On March 28, 2023, Gray & Osborne provided the City of Anacortes a Technical Memorandum regarding the Stormwater Model results for Basin G11. In response to this initial modeling effort, the City, along with the Developer, requested an additional review of the Model. The additional items to be reviewed included the following.

- Model with existing land use as opposed to allowable proposed land use.
- Model detention ponds where information is available (the previous Model assumed all ponds were taken offline for conservative purposes).
- Include new field measurements obtained by the City for inverts associated from 17th Street, downstream toward the outfall.
- Model scenario including with, and without the 50 percent safety factor.

**EXISTING LAND USE**

As noted in our meeting with the City and developer, Gray & Osborne intended to remodel Basin G11 as determined from “existing” land uses, as opposed to what was allowable in the future. We intended to estimate the existing land use based upon Table III-2.5 of the Department of Ecology’s 2019 Stormwater Management Manual for Western Washington.

However, upon further review, it was determined that this would have resulted in higher impervious surfaces than what was currently being modeled. Therefore, we left the impervious surface coverage as it was in the original Model. The table in the previous Memo was a bit misleading, so Table 1 is being provided to show the actual impervious surface coverage utilized for each subbasin. The acreages presented in Table 1 were determined based upon the acreage of land use within each subbasin and then the
allowable impervious coverage for each type of land use. For instance, Subbasin 1 consists of 54 percent Low Density Residential (or 21.8 acres) and 46 percent Public Land Use (or 18.5 acres). Low Density Residential allows for up to 35 percent impervious coverage, so 35 percent of the 21.8 acres results in 7.6 acres of imperviousness. The Public Land Use was considered to be completely forested in this instance, so it was assigned 0 percent imperviousness, or zero acres; therefore, the total impervious acreage for Subbasin 1 resulted in 7.6 acres.

**TABLE 1**

<table>
<thead>
<tr>
<th>Subbasin Number</th>
<th>Total Subbasin Area</th>
<th>Impervious Coverage</th>
<th>Pervious Coverage</th>
<th>Impervious Area (acres)</th>
<th>Pervious Area (acres)</th>
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<td>1</td>
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<td>81%</td>
<td>7.63</td>
<td>32.65</td>
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<tr>
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<td>65%</td>
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<tr>
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<tr>
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<td>32%</td>
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<tr>
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<td>73%</td>
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<td>61%</td>
<td>8.16</td>
<td>12.74</td>
</tr>
</tbody>
</table>

**EXISTING DETENTION FACILITIES**

The City provided Gray & Osborne four record drawings related to detention facilities for the following areas.

- Detention pond at Windward Village (18th and D Avenue; Subbasin 7).
- Detention pond at Cascade Court (Subbasin 2).
- StormTech Chambers under the field at the High School (Subbasin 6).
• Detention tank at the north parking area of the High School (Subbasin 6).

These four detention facilities were incorporated into the Model based upon the drawings provided.

FIELD MEASUREMENTS

On April 27, 2023, the City provided field measurements (i.e., measure downs) from 17th Street down toward the outfall. A number of downstream pipes were upsized to 36-inch (from 30-inch).

MODEL RESULTS

Based on the revisions previously noted, the Model resulted in no surcharge downstream of the proposed development near 18th Street and D Avenue. Five pipes are shown to be surcharged within Basin G11 as shown in Figure 1. Two of the pipes are located on the west side of the Basin along Cascade Court, and the other three are located west of the High School. Replacing the existing 12-inch pipes along Cascade Court with 18-inch pipe replacements is shown to alleviate any surcharging in this area, whereas installing 36-inch pipes west of the High School would alleviate surcharging shown in the Model for this region.

The results previously noted reflect a 50 percent safety factor added to the flow. If this safety factor is removed, all surcharging along Cascade Court is removed; however, the area west of the High School still surcharges (from 3.8 feet to 6.3 feet above the top of the pipe). With this amount of surcharge, it is still recommended that 36-inch pipe replacements be installed within this area.

SAC/sr
Outfall
Existing Pipe: 18-Inch
Surcharge: 7.9'
Replace with 36-Inch Pipe Equiv. - 355 ft
Existing Pipe: 18-Inch
Surcharge: 7.3'
Replace with 36-Inch Pipe - 274 ft
Existing Pipe: 18-Inch
Surcharge: 4.4'
Replace with 36-Inch Pipe - 400 ft
Existing Pipe: 12-Inch
Surcharge: 0.5'
Replace with 18-Inch Pipe - 217 ft
Existing Pipe: 12-Inch
Surcharge: 0.1'
Replace with 18-Inch Pipe - 37 ft

LEGEND:

- Surcharged Pipe
- Basin G11 Parcels
- Existing Culvert
- Existing Ditch
- Existing Storm Pipe
- Modeled Culvert
- Modeled Ditch
- Modeled MH
- Modeled Detention

CITY OF ANACORTES
BASIN G11 REMODEL
FIGURE 1
PIPE RECOMMENDATIONS