

Willow Creek, Little Dry Creek, and Greenwood Gulch OSP Progress Meeting

ATTENDEES: Ken MacKenzie - UDFCD
 Paul Hindman - UDFCD
 Shea Thomas - UDFCD
 Ward Mahanke - Lone Tree
 Greg Weeks - Lone Tree
 Monica Bortolini - SEMSWA
 Suzanne Moore - City of Greenwood Village
 Brad Robenstein - Douglas County
 Mark Glidden - CH2M HILL
 Cory Hooper - CH2M HILL
 Lisa Porta - CH2M HILL

COPIES: Bill Woodcock - South Suburban Parks and Recreation District
 File

LOCATION: CH2M HILL Office

DATE: October 14, 2008

On October 14, 2008 a project meeting was held for Willow Creek, Little Dry Creek, and Greenwood Gulch Outfall Systems Planning (OSP) Project. This meeting summary documents the key items discussed at the meeting. Please notify Cory Hooper if your notes differ significantly from these.

Action Items

TABLE 1
 Action Items

| Action Item | Item Description | Responsible Party |
|---|--|--|
| Review calibration results and finalize hydrology | Based on discussion at meeting, refine calibration of peak flow rates at previously published design points | CH2M HILL |
| Naming of Tributaries to Willow Creek, Little Dry Creek and Greenwood Gulch | A number of tributaries have no official name. CH2M HILL will check the UDFCD EDM project to get names and Shea will supply additional names as needed. | L. Porta /CH2M HILL S. Thomas/UDFCD |
| Major Road Crossings Data | A list of data needs was distributed to the sponsors. Sponsors will try to provide major road crossing data to CH2M HILL. In addition, CH2M HILL will review UDFCD | All sponsors/CH2M HILL |

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| | data available through the EDM project for culvert and road crossings. | |
| Draft Baseline Hydrology Report | Review the report and provide comments to CH2M HILL by Monday, October 20th | All sponsors |
| Final Baseline Hydrology Report | Incorporate the comments and revised calibration analysis to finalize the report. | CH2M HILL |

Meeting Objectives

The objectives for the meeting were to accomplish the following:

- ❖ *Review the hydrology work accomplished to date, including calibration efforts.*
- ❖ *Review hydrology results and get concurrence on the hydrology so that alternatives analysis can start.*
- ❖ *Distribute the Draft Baseline Hydrology report for review and comments by sponsors.*
- ❖ *Discuss data needs and revised schedule for completion of the project.*

Review of Hydrology Work Performed

CH2M HILL provided a summary of the modeling efforts, and the project experience with CUHP. A timeline showing the progression of the hydrology was presented.

- a. May 2008 – First hydrologic modeling results presented and Draft Baseline Hydrology Report Distributed
- b. June 2008 - Comments Received from Sponsors
- c. June 2008 – Modeling issues discovered, project put on hold as model is revised
- d. September 2008 – Model is corrected and hydrology is updated

Cory and Ken provided a summary of the problems discovered in CUHP and the revisions that were performed by UDFCD. The original problem was the ‘waterfall’ effect of peak flow vs. area that occurred at the 90 acres basin size. This resulted in drastically different peak flow rates for basins less than 90 acres. To resolve this problem CH2M HILL developed a calibration methodology that was presented in previous meetings and incorporated into the original Draft Baseline Hydrology Report. This methodology utilized an adjustment of the Cp parameter to increase peak flows for basins less than 90 acres. UDFCD made an adjustment to CUHP that made a similar correction to the Cp calculation

and provided a revised model, version 1.3.0. This version resulted in an over estimation of peak flow rates for basins less than 90 acres. UDFCD recognized the problem with the C_p revision in the model and utilized Dr. Guo and Ben Urbonas to revise the model. The revised version 1.3.1 revised the C_t parameter and the T_p equation and returned the C_p calculation to the original methodology prior to the 1.3.0 release. The latest revision correctly computes flow rates in basins less than 90 acres and has a slight decrease in flow rates for basins greater than 90 acres. There is very little impact of the corrected models to this study because the majority of the basins are greater than 90 acres in size.

Model Calibration

CH2M HILL discussed model results, reasons for calibrating the SWMM routing model, and how the calibration was performed.

