodgett, Project Manager