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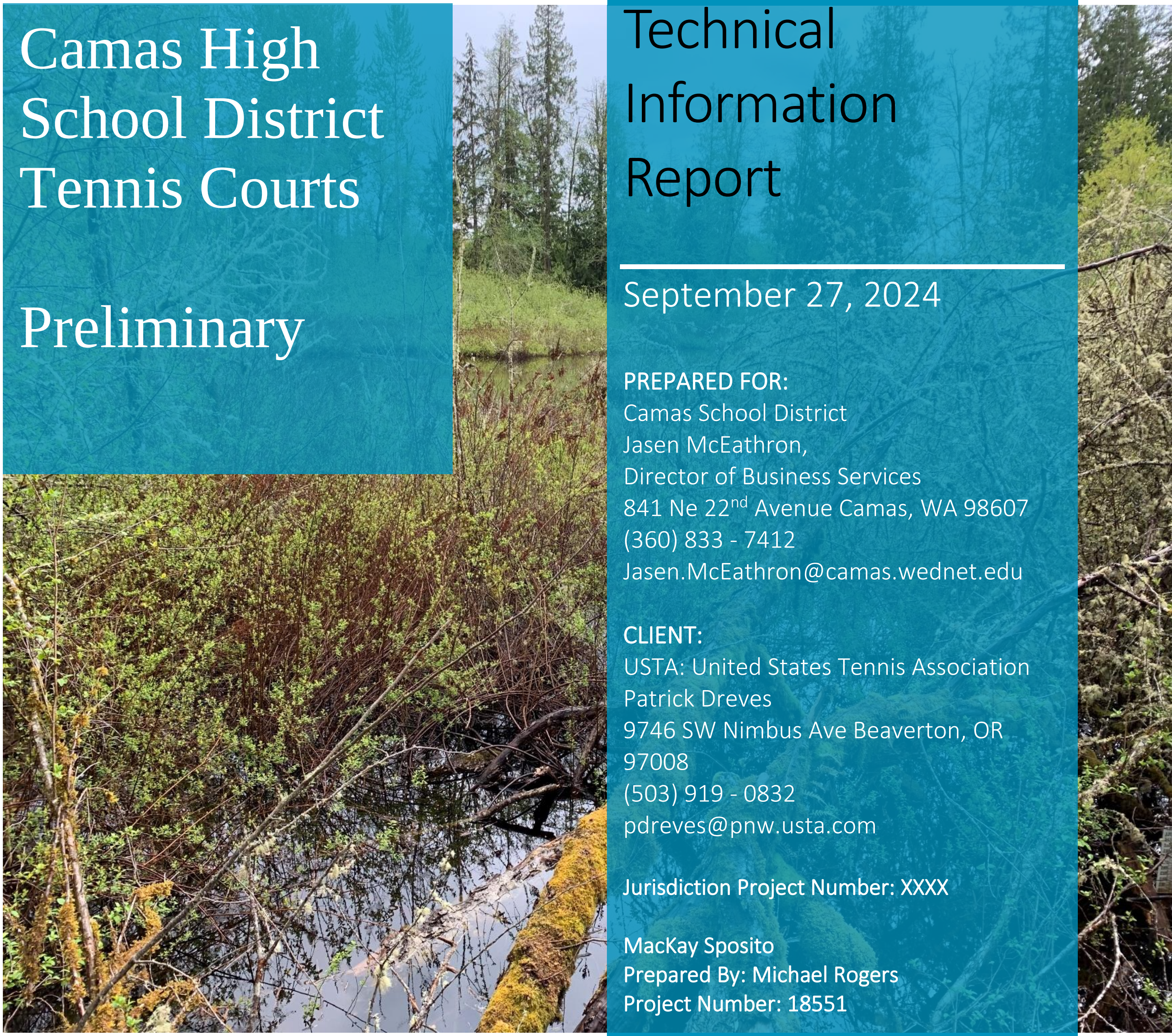

Camas High School District Tennis Courts

Preliminary

Technical Information Report

September 27, 2024

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Jurisdiction Project Number: XXXX

MacKay Sposito
Prepared By: Michael Rogers
Project Number: 18551

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STATE OF WASHINGTON
49506
REGISTERED PROFESSIONAL ENGINEER

MacKay Sposito

September 27, 2024

Vancouver Office
18405 SE Mill Plain Blvd, Suite 100 • Vancouver, WA 98683
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Exhibit 13 CUP24-1001

Preliminary Technical Information Report (TIR)

September 27, 2024
Clark County, Washington
Project Engineer

“I hereby state this Technical Information Report (TIR) has been prepared under my supervision and meets the standards of care and expertise which is usual and customary in this community for professional engineers. The TIR includes the required information per the 2021 Clark County Stormwater Manual and complies with CCC 40.386. The proposed stormwater design is feasible.”

GREGORY C. OEHLEY
49506

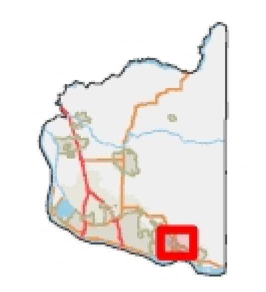
Gregory Oehley, PE
Project Engineer

Exhibit 13 CUP24-1001

Maps

Exhibit 13 CUP24-1001

Vicinity Map



Legend

☐ Taxlots

Major Roads

— Interstate

— State Route

— Arterial

— Forest Arterial

6,018.7	0	3,009.33	6,018.7	Feet

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

This map was generated by Clark County's "MapsOnline" website. Clark County does not warrant the accuracy, reliability or timeliness of any information on this map, and shall not be held liable for losses caused by using this information. Taxlot (i.e., parcel) boundaries cannot be used to determine the location of property lines on the ground.

Notes:

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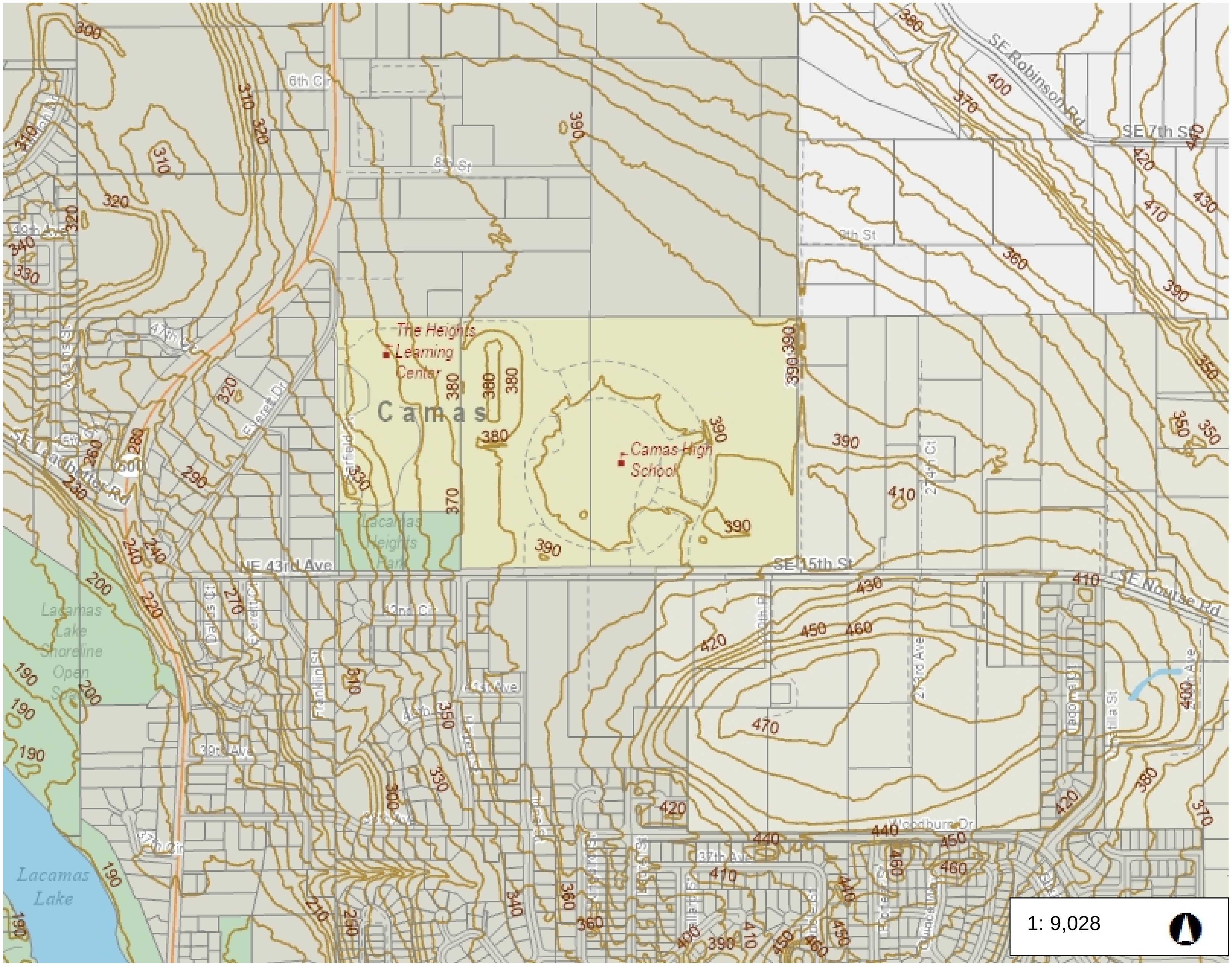
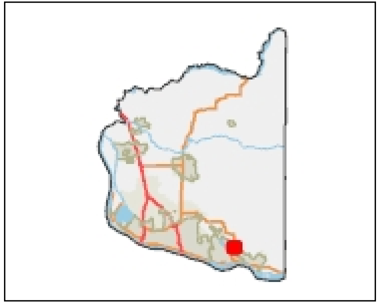
Aerial with Contours





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☐ Taxlots

— Contour Lines - 10 ft

Notes:

1,504.7 0 752.33 1,504.7 Feet

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Clark County, WA. GIS - http://gis.clark.wa.gov

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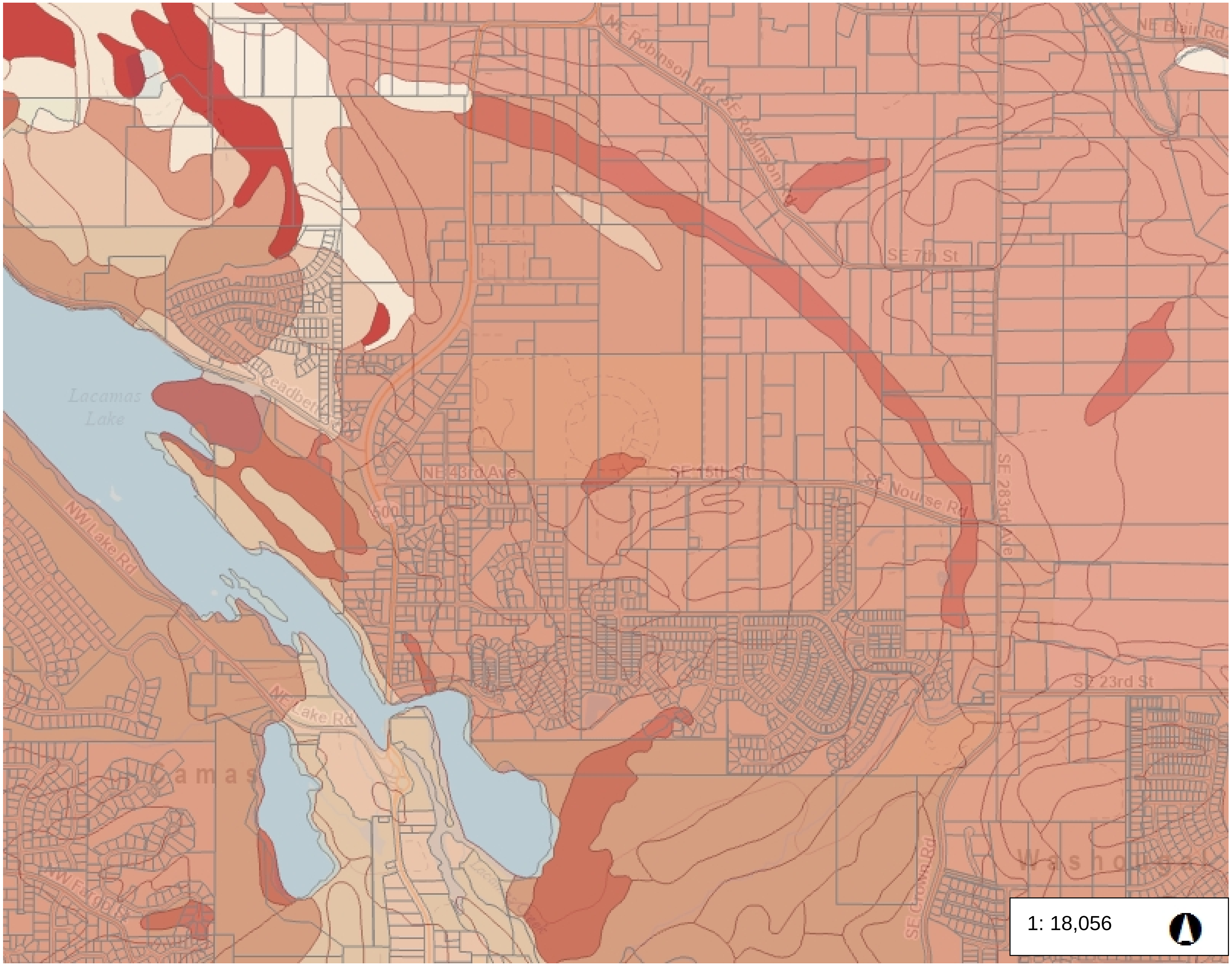
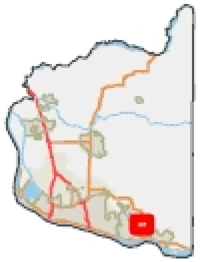
WWHM Soil Group Classification





Legend

☐ Taxlots

WWHM Soil Group

- 1 - Excessively drained soils
- 2 - Well drained soils
- 3 - Moderately drained soils
- 4 - Poorly drained soils
- 5 - Wetland soils
- Unknown

Notes:

3,009.3 | 0 | 1,504.67 | 3,009.3 | Feet

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

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Narrative

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Appendix B	Figure I-3.2: Re-Development Flow Chart Figure I-3.3: Flow Chart for Determining MR #5 Requirements
Appendix C	WWHM2012 Modeling ▪ WWHM Water Quality Project Report ▪ WWHM Infiltration Trench Project Report
Appendix D	Geocon Northwest – Infiltration testing report and soil logs, dated July 27, 2000 Columbia West – Geotechnical Site investigation for Camas High School Field House, dated December 20, 2019
Appendix E	Camas Stormwater Sewer System Operations and Maintenance Manual, June 2022
Appendix F	City of Camas Pre-Application Report dated issued 5/14/2024
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Section A - Project Overview

Section A.1: Site Information

- *Location of the site, either with a parcel number, an address, or adjacent streets and distance to the nearest cross street.*

  The site is in the southeast quarter of the southwest quarter of Section 35, Township 2 North, Range 3 East of the Willamette Meridian and identified as parcel #178174000 and #178111000. The site is part of the Camas High School which is located at 26600 SE 15th St, Camas, WA 98607.

- *A description of the topography, natural drainage patterns, vegetative ground cover, and presence of critical areas, which include Critical Aquifer Recharge Areas, Flood Hazard Areas , Geologic Hazard Areas, Habitat Conservation Areas, Wetland Protection Areas, and Shoreline Master Program Areas. Critical areas that receive runoff from the site shall be described to a minimum of* X *mile away from the site boundary.*

  The proposed re-development site consists of tennis courts, paved walkways and landscaping/grassed areas. The site area has a stormwater system which provides treatment and detention which was installed with the construction of the school. All runoff from the site is infiltrated onsite. The project is mostly flat (tennis courts) with a strip of grassy area to the north which forms a shallow channel which conveys runoff to the existing field inlets and ultimately to the existing infiltration systems.

- *A description of existing on-site stormwater systems and their functions, including drainage patterns to and from adjacent properties. Identify the primary discharge point or points from the site, and the suitability of the use of these BMPs on the site.*

  The site is developed and contains a stormwater treatment (swale) system and two infiltration facilities for the disposal of runoff. These systems have been designed to meet the current standards and have been detailed in the as-built plans for the school and addition of the Fieldhouse. The technical information reports have been used in the design of this redevelopment, excerpts of which are contained in this report. Stormwater is collected and conveyed to the facilities via a network of catchbasins and pipes as detailed in the as-built plans.

- *A general description of proposed site improvements, including the size of improvements and proposed methods of mitigating stormwater runoff quantity and quality impacts.*

  The project includes resurfacing eight existing tennis courts, installing lighting and an air dome enclosure over the tennis courts as well as the placement of an entrance structure (with restrooms and a small locker area) utility extensions/connections, site improvements for access from the parking lot, additional parking spaces and landscaping.

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Quantity Control:

See Appendix G for the utility and catchment plans used in the following discussion on stormwater function for the proposed site. Based on the catchment plan from the Camas High School Fieldhouse TIR (see Appendix G) the western portion of the proposed site currently flows to the existing stormwater infiltration facility directly west of our site. The eastern portion of our site is part of another catchment to the east which flows to an existing stormwater infiltration system to the east of our site. The dividing line (as shown on the plan) is approximately in the center of the existing tennis court. The tennis court slopes to the north and runoff flows from the court to the landscape tract directly to the north which contains two shallow channels which direct runoff to two existing field inlets which convey the runoff to the respective infiltration facilities.

The first step in our design was to determine the existing flow to the west facility and the existing flow to the east facility. Our proposed site area was divided into two catchments based on the existing condition named H1 which flows to the western facility and H2 which flows to the eastern facility. These catchments are shown on sheet CP-1 in Appendix G. The flows for these two catchments were determined using WWHM. The redevelopment of the site as stated above includes the installation of an air dome, a drive isle and additional parking. This results in an increase in stormwater which will need to be mitigated. The two existing facilities were not designed to accept the additional runoff which will be generated by the proposed redevelopment. An additional infiltration facility is proposed to mitigate for the excess runoff.

The developed catchment (as shown in Appendix G) consists of 4 catchments which have been sized according to the allowable flows as determined by the flow calculations for the existing condition. Catchment 1A and 1B will flow to the existing stormwater infiltration facility to the west and the area is sized such that it does not exceed the existing flow for that facility. In the same way, catchment 2 has been sized not to exceed the flow the existing eastern stormwater infiltration facility. The comparison of the existing to proposed flows for the 100-year storm as determined by WWHM (Report in Appendix C) for the two existing facilities are shown in the table below:

Contributing Catchments	Flow (100-year)
H1	0.7956
1A & 1B	0.7430

Table A1 - Flow to Existing Western Stormwater Infiltration Facility

Contributing Catchments	Flow (100-year)
H2	1.0066
2	0.9391

Table A2 - Flow to Existing Eastern Stormwater Infiltration Facility

The remaining area which consists of catchments 3 and 4 on the developed catchment plan will flow to the new stormwater infiltration facility which is located beneath the proposed east side parking area. This facility was also sized using WWHM. Based on previous infiltration testing as shown in the geotechnical report by Geocon Northwest in Appendix G, infiltration rates in the vicinity of the proposed facility range from less the 1in/hour (T-16) and up to 90 in/hour (T-15). Since our proposed facility is located approximately in between the two we have assumed a conservative rate of 30in/hour and applied a safety factor of 2 to that for a design rate of 15in/hour for calculations. Note that there are areas in the vicinity with infiltration rates up to 250 in/hour. The facility design is discussed in further detail in MR#7 on page 10 of this report,

The proposed stormwater system for quantity control has been designed and modeled per the latest edition of the Stormwater Management Manual for Western Washington (SMMWW).

Quality Control:

Proposed runoff from the pollution generating/paved areas will be collected and treated by StormFilter treatment catch basins before being infiltrated. Stormwater treatment is discussed in further detail in MR#6 on page 9 of this report.

The proposed stormwater system for quality control has been designed and modeled per the latest edition of the Stormwater Management Manual for Western Washington (SMMWW).

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Section A.2: Determination of Applicable Minimum Requirements

Based upon the preliminary site layout, determine whether Minimum Requirements #1-#5 or #1-#9 apply to the project.

Site Characteristics	
The amount of existing hard surface	1.453 acres
The amount of new hard surface	2.158 acres
The amount of replaced hard surface	1.293 acres
The amount of native vegetation converted to lawn or landscaping	0.000acres
The amount of native vegetation converted to pasture	0.000 acres
The total amount of land-disturbing activity	2.746 acres
The amount of pollution-generating hard surface (PGHS): this includes pollution-generating impervious surface	0.631 acres (road and parking lot)
The amount of pollution-generating pervious surfaces (PGPS)	0.000 acres
The total amount of pollution-generating surfaces	0.631 acres
The total amount of non-pollution generating surfaces	2.115 acres

Table B1: Site Improvement Summary

Provide a statement that confirms which Minimum Requirements apply to the development activity. Trace on the flow chart (Figure I-3.1 or Figure I-3.2) to show how applicable Minimum Requirements were determined.

Based on Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment (Appendix B), all minimum requirements #1 - #9 apply to this project. Figure I-3.2 comes from Stormwater Management Manual for Western Washington Requirements, Volume 1.

For development or redevelopment where Minimum Requirements #1-#9 must be met:

- *Provide the amount of effective impervious area in each TDA, and document through approved continuous flow model the increase in the 100-year flood frequency from pre-developed to developed conditions for each TDA.*

  All runoff from the site will be infiltrated and will not increase the flood frequency in the developed condition. Since 100% of runoff is infiltrated the effective impervious area is zero. Refer to Appendix C for continuous flow model.

- *List the TDAs that must meet the runoff treatment requirements listed in Minimum Requirement #6.*

  The total pollution generating hard surface (PGHS) which consists of roads and parking equals 0.631 acres which is greater than 5,000 square feet, therefore, construction of stormwater treatment facilities are required for this project.

- *List the TDAs that must meet the flow control requirements listed in Minimum Requirement #7.*

  The total effective impervious surface, which consists of roads, parking, sidewalks and roofs, is 2.16 acres which is greater than 10,000 square feet. Therefore, flow control requirements are required for this project.

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- *List the TDAs that must meet the wetlands protection requirements listed in Minimum Requirement #8.*
  There are no wetlands on this site therefore, Minimum Requirement 8 is not applicable.

Section B - Minimum Requirements

This section shall discuss how each Minimum Requirement applicable to the project (as identified in Section A.2) will be met.

Minimum Requirement #1 - Preparation of Stormwater Site Plans

All projects meeting the thresholds in Section I-1.3 shall submit a Stormwater Site Plan for review by City of Camas. Stormwater Site Plans shall use site-appropriate development principles to retain native vegetation and minimize impervious surfaces to the extent feasible.
A development plan showing how the stormwater requirements are being met is included in the appendices. See the Preliminary Development Plan, found in Appendix G.

Minimum Requirement #2 - Construction Stormwater Pollution Prevention

The Construction Stormwater Pollution Prevention plan will be provided with final design.

Minimum Requirement #3 - Source Control of Pollution

Following construction, all new development and redevelopment projects meeting the Project Thresholds in I-3.3 Applicability of the Minimum Requirements shall apply all known, available, and reasonable Source Control BMPs. See Volume IV for source control BMPs.
The project includes resurfacing eight existing tennis courts, installing lighting and an enclosure over the tennis courts as well as the placement of an entrance structure (with restrooms and a small locker area) utility extensions/connections, site improvements for access from the parking lot, additional parking spaces and landscaping. In order to address the potential for undesirable concentrations of pollutants, the following BMPs have been identified to be applicable to this project:

- S410 Correcting Illicit Discharge to Storm Drains
- S408 Dust Control at Manufacturing Areas
- S411 Landscaping and Lawn/Vegetation Management
- S450 Irrigation
- S451 Building, Repair, Remodeling, Painting, and Construction
- S453 Formation of a Pollution Prevention Team
- S454 Preventative Maintenance/Good Housekeeping
- S455 Spill Prevention and Cleanup
- S456 Employee Training
- S457 Inspections
- S458 Record Keeping

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Minimum Requirement #4 - Preservation of Natural Drainage Systems and Outfalls

Describe how natural drainage patterns are being maintained, and how discharges from the project site shall occur at the natural location, to the maximum extent practicable. The manner by which runoff is discharged from the project site must not cause a significant adverse impact to downstream receiving waters and down gradient properties. All outfalls require energy dissipation.

Currently all runoff from the existing site infiltrates onsite. In the re-developed state, all runoff will be collected and routed to treatment BMP's where applicable and to infiltration BMPs. All runoff will be infiltrated. Therefore, the natural drainage patterns will be preserved.

Minimum Requirement #5 - Onsite Stormwater Management BMPs

Describe how on-site stormwater management BMPs, including LID BMPs, will be effectively implemented on the site, in accordance with this Minimum Requirement.

Since 100% of runoff will be infiltrated, the Low Impact Development Performance Standard will be met. In the full WWHM report, the LID Performance standard is listed as "passed."

See Appendix C for the full WWHM report as well as screenshots of basins, water quality flows, and the infiltration trench.

1. *General*

- *Describe the suitability of the site for the selected BMPs, including hydrologic soil groups, geologic media, infiltration rates, slopes, and groundwater elevations.*

  A geotechnical study was conducted on this site by Geocon Northwest for the construction of the high school and later a report by Columbia West dated December 20, 2019 for the construction of the Fieldhouse. Boring logs identifying soils can be found in the reports which can be found in Appendix C. Soils in the area are identified as Hesson Clay loam (HcB) by the NRCS Soil Survey, with a Hydrologic Soil Group designation of C. Clark County GIS Maps Online shows a WWHM Soil Classification of Group 2 (Well drained soils). The onsite infiltration tests measured rates ranging from 0 in/hour to 250 in/hour at various depths, meaning that infiltration is a viable option and already used onsite. Based on the geotechnical reports and Camas Code, the factor of safety for the infiltration trenches is 2. Further testing in the proposed location of the infiltration trench will be necessary to determine the design rate for final design.

- *Summarize the pertinent results from geotechnical studies or other information used to complete the design of each on-site stormwater BMP.*

  A geotechnical study was conducted on this site by Geocon Northwest for the construction of the high school and later a report by Columbia West dated December 20, 2019 for the construction of the Fieldhouse. See Appendix D for the full reports. The onsite infiltration tests measured a rate of up to 250 in/hour. See test results and resulting design conclusions above.

- *Identify the design criteria in this manual for each on-site stormwater management BMP selected and describe how the criteria will be met.*

  The onsite soil has functional infiltration rates; therefore, infiltration will be utilized to dispose of runoff. BMPs have been designed according to the design guidelines in the Stormwater Manual for Western Washington. StormFilter treatment catch basins are a key component in managing stormwater runoff, particularly in urban areas where impervious surfaces like roads and parking lots prevent natural infiltration. Basic treatment catch basins are designed to remove sediments, debris, and some pollutants from stormwater before it enters the stormwater drainage system. A stormwater infiltration trench is also a Best Management Practice (BMP) designed to manage and treat stormwater runoff by allowing it to infiltrate into the ground. This technique is particularly effective in reducing runoff volume, recharging groundwater, and improving water quality by filtering pollutants through the soil. Based on this, the above BMP's have been chosen as to treat and dispose of stormwater.

2. *Low Impact Development (LID)*

- *Indicate whether a mandatory list is being used to select LID BMPs or if the LID Performance Standard will be met.*

  LID performance standards will be met since 100% of runoff is to be infiltrated on site, therefore a list is not required.

- *If using List #1 or List #2, provide written justification, including citation of site conditions identified in the soils report, for any on-site stormwater management BMPs that are determined to be infeasible for the project site. Complete the LID*

  No list has been used since the design performance standard will be met with 100% infiltration on site.

Minimum Requirement #6 - Runoff Treatment Analysis and Design

For land-disturbing activities where the thresholds within Minimum Requirement #6 (see Section I-3.4.6) indicate that runoff treatment facilities are required:

2.746 acres will be disturbed in construction. The total pollution generating hard surface (PGHS) that will be created with this project equals 0.631 acres, which is greater than 5,000 square feet. Therefore, construction of stormwater treatment facilities are required. To address treatment requirements, treatment cartridge catchbasins with ZPG will be used.

- *Document the level of treatment required (basic, enhanced, phosphorus, oil/water separation), based on procedures in Chapter* 3.

  Since this project is infiltrating storm water runoff into the ground and the project is over ¼ mile from a fish bearing stream, only basic treatment will be required according to Stormwater Manual for Western Washington, Volume 1 page 4-8.

- *Identify the BMPs used in the design and list the reference or design manual used to design them.*

  This project will be using treatment cartridges with ZPG media. References used for design include the Western Washington Storm Water Manual.

- *Include an analysis of initial construction costs and long-term maintenance costs.*

  Initial construction cost has not been estimated at this time. The long-term maintenance costs of cartridge media filters for stormwater management are influenced by inspection frequency, sediment accumulation rates, required maintenance tasks, replacement intervals and costs, labor requirements, manufacturer support programs, and available operational data. By carefully evaluating these factors during the selection process of filtration systems, site planners can better

Exhibit 13 CUP24-1001

estimate potential long-term expenses associated with maintaining these critical components of stormwater management infrastructure. The costs will be estimated at the time of final design.

- *Show the approximate location and size of proposed runoff treatment facilities on the preliminary development plan.*

For the roof and most of the landscape areas, there is no runoff from pollution generating surfaces. Therefore, no treatment is required, and runoff will be sent directly to the infiltration trenches.

For Basin WQ1, WQ2, WQ3 and WQ4 shown on the Water Quality Catchment Plan in Appendix G, StormFilter catchbasins with treatment cartridges are proposed to treat the onsite pollution generated surface runoff. The sizing for the treatment catchbasins is based on the offline water quality flow from WWHM and is as follows:

Offline Water Quality Flow: 0.0114 CFS (5.116gpm)
Number of Cartridges: 5.116gpm/7.5gpm/cartridge = 1 Cartridge.

Offline Water Quality Flow: 0.0153 CFS (6.867gpm)
Number of Cartridges: 6.867gpm/7.5gpm/cartridge = 1 Cartridges.

Offline Water Quality Flow: 0.0325 CFS (14.586gpm)
Number of Cartridges: 14.586gpm/11.25gpm/cartridge = 2 Cartridges.

Offline Water Quality Flow: 0.0222 CFS (9.963gpm)
Number of Cartridges: 9.963gpm/5.0gpm/cartridge = 2 Cartridges.

While the StormFilter catchbasins with treatment cartridges are sized to only treat the pollution generating surfaces, an infiltration trench is sized to take all the excess runoff created by the additional impervious area in conjunction with the two existing infiltration facilities. WWHM was used to calculate the water quality flow to each StormFilter treatment catchbasin. The following table shows the required size for each StormFilter catchbasin in its respective sub-catchment. Each StormFilter catchbasin was sized to treat a minimum of 92% of all flow to them. The results are tabulated below:

Facility ID	Contributing Basins	Pervious Area (AC)	Impervious Area (AC)	WQ Flow Rate (cfs)	Cartridge (#) Size	StormFilter Flow Capacity (cfs)
1	WQ1	0.098	0.00	0.0114	(1) 18''	0.017
2	WQ2	0.131	0.00	0.0153	(1) 18''	0.017
3	WQ3	0.278	0.00	0.0325	(2) 18''	0.034
4	WQ4	0.190	0.00	0.0222	(1) 27”	0.025

Table C1 - StormFilter Catchbasin Sizing

See Appendix C for WWHM Reports. In addition to the reports, screen shots of each facility have been provided.

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Minimum Requirement #7 - Flow Control analysis and Design

For land-disturbing activities where the thresholds within Minimum Requirement #7 indicate that runoff treatment facilities are required:

To address flow control requirements, an infiltration trench is being utilized.

- *Summarize the site's suitability for infiltration, including tested infiltration rates, logs of soil borings and other information provided in the Soils Report.*

  A geotechnical study was conducted on this site by Geocon Northwest for the construction of the high school and later a report by Columbia West dated December 20, 2019 for the construction of the Fieldhouse. See Appendix C for full reports and results. From the onsite study, test pit locations are shown in the Geotechnical Report Geocon, attached in Appendix D. The proposed infiltration trench falls between test pits T-16 and T-15 which have infiltration rates of<1 in/hr to 90 in/hour respectively. Based on these rates, a 30 in/hour rate will be assumed as the measured rate until further testing in the exact location is done. Per Table 4-1 in the Camas Stormwater Manual for Western Washington a correction factor of 2 will be used (for general soils) resulting in a design infiltration rate of 15 in/hr. Per the Geotechnical Report, static groundwater was not encountered onsite for almost all test pits and at 10' for test pit T-16 and not encountered in test pit T-15 at 6.5ft deep. With infiltration rates ranging from <1 in/hour up to 250 in/hour randomly across the site further investigation will be necessary and conservative assumptions for the preliminary design have been made.

- *If infiltration is infeasible for flow control, provide the following additional information:*

  Infiltration is feasible for this site.

- *If infiltration is infeasible for flow control, provide the following additional information:*

  Infiltration is feasible for the site.

- *Identify the areas where flow control credits can be obtained for dispersion, LID, or other measures, in accordance with the requirements in SWMWW.*

  This is not necessary since infiltration is being used, therefore N/A.

- *Provide the approximate sizing and location of flow control facilities for each TDA.*

  For the developed basin, there are two existing infiltration trenches to which a portion of the runoff will be routed (not to exceed pre-development flows) and a new infiltration trench is proposed to meet flow control requirements for the remainder of the flow. The size of the trench is as follows:

Facility ID	Tributary Basins	Length (FT)	Width (FT)	Depth (FT)	Percent of 100-Year Storm Infiltrated (%)
IT3	3, 4	94	16	3	100

Table C2 - Infiltration Trench Sizing

- *Identify the criteria (and their sources) used to complete the analyses, including pre-developed and post-developed land use characteristics.*

  The design criteria used can be found in Appendix B in the Western Washington Stormwater Manual, and WWHM model found in Appendix C.

- *For sites considered to be historic prairie, submit a project site report prepared by a wetland scientist or horticulturist experienced in identifying soils, plant, and other evidence associated with historic prairies that demonstrates the existence of historic prairie on the project site.*

  Historic Prairie is not being utilized on this project therefore this section is not applicable.

- *Complete a hydrologic analysis for historic and developed site conditions, in accordance with the requirements of SWMMWW, using an approved continuous flow model. Compute historic and developed flow duration of all TDAs. Provide an output table from the approved continuous flow model.*

  See Appendix C for results from WWHM model showing pre-developed and developed site conditions.

- *Include and reference all hydrologic computations, equations, graphs, and any other aids necessary to clearly show the methodology and results.*

  All BMPs have been sized using WWHM program for the Washington State Department of Ecology. See Appendix C for results from WWHM model.

- *Include all maps, exhibits, graphics, and references used to determine predeveloped and developed site hydrology.*

  For maps see the maps section in Appendix A, for exhibits and references used to determine the predeveloped condition see Appendix A, Appendix B, and Appendix C. The existing site hydrology was determined using WWHM program (see Appendix C).

Minimum Requirement #8 - Wetlands Protection

All new development and redevelopment projects meeting the Project Thresholds in I-3.3 Applicability of the Minimum Requirements shall include Stormwater Management BMPs in accordance with the following thresholds, standards, and requirements to reduce the impacts of stormwater runoff to wetlands.

There are no wetlands on this site therefore this section does not apply.

Minimum Requirement #9 - Operation and Maintenance

- *Provide information on who will own, operate, and maintain the stormwater facilities, including LID BMPs that are considered in the design of treatment and flow control facilities meeting Minimum Requirements #5, #6 or #7.*

  Maintenance of the facilities will be in accordance with City of Camas Operations and Maintenance Manual in Appendix E. Onsite BMP’s will be owned and maintained by the Camas School District. There are no BMP’s expected to be in the right of way.

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Appendix A

Clark County Hydrology Soil Group map
WWHM Soil Group Classification
Table 7: Estimated Physical and Chemical Properties of Soils
Clark County Soil Group
TableFigure B-5: Clark County – 100-year 24-hour Isopluvial

Hydrologic Soil Group—Clark County, Washington

Map Scale: 1:1,220 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

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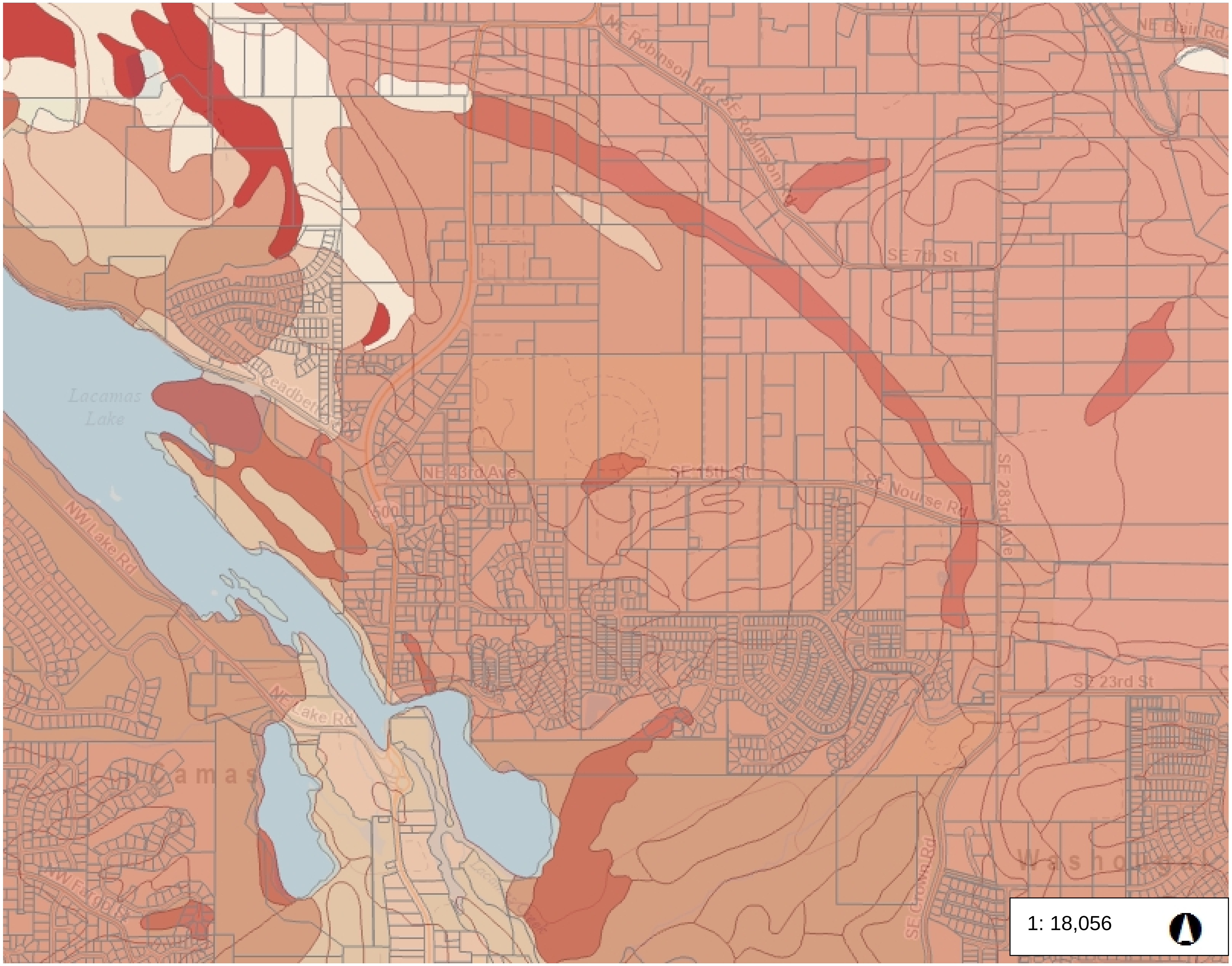
WWHM Soil Group Classification



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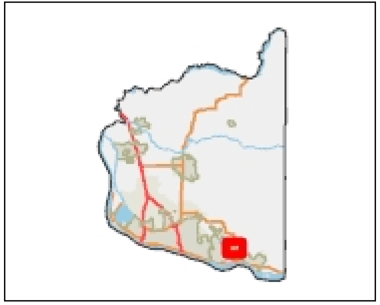


Legend

☐ Taxlots

WWHM Soil Group

- ▨ 1 - Excessively drained soils
- ▨ 2 - Well drained soils
- ▨ 3 - Moderately drained soils
- ▨ 4 - Poorly drained soils
- ▨ 5 - Wetland soils
- ▨ Unknown

Notes:

3,009.3 0 1,504.67 3,009.3 Feet

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

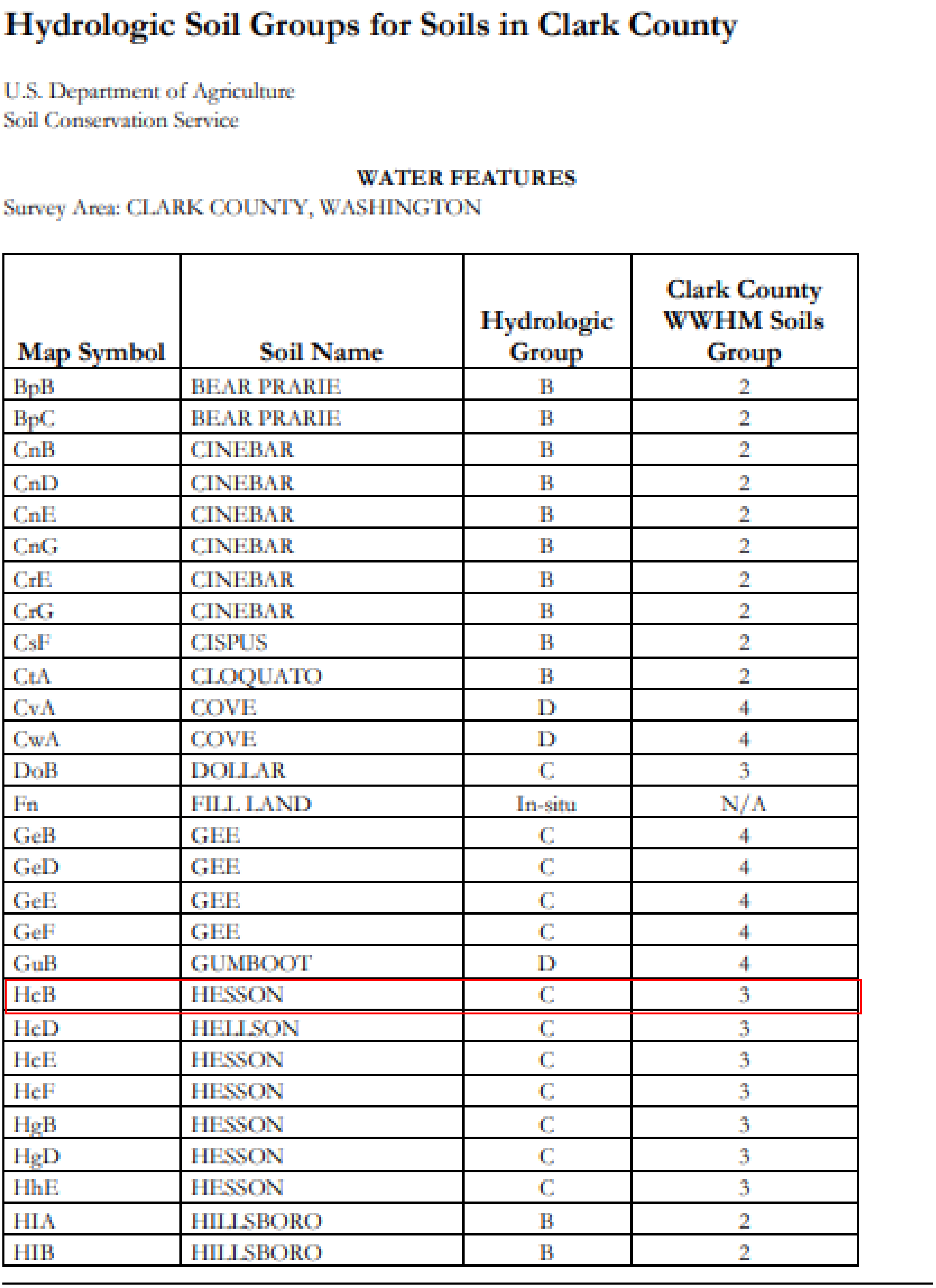
Exhibit 13 CUP24-1001

TABLE 7.—*Estimated physical and chemical properties of the soils*

Soil series and map symbols	Depth from surface	Classification			Percentage passing sieve—			Permeability	Available water capacity	Reaction
		Dominant USDA texture	Unified	AASHO	No. 4 (4.76 mm.) [1]	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
	Inches							*Inches per hour*	*Inches per inch of soil*	*pH*
Bear Prairie: BpB, BpC.	0–51	Silt loam	CL	A–6	90–100	85–95	75–85	0.63–2.0	0.19–0.21	4.5–5.5
	51–75	Gravelly loam	ML	A–4	70–80	65–75	50–60	0.63–2.0	0.14–0.16	5.1–6.0
Cinebar: CnB, CnD, CnE, CnG.	0–65	Silt loam and loam.	ML	A–4	90–100	85–95	60–70	0.63–2.0	0.19–0.21	5.1–6.5
CrE, CrG.	0–60	Silt loam	CL	A–4	70–80	60–80	50–70	0.63–2.0	0.12–0.14	5.1–6.5
Cispus: CsF.	0–24	Gravelly sandy loam.	SM	A–2	70–80	65–75	20–30	2.0–6.3	0.08–0.10	5.6–6.5
	24–53	Very cobbly sand	SM	A–1	35–50	30–50	5–10	>20.0	0.03–0.05	5.6–6.5
Cloquato: CtA.	0–40	Silt loam	ML	A–4	------	100	70–80	0.63–0.20	0.19–0.21	5.6–7.3
	40–72	Sandy loam and sand.	SM	A–2	100	95–100	15–30	>6.3	0.08–0.10	5.6–7.3
Cove: CvA.	0–36	Clay	CH	A–7	------	100	70–80	<0.06	0.14–0.16	5.6–7.3
	36–54	Gravelly silty clay loam.	CL	A–7	65–75	60–70	50–60	0.06–0.20	0.15–0.17	5.6–7.3
Cove, thin solum: CwA.	0–14	Silty clay loam	CL	A–7	------	100	85–95	0.06–0.20	0.19–0.21	4.5–6.0
	14–21	Clay	CH	A–7	------	100	70–80	<0.06	0.14–0.16	5.6–7.3
	21–60	Silt loam	ML or CL	A–4 or A–6.	------	100	65–75	0.06–0.20	0.19–0.21	6.6–7.3
Dollar: DoB.	0–32	Loam	ML	A–4	100	90–95	60–70	0.63–2.0	0.16–0.18	4.5–6.0
	32–60	Loam (fragipan)	ML or CL	A–4	100	95–100	60–70	<0.06	0.06–0.08	6.0
Fill land: Fn.	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Gee: GeB, GeD, GeE, GeF.	0–22	Silt loam	ML or CL	A–6	------	100	70–85	0.63–2.0	0.19–0.21	5.1–6.0
	22–72	Silty clay loam	CL	A–6	------	100	70–80	<0.06	0.06–0.08	5.1–6.0
Gumboot: GuB.	0–12	Silt loam	OL	A–7	90–95	85–95	75–85	0.63–2.0	0.19–0.21	4.5–7.3
	12–50	Gravelly silty clay loam, clay loam.	CL	A–6	90–100	85–95	65–75	0.06–0.2	0.19–0.21	6.1–7.3
	50–60	Very gravelly silty clay.	GC	A–7	40–50	35–50	25–35	<0.06	0.06–0.08	6.1–7.3
Hesson: HcB, HcD, HcE, HcF.	0–22	Clay loam	CL	A–7	85–95	85–95	65–75	0.63–2.0	0.19–0.21	4.5–6.0
	22–91	Clay	CH	A–7	85–90	85–90	75–85	0.2–0.63	0.14–0.16	4.5–6.0
HgB, HgD, HhE.	0–22	Gravelly clay loam.	SC	A–6	75–85	70–80	40–50	0.63–2.0	0.14–0.16	4.5–6.0
	22–91	Gravelly clay	CH	A–7	75–85	70–80	60–70	0.2–0.63	0.11–0.13	4.5–6.0
Hillsboro: HlA, HlB, HlC, HlD, HlE, HlF.	0–36	Loam	ML	A–4	------	100	55–65	0.63–2.0	0.16–0.18	5.1–6.5
	36–62	Sandy loam and sand.	SM	A–1	95–100	95–100	15–25	2.0–6.3	0.10–0.12	5.6–7.3
HoA, HoB, HoC, HoD, HoE, HoG, HsB.	0–65	Silt loam (boulders on surface of HsB).	ML	A–4	------	100	80–90	0.63–2.0	0.19–0.21	5.0–6.0

See footnotes at end of table.