Before initiating the calibration, the peak flow rates at design points in the upper portions of the watersheds were very close to the ones reported in previous studies. The peak flow rates at design points in the lower portions of the watersheds were much higher than the ones reported in previous studies. These results indicated that there were peak flow routing issues in the model.

Since CUHP was corrected, the calibration efforts were directed towards the routing in SWMM. A methodology was developed to adjust Manning's "n" value (channel roughness coefficient) in the basins to account for routing problems. In summary, the n value was increased the most in the downstream channels to slow the flows. The calibration was done to reflect basin conditions present in 1974 for Willow Creek and Little Dry Creek and 1986 for Greenwood Gulch, when the last hydrology studies were published for these watersheds. With this methodology, the 12 design points compared to previous studies were calibrated within 10-11%.

After the calibration was performed, the baseline hydrology was updated with the future land use data and the seven modeled ponds and presented to the sponsors at the meeting. At critical design points, the new peak flows were 10 to 30% higher than previously published flows, lower in the watersheds.

Sponsors raised concerns about the numbers, in light of current construction projects undertaken at road crossings in the basins. Therefore, it was decided that the calibration should be revised to be closer to previously published data as follows:

- Calibrate Willow Creek and Greenwood Gulch design points within 5% of previous studies.
- Calibrate Little Dry Creek design points within 3% of previous studies.

Ken also emphasized that no formal methodology for "n" calibration needed to be adopted. Previous flows should be matched as close as possible.

The CH2M HILL team was requested to revise the calibration and update the final baseline hydrology report.

Tributary Stream Naming

The project team discussed naming of tributaries to the main streams. Many of them are not officially named. CH2M HILL is updating the UDFCD stream network naming convention as part of the DEM project underway. The team will be looking into EDM stream names to update unnamed tributaries in this study.

Project Schedule and Meetings

| | |
|--|---------------------------------|
| Draft Alternatives Evaluation Report | November 26, 2008 |
| <i>Progress Meeting to Review Hydrology</i> | <i>October 14, 2008</i> |
| <i>Public Meeting</i> | <i>November 20, 2008</i> |
| <i>Baseline Hydrology Report</i> | <i>Week of October 27, 2008</i> |
| Review of Draft Alternatives Evaluation Report | January 9, 2009 |
| Final Alternative Evaluation Report (30 days) | February 9, 2009 |
| Team Select Best Alternative (60 days) | April 10, 2009 |
| Draft Conceptual Preliminary Report (60 days) | June 10, 2009 |
| Review of Draft Conceptual Preliminary Report (30 days) | July 10, 2009 |
| Final Conceptual Preliminary Report (30 days) | August 10, 2009 |

Data Needs

As a reminder, the team is looking for the following data:

Major Road Crossing Data Request

| Drainageway | Roadway Crossing | Jurisdiction | Jurisdiction |
|-------------------------|-------------------------|---------------------|---------------------|
| Greenwood Gulch | Holly Street | Greenwood Village | |
| Greenwood Gulch | Orchard Road | Greenwood Village | SEMSWA |
| Greenwood Gulch | Quebec Street | Greenwood Village | SEMSWA |
| Little Dry Creek | Arapahoe Road | SEMSWA | |
| Little Dry Creek | Quebec Street | SEMSWA | |
| Willow Creek | Quebec Street | SEMSWA | |
| Willow Creek | County Line | SEMSWA | |
| Willow Creek | C470 | CDOT | Lone Tree |
| Willow Creek | Dry Creek Road | SEMSWA | |
| Fox Hill Park Tributary | Dry Creek Road | SEMSWA | |

In addition, CH2M HILL is compiling a list of drop structures for the sponsors' review and decision on which structures shall be incorporated into the alternatives evaluation.

As part of the EDM project, CH2M HILL has access to UDFCD documents on channel improvements and stream crossing plans. These documents will be reviewed as part of the data collection effort.

Upcoming Activities

- **Next Meeting:** The sponsors will meet on November 10th, 2008 at the SEMSWA office to discuss conceptual alternatives in preparation of the public meeting. The public meeting is scheduled for November 20th at a location to be determined.