Exhibit 13 CUP24-1001



Hydrologic Soil Groups for Soils in Clark County

U.S. Department of Agriculture
Soil Conservation Service

WATER FEATURES

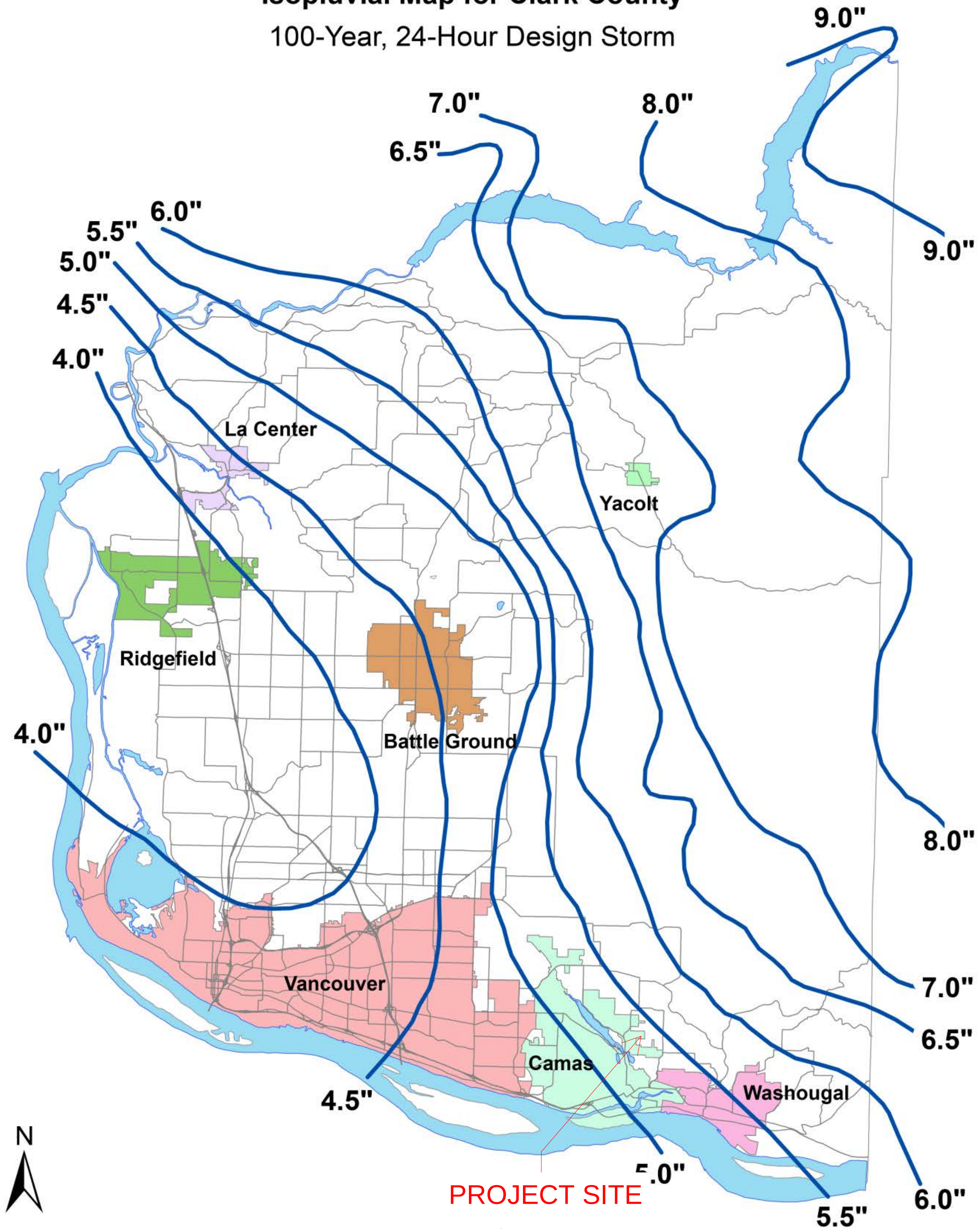
Survey Area: CLARK COUNTY, WASHINGTON

Map Symbol	Soil Name	Hydrologic Group	Clark County WWHM Soils Group
BpB	BEAR PRARIE	B	2
BpC	BEAR PRARIE	B	2
CnB	CINEBAR	B	2
CnD	CINEBAR	B	2
CnE	CINEBAR	B	2
CnG	CINEBAR	B	2
CrE	CINEBAR	B	2
CrG	CINEBAR	B	2
CsF	CISPUS	B	2
CtA	CLOQUATO	B	2
CvA	COVE	D	4
CwA	COVE	D	4
DoB	DOLLAR	C	3
Fn	FILL LAND	In-situ	N/A
GeB	GEE	C	4
GeD	GEE	C	4
GeE	GEE	C	4
GeF	GEE	C	4
GuB	GUMBOOT	D	4
HcB	HESSON	C	3
HcD	HELLSON	C	3
HcE	HESSON	C	3
HcF	HESSON	C	3
HgB	HESSON	C	3
HgD	HESSON	C	3
HhE	HESSON	C	3
HlA	HILLSBORO	B	2
HlB	HILLSBORO	B	2

Exhibit 13 CUP24-1001

Isopluvial Map for Clark County

100-Year, 24-Hour Design Storm



Boundaries current as of 2015.

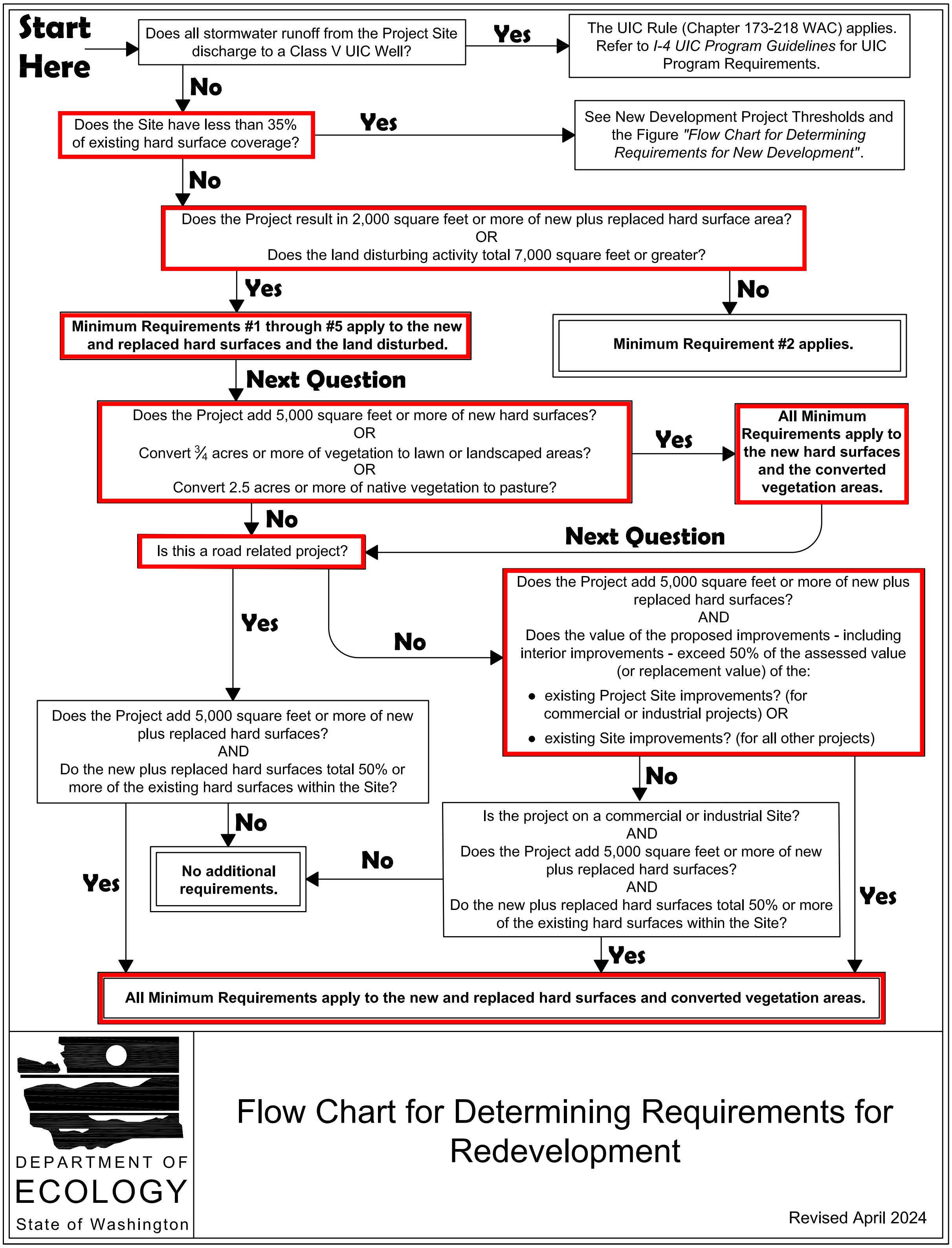
Exhibit 13 CUP24-1001

Appendix B

Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment
Figure I-3.3: Chart for Determining MR#5 Requirements

Exhibit 13 CUP24-1001

Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment



Does all stormwater runoff from the Project Site discharge to a Class V UIC Well?

The UIC Rule (Chapter 173-218 WAC) applies. Refer to *I-4 UIC Program Guidelines* for UIC Program Requirements.

Does the Site have less than 35% of existing hard surface coverage?

See New Development Project Thresholds and the Figure *"Flow Chart for Determining Requirements for New Development"*.

Does the Project result in 2,000 square feet or more of new plus replaced hard surface area?
OR
Does the land disturbing activity total 7,000 square feet or greater?

Minimum Requirements #1 through #5 apply to the new and replaced hard surfaces and the land disturbed.

Minimum Requirement #2 applies.

Does the Project add 5,000 square feet or more of new hard surfaces?
OR
Convert ¾ acres or more of vegetation to lawn or landscaped areas?
OR
Convert 2.5 acres or more of native vegetation to pasture?

All Minimum Requirements apply to the new hard surfaces and the converted vegetation areas.

Is this a road related project?

Does the Project add 5,000 square feet or more of new plus replaced hard surfaces?
AND
Does the value of the proposed improvements - including interior improvements - exceed 50% of the assessed value (or replacement value) of the:

- existing Project Site improvements? (for commercial or industrial projects) OR
- existing Site improvements? (for all other projects)

Does the Project add 5,000 square feet or more of new plus replaced hard surfaces?
AND
Do the new plus replaced hard surfaces total 50% or more of the existing hard surfaces within the Site?

No additional requirements.

Is the project on a commercial or industrial Site?
AND
Does the Project add 5,000 square feet or more of new plus replaced hard surfaces?
AND
Do the new plus replaced hard surfaces total 50% or more of the existing hard surfaces within the Site?

All Minimum Requirements apply to the new and replaced hard surfaces and converted vegetation areas.

DEPARTMENT OF ECOLOGY
State of Washington

Flow Chart for Determining Requirements for Redevelopment

Revised April 2024

Exhibit 13 CUP24-1001

Figure I-3.3: Flow Chart for Determining MR #5 Requirements

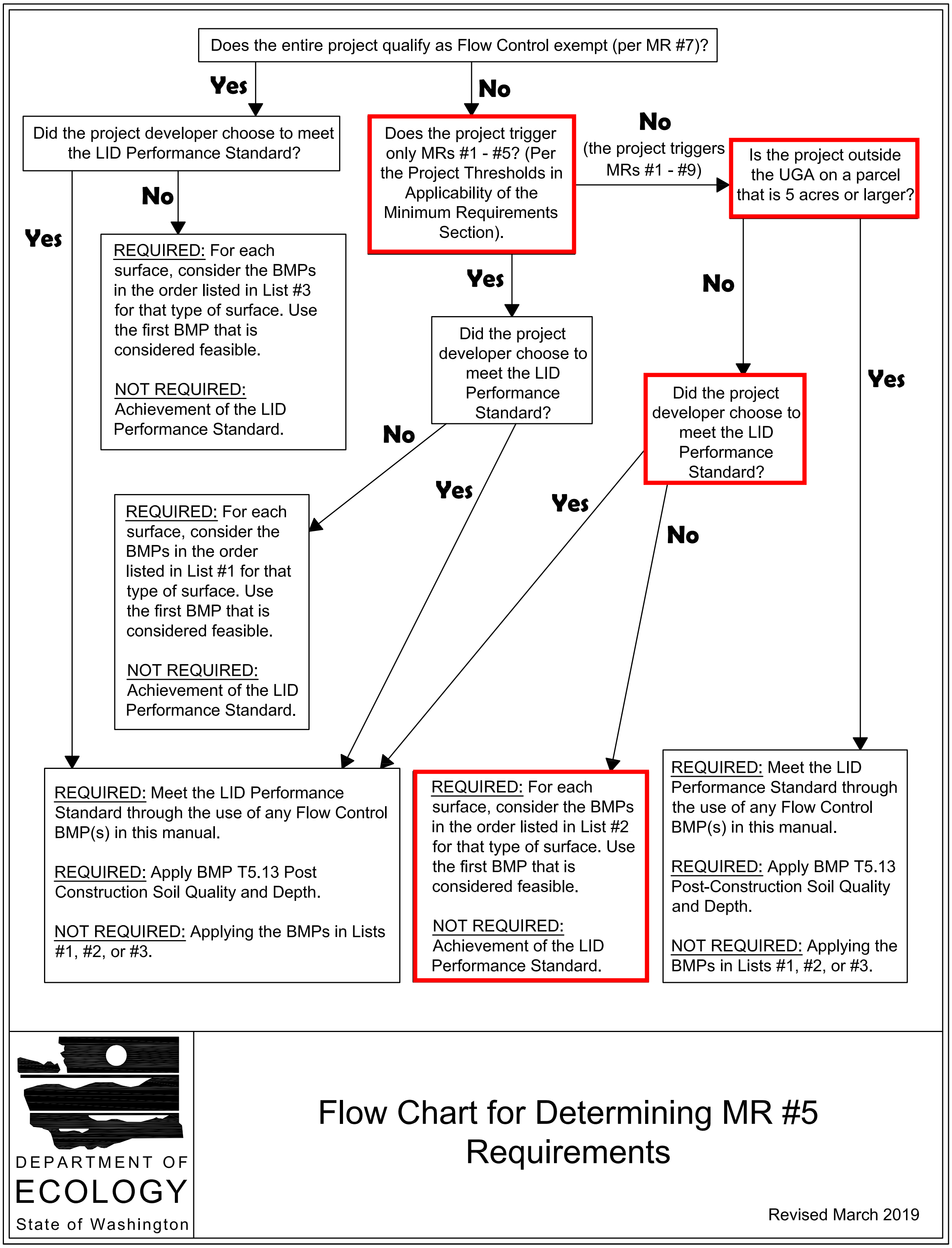


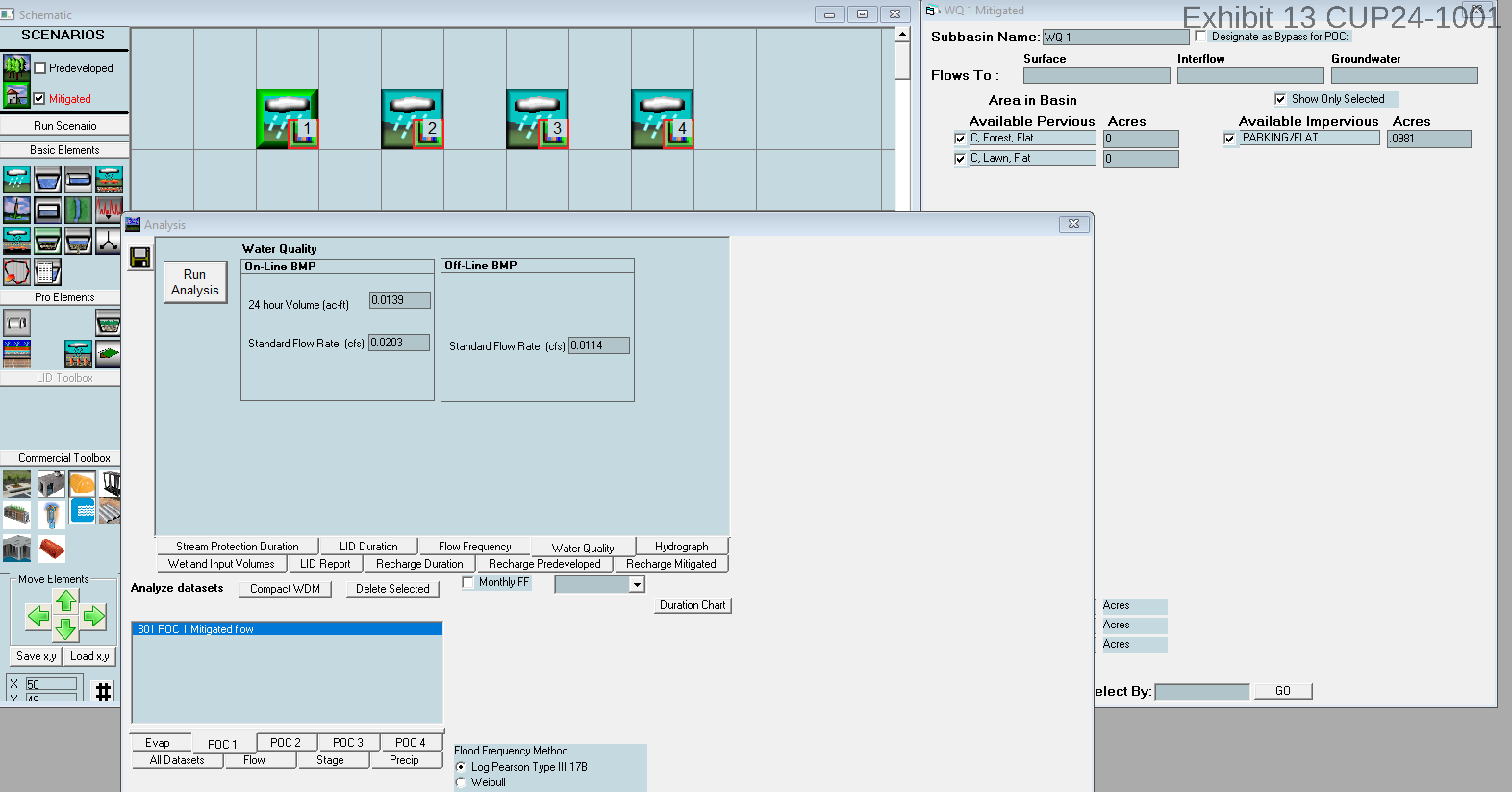
Exhibit 13 CUP24-1001

Appendix C

WWHM2012 Modeling

- WWHM Water Quality Project Report

Exhibit 13 CUP24-1001



SCENARIOS

☐ Predeveloped

☑ Mitigated

WQ 1 Mitigated

Subbasin Name: WQ 1

☐ Designate as Bypass for POC:

Flows To :

Surface	Interflow	Groundwater

Area in Basin

☑ Show Only Selected

Available Pervious	Acres
☑ C, Forest, Flat	0
☑ C, Lawn, Flat	0

Available Impervious	Acres
☑ PARKING/FLAT	.0981

Analysis

Water Quality

On-Line BMP

24 hour Volume (ac-ft) 0.0139

Standard Flow Rate (cfs) 0.0203

Off-Line BMP

Standard Flow Rate (cfs) 0.0114

Analyze datasets

801 POC 1 Mitigated flow

☐ Monthly FF

Flood Frequency Method

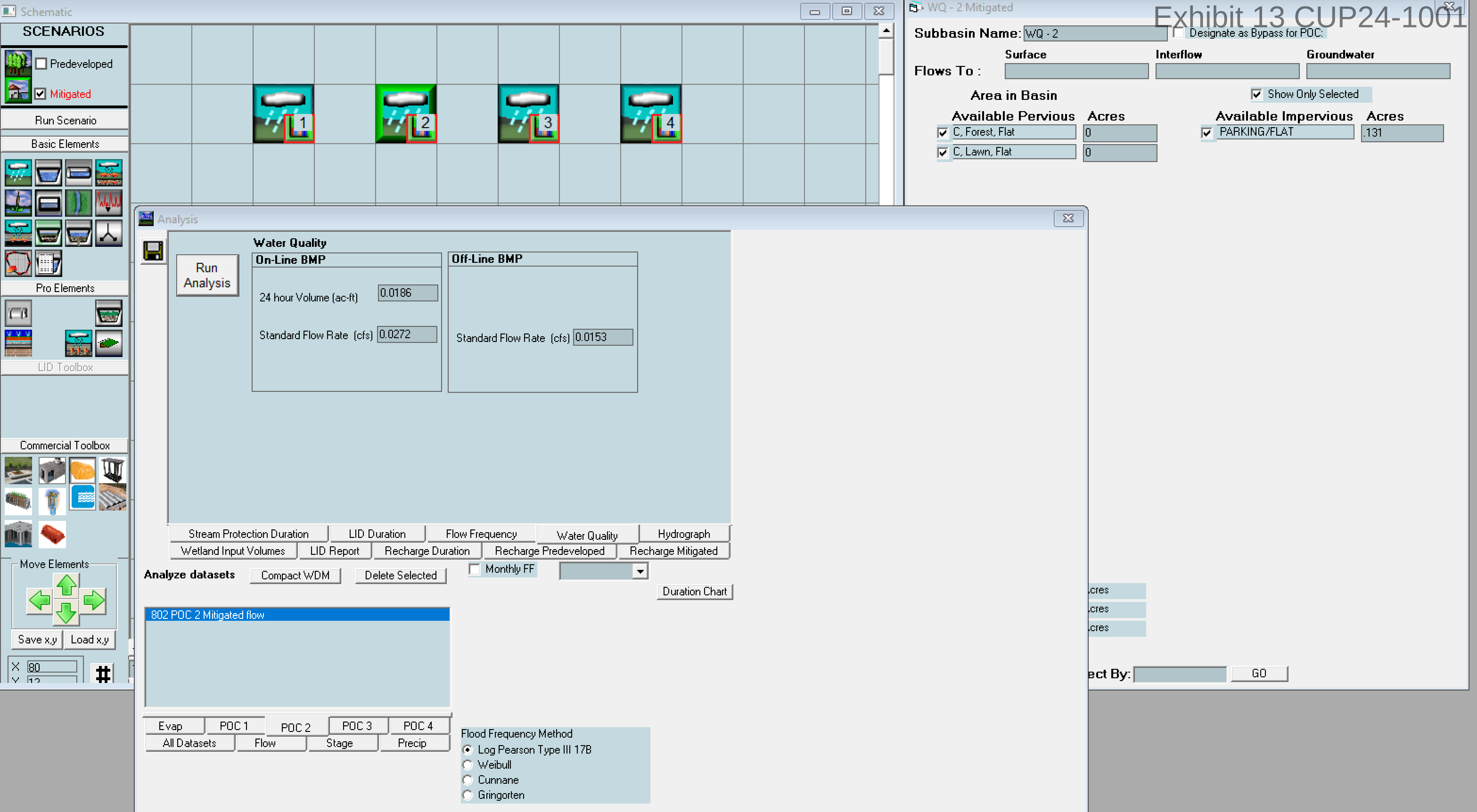
● Log Pearson Type III 17B

○ Weibull

X 50

Y 48

Exhibit 13 CUP24-1001



WQ - 2 Mitigated

Subbasin Name: WQ - 2

☐ Designate as Bypass for POC:

	Surface	Interflow	Groundwater
Flows To :			

Area in Basin

☑ Show Only Selected

Available Pervious	Acres
☑ C, Forest, Flat	0
☑ C, Lawn, Flat	0

Available Impervious	Acres
☑ PARKING/FLAT	.131

X 80

Water Quality

On-Line BMP

24 hour Volume (ac-ft) 0.0186

Standard Flow Rate (cfs) 0.0272

Off-Line BMP

Standard Flow Rate (cfs) 0.0153

Analyze datasets

☐ Monthly FF

802 POC 2 Mitigated flow

Flood Frequency Method

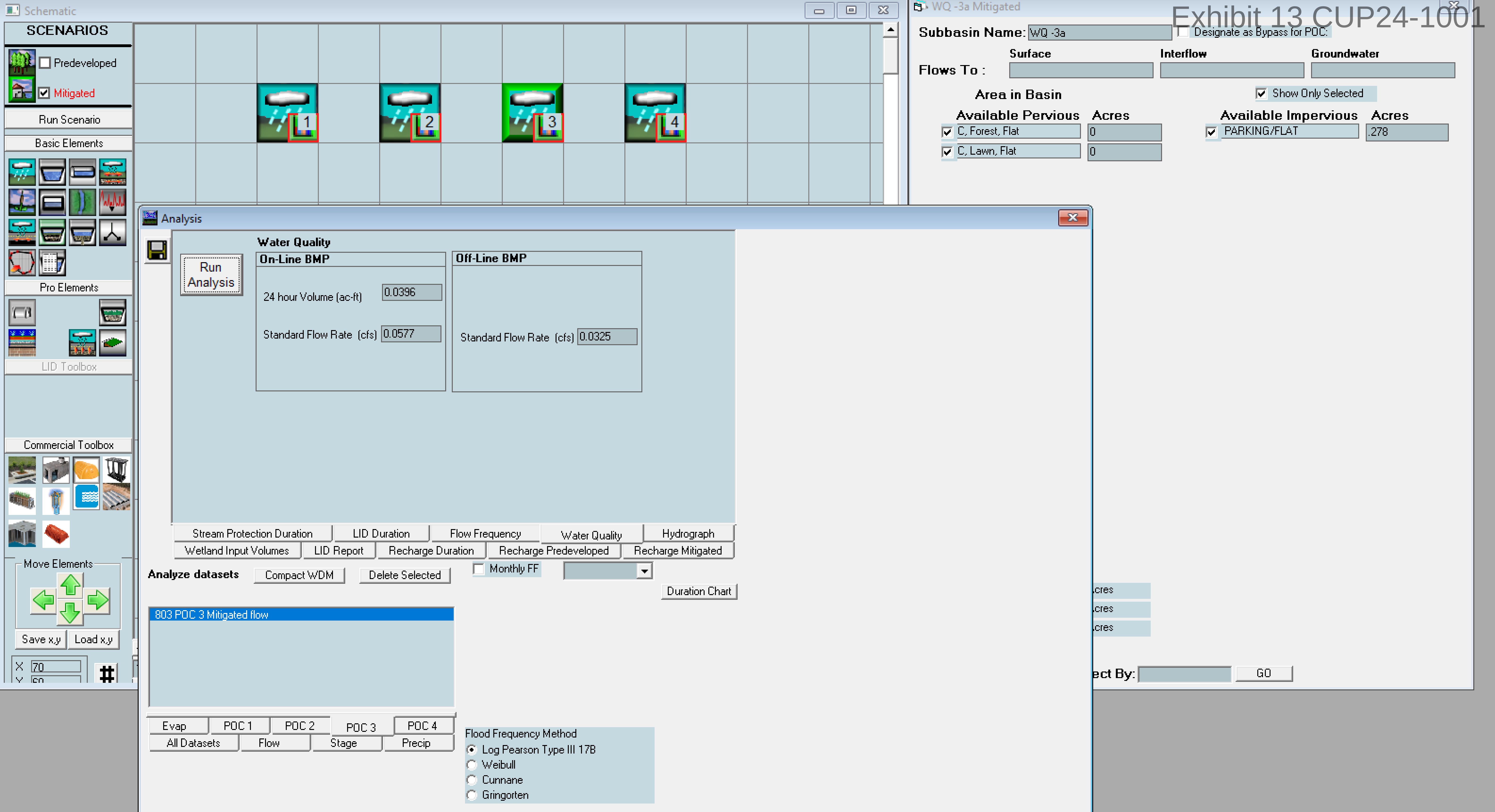
● Log Pearson Type III 17B

○ Weibull

○ Cunnane

○ Gringorten

Exhibit 13 CUP24-1001



☐ Predeveloped

☑ Mitigated

X 70

Y 50

Analysis

Water Quality

On-Line BMP

24 hour Volume (ac-ft) 0.0396

Standard Flow Rate (cfs) 0.0577

Off-Line BMP

Standard Flow Rate (cfs) 0.0325

☐ Monthly FF

803 POC 3 Mitigated flow

Flood Frequency Method

● Log Pearson Type III 17B

○ Weibull

○ Cunnane

○ Gringorten

WQ -3a Mitigated

Subbasin Name: WQ -3a

☐ Designate as Bypass for POC:

	Surface	Interflow	Groundwater
Flows To :			

Area in Basin

☑ Show Only Selected

Available Pervious	Acres
☑ C, Forest, Flat	0
☑ C, Lawn, Flat	0

Available Impervious	Acres
☑ PARKING/FLAT	.278

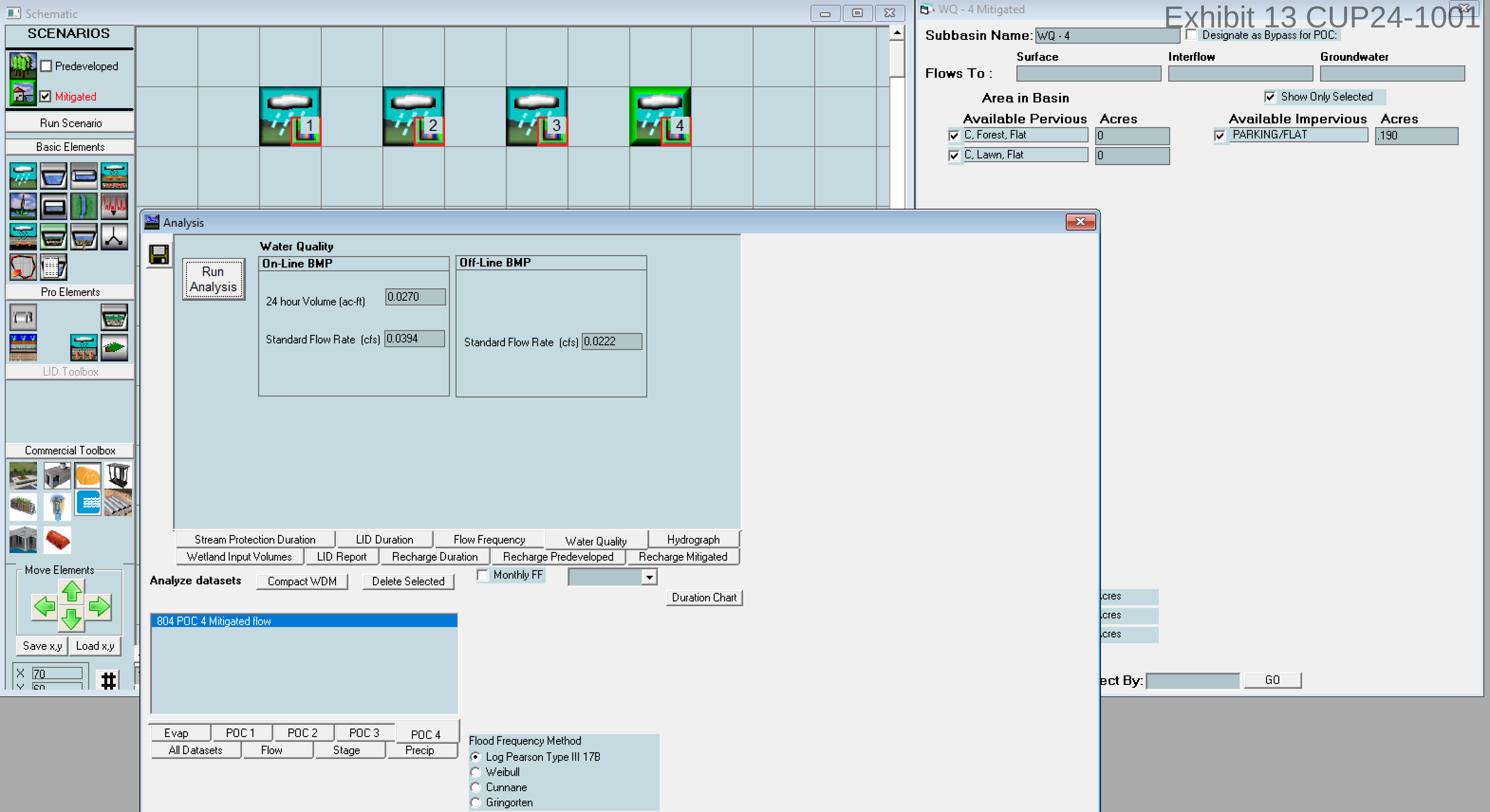
cres

cres

cres

ect By:

Exhibit 13 CUP24-1001



WQ - 4 Mitigated

Subbasin Name: WQ - 4
☐ Designate as Bypass for POC:

Flows To :

Surface	Interflow	Groundwater

Area in Basin
☑ Show Only Selected

	Available Pervious	Acres
☑	C, Forest, Flat	0
☑	C, Lawn, Flat	0

	Available Impervious	Acres
☑	PARKING/FLAT	.190

Analysis

Water Quality

On-Line BMP

24 hour Volume (ac-ft) 0.0270

Standard Flow Rate (cfs) 0.0394

Off-Line BMP

Standard Flow Rate (cfs) 0.0222

Analyze datasets

804 POC 4 Mitigated flow

☐ Monthly FF

Flood Frequency Method
● Log Pearson Type III 17B
○ Weibull
○ Cunnane
○ Gringorten

Schematic

SCENARIOS
☐ Predeveloped
☑ Mitigated

X 70

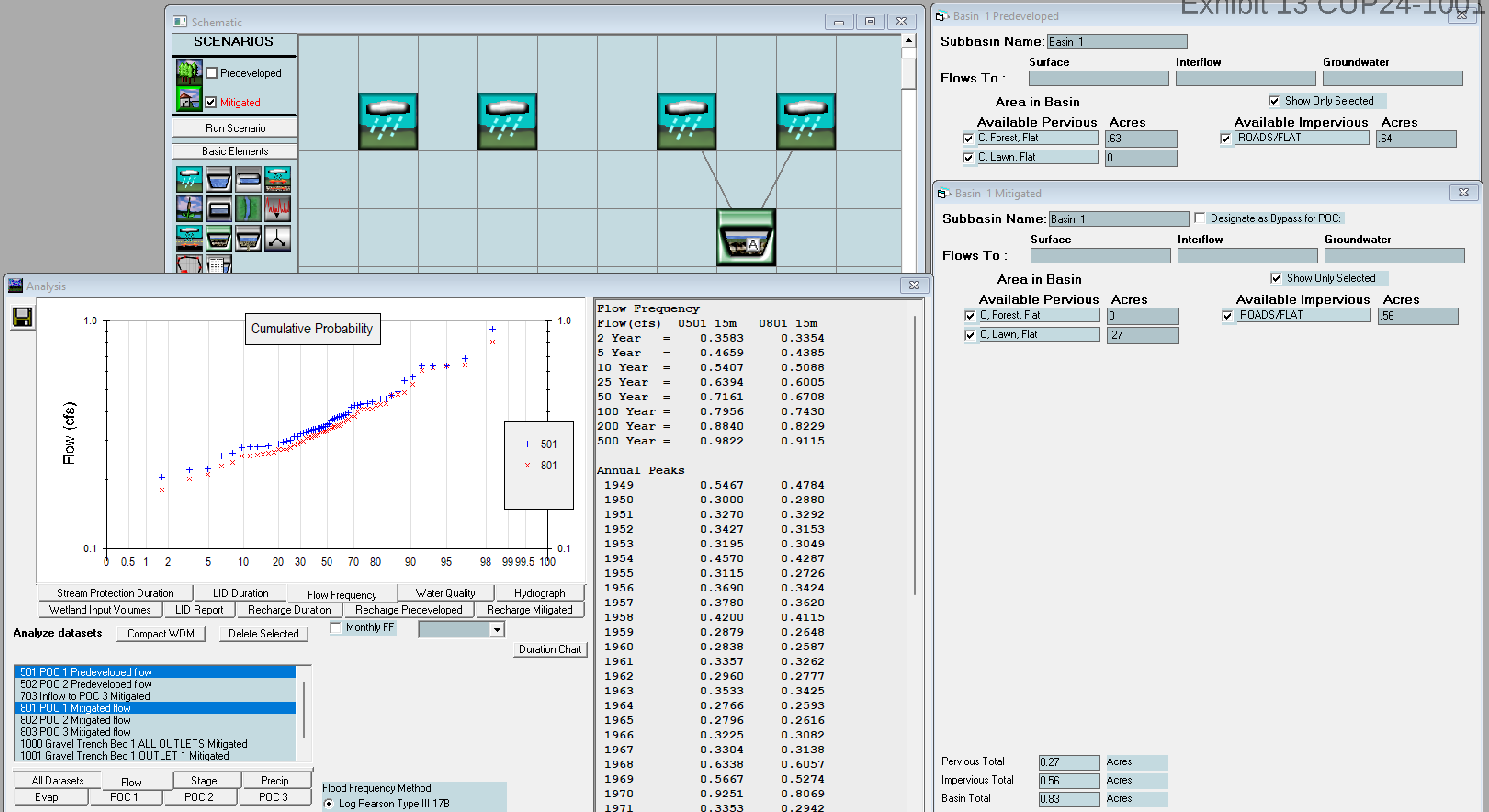
Exhibit 13 CUP24-1001

Appendix C

WWHM2012 Modeling

- WWHM Infiltration Trench Project Report

Exhibit 13 CUP24-1001



☐ Predeveloped
☑ Mitigated

Analyze datasets

☐ Monthly FF

- 501 POC 1 Predeveloped flow
- 502 POC 2 Predeveloped flow
- 703 Inflow to POC 3 Mitigated
- 801 POC 1 Mitigated flow
- 802 POC 2 Mitigated flow
- 803 POC 3 Mitigated flow
- 1000 Gravel Trench Bed 1 ALL OUTLETS Mitigated
- 1001 Gravel Trench Bed 1 OUTLET 1 Mitigated

Flood Frequency Method
● Log Pearson Type III 17B

```
Flow Frequency
Flow(cfs)   0501 15m    0801 15m
2 Year    =    0.3583     0.3354
5 Year    =    0.4659     0.4385
10 Year   =    0.5407     0.5088
25 Year   =    0.6394     0.6005
50 Year   =    0.7161     0.6708
100 Year  =    0.7956     0.7430
200 Year  =    0.8840     0.8229
500 Year  =    0.9822     0.9115

Annual Peaks
 1949          0.5467     0.4784
 1950          0.3000     0.2880
 1951          0.3270     0.3292
 1952          0.3427     0.3153
 1953          0.3195     0.3049
 1954          0.4570     0.4287
 1955          0.3115     0.2726
 1956          0.3690     0.3424
 1957          0.3780     0.3620
 1958          0.4200     0.4115
 1959          0.2879     0.2648
 1960          0.2838     0.2587
 1961          0.3357     0.3262
 1962          0.2960     0.2777
 1963          0.3533     0.3425
 1964          0.2766     0.2593
 1965          0.2796     0.2616
 1966          0.3225     0.3082
 1967          0.3304     0.3138
 1968          0.6338     0.6057
 1969          0.5667     0.5274
 1970          0.9251     0.8069
 1971          0.3353     0.2942
```

Basin 1 Predeveloped

Subbasin Name: Basin 1

Flows To : Surface | Interflow | Groundwater

Area in Basin ☑ Show Only Selected

Available Pervious	Acres	Available Impervious	Acres
☑ C, Forest, Flat	.63	☑ ROADS/FLAT	.64
☑ C, Lawn, Flat	0		

Basin 1 Mitigated

Subbasin Name: Basin 1 ☐ Designate as Bypass for POC:

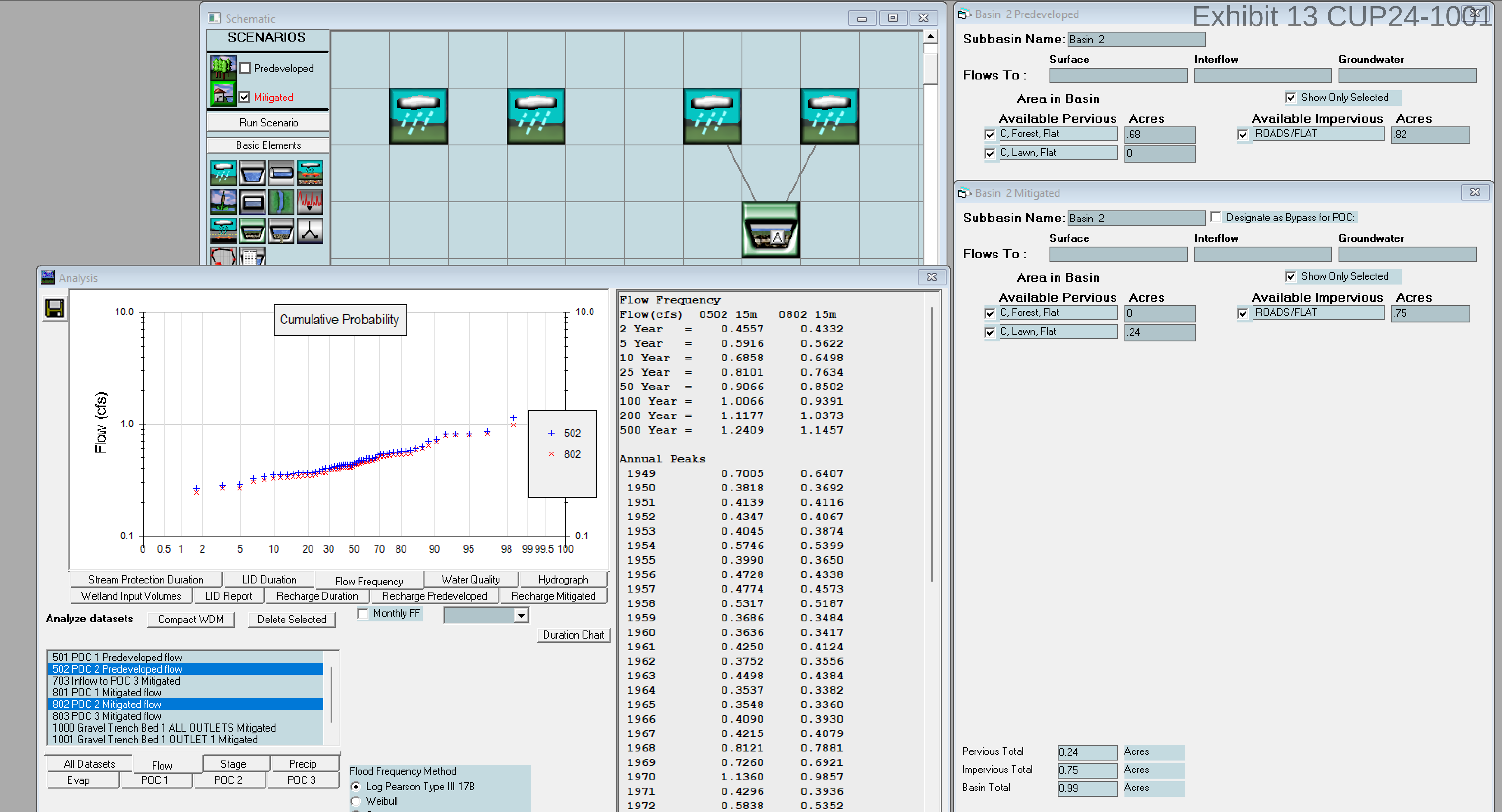
Flows To : Surface | Interflow | Groundwater

Area in Basin ☑ Show Only Selected

Available Pervious	Acres	Available Impervious	Acres
☑ C, Forest, Flat	0	☑ ROADS/FLAT	.56
☑ C, Lawn, Flat	.27		

Pervious Total	0.27	Acres
Impervious Total	0.56	Acres
Basin Total	0.83	Acres

Exhibit 13 CUP24-1001



☐ Predeveloped
☑ Mitigated

Analyze datasets

☐ Monthly FF

- 501 POC 1 Predeveloped flow
- 502 POC 2 Predeveloped flow
- 703 Inflow to POC 3 Mitigated
- 801 POC 1 Mitigated flow
- 802 POC 2 Mitigated flow
- 803 POC 3 Mitigated flow
- 1000 Gravel Trench Bed 1 ALL OUTLETS Mitigated
- 1001 Gravel Trench Bed 1 OUTLET 1 Mitigated

Flood Frequency Method
● Log Pearson Type III 17B
○ Weibull

```
Flow Frequency
Flow(cfs)   0502 15m   0802 15m
2 Year   =     0.4557     0.4332
5 Year   =     0.5916     0.5622
10 Year  =     0.6858     0.6498
25 Year  =     0.8101     0.7634
50 Year  =     0.9066     0.8502
100 Year =     1.0066     0.9391
200 Year =     1.1177     1.0373
500 Year =     1.2409     1.1457

Annual Peaks
 1949          0.7005     0.6407
 1950          0.3818     0.3692
 1951          0.4139     0.4116
 1952          0.4347     0.4067
 1953          0.4045     0.3874
 1954          0.5746     0.5399
 1955          0.3990     0.3650
 1956          0.4728     0.4338
 1957          0.4774     0.4573
 1958          0.5317     0.5187
 1959          0.3686     0.3484
 1960          0.3636     0.3417
 1961          0.4250     0.4124
 1962          0.3752     0.3556
 1963          0.4498     0.4384
 1964          0.3537     0.3382
 1965          0.3548     0.3360
 1966          0.4090     0.3930
 1967          0.4215     0.4079
 1968          0.8121     0.7881
 1969          0.7260     0.6921
 1970          1.1360     0.9857
 1971          0.4296     0.3936
 1972          0.5838     0.5352
```

Basin 2 Predeveloped

Subbasin Name: Basin 2

Flows To : Surface | Interflow | Groundwater

Area in Basin ☑ Show Only Selected

Available Pervious	Acres	Available Impervious	Acres
☑ C, Forest, Flat	.68	☑ ROADS/FLAT	.82
☑ C, Lawn, Flat	0		

Basin 2 Mitigated

Subbasin Name: Basin 2 ☐ Designate as Bypass for POC:

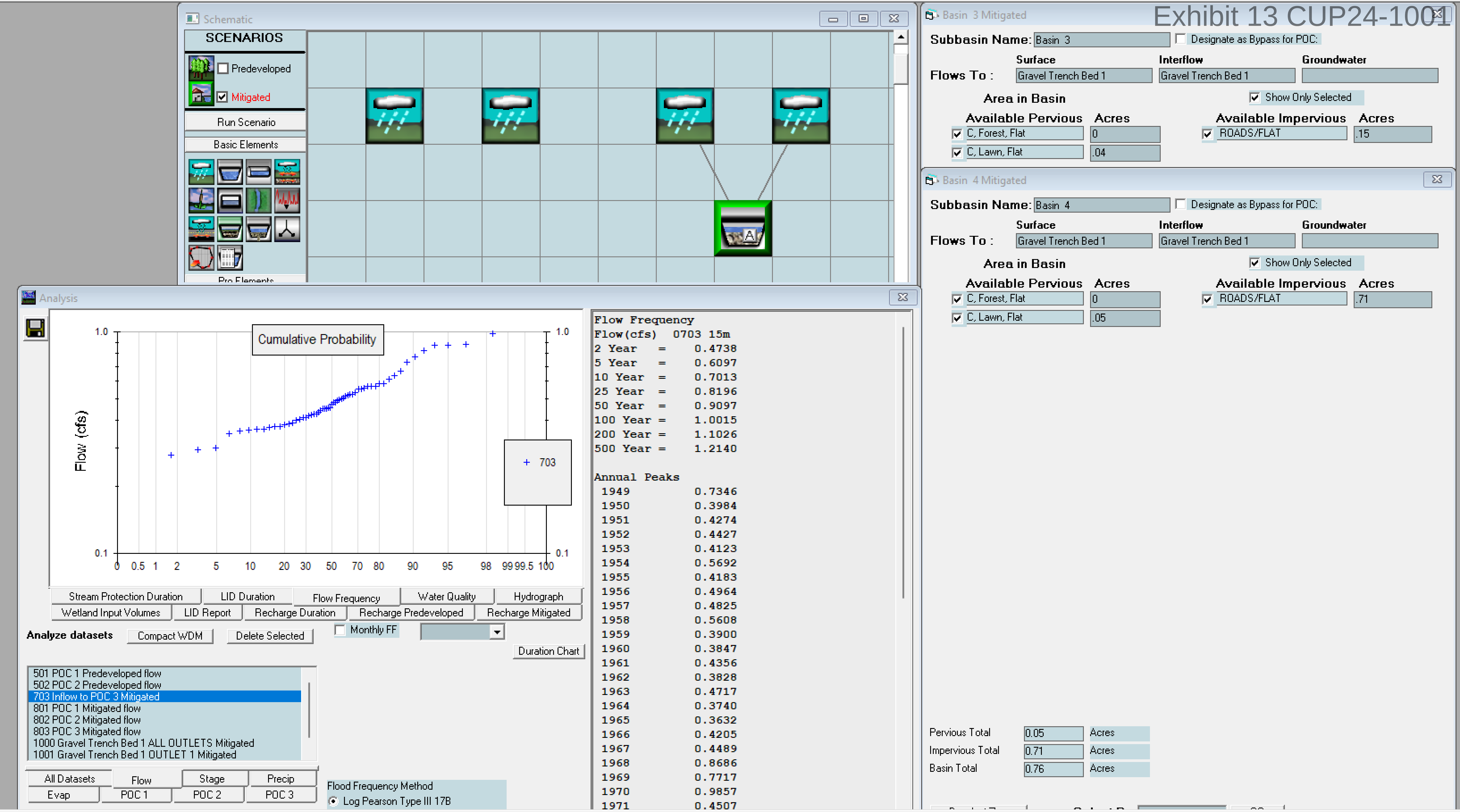
Flows To : Surface | Interflow | Groundwater

Area in Basin ☑ Show Only Selected

Available Pervious	Acres	Available Impervious	Acres
☑ C, Forest, Flat	0	☑ ROADS/FLAT	.75
☑ C, Lawn, Flat	.24		

Pervious Total	0.24	Acres
Impervious Total	0.75	Acres
Basin Total	0.99	Acres

Exhibit 13 CUP24-1001



☐ Predeveloped

☑ Mitigated

Analyze datasets

☐ Monthly FF

- 501 POC 1 Predeveloped flow
- 502 POC 2 Predeveloped flow
- 703 Inflow to POC 3 Mitigated
- 801 POC 1 Mitigated flow
- 802 POC 2 Mitigated flow
- 803 POC 3 Mitigated flow
- 1000 Gravel Trench Bed 1 ALL OUTLETS Mitigated
- 1001 Gravel Trench Bed 1 OUTLET 1 Mitigated

Flood Frequency Method

● Log Pearson Type III 17B

```
Flow Frequency
Flow(cfs)  0703 15m
2 Year   =    0.4738
5 Year   =    0.6097
10 Year  =    0.7013
25 Year  =    0.8196
50 Year  =    0.9097
100 Year =    1.0015
200 Year =    1.1026
500 Year =    1.2140

Annual Peaks
 1949         0.7346
 1950         0.3984
 1951         0.4274
 1952         0.4427
 1953         0.4123
 1954         0.5692
 1955         0.4183
 1956         0.4964
 1957         0.4825
 1958         0.5608
 1959         0.3900
 1960         0.3847
 1961         0.4356
 1962         0.3828
 1963         0.4717
 1964         0.3740
 1965         0.3632
 1966         0.4205
 1967         0.4489
 1968         0.8686
 1969         0.7717
 1970         0.9857
 1971         0.4507
```

Basin 3 Mitigated

Subbasin Name: Basin 3 ☐ Designate as Bypass for POC:

	Surface	Interflow	Groundwater
Flows To :	Gravel Trench Bed 1	Gravel Trench Bed 1	

Area in Basin ☑ Show Only Selected

Available Pervious	Acres	Available Impervious	Acres
☑ C, Forest, Flat	0	☑ ROADS/FLAT	.15
☑ C, Lawn, Flat	.04		

Basin 4 Mitigated

Subbasin Name: Basin 4 ☐ Designate as Bypass for POC:

	Surface	Interflow	Groundwater
Flows To :	Gravel Trench Bed 1	Gravel Trench Bed 1	

Area in Basin ☑ Show Only Selected

Available Pervious	Acres	Available Impervious	Acres
☑ C, Forest, Flat	0	☑ ROADS/FLAT	.71
☑ C, Lawn, Flat	.05		

Pervious Total	0.05	Acres
Impervious Total	0.71	Acres
Basin Total	0.76	Acres

Exhibit 13 CUP24-1001

WWHM2012

PROJECT REPORT

Exhibit 13 CUP24-1001

General Model Information

WWHM2012 Project Name: 18551 - Covered Tennis Center

Site Name:

Site Address:

City: camas

Report Date: 9/26/2024

Gage: Lacamas

Data Start: 1948/10/01

Data End: 2008/09/30

Timestep: 15 Minute

Precip Scale: 1.300

Version Date: 2023/01/27

Version: 4.2.19

POC Thresholds

Exhibit 13 CUP24-1001

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.63
Pervious Total	0.63
Impervious Land Use	acre
ROADS FLAT	0.64
Impervious Total	0.64
Basin Total	1.27

Exhibit 13 CUP24-1001

Basin 2

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.68
Pervious Total	0.68
Impervious Land Use	acre
ROADS FLAT	0.82
Impervious Total	0.82
Basin Total	1.5

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.27
Pervious Total	0.27
Impervious Land Use	acre
ROADS FLAT	0.56
Impervious Total	0.56
Basin Total	0.83

Exhibit 13 CUP24-1001

Basin 2

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.24
Pervious Total	0.24
Impervious Land Use	acre
ROADS FLAT	0.75
Impervious Total	0.75
Basin Total	0.99

Basin 3

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.04
Pervious Total	0.04
Impervious Land Use	acre
ROADS FLAT	0.15
Impervious Total	0.15
Basin Total	0.19

Basin 4

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.05
Pervious Total	0.05
Impervious Land Use	acre
ROADS FLAT	0.71
Impervious Total	0.71
Basin Total	0.76

Exhibit 13 CUP24-1001

Routing Elements

Predeveloped Routing

Exhibit 13 CUP24-1001

Mitigated Routing

Infiltration Trench 1

Bottom Length:	94.00 ft.
Bottom Width:	16.00 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	3
Pour Space of material for first layer:	0.33
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	30
Infiltration safety factor:	0.5
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	178.468
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	178.468
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0

Discharge Structure

Riser Height:	5 ft.
Riser Diameter:	12 in.

Element Flows To:

Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.034	0.000	0.000	0.000
0.0333	0.034	0.000	0.000	0.522
0.0667	0.034	0.000	0.000	0.522
0.1000	0.034	0.001	0.000	0.522
0.1333	0.034	0.001	0.000	0.522
0.1667	0.034	0.001	0.000	0.522
0.2000	0.034	0.002	0.000	0.522
0.2333	0.034	0.002	0.000	0.522
0.2667	0.034	0.003	0.000	0.522
0.3000	0.034	0.003	0.000	0.522
0.3333	0.034	0.003	0.000	0.522
0.3667	0.034	0.004	0.000	0.522
0.4000	0.034	0.004	0.000	0.522
0.4333	0.034	0.004	0.000	0.522
0.4667	0.034	0.005	0.000	0.522
0.5000	0.034	0.005	0.000	0.522
0.5333	0.034	0.006	0.000	0.522
0.5667	0.034	0.006	0.000	0.522
0.6000	0.034	0.006	0.000	0.522
0.6333	0.034	0.007	0.000	0.522
0.6667	0.034	0.007	0.000	0.522
0.7000	0.034	0.008	0.000	0.522
0.7333	0.034	0.008	0.000	0.522

0.7667	0.034	0.008	0.000	0.522
0.8000	0.034	0.009	0.000	0.522
0.8333	0.034	0.009	0.000	0.522
0.8667	0.034	0.009	0.000	0.522
0.9000	0.034	0.010	0.000	0.522
0.9333	0.034	0.010	0.000	0.522
0.9667	0.034	0.011	0.000	0.522
1.0000	0.034	0.011	0.000	0.522
1.0333	0.034	0.011	0.000	0.522
1.0667	0.034	0.012	0.000	0.522
1.1000	0.034	0.012	0.000	0.522
1.1333	0.034	0.012	0.000	0.522
1.1667	0.034	0.013	0.000	0.522
1.2000	0.034	0.013	0.000	0.522
1.2333	0.034	0.014	0.000	0.522
1.2667	0.034	0.014	0.000	0.522
1.3000	0.034	0.014	0.000	0.522
1.3333	0.034	0.015	0.000	0.522
1.3667	0.034	0.015	0.000	0.522
1.4000	0.034	0.016	0.000	0.522
1.4333	0.034	0.016	0.000	0.522
1.4667	0.034	0.016	0.000	0.522
1.5000	0.034	0.017	0.000	0.522
1.5333	0.034	0.017	0.000	0.522
1.5667	0.034	0.017	0.000	0.522
1.6000	0.034	0.018	0.000	0.522
1.6333	0.034	0.018	0.000	0.522
1.6667	0.034	0.019	0.000	0.522
1.7000	0.034	0.019	0.000	0.522
1.7333	0.034	0.019	0.000	0.522
1.7667	0.034	0.020	0.000	0.522
1.8000	0.034	0.020	0.000	0.522
1.8333	0.034	0.020	0.000	0.522
1.8667	0.034	0.021	0.000	0.522
1.9000	0.034	0.021	0.000	0.522
1.9333	0.034	0.022	0.000	0.522
1.9667	0.034	0.022	0.000	0.522
2.0000	0.034	0.022	0.000	0.522
2.0333	0.034	0.023	0.000	0.522
2.0667	0.034	0.023	0.000	0.522
2.1000	0.034	0.023	0.000	0.522
2.1333	0.034	0.024	0.000	0.522
2.1667	0.034	0.024	0.000	0.522
2.2000	0.034	0.025	0.000	0.522
2.2333	0.034	0.025	0.000	0.522
2.2667	0.034	0.025	0.000	0.522
2.3000	0.034	0.026	0.000	0.522
2.3333	0.034	0.026	0.000	0.522
2.3667	0.034	0.027	0.000	0.522
2.4000	0.034	0.027	0.000	0.522
2.4333	0.034	0.027	0.000	0.522
2.4667	0.034	0.028	0.000	0.522
2.5000	0.034	0.028	0.000	0.522
2.5333	0.034	0.028	0.000	0.522
2.5667	0.034	0.029	0.000	0.522
2.6000	0.034	0.029	0.000	0.522
2.6333	0.034	0.030	0.000	0.522
2.6667	0.034	0.030	0.000	0.522

2.7000	0.034	0.030	0.000	0.522
2.7333	0.034	0.031	0.000	0.522
2.7667	0.034	0.031	0.000	0.522
2.8000	0.034	0.031	0.000	0.522
2.8333	0.034	0.032	0.000	0.522
2.8667	0.034	0.032	0.000	0.522
2.9000	0.034	0.033	0.000	0.522
2.9333	0.034	0.033	0.000	0.522
2.9667	0.034	0.033	0.000	0.522
3.0000	0.034	0.034	0.000	0.522

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Analysis Results

POC 1

POC #1 was not reported because POC must exist in both scenarios and both scenarios must have been run.

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POC 2

POC #2 was not reported because POC must exist in both scenarios and both scenarios must have been run.

POC 3

POC #3 was not reported because POC must exist in both scenarios and both scenarios must have been run.

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

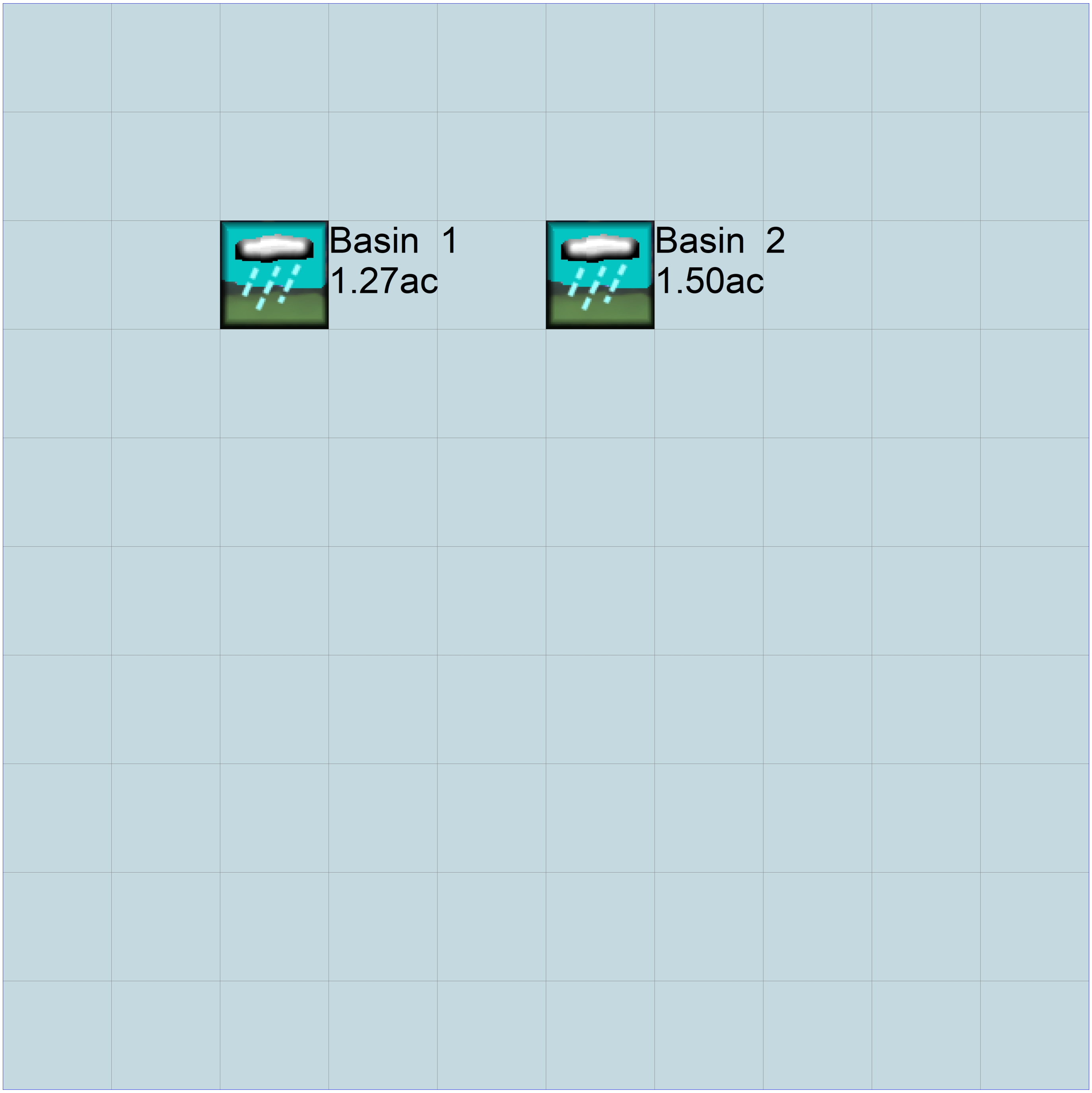
IMPLND Changes

No IMPLND changes have been made.

Exhibit 13 CUP24-1001

Appendix

Predeveloped Schematic



Mitigated Schematic

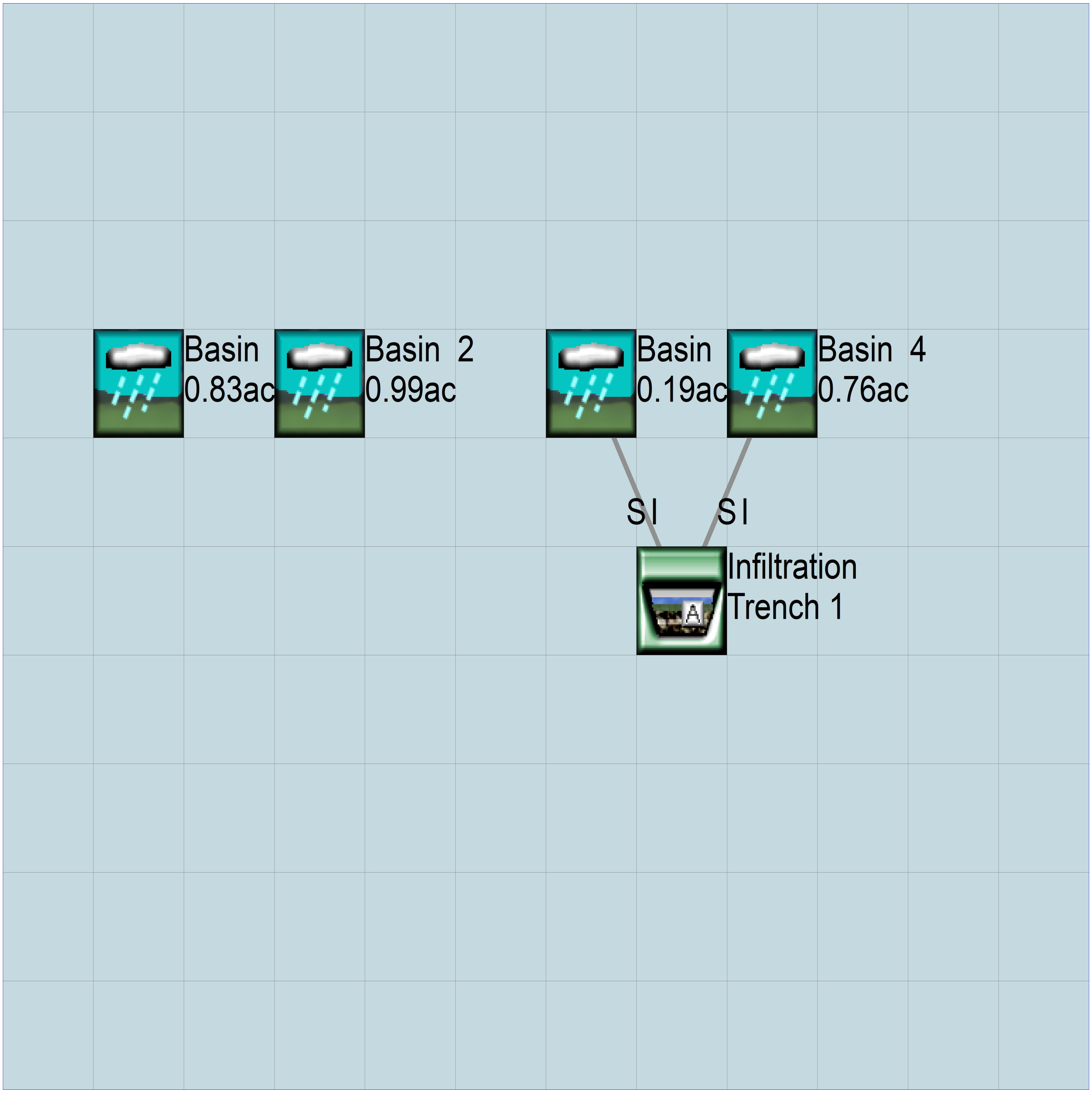


Exhibit 13 CUP24-1001

Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2008 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------->***
<-ID->                                                               ***
WDM        26   18551 - Covered Tennis Center.wdm
MESSU      25   Pre18551 - Covered Tennis Center.MES
           27   Pre18551 - Covered Tennis Center.L61
           28   Pre18551 - Covered Tennis Center.L62
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      10
      IMPLND       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                            User  t-series Engl Metr ***
                                           in  out           ***
   10     C, Forest, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   10         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   10         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   10         0    0    0    0    0    0    0    0    0    0    0
```

Exhibit 13 CUP24-1001

```
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   10              0       4.5      0.08       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   10              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   10            0.2       0.5      0.35         6       0.5       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   10              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out            ***
    1      ROADS/FLAT             1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    4    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
```

```
    1              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                          in  out                            ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *        *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.3            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.3            IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.8            PERLND   1 999 EXTNL  PETINP
```

```
WDM      1 EVAP     ENGL    0.8            IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***

END MASS-LINK

END RUN
```

Exhibit 13 CUP24-1001

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2008 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   18551 - Covered Tennis Center.wdm
MESSU      25   Mit18551 - Covered Tennis Center.MES
           27   Mit18551 - Covered Tennis Center.L61
           28   Mit18551 - Covered Tennis Center.L62
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      16
      IMPLND       1
      RCHRES       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                           in  out           ***
   16      C, Lawn, Flat           1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   16         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   16         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
```

Exhibit 13 CUP24-1001

```
    16         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   16           0       4.5      0.03       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   16           0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   16            0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   16           0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out         ***
    1      ROADS/FLAT             1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    4    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1           0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
```

Exhibit 13 CUP24-1001

```
    # -  # ***  RETS      SURS
    1              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  3***
PERLND  16                        0.04     RCHRES   1      2
PERLND  16                        0.04     RCHRES   1      3
IMPLND   1                        0.15     RCHRES   1      5
Basin  4***
PERLND  16                        0.05     RCHRES   1      2
PERLND  16                        0.05     RCHRES   1      3
IMPLND   1                        0.71     RCHRES   1      5

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<-------------------><---> User T-series  Engl Metr LKFG            ***
                                          in  out                            ***
    1     Gravel Trench Be-012    2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                     ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
    1        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1              1      0.02       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                        ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
```

Exhibit 13 CUP24-1001

```
    1           0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   92    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)    (cfs)      (cfs)  (ft/sec)    (Minutes)***
  0.000000  0.034527  0.000000  0.000000  0.000000
  0.033333  0.034527  0.000380  0.000000  0.522222
  0.066667  0.034527  0.000760  0.000000  0.522222
  0.100000  0.034527  0.001139  0.000000  0.522222
  0.133333  0.034527  0.001519  0.000000  0.522222
  0.166667  0.034527  0.001899  0.000000  0.522222
  0.200000  0.034527  0.002279  0.000000  0.522222
  0.233333  0.034527  0.002659  0.000000  0.522222
  0.266667  0.034527  0.003038  0.000000  0.522222
  0.300000  0.034527  0.003418  0.000000  0.522222
  0.333333  0.034527  0.003798  0.000000  0.522222
  0.366667  0.034527  0.004178  0.000000  0.522222
  0.400000  0.034527  0.004558  0.000000  0.522222
  0.433333  0.034527  0.004937  0.000000  0.522222
  0.466667  0.034527  0.005317  0.000000  0.522222
  0.500000  0.034527  0.005697  0.000000  0.522222
  0.533333  0.034527  0.006077  0.000000  0.522222
  0.566667  0.034527  0.006457  0.000000  0.522222
  0.600000  0.034527  0.006836  0.000000  0.522222
  0.633333  0.034527  0.007216  0.000000  0.522222
  0.666667  0.034527  0.007596  0.000000  0.522222
  0.700000  0.034527  0.007976  0.000000  0.522222
  0.733333  0.034527  0.008356  0.000000  0.522222
  0.766667  0.034527  0.008735  0.000000  0.522222
  0.800000  0.034527  0.009115  0.000000  0.522222
  0.833333  0.034527  0.009495  0.000000  0.522222
  0.866667  0.034527  0.009875  0.000000  0.522222
  0.900000  0.034527  0.010255  0.000000  0.522222
  0.933333  0.034527  0.010634  0.000000  0.522222
  0.966667  0.034527  0.011014  0.000000  0.522222
  1.000000  0.034527  0.011394  0.000000  0.522222
  1.033333  0.034527  0.011774  0.000000  0.522222
  1.066667  0.034527  0.012154  0.000000  0.522222
  1.100000  0.034527  0.012533  0.000000  0.522222
  1.133333  0.034527  0.012913  0.000000  0.522222
  1.166667  0.034527  0.013293  0.000000  0.522222
  1.200000  0.034527  0.013673  0.000000  0.522222
  1.233333  0.034527  0.014053  0.000000  0.522222
  1.266667  0.034527  0.014432  0.000000  0.522222
  1.300000  0.034527  0.014812  0.000000  0.522222
  1.333333  0.034527  0.015192  0.000000  0.522222
  1.366667  0.034527  0.015572  0.000000  0.522222
  1.400000  0.034527  0.015952  0.000000  0.522222
  1.433333  0.034527  0.016331  0.000000  0.522222
  1.466667  0.034527  0.016711  0.000000  0.522222
  1.500000  0.034527  0.017091  0.000000  0.522222
  1.533333  0.034527  0.017471  0.000000  0.522222
  1.566667  0.034527  0.017851  0.000000  0.522222
  1.600000  0.034527  0.018230  0.000000  0.522222
  1.633333  0.034527  0.018610  0.000000  0.522222
  1.666667  0.034527  0.018990  0.000000  0.522222
  1.700000  0.034527  0.019370  0.000000  0.522222
  1.733333  0.034527  0.019749  0.000000  0.522222
  1.766667  0.034527  0.020129  0.000000  0.522222
  1.800000  0.034527  0.020509  0.000000  0.522222
  1.833333  0.034527  0.020889  0.000000  0.522222
  1.866667  0.034527  0.021269  0.000000  0.522222
  1.900000  0.034527  0.021648  0.000000  0.522222
  1.933333  0.034527  0.022028  0.000000  0.522222
```

Exhibit 13 CUP24-1001

```
  1.966667  0.034527  0.022408  0.000000  0.522222
  2.000000  0.034527  0.022788  0.000000  0.522222
  2.033333  0.034527  0.023168  0.000000  0.522222
  2.066667  0.034527  0.023547  0.000000  0.522222
  2.100000  0.034527  0.023927  0.000000  0.522222
  2.133333  0.034527  0.024307  0.000000  0.522222
  2.166667  0.034527  0.024687  0.000000  0.522222
  2.200000  0.034527  0.025067  0.000000  0.522222
  2.233333  0.034527  0.025446  0.000000  0.522222
  2.266667  0.034527  0.025826  0.000000  0.522222
  2.300000  0.034527  0.026206  0.000000  0.522222
  2.333333  0.034527  0.026586  0.000000  0.522222
  2.366667  0.034527  0.026966  0.000000  0.522222
  2.400000  0.034527  0.027345  0.000000  0.522222
  2.433333  0.034527  0.027725  0.000000  0.522222
  2.466667  0.034527  0.028105  0.000000  0.522222
  2.500000  0.034527  0.028485  0.000000  0.522222
  2.533333  0.034527  0.028865  0.000000  0.522222
  2.566667  0.034527  0.029244  0.000000  0.522222
  2.600000  0.034527  0.029624  0.000000  0.522222
  2.633333  0.034527  0.030004  0.000000  0.522222
  2.666667  0.034527  0.030384  0.000000  0.522222
  2.700000  0.034527  0.030764  0.000000  0.522222
  2.733333  0.034527  0.031143  0.000000  0.522222
  2.766667  0.034527  0.031523  0.000000  0.522222
  2.800000  0.034527  0.031903  0.000000  0.522222
  2.833333  0.034527  0.032283  0.000000  0.522222
  2.866667  0.034527  0.032663  0.000000  0.522222
  2.900000  0.034527  0.033042  0.000000  0.522222
  2.933333  0.034527  0.033422  0.000000  0.522222
  2.966667  0.034527  0.033802  0.000000  0.522222
  3.000000  0.034527  0.034182  0.000000  0.522222
  3.033333  0.034527  0.035333  0.000000  0.522222
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.3            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.3            IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.8            PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.8            IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1001 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      2 1        1      WDM   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1003 STAG     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK       3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK       5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5
```

Exhibit 13 CUP24-1001

```
END MASS-LINK

END RUN
```

Exhibit 13 CUP24-1001

Predeveloped HSPF Message File

Exhibit 13 CUP24-1001

Mitigated HSPF Message File

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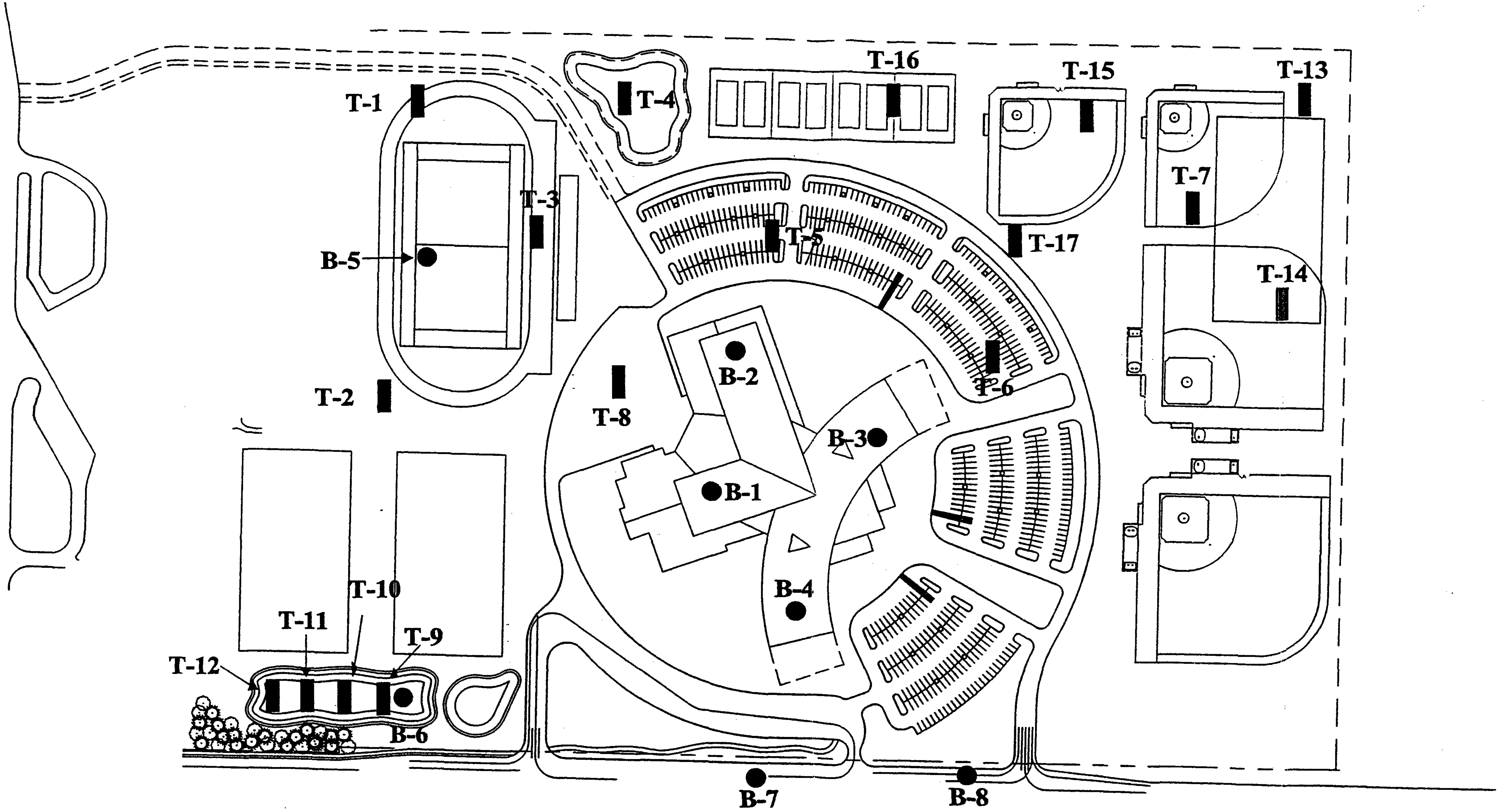
Local (360)943-0304

www.clearcreeksolutions.com

Appendix D-1

Geotechnical Engineering Evaluation, by Geocon Northwest

Exhibit 13 CUP24-1001



LEGEND

B-8 ●.....APPROX. LOCATION OF EXPLORATORY BORING

T-17 ▬.....APPROX. LOCATION OF EXPLORATORY TRENCH

SITE PLAN

CAMAS HIGH SCHOOL
CAMAS, WASHINGTON

GEOCON
NORTHWEST
GEOTECHNICAL CONSULTANTS
8270 SW NIMBUS AVENUE - BEAVERTON, OREGON 97008
PHONE 503 626-9889 - FAX 503 626-8611

SCALE NO SCALE
DATE 07 - 27 - 2000
PROJECT NO. P1007 - 05 - 02
SHEET OF
FIGURE 2

X:\P1007WS.DWG \ RSS

5. INFILTRATION TESTING

5.1. Methodology

The infiltration tests were conducted as falling head permeability tests in general accordance with the King County Surface Water Design Manual. The tests were conducted by pushing a six-inch diameter infiltrometer standpipe into the soil at the desired test depth. The soil was prepared for infiltration testing under saturated conditions by filling the standpipe with water and thoroughly soaking the test zone for approximately one-half hour. Beginning with a three-foot head of water in the standpipe, the elapsed time required for the head to drop six inches is recorded. In soils with low permeability, the hydraulic head is allowed to drop for one hour and the measured drop in head is recorded.

5.2. Infiltration Test Results

Field infiltration tests were conducted in seven of the exploratory trenches, at varying depths, to evaluate soil infiltration capacity for use in design. The field infiltration rates provided in Table 1 are field measured infiltration rates in native soil and do not include a factor of safety.

Table 1: Infiltration Test Results

Exploratory Trench No.	Test Depth (ft)	Infiltration Rate (in/hr)	Depth to Groundwater (ft)
1	4	7.6	Not Encountered
1	10	250	Not Encountered
2	5	4.5	8
3	6	27	Not Encountered
4	8	14	Not Encountered
5	6	48	Not Encountered
7	7	250	10
8	8	<1	Not Encountered
9	6	<1	Not Encountered
11	5	<1	Not Encountered
13	9	45	Not Encountered
14	7	250	10
15	6.5	90	Not Encountered
16	7	<1	10

Soil types can vary significantly over relatively short distances. The infiltration rates noted above are representative of one discrete location and depth. Moderate to high infiltration rates were measured on the northeast and northwest portions of the site. In general, the soils within the southwest portion of the site have low measured infiltration rates. Installation of infiltration systems within the layer in which the field rate was measured is considered critical to proper performance of the systems. Because of near-surface fines content in the native soil, and the potential for eventual siltation of subsurface infiltration facilities, a conservative design safety factor should be applied to the field rate. If filter fabric is used to protect drain rock, the permeability of the geotextile should be considered in the design. Care should be taken during construction to avoid unnecessary compaction or contamination of native soils in the proposed infiltration zone. Construction disturbance, siltation and compaction with construction equipment can dramatically reduce soil infiltration capacity. Regular maintenance of the infiltration system is critical for proper performance.

A member of Geocon Northwest's geotechnical engineering staff should be retained to observe installation of the infiltration system to verify that subsurface conditions are consistent with those encountered during this investigation.

6. LABORATORY TESTING

Laboratory testing was performed on selected soil samples to evaluate moisture content, grain size distribution, plasticity index, expansion index, compaction characteristics, and California Bearing Ratio. Visual soil classification was performed both in the field and laboratory, in general accordance with the Unified Soil Classified System. Moisture content determinations (ASTM D2216) were performed on soil samples to assist in their evaluation. Compaction characteristics and the California Bearing Ratio for near surface samples were evaluated in substantial accordance with ASTM D1557 and ASTM D1883, respectively. Grain size analyses were performed on selected samples using procedures ASTM D421 and ASTM D422. The plasticity index was determined in general accordance with ASTM D4318. The expansion index was determined using procedure ASTM D4829. Moisture contents are indicated on the exploration logs, which are located in Appendix A of this report. The remaining laboratory test results for this project are included in Appendix B.

There appears to be little correlation between laboratory grain size analyses and the field measured infiltration rates. This is likely due to the combination of the presence of cobbles and boulders skewing the laboratory test results and the in situ weathering of the material.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1. General

7.1.1. It is our opinion that the proposed project is geotechnically feasible, provided the recommendations within this report are followed.

Exhibit 13 CUP24-1001

APPENDIX A

FIELD INVESTIGATION

The field investigation was performed on July 6,7,17, and 18, 2000, and consisted of a site reconnaissance, the advancement of six borings, the excavation of seventeen exploratory trenches, and fourteen field-infiltration tests. The approximate locations of the exploratory excavations are shown in Figure 2.

Borings were advanced to approximately 8 to 44 feet below the ground surface. In general, the borings were terminated due to refusal. Two additional shallow borings were advanced within SE 15th Street to evaluate the existing pavement section. The exploratory trenches were excavated to depths varying from 6 to 12 feet below the ground surface using a John Deere 550 rubber tired backhoe. Samples were obtained at selected depths during the field investigation and returned to the laboratory for additional testing. Logs of the exploratory borings and trenches are provided in the following pages.

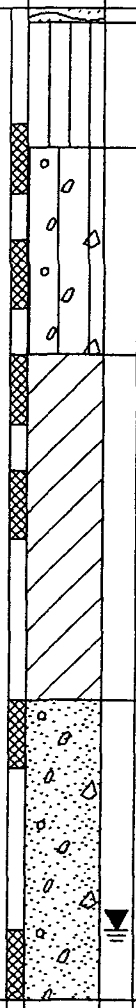
Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

BORING B 1

ELEV. (MSL.) ______ DATE COMPLETED 7/7/00

EQUIPMENT B-57 HOLLOW STEM AUG



DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			APPROX. 4 INCHES TOPSOIL			
		ML	Medium stiff, moist, reddish-brown, SILT			
2						
	B1-1			21		21.6
4			Medium dense, moist, reddish-brown, Silty GRAVEL			
	B1-2	GM		15		36.1
6						
8	B1-3	CL	Stiff, moist, mottled, CLAY, occasional gravels	10		31.8
10	B1-4			18		25.6
12						
14						
	B1-5	GM		>50		30.5
16			Very dense, wet, brown, Silty SAND and gravel			
18						
20						
	B1-6			48		23.8
			Very dense, saturated, brown to gray SAND and gravel			

BORING TERMINATED AT 21.5 FEET
Groundwater encountered at 20 feet

Figure A-1, Log of Boring B 1

NCHS

SAMPLE SYMBOLS
☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
▩ ... DISTURBED OR BAG SAMPLE
◪ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

BORING B 2

ELEV. (MSL.) ____________ DATE COMPLETED 7/7/00

EQUIPMENT B-57 HOLLOW STEM AUG

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 4 INCHES TOPSOIL			
					Medium dense, moist, brown, Silty SAND and GRAVEL			
2								
	B2-1			GM		16		26.2
4								
	B2-2					10		40.8
6								
					-Becomes loose			
8	B2-3					7		38.0
10								
	B2-4					21		38.2
					Stiff, moist, mottled, Clayey SILT, some gravel			
12								
				CL				
14								
	B2-5					50/5.5"		31.5
16								

BORING TERMINATED AT 16.5 FEET DUE TO REFUSAL
Groundwater was not encountered

Figure A-2, Log of Boring B 2

NCHS

SAMPLE SYMBOLS
☐ ... SAMPLING UNSUCCESSFUL
▨ ... DISTURBED OR BAG SAMPLE
◧ ... STANDARD PENETRATION TEST
◩ ... CHUNK SAMPLE
■ ... DRIVE SAMPLE (UNDISTURBED)
▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

BORING B 3

ELEV. (MSL.) ____ DATE COMPLETED 7/7/00

EQUIPMENT B-57 HOLLOW STEM AUG

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 4 INCHES TOPSOIL			
					Stiff, moist, mottled, Silty CLAY			
2								
	B3-1			CL		13		24.6
4								
	B3-2					14		36.3
6								
8	B3-3				-Occasional gravels	27		28.3
10	B3-4				Medium dense, moist, mottled, Silty SAND and gravel, some clay	33		30.0
12								
14								
	B3-5			GM	-Cobbles	>50		21.5
16								
18								
20	B3-6					50/35"		16.9

BORING TERMINATED AT 21.5 FEET DUE TO REFUSAL

Groundwater was not encountered

Figure A-3, Log of Boring B 3

NCHS

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	☒ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

BORING B 4

ELEV. (MSL.) ______ DATE COMPLETED 7/7/00

EQUIPMENT B-57 HOLLOW STEM AUG

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 4 INCHES TOPSOIL			
					Stiff, damp, yellowish-brown SILT, some clay			
2								
	B4-1	▨		ML/CL		20		41.4
4								
					Stiff, damp, mottled, CLAY, some silt			
	B4-2	▨				12		36.6
6								
8	B4-3	▨			Medium dense, moist, brown, Silty, medium to coarse-grained SAND, some clay	12		28.6
10	B4-4	▨		SM/GM		47		27.2
					-Gravels below 10.5 feet			
12								
14								
	B4-5	▨				41		21.7
16					-Becomes wet to saturated, decreased fines, increased gravel and cobbles			
18								
20	B4-6	▨	▼			>50		18.7

BORING TERMINATED AT 21 FEET DUE TO REFUSAL
Groundwater encountered at 20 feet

Figure A-4, Log of Boring B 4

NCHS

SAMPLE SYMBOLS
☐ ... SAMPLING UNSUCCESSFUL
▨ ... DISTURBED OR BAG SAMPLE
◧ ... STANDARD PENETRATION TEST
◩ ... CHUNK SAMPLE
■ ... DRIVE SAMPLE (UNDISTURBED)
▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

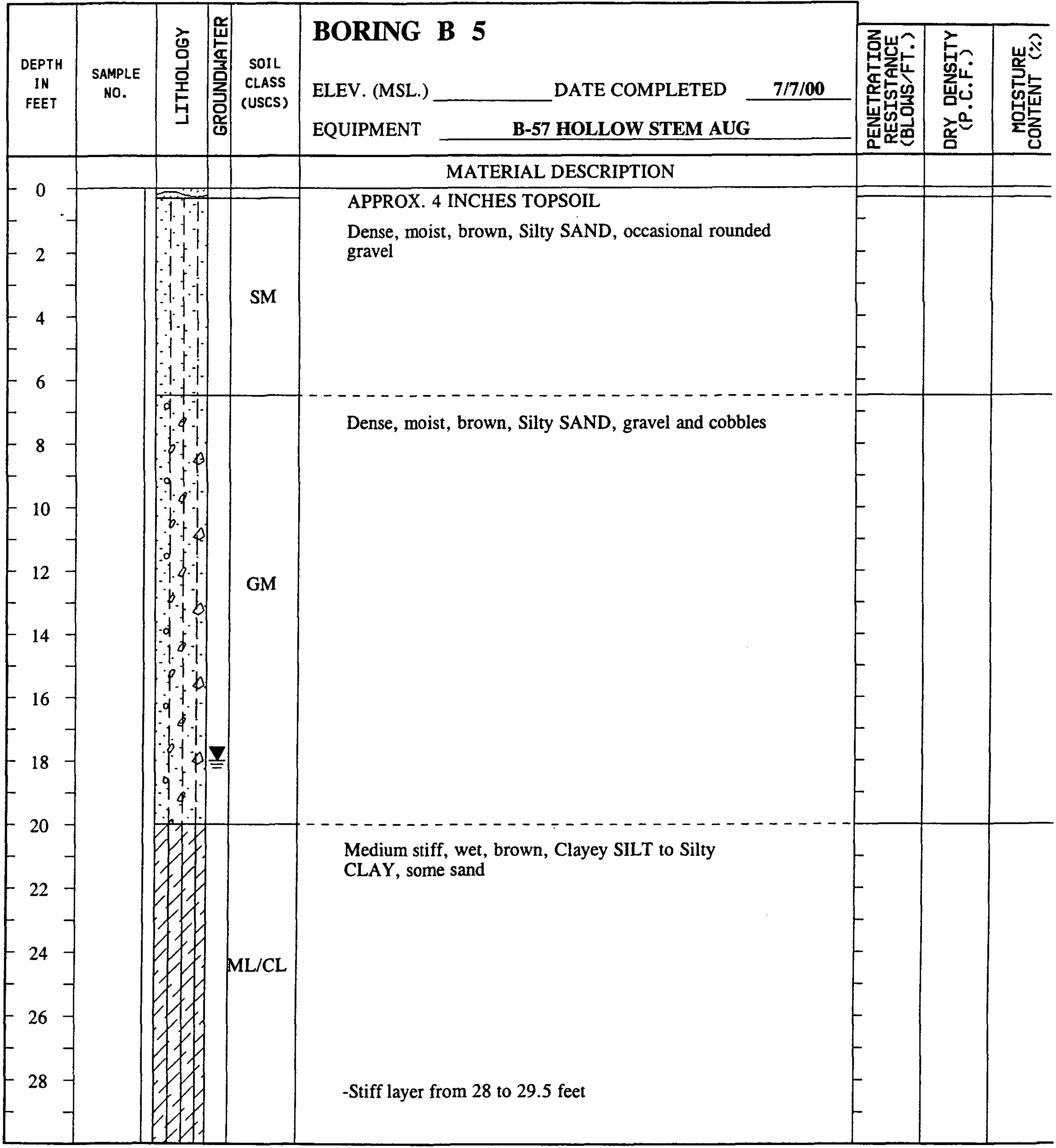
Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

BORING B 5

ELEV. (MSL.) ____________ DATE COMPLETED 7/7/00

EQUIPMENT B-57 HOLLOW STEM AUG



MATERIAL DESCRIPTION

APPROX. 4 INCHES TOPSOIL

Dense, moist, brown, Silty SAND, occasional rounded gravel

Dense, moist, brown, Silty SAND, gravel and cobbles

Medium stiff, wet, brown, Clayey SILT to Silty CLAY, some sand

-Stiff layer from 28 to 29.5 feet

Figure A-5, Log of Boring B 5

NCHS

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL

◧ ... STANDARD PENETRATION TEST

■ ... DRIVE SAMPLE (UNDISTURBED)

▩ ... DISTURBED OR BAG SAMPLE

◩ ... CHUNK SAMPLE

▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

BORING B 5

ELEV. (MSL.) ____________ DATE COMPLETED 7/7/00

EQUIPMENT B-57 HOLLOW STEM AUG

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30		▨						
32		▨						
34		▨		ML/CL	-Stiff layer from 33 to 34.5 feet			
36		▨						
38		▨						
40		▨						
42		▨			-Becomes hard at 42 feet			
44					BORING TERMINATED AT 44 FEET DUE TO REFUSAL Groundwater encountered at 18 feet			

Figure A-6, Log of Boring B 5

NCHS

SAMPLE SYMBOLS
☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
☒ ... DISTURBED OR BAG SAMPLE
◪ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

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Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

BORING B 6

ELEV. (MSL.) __________ DATE COMPLETED 7/7/00

EQUIPMENT B-57 HOLLOW STEM AUG

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 4 INCHES TOPSOIL Medium stiff, moist, brown, SILT			
2				ML				
4					Medium dense, moist, reddish-brown, Silty GRAVEL and cobbles -Scattered boulders			
6				GM				
8					BORING TERMINATED AT 8 FEET DUE TO REFUSAL Groundwater was not encountered			

Figure A-7, Log of Boring B 6

NCHS

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL

▨ ... DISTURBED OR BAG SAMPLE

◧ ... STANDARD PENETRATION TEST

◩ ... CHUNK SAMPLE

■ ... DRIVE SAMPLE (UNDISTURBED)

▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

BORING B 7

ELEV. (MSL.) ____________ DATE COMPLETED 7/7/00

EQUIPMENT B-57 HOLLOW STEM AUG

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 3 INCHES ASPHALT			
					BASEROCK			
2								
					BORING TERMINATED AT NATIVE SOIL (2')			

Figure A-8, Log of Boring B 7

NCHS

SAMPLE SYMBOLS	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. P1007-05-02

BORING B 8

ELEV. (MSL.) ____________ DATE COMPLETED 7/7/00

EQUIPMENT B-57 HOLLOW STEM AUG

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 2 INCHES ASPHALT			
					BASEROCK			
2								
					BORING TERMINATED AT NATIVE SOIL (2.25')			

Figure A-9, Log of Boring B 8

NCHS

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

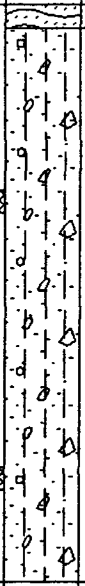
Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 1

ELEV. (MSL.) ____________ DATE COMPLETED 7/6/00

EQUIPMENT **FORD 555 BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 6 INCHES TOPSOIL			
					Dense, moist, light reddish-brown, Silty SAND, sub-rounded GRAVEL and COBBLES			
2								
4	T1-1 ▨							23.5
6				GM				
					-Decreasing fines with depth			
8								
10	T1-2 ▨							25.6
12								

TRENCH TERMINATED AT 12.5 FEET
Infiltration test at 4 feet
Infiltration test at 10 feet
Groundwater was not encountered

Figure A-10, Log of Trench T 1

NCHS

SAMPLE SYMBOLS
☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
▨ ... DISTURBED OR BAG SAMPLE
◩ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

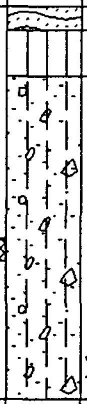
Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 2

ELEV. (MSL.) ____________ DATE COMPLETED 7/6/00

EQUIPMENT FORD 555 BACKHOE



DEPTH IN FEET	SAMPLE NO.	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				APPROX. 6 INCHES TOPSOIL			
			ML	Medium stiff, damp, brown, SILT			
2				Medium dense, moist, light reddish-brown, Silty SAND, occasional sub-rounded gravel and cobbles, some clay			
4							
	T2-1 ☒		SM/GM				
6							
8		▼					

TRENCH TERMINATED AT 8.5 FEET
Infiltration test at 5 feet
Groundwater was encountered at 8 feet

Figure A-11, Log of Trench T 2

NCHS

SAMPLE SYMBOLS
☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
☒ ... DISTURBED OR BAG SAMPLE
◪ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

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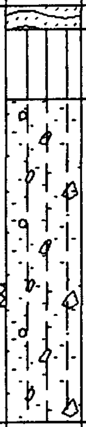
Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 3

ELEV. (MSL.) ____________ DATE COMPLETED 7/6/00

EQUIPMENT FORD 555 BACKHOE



DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 6 INCHES TOPSOIL			
				ML	Medium stiff, damp, brown, SILT			
2					Dense, moist, reddish-brown, Silty SAND, sub-rounded GRAVEL and COBBLES			
4								
6	T3-1 ☒			GM				19.2
8								

TRENCH TERMINATED AT 9 FEET DUE TO CAVING
Infiltration test at 6 feet
Groundwater was not encountered

Figure A-12, Log of Trench T 3

NCHS

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	☒ ... DISTURBED OR BAG SAMPLE	◣ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 4

ELEV. (MSL.) ____________ DATE COMPLETED 7/6/00

EQUIPMENT FORD 555 BACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 4 INCHES TOPSOIL			
				ML	Medium stiff, damp, brown SILT			
2								
4					Dense, moist, light reddish-brown, Silty SAND, some sub-rounded gravel and cobbles, decreasing fines with depth			
6								
8	T4-1	☒		SM/GM				28.4
10								
					TRENCH TERMINATED AT 11 FEET DUE TO CAVING Infiltration test at 8 feet Groundwater was not encountered			

Figure A-13, Log of Trench T 4

NCHS

SAMPLE SYMBOLS	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	☒ ... DISTURBED OR BAG SAMPLE	◩ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

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Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 5

ELEV. (MSL.) ____________ DATE COMPLETED 7/6/00

EQUIPMENT FORD 555 BACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 4 INCHES TOPSOIL			
				ML	Medium stiff, damp, brown SILT			
2					Dense, moist, yellowish-brown, Silty SAND, sub-rounded GRAVEL and COBBLES			
4								
6	T5-1 ⊠							18.9
	T5-2 ⊠							26.5
8				CL	Stiff, moist, brown and gray, Silty CLAY			

TRENCH TERMINATED AT 9 FEET
Infiltration test at 6 feet
Groundwater was not encountered

Figure A-14, Log of Trench T 5

NCHS

SAMPLE SYMBOLS
☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
⊠ ... DISTURBED OR BAG SAMPLE
◪ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

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Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 6

ELEV. (MSL.) ____________ DATE COMPLETED 7/6/00

EQUIPMENT FORD 555 BACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 6 INCHES TOPSOIL			
2					Medium dense to dense, moist to wet, light yellowish-brown, Clayey SILT, SAND and sub-rounded GRAVEL, occasional cobbles			
	T6-1	⊠		GM				32.9
4								
6								
8								
10				SM	Dense, moist, reddish-brown, Silty SAND and sub-rounded gravel			

TRENCH TERMINATED AT 11 FEET
Groundwater was not encountered

Figure A-15, Log of Trench T 6

NCHS

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◩ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

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Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 7

ELEV. (MSL.) ______ DATE COMPLETED 7/7/00

EQUIPMENT FORD 555 BACKHOE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 6 INCHES TOPSOIL			
					Moist, reddish-brown, Silty GRAVEL and COBBLES, some clay			
2								
4								
				GM	-Decreasing fines with depth			
6								
					-Loose gravels and cobbles			
8								
10			▼					
					TRENCH TERMINATED AT 10 FEET Infiltration test at 7 feet Groundwater encountered at 10 feet			

Figure A-16, Log of Trench T 7

NCHS

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
▨ ... DISTURBED OR BAG SAMPLE
◩ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

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Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 8

ELEV. (MSL.) ____________ DATE COMPLETED 7/7/00

EQUIPMENT **FORD 555 BACKHOE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 6 INCHES TOPSOIL			
					Moist, reddish-brown, Clayey GRAVEL, some medium to coarse-grained sand			
2	⊠ T8-1							18.6
4								
6				GM				
					-Decreasing gravel and cobbles with depth			
8	⊠ T8-2							
10								
12					TRENCH TERMINATED AT 12 FEET DUE TO CAVING Infiltration test at 8 feet Groundwater was not encountered			

Figure A-17, Log of Trench T 8

NCHS

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
⊠ ... DISTURBED OR BAG SAMPLE
◩ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

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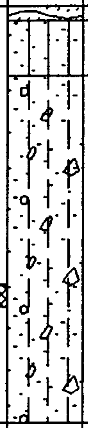
Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 9

ELEV. (MSL.) ____________ DATE COMPLETED 7/17/00

EQUIPMENT FORD 555E

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 4 INCHES TOPSOIL			
				SM	Medium stiff, damp, reddish-brown, Sandy SILT, some clay			
2					Very dense, moist, brown, Silty, coarse SAND, gravel, cobbles and boulders			
4								
6	T9-1 ☒			GM				
8								

TRENCH TERMINATED AT 9 FEET DUE TO REFUSAL
Infiltration test at 6 feet
Groundwater was not encountered

Figure A-18, Log of Trench T 9

NCHS1

SAMPLE SYMBOLS	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	☒ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

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Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 10

ELEV. (MSL.) ________ DATE COMPLETED 7/17/00

EQUIPMENT FORD 555E

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 4 INCHES TOPSOIL			
				ML	Medium stiff, reddish-brown, SILT			
2								
				GM	Dense, moist, Silty, coarse SAND. gravel, cobbles, and boulders -Decreasing fines with depth			
4								
6					-Weathering to clay			
					TRENCH TERMINATED AT 7 FEET Groundwater was not encountered			

Figure A-19, Log of Trench T 10

NCHS1

SAMPLE SYMBOLS	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	☒ ... DISTURBED OR BAG SAMPLE	◩ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

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Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 11

ELEV. (MSL.) ______ DATE COMPLETED 7/17/00

EQUIPMENT **FORD 555E**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2				ML	Dense, moist, reddish-brown, Gravelly SILT with cobbles			
4					Medium dense, moist, subrounded GRAVEL and cobbles, some sand, silt and clay -Scattered boulders, caving observed			
6	T11-1 ⊠			GM				
8					-Weathering to clay			

TRENCH TERMINATED AT 8 FEET
Infiltration test at 5 feet
Groundwater was not encountered

Figure A-20, Log of Trench T 11

NCHS1

SAMPLE SYMBOLS	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◩ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 12

ELEV. (MSL.) ______ DATE COMPLETED 7/17/00

EQUIPMENT FORD 555E

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 4 INCHES TOPSOIL			
0 - 6				ML	Medium stiff, moist, reddish-brown, SILT, scattered boulders			
6 - 10	T12-1 ☒ (8)			GM	Medium dense, Silty SAND, gravel, and cobbles, weathering to clay			
10					TRENCH TERMINATED AT 10 FEET Groundwater was not encountered			

Figure A-21, Log of Trench T 12

NCHS1

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
☒ ... DISTURBED OR BAG SAMPLE
◩ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

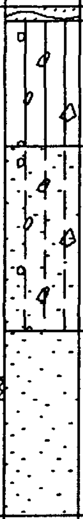
Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 13

ELEV. (MSL.) ____________ DATE COMPLETED 7/17/00

EQUIPMENT FORD 555E



DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 4 INCHES TOPSOIL			
2				ML	Medium dense to dense, moist, reddish-brown, Gravelly SILT with some cobbles			
4 6				GM	Medium dense to dense, moist, brown, Silty, coarse SAND and gravel, occasional cobbles -			
8 10	T13-1 ⊠			SM	Medium dense, moist, brown, coarse SAND, some gravel, occasional cobbles			
					TRENCH TERMINATED AT 11 FEET Infiltration test at 8 feet Groundwater was not encountered			

Figure A-22, Log of Trench T 13

NCHS1

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL ◧ ... STANDARD PENETRATION TEST ■ ... DRIVE SAMPLE (UNDISTURBED)

⊠ ... DISTURBED OR BAG SAMPLE ◪ ... CHUNK SAMPLE ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 14

ELEV. (MSL.) ____________ DATE COMPLETED 7/17/00

EQUIPMENT FORD 555E

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 4 INCHES TOPSOIL			
2				ML	Medium dense, damp to moist, reddish-brown, SILT, scattered cobbles			
4					Medium dense, moist, brown, Silty SAND and gravel, scattered cobbles, occasional boulders			
6								
8	T14-1 ▨			GM				
10			▼					

TRENCH TERMINATED AT 10 FEET

Infiltration test at 7 feet

Groundwater encountered at 10 feet

Figure A-23, Log of Trench T 14

NCHS1

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	▨ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

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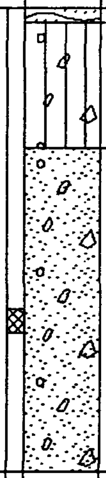
Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 15

ELEV. (MSL.) ______ DATE COMPLETED 7/18/00

EQUIPMENT FORD 555E



DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 4 INCHES TOPSOIL			
2				ML	Medium stiff, damp, reddish-brown, Gravelly SILT, scattered cobbles and boulders			
4				GM	Dense, moist, brown, Silty SAND and gravel, occasional cobbles			
6	T15-1 ☒				-Decreasing fines with depth			
8								
10					-Slight weathering to clay			

TRENCH TERMINATED AT 10 FEET
Infiltration test at 6.5 feet
Groundwater was not encountered

Figure A-24, Log of Trench T 15

NCHS1

SAMPLE SYMBOLS
☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
☒ ... DISTURBED OR BAG SAMPLE
◩ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 16

ELEV. (MSL.) ____________ DATE COMPLETED 7/18/00

EQUIPMENT FORD 555E

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 6 INCHES TOPSOIL			
2 4				ML	Medium stiff, damp to moist, reddish-brown, Gravelly SILT			
6 8	▨ T16-1			SM	Medium dense, moist, reddish-brown, Gravelly, medium-grained SAND			
10			▼		-Slightly weathering to clay			

TRENCH TERMINATED AT 10 FEET
Infiltration test at 7 feet
Groundwater encountered at 10 feet

Figure A-25, Log of Trench T 16

NCHS1

SAMPLE SYMBOLS	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	▨ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

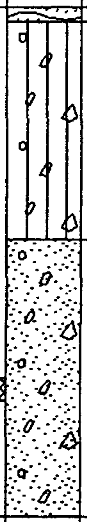
Exhibit 13 CUP24-1001

PROJECT NO. P1007-05-02

TRENCH T 17

ELEV. (MSL.) ____________ DATE COMPLETED 7/18/00

EQUIPMENT FORD 555E



DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					APPROX. 4 INCHES TOPSOIL			
2				ML	Medium stiff, damp to moist, reddish-brown, Gravelly SILT			
4								
6				GM	Very dense, Cobbly SAND and GRAVEL, weathering to clay			
8	T17-1 ☒							
10								

TRENCH TERMINATED AT 11 FEET

Groundwater was not encountered

Figure A-26, Log of Trench T 17

NCHS1

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	▩ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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TABLE B-I
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS
ASTM D 1557-91

Sample No.	Depth (ft)	Material Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
Composite	1.0 – 3.0	SILT	103.2	20.8

TABLE B-2
SUMMARY OF PARTICLE SIZE DISTRIBUTION
ASTM D421 AND D422

Sample No.	Depth (ft)	% Gravel	% Sand	% Silt	% Clay
T1 – S2	7 – 8	16.1	51.1	32.8	
T2 – S3	6 - 7	21.4	37.5	27.6	13.5
T3 – S2	5.5 - 6	0.9	73.5	25.6	
T4 – S1	7 - 8	56.4	33.3	10.3	
T6 – S1	5 - 6	43.3	37.6	19.1	
T10 – S1	2 – 2.5	0	30.7	34	35.3
T11 – S1	7 - 8	0	51.7	26.3	22

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TABLE B-3
SUMMARY OF LABORATORY PLASTICITY INDEX TEST RESULTS
ASTM D 4318

Sample No.	Depth (ft)	Plastic Limit	Liquid Limit	Plasticity Index
T1 – S2	7 - 8	31	59	28
T5 – S2	4 - 5	21	77	56
T6 – S1	5 – 6	26	56	30
T8 – S1	2 – 2.5	21	80	59
T8 – S2	4 - 5	24	70	46
T10 – S2	2 – 2.5	25	45	20

TABLE B-4
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D4829

Sample No.	Depth (ft)	Water Content	Expansion Index
T5 – S2	4 - 5	16.9	93

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GEOCON
NORTHWEST

GEOTECHNICAL CONSULTANTS

April 16, 2001
P1007-05-04

Mr. Doug McCudden
c/o Camas School District
2041 NE Ione Street
Camas, Washington 98607

Subject: NEW CAMAS HIGH SCHOOL
CAMAS, WASHINGTON
CONSULTATION

Dear Mr. McCudden,

Geocon Northwest, Inc. is pleased to provide this letter summarizing the results of the additional geotechnical evaluation requested by the project civil engineers to satisfy Clark County permitting requirements. The fieldwork was completed on April 6, 2001. A total of eleven exploratory trenches were excavated in locations requested by Otak. Table 1, Depth to Groundwater, summarizes the groundwater depth and soil conditions encountered during the field investigation.

An additional pit was excavated in the location of an existing culvert, where the outlet of two drainage tiles was observed. One tile consisted of a 6-inch-diameter clay pipe while the other consisted of a 10-inch-diameter cement mortar pipe. The general direction of the drainage systems was northeasterly from the outlet. A field measurement of the flow rate was obtained at the outlet. During the field investigation, the flow rate was measured at approximately 50 to 60 gallons per minute. This value includes the outflow from both sources.

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Table1: Depth to Groundwater

	TEST PIT LOCATION			STATIC GROUNDWATER (ft)	GROUNDWATER SEEPAGE (ft)	GENERAL SOIL TYPE
	Site Reference	E/W distance (ft)	N/S distance (ft)			
1	NE Corner	300 W	350 S	8	None	Sand, gravel, cobbles
2	NE Corner	200 W	370 S	8	None	Sand, gravel, cobbles
3	NE Corner	100 W	400 S	8	None	Sand, gravel, cobbles
4	NE Corner	150 W	320 S	9	None	Sand, gravel, cobbles
5	NE Corner	250 W	320 S	8.5	None	Sand, gravel, cobbles
6	NW Corner	60 E	70 S	Not Encountered*	None	Silty sand, gravel, cobbles
7	NW Corner	60 E	140 S	Not Encountered*	None	Silty sand, gravel, cobbles
8	East Driveway	350 E	50 N	Not Encountered*	3, 8, and 9	Gray clay
9	East Driveway	600 E	50 N	Not Encountered*	7.5	Clayey gravel and cobbles
10	East Driveway	800 E	200 N	3	None	Silty sand, gravel, cobbles
11	East Driveway	400 E	200 N	5.5	None	Silty sand, gravel, cobbles

*Exploratory trenches where groundwater was not encountered were excavated to a depth of approximately 10 to 12 feet.

We have been requested to provide an estimate of the maximum “base flow” which may occur within the two drainage tiles to assist Otak in their assessment of the existing site drainage conditions. The measured flow of 50 to 60 gallons per minute (0.13 cubic feet per second, cfs) represents a value less than the theoretical maximum flow rate. Review of existing topographic maps indicated the area of capture of the drainage tiles is approximately 13 acres. Assuming a conservative (i.e. high) permeability value of 10^{-3} cm/sec for the soil within the capture area, a maximum theoretical base flow of 0.5 cubic feet per second was calculated for the existing two drain tile system.

It was also requested that we estimate a post construction (as built) value of the water flow into the proposed drainage swales to be constructed within the southeast portion of the property. A total surface area of approximately 9,161 square feet was determined by Otak for the swale area exposed to groundwater flow. Assuming a permeability value of 10^{-3} cm/sec and a hydraulic gradient of 10%, a maximum flow rate of 0.03 cubic feet per second was estimated for the post construction flow within the swale system. The assumed soil permeability value of 10^{-3} cm/sec is conservative as it represents the flow characteristics of a medium to fine grained sand. The majority of soils within the potential zone of groundwater flow are silts and clays.

We appreciate the opportunity to work with you on this project. If you have any questions, or require additional information, please contact the undersigned at your convenience.

Sincerely,

GEOCON NORTHWEST, INC.

Heather Devine

Heather Devine, P.E.
Geotechnical Engineer

Wesley Spang

Wesley Spang, Ph.D., P.E
President

cc: Mr. Don Proctor, Otak

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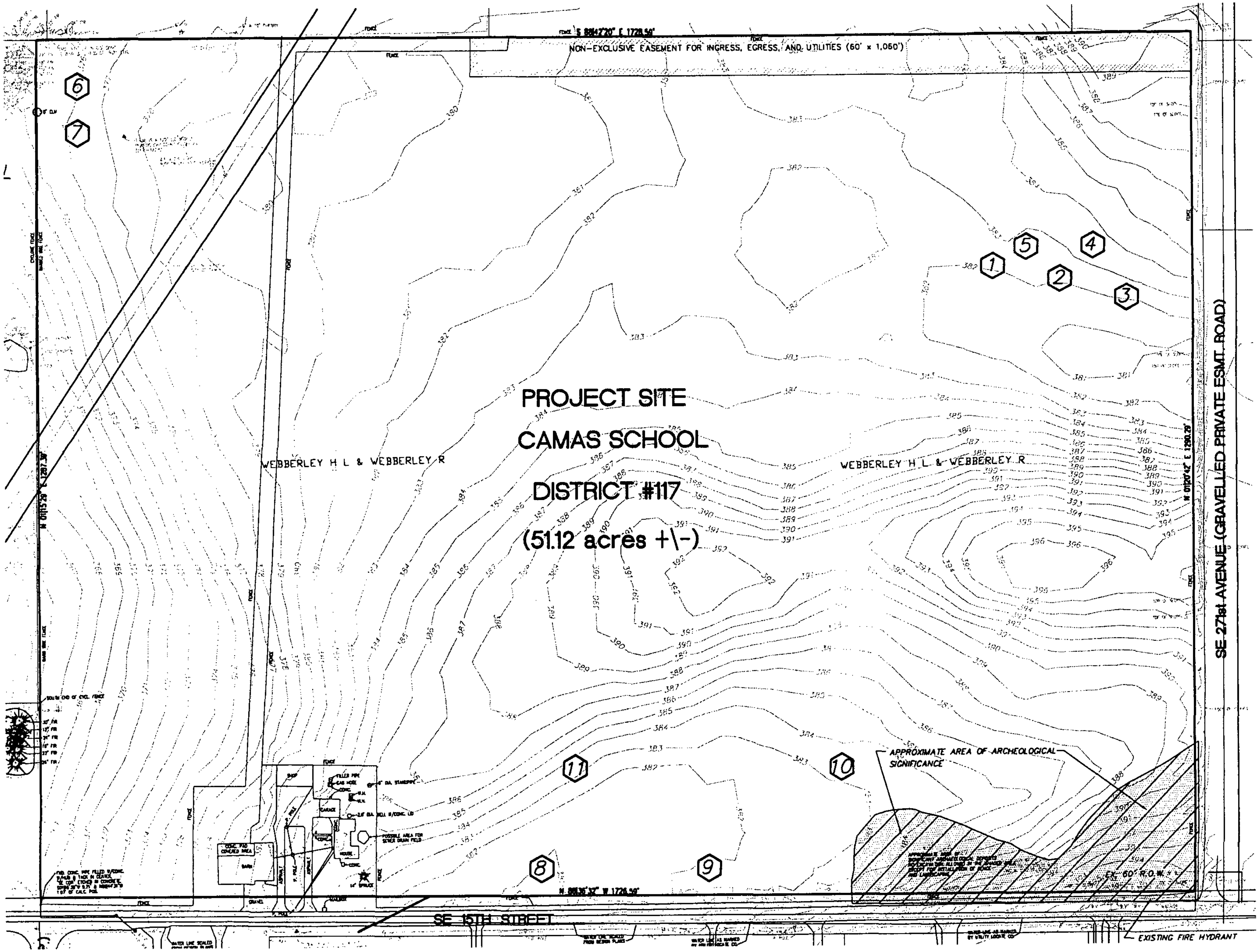

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Appendix D-2

Geotechnical Engineering Report , by Columbia West dated December 20, 2024

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Geotechnical Site Investigation

Camas High School Field House

Camas, Washington

December 20, 2019

Geotechnical ▪ Environmental ▪ Special Inspections

Columbia West Engineering, Inc

11917 NE 95th Street
Vancouver, Washington
98682
Phone: 360-823-2900
Fax: 360-823-2901

www.columbiawestengineering.com

Exhibit 13 CUP24-1001

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West
Engineering, Inc

GEOTECHNICAL SITE INVESTIGATION
CAMAS HIGH SCHOOL FIELD HOUSE
CAMAS, WASHINGTON

Prepared For:	**Mr. Chris Robertson** **Robertson Engineering, PC** **1101 Broadway Street #201** **Vancouver, WA 98660**
Site Location:	**26600 SE 15th Street** **Parcel No. 178111000** **Camas, Washington**
Prepared By:	**Columbia West Engineering, Inc.** **11917 NE 95th Street** **Vancouver, Washington 98682** **Phone: 360-823-2900** **Fax: 360-823-2901**
Date Prepared:	**December 20, 2019**

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GEOTECHNICAL SITE INVESTIGATION
CAMAS HIGH SCHOOL FIELD HOUSE
CAMAS, WASHINGTON

1.0 INTRODUCTION

Columbia West Engineering, Inc. (Columbia West) was retained by Robertson Engineering, PC to conduct a geotechnical site investigation for the proposed Camas High School Field House project located in Camas, Washington. The purpose of the investigation was to observe and assess subsurface soil conditions at specific locations and provide geotechnical engineering analyses, planning, and design recommendations for proposed development. The specific scope of services was outlined in a proposal contract dated August 23, 2019. This report summarizes the investigation and provides field assessment documentation and laboratory analytical test reports. This report is subject to the limitations expressed in Section 6.0, *Conclusion and Limitations*, and Appendix E.

1.1 General Site Information

As indicated on Figures 1 and 2, the subject site is located at 26600 SE 15th Street in Camas, Washington. The proposed development area is comprised of a portion of tax parcel 178111000 totaling approximately 1.15 acres. The regulatory jurisdictional agency is the City of Camas, Washington. The approximate latitude and longitude are N 45° 36' 51" and W 122° 23' 58", and the legal description is a portion of the SE ¼ of Section 35, T2N, R3E Willamette Meridian.

1.2 Proposed Development

Correspondence with the design team indicates that proposed development will consist of an athletic field house structure and associated underground utilities, stormwater management facilities, and asphalt concrete access drives and walkways. Columbia West has not reviewed preliminary grading plans but understands that minor cut and fill will likely be proposed at the property. This report is based upon proposed development as described above and may not be applicable if modified.

2.0 REGIONAL GEOLOGY AND SOIL CONDITIONS

The subject site lies within the Willamette Valley/Puget Sound Lowland, a wide physiographic depression flanked by the mountainous Coast Range on the west and the Cascade Range on the east. Inclined or uplifted structural zones within the Willamette Valley/Puget Sound Lowland constitute highland areas and depressed structural zones form sediment-filled basins. The site is located in the eastern portion of the Portland/Vancouver Basin, an open, somewhat elliptical, northwest-trending syncline approximately 60 miles wide.

According to the *Geologic Map of the Camas Quadrangle, Clark County, Washington, and Multnomah County, Oregon* (USGS Geological Survey, Scientific Investigations Map 3017, 2008), site soils are mapped as Pleistocene- and Pliocene-aged, unconsolidated to cemented, thick bedded, pebble to boulder sedimentary conglomerate (Qtc).

The *Web Soil Survey* (United States Department of Agriculture, Natural Resource Conservation Service [USDA NRCS], 2019 Website) identifies surface soils as Hesson clay loam. Hesson series soils are generally fine-textured sands, silts, and clays with low permeability, moderate to high water capacity, and low shear strength. Hesson soils are generally moisture sensitive, somewhat compressible, and described as having low to moderate shrink-swell potential. The erosion hazard of these soils is slight primarily based primarily upon slope grade.

3.0 REGIONAL SEISMOLOGY

Recent research and subsurface mapping investigations within the Pacific Northwest appear to suggest the historic potential risk for a large earthquake event with strong localized ground movement may be underestimated. Past earthquakes in the Pacific Northwest appear to have caused landslides and ground subsidence, in addition to severe flooding near coastal areas. Earthquakes may also induce soil liquefaction, which occurs when elevated horizontal ground acceleration and velocity cause soil particles to interact as a fluid as opposed to a solid. Liquefaction of soil can result in lateral spreading and temporary loss of bearing capacity and shear strength.

There are at least four major known fault zones in the vicinity of the site that may be capable of generating potentially destructive horizontal accelerations. These fault zones are described briefly in the following text.

Portland Hills Fault Zone

The Portland Hills Fault Zone consists of several northwest-trending faults located along the northeastern margin of the Tualatin Mountains, also known as the Portland Hills, and the southwest margin of the Portland Basin. The fault zone is approximately 25 to 30 miles in length and is located approximately 15 miles west-southwest of the site. According to *Seismic Design Mapping, State of Oregon* (Geomatrix Consultants, 1995), there is no definitive consensus among geologists as to the zone fault type. Several alternate interpretations have been suggested.

According to the *USGS Earthquake Hazards Program*, the fault was originally mapped as a down-to-the-northeast normal fault, but has also been mapped as part of a regional-scale zone of right-lateral, oblique slip faults, and as a steep escarpment caused by asymmetrical folding above a south-west dipping, blind thrust fault. The Portland Hills fault offsets Miocene-aged Columbia River Basalts, and Miocene- to Pliocene-aged sedimentary rocks of the Troutdale Formation. No fault scarps on surficial Quaternary-aged deposits have been described along the fault trace, and the fault is mapped as buried by the Pleistocene-aged Missoula flood deposits.

However, evidence suggests that fault movement has impacted shallow Holocene-aged deposits and deeper Pleistocene-aged sediments. Seismologists recorded a magnitude (M) 3.2 earthquake in November 2012, and a M3.9 earthquake in April 2003 thought to be associated with the fault zone near Kelly Point Park. A M3.5 earthquake also possibly associated with the Portland Hills Fault Zone occurred approximately 1.3 miles east of the fault in 1991. Therefore, the Portland Hills Fault Zone is generally thought to be potentially active and capable of producing potentially damaging earthquakes.

Gales Creek-Newberg-Mt. Angel Fault Zone

Located approximately 36 miles west-southwest of the site, the northwest-striking, approximately 50-mile long Gales Creek-Newberg-Mt. Angel Structural Zone forms the northwestern boundary between the Oregon Coast Range and the Willamette Valley, and consists of a series of discontinuous northwest-trending faults. The southern end of the fault zone forms the southwest margin of the Tualatin basin. Possible late-Quaternary-aged geomorphic surface deformation may exist along the structural zone (Geomatrix Consultants, 1995).

According to the *USGS Earthquake Hazards Program*, the Mount Angel fault is mapped as a high-angle, reverse-oblique fault, which offsets Miocene-aged rocks of the Columbia River Basalts, and Miocene and Pliocene-aged sedimentary rocks. The fault appears to have controlled emplacement of the Frenchman Spring Member of the Wanapum Basalts, and thus must have a history that predates the Miocene age of these rocks. No unequivocal evidence of deformation of Quaternary-aged deposits has been described, but a thick sequence of sediments deposited by the Missoula floods covers much of the southern part of the fault trace.

Although no definitive evidence of impacts to Holocene-aged sediments have clearly been identified, the Mount Angel fault appears to have been the location of minor earthquake swarms in 1990 near Woodburn, Oregon, and a M5.6 earthquake in March 1993 near Scotts Mills, approximately four miles south of the mapped extent of the Mt. Angel fault. It is unclear if the earthquake occurred along the fault zone or a parallel structure. Therefore, the Gales Creek-Newberg-Mt. Angel Structural Zone is considered potentially active.

Lacamas Lake-Sandy River Fault Zone

The northwest-trending Lacamas Lake Fault and northeast-trending Sandy River Fault intersect north of Camas, Washington approximately 0.8 miles south-southwest of the site, and form part of the northeastern margin of the Portland basin. According to *Geology and Groundwater Conditions of Clark County Washington* (USGS Water Supply Paper 1600, Mundorff, 1964) and the *Geologic Map of the Lake Oswego Quadrangle* (Oregon DOGAMI Series GMS-59, 1989), the Lacamas Lake fault zone consists of shear contact between the Troutdale Formation and underlying Oligocene-aged andesite-basalt bedrock. Secondary shear contact associated with the fault zone may have produced a series of prominent northwest-southeast geomorphic lineaments in proximity to the site.

According to the *USGS Earthquake Hazards Program* the fault has been mapped as a normal fault with down-to-the-southwest displacement and has also been described as a steeply northeast or southwest-dipping, oblique, right-lateral, slip-fault. The trace of the Lacamas Lake fault is marked by the very linear lower reach of Lacamas Creek. No fault scarps on Quaternary-aged surficial deposits have been described. The Lacamas Lake

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fault offsets Pliocene-aged sedimentary conglomerates generally identified as the Troutdale formation, and Pliocene- to Pleistocene-aged basalts generally identified as the Boring Lava formation.

Recent seismic reflection data across the probable trace of the fault under the Columbia River yielded no unequivocal evidence of displacement underlying the Missoula flood deposits, however, recorded mild seismic activity during the recent past indicates this area may be potentially seismogenic.

Cascadia Subduction Zone

The Cascadia Subduction Zone has recently been recognized as a potential source of strong earthquake activity in the Portland/Vancouver Basin. This phenomenon is the result of the earth's large tectonic plate movement. Geologic evidence indicates that volcanic ocean floor activity along the Juan de Fuca ridge in the Pacific Ocean causes the Juan de Fuca Plate to perpetually move east and subduct under the North American Continental Plate. The subduction zone results in historic volcanic and potential earthquake activity in proximity to the plate interface, believed to lie approximately 20 to 50 miles west of the general location of the Oregon and Washington coast (Geomatrix Consultants, 1995).

4.0 GEOTECHNICAL AND GEOLOGIC FIELD INVESTIGATION

A geotechnical field investigation consisting of visual reconnaissance, three test pits (TP-1 through TP-3), one infiltration test, and one soil boring (SB-1) was conducted at the site on November 5 and 11, 2019. Test pits were explored with a track-mounted excavator. Soil borings were explored with a track-mounted mud-rotary drill system. Subsurface soil profiles were logged in accordance with Unified Soil Classification System (USCS) specifications. Disturbed and relatively undisturbed soil samples were collected from relevant soil horizons and submitted for laboratory analysis. Analytical laboratory test results are presented in Appendix A. Exploration locations are indicated on Figure 2. Subsurface exploration logs are presented in Appendix B. Soil descriptions and classification information are provided in Appendix C. A photo log is presented in Appendix D.

4.1 Surface Investigation and Site Description

The approximate 1.15-acre subject site is located at 26600 SE 15th Street in Camas, Washington. The subject site is located on the Camas High School campus and is bounded by an access drive to the west, an access drive and parking lots to the south, tennis courts to the east, and undeveloped acreage to the north. No existing buildings were observed on the site. Observed utility infrastructure included an underground storm line extending southeast from the central portion of the site to the adjacent stormwater facility. The western and northern portions of the site consist of open, landscaped areas with several mature trees bordering the northern site boundary.

Field reconnaissance and topographic mapping published by *Clark County Maps Online* indicates relatively flat terrain with slope grades of 0 to 5 percent and site elevations ranging from 378 to 382 feet above mean sea level (amsl).

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4.2 Subsurface Exploration and Investigation

Test pit explorations TP-1 through TP-3 were advanced at the site to a maximum depth of 14 feet below ground surface (bgs). Soil boring exploration (SB-1) was advanced to a maximum depth of 51 ½ feet bgs. Exploration locations were selected to observe subsurface soil characteristics in proximity to proposed development areas and are indicated on Figure 2. Detailed field logs of the encountered materials are presented in Appendix B, *Subsurface Exploration Logs.*

4.2.1 Soil Type Description

The field investigation indicated the presence of approximately 6 to 12 inches of sod and topsoil in the areas observed. Underlying the topsoil layer, undocumented fill and subsurface soils resembling native USDA Hesson soil series descriptions were encountered. Subsurface lithology may generally be described by soil types identified in the following text.

Soil Type 1 – Undocumented FILL

Soil Type 1 represents undocumented FILL and was observed to primarily consist of tan, mottled, moist, medium dense clayey sand with gravel. Soil Type 1 was observed at ground surface in explorations TP-1 and TP-2 and extended to an observed depth of approximately 24 inches. Soil Type 1 was underlain by Soil Type 2 in test pit TP-1 and Soil Type 3 in test pit TP-2. Additional recommendations regarding Soil Type 1 are provided in Section 5.1.1, *Undocumented Fill.*

Soil Type 2 – Sandy Lean CLAY with Gravel

Soil Type 2 was observed to primarily consist of brown, mottled, moist, medium stiff to stiff sandy lean CLAY with gravel. Soil Type 2 was observed below the topsoil layer in soil boring SB-1, below Soil Type 1 in test pit TP-1, and below Soil Type 3 in test pit TP-2. Soil Type 2 extended to observed depths ranging from approximately 3 to 5 feet bgs where it was underlain by Soil Type 4.

Soil Type 3 – Fat CLAY with Sand

Soil Type 3 was observed to primarily consist of gray to tan, mottled, moist, stiff fat CLAY with sand. Soil Type 3 was observed below the topsoil layer in test pit TP-3 and below Soil Type 1 in test pit TP-2. Soil Type 3 extended to an observed depth of approximately 2 ½ feet bgs, where it was underlain by Soil Type 2 in TP-2 and Soil Type 4 in TP-3.

Recommendations regarding the suitability of Soil Type 3 to be reused as structural fill or bear structural foundations are presented respectively in Section 5.2, *Engineered Structural Fill* and Section 5.4, *Foundations*.

Analytical laboratory testing conducted upon a representative soil sample obtained from test pit TP-2 indicated approximately 85 percent by weight passing the No. 200 sieve and an in situ moisture content of approximately 40 percent. Atterberg Limits analysis indicated a liquid limit of 76 percent and a plasticity index of 50 percent. The laboratory tested sample of Soil Type 3 is classified CH according to USCS specifications and A-7-6(47) according to AASHTO specifications.

Soil Type 4 – Sedimentary CONGLOMERATE

Soil Type 4 was observed to consist of tan to orange-brown, moderately- to severely-weathered, moist, loose to dense sedimentary CONGLOMERATE of poorly-graded gravel in a sand, silt, and clay matrix. Soil Type 4 was observed below Soil Type 2 in explorations TP-1, TP-2, and SB-1 and below Soil Type 3 in test pit TP-3. Soil Type 4 extended to the maximum depth of exploration in each of the observed locations. Soil Type 4 may represent unconsolidated to cemented, thick-bedded, pebble to boulder sedimentary conglomerate (QTc) of Evarts, 2008.

Analytical laboratory testing conducted upon representative soils samples obtained from explorations TP-2 and SB-1 indicated approximately 8 to 39 percent by weight passing the No. 200 sieve and in situ moisture contents ranging from approximately 19 to 56 percent. Atterberg Limits analysis indicated liquid limits ranging from 47 to 57 percent and plasticity index ranging from 18 to 24 percent. Laboratory tested samples of Soil Type 4 are classified GP-GM and SM according to USCS specifications and A-2-7(0) and A-7-5(5) according to AASHTO specifications.

4.2.2 Groundwater

Groundwater was not encountered in the test pit explorations to the maximum explored depth of 14 feet bgs. Due to the use of mud-rotary drilling techniques, depth to groundwater was not measured within soil boring SB-1. Review of nearby well logs obtained from the State of Washington Department of Ecology indicates that groundwater levels in the area are approximately 18 to 180 feet bgs. Variations in groundwater elevations likely reflect the screened interval depth of these wells, changes in ground surface elevation, and the presence of multiple aquifers and confining units.

Groundwater levels are often subject to seasonal variance and may rise during extended periods of increased precipitation. Perched groundwater may also be present in localized areas. Seeps and springs may become evident during site grading, primarily along slopes or in areas cut below existing grade. Structures, roads, and drainage design should be planned accordingly.

5.0 DESIGN RECOMMENDATIONS

The geotechnical site investigation suggests the proposed development is generally compatible with surface and subsurface soils, provided the recommendations presented in this report are utilized and incorporated into the design and construction processes. The primary geotechnical concerns associated with the site are undocumented fill and high-plasticity soils. Design recommendations are presented in the following text sections.

5.1 Site Preparation and Grading

Vegetation, organic material, unsuitable fill, and deleterious material that may be encountered should be cleared from areas identified for structures and site grading. Vegetation, other organic material, and debris should be removed from the site. Stripped topsoil should also be removed, or used only as landscape fill in nonstructural areas with slopes less than 25 percent. The stripping depth for sod and highly organic topsoil is anticipated to vary between approximately 6 and 12 inches. Stripping depths may increase in areas of heavy organics or disturbed soil. Actual stripping depths should be determined based upon visual observations made during construction when soil conditions are exposed. The post-construction maximum depth of landscape fill placed or spread at any location onsite should not exceed one foot.

Previously disturbed soil, debris, or unconsolidated fill encountered during grading or construction activities should be removed completely and thoroughly from structural areas. This includes old foundations, basement walls, utilities, associated soft soils, and debris. Excavation areas should be backfilled with engineered structural fill.

Test pits excavated during site exploration were backfilled loosely with onsite soils. These test pits should be located and properly backfilled with structural fill during site improvements construction. Trees, stumps, and associated roots should also be removed from structural areas, individually and carefully. Resulting cavities and excavation areas should be backfilled with engineered structural fill.

Site grading activities should be performed in accordance with requirements specified in the 2015 *International Building Code* (IBC), Chapter 18 and Appendix J, with exceptions noted in the text herein. Site preparation, soil stripping, and grading activities should be observed and documented by Columbia West.

5.1.1 Undocumented Fill

As previously described, undocumented fill was observed in areas proposed for development. Approximate locations where undocumented fill was observed are indicated on Figure 2. The undocumented fill was observed to primarily consist of tan, mottled, moist, medium dense clayey sand with gravel. Undocumented fill extended to an approximate depth of 24 inches in locations observed.

Undocumented fill and other previously disturbed soils or debris are not suitable for bearing structures in their current state and should be removed completely and thoroughly from proposed building envelopes. In some areas, undocumented fill may directly overlie vegetation and the original topsoil layer. This material should also be removed completely. Upon removal of undocumented fill, Columbia West should observe the exposed subgrade to verify adequate support conditions.

Based upon Columbia West’s investigation, most undocumented fill soils (clean clayey sand with gravel) appear to be acceptable for reuse as structural fill, provided materials are observed to exhibit index properties similar to those observed during this investigation and that construction adheres to the specifications presented in this report. Portions of undocumented fill found to contain highly organic soils, debris, or other deleterious material are not suitable for re-use and should be thoroughly removed. Recommendations regarding the suitability of reusing existing fill soils as structural fill material should be provided in the field by Columbia West during construction. It should be noted that the limited scope of exploration conducted for this investigation cannot wholly eliminate uncertainty regarding the presence of unsuitable soils in areas not explored.

5.2 Engineered Structural Fill

Areas proposed for fill placement should be appropriately prepared as described in the preceding text. Surface soils should then be scarified and compacted prior to additional fill placement. Engineered structural fill should be placed in loose lifts not exceeding 12 inches in depth and compacted using standard conventional compaction equipment. The soil moisture content should be within two percentage points of optimum conditions. A field density at least equal to 95 percent of the maximum dry density, obtained from the standard Proctor moisture-density relationship test (ASTM D698), is recommended for structural fill placement. Engineered structural fill placed on sloped grades should be benched to provide a horizontal surface for compaction.

Compaction of engineered structural fill should be verified by nuclear gauge field compaction testing performed in accordance with ASTM D6938. Field compaction testing should be performed for each vertical foot of engineered fill placed followed by subsequent proof-roll evaluation where feasible. Engineered fill placement should be observed by Columbia West.

Engineered structural fill placement activities should be performed during dry summer months if possible. Some clean native soils (Soil Type 2 and Soil Type 4) may be suitable for use as structural fill if adequately dried or moisture-conditioned to achieve recommended compaction specifications. Native soils with a plasticity index greater than 25 should be evaluated and approved by Columbia West prior to re-use as structural fill. Native fat CLAY soils (Soil Type 3) are not anticipated to be suitable for reuse as structural fill.

Fine-textured soils may require addition of moisture during late summer months or after extended periods of warm dry weather. Compacted fine-textured fill soils should be covered shortly after placement. If adequate compaction is not achievable with clean native soils, import structural fill consisting of granular fill meeting WSDOT specifications for *Gravel Borrow 9-03.14(1)* is recommended.

Representative samples of proposed engineered structural fill should be submitted for laboratory analysis and approval by Columbia West prior to placement. Laboratory analyses should include particle-size gradation and standard Proctor moisture-density analysis.

5.3 Cut and Fill Slopes

Fill placed on existing grades steeper than 5H:1V should be horizontally benched at least 10 feet into the slope. Fill slopes greater than six feet in height should be vertically keyed into existing subsurface soil. A typical fill slope cross-section is shown in Figure 3. Drainage implementations, including subdrains or perforated drain pipe trenches, may also be necessary in proximity to cut and fill slopes if seeps or springs are encountered. Drainage design may be performed on a case-by-case basis. Extent, depth, and location of drainage may be determined in the field by Columbia West during construction when soil conditions are exposed. Failure to provide adequate drainage may result in soil sloughing, settlement, or erosion.

Final cut or fill slopes at the site should not exceed 2H:1V or 20 feet in total height without individual slope stability analysis. The values above assume a minimum horizontal setback for loads of 10 feet from top of cut or fill slope face or overall slope height divided by three (H/3), whichever is greater. A minimum slope setback detail for structures is presented in Figure 4.

Concentrated drainage or water flow over the face of slopes should be prohibited, and adequate protection against erosion is required. Fill slopes should be constructed by placing fill material in maximum 12-inch level lifts, compacting as described in Section 5.2, *Engineered Structural Fill* and horizontally benching where appropriate. Fill slopes should be overbuilt, compacted, and trimmed at least two feet horizontally to provide adequate compaction of the outer slope face. Proper cut and fill slope construction is critical to overall project stability and should be observed and documented by Columbia West.

5.4 Foundations

Foundations for proposed structures are anticipated to consist of shallow continuous perimeter or column spread footings. Correspondence with the project structural engineer, Kramer Ghelen and Associates, Inc., indicates that foundation loads are not anticipated to exceed approximately 4 kips per foot for perimeter footings or 75 kips per column. If actual loading exceeds anticipated loading, additional analysis should be conducted for the specific load conditions and proposed footing dimensions. Footings should be designed by a licensed structural engineer and conform to the recommendations below.

The existing ground surface should be prepared as described in Section 5.1, *Site Preparation and Grading*, and Section 5.2, *Engineered Structural Fill*. Foundations should bear only upon firm, native soils (Soil Type 2 or Soil Type 4) or engineered structural fill.

To evaluate bearing capacity for proposed structures, serviceability and reliability of shear resistance for subsurface soils was considered. Allowable bearing capacity is typically a function of footing dimension and subsurface soil properties, including settlement and shear resistance. Based upon in situ field testing and laboratory analysis, an estimated allowable static bearing capacity of 3,000 psf may be achieved by adhering to the following design and construction recommendations. Footings should maintain a minimum embedment depth of 36 inches below the lowest adjacent grade and bear only upon Soil Type 2, Soil Type 4, or engineered structural fill. Soil Types 1 or 3, if encountered within proposed foundation alignments, should be over-excavated to expose Soil Type 2 or 4. Over-excavations which extend beyond the minimum embedment recommendation may be backfilled with 1 ¼”-0 crushed aggregate compacted to at least 95 percent of the modified Proctor maximum dry density (ASTM D1557).

Bearing capacity may be increased by one-third for transient lateral forces such as seismic or wind. The estimated coefficient of friction between in situ compacted native soil or engineered structural fill and in-place poured concrete is 0.40. Lateral forces may also be resisted by an assumed passive soil equivalent fluid pressure of 250 psf/f against embedded footings.

Footings should extend to a depth at least 36 inches below lowest adjacent grade to provide adequate bearing capacity and protection against frost heave. Foundations constructed during wet weather conditions will require over-excavation of saturated subgrade soils and granular structural backfill prior to concrete placement. Over-excavation recommendations should be provided by Columbia West during foundation excavation and construction. Excavations adjacent to foundations should not extend within a 2H:1V angle projected down from the outside bottom footing edge without additional geotechnical analysis.

Foundations should not be permitted to bear upon undocumented fill (Soil Type 1), disturbed soil, or Soil Type 3. Because soil is often heterogeneous and anisotropic, Columbia West should observe foundation excavations prior to placing forms or reinforcing bar to verify subgrade support conditions are as anticipated in this report.

5.4.1 Luminaire, Signal, and Sign Foundations

Foundations for luminaire, signal, and sign poles should be designed in accordance with the *International Building Code (IBC) Chapter 18* by a licensed structural engineer. Based upon review of *IBC* literature, and SPT blow count observations made during the field exploration, the allowable lateral bearing pressure for foundations installed in competent native Soil Type 2, Soil Type 4, or engineered structural fill is 150 psf/ft up to a maximum of 2,500 psf. Columbia West should be contacted to review foundation designs and evaluate compatibility with geotechnical design assumptions.

5.5 Slabs on Grade

The proposed structures may have slab-on-grade floors. Slabs should be supported on firm, competent, in situ native soil or engineered structural fill. Disturbed soils and unsuitable fills in proposed slab locations should be removed and replaced with structural fill.

Preparation and compaction beneath slabs should be performed in accordance with the recommendations presented in Section 5.1, *Site Preparation and Grading* and Section 5.2, *Engineered Structural Fill*. Slabs should be underlain by at least 6 inches of free-draining 1¼” - 0 crushed aggregate meeting WSDOT 9-03.9(3). Geotextile filter fabric conforming to *WSDOT 2010 Standard Specification M 41-10, 9-33.2(1), Geotextile Properties, Table 3: Geotextile for Separation or Soil Stabilization* may be used below the crushed aggregate to increase subgrade support. The modulus of subgrade reaction is estimated to be 100 psi/inch. If desired, a moisture barrier may be constructed beneath the slabs. Slabs should be appropriately waterproofed in accordance with the desired type of finished flooring. Slab thickness and reinforcement should be designed by an experienced structural engineer in accordance with anticipated loads.

5.6 Static Settlement

Total long-term static footing displacement for shallow foundations constructed as described in this report is not anticipated to exceed approximately 1 inch. Differential settlement between comparably loaded footing elements is not expected to exceed approximately ½ inch over a span of 50 feet. The resulting vertical displacement after loading may be due to elastic distortion, dissipation of excess pore pressure, or soil creep.

5.7 Excavation

Soils at the site were explored to a maximum depth of approximately 51 ½ feet using a track-mounted mud-rotary drill system. Blasting or specialized rock-excavation techniques are not anticipated.

Groundwater was not encountered within test pit explorations to the maximum excavated depth of 14 feet bgs. However, perched groundwater layers may exist at shallower depths depending on seasonal fluctuations of the water table.

Based upon laboratory analysis and field testing, near-surface soils may be Washington State Industrial Safety and Health Administration (WISHA) Type C. For temporary open-cut excavations deeper than four feet, but less than 20 feet in soils of these types, the maximum allowable slope is 1.5H:1V. WISHA soil type should be confirmed during field construction activities by the contractor. Soil is often anisotropic and heterogeneous, and it is possible that WISHA soil types determined in the field may differ from those described above.

Site-specific shoring design may be required if open-cut excavations are infeasible or if excavations are proposed adjacent to existing infrastructure. Typical methods for stabilizing excavations consist of soldier piles and timber lagging, sheet pile walls, tiebacks and shotcrete, or pre-fabricated hydraulic shoring. Because lateral earth pressure distributions acting on below-grade structures are dependent upon the type of shoring system used, Columbia West should be contacted to conduct additional analysis when shoring type, excavation depths, and locations are known.

The contractor should be held responsible for site safety, sloping, and shoring. Columbia West is not responsible for contractor activities and in no case should excavation be conducted in excess of all applicable local, state, and federal laws.

5.8 Lateral Earth Pressure

If retaining walls are proposed, lateral earth pressures should be carefully considered in the design process. Hydrostatic pressure and additional surcharge loading should also be considered. Retained material may include engineered structural backfill or undisturbed native soil. Structural wall backfill should consist of imported granular material meeting *Section 9-03.12(2)* of WSDOT Standard Specifications. Backfill should be prepared and compacted to at least 95 percent of maximum dry density as determined by the modified Proctor test (ASTM D1557). Recommended parameters for lateral earth pressures for retained soils and engineered structural backfill consisting of imported granular fill meeting WSDOT specifications for *Gravel Backfill for Walls 9-03.12(2)* are presented in Table 1.

The design parameters presented in Table 1 are valid for static loading cases only and are based upon in situ undistributed native soils or compacted granular fill. The recommended earth pressures do not include surcharge loads, dynamic loading, hydrostatic pressure, or seismic design.

If seismic design is required for unrestrained walls, seismic forces may be calculated by superimposing a uniform lateral force of $10H^2$ pounds per lineal foot of wall, where H is the total wall height in feet. The resultant force should be applied at 0.6H from the base of the

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wall. If sloped backfill conditions are proposed for the site, Columbia West should be contacted for additional analysis and associated recommendations.

Table 1. Lateral Earth Pressure Parameters for Level Backfill

Retained Soil	Equivalent Fluid Pressure for Level Backfill			Wet Density	Drained Internal Angle of Friction
	At-rest	Active	Passive		
Undisturbed native Sandy Lean CLAY with Gravel (Soil Type 2)	59 pcf	40 pcf	331 pcf	115 pcf	29°
Undisturbed native Fat CLAY with Sand (Soil Type 3)	69 pcf	50 pcf	242 pcf	110 pcf	22°
Undisturbed native Sedimentary CONGLOMERATE (Soil Type 4)	53 pcf	34 pcf	424 pcf	120 pcf	34°
Approved Structural Backfill Material	52 pcf	32 pcf	568 pcf	135 pcf	38°
WSDOT 9-03.12(2) compacted aggregate backfill					

** The upper 6 inches of soil should be neglected in passive pressure calculations. If exterior grade from top or toe of retaining wall is sloped, Columbia West should be contacted to provide location-specific lateral earth pressures.*

A continuous one-foot-thick zone of free-draining, washed, open-graded 1-inch by 2-inch drain rock and a 4-inch perforated gravity drain pipe is assumed behind retaining walls. Geotextile filter fabric should be placed between the drain rock and backfill soil. Specifications for drain pipe design are presented in Section 5.11, *Drainage*. If walls cannot be gravity drained, saturated base conditions and/or applicable hydrostatic pressures should be assumed.

Final retaining wall design should be reviewed and approved by Columbia West. Retaining wall subgrade and backfill activities should also be observed and tested for compliance with recommended specifications by Columbia West during construction.

5.9 Seismic Design Considerations

According to the *American Society of Civil Engineers* (ASCE) *ASCE 7 Hazard Tool,* the anticipated peak ground and maximum considered earthquake spectral response accelerations resulting from seismic activity for the subject site are summarized in Table 2.

Table 2. Approximate Probabilistic Ground Motion Values for 'firm rock' sites based on subject property longitude and latitude

	2% Probability of Exceedance in 50 yrs
Peak Ground Acceleration	0.367 g
0.2 sec Spectral Acceleration	0.864 g
1.0 sec Spectral Acceleration	0.369 g

The listed probabilistic ground motion values are based upon "firm rock" sites with an assumed shear wave velocity of 2,500 ft/s in the upper 100 feet of soil profile. These values should be adjusted for site class effects by applying site coefficients Fa, Fv, and

F_{PGA} as defined in *ASCE 7-10, Tables 11.4-1, 11.4-2, and 11.8-1*. The site coefficients are intended to more accurately characterize estimated peak ground and respective earthquake spectral response accelerations by considering site-specific soil characteristics and index properties.

The *Site Class Map of Clark County, Washington* (Washington State Department of Natural Resources, 2004) indicates that site soils may represented by Site Class B to C as defined by the *ASCE 7, Chapter 20 Table 20.3-1*. However, subsurface exploration, in situ soil testing, and review of geologic mapping indicates that site soils exhibit characteristics of Site Class D. This site class designation indicates that some amplification of seismic energy may occur during a seismic event because of subsurface conditions.

Localized peak ground accelerations exceeding the adjusted values may occur in some areas in direct proximity to an earthquake's origin. This may be a result of amplification of seismic energy due to depth to competent bedrock, compression and shear wave velocity of bedrock, presence and thickness of loose, unconsolidated alluvial deposits, soil plasticity, grain size, and other factors.

Identification of specific seismic response spectra is beyond the scope of this investigation. If site structures are designed in accordance with recommendations specified in the *2015 IBC*, the potential for peak ground accelerations in excess of the adjusted and amplified values should be understood.

5.10 Soil Liquefaction and Dynamic Settlement

According to the *Liquefaction Susceptibility Map of Clark County Washington* (Washington State Department of Natural Resources, 2004), the site is mapped as very low susceptibility for liquefaction.

Liquefaction, defined as the transformation of the behavior of a granular material from a solid to a liquid due to increased pore-water pressure and reduced effective stress, may occur when granular materials quickly compact under cyclic stresses caused by a seismic event. The effects of liquefaction may include immediate ground settlement and lateral spreading.

Soils most susceptible to liquefaction are generally saturated, cohesionless, loose to medium-dense sands within 50 feet of the ground surface. Recent research has also indicated that low plasticity silts and clays may also be subject to sand-like liquefaction behavior if the plasticity index determined by the Atterberg Limits analysis is less than 8. Potentially liquefiable soils located above the existing, historic, or expected ground water levels do not generally pose a liquefaction hazard. It is important to note that changes in perched ground water elevation may occur due to project development or other factors not observed at the time of investigation.

The above-mentioned criteria were not observed during the geotechnical site investigation. Therefore, the potential for liquefaction of site soils is considered to be very low.

5.11 Drainage

At a minimum, site drainage should include surface water collection and conveyance to properly designed stormwater management structures and facilities. Drainage design in general should conform to City of Camas regulations. Finished site grading should be conducted with positive drainage away from structures. Depressions or shallow areas that may retain ponding water should be avoided. Roof drains, low-point drains, and perimeter foundation drains are recommended for structures. Drains should consist of separate systems and gravity flow with a minimum two-percent slope away from foundations into the stormwater system or approved discharge location.

Perimeter foundation drains should consist of 3-inch perforated PVC pipe surrounded by a minimum of 1 ft^3 of clean, washed drain rock per linear foot of pipe and wrapped with geotextile filter fabric. Open-graded drain rock with a maximum particle size of 3 inches and less than 2 percent passing the No. 200 sieve is recommended. Geotextile filter fabric should consist of Mirafi 140N or approved equivalent, with an apparent opening size (AOS) between No. 70 and No. 100 sieve. The water permittivity should be greater than 1.5/sec. Figure 5 presents a typical perimeter footing drain. Perimeter drains may limit increased hydrostatic pressure beneath footings and assist in reducing potential perched moisture areas.

Subdrains should also be considered if portions of the site are cut below surrounding grades. Shallow groundwater, springs, or seeps should be conveyed via drainage channel or perforated pipe into the stormwater management system or an approved discharge. Recommendations for design and installation of perforated drainage pipe may be performed on a case-by-case basis by Columbia West during construction. Failure to provide adequate surface and sub-surface drainage may result in soil slumping or unanticipated settlement of structures exceeding tolerable limits. A typical perforated drain pipe trench detail is presented in Figure 6.

Foundation drains and subdrains should be closely monitored after construction to assess their effectiveness. If additional surface or shallow subsurface seeps become evident, the drainage provisions may require modification or additional drains. Columbia West should be consulted to provide appropriate recommendations.

5.12 Infiltration Testing Results

To investigate the feasibility of subsurface disposal of stormwater, Columbia West conducted in situ infiltration testing at one location within the project area on November 5, 2019. Results, location, and associated depth of in situ infiltration testing are presented in Table 3. The reported infiltration rate, as defined by the soil coefficient of permeability, reflects approximate raw observed data, without application of a factor of safety. Soils in the tested location were observed and sampled where appropriate to adequately characterize the subsurface profile. Tested native soils were visually classified as CL, sandy lean CLAY with gravel.

Single-ring, falling head infiltration testing was performed by inserting a three-inch diameter pipe into the soil at the noted depth. The test was conducted by filling the apparatus with water and measuring time relative to changes in hydraulic head at regular intervals. Using Darcy's Law for saturated flow in homogenous media, the coefficient of permeability (k) was then calculated.

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Table 3. Infiltration Test Data

Test Number	Location (See Figure 2)	Approximate Test Depth (feet bgs)	Approximate Depth to Groundwater on 11-05-19 (feet bgs)	USCS Soil Type (*Indicates Visual Classification)	Passing No. 200 Sieve (%)	Infiltration Rate (Coefficient of Permeability, k) (inches/hour)
IT-1.1	TP-1	3.0	Not Encountered to 14 feet	CL, Sandy Lean CLAY with Gravel*	–	< 0.1

Due to the observed presence of fine-textured, low permeability soils, subsurface disposal of concentrated stormwater is likely infeasible and is not recommended without further study.

5.13 Bituminous Asphalt and Portland Cement Concrete

Correspondence with the design team indicates that proposed development includes private asphalt paved access drives and walkways. Columbia West recommends adherence to City of Camas paving guidelines for roadway improvements in the public right-of-way. General recommendations for private onsite flexible pavement sections are summarized in Table 4.

Table 4. Private Onsite Flexible Pavement Section Recommendations

Pavement Section Layer	**Minimum Layer Thickness**		**Specifications**
	Passenger Vehicle Parking and Access Drives	***Heavy Truck Access Drives**	
Asphalt concrete surface HMA Class ½" PG 64-22	3 inches	4 inches	91 percent of maximum Rice density (ASTM D2041)
Base course (WSDOT 9-03.9(3) 1¼"-0 crushed aggregate	8 inches	12 inches	95 percent of maximum modified Proctor density (ASTM D1557)
Scarified and compacted existing subgrade material	12 inches	12 inches	Compacted to 95 percent of maximum modified Proctor density (ASTM D1557)

*General recommendation based upon maximum traffic loading of up to 15 heavy trucks per day. If actual truck traffic exceeds 15 trucks per day, reduced pavement serviceability and design life should be expected.

For dry weather construction, pavement surface sections should bear upon competent subgrade consisting of scarified and compacted native soil or engineered structural fill. Wet weather pavement construction is discussed in Section 5.14, *Wet Weather Construction Methods and Techniques*. Subgrade conditions should be evaluated and tested by Columbia West prior to placement of crushed aggregate base. Subgrade evaluation should include nuclear gauge density testing and wheel proof-roll observations conducted with a loaded 12-cubic yard, double-axle dump truck or equivalent. Nuclear gauge density testing should be conducted at 150-foot intervals or as determined by the onsite geotechnical engineer. Subgrade soil should be compacted to at least 95 percent of the modified Proctor dry density, as determined by ASTM D1557. Areas of observed deflection or rutting during proof-roll evaluation should be excavated to a firm surface and replaced with compacted crushed aggregate.

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Crushed aggregate base should be compacted and tested in accordance with the specifications outlined above. Asphalt concrete pavement should be compacted to at least 91 percent of maximum Rice density. Nuclear gauge density testing should be conducted to verify adherence to recommended specifications. Testing frequency should be in accordance with Washington Department of Transportation and City of Camas specifications.

Portland cement concrete curbs and sidewalks should be installed in accordance with City of Camas specifications. Curb and sidewalk aggregate base should be observed and proof-rolled by Columbia West. Soft areas that deflect or rut should be stabilized prior to pouring concrete. Concrete should be tested during installation in accordance with ASTM C171, C138, C231, C143, C1064, and C31. This includes casting of cylinder specimens at a frequency of four cylinders per 100 cubic yards of poured concrete. Recommended field concrete testing includes slump, air entrainment, temperature, and unit weight.

5.14 Wet Weather Construction Methods and Techniques

Wet weather construction often results in significant shear strength reduction and soft areas that may rut or deflect. Installation of granular working layers may be necessary to provide a firm support base and sustain construction equipment. Granular layers should consist of all-weather gravel, two- to four-inch gabion, or other similar material (six-inch maximum size with less than five percent passing the No. 200 sieve).

Construction equipment traffic across exposed soil should be minimized. Equipment traffic induces dynamic loading, which may result in weak areas and significant reduction in shear strength for wet soils. Wet weather construction may also result in generation of significant excess quantities of soft wet soil. This material should be removed from the site or stockpiled in a designated area.

Construction during wet weather conditions may require increased base thickness. Over-excavation of subgrade soils or subgrade amendment with lime and/or cement may be necessary to provide a firm base upon which to place crushed aggregate. Geotextile filter fabric is also recommended. If soil amendment with lime or cement is considered, Columbia West should be contacted to provide appropriate recommendations based upon observed field conditions and desired performance criteria.

Crushed aggregate base should be installed in a single lift with trucks end-dumping from an advancing pad of granular fill. During extended wet periods, stripping activities may also need to be conducted from an advancing pad of granular fill. Once installed, the crushed aggregate base should be compacted with several passes from a static drum roller. A vibratory compactor is not recommended because it may further disturb the subgrade. Subdrains may also be necessary to provide subgrade drainage and maintain structural integrity.

Crushed aggregate base should be compacted to at least 95 percent of maximum dry density according to the modified Proctor density test (ASTM D1557). Compaction should be verified by nuclear gauge density testing. Observation of a proof-roll with a loaded dump truck is also recommended as an indication of the compacted aggregate's performance.

It should be understood that wet weather construction is risky and costly. Columbia West should observe and document wet weather construction activities. Proper construction methods and techniques are critical to overall project integrity.

5.15 Erosion Control Measures

Based upon field observations and laboratory testing, the erosion hazard for site soils in flat to shallow-gradient portions of the property is likely to be low. The potential for erosion generally increases in sloped areas. Therefore, disturbance to vegetation in sloped areas should be minimized during construction activities. Soil is also prone to erosion if unprotected and unvegetated during periods of increased precipitation. Erosion can be minimized by performing construction activities during dry summer months.

Site-specific erosion control measures should be implemented to address the maintenance of exposed areas. This may include silt fence, biofilter bags, straw wattles, or other suitable methods. During construction activities, exposed areas should be well-compacted and protected from erosion with visqueen, surface tackifier, or other means, as appropriate. Temporary slopes or exposed areas may be covered with straw, crushed aggregate, or riprap in localized areas to minimize erosion. Erosion and water runoff during wet weather conditions may be controlled by application of strategically placed channels and small detention depressions with overflow pipes.

After grading, exposed surfaces should be vegetated as soon as possible with erosion-resistant native vegetation. Jute mesh or straw may be applied to enhance vegetation. Once established, vegetation should be properly maintained. Disturbance to existing native vegetation and surrounding organic soil should also be minimized during construction activities.

5.16 Utility Installation

Utility installation may require subsurface excavation and trenching. Excavation, trenching and shoring should conform to federal (Occupational Safety and Health Administration) (OSHA) (29 CFR, Part 1926) and *WISHA* (WAC, Chapter 296-155) regulations. Site soils may slough when cut vertically and sudden precipitation events or perched groundwater may result in accumulation of water within excavation zones and trenches.

Utilities should be installed in general accordance with manufacturer's recommendations. Utility trench backfill should consist of *WSDOT 9-03.19 Bank Run Gravel for Trench Backfill* or *WSDOT 9-03.14(2) Select Borrow* with a maximum particle size of 2 ½-inches. Trench backfill material within 18 inches of the top of utility pipes should be hand compacted (i.e., no heavy compaction equipment). The remaining backfill should be compacted to at least 95 percent of maximum dry density as determined by the standard Proctor moisture-density test (ASTM D698). Clean, free-draining, fine bedding sand is recommended for use in the pipe zone. With exception of the pipe zone, backfill should be placed in loose lifts not exceeding 12 inches in thickness.

Compaction of utility trench backfill material should be verified by nuclear gauge field compaction testing performed in accordance with ASTM D6938. It is recommended that field compaction testing be performed at 200-foot intervals along the utility trench centerline at the surface and midpoint depth of the trench. Compaction frequency and

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specifications may be modified for non-structural areas in accordance with recommendations of the site geotechnical engineer.

6.0 CONCLUSION AND LIMITATIONS

This geotechnical site investigation report was prepared in accordance with accepted standard conventional principles and practices of geotechnical engineering. This investigation pertains only to material tested and observed as of the date of this report, and is based upon proposed site development as described in the text herein. This report is a professional opinion containing recommendations established by engineering interpretations of subsurface soils based upon conditions observed during site exploration. Soil conditions may differ between tested locations or over time. Slight variations may produce impacts to the performance of structural facilities if not adequately addressed. This underscores the importance of diligent QA/QC construction observation and testing to verify soil conditions are as anticipated in this report.

Therefore, this report contains several recommendations for field observation and testing by Columbia West personnel during construction activities. Columbia West cannot accept responsibility for deviations from recommendations described in this report. Future performance of structural facilities is often related to the degree of construction observation by qualified personnel. These services should be performed to the full extent recommended.

This report is not an environmental assessment and should not be construed as a representative warranty of site subsurface conditions. The discovery of adverse environmental conditions, or subsurface soils that deviate from those described in this report, should immediately prompt further investigation. The above statements are in lieu of all other statements expressed or implied.

This report was prepared solely for the client and is not to be reproduced without prior authorization from Columbia West. Final engineering plans and specifications for the project should be reviewed and approved by Columbia West as they relate to geotechnical and grading issues prior to final design approval. Columbia West is not responsible for independent conclusions or recommendations made by other parties based upon information presented in this report. Unless a particular service was expressly included in the scope, it was not performed and there should be no assumptions based upon services not provided. Additional report limitations and important information about this document are presented in Appendix E. This information should be carefully read and understood by the client and other parties reviewing this document.

Sincerely,

COLUMBIA WEST ENGINEERING, Inc.

Lance V. Lehto, PE, GE
President

LANCE V. LEHTO
36301
12-20-19

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FIGURES

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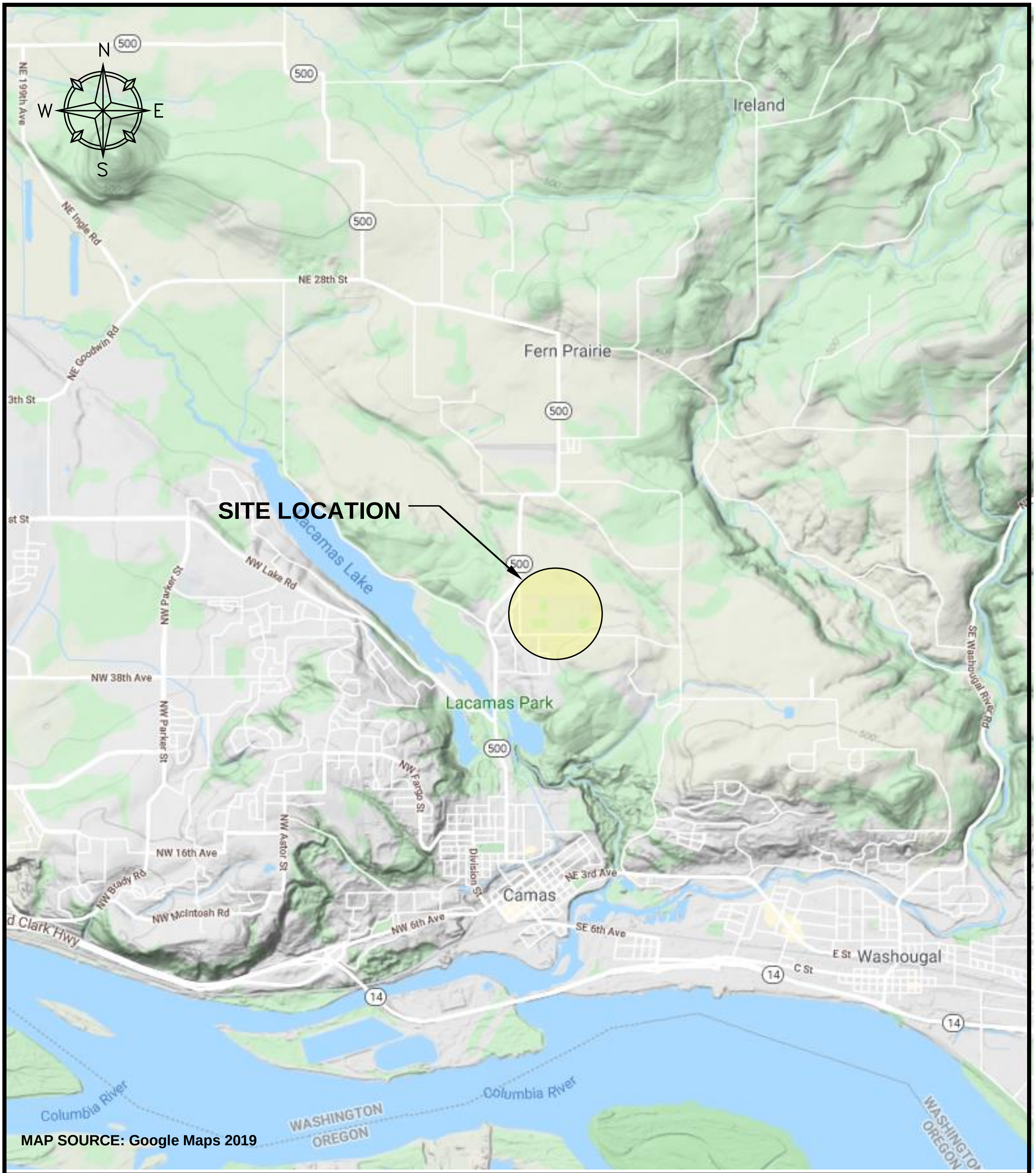

SITE LOCATION

MAP SOURCE: Google Maps 2019

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Design
Checked: GLW
Client: ROBERTSON
Job No.: 19276
CAD File: FIGURE 1
Scale: NTS

Drawn: MCK
Date: 11/18/19

Rev	By	Date

SITE LOCATION MAP

CAMAS HIGH SCHOOL
FIELD HOUSE
CAMAS, WASHINGTON

FIGURE
1

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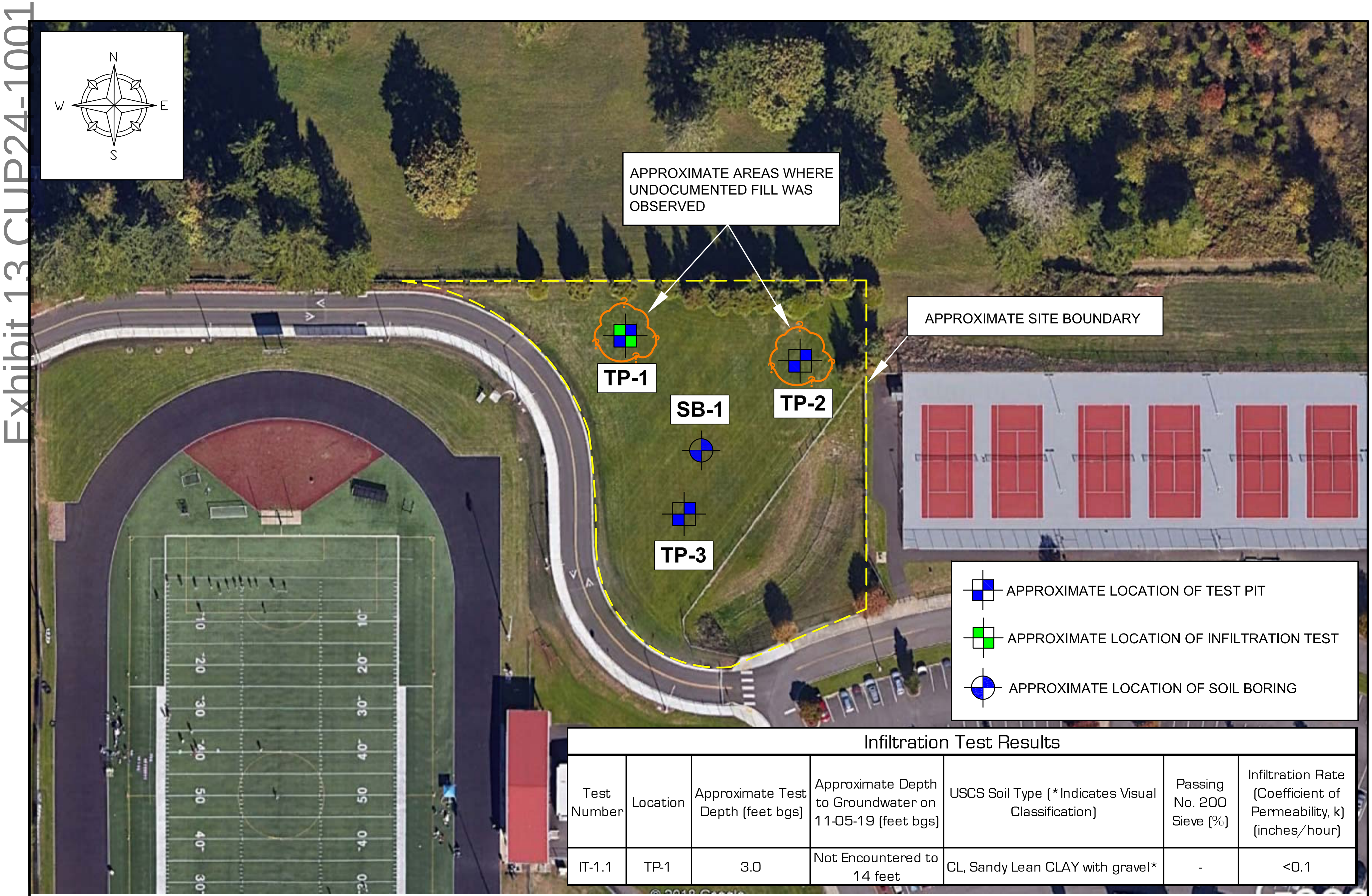

- ▨ APPROXIMATE LOCATION OF TEST PIT
- 🟩 APPROXIMATE LOCATION OF INFILTRATION TEST
- ● APPROXIMATE LOCATION OF SOIL BORING

Infiltration Test Results

Test Number	Location	Approximate Test Depth (feet bgs)	Approximate Depth to Groundwater on 11-05-19 (feet bgs)	USCS Soil Type (*Indicates Visual Classification)	Passing No. 200 Sieve (%)	Infiltration Rate (Coefficient of Permeability, k) (inches/hour)
IT-1.1	TP-1	3.0	Not Encountered to 14 feet	CL, Sandy Lean CLAY with gravel*	-	<0.1

NOTES:

1. SITE LOCATION: 26600 SE 15TH STREET, CAMAS, WASHINGTON.
2. SITE CONSISTS OF A PORTION OF PARCEL 178111000 TOTALING APPROXIMATELY 1.15 ACRES.
3. DRAWING IS NOT TO SCALE.
4. AERIAL IMAGE SOURCED FROM GOOGLE EARTH.
5. EXPLORATION LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.
6. TEST PITS BACKFILLED LOOSELY WITH ONSITE SOIL ON NOVEMBER 5, 2019.
7. SOIL BORING BACKFILLED WITH BENTONITE ON NOVEMBER 11, 2019.
8. INFILTRATION RATES ARE APPROXIMATE COEFFICIENTS OF PERMEABILITY AND DO NOT INCLUDE A FACTOR OF SAFETY.

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Design:	Drawn: MCK			
Checked: GLW	Date: 11/11/19			
Client: ROBERTSON	Rev	By	Date	
Job No: 19276				
CAD File: FIGURE 2				
Scale: NONE				

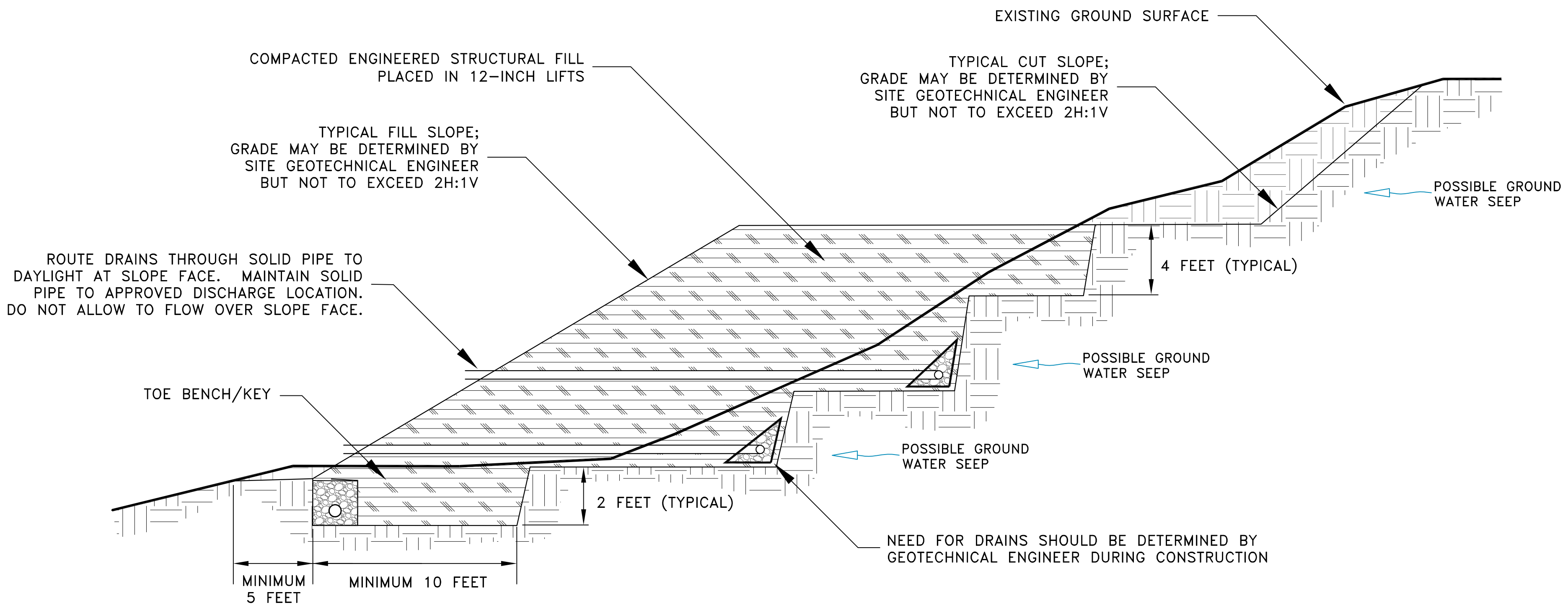
EXPLORATION LOCATION MAP

CAMAS HIGH SCHOOL
FIELD HOUSE
CAMAS, WASHINGTON

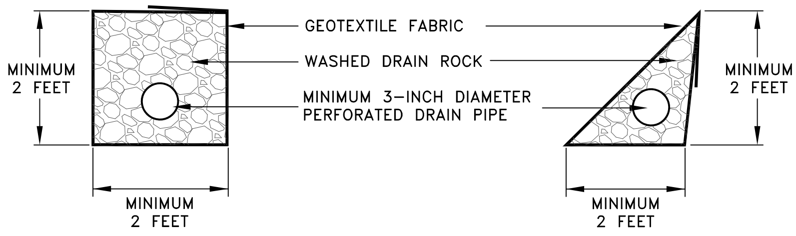
FIGURE
2

Exhibit 13 CUP24-1001

TYPICAL CUT AND FILL SLOPE CROSS-SECTION



TYPICAL DRAIN SECTION DETAIL



DRAIN SPECIFICATIONS

GEOTEXTILE FABRIC SHALL CONSIST OF MIRAFI 140N OR APPROVED EQUIVALENT WITH AOS BETWEEN No. 70 AND No. 100 SIEVE.

WASHED DRAIN ROCK SHALL BE OPEN-GRADED ANGULAR DRAIN ROCK WITH LESS THAN 2 PERCENT PASSING THE No. 200 SIEVE AND A MAXIMUM PARTICLE SIZE OF 3 INCHES.

NOTES:
1. DRAWING IS NOT TO SCALE.
2. SLOPES AND PROFILES SHOWN ARE APPROXIMATE.
3. DRAWING REPRESENTS TYPICAL FILL AND CUT SLOPE SECTION, AND MAY NOT BE SITE-SPECIFIC.

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Design:
Checked: GLW
Client: ROBERTSON
Job No: 19276
CAD File: FIGURE 3
Scale: NONE

Drawn: MCK
Date: 11/18/19

Rev	By	Date

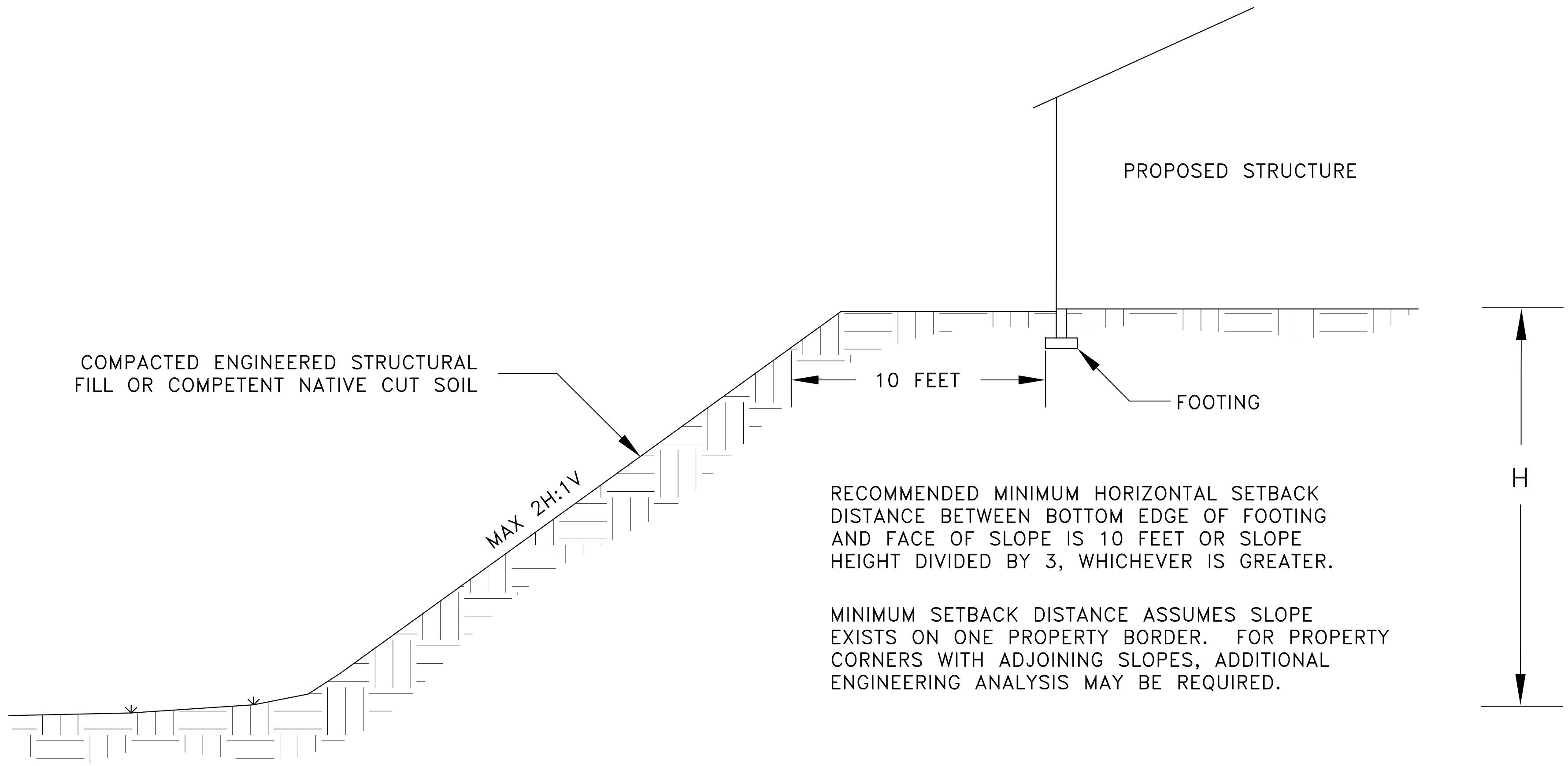
TYPICAL CUT AND FILL
SLOPE CROSS-SECTION

CAMAS HIGH SCHOOL
FIELD HOUSE
CAMAS, WASHINGTON

FIGURE
3

Exhibit 13 CUP24-1001

MINIMUM FOUNDATION SLOPE SETBACK DETAIL



RECOMMENDED MINIMUM HORIZONTAL SETBACK DISTANCE BETWEEN BOTTOM EDGE OF FOOTING AND FACE OF SLOPE IS 10 FEET OR SLOPE HEIGHT DIVIDED BY 3, WHICHEVER IS GREATER.

MINIMUM SETBACK DISTANCE ASSUMES SLOPE EXISTS ON ONE PROPERTY BORDER. FOR PROPERTY CORNERS WITH ADJOINING SLOPES, ADDITIONAL ENGINEERING ANALYSIS MAY BE REQUIRED.

NOTES:
1. DRAWING IS NOT TO SCALE.
2. SLOPES AND PROFILES SHOWN ARE APPROXIMATE.
3. DRAWING REPRESENTS TYPICAL FOUNDATION SETBACK DETAIL, AND MAY NOT BE SITE-SPECIFIC.

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Design:	Drawn: MCK			
Checked: GLW	Date: 11/18/19			
Client: ROBERTSON	Rev	By	Date	
Job No: 19276				
CAD File: FIGURE 4				
Scale: NONE				

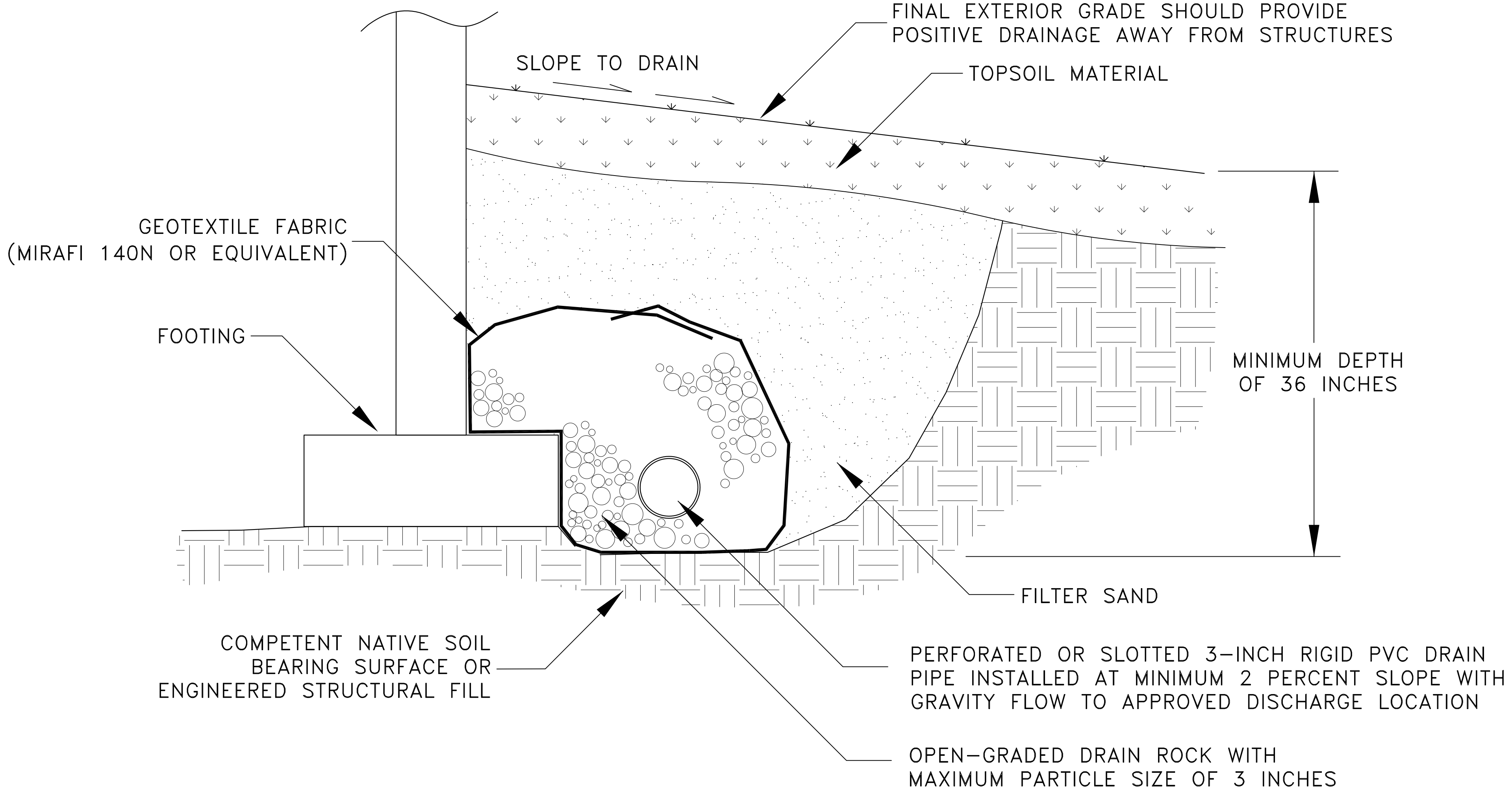
TYPICAL MINIMUM SLOPE SETBACK DETAIL

CAMAS HIGH SCHOOL
FIELD HOUSE
CAMAS, WASHINGTON

FIGURE
4

Exhibit 13 CUP24-1001

TYPICAL PERIMETER FOOTING DRAIN DETAIL



NOTES:
1. DRAWING IS NOT TO SCALE.
2. DRAWING REPRESENTS TYPICAL FOOTING DRAIN DETAIL AND MAY NOT BE SITE–SPECIFIC.

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Design:
Checked: GLW
Client: ROBERTSON
Job No: 19276
CAD File: FIGURE 5
Scale: NONE

Drawn: MCK
Date: 11/18/19

Rev	By	Date

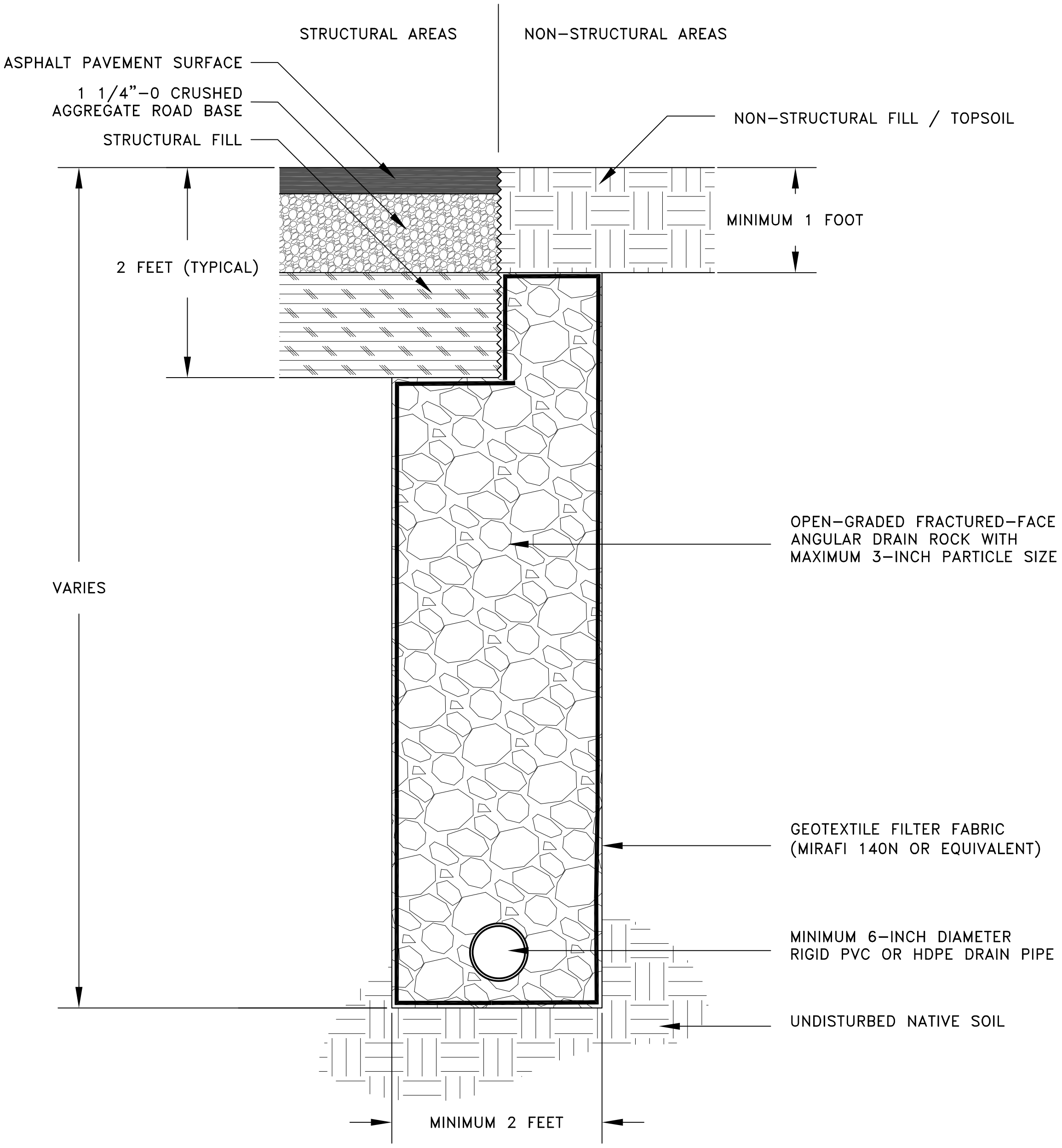
TYPICAL PERIMETER
FOOTING DRAIN DETAIL

CAMAS HIGH SCHOOL
FIELD HOUSE
CAMAS, WASHINGTON

FIGURE
5

Exhibit 13 CUP24-1001

TYPICAL PERFORATED DRAIN PIPE TRENCH DETAIL



NOTE: LOCATION, INVERT ELEVATION, DEPTH OF TRENCH, AND EXTENT OF PERFORATED PIPE REQUIRED MAY BE MODIFIED BY THE GEOTECHNICAL ENGINEER DURING CONSTRUCTION BASED UPON FIELD OBSERVATION AND SITE–SPECIFIC SOIL CONDITIONS.

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Design:	Drawn: MCK			
Checked: GLW	Date: 11/18/19			
Client: ROBERTSON	Rev	By	Date	
Job No: 19276				
CAD File: FIGURE 6				
Scale: NONE				

TYPICAL PERFORATED
DRAIN PIPE TRENCH DETAIL

CAMAS HIGH SCHOOL FIELD HOUSE
CAMAS, WASHINGTON

FIGURE
6

Exhibit 13 CUP24-1001

APPENDIX A
LABORATORY TEST RESULTS

Exhibit 13 CUP24-1001

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Camas High School Field House 26600 SE 15th Street Camas, Washington	Robertson Engineering, PC 1101 Broadway Street, Suite 201 Vancouver, Washington 98660	19276	S19-1115
		REPORT DATE 11/22/19	FIELD ID TP2.1
		DATE SAMPLED 11/05/19	SAMPLED BY MCK

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Fat CLAY with Sand	Test Pit TP-02 depth = 2 feet	CH, Fat Clay with Sand

SPECIFICATIONS	AASHTO SOIL TYPE
none	A-7-6(47)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913

ADDITIONAL DATA

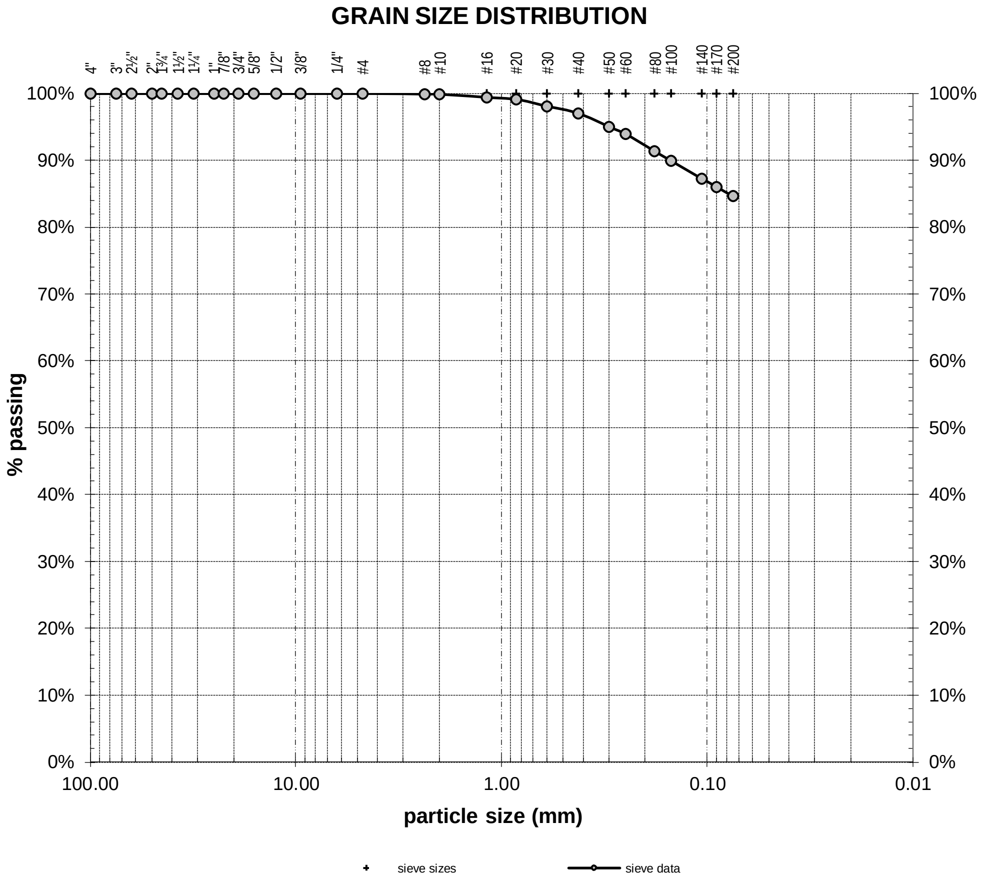
initial dry mass (g) = 159.83
as-received moisture content = 40.1%
liquid limit = 76
plastic limit = 26
plasticity index = 50
fineness modulus = n/a

coefficient of curvature, C_C = n/a
coefficient of uniformity, C_U = n/a
effective size, $D_{(10)}$ = n/a
$D_{(30)}$ = n/a
$D_{(60)}$ = n/a

SIEVE DATA

% gravel = 0.0%
% sand = 15.3%
% silt and clay = 84.7%

	SIEVE SIZE		PERCENT PASSING			
			SIEVE		SPECS	
	US	mm	act.	interp.	max	min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50		100%		
	1/4"	6.30		100%		
	#4	4.75	100%			
SAND	#8	2.36		100%		
	#10	2.00	100%			
	#16	1.18		99%		
	#20	0.850	99%			
	#30	0.600		98%		
	#40	0.425	97%			
	#50	0.300		95%		
	#60	0.250	94%			
	#80	0.180		91%		
	#100	0.150	90%			
	#140	0.106		87%		
	#170	0.090		86%		
	#200	0.075	85%			



DATE TESTED	TESTED BY
11/19/19	BTT

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ATTERBERG LIMITS REPORT

PROJECT Camas High School Field House 26600 SE 15th Street Camas, Washington	CLIENT Robertson Engineering, PC 1101 Broadway Street, Suite 201 Vancouver, Washington 98660	PROJECT NO. 19276 REPORT DATE 11/22/19 DATE SAMPLED 11/05/19	LAB ID S19-1115 FIELD ID TP2.1 SAMPLED BY MCK

MATERIAL DATA

MATERIAL SAMPLED Fat CLAY with Sand	MATERIAL SOURCE Test Pit TP-02 depth = 2 feet	USCS SOIL TYPE CH, Fat Clay with Sand

LABORATORY TEST DATA

LABORATORY EOUIPMENT Liquid Limit Machine, Hand Rolled	TEST PROCEDURE ASTM D4318

ATTERBERG LIMITS

liquid limit = 76
plastic limit = 26
plasticity index = 50

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	32.21	31.56	31.49	31.50
dry soil + pan weight, g =	27.37	26.91	26.78	26.85
pan weight, g =	20.91	20.77	20.61	20.92
N (blows) =	31	24	21	19
moisture, % =	74.9 %	75.7 %	76.3 %	78.4 %

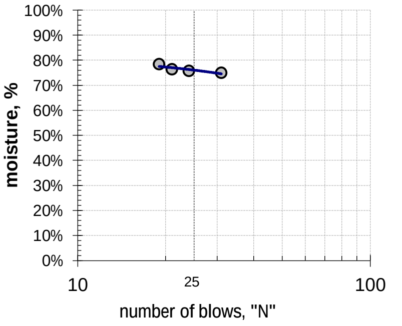
SHRINKAGE

shrinkage limit = n/a
shrinkage ratio = n/a

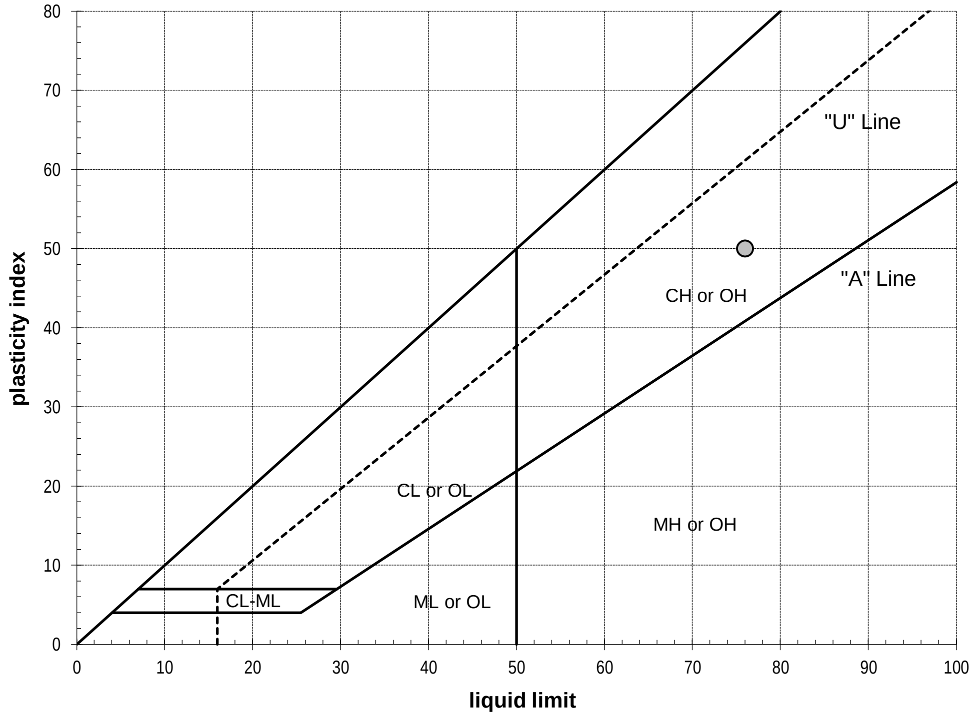
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.15	27.23		
dry soil + pan weight, g =	25.85	25.93		
pan weight, g =	20.74	20.87		
moisture, % =	25.4 %	25.7 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.0%
% sand =	15.3%
% silt and clay =	84.7%
% silt =	n/a
% clay =	n/a
moisture content =	40.1%

DATE TESTED 11/21/19	TESTED BY KMS

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Camas High School Field House 26600 SE 15th Street Camas, Washington	Robertson Engineering, PC 1101 Broadway Street, Suite 201 Vancouver, Washington 98660	19276	S19-1116
		REPORT DATE 11/22/19	FIELD ID TP2.3
		DATE SAMPLED 11/05/19	SAMPLED BY MCK

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Poorly graded GRAVEL with Silt and Sand	Test Pit TP-02 depth = 9 feet	GP-GM, Poorly graded gravel with silt and sand

SPECIFICATIONS	AASHTO SOIL TYPE
none	A-2-7(0)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913

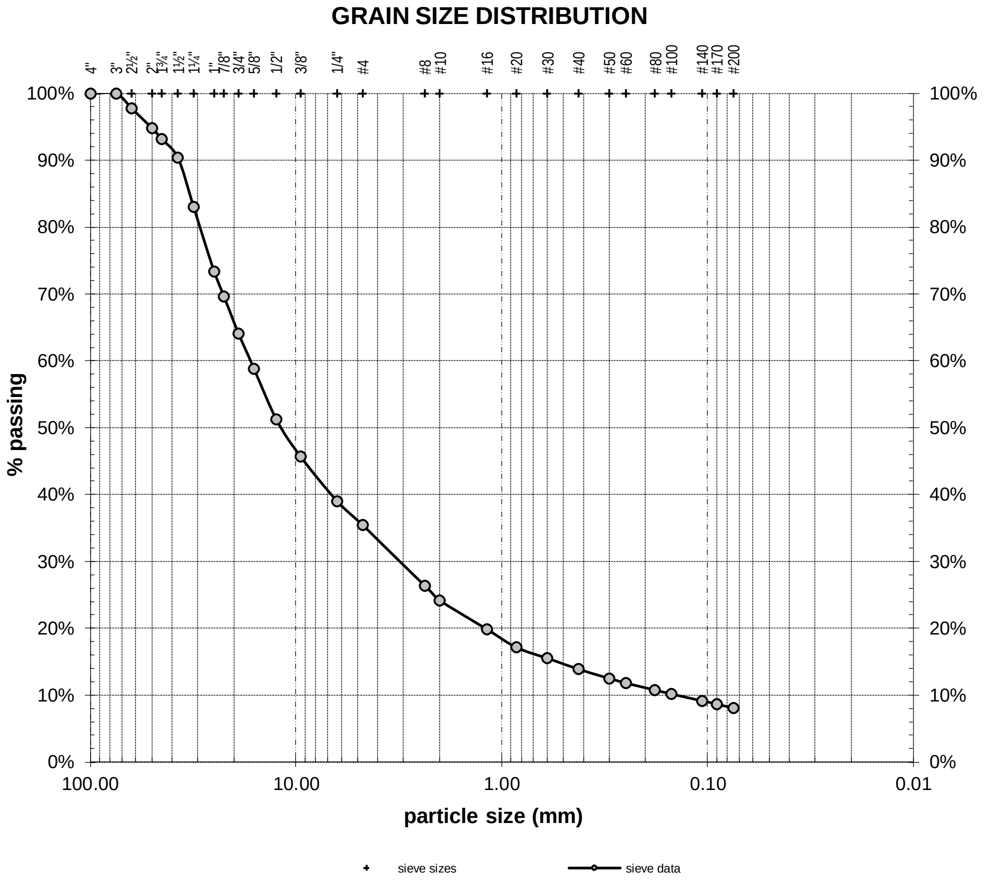
ADDITIONAL DATA

initial dry mass (g) = 17836.8
as-received moisture content = 18.7%
liquid limit = 47
plastic limit = 29
plasticity index = 18
fineness modulus = n/a

coefficient of curvature, C_C = 4.19
coefficient of uniformity, C_U = 118.56
effective size, $D_{(10)}$ = 0.140 mm
$D_{(30)}$ = 3.122 mm
$D_{(60)}$ = 16.612 mm

SIEVE DATA

% gravel = 64.6%
% sand = 27.3%
% silt and clay = 8.1%



	SIEVE SIZE		PERCENT PASSING			
			SIEVE		SPECS	
	US	mm	act.	interp.	max	min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0	100%			
	2.50"	63.0		98%		
	2.00"	50.0	95%			
	1.75"	45.0		93%		
	1.50"	37.5	90%			
	1.25"	31.5		83%		
	1.00"	25.0	73%			
	7/8"	22.4		70%		
	3/4"	19.0	64%			
	5/8"	16.0		59%		
	1/2"	12.5	51%			
	3/8"	9.50	46%			
	1/4"	6.30	39%			
	#4	4.75	35%			
SAND	#8	2.36		26%		
	#10	2.00	24%			
	#16	1.18		20%		
	#20	0.850	17%			
	#30	0.600		16%		
	#40	0.425	14%			
	#50	0.300		13%		
	#60	0.250	12%			
	#80	0.180		11%		
	#100	0.150	10%			
	#140	0.106		9%		
	#170	0.090		9%		
	#200	0.075	8%			

DATE TESTED	TESTED BY
11/19/19	BTT

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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Camas High School Field House 26600 SE 15th Street Camas, Washington	Robertson Engineering, PC 1101 Broadway Street, Suite 201 Vancouver, Washington 98660	19276	S19-1116
		REPORT DATE 11/22/19	FIELD ID TP2.3
		DATE SAMPLED 11/05/19	SAMPLED BY MCK

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Poorly graded GRAVEL with Silt and Sand	Test Pit TP-02 depth = 9 feet	GP-GM, Poorly graded gravel with silt and sand

LABORATORY TEST DATA

LABORATORY EOUIPMENT	TEST PROCEDURE
Liquid Limit Machine, Hand Rolled	ASTM D4318

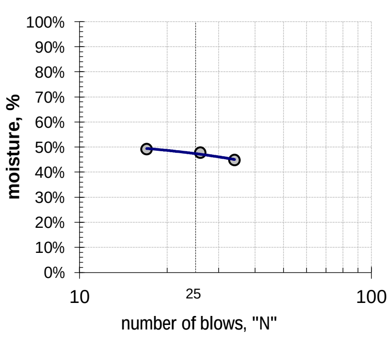
ATTERBERG LIMITS

liquid limit = 47
plastic limit = 29
plasticity index = 18

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	34.55	34.45	34.82	
dry soil + pan weight, g =	30.30	30.04	30.22	
pan weight, g =	20.80	20.79	20.86	
N (blows) =	34	26	17	
moisture, % =	44.7 %	47.7 %	49.2 %	

LIQUID LIMIT



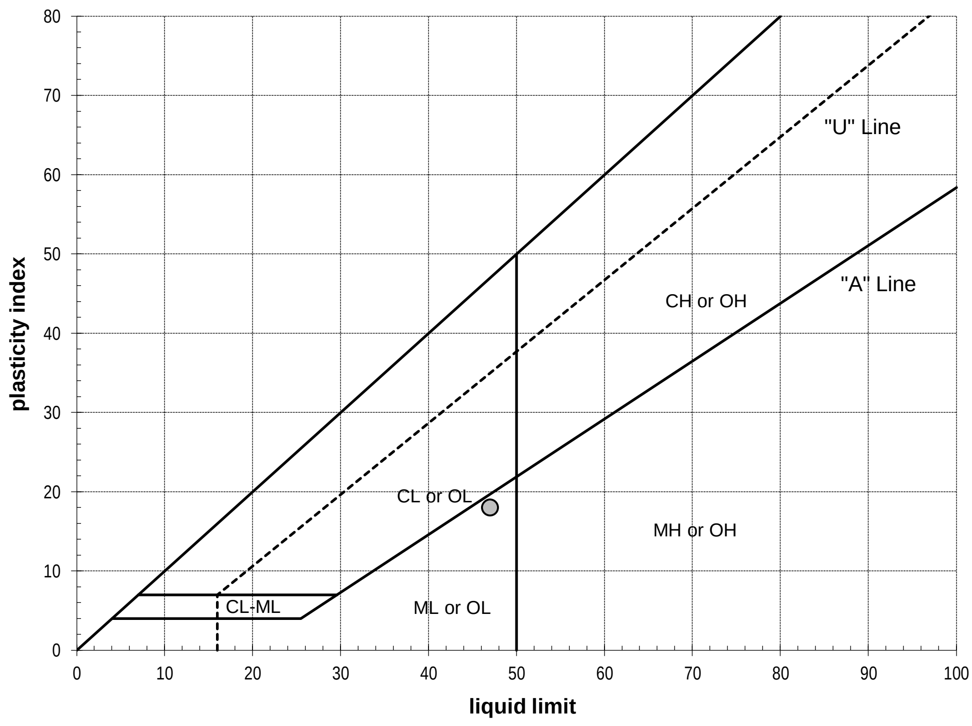
SHRINKAGE

shrinkage limit = n/a
shrinkage ratio = n/a

PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.60	27.15		
dry soil + pan weight, g =	26.05	25.67		
pan weight, g =	20.75	20.60		
moisture, % =	29.3 %	29.2 %		

PLASTICITY CHART



ADDITIONAL DATA

% gravel =	64.6%
% sand =	27.3%
% silt and clay =	8.1%
% silt =	n/a
% clay =	n/a
moisture content =	18.7%

DATE TESTED	TESTED BY
11/21/19	KMS

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT
Camas High School Field House
26600 SE 15th Street
Camas, Washington

CLIENT
Robertson Engineering, PC
1101 Broadway Street, Suite 201
Vancouver, Washington 98660

PROJECT NO.	LAB ID
19276	S19-1109
REPORT DATE	**FIELD ID**
11/20/19	SB1.9
DATE SAMPLED	**SAMPLED BY**
11/11/19	MCK

MATERIAL DATA

MATERIAL SAMPLED
Silty SAND

MATERIAL SOURCE
Soil Boring SB-01
depth = 35 feet

USCS SOIL TYPE
SM, Silty Sand

SPECIFICATIONS
none

AASHTO SOIL TYPE
A-7-5(5)

LABORATORY TEST DATA

LABORATORY EQUIPMENT
Rainhart "Mary Ann" Sifter 637

TEST PROCEDURE
ASTM D6913

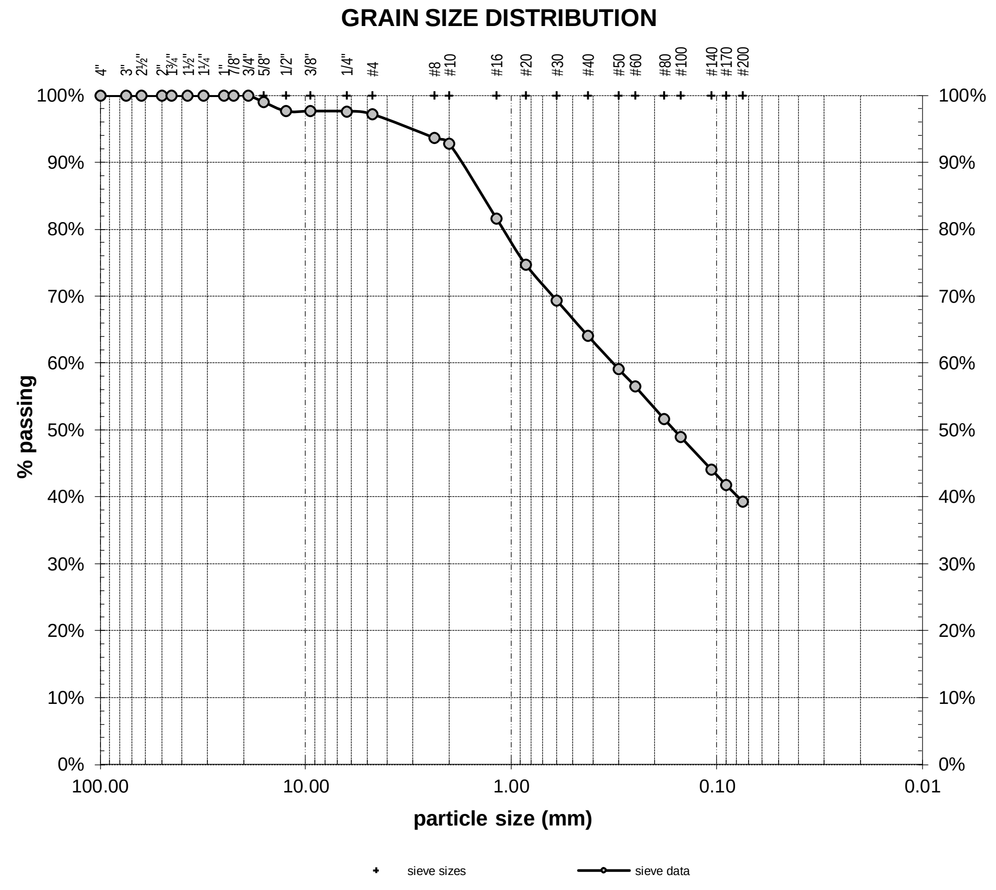
ADDITIONAL DATA

initial dry mass (g) = 112.40
as-received moisture content = 56.0%
liquid limit = 57
plastic limit = 33
plasticity index = 24
fineness modulus = n/a

coefficient of curvature, C_C = n/a
coefficient of uniformity, C_U = n/a
effective size, $D_{(10)}$ = n/a
$D_{(30)}$ = n/a
$D_{(60)}$ = 0.319 mm

SIEVE DATA

% gravel = 2.7%
% sand = 58.0%
% silt and clay = 39.3%



	SIEVE SIZE		PERCENT PASSING			
			SIEVE		SPECS	
	US	mm	act.	interp.	max	min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0	100%			
	5/8"	16.0		99%		
	1/2"	12.5	98%			
	3/8"	9.50		98%		
	1/4"	6.30	98%			
	#4	4.75	97%			
SAND	#8	2.36		94%		
	#10	2.00	93%			
	#16	1.18		82%		
	#20	0.850	75%			
	#30	0.600		69%		
	#40	0.425	64%			
	#50	0.300		59%		
	#60	0.250	57%			
	#80	0.180		52%		
	#100	0.150	49%			
	#140	0.106		44%		
	#170	0.090		42%		
	#200	0.075	39%			

DATE TESTED	TESTED BY
11/14/19	BTT

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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Camas High School Field House 26600 SE 15th Street Camas, Washington	Robertson Engineering, PC 1101 Broadway Street, Suite 201 Vancouver, Washington 98660	19276	S19-1109
		REPORT DATE	FIELD ID
		11/20/19	SB1.9
		DATE SAMPLED	SAMPLED BY
		11/11/19	MCK

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Silty SAND	Soil Boring SB-01 depth = 35 feet	SM, Silty Sand

LABORATORY TEST DATA

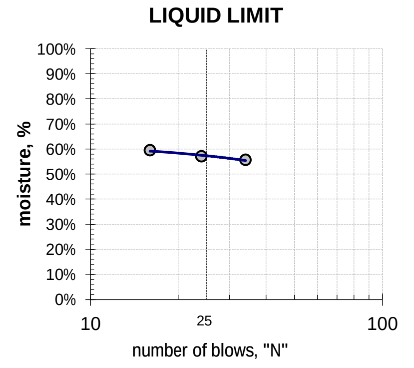
LABORATORY EOUIPMENT	TEST PROCEDURE
Liquid Limit Machine, Hand Rolled	ASTM D4318

ATTERBERG LIMITS

liquid limit = 57
plastic limit = 33
plasticity index = 24

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	32.46	32.26	32.16	
dry soil + pan weight, g =	28.30	28.12	27.94	
pan weight, g =	20.82	20.86	20.84	
N (blows) =	34	24	16	
moisture, % =	55.6 %	57.1 %	59.4 %	

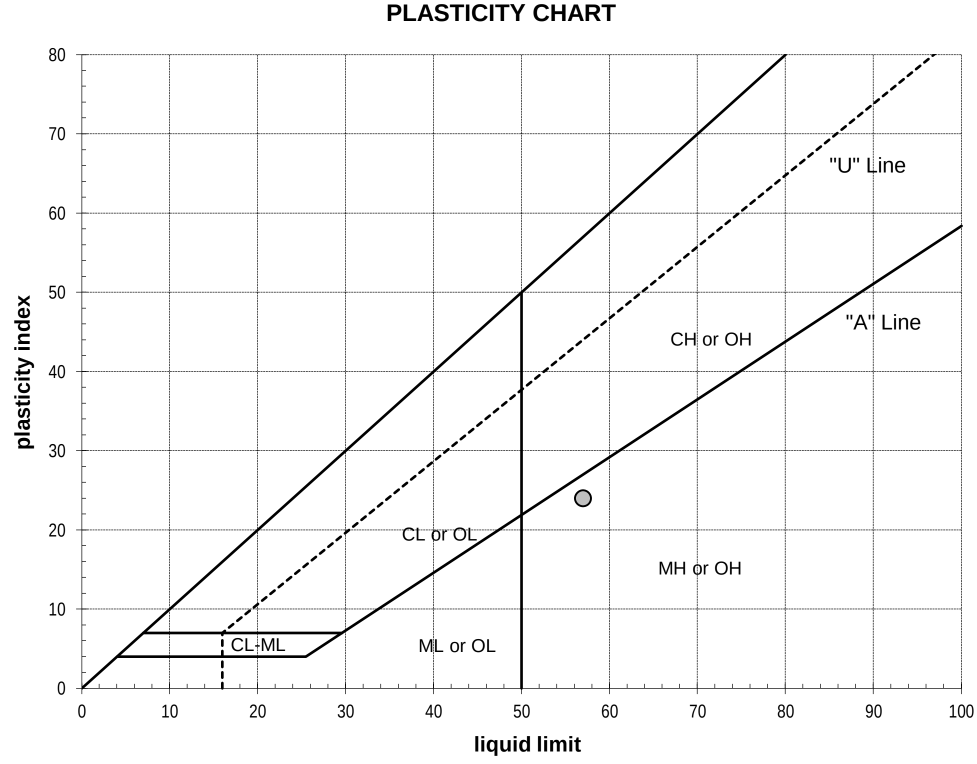


SHRINKAGE

shrinkage limit = n/a
shrinkage ratio = n/a

PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.17	27.46		
dry soil + pan weight, g =	25.60	25.76		
pan weight, g =	20.87	20.68		
moisture, % =	33.2 %	33.5 %		



ADDITIONAL DATA

% gravel = 2.7%
% sand = 58.0%
% silt and clay = 39.3%
% silt = n/a
% clay = n/a
moisture content = 56.0%

DATE TESTED	TESTED BY
11/19/19	KMS

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MOISTURE CONTENT

PROJECT	CLIENT	PROJECT NO.	REPORT DATE
Camas High School Field House 26600 SE 15th Street Camas, Washington	Robertson Engineering, PC 1101 Broadway Street, Suite 201 Vancouver, Washington 98660	19276	11/20/19

DATE SAMPLED: 11/11/19

SAMPLED BY: MCK

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Despatch LEB2

TEST PROCEDURE: ASTM D2216, Method A

LAB ID	CONTAINER MASS	MOIST MASS + PAN	DRY MASS + PAN	MATERIAL DESCRIPTION	FIELD ID	SAMPLE DEPTH	MOISTURE CONTENT
S19-1105	86.83	350.94	283.13	sandy clay	SB1.1	2.5 feet	35%
S19-1106	87.70	308.23	260.08	sandy clay with gravel	SB1.3	7.5 feet	28%
S19-1107	87.20	370.48	324.81	clayey gravel with sand	SB1.4	15 feet	19%
S19-1108	87.37	313.29	264.70	sandy clay with gravel	SB1.6	25 feet	27%
S19-1109	87.61	276.89	208.95	Silty SAND weathered conglomerate	SB1.9	35 feet	56%
S19-1110	85.26	274.90	210.70	sandy silt/clay weathered conglomerate	SB1.11	45 feet	51%

NOTES:

DATE TESTED	TESTED BY
11/13/19	KMS

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APPENDIX B
SUBSURFACE EXPLORATION LOGS

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TEST PIT LOG

PROJECT NAME Camas High School Field House	CLIENT Robertson Engineering, PC		PROJECT NO. 19276	TEST PIT NO. TP-1
PROJECT LOCATION Camas, Washington	CONTRACTOR L&S Contractors	EQUIPMENT Excavator	ENGINEER MCK	DATE 11/05/19
TEST PIT LOCATION See Figure 2	APPROX. SURFACE ELEVATION 378 ft amsl	GROUNDWATER DEPTH Not Encountered	START TIME 0923	FINISH TIME 1145

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0					▩	FILL. Approximately 8 to 10 inches of grass and topsoil underlain by apprent reworked tan, mottled, moist, medium dense clayey sand with gravel [Soil Type 1].					
		Hesson clay loam	A-7	CL	▨	Brown, moist, medium stiff sandy lean CLAY with gravel [Soil Type 2].					IT-1.1 ⊓ D = 3.0-ft k = < 0.1 in/hr
5 10			A-7	GP-GM SM	◌	Tan to orange-brown, mottled, weathered, moist, medium dense sedimentary CONGLOMERATE of poorly-graded gravel in a sand, silt, and clay matrix [Soil Type 4]. Soil may represent unconsolidated to cemented, thick-bedded, pebble to boulder sedimentary CONGLOMERATE of Evarts, 2008.					
15 20						Bottom of test pit at 14 feet bgs. Groundwater not observed to 14 feet bgs on 11/05/19.					

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TEST PIT LOG

PROJECT NAME Camas High School Field House	CLIENT Robertson Engineering, PC		PROJECT NO. 19276	TEST PIT NO. TP-2
PROJECT LOCATION Camas, Washington	CONTRACTOR L&S Contractors	EQUIPMENT Excavator	ENGINEER MCK	DATE 11/05/19
TEST PIT LOCATION See Figure 2	APPROX. SURFACE ELEVATION 381 ft amsl	GROUNDWATER DEPTH Not Encountered	START TIME 0958	FINISH TIME 1029

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0					▩	FILL. Approximately 6 to 8 inches of grass and topsoil underlain by apparent reworked tan, mottled, moist, medium dense clayey sand with gravel [Soil Type 1].					
	TP2.1	Hesson clay loam	A-7-6(47)	CH	▨	Gray, mottled, moist, stiff fat CLAY with sand [Soil Type 3].	40.1	84.7	76	50	
			A-7	CL	▨	Brown, moist, medium stiff sandy lean CLAY with gravel [Soil Type 2].					
5				GP-GM SM	○	Tan to orange-brown, mottled, weathered, moist, medium dense sedimentary CONGLOMERATE of poorly-graded gravel in a sand, silt, and clay matrix [Soil Type 4]. Soil may represent unconsolidated to cemented, thick-bedded, pebble to boulder sedimentary CONGLOMERATE of Evarts, 2008.					
	TP2.3		A-2-7(0)		○		18.7	8.1	47	18	
10					○						
						Bottom of test pit at 13 feet bgs. Groundwater not observed to 13 feet bgs on 11/05/19.					
15											
20											

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TEST PIT LOG

PROJECT NAME Camas High School Field House	CLIENT Robertson Engineering, PC	PROJECT NO. 19276	TEST PIT NO. TP-3
PROJECT LOCATION Camas, Washington	CONTRACTOR L&S Contractors	EQUIPMENT Excavator	ENGINEER MCK	DATE 11/05/19
TEST PIT LOCATION See Figure 2	APPROX. SURFACE ELEVATION 378 ft amsl	GROUNDWATER DEPTH Not Encountered	START TIME 1031	FINISH TIME 1102

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 10 to 12 inches of grass and topsoil					
		Hesson clay loam	A-7	CH	▨	Tan to gray, moist, stiff fat CLAY with sand [Soil Type 3].					
			A-7	GP-GM SM	○	Tan to orange-brown, mottled, weathered, moist, medium dense sedimentary CONGLOMERATE of poorly-graded gravel in a sand, silt, and clay matrix [Soil Type 4]. Soil may represent unconsolidated to cemented, thick-bedded, pebble to boulder sedimentary CONGLOMERATE of Evarts, 2008.					
5											
10											
						Bottom of test pit at 14 feet bgs. Groundwater not observed to 14 feet bgs on 11/05/19.					
15											
20											

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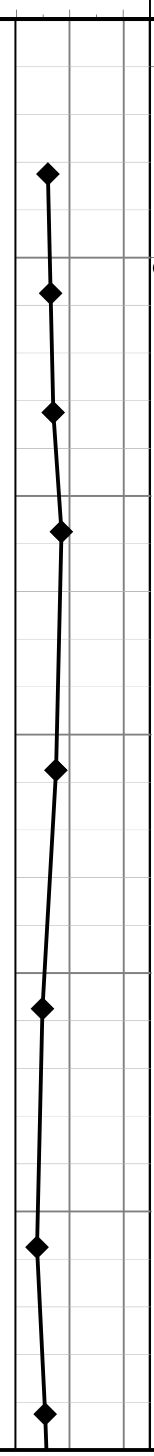
SOIL BORING LOG

PROJECT NAME Camas High School Field House	CLIENT Robertson Engineering, PC		PROJECT NO. 19276	BORING NO. SB-1
PROJECT LOCATION Camas, Washington	DRILLING CONTRACTOR Western States	DRILL RIG CME Track-Rig	ENGINEER MCK	PAGE NO. 1 of 2
BORING LOCATION See Figure 2	DRILLING METHOD Mud-rotary	SAMPLING METHOD SPT/SHELBY	START DATE 11/11/19	START TIME 0840
REMARKS None	APPROX. SURFACE ELEVATION 379 ft amsl	GROUNDWATER DEPTH Not Observed	FINISH DATE 11/11/19	FINISH TIME 1200



Depth (ft)	Elevation (ft amsl)	Field ID + Sample Type	SPT N-value (uncorrected)	USCS Soil Type	AASHTO Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Wet Density (PCF)	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index
0							Approximately 6 to 8 inches of grass and topsoil.					
				CL	A-7	▨	Brown, mottled, moist, stiff sandy lean CLAY with gravel [Soil Type 2].					
2	376	SPT SB1.1	12						35.0			
4		SPT SB1.2	13	GP-GM SM	A-7-5(5)		Tan to orange-brown, mottled, moderately- to severly-weathered, moist, loose to dense sedimentary CONGLOMERATE of poorly-graded gravel in a sand, silt, and clay matrix [Soil Type 4].					
6	372	SPT SB1.3	14						28.0			
8							Soil may represent unconsolidated to cemented, thick-bedded, pebble to boulder sedimentary CONGLOMERATE of Evarts, 2008.					
10	368	SPT NR	17									
12												
14	364	SPT SB1.4	15						19.0			
16												
18	360											
20		SPT SB1.5	10									
22	356											
24		SPT SB1.6	8						27.0			
26	352	SHELBY SB1.7										
28		SPT SB1.8	11									
30												

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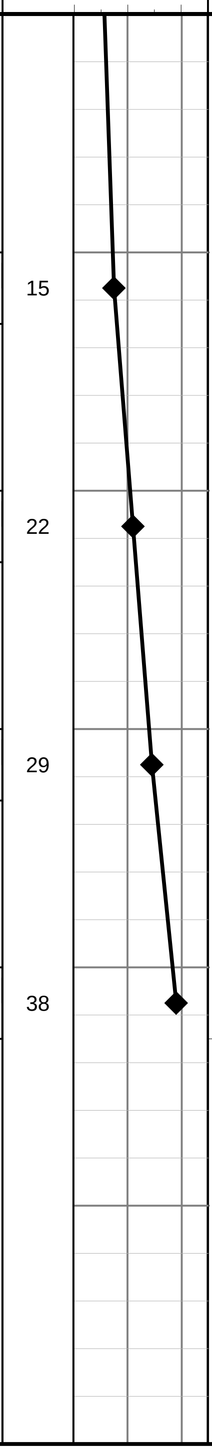
SOIL BORING LOG

PROJECT NAME Camas High School Field House	CLIENT Robertson Engineering, PC		PROJECT NO. 19276	BORING NO. SB-1
PROJECT LOCATION Camas, Washington	DRILLING CONTRACTOR Western States	DRILL RIG CME Track-Rig	ENGINEER MCK	PAGE NO. 2 of 2
BORING LOCATION See Figure 2	DRILLING METHOD Mud-rotary	SAMPLING METHOD SPT/SHELBY	START DATE 11/11/19	START TIME 0840
REMARKS None	APPROX. SURFACE ELEVATION 379 ft amsl	GROUNDWATER DEPTH Not Observed	FINISH DATE 11/11/19	FINISH TIME 1200



Depth (ft)	Elevation (ft amsl)	Field ID + Sample Type	SPT N-value (uncorrected)	USCS Soil Type	AASHTO Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Wet Density (PCF)	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index
30	348						Tan to orange-brown, mottled, moderately- to severly-weathered, moist, loose to dense sedimentary CONGLOMERATE of poorly-graded gravel in a sand, silt, and clay matrix [Soil Type 4].					
36	344	SPT SB1.9	15						56.0	39.3	57	24
40	340	SPT SB1.10	22									
46	332	SPT SB1.11	29						51.0			
50	328	SPT SB1.12	38									
52							Bottom of soil boring at 51.5 feet bgs. Groundwater not not measured due to mud-rotary drilling technique.					

Depth (ft): 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60

Elevation (ft amsl): 348, 344, 340, 336, 332, 328, 324, 320

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APPENDIX C
SOIL CLASSIFICATION INFORMATION

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SOIL DESCRIPTION AND CLASSIFICATION GUIDELINES

Particle-Size Classification

COMPONENT	**ASTM/USCS**		**AASHTO**	
	size range	sieve size range	size range	sieve size range
Cobbles	> 75 mm	greater than 3 inches	> 75 mm	greater than 3 inches
Gravel	75 mm – 4.75 mm	3 inches to No. 4 sieve	75 mm – 2.00 mm	3 inches to No. 10 sieve
Coarse	75 mm – 19.0 mm	3 inches to 3/4-inch sieve	-	-
Fine	19.0 mm – 4.75 mm	3/4-inch to No. 4 sieve	-	-
Sand	4.75 mm – 0.075 mm	No. 4 to No. 200 sieve	2.00 mm – 0.075 mm	No. 10 to No. 200 sieve
Coarse	4.75 mm – 2.00 mm	No. 4 to No. 10 sieve	2.00 mm – 0.425 mm	No. 10 to No. 40 sieve
Medium	2.00 mm – 0.425 mm	No. 10 to No. 40 sieve	-	-
Fine	0.425 mm – 0.075 mm	No. 40 to No. 200 sieve	0.425 mm – 0.075 mm	No. 40 to No. 200 sieve
Fines (Silt and Clay)	< 0.075 mm	Passing No. 200 sieve	< 0.075 mm	Passing No. 200 sieve

Consistency for Cohesive Soil

CONSISTENCY	**SPT N-VALUE (BLOWS PER FOOT)**	**POCKET PENETROMETER (UNCONFINED COMPRESSIVE STRENGTH, tsf)**
Very Soft	2	less than 0.25
Soft	2 to 4	0.25 to 0.50
Medium Stiff	4 to 8	0.50 to 1.0
Stiff	8 to 15	1.0 to 2.0
Very Stiff	15 to 30	2.0 to 4.0
Hard	30 to 60	greater than 4.0
Very Hard	greater than 60	-

Relative Density for Granular Soil

RELATIVE DENSITY	**SPT N-VALUE (BLOWS PER FOOT)**
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	more than 50

Moisture Designations

TERM	**FIELD IDENTIFICATION**
Dry	No moisture. Dusty or dry.
Damp	Some moisture. Cohesive soils are usually below plastic limit and are moldable.
Moist	Grains appear darkened, but no visible water is present. Cohesive soils will clump. Sand will bulk. Soils are often at or near plastic limit.
Wet	Visible water on larger grains. Sand and silt exhibit dilatancy. Cohesive soil can be readily remolded. Soil leaves wetness on the hand when squeezed. Soil is much wetter than optimum moisture content and is above plastic limit.

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AASHTO SOIL CLASSIFICATION SYSTEM

TABLE 1. Classification of Soils and Soil-Aggregate Mixtures

	Granular Materials			Silt-Clay Materials			
General Classification	(35 Percent or Less Passing .075 mm)			(More than 35 Percent Passing 0.075)			
Group Classification	A-1	A-3	A-2	A-4	A-5	A-6	A-7
Sieve analysis, percent passing:							
2.00 mm (No. 10)	-	-	-				
0.425 mm (No. 40)	50 max	51 min	-	-	-	-	-
0.075 mm (No. 200)	25 max	10 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)							
Liquid limit				40 max	41 min	40 max	41 min
Plasticity index	6 max	N.P.		10 max	10 max	11 min	11 min
General rating as subgrade	Excellent to good			Fair to poor			

Note: The placing of A-3 before A-2 is necessary in the "left to right elimination process" and does not indicate superiority of A-3 over A-2.

TABLE 2. Classification of Soils and Soil-Aggregate Mixtures

	Granular Materials							Silt-Clay Materials			
General Classification	(35 Percent or Less Passing 0.075 mm)							(More than 35 Percent Passing 0.075 mm)			
	A-1			A-2							A-7
Group Classification	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7-5, A-7-6
Sieve analysis, percent passing:											
2.00 mm (No. 10)	50 max	-	-	-	-	-	-	-	-	-	-
0.425 mm (No. 40)	30 max	50 max	51 min	-	-	-	-	-	-	-	-
0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid limit				40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11min
Usual types of significant constituent materials	Stone fragments, gravel and sand		Fine sand	Silty or clayey gravel and sand				Silty soils		Clayey soils	
General ratings as subgrade	Excellent to Good							Fair to poor			

Note: Plasticity index of A-7-5 subgroup is equal to or less than LL minus 30. Plasticity index of A-7-6 subgroup is greater than LL minus 30 (see Figure 2).

AASHTO = American Association of State Highway and Transportation Officials

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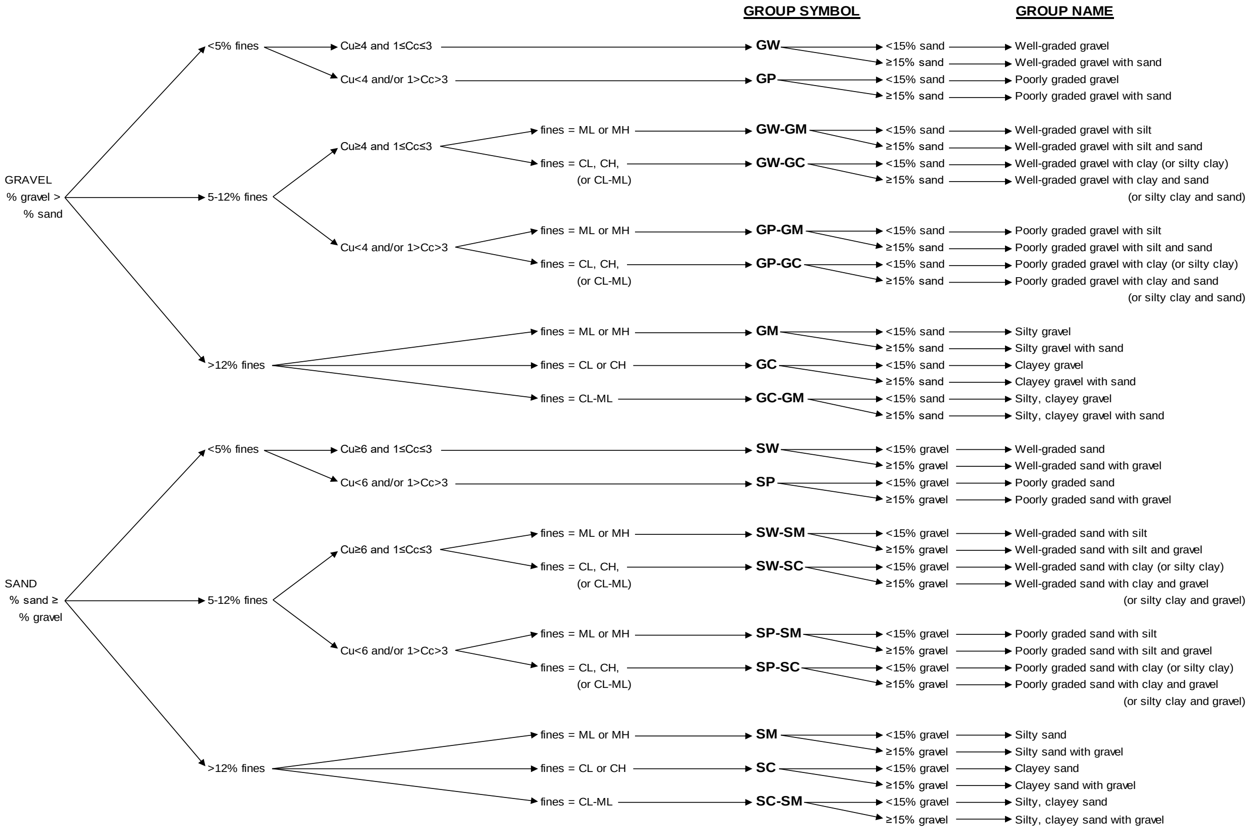
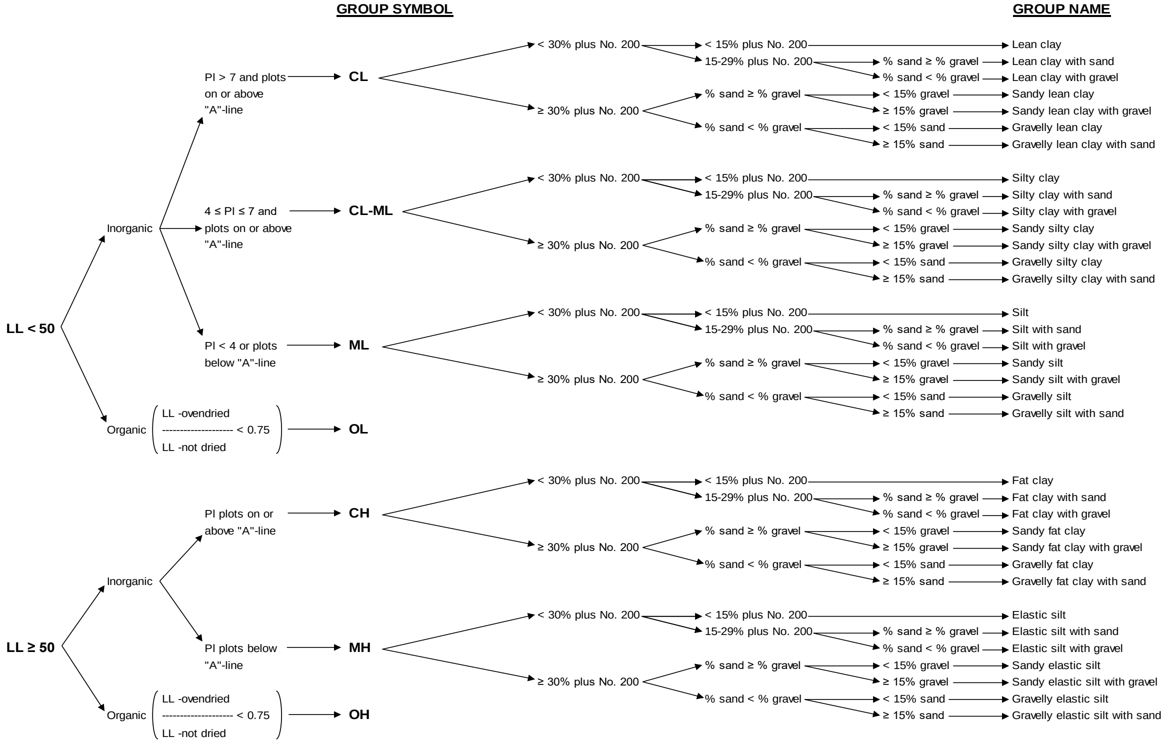
USCS SOIL CLASSIFICATION SYSTEM



Flow Chart for Classifying Coarse-Grained Soils (More Than 50% Retained on No. 200 Sieve)



Flow Chart for Classifying Fine-Grained Soil (50% or More Passes No. 200 Sieve)

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APPENDIX D
PHOTO LOG

Camas High School Field House

November 2019

Camas, Washington

Central Site Area, Facing Southwest

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Camas High School Field House

November 2019

Camas, Washington

Eastern Site Area Facing South

Camas High School Field House

November 2019

Camas, Washington

Test Pit Profile, TP-1

Camas High School Field House

November 2019

Camas, Washington

Test Pit Profile, TP-2

Camas High School Field House

November 2019

Camas, Washington

Test Pit Profile, TP-3

Camas High School Field House

November 2019

Camas, Washington

Soil Boring, SB-1

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APPENDIX E
REPORT LIMITATIONS AND IMPORTANT INFORMATION

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Geotechnical ■ Environmental ■ Special Inspections
Columbia West
Engineering, Inc

Date: December 20, 2019
Project: Camas High School Field House
Camas, Washington

Geotechnical and Environmental Report Limitations and Important Information

Report Purpose, Use, and Standard of Care

This report has been prepared in accordance with standard fundamental principles and practices of geotechnical engineering and/or environmental consulting, and in a manner consistent with the level of care and skill typical of currently practicing local engineers and consultants. This report has been prepared to meet the specific needs of specific individuals for the indicated site. It may not be adequate for use by other consultants, contractors, or engineers, or if change in project ownership has occurred. It should not be used for any other reason than its stated purpose without prior consultation with Columbia West Engineering, Inc. (Columbia West). It is a unique report and not applicable for any other site or project. If site conditions are altered, or if modifications to the project description or proposed plans are made after the date of this report, it may not be valid. Columbia West cannot accept responsibility for use of this report by other individuals for unauthorized purposes, or if problems occur resulting from changes in site conditions for which Columbia West was not aware or informed.

Report Conclusions and Preliminary Nature

This geotechnical or environmental report should be considered preliminary and summary in nature. The recommendations contained herein have been established by engineering interpretations of subsurface soils based upon conditions observed during site exploration. The exploration and associated laboratory analysis of collected representative samples identifies soil conditions at specific discreet locations. It is assumed that these conditions are indicative of actual conditions throughout the subject property. However, soil conditions may differ between tested locations at different seasonal times of the year, either by natural causes or human activity. Distinction between soil types may be more abrupt or gradual than indicated on the soil logs. This report is not intended to stand alone without understanding of concomitant instructions, correspondence, communication, or potential supplemental reports that may have been provided to the client.

Because this report is based upon observations obtained at the time of exploration, its adequacy may be compromised with time. This is particularly relevant in the case of natural disasters, earthquakes, floods, or other significant events. Report conclusions or interpretations may also be subject to revision if significant development or other manmade impacts occur within or in proximity to the subject property. Groundwater conditions, if presented in this report, reflect observed conditions at the time of investigation. These conditions may change annually, seasonally or as a result of adjacent development.

Additional Investigation and Construction QA/QC

Columbia West should be consulted prior to construction to assess whether additional investigation above and beyond that presented in this report is necessary. Even slight variations in soil or site conditions may produce impacts to the performance of structural facilities if not adequately addressed. This underscores the importance of diligent QA/QC construction observation and testing to verify soil conditions do not differ materially or significantly from the interpreted conditions utilized for preparation of this report.

Therefore, this report contains several recommendations for field observation and testing by Columbia West personnel during construction activities. Actual subsurface conditions are more readily observed and discerned during the earthwork phase of construction when soils are exposed. Columbia West cannot accept responsibility for deviations from recommendations described in this report or future

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performance of structural facilities if another consultant is retained during the construction phase or Columbia West is not engaged to provide construction observation to the full extent recommended.

Collected Samples

Uncontaminated samples of soil or rock collected in connection with this report will be retained for thirty days. Retention of such samples beyond thirty days will occur only at client's request and in return for payment of storage charges incurred. All contaminated or environmentally impacted materials or samples are the sole property of the client. Client maintains responsibility for proper disposal.

Report Contents

This geotechnical or environmental report should not be copied or duplicated unless in full, and even then only under prior written consent by Columbia West, as indicated in further detail in the following text section entitled *Report Ownership*. The recommendations, interpretations, and suggestions presented in this report are only understandable in context of reference to the whole report. Under no circumstances should the soil boring or test pit excavation logs, monitor well logs, or laboratory analytical reports be separated from the remainder of the report. The logs or reports should not be redrawn or summarized by other entities for inclusion in architectural or civil drawings, or other relevant applications.

Report Limitations for Contractors

Geotechnical or environmental reports, unless otherwise specifically noted, are not prepared for the purpose of developing cost estimates or bids by contractors. The extent of exploration or investigation conducted as part of this report is usually less than that necessary for contractor's needs. Contractors should be advised of these report limitations, particularly as they relate to development of cost estimates. Contractors may gain valuable information from this report, but should rely upon their own interpretations as to how subsurface conditions may affect cost, feasibility, accessibility and other components of the project work. If believed necessary or relevant, contractors should conduct additional exploratory investigation to obtain satisfactory data for the purposes of developing adequate cost estimates. Clients or developers cannot insulate themselves from attendant liability by disclaiming accuracy for subsurface ground conditions without advising contractors appropriately and providing the best information possible to limit potential for cost overruns, construction problems, or misunderstandings.

Report Ownership

Columbia West retains the ownership and copyright property rights to this entire report and its contents, which may include, but may not be limited to, figures, text, logs, electronic media, drawings, laboratory reports, and appendices. This report was prepared solely for the client, and other relevant approved users or parties, and its distribution must be contingent upon prior express written consent by Columbia West. Furthermore, client or approved users may not use, lend, sell, copy, or distribute this document without express written consent by Columbia West. Client does not own nor have rights to electronic media files that constitute this report, and under no circumstances should said electronic files be distributed or copied. Electronic media is susceptible to unauthorized manipulation or modification, and may not be reliable.

Consultant Responsibility

Geotechnical and environmental engineering and consulting is much less exact than other scientific or engineering disciplines, and relies heavily upon experience, judgment, interpretation, and opinion often based upon media (soils) that are variable, anisotropic, and non-homogenous. This often results in unrealistic expectations, unwarranted claims, and uninformed disputes against a geotechnical or environmental consultant. To reduce potential for these problems and assist relevant parties in better understanding of risk, liability, and responsibility, geotechnical and environmental reports often provide definitive statements or clauses defining and outlining consultant responsibility. The client is encouraged to read these statements carefully and request additional information from Columbia West if necessary.

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SECTION 5 – EXCERPT FROM PRIOR STORM REPORTS

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Appendix E

City of Camas Stormwater Sewer System Operations and Maintenance Manual

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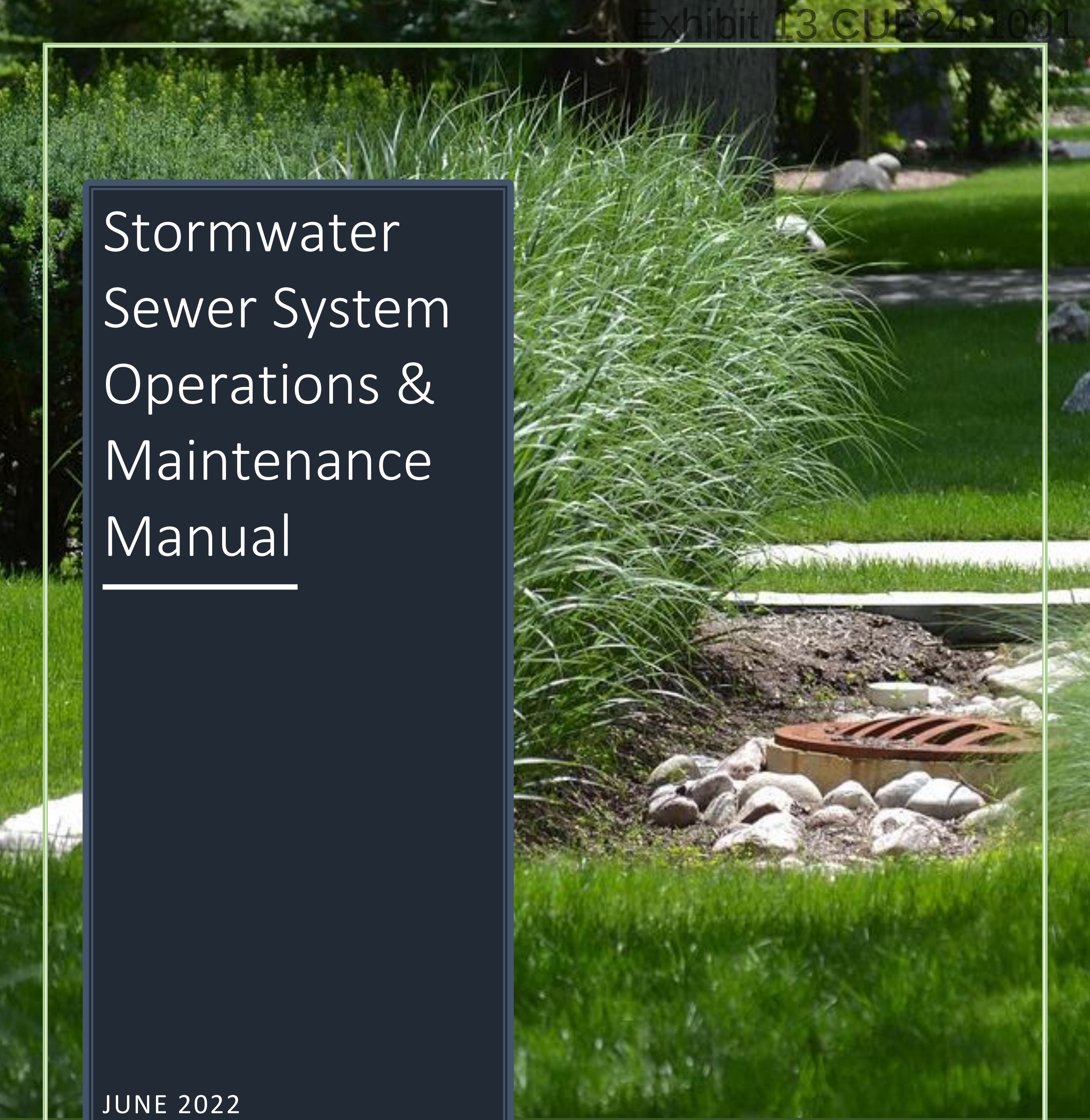

Stormwater Sewer System Operations & Maintenance Manual

JUNE 2022

City of Camas
Stormwater Division | Public Works

City of Camas
WASHINGTON

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Table of Contents

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Introduction

Background

All public and privately owned, roads, parking lots, residential developments, commercial or industrial developments, or school facilities have various components that make up a storm system. These components consist of conveyance pipes, catch basins, manholes, roadside ditches, stormwater facilities (such as bioswales, detention ponds, wet ponds, treatment filters, etc.), landscaping and any other structure that collects, conveys, controls, and/or treats stormwater. Regardless of the component, all storm systems eventually discharge into 'waters of the state' which are streams, rivers, lakes, and wetlands.

Under the Federal Clean Water Act (FCWA) and in compliance with the Department of Ecology's NPDES Phase II Permit, 'waters of the state' are to be protected from contamination. This in turn protects threatened and endangered species under the Federal Endangered Species Act (FESA).

One way to protect 'waters of the state' is to provide the proper maintenance of all storm system components. It is the responsibility of the City of Camas (City) to ensure that all components of the public storm system be properly maintained and operated. The City is responsible for those components that are located within the City's right-of-way, such as the conveyance pipes, manholes, catch basins, roadside ditches, and stormwater facilities. A large part of the stormwater facilities in the City are privately owned and maintained by the property owners. These property owners include, but are not limited to, Homeowners Associations (HOAs), school district, businesses, and commercial/industrial site owners.

Purpose

This manual is intended to help, both public and private stormwater facility maintenance operators, meet the requirements of City Municipal Code 14.02.090 for proper maintenance and operation of the various storm system components. Proper maintenance will help to assure that:

- Stormwater facilities operate as they were designed;
- Storm systems are cleaned of the pollutants that they trap, such as sediment and oils, so that storm systems are not overwhelmed and become pollutant sources;
- Pollutant sources are removed, or minimized, prior to entering the storm system.

Along with keeping a site from flooding, properly maintained storm system can help reduce surface water and groundwater pollution. Most sites have some type of stormwater control component designed to limit the environmental and flooding damage caused by stormwater runoff. These components require more labor intensive maintenance than a system of pipes and catch basins.

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Manual Layout

This manual is broken out into various best management practice (BMP) maintenance components. For each BMP maintenance component, this manual will:

- Briefly describe the component type, e.g. facility or activity.
- Describes potential maintenance issues and/or problems.
- Describes conditions when maintenance is required.
- Minimum performance standards and suggested maintenance methods.

Additional information may be found in other manuals, such as the Washington Department of Ecology's *Stormwater Management Manual for Western Washington (SWMMWW), Vols. V*, and Ecology's LID manual.

Inspection of a stormwater facility will determine if conditions require a maintenance action. The maintenance standard is not the required condition at all times. Exceeding a condition, between inspections and/or maintenance, does not automatically constitute a violation of these standards. The inspection and maintenance schedules should be adjusted to minimize the length of time that a facility is in a condition that requires maintenance.

Emergent Treatment Technologies

Some stormwater treatment facilities are designed and installed with emerging technologies that are not standard at the time of their installation. If not found in this manual, a treatment facility may be an emerging technology approved by Washington Department of Ecology; the maintenance standards can be found at Emerging Stormwater Treatment Technologies.

Mosquito Control

Mosquitoes are annoying and sometimes pose a serious risk to public health. They can transmit diseases such as West Nile Virus and equine encephalitis. Above-ground stormwater facilities should be designed to allow water to flow through or infiltrate in less than 48 hours. Presence of mosquitos in a stormwater facility may indicate a clogged outlet, compromised infiltration capacity, or other defect that should trigger inspection and may require maintenance.

If mosquitos are identified during a stormwater facility maintenance or inspection and are a concern, a request to the Clark County Mosquito Control District for service or information regarding mosquito control can be made online at Mosquito Control District or at the 24-hour request line, 360-397-8430.

Material Disposal and Spills

The disposal of waste, e.g. sediment or standing water, from the maintenance of the stormwater facilities and storm system components shall be conducted in accordance with federal, state, and local regulations, including the Solid Waste Handling Standards chapter 173-350 WAC, Minimum Functional Standards for Solid

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Waste Handling chapter 173-304 WAC and Appendix IV-B: Management of Street Waste Solids and Liquids of the SWMMWW. Dangerous waste must be handled following, Dangerous Waste Regulations chapter 173-303 WAC. Vegetation to be recycled and disposed of at local receptacle locations.

For major spills, coordinate removal/cleanup with the City at 360-817-1563 and notify Department of Ecology at 360-407-6300.

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Vegetated Facilities

Biofiltration Swale

Biofiltration swales use grass or other dense vegetation to filter sediment and oily materials out of stormwater. Usually, they look like flat-bottomed channels with grass growing in them. As water passes through the vegetation, pollutants are removed through the effects of filtration, infiltration and settling.

See SWMMWW Appendix V-A, Table V-A.8 for biofiltration swale maintenance standards. If available, reference record drawings for seed mix and groundcover replacements, or see SWMMWW BMP T9.10, Tables V-7.3 and V-7.4. Presence of cattails is a sign that that there is water ponding and the facility is not functioning as design. Cattails will need to be removed and further investigation may be required.

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Wet Biofiltration Swale

A wet biofiltration swale is a variation of basic biofiltration swale for use where the centerline slope is slight, groundwater table are high, or a continuous low base flow is likely to result in wet soil conditions for long periods of time. Where continuously wet soil exceeds about 2 weeks, typically grasses will die. Thus, vegetation specifically adapted to wet soil conditions is needed. Different vegetation requires modification of several of the design and maintenance requirements from the basic biofiltration swale.

See SWMMWW Appendix V-A, Table V-A.9 for wet biofiltration swale maintenance standards. If available, reference record drawings for seed mix and groundcover replacements, or see SWMMWW BMP T9.20, Table V-7.5. Removal of cattail is required when vegetation is crowded out by very dense clumps of cattails, prevents water flow, or alters the designed functionality.

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Filter Strip

Filter strips are linear strips of grass that remove sediment and oils from stormwater by filtering it. Stormwater is treated as it sheet flows across the filter strip. Usually, filter strips are placed along the edge of linear paved areas, such as parking lots and roads. Where designed filter strips are installed; road shoulders should only be graded to maintain level flow off the road.

See SWMMWW Appendix V-A, Table V-A.10 for filter strip maintenance standards. If available, reference record drawings for seed mix replacement, or see SWMMWW BMP T9.10, Table V-7.3.

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Detention Pond

Detention pond facilities are designed to hold and slowly release stormwater by use of a pond with a specially designed control structure. Styles vary greatly from well-manicured to natural appearing. Generally, native vegetation is preferred for reduced maintenance and enhance wildlife habitat. Some facilities are designed to appear as natural water bodies or are in a park-like setting.

See SWMMWW Appendix V-A, Table V-A.1 for detention pond maintenance standards. If available, reference record drawings for seed mix replacement, or see SWMMWW BMP D.1, Table V-12.3. Removal of cattail is required when vegetation is crowded out by very dense clumps of cattails, prevents water flow, or alters the designed functionality.

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Wet Pond

A wet pond is an open basin that retains a permanent pool of water year-round or only during the wet season. The volume of the wet pond allows sediment and other pollutants to settle out of the runoff. Wetland vegetation is typically planted within the wet pond to provide additional treatment through nutrient removal. Detention quantity control can be provided with additional temporary storage volume above the permanent pool elevation.

See SWMMWW Appendix V-A, Table V-A.11 for wet pond maintenance standards. If available, reference record drawings for seed mix and plants replacement, or see SWMMWW BMP D.1, Table V-12.3 for seed mix and BMP T10.10, Table V-8.1 for plants. Removal of cattail is required when vegetation is crowded out by very dense clumps of cattails, prevents water flow, or alters the designed functionality.

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Infiltration Facility

Infiltration facilities dispose of water by holding it in an area where it can soak into the ground. These are open facilities that may either drain rapidly and have grass bases or have perpetual ponds where water levels rise and fall with stormwater flows. Infiltration facilities may be designed to handle all of the runoff from an area or they may overflow and bypass larger storms.

Since the facility is designed to pass water into the ground, generally after passing through a sediment trap/manhole, anything that can cause the base to clog will reduce the performance and is a large concern. Generally, infiltration basins are managed like detention ponds, but with greater emphasis on maintaining the capacity to infiltrate stormwater.

See SWMMWW Appendix V-A, Table V-A.2 for infiltration facility maintenance standards. If available, reference record drawings for seed mix replacement, or see SWMMWW BMP D.1, Table V-12.3. Removal of cattail is required when vegetation is crowded out by very dense clumps of cattails, prevents water flow, or alters the designed functionality.

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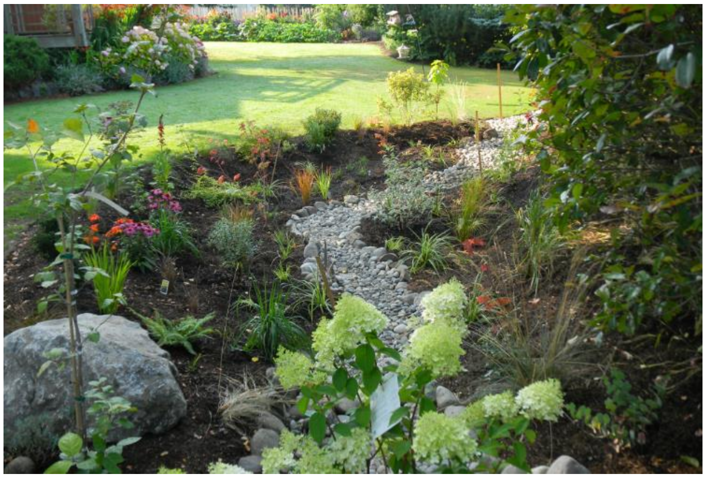
Rain Garden

Rain gardens are non-engineered, shallow, landscaped depressions with compost-amended soils and adapted plants. The depression temporarily stores stormwater runoff from adjacent areas. Some or all the influent stormwater passes through the amended soil profile and into the underlying native soil. Stormwater that exceeds the storage capacity is designed to overflow to an adjacent drainage system.

If available, reference record drawings for plant replacements, or see Rain Garden Handbook for Western Washington, Appendix A for recommendation on rain garden plants. Presence of cattails is a sign that that there is water ponding and the facility is not functioning as design. Cattails will need to be removed and further investigation may be required.



Rain Garden

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Minimum Maintenance Required
General	Trash and Debris	Evidence of trash and debris	Remove trash and debris
Side slopes	Erosion	Persistent soil erosion on slopes	Replenish mulch areas throughout rain garden - on the sides and bottom of the rain garden and around the perimeter (and on berm if applicable).
Bottom area	Sediment	Visible sediment that reduces drainage rate	Remove sediment accumulation
		Sediment deposited from water entering the rain garden	Remove sediment, determine the source, and stabilize area
	Leaves	Matted accumulation of leaves reducing drainage rate	Remove leaves
Ponded water	Ponding	Ponded water remains for more than 3 days after the end of a storm	Remove sediment, leaf litter and/or debris accumulation
Pipe inlet/outlet	Pipe	Water is backing up in pipe	Clear pipes of sediment and debris with snake and/or flush with water
		Damaged or cracked drain pipes	Repair or seal cracks, or replace as needed
Inlet rock pad	Erosion	Rock or cobble is removed, missing and flow is eroding soil.	Replace rock and reestablish pad
Weeds	Weeds	Weeds are present	Remove weeds and apply mulch after weeding
Vegetation	Dying Vegetation	Dying, dead or unhealthy plants	Remove diseased plants or plant parts and dispose, then replace
	Sight Distance	Vegetation reduces sight distances and sidewalk	Keep sidewalks and sight distances on roadways clear
	Blockage	Vegetation is crowding inlets and outlets	Remove vegetation crowding inlets and outlets
	Poor Vegetation Growth	Yellowing, poor growth, poor flowering, spotting or curled leaves, weak roofs, or stems	Test soil to identify specific nutrient deficiencies.
			Do not use synthetic fertilizers
			Consider selecting different plant for soil conditions
Mulch	Bare Soil	Bare spots are present or mulch depth less than 2 inches	Supplement mulch with hand tools to a depth of 2 to 3 inches, keep mulch away from woody stems.

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Bioretention

Bioretention facilities are engineered facilities that store and treat stormwater by filtering it through a specified soil profile. Water that enters the facility ponds in an earthen depression or other basin (e.g., concrete planter) before it infiltrates into the underlaying bioretention soil. Stormwater that exceeds the surface storage capacity overflow to an adjacent drainage system. Treated water is either infiltrated into the underlying native soil or collected by an underdrain and discharged. An underdrain system can be comprised of perforated or slotted pipe, wrapped in an aggregate blanket.

See SWMMWW Appendix V-A, Table V-A.21 for bioretention maintenance standards. If available, reference record drawings for plant replacements, or see LID Technical Guidance Manual for Puget Sound, Appendix 1 for plant recommendations. Presence of cattails is a sign that that there is water ponding and the facility is not functioning as design. Cattails will need to be removed and further investigation may be required.

Conveyance Ditch

Ditches are often manmade open-channels that convey stormwater runoff. These ditches are maintained to prevent localized flooding.

Conveyance Ditch			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
General	Sediment	Sediment exceeds 20% of ditch depth or affects the historic or designed hydraulic capacity.	Remove sediment deposits. When finished, ditch should be level from side to side and drain freely in intended direction.
	Standing Water	Excessive standing water in ditch between storms due to ditch not draining freely	If possible, repair cause of poor drainage. This may include but is not limited to the following activities: remove sediment or trash blockages, improve grade of ditch.
	Eroded or Unstable Side Slopes	When grass is sparse, bare or eroded, patches occur in more than 20% of the ditch	Determine why grass growth is poor and correct that condition. Replant with plugs of grass at eight-inch intervals or reseed. If cause is excessive moisture replace grass with wetland plantings.
	Vegetation	Grass is excessively tall (greater than 15 inches). Nuisance weeds and other vegetation start to take over ditch.	Mow vegetation and/or remove nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 3 to 4 inches.
	Bare Soil	Poor vegetation coverage.	Reseed poor vegetation areas. Reference "Low Grow" seed mix, see SWMMWW BMP C120 Table II-3.4
	Inlet/Outlet Pipes or Culverts	Inlet/outlet area clogged with sediment and/or debris	Remove material so that there is no clogging or blockage in the inlet and outlet area
	Trash and Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping.	Remove trash and debris from ditch.
	Erosion/Scouring	Eroded or scoured ditch bottom	Permanently stabilize ditch bottom

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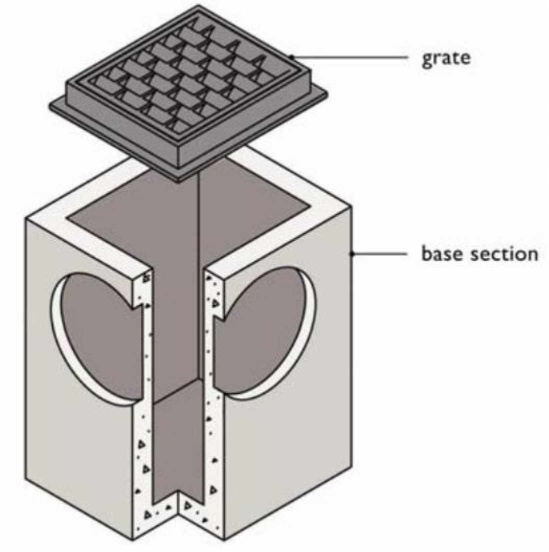
Stormwater Structures

Catch Basin

A catch basin is an underground concrete structure with a slotted grate that collects stormwater runoff and route it through the underground pipes. Catch basins typically provide a sump below the outlet pipe to allow sediment and debris to settle out of the stormwater runoff. Some catch basins are fitted with a spill control device such as an inverted elbow on the outlet pipe to control grease or oils. The most common tool for cleaning catch basins is a vactor truck which is used to remove sediment and debris from the sump. The sediment and oils if not removed from the catch basins have the potential to pollute downstream waterbodies. Unless you have Occupational Safety and Health Administration (OSHA) approved confined space training and equipment, never enter a catch basin. There is a considerable risk of poisonous gas and injury.

See SWMMWW Appendix V-A, Table V-A.5 for catch basin maintenance standards.



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Field/Ditch Inlet

An inlet is a concrete, plastic or steel structure fitted with a slotted grate to collect stormwater runoff and route through underground pipes. A field inlet has a flat grate, and a ditch inlet has an angled grate. These inlets typically provide a sump below the outlet pipe to allow sediment and debris to settle out of the stormwater runoff. Some of these inlets are fitted with a spill control device such as an inverted elbow on the outlet pipe to control grease or oils. The most common tool for cleaning out the inlet is a vactor truck which is used to remove sediment and debris from the sump. The sediment and oils if not removed from the inlet has the potential to pollute downstream water bodies. Unless you have OSHA approved confined space training and equipment, never enter an inlet. There is a considerable risk of poisonous gas and injury.

Field Inlet

Ditch Inlet

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Field Inlet/Ditch Inlet

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Minimum Maintenance Required
General	Trash & Debris	Trash or debris blocking inletting capacity by more than 10%.	Remove trash or debris blocking grate opening.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	Remove dead animals or vegetation present within the field/ditch inlet.
	Sediment	Sediment has accumulated to within six inches of the invert of the lowest pipe	Remove sediment
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch.	Repair top slab to be free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Make adjustments so that frame is sitting flush on the riser rings or top slab and is firmly attached.
	Fractures or Cracks in Field Inlet Walls/Bottom	Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Regrout pipe and secure at field inlet wall.
	Settlement/ Misalignment	If failure of field inlet has created a safety, function, or design problem.	Replace or repair field inlet to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the inlet opening.	Remove vegetation blockage from basin opening.
	Contamination and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Identify and remove source. Notify City at (360) 817-1567.
Metal Grates	Grate Not in Place	Grate is missing or only partially in place. Any open field inlet requires maintenance.	Replace missing grate, cover field inlet
	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Repair grate opening
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Replace missing grate or repair broken member(s)

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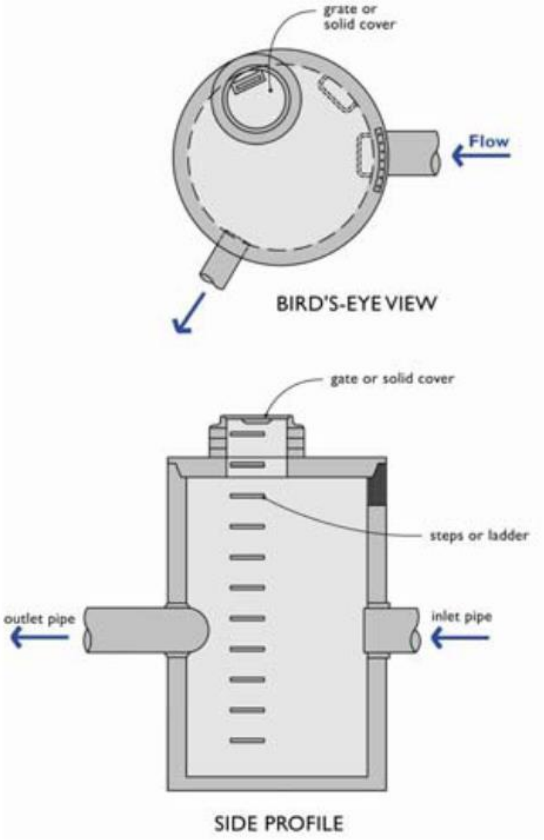
Manhole

Manholes are large cylindrical underground structures usually set at storm sewer pipe connections. Manholes are used in storm sewer system at any change in direction, slope, pipe material or pipe size. Some manholes have sumps and fitted with stormwater flow control structures such as orifices or weirs. Unless you have OSHA approved confined space training and equipment, never enter a manhole. There is a considerable risk of poisonous gas and injury.



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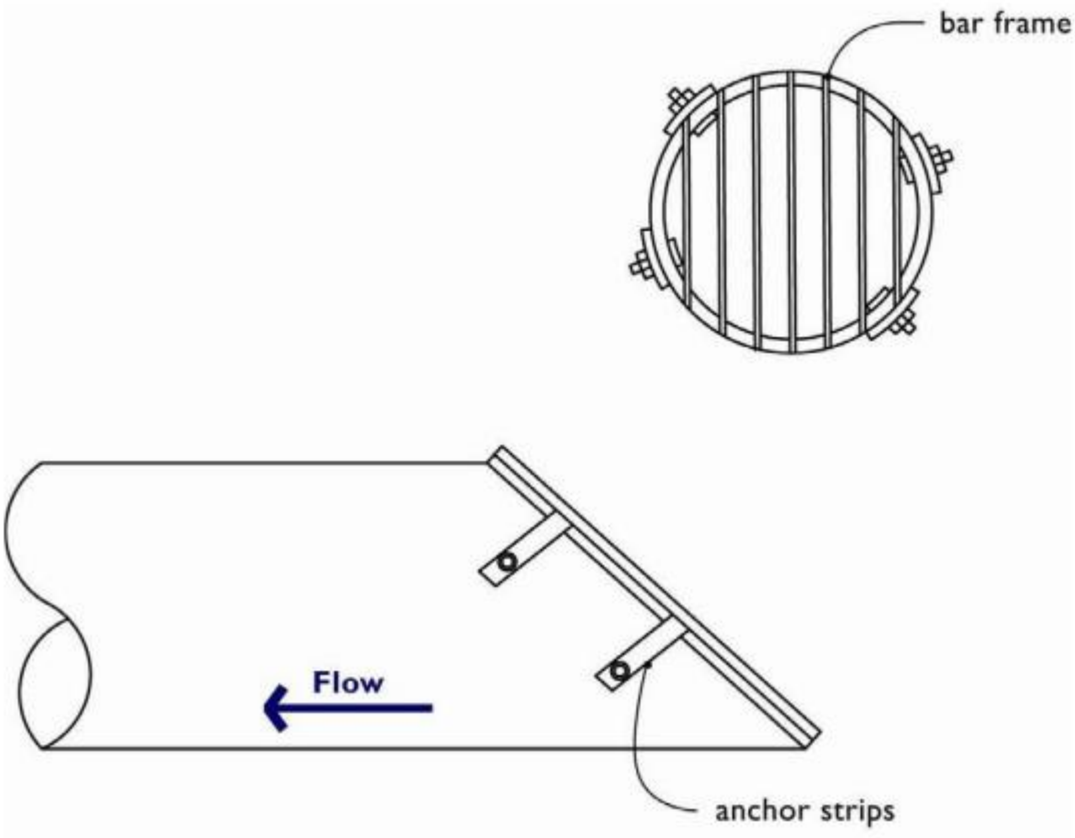
Manhole			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
General	Trash and Debris	Trash or debris has accumulated to within six inches of the invert of the lowest pipe.	Remove all trash or debris from manhole.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Remove trash or debris from inlet and outlet pipes.
	Sediment	Sediment has accumulated to within six inches of the invert of the lowest pipe.	Remove all sediment from manhole
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch.	Repair top slab to be free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Make adjustments so that frame is sitting flush on the riser rings or top slab and is firmly attached.
	Fractures or Cracks in Manhole Walls/Bottom	Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering manhole through cracks.	Regrout pipe and secure at manhole wall.
	Settlement/ Misalignment	If failure of manhole has created a safety, function, or design problem.	Replace or repair manhole to design standards.
Cover	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Replace missing cover, cover manhole.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Repair opening mechanism
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure.	Make adjustments so that one maintenance person can remove the manhole cover.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Repair or replace ladder to meet design standards and allow maintenance person safe access.
Control Structure/Flow Restrictor	See Control Structure/Flow Restrictor		

Debris Barrier

Debris barriers and trash racks are barred covers to pipe openings. They prevent large objects from entering pipes and keeps pets and people out of the pipes as well.

See SWMMWW Appendix V-A, Table V-A.6 for debris barrier maintenance standards.



Profile View

Exhibit 13 CUP24-1001

Sediment Trap

A sediment trap is a concrete structure typically fitted with slotted grate or multiple slotted grates. The concrete structure provides a storage volume (sump) below the outlet pipe to allow sediment and debris to settle out of the stormwater runoff. A sediment trap can be a fully enclosed concrete structure (above or below ground) with a sump, inlet pipe(s) and outlet pipe.

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Sediment Trap			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
General	Trash and Debris	Trash and debris which is located immediately in front of the sediment trap opening or is blocking the inlet capacity of the basin by more than 10%	Remove trash and debris
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	Remove dead animals or vegetation present within the sediment trap.
	Sediment (non-enclosed structure)	Sediment depth exceeds 2 inches.	Remove sediment
	Sediment (enclosed structure)	Sediment depth within 6 inches from lowest invert	Remove sediment
	Fractures or Cracks in Sediment Trap	Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering sediment trap through cracks.	Regrout pipe and secure at sediment trap wall.
	Settlement/ Misalignment	If failure of sediment trap has created a safety, function, or design problem.	Replace or repair sediment trap to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the sediment trap opening	Remove vegetation
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Remove contaminants and/or pollutants. (Coordinate removal/cleanup with local water quality response agency)
Slotted Grate	Trash and Debris	Trash and debris that is blocking more than 20% of the grate surface inlet capacity	Remove trash and debris from grate
	Damaged or Missing Grate	Grate missing or broken member(s) of the grate	Replace or repair grate to design standards.
Cover (enclosed structure)	Cover Not in Place	Cover is missing or only partially in place.	Replace missing cover
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure or latch broken	Make adjustments so that one maintenance person can remove the cover and/or repair broken latch.

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Energy Dissipater

Energy dissipaters are critical for preventing erosion at storm drain outfalls. There are a variety of designs, including wire gabion baskets, rock splash pads, trenches, and specially designed pools or manholes. They are installed on or near the inlet or outlet to a closed pipe system to prevent erosion at these locations.

See SWMMWW Appendix V-A, Table V-A.7 for energy dissipater maintenance standards.

Discharge Point

Stormwater facility discharge points may convey drainage from the stormwater facility into open channels, ditches, ponds, wetlands, streams, or lakes. Stormwater facility discharge points need to be assessed to make sure stormwater is not causing any negative impacts to these drainage areas.

Discharge Point			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
Monitoring	Contaminants and Pollution	Any evidence of oil, gasoline, sewage, contaminants, or other pollutants	Identify and remove source. The effluent discharge should be clear and free of odor. Notify City at (360) 817-1567.
	Ditch or Stream Banks Eroding	Erosion, scouring, or head cuts in ditch or stream banks downstream of facility discharge point due to flow channelization or higher flows.	Stabilize ditch or stream banks. Report to City for engineer evaluation.
General	Missing or Moved Rock	Only one layer of rock exists above native soil in an area five square feet or larger, or any exposure of native soil	Replace or repair rock pad to design standards
	Erosion	Soil erosion in or adjacent to rock pad	Replace or repair rock pad to design standards
	Sediment	Sediment blocking 20% of the pipe diameter	Remove sediment
	Obstructions	Roots or debris enters pipe or deforms pipe, reducing flow	Remove roots from pipe by mechanical methods; do not use root-dissolving chemicals in storm sewer pipes. If necessary, remove vegetation over the line.
	Pipe Rusted or Deteriorated	Any part of the piping that is crushed or deformed excessively or any other failure to the piping	Repair or replace pipe
Energy Dissipater	See Energy Dissipater		

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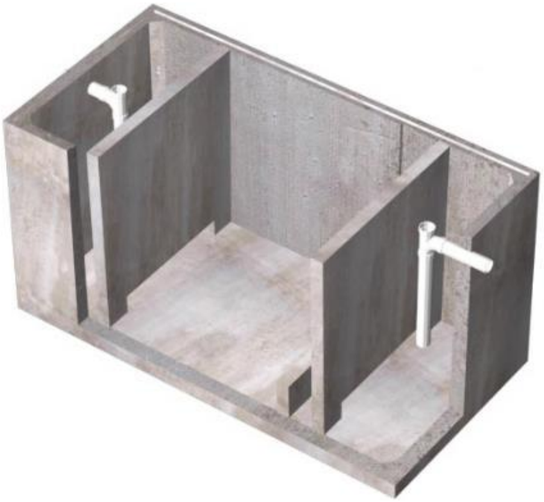
Oil/Water Separators

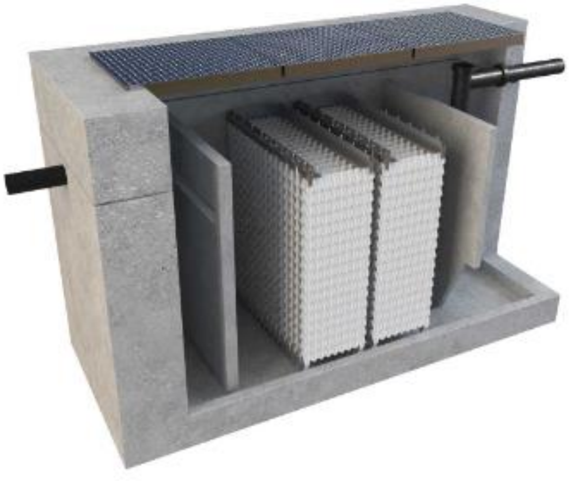
An oil/water separator is an underground vault that treats stormwater by mechanically separating oil from water. The oil rises to the surface and floats on the water and sediment settles to the bottom. Oil/water separators are typically utilized in locations where high oil concentrations in the stormwater runoff are anticipated (e.g., service and fuel stations). Oil/water separators are most commonly used as the first pretreatment facility in a series of stormwater management facilities.

These facilities have special problems for maintenance and should be serviced by contractors. The main issues are working in confined spaces and properly handling any sludge and oil cleaned from vaults or oil/water separators. Manufacturer's recommendations for maintenance should be followed at a minimum.

See SWMMWW Appendix V-A, Table V-A.16 for baffle oil/water separator maintenance standards and Table V-A.17 for coalescing plate oil/water separator maintenance standards.



Baffle Oil/Water Separator



Coalescing Plate Oil/Water Separator

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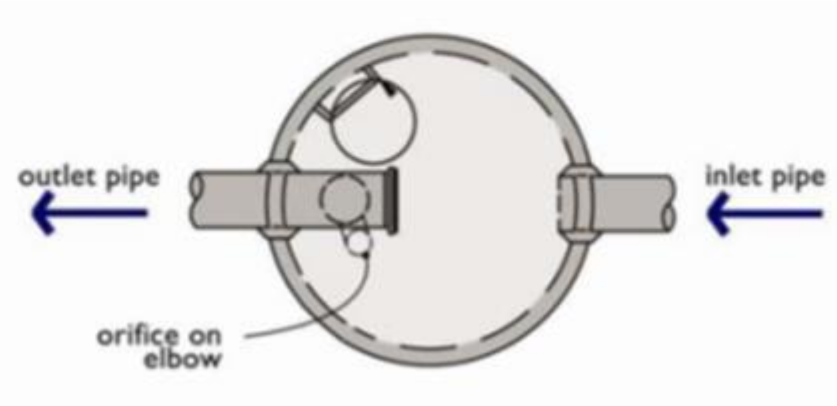
Flow Control Structures/Flow Restrictors

Flow control structures and flow restrictors direct or restrict flow in or out of facility components. Outflow controls on detention facilities are a common example where flow control structures slowly release stormwater at a specific rate. The flow is regulated by a combination of orifices (holes with specifically sized diameters) and weirs (plates with rectangular or 'V' shaped notch). Lack of maintenance of the control structure can result in the plugging of an orifice. If these flow controls are damaged, plugged, bypassed, or not working properly, the facility could overtop or release water too quickly.

See SWMMWW Appendix V-A, Table V-A.4 for control structure/flow restrictor maintenance standards.



Plan View

Exhibit 13 CUP24-1001

Storm Sewer Pipe

Storm sewer pipes convey stormwater. Storm pipes are constructed of many different types of materials and are sometimes perforated to allow groundwater to be collected by the storm system. Storm pipes are cleaned to remove sediment or blockages when problems are identified. Storm pipes must be clear of obstructions and breaks to prevent localized flooding.

Storm Sewer Pipe			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
General	Obstructions, Including Roots	Obstruction exists in pipe, reducing flow capacity	Remove obstruction. Use mechanical methods. Do not put root-dissolving chemicals in storm sewer pipes. If necessary, remove the vegetation over the line.
	Pipe Dented or Broken	Inlet/outlet pipe damaged or broken	Repair or replace pipe
	Pipe rusted or deteriorated	Any part of the piping that is crushed or deformed excessively or any other failure to the piping	Repair or replace pipe
	Sediment and Debris	Sediment or debris depth is greater than 15% of the pipe diameter	Clean pipe. Evaluate source of sediment upstream of the pipe and stabilize if possible.
	Broken Trash Screen	Trash screen is broken or missing parts	Repair or replace trash screen
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Identify and remove source. Notify City at (360) 817-1567.

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Closed Detention System

A closed detention system functions similarly to a detention pond but with the storage volume provided by an underground structure. The structure is typically constructed of large diameter pipe, plastic chamber structure or a concrete vault. These systems are typically utilized for sites that do not have space available for an above-ground system and are more commonly associated with commercial sites.

Underground detention systems are enclosed spaces where harmful chemicals and vapors can accumulate. Therefore, the maintenance of these facilities should be conducted by an individual trained and certified to work in hazardous confined spaces.

See SWMMWW Appendix V-A, Table V-A.3 for closed detention maintenance standards.

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Drywell

Drywells are perforated, open-bottomed manholes used to infiltrate stormwater into the ground. While not the intended use, drywells trap sediment and some of the oil pollutants in stormwater runoff. Drywells are more likely to fill with oily sediment in areas that lack swales or other treatment facilities. Fine oil sediment can clog drywells and lead to localized street flooding. Also, pollutants discharged into drywells can migrate into groundwater. Drywells were often installed in closed topographic depressions, areas with will-drained soils, or areas having inadequate storm sewers. Often, drywells contain groundwater.

Drywell

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Minimum Maintenance Required
General	Does not Dissipate Stormwater	Does not dissipate stormwater	Replace or repair
	Opening Clogged	Openings are clogged, reducing capacity	Clear openings or convert existing drywell to a sediment trap and install a new drywell or drainage trench. To convert to a sediment trap: grout holes, cover base with concrete, and add piping. Alterations to any storm facility cannot be done without approval from the City of Camas.
	Standing Water	Standing water indicates the drywell is into the groundwater table	Rebuild drywell to prevent stormwater from going directly into groundwater
	Trash and Debris	Trash or debris blocking any inlet or outlet pipe	Remove trash and debris
	Sediment	Sediment in drywell exceeds 60 percent of the depth below the lowest pipe	Remove sediment
	Structure Damage	Structure unsound	Replace or repair drywell to design standards.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Identify and remove source. Notify City at (360) 817-1567.
Cover	Cover Not in Place	Cover is missing or only partially in place.	Replace missing cover
	Cover Difficult to Remove	One maintenance person cannot remove cover after applying normal lifting pressure.	Make adjustments so that one maintenance person can remove the drywell cover.

Exhibit 13 CUP24-1001

Pond Leveler System

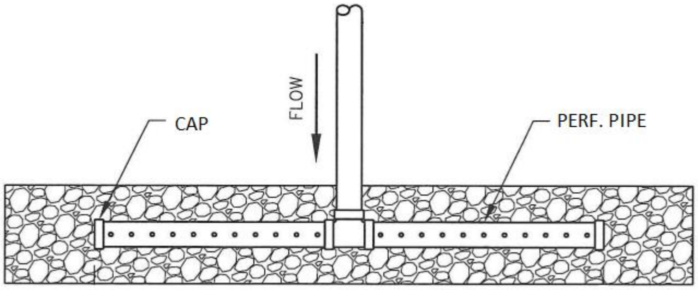
The pond leveler system consists of an intake cage and outlet pipe. This system is used to bypass beaver dams. The pond leveler system creates a permanent leak through the beaver dam that the beavers cannot stop.

Pond Leveler			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
Intake Cage	Debris and sediment	Debris and sediment build up around cage	Remove debris and sediment build up around cage. Recommended tools: potato rake and a narrow, stiff shop broom.
	Structure	Broken cage, resulting in holes larger than 6" diameter.	Repair hole with similar cage material, attach with hog rings.
	Obstruction to inflow pipe	Debris obstructing pipe flow inside intake cage	Remove obstruction
Outflow Pipe	Obstruction	Debris obstructing outflow	Remove obstruction

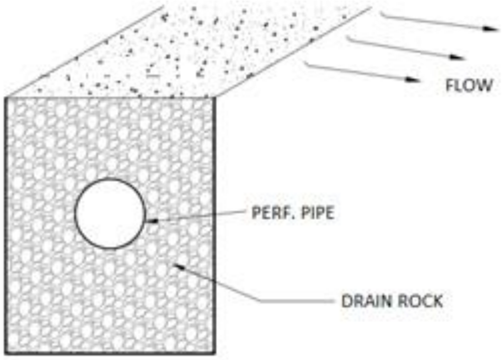
Exhibit 13 CUP24-1001

Dispersion Trench

Dispersion trench are grave-filled trenches, which serve to spread runoff over vegetated pervious areas. This BMP reduce peak flows, provide some infiltration, and water quality benefits.



Plan View



Cross Section

Dispersion Trench

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Minimum Maintenance Required
General	Trash and Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping.	Remove trash and debris from site.
	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations.	Remove noxious weeds. Compliance with State or local eradication policies required. Apply requirements of adopted IPM policies for the use of herbicides.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Identify and remove source. Notify City at (360) 817-1567.
	Rodent Holes	Any evidence of rodent holes.	Fill holes.
Perforated Pipe	Sediment and/or obstruction	Sediment and/or obstruction impeding the flow, causing backup	Remove sediment and/or obstruction

Exhibit 13 CUP24-1001

Special Facilities

Manufactured Media Filter

Manufacture media filters are passive, flow-through, stormwater treatment systems. They are comprised of manholes or vaults that house media-filled filter cartridges. Stormwater passes through a filtering medium, which traps particulates and/or absorb pollutants such as dissolved metals and hydrocarbons. Once filtered through the media, the treated stormwater is directed to a collection pipe or discharge to a pond or open channel drainage way.

The filter media can be housed in cartridge filters enclosed in concrete vaults or catch basins. Structures will have vault doors or manhole lids for maintenance access. Various types of filter media are available from different manufactures. Determine the type of filter media used and consult manufacturer for maintenance recommendations.

See SWMMWW Appendix V-A, Table V-A.15 for manufactured media filters maintenance standards.

Manufactured Media Filter – Additional Maintenance Standards

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Minimum Maintenance Required
Below Ground Vault or Manhole	Sediment Accumulation in Vault (no first chamber)	Sediment depth exceeds 4-inches on vault floor.	Remove sediment from vault floor. May require replacing media cartridges, consult manufacturer.

Exhibit 13 CUP24-1001

Permeable Pavement

Permeable pavement is a paving system which allows rainfall to percolate through the surface into the underlying soil or an aggregate bed, where stormwater is stored and infiltrated to underlying subgrade, or removed by an overflow drainage system.

See SWMMWW Appendix V-A, Table V-A.22 for permeable pavement maintenance standards.

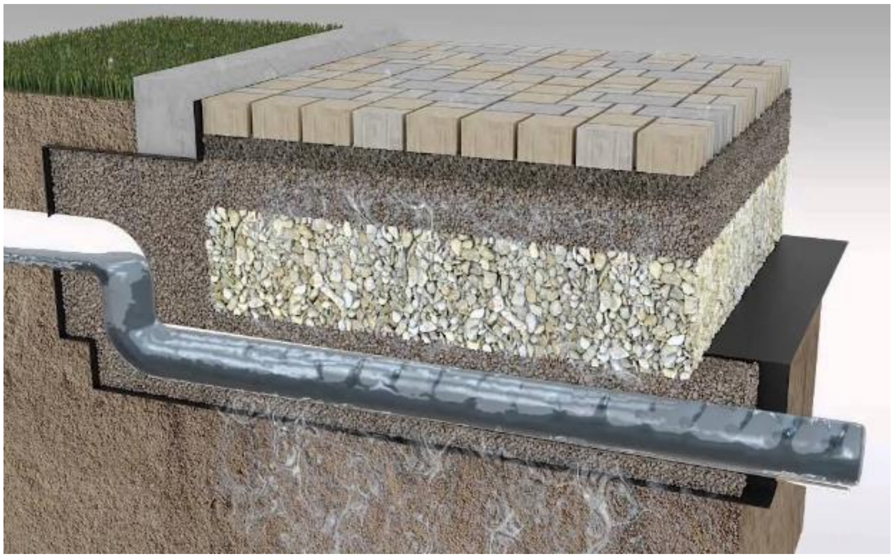


Exhibit 13 CUP24-1001

Modular Wetland

Modular wetlands linear is a biofiltration system that utilizes horizontal flow which allows for a smaller footprint, higher treatment capacity and design versatility. This system can be utilized downstream of storage for additional volume control and treatment. The modular wetland is contained in an underground vault that has different chambers containing media. Some modular wetlands can have plants growing out of it, but it is not required for the system to function. Once filtered through the media, the treated stormwater is directed to a collection pipe or discharge to a pond or open channel drainage way.

Modular Wetland			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
General	Missing or damaged components	Missing or damaged internal components or cartridges	Replace missing or repair damaged internal components or cartridges
Inlet or Outlet	Obstruction	Obstruction to inlet or outlet that impedes flow	Remove obstruction
Pretreatment Chamber	Floatables	Excessive accumulation of floatables, in which the length and width of the chamber is fully impacted more than 18"	Remove floatables
	Sediment	Excessive accumulation of sediment, more than 6"in depth	Remove sediment
Filter Cartridges	Sediment	Excessive accumulation of sediment on media, more than 85% clogged (blackish color)	Replace media
Vegetation (if applicable)	Overgrown	Overgrown vegetation	Trim/prune vegetation in accordance with landscaping and safety needs
Structure	Cracks in structure	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through cracks	Repair cracks in vault

Exhibit 13 CUP24-1001

Tree Box Filter

Tree box filter is a stormwater treatment system incorporating high performance biofiltration media to remove pollutants from stormwater runoff.

Tree Box Filter			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
Inlet	Excessive sediment or trash accumulation	Accumulated sediments or trash impair free flow of water into system	Remove sediment and/or trash
Mulch cover	Trash and debris	Excessive trash and/or debris accumulation	Remove trash and/or debris.
	Standing water	Ponding of water over mulch due to excessive fine sediment accumulation or spill of petroleum oils	Remove mulch and replace, contact manufacturer for advice
Vegetation	Plant not growing or in poor condition	Soil/mulch too wet, evidence of spill, incorrect plant selection, pest infestation, vandalism to plants	Plants should be healthy and pest free, contact manufacturer for advice
	Plant growth excessive	Plants should be appropriate to the species and location	Trim/prune plants in accordance with landscaping and safety needs
Structure	Cracks in structure	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through cracks	Repair cracks in vault

Exhibit 13 CUP24-1001

Miscellaneous Items

Fences, Gates and Water Quality Signs

Fences are installed around the perimeter of stormwater facilities as a means of protecting the public, as they restrict entrance to the facility. Gates are installed to allow for maintenance access. Gates will be secured, typically with a double lock system (daisy chain) that allows access to the City and to the property owner's maintenance crew.

Water Quality Signs are installed on the fences, or on sign poles, within public view as a means of educating the public as to the presence of a stormwater facility. These signs also have a number located in the upper right hand corner that is cross referenced, at the City, to an address and maintenance responsibility. The publicly owned storm facility signs are green and the privately owned storm facility signs are white.

Public Storm Sign (Green) **Private Storm Sign (White)**

Exhibit 13 CUP24-1001

Fence, Gate and Water Quality Sign

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Minimum Maintenance Required
General	Gate or Fence Allows Unauthorized Entry	Openings in fence, missing gate, openings beneath fence allowing unauthorized access	Repaired gate and/or fence to prevent unauthorized access
	Locking Mechanism	Mechanism cannot be opened by one maintenance person with proper tools	Repair/replace lock
		No lock on gate, allows unauthorized entry	Add lock
	Damaged Parts	Posts out of plumb more than six inches	Plumb post
		Top rails of plump more than six inches	Repair top rails so that it is free of bends greater than 1 inch
	Erosion	Erosion has resulted in an opening under a fence that allows entry by people or pets	Replace soil under fence so that no opening exceeds 4 inches in height
	Sign	Sign is leaning more than 8 inches off vertical	Reset sign to plumb
		Sign is missing or 20% of surface is unreadable	Replace sign

Exhibit 13 CUP24-1001

Access Roads and Easements

Many stormwater facilities have access roads to bring in heavy equipment for facility maintenance. These roads are typically gravel and should be maintained for inspection access and ease of equipment entry. All facilities should allow access for the inspection process. The easement area should be adequately or otherwise stabilized. Bare soil areas will generate higher levels of stormwater runoff and increase erosion and sedimentation in stormwater facilities.

Access Road and Easements

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Minimum Maintenance Required
General	Erosion	Soils are bare or eroded	Seed or use other stabilization BMP
	Road Surface	Conditions of road surface may lead to erosion of the facility or limit access	Repair road
	Erosion of Ground Surface	Noticeable rills are seen in landscaped areas	Identify causes of erosion and implement BMPs to slow down/spread out the water. Fill, contour, and seed eroded areas. If needed, re-grade affected areas.
	Trash and Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping.	Remove trash and debris from site.
	Poisonous Vegetation and Noxious Weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations.	Remove noxious weeds. Compliance with State or local eradication policies required. Apply requirements of adopted IPM policies for the use of herbicides.
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If dead, diseased, or dying trees are identified.	Remove hazardous tree that impede with maintenance access and activities. Remove trees that are damaging the pipe system and/or blocking drain inlet. Remove dead, diseased, or dying trees. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood).
	Weeds (Non-poisonous)	Weeds growing in more than 20% of the landscaped area (tree and shrubs only).	Remove weeds
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Destroy or remove insects from site. Apply insecticides in compliance with adopted IPM policies.

Exhibit 13 CUP24-1001

Pavement Sweeping

Pavement sweeping is performed as a means of removing sand, dirt, and litter from streets and curb gutters. Sweeping also reduces dust during dry weather. Pavement sweeping plays a large part in stormwater maintenance because it limits the amount of sediment washed into the municipal storm sewer system. The water quality procedure for street sweeping focuses on sediment removal and disposal. Reducing the amount of sediment washed into catch basins, curb inlets, detention facilities, drywells, and other facilities can save money because sweeping is generally cheaper that removing sediment from facilities. Sweeping also helps protect facilities from clogging with sediment.

Typically, the City sweeps the downtown area once a week and the whole city about three times per year. Most of the downtown area does not have water quality treatment. Pavement sweeping is the main source for pollution control.

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Repair/Replacement Activities

Minor Culvert Repair (Not in a Stream)

This activity is for the replacement or repair of culverts and inlets. It applies only to structures that are in ditches that are specifically for storm drainage. These are ditches that do not carry water during dry weather. If there is any question about whether the ditch is a storm drain or a stream, consult with the Washington Department of Fish and Wildlife and the City of Camas Public Works Department.

Major Culvert Repair (at a Stream Crossing)

This activity is the replacement or repair of culverts and inlets bridging a stream or ditch with flowing water during dry weather. If there is any question about whether the ditch is a storm drain or a stream, consult the Washington Department of Fish and Wildlife and the City of Camas Public Works Department.

These projects must meet all regulatory requirements such as State Environmental Policy Act (SEPA), Shoreline Permit, Hydraulic Project Approval (HPA) and Flood Plain.

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Vegetation Management

The City recognizes the special importance of the rivers, streams, wetlands, ponds, and stormwater control and treatment facilities. The sensitive nature of such habitat, their plant and animal communities, and their direct link with other waterways require that we establish specific policies to ensure their health. All landscape management decisions for controlling unwanted vegetation, diseases, and pests should follow the Integrated Pest Management (IPM) principles and decision-making rationale.

Integrated Pest Management (IPM) Principles

1. Correctly identify the pest problem and understand their life cycle. Refer to online resources such as Washington State Noxious Weed Control Board and Washington Invasive Species Council.
2. Every landscape has a population of some pest insects, weeds, and diseases. Once the pest has been identified and studied, determine if low levels of the pest are tolerable. Small numbers of certain pests may not be harmful. If this is the case, simply continue to monitor the pest population.
3. If pest exceed tolerance thresholds, choose a safe and effective control method.
    a. Cultural methods of vegetation and pest control are preferred and are first employed. Cultural control changes the pest's environment: landscape fabric, mulch, soil amendments, altering the irrigation method of duration, crop rotation, crop covers, etc.
    b. Mechanical means of vegetation and pest control are next in line of preference and are utilized where feasible. Mechanical means consist of digging, hand-pulling, mowing, tilling, trapping, etc.
    c. Biological methods of vegetation and pest control are considered before chemical means, where they are feasible. Biological control uses natural enemies: beneficial insects, managed grazing, bird boxes and perches, etc.
    d. Chemical methods are used only when no other feasible methods exist. Chemical control is the use of pesticides to remove vegetation and pests.
4. Observe and record the results of the control treatment. Evaluate the effectiveness. If necessary, modify maintenance practices to support a healthy landscape and prevent recurrence of the pest.

A licensed pesticide applicator is required for performing any chemical application in stormwater facilities. Applicators must be licensed in Washington State with an aquatic endorsement (WAC 16-228-1545). Applicator must submit a copy of their license to the City prior to starting work. Aquatic pesticide products are recommended. No chemical application shall be applied directly in the water. Do not apply pesticide when it is raining. Check the weather and ensure there are multiple dry days before and after application. Do not apply pesticide on windy days to prevent drift movement of pesticide from target areas.

For vegetated areas outside of stormwater facilities, Washington State pesticide application laws and rules are followed, Chapter 17.21 RCW and Chapter 16-228 WAC.

Exhibit 13 CUP24-1001

Plants and Groundcover

Use plants that will thrive in the growing conditions of each facility. Growing conditions are affected by moisture, soil conditions, and light. Plants native to western Washington are preferred. Recommended plants, seed mixes and groundcover list for biofiltration swales, bioretention systems, rain gardens, and other facility types are given in the respective BMP maintenance sections. It is best to reference the stormwater facility record drawings for vegetation replacements, if available. Fertilization of vegetated stormwater facilities should be avoided.

The City has adopted a list of approved plants for use in development projects, and to assist homeowners in choosing appropriate plantings. The list also has prohibited undesirable plants. Only plants approved for use on the City of Camas Plant Materials are allowed within the City’s right-of-way.

Mulches and other ground coverings are useful during the installation and restoration of landscapes as well as their ongoing maintenance. Mulches meet a variety of needs. They suppress weeds, help to retain moisture around plants, reduce possible erosion and provide visual enhancement. Possible risk impacts to consider when using mulch are inadvertent introduction of non-native plants or migration of mulch material into waterways.

Possible scenarios where trees should be removed and/or trimmed in a stormwater facility (always check if the stormwater facility has a liner before tree removal):

- Trees that pose a risk to a stormwater structure due to root growth should be removed.
- Trees that are growing on spillways that would impede drainage should be removed.
- Hazardous trees should be removed.
- Trees/shrubs that hinder accessibility to access roads should be trimmed or removed.

Exhibit 13 CUP24-1001

References

Clark County. (July 2021). *Clark County Stormwater Manual 2015 Book 4 Stormwater Facility Operation and Maintenance*. https://clark.wa.gov/sites/default/files/media/document/2021-11/CCSM%20Book%204%20Maintenance%20and%20Operations.pdf

City of Battle Ground. (March 2019). *Stormwater Facility Maintenance Manual BG02.02*. https://www.cityofbg.org/DocumentCenter/View/2100/2019-Stormwater-Facility-Maintenance-Manual-Final?bidId=

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Hinman, Curtis. (June 2013). *Rain Garden Handbook for Western Washington: A Guide for Design, Installation, and Maintenance*. https://apps.ecology.wa.gov/publications/publications/1310027.pdf

Washington Department of Ecology. (July 2019). *Stormwater Management Manual for Western Washington*. https://fortress.wa.gov/ecy/ezshare/wq/Permits/Flare/2019SWMMWW/2019SWMMWW.htm#Topics/FrontCover.htm?TocPath=2019%2520SWMMWW%257C 0

Washington State. *Noxious Weed Control Board*. https://www.nwcb.wa.gov/

Washington State Legislature. (1974). *Revised Code of Washington (RCW)*. https://apps.leg.wa.gov/RCW/default.aspx

Washington State Legislature. (2004). *Washington Administrative Code (WAC)*. https://app.leg.wa.gov/WAC/default.aspx

Washington State Recreation and Conservation Office. *Washington Invasive Species Council*. https://invasivespecies.wa.gov/

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Appendix F

City of Camas Pre-Application Final Report dated 5/14/2024

Exhibit 13 CUP24-1001

Pre-Application Meeting Notes
Camas High School District Tennis Courts
Planning Case Number: PA24-08

Meeting held via Zoom: May 2, 2024
Notes issued via email: May 14, 2024

Applicant:
Martin Snell, MacKay Sposito
18405 SE Mill Plain Boulevard, Suite 100
Vancouver, WA 98683
msnell@mackaysposito.com

Representing City of Camas:	Yvette Sennewald, Senior Planner Robert Maul, Planning Manager Randy Miller, Fire Marshal Brian Smith, Building Official Ahmed Yanka, Engineering
Location:	Camas High School 29600 SE 15th Street
Tax Accounts:	178111000 and 178174000
Zoning:	R-7.5
Description:	The project includes resurfacing eight existing tennis courts, installing lighting and an enclosure over the tennis courts as well as the placement of an entrance structure (with restrooms and a small locker area) utility extensions/connections, site improvements for access from the parking lot, additional parking spaces and landscaping.

NOTICE: Notwithstanding any representation by City staff at a pre-application conference, staff is not authorized to waive any requirement of the City Code. Any omission or failure by staff to recite to an applicant all relevant applicable code requirements shall not constitute a waiver by the City of any standard or requirement. [CMC 18.55.060 (C)] This pre-application conference shall be valid for a period of 180 days from the date it is held. If no application is filed within 180 days of the conference or meeting, the applicant must schedule and attend another conference before the city will accept a permit application. [CMC 18.55.060 (D)] Any changes to the code or other applicable laws, which take effect between the pre-application conference and submittal of an application, shall be applicable. [CMC 18.55.060 (D)]. **A link to the Camas Municipal Code (CMC) can be found on the City of Camas website, http://www.cityofcamas.us/ on the main page under "Business and Development".**

Exhibit 13 CUP24-1001

STAFF NOTES

PLANNING DIVISION

Yvette Sennewald |817-7269

Applicable codes for development include Title 16 Environment, and Title 18 Zoning, of the Camas Municipal Code (CMC), which can be found on the city website. Please note it remains the applicant's responsibility to review the CMC and address all applicable provisions. The following pre-application notes are based on application materials and site plan submitted on March 29, 2024.

Type III Conditional Use Permit	Fees (as of 2/29/24)
Conditional Use Permit	$4,949
Minor Design Review	$495

Application Requirements

Your proposal is required to comply with the general application requirements per CMC Section **18.55.110.**

The following items are required to be submitted for consideration of the proposed project:

1. **APPLICATION.** Required materials are listed at CMC18.55.110 (A through G) and include the following:
   - A completed city application form and required fees,
   - A complete list of the permit approvals sought by the applicant for this project,
   - One set of mailing labels for property owners as noted in CMC Section 18.55.110,
   - A detailed narrative description that describes the proposed development, existing site conditions, existing structures, public facilities and services, and other natural features. The narrative should also include ownership and maintenance of open spaces, stormwater facilities, public trails, and critical areas. It should also address any proposed building conditions or restrictions.
   - Three sets of drawings and an electronic copy (sent as a PDF by email). All documents and reports must be submitted as separate pdf files.
   - A copy of Preapplication meeting notes,
   - Preliminary Civil plans,
   - A vicinity map showing location of the site, and
   - Copy of a full title report.
2. **CONDITIONAL USE PERMIT**. The application should include photos of adjacent properties, and a description of the development patterns of the area. The applicant must include a written narrative that responds to each of the criteria in CMC §18.43.050 Criteria:

   > *A. The proposed use will not be materially detrimental to the public welfare, or injurious to the property or improvements in the vicinity of the proposed use, or in the district in which the subject property is situated.*
   >
   > *B. The proposed use shall meet or exceed the development standards that are required in the zoning district in which the subject property is situated.*

> *C. The proposed use shall be compatible with the surrounding land uses in terms of traffic and pedestrian circulation, density, building, and site design.*
>
> *D. Appropriate measures have been taken to minimize the possible adverse impacts that the proposed use may have on the area in which it is located.*
>
> *E. The proposed use is consistent with the goals and policies expressed in the comprehensive plan.*
>
> *F. Any special conditions and criteria established for the proposed use have been satisfied. In granting a conditional use permit the hearings examiner may stipulate additional requirements to carry out the intent of the Camas Municipal Code and comprehensive plan.*

3. **DESIGN REVIEW**. An application for design review must include (at a minimum) building elevations, materials, exterior colors, and landscaping plans. Preliminary site plan should show all existing conditions per CMC Section 17.11.030.B.6(a-p),

Landscaping Regulations. A Landscape, Tree, and Vegetation plan must be submitted pursuant to CMC 18.13.040.A. If trees are proposed for removal, a Tree Survey is required and must be prepared by a certified arborist or professional forester.

Development sign. The applicant must install a 4'x8' sign on the property that provides details about the project, site plan, contact information, and includes space for public hearing information to be filled in when a date is scheduled. Staff can provide a handout if requested.

BUILDING DIVISION Brian Smith | 817-1568

- The structure will be reviewed under the most current building codes as adopted by the State of Washington. Specifically, the requirements of IBC 3102 regulate this type of structure.
- The plans will need to be prepared by a State of Washington licensed architect.
- Structural drawings and calculations will be required and shall be prepared and stamped by a Professional Engineer licensed by the State of Washington.
- A separate construction permit from the Camas/Washougal Fire Marshal's office may be required, contact the Fire Marshal's Office to confirm.
- Impact fees and System Development charges will be applicable.
- If the structure is conditioned compliance with the Washington State Energy Code will be required.

ENGINEERING DIVISION Ahmed Yanka | 817-7258

Applicant's 'Proposed Scope of Work' are not applicable to Engineering.

Responses to the Applicant's TIA questions are addressed separately.

General Requirements:

1. Civil site construction plans shall be prepared by a licensed Washington State Engineer in accordance with the *Camas Design Standards Manual (CDSM)* and CMC 17.19.040.
2. Engineering site improvement plans are to be submitted to Community Development (CDev) Engineering for review and approval.
3. The Community Development Engineering Dept. is responsible for plan review (PR) and construction inspection (CI). A 3% PR&CI fee is collected by engineering for all infrastructure improvements.
    a. The 3% fee is based on an engineer's estimate.
    b. The engineer's estimate is to include all improvements outside of the proposed building footprints.
    c. <u>*Payment of the 1% plan review (PR) portion is required when the civil plans are submitted for first review*</u>.
    d. Payment of the 2% construction inspection (CI) portion is to be paid prior to release of approved construction drawings by the CDev Engineering Dept.
4. The applicant will be required to purchase all permanent traffic control signs, street name signs, street lighting, and traffic control markings for the proposed development.
5. A general encroachment permit, certificate of insurance, and approved traffic control plan (TCP) is required prior to the start of any work within the right-of-way.

<u>Traffic/Transportation:</u>

1. As the change in use is from tennis courts for high school usage to a USTA Tennis Center, the applicant is to provide a TIA memo addressing the potential increase in AM and PM Peak hour trip distribution to and from the site.
2. Based on the information requested above, an intersection impact analysis may be required.
3. If the Traffic Engineer has any additional questions, they can contact the City Engineer, James (Curleigh) Carothers.

<u>Streets:</u>

1. The proposed tennis court improvements, including construction of a new on-site access road to be located on the north side of the existing tennis courts, which are north of the Camas High School parking lot.
2. The high school has an existing ingress and egress at SE 15th Street and an existing egress onto NE Garfield Street.
3. Per the 2016 Transportation Comprehensive Plan Map:
    a. SE 15th Street is designated as an existing 3-lane fully improved road along the frontage of the high school.
4. NE Garfield Street is designated as a local road without sidewalk improvements on the west side of the road nor in the vicinity of the intersection of the high school's North Access Road and NE Garfield Street.
    a. The applicant is not required to construct any improvements on NE Garfield Street.
5. The applicant is proposing a new 16-foot-wide one-way drive aisle around the existing tennis courts with approximately 56 new parking stalls.

   a. The proposed one-way drive aisle is shown to intersect the existing drive aisle and parking lot and to be located between the existing baseball field and easternmost tennis court. The easternmost tennis court is proposed to be eliminated in order to construct the new drive aisle.
   b. The proposed egress for the new one-way drive aisle is shown as a new intersection with the existing North Access Road.
   c. The new road is to be signed as one-way at the east intersection and 'stop controlled' at the west intersection.

Stormwater:

1. The proposed tennis court is within combined parcels of 2,281,238 sf (52.37 acres) in size per Clark County records.
2. Stormwater treatment and detention shall be designed in accordance with the latest edition of Ecology's *Stormwater Management Manual for Western Washington (SWMMWW)*. The current Ecology manual is the 2019 version.
3. Refer to Ecology's *Figure I-3.2 Flow Chart for Determining Requirements for Re-Development (Vol. I, Chapter 3, Page 90)*.
   a. As the project results in 5,000 sf, or greater, of new plus replaced hard surface area; then Minimum Requirements (MR) #1- #9 will apply.
4. The applicant will be responsible for determining if the existing stormwater conveyance and treatment and detention system at the southeast corner of the site is adequately sized for additional stormwater discharge from the proposed road construction.
5. A revised TIR will be required addressing the proposed changes.
6. A designated concrete washout area (BMP C154, Vol. II, Chap. 3, pgs. 320-326) is to be shown on the site plans. The washout area is to be removed prior to issuance of final acceptance.

Erosion Control

1. If the new proposed improvements are greater than an acre of land-disturbing activities the applicant will be required to obtain an *NPDES Construction Stormwater General Permit* from Ecology and provide an ESC bond to the city.
2. The applicant will be responsible for all erosion and sediment control measures to ensure that sediment laden water does not leave the site or impact adjacent parcels.
3. Mud tracking onto the road surface is discouraged and any mud tracking is to be cleaned up immediately.

Water:

1. There is an existing 2.5-inch schedule 40 PVC water service at the southwest corner and another water service located approximately 325-feet of the southeast corner.
2. A new water service to the proposed bathrooms is to be shown on the proposed site plans.
3. All taps to be performed by a tapping Contractor approved by the City's Water/Sewer Dept.

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4. Utility trenching and trench backfill are to be per CDSM Detail G2. Surface restoration will be per CDSM Detail G2A.

Sanitary Sewer:

1. There is an existing 6-inch PVC sanitary STEF main that runs along the southside of the proposed tennis court location in the High School parking lot.
2. A new sanitary sewer lateral to the proposed bathrooms is to be shown on the proposed site plans.
3. All taps to be performed by a tapping Contractor approved by the City's Water/Sewer Dept.
4. Utility trenching and trench backfill are to be per CDSM Detail G2. Surface restoration will be per CDSM Detail G2A.

City Approved Tapping Contractors:

1. A&A Drilling Services, Inc (water & pressure sewer):
    a. 16734 SE Kens Ct. #B, Milwaukie, OR 97267, 800-548-3827, http://www.aadrilling.com

2. Ferguson Waterworks (water only):
    a. 14103 NW 3rd Court, Vancouver, WA 98685, 360-896-8708, https://www.ferguson.com/branch/nw-3rd-ct-vancouver-wa-waterworks

Parks/Trails:

1. Not applicable.

Garbage & Recycling:

1. Applicant to use existing garbage & recycling system.

Impact Fees & System Development Charges (SDCs):

1. Camas High School is in the South District.
2. Impact Fees and SDCs are collected at the time of building permit issuance.
3. Impact fees and SDCs are adjusted on January 1st of each year.

Impact Fees for 2024:

1. Traffic Impact Fees - $3,988.00 per PM Peak Hour Trip
2. School Impact Fees (SIF) (Camas) – NA
3. Park/Open Space Impact Fees (PIF) – NA
4. Fire Impact Fees (FIF) - $0.69 sf

System Development Charges (SDCs) for 2024:

1. Water
    a. 3/4" meter - $9,056.00 + $450.00 connection fee

2. Sewer
    a. Residential - $7,184.00 + $199.00 STEP/STEF Inspection

FIRE MARSHAL **Randy Miller | 834-6191**

No building or structure regulated by the building and/or fire code shall be erected, constructed, enlarged, altered, repaired, moved, converted, or demolished unless a separate permit for each building or structure has first been obtained from the CWFMO Camas Municipal Code 15.04.030.D.12.a

Any inadvertent omission or failure to site or include any applicable codes or code language by the Fire Marshal's office or the City shall not be considered a waiver by the applicant.

1) Permit(s) with the Fire Marshals Office required.
    a. Site Plan
    b. New Construction/Life Safety Permit required with the FMO
    c. Other permits may be required as this project is further explained in use and design.

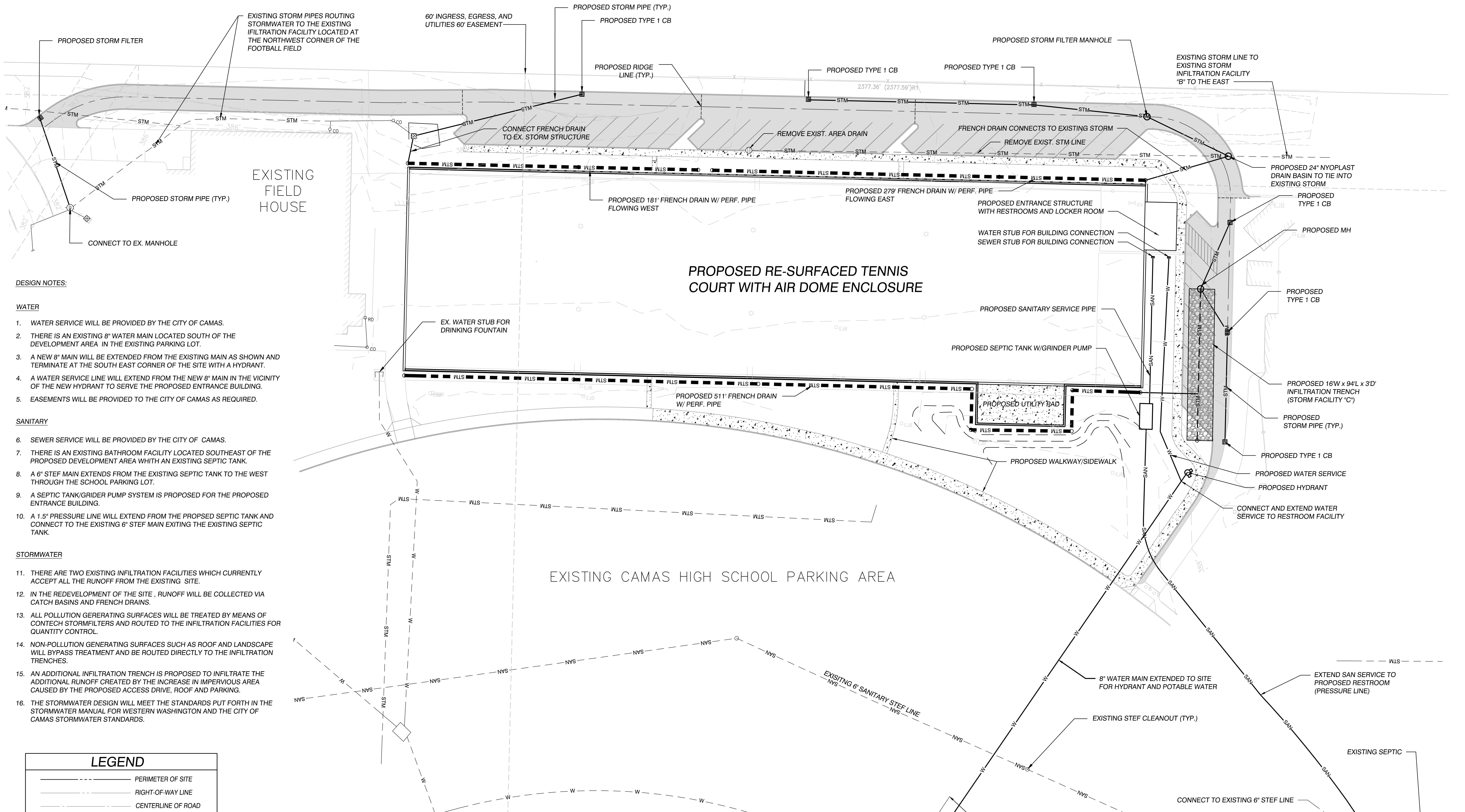
3. Contact the FMO if you have any questions: 360-834-6191 or FMO@cityofcamas.us

Exhibit 13 CUP24-1001

Appendix G

Preliminary Utility Plan
Proposed Basins Map (Camas High School Fieldhouse TIR)
Existing Catchment Plan (Quantity Control)
Developed Catchment Plan (Quantity Control)
Developed Catchment Plan (Quality Control)

Exhibit 13 CUP24-1001



DESIGN NOTES:

WATER

1. WATER SERVICE WILL BE PROVIDED BY THE CITY OF CAMAS.
2. THERE IS AN EXISTING 8" WATER MAIN LOCATED SOUTH OF THE DEVELOPMENT AREA IN THE EXISTING PARKING LOT.
3. A NEW 8" MAIN WILL BE EXTENDED FROM THE EXISTING MAIN AS SHOWN AND TERMINATE AT THE SOUTH EAST CORNER OF THE SITE WITH A HYDRANT.
4. A WATER SERVICE LINE WILL EXTEND FROM THE NEW 8" MAIN IN THE VICINITY OF THE NEW HYDRANT TO SERVE THE PROPOSED ENTRANCE BUILDING.
5. EASEMENTS WILL BE PROVIDED TO THE CITY OF CAMAS AS REQUIRED.

SANITARY

6. SEWER SERVICE WILL BE PROVIDED BY THE CITY OF CAMAS.
7. THERE IS AN EXISTING BATHROOM FACILITY LOCATED SOUTHEAST OF THE PROPOSED DEVELOPMENT AREA WHITH AN EXISTING SEPTIC TANK.
8. A 6" STEF MAIN EXTENDS FROM THE EXISTING SEPTIC TANK TO THE WEST THROUGH THE SCHOOL PARKING LOT.
9. A SEPTIC TANK/GRIDER PUMP SYSTEM IS PROPOSED FOR THE PROPOSED ENTRANCE BUILDING.
10. A 1.5" PRESSURE LINE WILL EXTEND FROM THE PROPSED SEPTIC TANK AND CONNECT TO THE EXISTING 6" STEF MAIN EXITING THE EXISTING SEPTIC TANK.

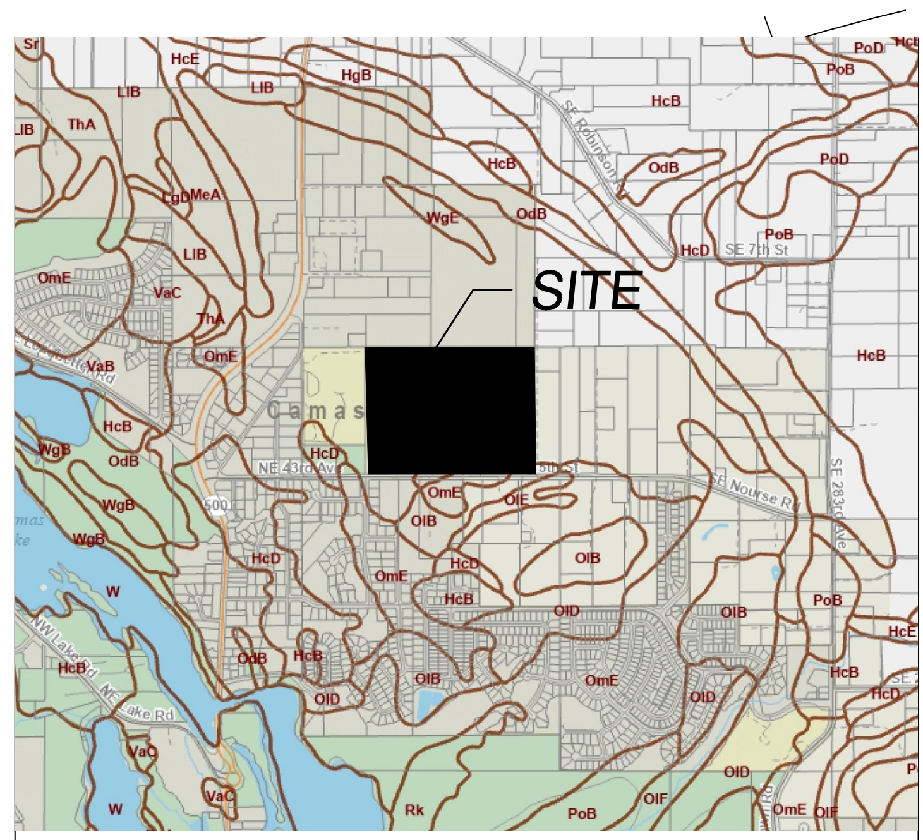
STORMWATER

11. THERE ARE TWO EXISTING INFILTRATION FACILITIES WHICH CURRENTLY ACCEPT ALL THE RUNOFF FROM THE EXISTING SITE.
12. IN THE REDEVELOPMENT OF THE SITE , RUNOFF WILL BE COLLECTED VIA CATCH BASINS AND FRENCH DRAINS.
13. ALL POLLUTION GERERATING SURFACES WILL BE TREATED BY MEANS OF CONTECH STORMFILTERS AND ROUTED TO THE INFILTRATION FACILITIES FOR QUANTITY CONTROL.
14. NON-POLLUTION GENERATING SURFACES SUCH AS ROOF AND LANDSCAPE WILL BYPASS TREATMENT AND BE ROUTED DIRECTLY TO THE INFILTRATION TRENCHES.
15. AN ADDITIONAL INFILTRATION TRENCH IS PROPOSED TO INFILTRATE THE ADDITIONAL RUNOFF CREATED BY THE INCREASE IN IMPERVIOUS AREA CAUSED BY THE PROPOSED ACCESS DRIVE, ROOF AND PARKING.
16. THE STORMWATER DESIGN WILL MEET THE STANDARDS PUT FORTH IN THE STORMWATER MANUAL FOR WESTERN WASHINGTON AND THE CITY OF CAMAS STORMWATER STANDARDS.

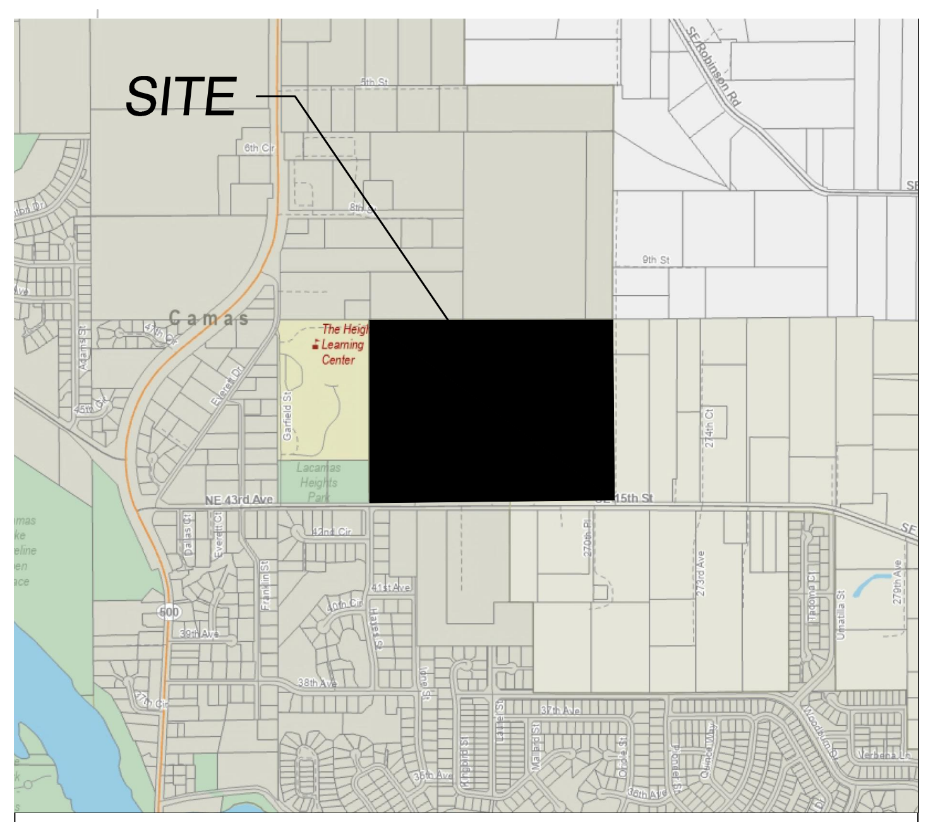
LEGEND

	PERIMETER OF SITE
	RIGHT-OF-WAY LINE
	CENTERLINE OF ROAD
	FACE OF CURB
	LOT LINE
	EASEMENT LINE
STM	STORM SEWER LINE
STM	EXIST STORM SEWER
SAN	SANITARY SEWER LINE
SAN	EXIST SANITARY SEWER
W	WATER SERVICE LINE
W	EXIST WATER LINE
123	GRADED CONTOUR LINE
123	EXIST CONTOUR LINE

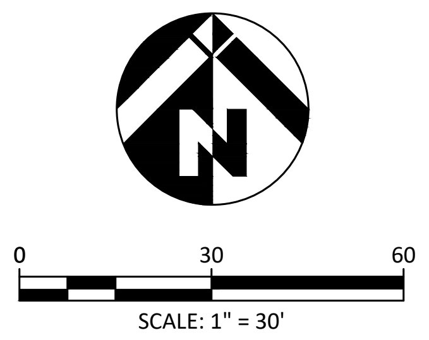
○	MANHOLE	W	WATER SERVICE METER
⊗	WATER VALVE AND BOX	T	TELEPHONE RISER
	FIRE HYDRANT ASSEMBLY	G	GAS RISER
○	CLEAN OUT	E	ELECTRIC RISER
▥	CATCH BASIN	☼	UTILITY POLE
△	THRUST BLOCK		UTILITY POLE W/ LIGHT
			SIGN POST



SOILS MAP
NTS



VICINITY MAP
NTS



FILE: W:\18551 USTA Covered Tennis Center\500 Design\502 Drawings\Sheets\18551 - Prelim Utility Plan.GCO.dwg PLOTSTYLE: Utilities.stb

MacKay Sposito
ENERGY PUBLIC WORKS LAND DEVELOPMENT
www.mackaysposito.com

GREGORY C. OEHLER
49506

9/19/2024

USTA COVERED TENNIS CENTER
CAMAS, WASHINGTON

PRELIMINARY UTILITY PLAN

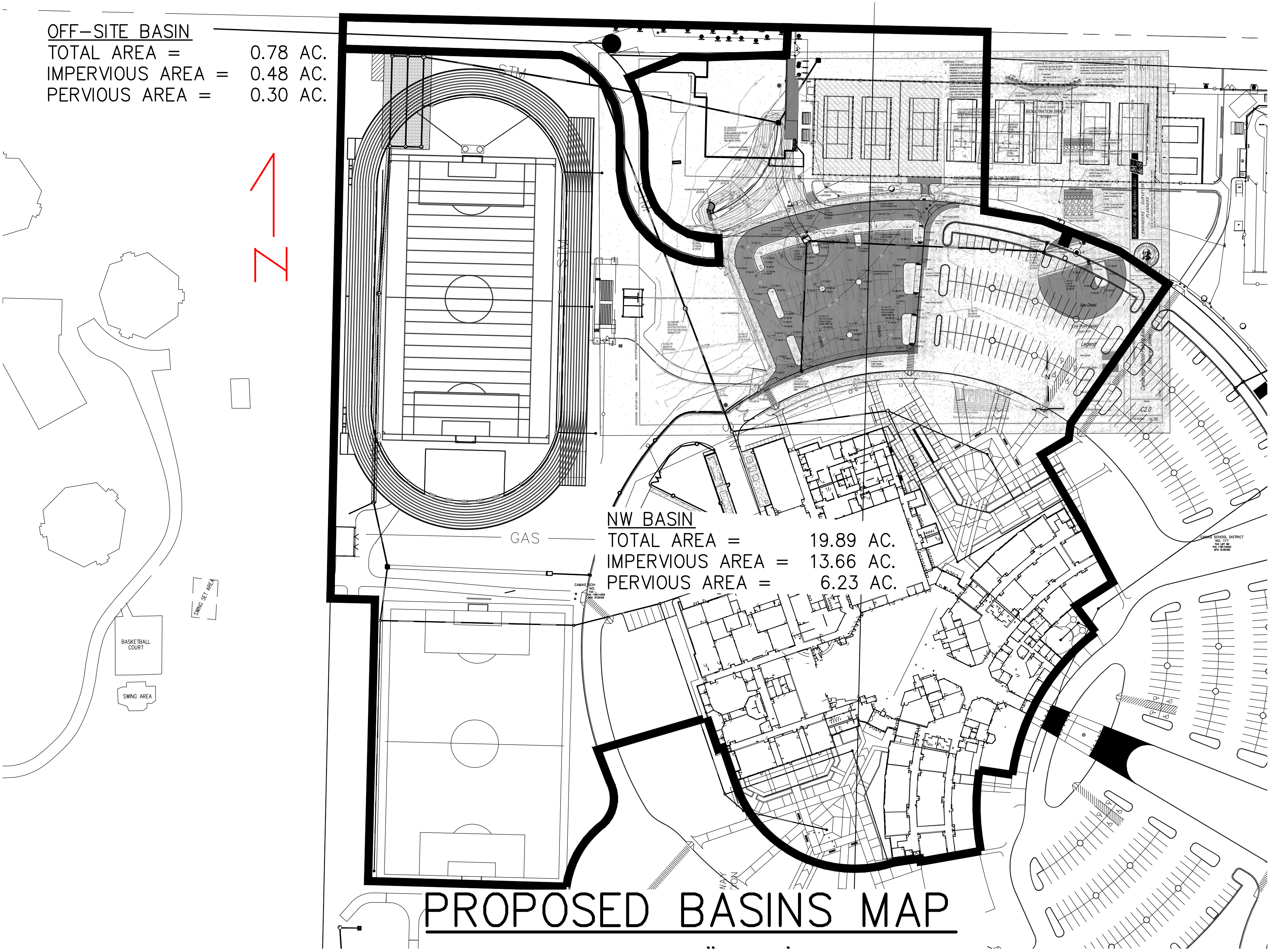
REVISIONS:

JOB NO.:	18551
DATE:	9/16/2024
SCALE: H:1"=40'	V: N/A
DESIGNED BY:	MDR
DRAWN BY:	MDR
CHECKED BY:	GCO

PRELIMINARY

C1.0

Exhibit 13 CUP24-1001



OFF-SITE BASIN
TOTAL AREA = 0.78 AC.
IMPERVIOUS AREA = 0.48 AC.
PERVIOUS AREA = 0.30 AC.

NW BASIN
TOTAL AREA = 19.89 AC.
IMPERVIOUS AREA = 13.66 AC.
PERVIOUS AREA = 6.23 AC.

PROPOSED BASINS MAP

Exhibit 13 CUP24-1001

BASIN	IMPERVIOUS AREA (AC)	PERVIOUS AREA (AC)	TOTAL
H1	0.64	0.63	1.27
H2	0.82	0.68	1.5
TOTAL	1.46	1.31	2.77

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COVERED TENNIS CENTER
EXISTING CATCHMENT PLAN (QUANTITY CONTROL)

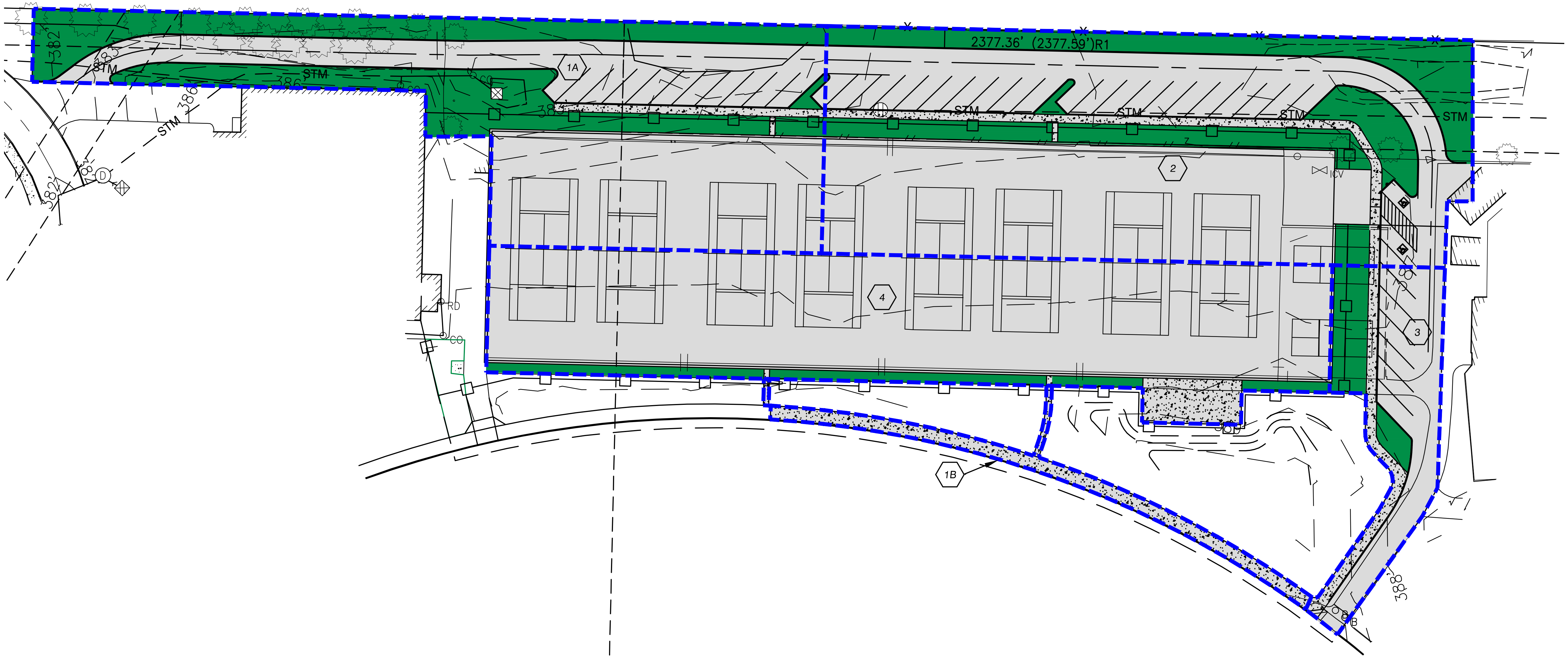
PROJECT NO.:	18551
DRAWN BY:	MDR
CHECKED BY:	GCO
DATE:	9/25/2024
SHEET NO.	CP-1

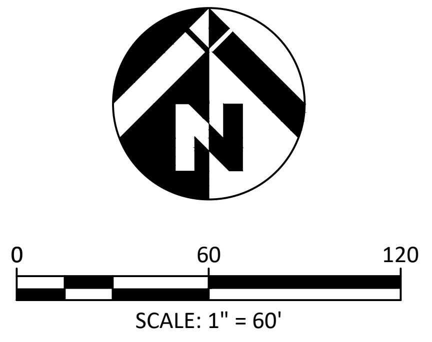
FILE: W:\18551 USTA Covered Tennis Center\500 Design\501 Documents\Technical Files\Stormwater\TIRA - Maps\Working Docs\18551 - Existing Basin Map.dwg PLOTSTYLE: Cover.stb

Exhibit 13 CUP24-1001

PLOTSTYLE: Cover.stb

FILE: W:\18551 USTA Covered Tennis Center\500 Design\501 Documents\Technical Files\Stormwater\TIRA - Maps\Working Docs\18551 - Proposed Basin Map.dwg





BASIN	IMPERVIOUS AREA (AC)	PERVIOUS AREA (AC)
1A	0.50	0.27
1B	0.06	0.00
2	0.75	0.24
3	0.15	0.04
4	0.71	0.05
TOTAL	2.17	0.60

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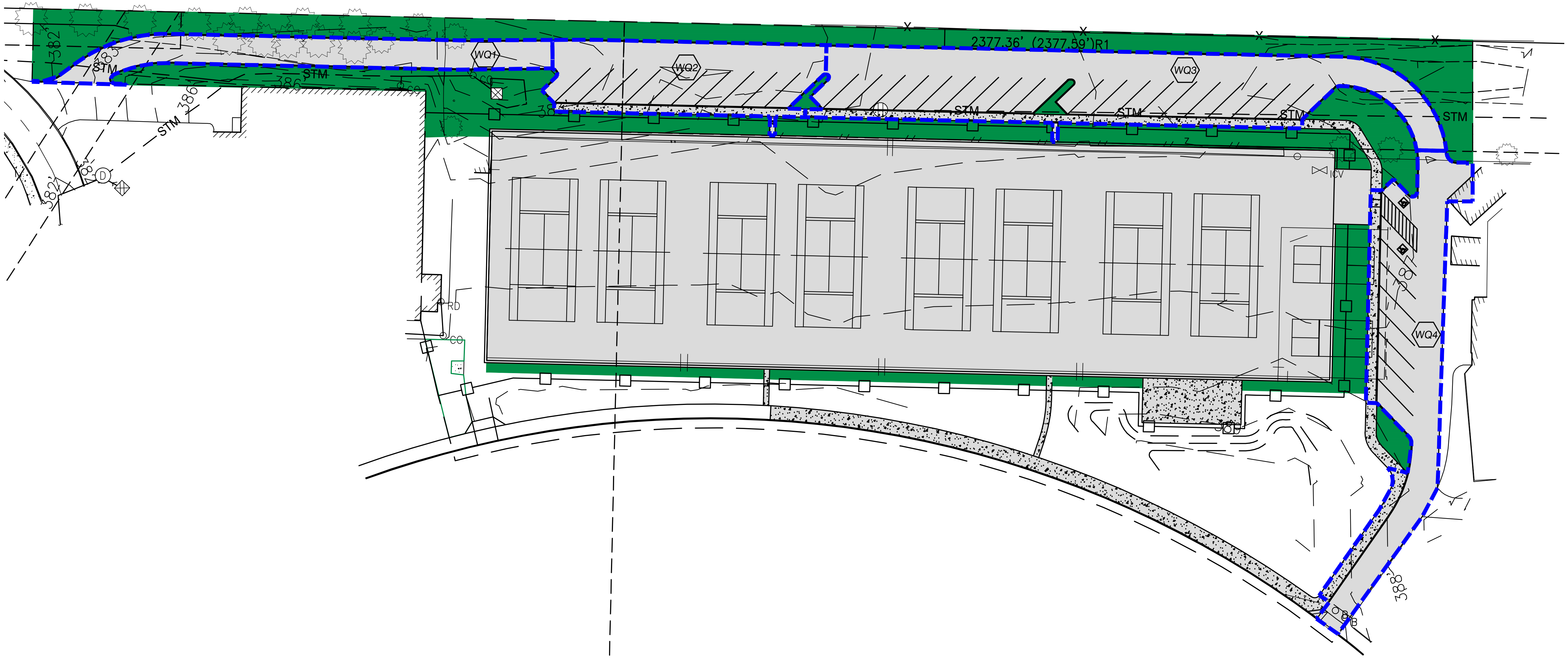
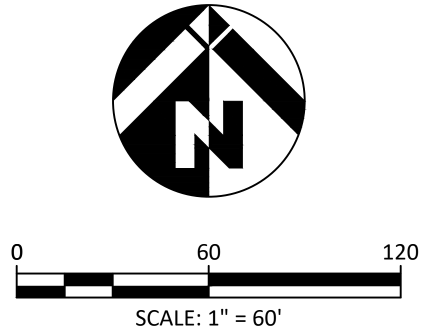
COVERED TENNIS CENTER
DEVELOPED CATCHMENT PLAN
(QUANTITY CONTROL)

PROJECT NO.:	18551
DRAWN BY:	MDR
CHECKED BY:	GCO
DATE:	9/25/2024
SHEET NO.	CP-2

Exhibit 13 CUP24-1001

FILE: W:\18551 USTA Covered Tennis Center\500 Design\501 Documents\Technical Files\Stormwater\TIRA - Maps\Working Docs\18551 - Proposed WQ Basin Map.dwg PLOTSTYLE: Cover.stb





SCALE: 1" = 60'

BASIN	IMPERVIOUS AREA (AC)	PERVIOUS AREA (AC)
WQ1	0.098	0.00
WQ2	0.131	0.00
WQ3	0.278	0.00
WQ4	0.190	0.00
TOTAL	0.697	0.00

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www.mackaysposito.com

COVERED TENNIS CENTER
DEVELOPED CATCHMENT PLAN
(QUALITY CONTROL)

PROJECT NO.: 18551
DRAWN BY: MDR
CHECKED BY: GCO
DATE: 9/25/2024
SHEET NO. CP-3